

**COMPARATIVE ANALYSIS OF TECHNIQUES FOR ESTIMATING
GEOHYDRAULIC PROPERTIES AND AQUIFER VULNERABILITY IN
IMO RIVER BASIN, SOUTHEASTERN NIGERIA**

BY

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APPLIED GEOPHYSICS, FUTO)

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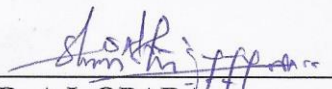
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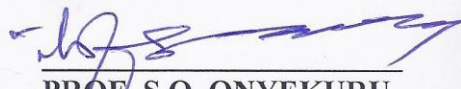
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CERTIFICATION

This is to certify that this work entitled “.Comparative Analysis of Techniques for Estimating Geohydraulic Properties and Aquifer Vulnerability in Imo River Basin, Southeastern Nigeria” was carried out by **Emberga, Terhemba Theophilus (20144025478)** in partial fulfillment of the requirements for the award of the degree of Ph.D. in Geophysics, in the Department of Geology, Federal University of Technology Owerri.


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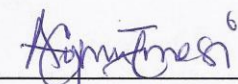
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DEDICATION

This work is dedicated to God Almighty, who made everything around and about me possible.

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ABSTRACT

Comparative Analysis of Techniques for Estimating Geohydraulic properties and Aquifer Vulnerability in Imo River Basin, Southeastern Nigeria was carried out to determine the most suitable and cost effective techniques for the determination of hydraulic properties and groundwater vulnerability in the Imo River Basin. The basin which lies between Latitudes $4^{\circ} 38'$ and $6^{\circ} 01' N$ and Longitudes $6^{\circ} 53'$ and $7^{\circ} 32' E$ with an area extent of about 9100 km^2 is underlain by the Ajali, Nsukka, Imo Shale, Ameki, Ogwashi-Asaba and Benin Formations. Five hundred and sixty-nine (569) vertical electrical soundings (VES) using the ABEM Terrameter (SAS) 4000 with maximum electrode spacing of 1000 m were acquired in the study area. Thirty (30) parametric soundings out of the entire VES data points were carried out in the vicinity of existing boreholes for comparative analyses and quality control. Twenty (20) sandstone samples collected from the six (6) formations were sieved and the resulting data processed to obtain hydraulic conductivities of aquiferous units. Comparatively, Da-Zarroch parameters (transverse unit resistance and longitudinal conductance) were used to determine aquifer depth, thickness and hydraulic characteristics from VES Data. Additionally, estimates of hydraulic conductivity were made using the techniques of Niwas & Singhal and the Heigold's method. A New model that is Novel and formation sensitive was also developed using resistivity and existing pumping test data. The mean aquifer resistivity revealed 1397.96 in Ajali, 2116.92 in Ameki, 2188.15 in Benin, 632.55 in Imo shale, 1355.08 in Nsukka and $2072.91 \Omega \text{ m}$ in Ogwasi-Asaba Formations while the mean aquifer thickness in Ajali revealed 40.83, while those in Ameki were 42.68, 39.38 in Benin, 26.78 in Imo Shale, 36.34 in Nsukka and 37.39 m in Ogwasi-Asaba. The study also revealed the aquifer thickness of 122.04 in Ajali, 121.86 in Ameki, 114.46 in Benin in 73.73 in Imo shale, 36.92 in Nsukka and 109.66m in Ogwasi- Asaba. The results of the hydraulic conductivity and that generated with the model revealed average values of 13.19, 1.74 and 4.62 m/day respectively. The hydraulic conductivity values estimated using the empirical formulae of Hazen, Kozeny-Carman, Breyer, Slitcher and USBR have mean values of 1.55, 256.8, 0.58, 2.82 and 0.046 m/day respectively. These results were validated with the existing pumping test data using Artificial Neural Networks. Mean Transmissivity (T_{mean}) and Storativity values computed from the hydraulic conductivity data revealed values of $140.8 \text{ m}^2/\text{day}$ and 5.3×10^{-5} , respectively for the aquiferous units in the Ajali Formation. In the same vein, T_{mean} of $193.5 \text{ m}^2/\text{day}$ and mean storativity of 5.54×10^{-5} were estimated for Ameki Formation aquifers, while Benin Formation aquifers revealed T_{mean} of $784 \text{ m}^2/\text{day}$ and mean storativity of 5.11×10^{-5} . The aquifers in the Imo Formation have a mean transmissivity $T_{\text{mean}} = 205.2 \text{ m}^2/\text{day}$ with a mean storativity of 3.48×10^{-5} . The aquifers in the Nsukka Formation have a mean transmissivity $T_{\text{mean}} = 211.5 \text{ m}^2/\text{day}$ with a mean storativity of 4.8×10^{-4} while the aquifers in the Ogwasi/Asaba Formation have a mean transmissivity $T_{\text{mean}} = 100.2 \text{ m}^2/\text{day}$ with a mean storativity of 4.86×10^{-5} . The vulnerability of the aquifers evaluated using Geologic (DRASTIC and GOD) and Geophysical (Integrated Electrical Conductivity, IEC) models generated vulnerability maps which displayed areas within the northern part of the study area to have low and moderate vulnerabilities while the southern part has aquifers with high vulnerability to pollution. The estimated percolation time of contaminants using IEC model revealed that it will take contaminants from several months to about 25 years to get to the groundwater system in the study area. The good correlation of hydraulic conductivity results between the new model and existing pumping data implies that generated model can substitute the laborious and expensive pumping tests of boreholes in areas with similar geologic formations.

Key words: Geohydraulic, Vertical electrical sounding, Aquifer resistivity, Da-Zarroch parameters, Aquifer Vulnerability, Sieve Analysis, Pumping test, and Artificial Neural Network,

CHAPTER I

INTRODUCTION

1.1 Background Information

The study area which lies between Latitudes 4° 38'N - 6° 01'N and Longitudes 6° 53'E - 7° 32'E covers an area of about 9100 km². The litho-stratigraphic units within the study area include the Ajali, Nsukka, Imo Shale, Ameki, Ogwashi/Asaba and Benin Formations.

The Ajali Sandstone of Maastrichtian age is the oldest exposed formation in the basin, outcropping at its north-eastern fringe along NW-SE band (2 to 4 km width). It consists of thick friable, loosely consolidated sandstones (Uma, 1989). Overlying the Ajali Sandstone conformably in the Nsukka Formation (Maastrichtian-Lower Paleocene), this extends to a relatively broader stretch of land than the former. It consists of alternating sequences of sandstones, shales and sandy shales. It dips at about 6°, on the average, to the south-west. The Imo Shale of Paleocene-Lower Eocene age overlies the Nsukka Formation unconformably. It consists of a thick sequence of blue and dark grey shales with occasional bands of clay-ironstones and subordinate sandstones (Ekwe et al., 2006). Next in the depositional sequence is the Ameki Formation (Eocene), which consists of sand and sandstones. The lithologic units of the Ameki Formation fall into two general groups (Whiteman, 1982; Arua, 1986); an upper grey-green sandstones and sandy clay and a lower unit with fine to coarse sandstones, and intercalations of calcareous shales and thin shelly limestone. Next in the depositional sequence is the Ogwashi/Asaba Formation (Oligocene to Miocene), which is generally made up of clays, sands, grits and seams of lignite alternating with gritty clay. This formation is characterized by its up dip and down dip pinch outs within the Imo Basin. The Ogwashi/Asaba Formation is overlain by the Benin Formation (Miocene to Recent) which is the most extensive of all the formations, which covers more than half of the area of the basin. It consists of sands, sandstones, and gravels, with intercalations of clay and sandy clay. The sands are fine-medium-coarse grained and poorly sorted.

Groundwater transmissivity, hydraulic conductivity and aquifer yield are fundamental hydraulic properties that describe the subsurface hydrogeology. Therefore, many techniques have been used for predicting these hydraulic parameters over the years as documented by key publications (Heigold et al., 1979, Niwas & Singhals 1981, Ejiogu et al 2019). However,

most of these techniques do not predict these hydraulic parameters accurately because they have little or no relationship with the local geology. Most of the equations currently used to predict/evaluate aquifer hydraulic and vulnerability characteristics are alien to the geological environments in sub-Saharan Africa and therefore not constrained by the local geology.

This insensitivity to local geology is probably the reason for the underprediction of aquifer characteristics and vulnerability in most parts of the study area. There is, therefore, a need to have model equations that are controlled by the local geology to predict these values. To solve this problem, novel analytical/predictive model equations that are constrained by the local geology were proposed and used in this study. These new equations will be compared with other known model equations to evaluate their inherent limitations and strengths. Besides, new model equations will be developed and validated using Artificial Neural Network (ANN). Also, there are significant sources of contaminant spreading and point pollution of groundwater from land-use activities like agricultural practices.

Groundwater pollution is, therefore, a growing worldwide environmental problem with the consumption of contaminated water most often resulting in epidemics and loss of lives, especially in developing countries.

Prevention of contamination is very critical for effective groundwater management. Aquifer vulnerability assessment has been recognized for its ability to delineate areas whose groundwater systems are more likely than others to become contaminated from anthropogenic activities at/or near the earth's surface (Ibe et al., 2003). Once identified, these areas can be targeted for careful land-use planning, intensive monitoring, and prevention of contamination of the underlying groundwater system. Several aquifer vulnerability techniques have been used over the past decades and include the DRASTIC, GOD, SINTACS and IEC techniques (Chenini & Zghibi A., 2015). Also, artificial neural networks (ANNs) are an alternative modelling and validation approach with a variety of applications in hydrology research (French et al., 1992; Maier & Dandy, 2000). Aquifers are natural systems and as a result, they have a high degree of variability.

Typical values of hydraulic conductivity for different materials vary from several hundreds of meters per day for gravels, down to imperceptible rates for consolidated hard rocks such as

schist. While the dimensions of hydraulic conductivity have the units of velocity (distance divided by time), it is, in fact, a flux representing a discharge of water per unit area under a hydraulic gradient of 1, with the full units of $\text{m}^3/\text{day}/\text{m}^2$. In other words, the volume of water passing through a square cross-sectional area of the aquifer in a given time.

It can't be used to describe the rate of groundwater flow on its own without knowledge of the hydraulic grade, which is the driving force causing water to move and the pore space through which the water movement occurs. Correlation of aquifer materials can be challenging, due to the intrinsic heterogeneity in the geometry and genesis of the geological units. Generating reliable hydrogeological data is time consuming and expensive, which makes impractical the efforts towards an exhaustive mapping of a given area and instead point measurements can be obtained by local-scale test to get representative values for the aquifer hydraulic parameters.

Groundwater is a major source of clean drinking water all over the world. It has been an important resource especially in the dry part of the world. Increased demands for water have stimulated development of underground water resources. As a result, techniques for investigating the occurrence and movement of groundwater have been improved and better equipment for extracting it have been developed, concepts for resource management have been established, and the research has contributed to a better understanding of the subject (Dodds and Ivic, 1999).

There are significant sources of spreading and point pollution of groundwater from land-use activities, particularly agricultural practices. Groundwater pollution is a growing worldwide environmental problem. Consumption of contaminated water has resulted in epidemics and loss of many lives, especially in developing countries. The percolation of these pollutants to groundwater alters the water quality and reduces its value to the consumer (Melloul and Azmon, 1997). Prevention of contamination is therefore critical for effective groundwater management. Spatial variability of data and constraints in data acquisitions preclude adequate groundwater monitoring and remediation activities are expensive and often impractical. Vulnerability assessment has been recognized for its ability to delineate areas whose groundwater systems are more likely than others to become contaminated as a result of anthropogenic activities at/or near the earth's surface (Ibe et al., 2003). Once identified, these

areas can be targeted by careful land-use planning, intensive monitoring, and by prevention of contamination of the underlying groundwater system.

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Accurate groundwater resource assessment and a quantitative description of aquifers have become imperative to address several hydrological and hydrogeological problems associated with groundwater exploration and exploitation. Since geophysical exploration is the scientific measurement of physical properties of the earth crust for investigation of mineral deposits or geologic structure, the present project mainly applied electrical resistivity method in groundwater exploration. Fluid transmissivity, transverse resistance, longitudinal conductance, hydraulic conductivity and aquifer depth are fundamental hydraulic properties describing the subsurface hydrology. As a result, many investigative techniques are commonly employed to estimate the spatial distribution of hydraulic parameters. Field estimations of the parameters are not always available. Hydraulic conductivity appears to be the most problematic to obtain because of either the great range of observed values or the unsatisfactory laboratory measurements (Mendoza et al., 2003).

Prevention of aquifer pollution is considered as an important factor in the management of groundwater resources; also, the assessment of aquifer vulnerability by scientists is an essential factor which gives us solutions to protect groundwater resources. To recognize the need to an efficient method to protect groundwater resources from contamination, scientists and managers develop aquifer vulnerability techniques such as DRASTIC, GOD and many others for predicting which areas are the most vulnerable (Chenini & Zghibi A., 2015)

Artificial neural networks (ANNs) have emerged as an alternative modelling and validation approach with a variety of applications in hydrology research (French et al., 1992; Maier & Dandy, 2000).

In this study, we shall generate a new model which will be validated using Artificial Neural Network (ANN)

1.1.1 Aquifer

An aquifer is a layer or layered sequence of rock or sediment comprising one or more geological formations that contain water and capable of transmitting significant quantities of water under ordinary hydraulic gradient (Willis & John, 2001). Aquifers, therefore, have sufficient permeability to transmit groundwater that can be exploited economically from wells or springs. The term significant quantity is relative depending upon the availability of groundwater. In the regions where groundwater is available with great difficulty, even fine-grained materials containing very less quantities of water may be classified as principal aquifers (Willis & John, 2001). The most common aquifers are unconsolidated sands and gravels, permeable sedimentary rocks such as sandstone and limestone and heavily fractured volcanic and crystalline rocks.

1.1.2 Aquitard

The term aquitard is used to describe a form of lower permeability that may transmit quantities of water that are significant in terms of regional groundwater flow, but from which negligible supplies of groundwater can be obtained (Willis & John 2001). Examples of aquitards include fluvial and glaciofluvial silts and sandy clays, sedimentary rocks with few fractures and fractured crystalline rock. In recent years, and the term aquitard has been coined to describe the less-permeable beds in a stratigraphic sequence. These beds may be permeable enough to transmit water in quantities that are significant in the study of regional groundwater flow, but their permeability is not sufficient to allow the completion of production wells within them (Willis & John, 2001). Most geologic strata are classified as either aquifers or aquitards; very few formations fit the classical definition of an aquiclude. As a result, there is a trend toward the use of the first two of these terms at the expense of the

third (Freeze & Cherry, 1979). The most common aquitards are clays, shales and dense crystalline rocks.

1.1.3 Aquiclude

An aquiclude is a saturated geological unit of low permeability that is incapable of transmitting significant quantities of water under ordinary hydraulic gradients and can act as a barrier to regional groundwater flow (Willis & John, 2001). Aquiclude rocks include clays, shales and metamorphic rocks.

1.1.4 Leaky Aquifers

These are aquifers that can be underlain or overlain by semi-permeable strata. It allows passage of water in and out of it. Example is as seen in alluvial valley plains or former lake basins.

1.1.5 Unconfined (Phreatic) Aquifer

Unconfined aquifer is also called water table aquifer or non-artesian aquifer. They are the top-most water-bearing strata having no confined impermeable over-burden lying over them. They are aquifers in which the water table forms the upper boundaries. The rise and fall of the water table is as a result of storage changes in the aquifer. When water infiltrates into the ground, gravity pulls it down until it encounters a confining layer. Because flow is inhibited, the zone of saturation piles up above this confining layer. The saturated thickness represents the height of the pile, and since the porosity of the overlying materials is connected to the land surface, it is called an unconfined aquifer (Willis & John, 2001). In other words, an unconfined aquifer is an aquifer with an unrestricted (free) upper boundary and an impermeable lower boundary (aquiclude).

1.1.6 Confined and Artesian Aquifer

Geologic materials that outcrop at the surface at a relatively high elevation (recharge area) receive water by infiltration recharge. Materials of sufficient transmissivity that become saturated and are overlain and underlain by confining layers become aquifer units with trapped groundwater (Cooley & Case, 1996). The elevation of the zone of saturation propagates pressure throughout the system from the weight of the water (Cooley & Case, 1996). When this occurs, there is sufficient pressure head within the system to lift the water within cased wells above the bottom of the upper confining layer. By definition, this is a confined or artesian aquifer. Both terms refer to the same condition. In other words confined aquifers are aquifers where the groundwater is confined under pressure greater than the atmospheric pressure due to overlying relatively impermeable strata and are also broadly inclined so as to expose the aquifer somewhere in the recharge area at a higher level for the creation of sufficient hydraulic head gradient (Cooley & Case, 1996). Such aquifer can act as channels for transportation of water from areas of recharge to areas where the confined bed reaches the surface and wells trapping water from such aquifers are free-flowing wells (Cooley & Case, 1996).

Generally, most confined aquifers receive recharge through vertically leaking geologic materials above or below them (Freeze & Cherry 1979). When water levels in cased wells rise to the land surface and become flowing wells, they are still considered to be from a confined aquifer.

The height to which water levels rise forms a surface known as the potentiometric surface. In an unconfined aquifer, the potentiometric surface is the water table. The slope of this surface is called the hydraulic gradient. The hydraulic gradient is proportional to the hydraulic conductivity (Freeze & Cherry 1979). Each aquifer has its potentiometric surface, from which groundwater flow and other interpretations are made.

It is important to note that the level to which the water will rise in an artesian well is determined by the highest point on the aquifer, from where it is fed from the rain falling in the catchment (i.e. by recharge). However, the water will not rise to this full height, because the friction of the water moving through the aquifer uses up some of the energy (Sekhar et al., 1992).

The question whether it will be a flowing artesian well or a non-flowing artesian well depends upon the topography of the area and is not the inherent property of the artesian aquifer (Edward & Frederick, 1997). If the pressure surface lies above the ground surface, the well will be a flowing artesian well, whereas, if the pressure surface is below the ground surface, the well will be an artesian but non-flowing, and will require a pump to bring the water to the surface. Such non-flowing artesian wells are sometimes referred to as sub-artesian wells (Edward & Frederick, 1997).

The mathematical expression of groundwater flow was first developed in 1856 by a French hydraulics engineer named Henri Darcy. The empirical relationship that now bears his name is a universally accepted method in assessing groundwater flow. Darcy's equation is used to calculate the velocity and volumetric rate of flow through a porous medium such as gravel or sand. Confined aquifers are less affected by surface microbial contamination due to the natural barrier formed by the low permeability capping strata and slower flow rates. Both these factors mean that microbial contaminants don't persist for as long underground. Potential problem chemicals such as nitrate and sulphate can also be transformed are normally valid under all conditions. The higher the hydraulic conductivity and the larger the hydraulic gradient, the greater the rate of groundwater flow through an aquifer. Hydraulic conductivity has the units of metres/second (m/s) or metres/day (m/day) and is related to permeability. While hydraulic conductivity reflects the characteristics of both the water and the geology, the fluid characteristics such as density, temperature or salinity are less important. The hydraulic conductivity may also be considered as a measure of the resistance to flow, where the greater the hydraulic conductivity, the lower the resistance to flow.

Typical values of hydraulic conductivity for different materials vary from several hundreds of metres per day for gravels, down to imperceptible rates for consolidated hard rocks such as schist. While the dimensions of hydraulic conductivity have the units of velocity (distance divided by time), it is, in fact, a flux representing a discharge of water per unit area under a hydraulic gradient of 1, with the full units of $\text{m}^3/\text{day}/\text{m}^2$. In other words, the volume of water passing through a square cross-sectional area of the aquifer in a given time. It can't be used to describe the rate of groundwater flow on its own without knowledge of the hydraulic grade, which is the driving force causing water to move and the pore space through which the water movement occurs.

Correlation of aquifer materials can be challenging, due to the intrinsic heterogeneity in the geometry and genesis of the geological units. Generating reliable hydrogeological data is time consuming and expensive, which makes impractical the efforts towards an exhaustive mapping of a given area and instead point measurements can be obtained by local-scale test to get representative values for the aquifer hydraulic parameters. These tests or methods can take place on the field or in the lab, and each particular method may provide a different parameter estimate that can then be associated with the same location within the natural aquifer. Geostatistical methods provide a means for exploring the correlation structure, allowing comparisons of the results from different geological settings and providing information about spatial distribution of the hydraulic parameters that can be used in numerical groundwater flow models. The first goal of this thesis is to explore the degree of correlation between conductivity values associated with interpretation from two different methods (Pumping test and particle-size distributions), (field and laboratory-based methods, respectively) but for samples from the same location using basic statistics and key geostatistical parameters.

Generally, what the hydrogeologist has is a group of scattered data of hydraulic parameters (grain size, hydraulic conductivity, infiltration rates, etc.) from a given area; if there is not any other information available (i.e. a geology map) the first approach is to correlate those data by an interpolation method, that is, distinguishing the zone in areas of similar characteristics (i.e. facies). Many methods exist for scattered data interpolation (Franke, 1982), and some have been used for geologic facies reconstruction (Ritzi et al., 1994, Guadagnini et al., 2004, Tartakovsky & Wohlberg 2004, Wohlberg et al., 2006, Tartakovsky et al., 2007).

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range of observed values or the unsatisfactory laboratory measurements (Mendoza et al., 2003).

1.2 Problem Statement

Most of the equations used to predict/evaluate aquifer hydraulic and vulnerability characteristics are alien to geological environment in sub-Saharan Africa and therefore not constrained by the local geology. This insensitivity to geology is probably the reason for underprediction of aquifer characteristics and vulnerability in most parts of the study area. There is, therefore, need to have model equations that controlled by the local geology to predict these values. These new equations will be compared with other model equations to evaluate this inherent limitations and strength of the model equations.

1.3 Objectives of Study

The main objective of this research work is to carry out a comparative assessment of techniques for estimating aquifer hydraulic and vulnerability characteristics.

The specific objectives include the following:

- i) Estimation of the aquifer layer and geometrical parameters.
- ii) Hydrogeophysical interpretation of the area
- iii) Hydrostratigraphical interpretation of the study area
- iv) Estimation of aquifer vulnerability using geologic methods (DRASTIC, GOD).
- v) Estimation of aquifer vulnerability using geophysical methods(IEC)
- vi) Estimation of aquifer hydraulic parameters from grain-size data
- vii) Estimation of aquifer hydraulic parameters from geophysical data
- viii) Comparative analysis of model equations and techniques used for aquifer hydraulic and vulnerability characteristics estimations.
- ix) Validation and optimization of results of the models using artificial neural network (ANN)

1.4 Justification of Study

The cost of determining aquifer hydraulic characteristics from pumping test is prohibitive. Therefore, geophysical methods provide a cost-effective means of estimating hydraulic parameters of an aquifer. Finally, new methods of predicting aquifer vulnerability characteristics from geophysics are emerging. These methods shall be used in this project.

1.5 Scope of the Study

The Study area covers Imo state and some parts of Abia and Rivers States that fall within Imo River Basin. The research work is aimed at investigating the subsurface geology and the groundwater distribution/condition through the comparative study of the vertical electrical sounding (resistivity sounding), pumping test result, the lithological logs of the subsurface as presented by the boreholes within the study area and the Grain Size Distribution Analysis (GSD). This research is also aimed at acquiring; preparing, processing and interpreting hydro-geophysical data of the aquifer systems in the study area to properly understand the characteristics of the aquifers and appropriate delineation of the geologic formations of the study area. The vulnerability of the aquifers to contamination will be determined using the IEC, DRASTIC and the GOD models of the aquifer systems of the study area

CHAPTER II

LITERATURE REVIEW

2.1 Review of Previous Related Literature

A good number of methods have been used to obtain estimates of hydraulic parameters at scales of a few centimetres/ decimetres. These methods can be typically divided into two categories:

(i) Field, and

(ii) Laboratory-based methods.

The latter can be based on the analysis and interpretation of observations taken on undisturbed or disturbed samples. Each particular method may provide a different parameter estimate that can then be associated with the same location within the natural aquifer. Therefore, it is relevant to properly compare the characterization of the system ensuing from estimates of hydraulic parameters obtained with different interpretive methods but representative of support scales of the same order of magnitude. Among the available techniques, the frequently used methods based on the analysis of

(a) Grain-size distribution (GSD) and

(b) Impeller Flowmetre (IFM) information are particularly relevant. Particle-size distribution methods have been the focus of intense research since the late part of the XIX Century. Several compilations of empirical formulations developed to obtain hydraulic conductivity from particle-size distributions of soil samples are available (Vukovic & Soro, 1992; Fetter, 2001; Kasenow, 2002; Carrier, 2003; Odong, 2007; Riera et al., 2010). The idea of estimating local hydraulic conductivities with the aid of a flowmeter device was first proposed and developed in the 1980s (Molz, et al., 1989) to estimate hydraulic parameters in intermediate to high permeability formations. Some analyses have presented the main features of the GSD and IFM methodologies to obtain estimates of K at the small scale (Molz, et al., 1989; Wolf, et al., 1991; Hess, et al., 1992; Stauffer & Manoranjan, 1994; Boman, et al., 1997; Carrier, 2003; Odong, 2007). Qualitative comparisons between

estimated conductivity values and associated key geostatistical parameters based on both methods can be found in the literature (Wolf et al., 1991; Stauffer & Manoranjan, 1994; Boman et al., 1997).

This work focuses on the impact that estimates of K obtained using:

- (i) Empirical formulations based on particle-size distributions and
- (ii) Hydraulic conductivity from geophysical data.

It is emphasized that, while the measurement scale associated with

Particle size-based methods is sufficiently clear, the precise definition of the support scale of pumping test hydraulic conductivities is still lacking (Beckie, 1996; Zlotnik, et al., 2000; Zlotnik & Zurbuchen, 2003). Here, for discussion, it is assumed that the characteristic length scales of pumping test measurements and GSD estimates are of the same order of magnitude of the borehole diameter, *i.e.* (10^{-1} m). The analysis of the main statistics and key geostatistical parameters characterizing the heterogeneity of hydraulic conductivities estimated with GSD and pumping test methods in the study area is presented. The degree of correlation between K values obtained with the different methodologies examined is then explored. The results provide evidence of the lack of correlation between GSD- and pumping test-based hydraulic conductivity values.

2.2. Estimates of Hydraulic Conductivity from Grain-Size Distributions (GSD)

It is well accepted that hydraulic conductivity is related to the particle-size distribution of granular porous media. An estimate of the hydraulic conductivity of a sample can then be obtained by using information on particle size distributions in empirical relationships (compilations of several existing relationships can be found, in Vukovic & Soro, 1992; Odong, 2007; Cheng & Chen, 2007; Payne et al., 2008, and references therein).

Grain-size-based methods are typically applied to porous medium samples and the estimates are assumed to be independent on flow configuration. These methods are appealing for the estimation of hydraulic conductivity because sieve analysis practices are well-established procedures in groundwater investigations and can be performed with a moderate

experimental effort. Hydraulic conductivity estimates based on GSD information, K_{GS} , provided by a series of empirical methods can be synthesized by the following relationship

$$K_{GS} = \frac{g}{\nu} C f(\phi) d_e^2 \quad (2.1)$$

Where g is gravity acceleration, ν is the kinematic viscosity of the fluid, $f(\phi)$ is a function of porosity, ϕ , d_e is an effective grain diameter, and C is defined as a sorting coefficient. The values of C , and d_e , and the type of relationship, $f(\phi)$, depend on the formulation adopted. When applied to the same sample, the different existing empirical relationships provide estimates of permeability that could span more than one or two orders of magnitude (Custodio & Llamas, 1984; Fogg et al., 1998; Riera et al., 2010). A widely used formulation is that of Kozeny-Carman, where $C = 8.3 \times 10^{-3}$

$$f(\phi) = \left(\frac{\phi^3}{(1-\phi)^2} \right); d_e = d_{10} \quad (2.2)$$

Here, d_{10} is the grain diameter (in mm) that corresponds to 10% (by weight) of the soil sample passing, and K_{GS} is given in m/day. Using (Equation 2.2) requires that porosity measurements be available. In case ϕ measurements are not directly available, an estimate of ϕ could be obtained using the following empirical formula (Vukovic and Soro, 1992)

$$\phi = 0.255(1 + 0.83^U); U = \left[\frac{d_{60}}{d_{10}} \right] \quad (2.3)$$

where d_{60} is the grain diameter that corresponds to the 60% (by weight) of the sample passing, and U is the coefficient of uniformity. It is remarked that, as a result of sample homogenization which might occur during particle size analysis, values based on GSD methods can be considered as lying in between the two components along the principal directions of the local conductivity tensor (vertical and horizontal if layers are not tilted).

The Kozeny-Carman equation has been applied to a large variety of fine and coarse grain sediments, ranging from non-plastic, cohesionless silts to sand and gravel mixtures (Carrier, 2003; Gallardo & Marui, 2007; Odong, 2007; Wilson et al., 2008).

The method is less reliable for very-poorly sorted soils, or soils with highly irregular shapes (Carrier, 2003), as well as for plastic soils (with significant clay or organic content, where fabric, destroyed by disturbance of the sample, influences hydraulic conductivity) or well-

sorted cobble-sized gravel. As a general rule, the Kozeny-Carman equation provides good estimates of K whenever d_{10} ranges between approximately 0.1 and 3.0 mm. Odong (2007) assessed the reliability of several competing empirical equations to estimate hydraulic conductivity from grain size distributions of unconsolidated aquifer materials and concluded that the best overall estimation of K is obtained using the Kozeny-Carman formula. Carrier (2003) and Barr (2005) have performed similar comparisons supporting the same conclusion. Examples of acceptable correlation between GSD K estimates and hydraulic tests have been documented by Zlotnik and McGuire (1998) and Cardenas and Zlotnik (2003).

2.3 Empirical Formulae used in Calculating Hydraulic Conductivities

2.3.1. Hazen:

The sediments must have coefficient of uniformity U less than 5 and effective grain size between 0.1 and 3mm

$$K = \frac{g}{v} \times 6 \times 10^{-4} [1 + 10 (n - 0.26)] \times d_{10}^2 \quad (2.4)$$

2.3.2. Breyer:

Poorly sorted grains with uniformity coefficient between 1 and 20 and effective grain size between 0.006 and 0.6mm

$$K = \frac{g}{v} \times 6 \times 10^{-4} \log \frac{500}{U} \times d_{10}^2 \quad (2.5)$$

2.3.3. Kozeny – Carman:

It is not appropriate for either soil with effective grain size above 3mm or clayed soil

$$K = \frac{g}{v} \times 8.3 \times 10^{-3} \left[\frac{n^3}{(1-n)^2} \right] \times d_{10}^2 \quad (2.6)$$

2.3.4. Slitcher:

The formula is most applicable for grain size between 0.01 and 5mm

$$K = \frac{g}{v} \times 1 \times 10^{-2} n^{3.283} \times d_{10}^2 \quad (2.7)$$

2.3.5. USBR:

The formula is most suitable for medium grain size sand with uniformity coefficient U less 5

$$K = \frac{g}{v} \times 4.8 \times 10^{-4} \times d_{20}^{0.3} \times d_{20} \quad (2.8)$$

2.4 Porosity

Frings et al (2011) studied the accuracy of porosity predictors for fluvial sand-gravel deposits. They looked at several ways to measure porosity based on different parameters such as effective grain size, standard deviation, deviation of the grain size distribution from a type curve and theoretical predictors that take mixing processes into account and calculate porosity computationally. They used laboratory methods and in-situ experiments to calculate the porosity and compared this to different methods based on the parameters mentioned above. The uncertainty of the laboratory methods could lead to an overestimation of the porosity, mainly due to disturbance of the packing near the container walls, but the authors believed that this overestimation was probably small. In addition to the experimentally obtained results, the authors also used two porosity data sets from literature to compare. The results showed that empirical predictors based on the relation between median grain size and the porosity did not correspond very well to the laboratory results. In part, this is because the finer sediments of a grain size distribution often represents a small percentage of the entire distribution, and does not affect the median grain size a lot even though this has a great impact on the porosity. The conclusion was that there is no unique relation between grain size and porosity. The empirical methods could be useful in cases when the geological conditions mirrored the original conditions in which the methods were developed, but were not generally applicable. When looking at methods based on the other parameters the correlation was better, especially when using theoretical predictions, but the methods based on these parameters were still not able to produce highly accurate porosity predictions. The authors developed a tailor-made equation for the studied area with multivariate regression analysis, which used two independent parameters: the sediment standard deviation and the number of grains smaller than 0.5 mm. They were still not able to produce accurate predictors but could see trends such as downstream decreasing porosities, and concluded that porosity predictors are useful to provide insights in the spatial variation in porosity. Sakata & Ikeda (2013) studied how hydraulic conductivity varied by depth in alluvial gravel deposits.

The dependence of hydraulic conductivity on depth in sediments is mainly due to decreasing porosity because of compaction and other physical or chemical effects. The hydraulic conductivity in unconsolidated gravel deposits varies quite a lot with even a slight change in porosity. When using a model that represents the hydraulic conductivity as a function of the porosity and volume fraction of each component in a sediment mixture, the hydraulic conductivity can range over several orders of magnitude by these factors. The authors cite a study that showed that a very small change in porosity (a few percent) could cause greater than 10-fold changes in hydraulic conductivity. To obtain as undisturbed samples as possible, the authors used tube-samplers that had been improved for high-quality sampling of gravel deposits. Grain size analyses were made on these gravel cores and was compared to the results from slug tests. As indirect methods based on grain-size distribution create discrepancies due to the simplifications to only one parameter, the authors classified the samples according to a matrix packing level index, by viewing the sample. This index categorizes the packing in the gravel cores into four levels, from full to very loose. This refers to the cavities between the gravel and to which degree the cavities are filled with finer material. The hydraulic conductivity was calculated by using grain size diameter and the matrix packing level index as seen in equation 2.9:

$$K = 6.89 \left(\frac{d_{20}}{1000} \right)^{1.9} \cdot (L_1 + L_2) + 0.0167 \cdot L_3^3 \quad (2.9)$$

The L-values give a form of visual way of measuring the porosity. The d_{20} -value was chosen because it produced the highest correlation to the slug tests. The authors concluded that there was a clear depth dependency, where an increase in depth of 1 metre corresponds to an approximately 10% decrease in hydraulic conductivity.

The DRASTIC model was used for vulnerability assessment in Portugal using Hydrogeological parameters, aquifer recharge and the final map of DRASTIC aquifer vulnerability for Portugal was developed (Lobo-Ferreira & Oliveira, 1997). The DRASTIC model can be a valuable tool for identifying groundwater supplies that are vulnerable to contamination using basic hydro-geologic variables believed to influence contaminant transport from surface sources to groundwater (Kalinski et al., 1994).

Foster, (1987) considered groundwater contamination risks as the interaction between the

natural vulnerability of the aquifer and the contaminant loading that is, or will be applied to the sub-surface environment as a result of human activity. He developed a rating system based on three parameters: Groundwater occurrence, Overlying lithology and Depth to groundwater table (GOD).

The resistivity values of common rocks, soils, chemicals and metals are given in Table 1 (Loke, 1997). Metamorphic and igneous rocks typically have high resistivity values. The resistivity of these rocks is greatly dependent on the degree of fracturing and the percentage of the fractures filled with groundwater. Sedimentary rocks, which usually are more porous and have higher water content, normally have lower resistivity values. Wet soils and fresh groundwater have even lower resistivity values. Clayey soils normally have a lower resistivity value than sandy soil. The resistivity of groundwater varies from 10 to 100 Ωm , depending on the concentration of dissolved salts

Table 1: Resistivity of Some Common Rocks, Minerals, Chemicals and Metals (Loke, 1997)

Material	Resistivity ($\Omega\text{.m}$)	Conductivity ($\Omega\text{.m}$)⁻¹
Igneous & metamorphic rocks	$5 \times 10^3 - 10^6$	$10^{-6} - 2 \times 10^{-4}$
Granite	$10^3 - 10^6$	$10^{-6} - 10^{-3}$
Basalt	$6 \times 10^2 - 4 \times 10^7$	$2.5 \times 10^{-8} - 1.7 \times 10^{-3}$
Slate	$10^2 - 2.5 \times 10^8$	$4 \times 10^{-9} - 10^{-2}$
Marble	$10^2 - 2 \times 10^8$	$5 \times 10^{-9} - 10^{-2}$
Quartzite	$8 - 4 \times 10^3$	$2.5 \times 10^{-4} - 0.125$
Sedimentary Rocks	$20 - 2 \times 10^3$	$5 \times 10^{-4} - 0.05$
Sandstone	$50 - 4 \times 10^2$	$2.5 \times 10^{-3} - 0.02$
Shale	$1 - 100$	$0.01 - 1$
Limestone	$10 - 800$	$1.25 \times 10^{-3} - 0.1$
Soils and Waters	$10 - 100$	$0.01 - 0.1$
Clay	$0 - 15$	6.7
Alluvium	9.074×10^{-8}	1.102×10^7
Groundwater (fresh)	0.708	1.413
Seawater	0.843	1.185

Chemicals Metals	and	6.13	0.163

2.5 Artificial Neural Network (ANN)

Artificial neural network are nonlinear sophisticated modelling techniques that can model complex functions. Artificial neural networks are primarily the most popular and promising areas of artificial intelligence research. Artificial Neural Networks are abstract computational models, roughly based on the organizational structure of the human brain. There are a wide variety of network architectures and learning methods that can be combined to produce neural networks with different computational abilities (Strukov, Snider, Stewart, & Williams, 2008). An artificial neural network is an interconnected group of nodes, akin to the vast network of neurons in a brain. ANNs are described as a mathematical understanding of the neurological functioning of the human brain and can emulate the brain's learning process by arithmetically modelling the network structure of interconnected nerve cells. Furthermore, ANNs are entirely data-based with no previous knowledge of the events that govern the process (Graves & Schmidhuber, 2009; Strukov et al, 2008). They consist of an input layer, one or more hidden layers and an output layer. The neurons of the hidden layer assist the network in establishing the complex associations that subsist between the input and output parameters. As shown schematically in figure 2.1, each circular node represents an artificial neuron and an arrow represents a connection from the output of one neuron to the input of another (Graves, & Schmidhuber, 2009).

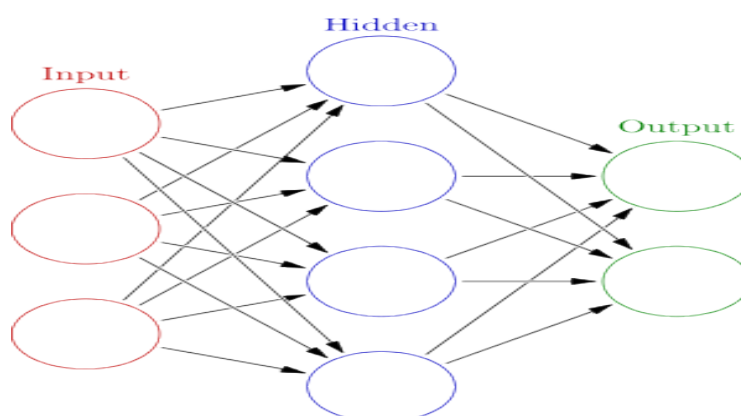


Figure 2.1: A schematic diagram of an Artificial Neural Network

The biological neural network (BNN) and artificial neural network (ANN) are network systems constructed from atomic components known as "neurons". Such computational units are massively interconnected and can model a system using a training algorithm. This algorithm attempts to minimize an error measure that is computed in different ways depending on the specific technique used to adjust the connections (i.e., the learning algorithm). There are two major approaches to train an artificial neural network (i.e., to adapt its parameters): supervised and unsupervised learning. In the supervised learning approach, specific examples of a target concept are given, and the goal is to learn how to recognize members of the class or to build a regression model using the description attributes. In this case, the synaptic weights among neurons are adjusted to minimize the error between the known desired outputs and the actual output given by the neural network during the learning process. In the unsupervised learning approach, the set of examples is provided without any prior classification, and the goal is to discover underlying regularities and patterns, most often by identifying clusters or subsets of similar examples.

The attractiveness of ANNs comes from their remarkable information processing characteristics that is mainly pertinent to nonlinearity, high parallelism, fault and noise tolerance, as well as their learning and generalization abilities,(Strukovet *al.*, 2008).In contrast to traditional modelling tools, ANNs offer a model-free, adaptive, parallel-processing and vigorous elucidation with error and failure tolerance. Moreover, their learning capability for processing inaccurate and fuzzy information and their ability to generalize unseen patterns are impeccable (Graves, & Schmidhuber, 2009). An ANN can map process input and output without underlying assumption about the distribution of data. They are powerful in data processing and analysis and can handle engineering problems, which are highly complex and nonlinear. They provide a powerful method for practically accurate solutions of precisely or imprecisely formulated problems and for phenomena that are only understood through experimental data and field observations. ANNs have become the most popular soft computing methods for solving problems in engineering (Basheer & Hajmeerb, 2002). They have been successfully used for several chemical engineering applications such as sensor data analysis, fault detection and process identification. Many cases show high utility value of various forms of ANN for different chemical processes (Hussain, 1999). Like other machine learning methods - systems that learn from data - neural networks have been used to solve a wide variety of tasks that are hard to solve using ordinary rule-based

programming, including computer vision and speech recognition. ANN can be trained to solve certain problems using a teaching method and sample data. In this way, identically constructed ANN can be used to perform different tasks depending on the training received. With proper training, ANN is capable of generalization and can predict analysis (Graves & Schmidhuber, 2009; Kurzweil, 2012). Optimizations using ANNs are concerned with the minimization of a particular cost function concerning certain constraints. ANN is shown to be capable of highly efficient optimization due to its ability to capture nonlinear behaviour, and thus provides a model that links the process inputs to the corresponding output parameters. (Ciresan, Meier, Masci & Schmidhuber, 2012).

2.6 Aquifer Parameters

Since the last decade, the input for accurate groundwater resources assessment has led to a rapidly growing awareness in the field of groundwater management. Therefore, quantitative description of aquifers has become vital to solve several hydrogeological problems. Hydraulic conductivity and aquifer depth are fundamental properties describing subsurface hydrology. As a result, many investigation techniques are commonly employed with the aim of the estimation of spatial distribution of hydraulic parameters such as hydraulic conductivity, transmissivity and aquifer depth. Field estimations of the above parameters are not always available and usually, the estimation appears to be problematic (Mendoza et al., 2003; Zecharias & Brutsaert, 1988).

Traditionally, one of the more effective ways of hydraulic conductivity calculation is the pumping tests that are carried out on certain boreholes sites. Nevertheless, a probable sparse spatial distribution of the available boreholes gives rise to significant problems in modelling the hydrogeological systems. In such cases, drilling new boreholes has proved to be rather expensive as well as time-consuming.

On the other hand, the integration of aquifer parameters calculated from the existed boreholes locations and surface resistivity parameters extracted from surface electrical measurements can be highly effective not only for aquifer hydraulic conductivity estimation but also for a group of hydraulic parameters. Knowledge of aquifer parameters is therefore essential for the assessment and management of groundwater resources.

2.6.1 Transverse Resistance and Longitudinal Conductance

Consider a column consisting of horizontal beds each with its characteristic resistivity ρ_i and thickness h_i as shown in figure 2.2 below:

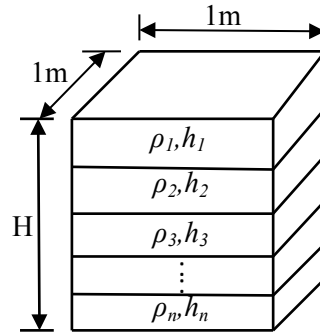


Figure 2.2: 1m $\times$ 1m Column of Rock Consisting of Layers (Ward, 1990)

The total thickness $H = \sum_i^n h_i$; $i = 1, 2, 3, \dots, n$ (2.10)

The total resistance due to the current flowing vertically through the column is simply by adding the resistance contributed by individual layer in the column.

Resistance of i^{th} layer is given by $R_i = \frac{\rho_i h_i}{A_i} = \rho_i h_i$; $A_i = 1\text{m}^2$ (2.11)

Therefore, some of the resistance known as the transverse resistance (T) is given by

$$T = \sum \rho_i h_i; i = 1, 2, 3, \dots, n \quad (2.12)$$

So the average transverse resistivity (ρ_t) which is the transverse resistance per unit thickness is given by

$$\rho_t = \frac{T}{H} = \frac{\sum \rho_i h_i}{\sum h_i}; i = 1, 2, 3, \dots, n \quad (2.13)$$

The total conductance due to the current flowing horizontally through the column is obtained by adding the conductance contributed by the individual layer in the column.

Conductance of the i^{th} layer is given by $S_i = \frac{1}{R_i} = \frac{h_i}{\rho_i}$ (2.14)

Therefore, some of the conductance known as the longitudinal conductance (S) is given by

$$S = \sum \frac{h_i}{\rho_i}; i = 1,2,3,\dots,n \quad (2.15)$$

So the average conductivity which is the longitudinal conductivity per unit thickness (σ_L) is given by

$$\sigma_L = \frac{S}{H} = \frac{\sum \frac{h_i}{\rho_i}}{\sum h_i}; i = 1,2,3,\dots,n \quad (2.16)$$

Therefore, the average longitudinal resistivity ($\frac{1}{\sigma_L}$) is given by

$$\rho_L = \frac{1}{\sigma_L} = \frac{H}{S} = \frac{\sum h_i}{\sum \frac{h_i}{\rho_i}}; i = 1,2,3,\dots,n \quad (2.17)$$

The coefficient of anisotropy which is defined as the square root of the ratio of the average transverse resistivity to the average longitudinal resistivity is given by

$$\lambda = \sqrt{\frac{\rho_t}{\rho_L}} = \sqrt{\frac{HS}{H^2}} = \left[\frac{(\sum h_i \rho_i)(\sum \frac{h_i}{\rho_i})}{(\sum h_i)^2} \right]^{0.5}; i = 1,2,3,\dots,n \quad (2.18)$$

The quantities Transverse resistance (T) = ρh and Longitudinal conductance (S) = $\frac{h}{\rho}$ are called Dar-Zarrock parameters.

2.6.2 Hydraulic Conductivity

It encompasses the ability of a material to conduct fluids under a unit hydraulic gradient considering the dynamic viscosity in units of length over time (LT^{-1}) (Fetter, 2007). Water contained within the interconnected voids of soils and rocks is capable of moving, and the ability of a rock to store and transmit water constitutes its hydraulic properties.

Darcy studied the flow of water through porous material contained in a column and found that the total flow, Q , is proportional to both the difference in water level, h_1-h_2 , measured in

manometer tubes at either end of the column and the cross-sectional area of flow, A , and inversely proportional to the column length, L . When combined with the constant of proportionality, K , Darcy obtained:

$$Q = KA \frac{(h_1 - h_2)}{L} \quad (2.19)$$

In general terms, Darcy's law, as it is known, can be written as:

$$Q = -KA \frac{dh}{dl} \quad (2.20)$$

Where, dh/dl represents the hydraulic gradient, with the negative sign indicating flow in the direction of decreasing hydraulic head. K is called the Hydraulic conductivity of the porous material.

Hydraulic conductivity or, as it is occasionally referred to in older publications, the coefficient of permeability, has dimensions of $[LT^{-1}]$ and is a measure of the ease of movement of water through a porous material.

Mathematically the unit is given as

$$K = -\frac{Q}{A} \cdot \frac{\partial l}{\partial h} = \frac{m^3/day}{m^2} \cdot \frac{m}{m} = m/day \quad (2.21)$$

The hydraulic conductivity of geological materials is not only a function of the physical properties of the porous material, but also the properties of the migrating fluid, including specific weight, $\gamma = \rho g$, where ρ is the density of the fluid and g is the gravitational acceleration), and viscosity, μ , such that:

$$K = k_1 \frac{\gamma}{\mu} \quad (2.22)$$

2.6.3 Transmissivity

For a confined aquifer of thickness, b and hydraulic conductivity K , the transmissivity, T , is defined as:

$$T = Kb = K \frac{R}{\rho} = K \sigma R = KS \rho = K \frac{S}{\sigma}, \quad (2.23)$$

where T is the transmissivity, K is hydraulic conductivity, S is the longitudinal conductance and R the transverse resistance. Transmissivity represents the rate at which water of a given density and viscosity is transmitted through a unit width of aquifer or aquitard under a unit hydraulic gradient. Transmissivity has the units of L^2T^{-1} .

For an unconfined aquifer, the transmissivity is not as well defined as in a confined aquifer, but equation 2.23 can be applied with b now representing the saturated thickness of the aquifer or the height of the water table above the top of a lower aquitard boundary. The transmissivity will, therefore, vary if there are large seasonal fluctuations in the elevation of the water table or if the saturated thickness of the aquifer shows lateral variation as a result of an irregular lower aquitard boundary or differences between recharge and discharge areas in the same aquifer.

Based on the equation 2.23 above, the quantities $(K\sigma)$ and (K/σ) are assumed to be fairly constant within the watershed. Thus knowing the values of K from existing boreholes and the conductivity, the inverse of resistivity from the sounding interpretation around the borehole, one can estimate the transmissivity and its variation from place to place using the

Dar-zarrook parameter determined for each aquifer. On the whole, σ or $1/\rho$ must be equivalent to any of the sets $K\sigma T$ or KS or KS/ρ to be used.

2.6.4 Storativity

The amount of water an aquifer can release or take into storage is known as the storage coefficient. The numerical value assigned to an aquifer is the storativity, a dimensionless value determined from pumping tests. In a pumping test the storativity represents the storativity from the saturated thickness contributing to the well. Storativity is defined according to equation 2.24.

$$S = S_Y + S_S \times b \quad (2.24)$$

The first term has already been defined as the specific yield (S_Y) defined as the volume of water released by gravity from storage per unit surface area of an unconfined aquifer per unit decline or drop in hydraulic head (water table). The second term is the specific storage (S_S) defined as the volume of water released from storage per unit volume of confined aquifer per

unit decline in hydraulic head, dimensioned L^{-1} , and multiplied by the saturated thickness (b). The specific yield is approximately equal to the total storativity value for most unconfined aquifers. The usual range of storativity values in unconfined aquifers is 0.03 to 0.3 (Fetter 1994). The value of specific storage (S_s) in unconfined aquifers is practically negligible unless there are sections within the aquifer where the grain size is very small. In confined aquifers, the water released from storage is a function of the compressibility of the aquifer materials and the compressibility of water. This is expressed by the equation below:

$$S_s = \rho g (\alpha + \eta \beta) \quad (2.25)$$

Where: ρ = fluid density, ML^{-3} , g = gravitational force, LT^{-2} , α = compressibility of mineral skeleton, $(1/(M/LT^2))$, β = compressibility of water, $(1/(M/LT^2))$

The standard value of storativity is $S \leq 0.005$ (Fetter, 2007). The storativity S , of the confined aquifer system and the deep and thick unconfined aquifer which may be hydraulically similar to it may be estimated from the rule of the thumb equation given by Lohman (1972) and Todd (1980)

2.6.5 Hydraulic Diffusivity

Although not commonly used, by combining the aquifer properties of transmissivity (T or K) and storativity (S or S_s) it is possible to define a single formation parameter, the hydraulic diffusivity, D , defined as either:

$$D = \frac{T}{S} \text{ or } \frac{K}{S_s} \quad (2.26)$$

Aquifer formations with a large hydraulic diffusivity respond quickly in transmitting changed hydraulic conditions at one location to other regions in an aquifer, for example in response to groundwater abstraction.

2.7 Groundwater Modeling

Since the observation of the pollution of groundwater became a serious subject of study in the sixties, mathematical models have been formulated to evaluate groundwater resources (Gorelick, 1983). The models integrate process descriptions with pollutant properties and environmental characteristics to yield quantitative estimates of subsurface transport and fate

of these substances in the soil mass. Modelling has now become an important tool in the management of groundwater resources and is used to predict the effect of current and future conditions as well as assessing aquifer vulnerability (Getchell, 1996). Studies have shown that well-calibrated models can provide a good estimate of the extent of groundwater contamination (Wang, 1997).

A groundwater model may be defined as a simplified version of a real-world groundwater system that approximately simulates the relative excitation-response relations of the real-world systems (Bear and Verrujit, 1987; Getchell, 1996). Mathematical models can be classified as numerical, analytical or empirical. Numerical models are the most sophisticated models and can be used to simulate the effects of either changing or steady-state aquifer conditions (Getchell, 1996). Models are built from a series of mathematical equations that simulate a groundwater situation in a real-world aquifer system. Mathematical equations describing groundwater flow in the aquifer are based on Darcy's law. According to Darcy's law, the average flow velocity is a function of the hydraulic head gradient and the effective porosity (Freeze and Cherry, 1979). The flow rate, Q , is given by:

$$Q = Av\eta \quad (2.27)$$

where Q is the flow rate in m^3/s , v is the velocity of the flow in m/s , η is the effective porosity of the porous medium and A is the cross-sectional area. The Darcy's law is given by:

$$V = \frac{-Kdh}{\eta dx} \quad (2.28)$$

where K is the hydraulic conductivity in m/s , h is the hydraulic head in m , η is the effective porosity, x is the distance of flow in the x -direction, and $\frac{dh}{dx}$ is the hydraulic gradient in the same direction. Darcy's law can be

expressed as:

$$Q = -KA \frac{dh}{dx} \quad (2.29)$$

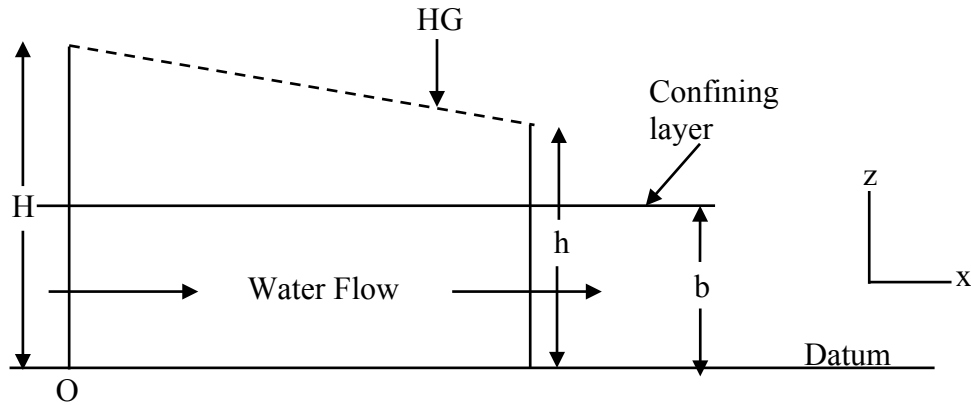


Figure 2.3: Aquifer Flow Model (b – Aquifer Thickness, HGL – Hydraulic Grade Line, H and h are Pressure Heads at O and X Respectively)

2.8 Equation of Groundwater Flow

Equations of groundwater flow are derived from a consideration of the basic flow law, Darcy's law, and an equation of continuity that describes the conservation of fluid mass during flow through a porous material. In the following treatment, steady-state and transient saturated flow conditions are considered in turn. Under steady-state conditions, the magnitude and direction of the flow velocity at any point are constant with time. For transient conditions, either the magnitude or direction of the flow velocity at any point may change with time, or the potentiometric conditions may change as groundwater either enters into or is released from storage.

2.9 Steady-State Saturated Flow

Consider the unit volume of a porous material (the elemental control volume) depicted in Figure 2.4 below:

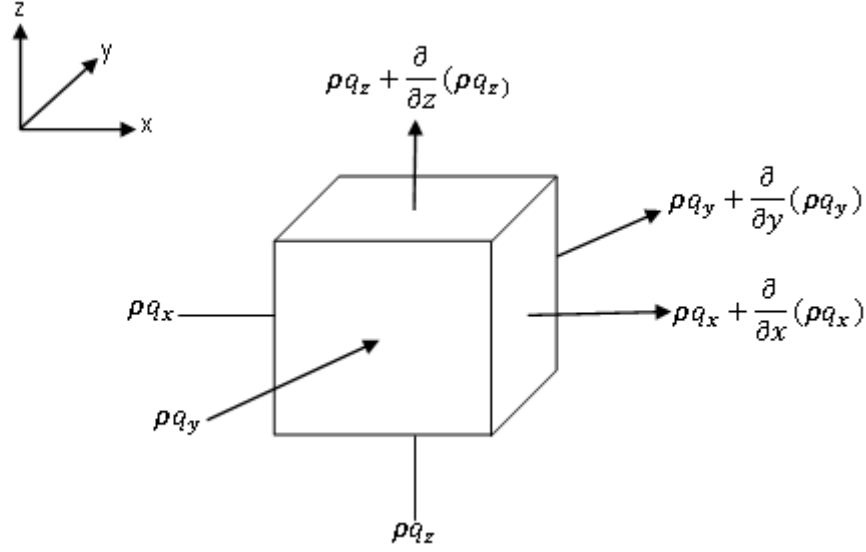


Figure.2.4: Unit Volume (Elemental Control Volume) for Flow through Porous Material

The law of conservation of mass for steady-state flow requires that the rate of fluid mass flow into the control volume, ρq (fluid density multiplied by specific discharge across a unit cross-sectional area), will be equal to the rate of fluid mass flow out of the control volume, such that the incremental differences in fluid mass flow, in each of the directions x , y , z , sum to zero (Willis and John, 2001), thus:

$$\left(\rho q_x + \frac{\partial(\rho q_x)}{\partial x} - \rho q_x\right) + \left(\rho q_y + \frac{\partial(\rho q_y)}{\partial y} - \rho q_y\right) + \left(\rho q_z + \frac{\partial(\rho q_z)}{\partial z} - \rho q_z\right) = 0 \quad (2.30)$$

From equation 3.38, the resulting equation of continuity is:

$$\frac{\partial(\rho q_x)}{\partial x} + \frac{\partial(\rho q_y)}{\partial y} + \frac{\partial(\rho q_z)}{\partial z} = 0 \quad (2.31)$$

If the fluid is incompressible, then density, $\rho(x, y, z)$, is constant and equation 2.31 becomes:

$$\frac{\partial q_x}{\partial x} + \frac{\partial q_y}{\partial y} + \frac{\partial q_z}{\partial z} = 0 \quad (2.32)$$

From Darcy's law, each of the specific discharge terms can be expressed as:

$$q_x = -K_x \frac{\partial h}{\partial x}; \quad q_y = -K_y \frac{\partial h}{\partial y}; \quad q_z = -K_z \frac{\partial h}{\partial z} \quad (2.33)$$

Substitute equation 2.32 in equation 2.33:

$$\frac{\partial}{\partial x}\left(K_{xx}\frac{\partial h}{\partial x}\right) + \frac{\partial}{\partial y}\left(K_{yy}\frac{\partial h}{\partial y}\right) + \frac{\partial}{\partial z}\left(K_{zz}\frac{\partial h}{\partial z}\right) = 0 \quad (2.34)$$

For an isotropic and homogeneous porous material, $K_x = K_y = K_z$ and $K(x, y, z) = \text{constant}$, respectively, it can be shown that:

$$\frac{\partial^2 h}{\partial x^2} + \frac{\partial^2 h}{\partial y^2} + \frac{\partial^2 h}{\partial z^2} = 0 \quad (2.35)$$

Thus, the steady-state groundwater flow equation is the Laplace equation and the solution $h(x, y, z)$ describes the value of the hydraulic head at any point in a three-dimensional flow field. For a 3-D groundwater flow equation through a saturated anisotropic heterogeneous porous medium, Darcy's law is expressed as:

$$\left(\frac{\partial}{\partial x}K_{xx}\frac{\partial h}{\partial x}\right) + \left(\frac{\partial}{\partial y}K_{yy}\frac{\partial h}{\partial y}\right) + \left(\frac{\partial}{\partial z}K_{zz}\frac{\partial h}{\partial z}\right) + R = S_s\frac{\partial h}{\partial t} \quad (2.36)$$

Where K_{xx} , K_{yy} , K_{zz} , are principal components of hydraulic conductivity tensor in x, y, and z-directions respectively. R represents sources/sinks in the system and S_s the specific storage. This is also called the diffusion equation.

For many problems, the velocity distribution, and hence the hydraulic head distribution does not change with time (implying a steady-state) (Mercer & Faust, 1980). Many regional groundwater flow systems can be represented as steady-state boundary value problems.

Thus for the steady-state flow, $\frac{\partial h}{\partial t} = 0$. Hence, equation 2.36 becomes,

$$\left(\frac{\partial}{\partial x}K_{xx}\frac{\partial h}{\partial x}\right) + \left(\frac{\partial}{\partial y}K_{yy}\frac{\partial h}{\partial y}\right) + \left(\frac{\partial}{\partial z}K_{zz}\frac{\partial h}{\partial z}\right) = 0 \quad (2.37)$$

For a closed homogenous sources medium in which sources and sinks are negligible, equation 2.37 reduces to:

$$K_{xx}\frac{\partial^2 h}{\partial x^2} + K_{yy}\frac{\partial^2 h}{\partial y^2} + K_{zz}\frac{\partial^2 h}{\partial z^2} = 0 \quad (2.38)$$

For an isotropic medium, $K_{xx} = K_{yy} = K_{zz}$, thus equation 2.38 reduces to:

$$\frac{\partial^2 h}{\partial x^2} + \frac{\partial^2 h}{\partial y^2} + \frac{\partial^2 h}{\partial z^2} = 0 \quad (2.39)$$

Where there are sources of recharge, such as precipitation, the 3-D steady-state equation becomes:

$$\frac{\partial^2 h}{\partial x^2} + \frac{\partial^2 h}{\partial y^2} + \frac{\partial^2 h}{\partial z^2} = - \frac{R(x,y,z)}{T} \quad (2.40)$$

Where $R(x,y,z)$ is the volume of water added per unit time per unit aquifer area, and T is the transmissivity of the aquifer (i.e. hydraulic conductivity times the saturated thickness, Kb). Transmissivity is defined as the rate at which water can pass through the thickness of a saturated aquifer of unit width under a unit hydraulic gradient (Clark, 1988).

2.10 Resistivity Method

The aquifer parameters in this study are obtained using the Schlumberger arrangement of the resistivity method while the vulnerability assessment was ascertained using the DRASTIC and the GOD modelling methods.

Resistivity method that images the earth by measuring the potential generated after injecting DC electricity into the ground. The resulting geoelectric image shows the distribution of the earth's resistivity, which can be related to different soil and rock types. Telford et al., (1990) & Ward (1990) all provide excellent discussions on the theory and application of the resistivity method. A typical, four-electrode resistivity measurement consists of injecting current I_s into the ground at the current electrodes, A and B, and measuring the potential difference, ΔV , between the potential electrodes, M and N (see Figure 2.5). The relationship between the current and potential for a given electrode geometry is called the apparent resistivity, ρ_a , and is defined as the resistivity of a homogeneous half-space that would reproduce the measurement; the measurement is typically made over a non-homogeneous half-space (Telford et al., 1990; Ward, 1990). The apparent resistivity is calculated by:

$$\rho_a = \frac{\Delta V}{I_s} \frac{2\pi}{\left(\frac{1}{r_{AM}} - \frac{1}{r_{AN}}\right) - \left(\frac{1}{r_{BM}} - \frac{1}{r_{BN}}\right)} \quad (2.41)$$

Where the r_{AM} , r_{AN} , r_{BM} , r_{BN} are the distances between the A and M electrodes, A and N electrodes, B and M electrodes, and B and N electrodes, respectively. The second term of the equation is often referred to as 'K', the geometry factor for a given electrode geometry (Telford et al., 1990 refer to the geometry factor as p). The 'K' factor accounts for all

potential variations due to the locations of the electrodes over a homogeneous half-space and is strictly due to the electrode geometry.

$$K = \frac{2\pi}{\left(\frac{1}{r_{AM}} - \frac{1}{r_{AN}}\right) - \left(\frac{1}{r_{BM}} - \frac{1}{r_{BN}}\right)} \quad (2.42)$$

and

$$\rho_a = K \frac{\Delta V}{I_s} \quad (2.43)$$

Conductivity, σ , is the inverse of resistivity ($\sigma = \rho^{-1}$). Resistivity and conductivity are both commonly used in geoelectric investigations.

Figure 2.5 shows the distribution of current and potential beneath two current electrodes (A and B) over a homogeneous half-space. A pair of potential electrodes (M and N) is used to measure the change in electrical potential, and the apparent resistivity can be determined. By increasing the distance between the current electrodes, current flows in a larger volume of earth and the array effectively 'looks' deeper. In a homogeneous half-space, the observed apparent resistivity would not change as AB expands or contracts. But in a heterogeneous half-space (1D, 2D, or 3D), the apparent resistivity would change with different AB spacing's.

Any deviation from a homogeneous half-space will result in a current and potential distribution differing from that shown in Figure 2.5. A different potential distribution for a given current will result in a different drop-in electrical potential across MN, AV, and a different apparent resistivity will be observed.

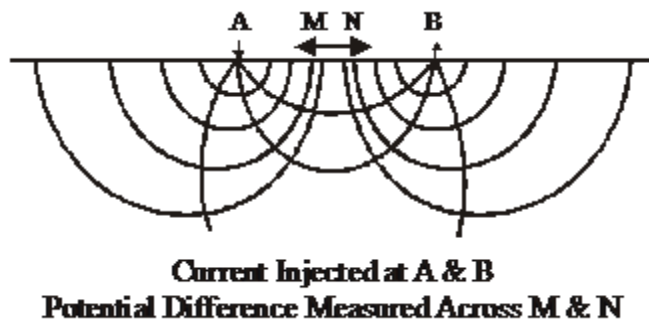


Figure 2.5: Current and Potential Distributions from Two Current Electrodes (A and B). Potential is measured at Electrodes at M and N

Thus we can detect resistivity changes in the earth by observing changes in the measured apparent resistivity at the surface. However, the change in current and potential distribution for a change in subsurface resistivity is a very complex phenomenon. Telford et al. (1990) and others describe the apparent resistivity over a layered, one-dimensional earth. Apparent resistivity over more complex earth models can be determined using a finite-difference (Dey & Morrison, 1979), or similar approach.

In the simplest sense, an apparent resistivity measurement is an 'average resistivity' of the volume of earth in which current is induced. By increasing the separation between the current electrodes, a larger volume extending to greater depths is investigated. The apparent resistivity is a complicated weighted average based on the non-linear distribution of current and potential beneath the electrodes in the presence of conductive or resistive anomalies. In general, however, the relationship between apparent resistivity and electrode spacing appears as a smooth, phase-shifted version of the relationship between true resistivity and depth (Zohdy, 1989).

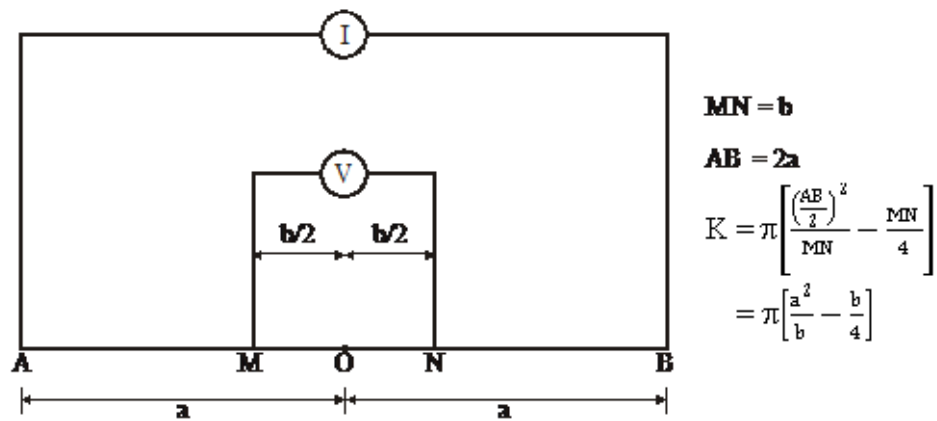
2.10.1 Common Array Types with K Parameters

While the current and potential electrodes can theoretically be placed anywhere, there are some common electrode geometries (or arrays) that are used in practice. The Wenner, Schlumberger, and dipole-dipole arrays are shown in figure 2.6. Each array has advantages and disadvantages and the appropriate array must be chosen for each specific investigation. Ward (1990) summarizes the arrays as follows:

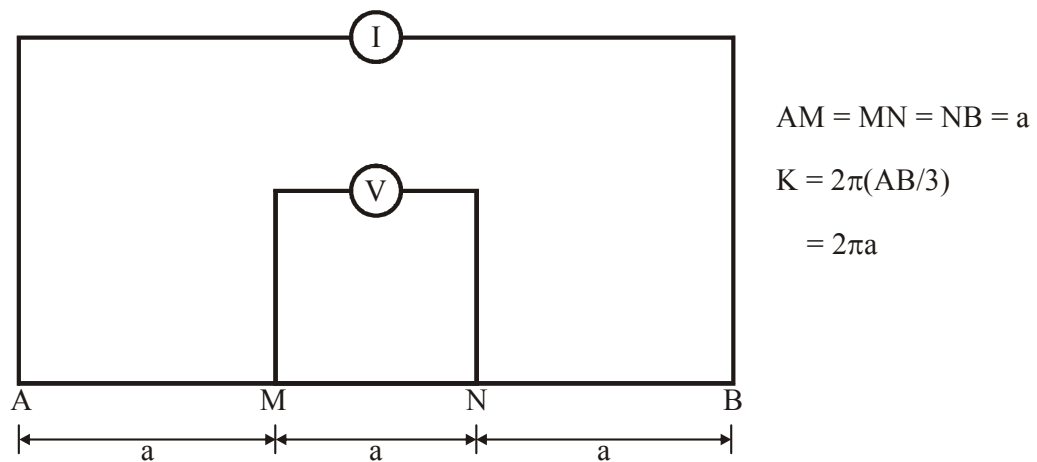
- (i) Wenner array – Excellent signal to noise ratio (S/N), excellent vertical resolution, poor lateral resolution, high EM coupling (poor for simultaneous IP survey).
- (ii) Schlumberger – Good S/N, excellent vertical resolution, poor lateral resolution, high EM coupling.
- (iii) Pole-dipole – Poor S/N, fair vertical resolution, good lateral resolution, low EM coupling.

- (iv) Dipole-dipole – Poor S/N, fair vertical resolution, good lateral resolution, low EM coupling.
- (v) Gradient – Excellent lateral resolution, but no sensitivity to depth.

Common Electrode Configurations



Schlumberger



Wenner

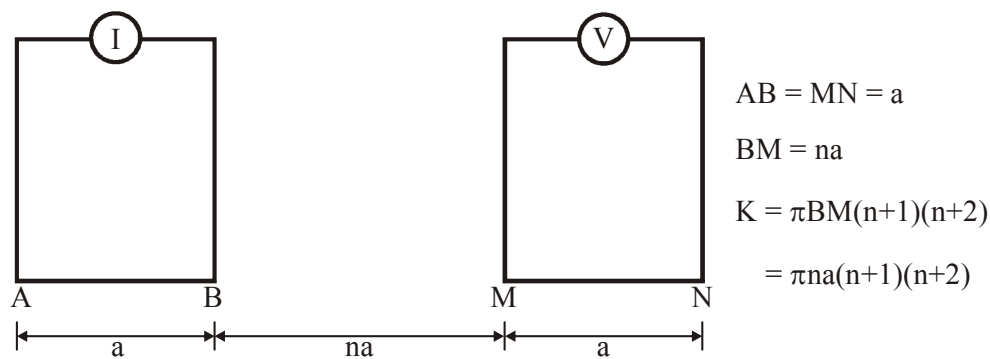


Figure.2.6: Common Electrode Arrays (Ward, 1990)

2.10.2 Dipole-Dipole

Pole-dipole and dipole-dipole arrays are popular when the resistivity survey is combined with an induced polarization (IP) survey (Telford et al., 1990; or Ward, 1990 for a discussion on IP). Wenner and Schlumberger arrays have better signal to noise ratios and have somewhat

better vertical resolution and might be more appropriate if IP is not to be conducted. The Schlumberger array is more efficient in the field than the Wenner array since the potential electrodes are not moved every time the current electrodes are moved.

The pole-pole array consists of one current electrode and one potential electrode located at a distance great enough from the survey site to approximate infinity. The separation of the remaining current and potential electrodes is changed to permit investigation to different depths. The K factor for a pole-pole array is $(2\pi DV)/I$, where D is the distance between the current and potential electrodes on site. The pole-pole array is very popular in 3D surveys where the electrodes are laid out in a 2D grid on the surface. Li & Oldenburg (1992)

There are commercial systems currently available that allow automated resistivity data collection. Many electrodes are placed in the ground and each electrode is connected to a computer-controlled switch box. Each switch box is connected to the resistivity instrument. The computer controller can specify which electrodes to inject current through and which electrodes to measure the potential across (i.e. how to combine the electrodes to provide the desired array). The resistivity data are collected for different electrode spacing centred at many locations along the survey line. This greatly increases the speed at which tomographic imaging data can be collected.

2.10.3 Sounding

Vertical electrical sounding (VES, or simply sounding) consists of measuring the apparent resistivity using various electrode separations about a central point. The VES curve (apparent resistivity vs. electrode separation) indicates the vertical change in earth resistivity. A one-dimensional earth consisting of laterally homogeneous layers of constant resistivity is assumed (Telford et al., 1990; Ward, 1990).

Wenner and Schlumberger arrays are commonly used in VES (Ward, 1990; Telford et al, 1990). The electrode spacing is typically increased six times per decade - i.e. six electrode spacing increase the spread by a factor of 10 (Ward, 1990). The electrode spacing is increased until the desired depth of investigation is reached. Roy & Apparao (1971) gave the approximate depth of investigation as $0.11 \cdot AB$ for a Wenner array and $0.125 \cdot AB$ for a Schlumberger array, but these depths can vary significantly due to local conditions. All four

electrodes are moved during a Wenner sounding since the inter-electrode distance is constant. That is $AM=MN=NB$ (see figure 2.6).

Only the two current electrodes are moved during a Schlumberger sounding (see figure 2.6). When the potential drop across the potential electrodes (M and N) drops below the detectable limits of the instrument, the potential electrodes are moved further apart. The apparent resistivity measurement is repeated with the new NM spacing. Since the apparent resistivity varies with MN, altering MN changes the apparent resistivity. This produces a 'clutch' in the sounding curve where there are two apparent resistivity for a given AB electrode spacing.

2.10.4 Profiling

In surveys where the horizontal resistivity variations are the primary concern, resistivity profiling is the preferred technique. In resistivity profiling, only one or two electrode spacing are used, but the entire array is moved across the site. Resistivity profiling can be used for detecting vertical structures and mapping overburden thickness. Keller & Frischknecht (1966) give a complete description of resistivity profiling.

2.10.5 1D/2D/3D

1D sounding works well when the assumption of laterally homogeneous layers of earth is approximately satisfied (Ward, 1990). But any lateral heterogeneities, especially at or near the surface, propagate into the deeper observations. Heterogeneities at the electrode locations will combine with any variability in electrode contact resistance to produce noise in the VES curve. This is potentially a serious problem since the electrodes will be moved often to provide sufficient depth coverage. Dipping layers also produce errors in VES analysis if the orientation of the array is normal to strike, especially if the expanding electrodes cross the outcrop of a dipping bed (Telford et al., 1990). VES provides a reasonable image of the earth if the layered earth assumption is reasonably met (Ward, 1990).

For cases where the 1D model of the earth is inappropriate, for example in geologically complex areas, or when the horizontal variation of the earth model is being investigated, a 2D model might be appropriate. Horizontal variation in resistivity along the survey line is determined in addition to the vertical variation of resistivity; it is assumed that the variation perpendicular to the survey line is negligible. Modelling of the apparent resistivity can

determine the effect of near-surface resistivity variation, and much of the effect of variable contact resistance will be accounted for as an incremental variation of the surface resistivity. 2D resistivity surveying should be done perpendicular to any geologic strike (Ward, 1990).

When the site is very complex geologically, strike of the geologic features is variable, geologic features of interest are limited in all horizontal directions, or a particularly complete geologic picture of the site is required, 3D resistivity must be employed (Dey & Morrison, 1979). However, the effort of collecting and modeling 3D resistivity is much greater than the effort required for a 2D survey.

2.10.6 Limitations of Resistivity

There are limits to the size and depth of a geoelectric feature that can be detected by surface resistivity observations.

First, the principle of equivalence describes the ambiguity in the resistivity and thickness of extremely resistive or conductive beds. It states that:

1. It is nearly impossible to distinguish between two models with a resistive intermediate layer if the thickness times the resistivity of the intermediate layer is the same.
2. It is also very difficult to distinguish between two models with a conductive intermediate layer if the thickness divided by the resistivity of the intermediate layer is the same (Telford et al., 1990). The only way to determine the true thickness of an extremely resistive or conductive bed is to use an electric log.

Secondly, the principle of suppression states that if a bed is very thin compared to the beds above and below, its effect on apparent resistivity observations is negligible unless its resistivity is very high or very low (Telford et al, 1990). These principles are equally valid for 2D and 3D observations.

These two principles – the principle of equivalence and the principle of suppression - mean that extreme geologic features can be detected, but not necessarily resolved, and subtle geologic features cannot be detected or resolved. Fortunately, many sites have resistivity contrasts that vary over only a few orders of magnitude so that equivalence is not an issue. In

cases where the resistivity varies enough that equivalence is an issue, detection of a target might be sufficient even if its exact size and resistivity cannot be resolved. Subtle resistivity contrasts become more and more difficult to detect with depth. Detection of subtle targets is limited to shallow investigations.

2.11 Electrical Properties of Rocks and Soils

Some earth materials, especially ore bodies, will conduct electricity by metal conduction, semi-conduction, or solid electrolytic conduction. However, the majority of earth materials at depths less than 15km have resistivities controlled by aqueous electrolytic conduction (Ward, 1990) due to the relatively high resistance of the rock/soil matrix relative to the resistance of the pore-water. Ward (1990) explains the electrical properties of earth materials in great detail. Ward (1990) describes the effects of soil and rock characteristics on resistivity. They are briefly stated as:

- (i) **Resistivity vs. Porosity:** The resistivity of a soil or rock is empirically related to its porosity by Archie's law, which states that the ratio of the bulk resistivity to pore-water resistivity is proportional to the inverse of the porosity raised to a constant ($\rho_r/\rho_w = F = a\phi^{-m}$). F is called the formation factor. This relationship only holds for clay-free rocks. The constants ' a ' and ' m ' are chosen empirically based on many material samples. Typical values of a are approximately 0.62 for sandstones and 1.87 for carbonates. Typical values of m are 2.15 for sandstones and one for carbonates. (Keller and Frischknecht, 1966).
- (ii) **Resistivity vs. Temperature:** An increase in temperature lowers the viscosity of the pore-water and increases the mobility of the pore-water ions. This reduces the resistivity of the material.
- (iii) **Resistivity vs. Texture:** The texture of a rock or soil, especially as viewed in a hand specimen influences its resistivity. Figure 2.7 shows some rock textures. Well sorted sand will have larger voids resulting in a lower resistivity. Poorly sorted sand will have smaller voids and a higher resistivity. Dissolution along fractures in limestone will increase the porosity and decrease the resistivity. Granitic rocks will typically have low porosity and high resistivity. Basalt can have many unconnected pore-spaces; porosity

is high, but resistivity is also high since there is no connected pore-water to conduct the current.

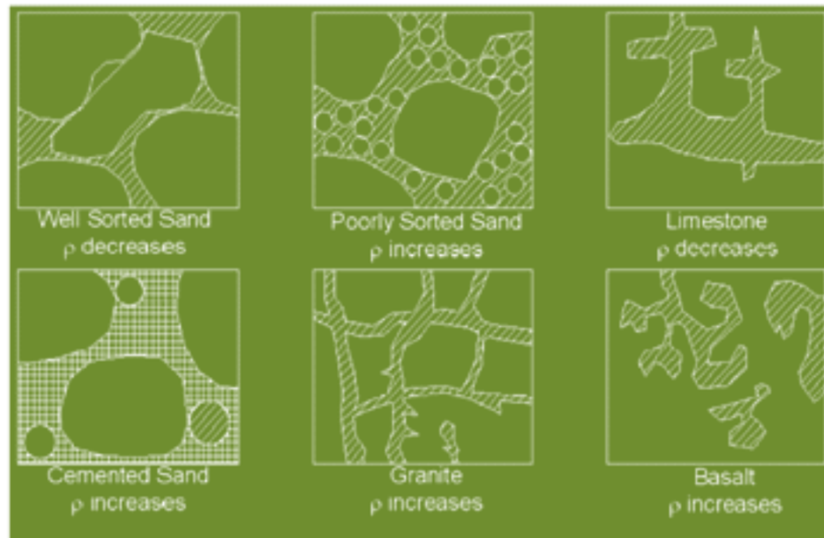


Figure 2.7: Resistivity Variations with Texture(Ward, 1990).

(iv) Resistivity vs. Geological Processes: Figure 2.8 shows the effect of geological processes on resistivity.

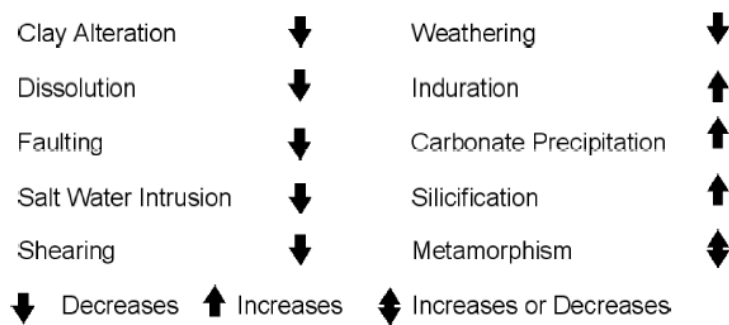


Figure.2.8: Resistivity Variations with Geologic Processes (Ward, 1990).

The above factors controlling the resistivity of an earth material assume the absence of clay. A clay particle acts as a distinct conducting pathway. This additional path is caused by the layer of exchange cations at the surface of a clay particle. Substitution within the crystal lattice and broken bonds at the crystal surfaces result in a negative charge on the surface of a clay particle (for electrolytes with $\text{pH} < 3$, this is no longer true). The generally negative

surface charge is balanced by a surplus of cations electrostatically attracted to the negative clay surface. Near the clay surface (within a few nm) electrostatic attraction is strong and a fixed layer is formed. At greater distances, thermal agitation overwhelms the electrostatic attraction and a diffuse layer of cations a few tens of nm is formed. The diffuse layer has an ion density that drops off exponentially with the distance from the surface of the clay particle. The ions in the diffuse layer are free to move under the influence of an electric field, and thus increase the availability of charge-carriers. This increases the surface conductivity (Ward, 1990; Hunter, 1993). To some extent, all silicates exhibit this behaviour, but it is more pronounced in clays.

The effect of the surface conductivity of clay (σ_s) on the bulk conductivity (σ_r) of a rock or soil is:

$$\sigma_r = \sigma_n + \sigma_s \quad (2.44)$$

Where σ_n is the normal, electrolytic conductivity which can be determined using Archie's law.

The 'true' formation factor, F_t for a clay-bearing material must be determined when the material is saturated with a very conductive pore-water so that the effect of surface conductivity is negligible. The resistivity of a rock or soil, σ_r , can now be written as (Ward, 1990 from Waxman & Smits, 1968):

$$\rho_r = \frac{\rho_w F_t}{1 + \rho_w B Q} \quad (2.45)$$

Where ρ_w , is the pore-water resistivity, B is a factor that relates the cation mobility in the pore-water salinity, and Q is the clay cation exchange capacity per unit volume.

Typically, the resistivity of a material will increase as the saturation decreases. This is shown empirically for clay-free materials by Archie's saturation law:

$$\rho_r = \frac{\rho_w a \phi^{-m}}{S_w^n} \quad (2.46)$$

Where S_w , is the percent water saturation and n is an empirical constant that is typically equal to two (Ward, 1990). For a material containing clay, the Simandoux equation (from Ward, 1990) can be used:

$$\frac{1}{\rho_r} = \frac{V_{cl}}{\rho_{cl}} S_w + \frac{\phi^m}{a \rho_w} S_w^2 \quad (2.47)$$

2.12 Aquifer Vulnerability Assessment

The definition of the term vulnerability is not unambiguous. First of all, vulnerability is often defined merely about water quality, though it may include aspects of water quantity. According to Vrba & Zoporozec (1994), one of the earliest definitions found in the literature is that of Albinet & Margat (1970) who stated that aquifer vulnerability is “the possibility of percolation and diffusion of contaminants from the ground surface into natural water table reservoirs under natural conditions”.

Many other attempts to define groundwater vulnerability have been made since then, some of which were presented at the first major conference within this topic, ‘International Conference on Vulnerability of Soil and Groundwater to Pollutants’, held in 1987 in the Netherlands. Vrba & Zoporozec (1994) give a good overview of these definitions in their ‘Guidebook on Mapping Groundwater Vulnerability’ including those provided by Bachmat & Collin (1987), Foster (1987) and the Committee on Techniques for Assessing Groundwater Vulnerability (1993), among others.

Vulnerability assessment of groundwater, as used in many methods, is not a characteristic that can be directly measured in the field. It is an idea based on the fundamental concept “that some land areas are more vulnerable to groundwater contamination than others” (Vrba and Zaporozec 1994). Nevertheless mapping the degree of groundwater vulnerability to contaminants, as a function of hydro-geological conditions, shows that effective protection provided by the natural environment may vary drastically from one place to another.

Often, the groundwater contamination level is determined by the natural attenuation processes, occurring within the zone located between the pollution source and the aquifer. Various natural, physical processes, and chemical reactions that operate in the soil, unsaturated, and saturated zones, may cause the

pollutant to change its physical state and chemical form. These changes may attenuate the degree of pollution or change the nature of the contamination. Especially in soil and the unsaturated zone, some mechanisms may affect the contaminant concentration much more than in the saturated zone. Chemical processes can be very complex and may work individually or in combination with other processes to provide varying attenuation degrees. These reactions depend on site-specific soil and aquifer characteristics as well as on the particular geochemical properties of each pollutant. Although the importance of these chemical reactions for attenuation of pollution is widely recognized and sometimes modeled, attenuation processes can be partially or completely bypassed depending on geochemical conditions in the aquifer and the infiltration conditions.

Pollution sensitive areas can be divided into three groups: naturally vulnerable areas, well-protection zones, and potential problem areas. Naturally vulnerable areas are more sensitive zones where the soils, subsoil, and bedrock do not provide adequate protection and the potential exists for rapid transfer of pollutants to groundwater. Areas of concern are, for example, the recharge zones of shallow aquifers. In the vicinity of pumping wells, each pollutant can potentially contaminate the pumped groundwater relatively quickly. In many countries, the methods for delineating well-protection zones are standardised using different criteria, based on the piezometric heads, on the advective transport time, on the advective-dispersion transport time or other parameters. Overlaying maps of the most vulnerable zones, with maps showing the location of each potential contamination sources or polluting land-use activities, generates the map of potential problem areas (risk maps).

The aquifer vulnerability concept mainly entails two particular notions: intrinsic vulnerability and specific vulnerability. European specialists of the COST Action 620 “vulnerability and risk mapping for the protection of carbonate (karst) aquifers”, agreed on the fact that intrinsic vulnerability is a “term used to define the vulnerability of groundwater to contaminants generated by human activities”, taking “account of the inherent geological, hydrological and hydro-geological

characteristics of an area”, but being “independent of the nature of contaminants”. On the contrary, specific vulnerability notion is used “to define the vulnerability of groundwater to a particular contaminant or group of contaminants”, taking “account of the contaminant properties and their relationship with the various components of intrinsic vulnerability”.

About groundwater protection, three main approaches can be distinguished in the assessment of groundwater vulnerability to contamination:

1. Vulnerability assessment considering only the soil and unsaturated zone without taking into account the transport processes within the saturated zone. In this case, the assessment is limited to the relative probability that troublesome concentrations of contaminants reach the saturated zone. Many classical vulnerability methods are based on this approach: the GOD method (Foster 1987) and the AVI method (Van Stempvoort et al., 1993) and others.
2. The approach based on delineation of protection zones for groundwater supply systems, where groundwater flow and contaminant transport processes within the saturated zone are considered to some extent (including dispersion transport as it is done in Walloon Region of Belgium, Derouane and Dassargues 1998).
3. An approach, targeting the soil and unsaturated zones as well as the aquifer medium.

Based on these different approaches, various methods of groundwater vulnerability assessment have been developed. They range from sophisticated numerical models simulating the physical, chemical and biological processes occurring in the subsurface, to techniques using weighting factors affecting vulnerability and also to statistical methods.

In this study, the DRASTIC, GOD (geologic methods) and the Integrated Electrical Conductivity IEC (geophysical Method) are used for groundwater vulnerability assessment. Most often they are based on overlay and index

techniques. The combination of maps with spatial distributions of specific attribute data (soil, geology, depth to water, etc.) leads to an assigned numerical index or score for each attribute. They are combined to produce a vulnerability score. Attempts are made to obtain values as quantitative as possible.

2.12.1 DRASTIC Point Count System Model

The drastic model is one of the most widely used groundwater vulnerability assessment methods, with applications in countries such as the United States (Rupert 2001), Sweden (Rosen 1994), Nigeria (Ibe et al., 1998) and Portugal (Lobo-Ferreira and Oliveira 1993), among many others.

The U.S. Environmental Protection Agency (EPA) in 1987, developed DRASTIC as a method for assessing groundwater pollution potential. This method considers the following seven parameters: depth to water, net recharge, aquifer media, soil media, topography, impact of the vadose zone, and hydraulic conductivity. Each mapped factor is classified either into ranges (for continuous variables) or into significant media types (for thematic data) which have an impact on pollution potential. The typical rating range is from 1 to 10. Weight factors are used for each parameter to balance and enhance their importance. The final vulnerability index (D_j) is a weighted sum of the seven parameters and can be computed using the formula:

$$D_j = \sum_{j=1}^7 (W_j \times R_j) \quad (2.48)$$

Where,

D_j = DRASTIC Index for a mapping unit

W_j = Weight factor for parameter j

R_j = Rating for parameter j

2.17.2 Hydrogeologic Factors

The hydro-geologic factors concerning the DRASTIC model are described below:

1. **Depth to Water (D):** The depth to water is the distance, in feet or meter, from the ground surface to the water table. It determines the depth of material through which a contaminant must travel before reaching the aquifer. Thus, the shallower the water depth, the more vulnerable the aquifer is to pollution.
2. **Net Recharge (R):** The primary source of recharge is precipitation, which infiltrates through the ground surface and percolates to the water table. Net recharge is the total quantity of water per unit area, in mm per year, which reaches the water table. Recharge is the principal vehicle for leaching and transporting contaminants to the water table. The recharge increases with the chance for contaminants to reach the water table. Recharge rates for the aquifers were usually derived from groundwater flow models and represent averages over large areas.
3. **Aquifer Media (A):** Aquifer media refers to the consolidated or unconsolidated rock that serves as an aquifer. The permeability and vulnerability of the aquifer are functions of grain size and fractures or openings within the aquifer. In unconsolidated aquifers, the rating is based on the sorting and amount of fine material within the aquifer. In consolidated aquifers, the rating is based on the amount of primary porosity and secondary porosity along fractures and bedding planes. Information on aquifer media was obtained from the resistivities of the aquifer materials.
4. **Soil Media (S):** Soil media is the upper weathered zone of the earth, which averages a depth of six feet (1.8 m) or less from the ground surface. Soil has a significant impact on the amount of recharge that can infiltrate into the ground. In general, the less the clay shrinks and swells and the smaller the grain size of the soil, the less likely contaminants will reach the water table. The general soil associations for an area were determined from the resistivities of the topsoils. The soil horizons were then evaluated to determine which will most significantly affect groundwater vulnerability, based on the texture and thickness of each layer. Soils in this study varied greatly from clay to sand.
5. **Topography (T):** Topography refers to the slope of the land surface. Topography helps control the likelihood that a pollutant will run off or remain long enough to infiltrate through the ground surface. Where slopes are low, there is little runoff, and the potential for pollution is greater. Conversely, where slopes are steep, runoff capacity is high and the potential for pollution to groundwater is lower.

6. **Impact of the Vadose Zone Media (I):** The vadose zone is the unsaturated zone above the water table. The texture of the vadose zone determines the time of travel of the contaminant through it. In surficial aquifers, the ratings for the vadose zone are generally the same as the aquifer media. Sometimes a lower rating is assigned if the aquifer media is overlain by a less permeable layer such as clay.
7. **Hydraulic Conductivity of the Aquifer (C):** Hydraulic conductivity refers to the rate at which water flows horizontally through an aquifer. As the conductivity of the aquifer increases, the vulnerability of the aquifer to contamination increases. Conductivity values for the aquifers were usually derived by calculating the hydraulic conductivities of the aquifer materials. Carbonate aquifers were rated lower than sand and sandstone aquifers.

The resulting DRASTIC index represents a relative measure of groundwater vulnerability. The vulnerability of the aquifer to contamination increases with the DRASTIC index. A site with a low DRASTIC index is not free from groundwater contamination, but it is less susceptible to contamination compared with the sites with high DRASTIC indices.

2.12.3 Ratings and Weights for the DRASTIC Parameters

Tables 2.3a to 2.3g show the weights and ratings assigned to the various DRASTIC parameters (Aller et al., 1987). Table 2.3h shows the qualitative risk categories of low, moderate, high and very high vulnerabilities, respectively (Aller, 1987, modified Piscopo, 2001).

Table 2.3a: Ratings and Weight Factor Assigned to Depth to Water Table

FACTOR WEIGHT =5	
DEPTH (m)	RATING
>50	1
45	2
40	3
35	4
30	5
25	6
20	7
15	8
10	9
5	10

Table 2.3b: Ratings and Weight Factor Assigned to Depth to Recharge

FACTOR WEIGHT = 4	
RECHARGE (mm)	RATING
0 – 100	1
100 – 200	2
200 – 300	3
300 – 400	4
400 – 500	5
500 – 600	6
600 – 700	7
700 – 800	8
800 – 900	9
>900	10

Table 2.3c: Ratings and Weight Factor Assigned to Aquifer Media

FACTOR WEIGHT = 3	
AQUIFER MATERIAL	RATING
SHALE	1
TILL	3
SILT	3
SCHIST	4
SANDSTONE	5
LIMESTONE	6
GREEN ROCKS	6
SAND	8
SAND AND GRAVEL	9
GRAVEL	10

Table 2.3d: Ratings and Weight Factor Assigned to Soil Media

FACTOR WEIGHT = 2	
SOIL TYPE	RATING
CLAY/ORGANIC SOIL	1
LOAMY CLAY	4
CLAYEY LOAM	5
LOAM	7
SANDY LOAM	8
LOAMY SAND	9
SAND/GRAVEL	10

Table 2.3e: Ratings and Weight Factor Assigned to Topography

FACTOR WEIGHT =1	
SLOPE	RATING
>18	1
16-18	2
14-16	3
12-14	4
10-12	5
8-10	6
6-8	7
4-6	8
2-4	9
0-2	10

Table 2.3f: Ratings and Weight Factor Assigned to Impact of the Vadose Zone

FACTOR WEIGHT = 5	
UNSATURATED MATERIAL	RATING
CLAY	1
SHALE	2
SILT	3
SCHIST	4
TILL	4
GREEN ROCKS	5
SANDSTONE	5
LIMESTONE	6
SAND	8
SAND AND GRAVEL	9
GRAVEL	10

Table 2.3g: Ratings and Weight Factor Assigned Hydraulic Conductivity

FACTOR WEIGHT = 3	
HYDRAULIC CONDUCTIVITY(gpd/ft²)	RATING
1-100	1
100-300	2
300-700	4
700-1000	6
1000-2000	8

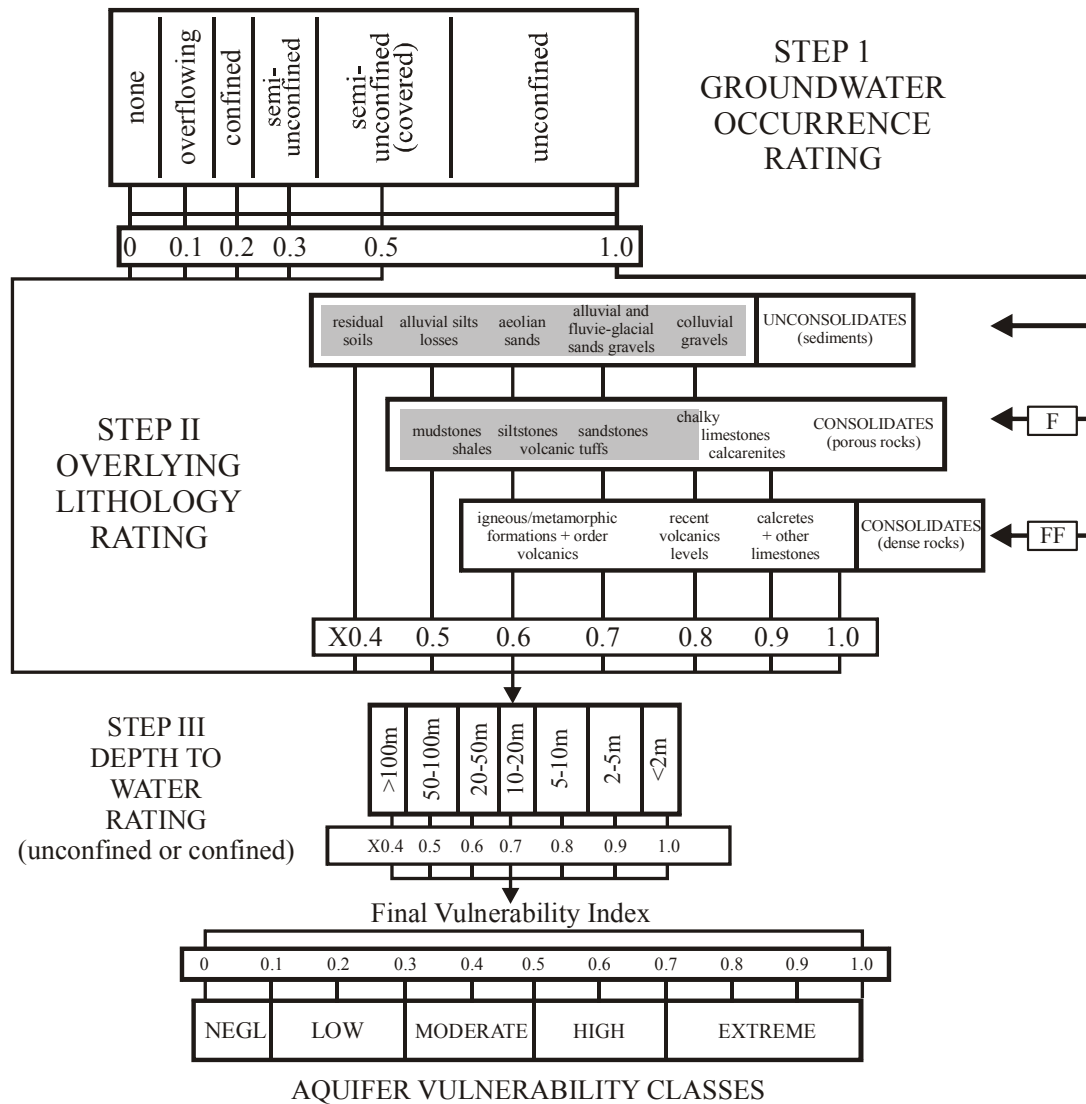
Table 2.3h: DRASTIC index ranges for qualitative risk categories (Aller, 1987; modified after Piscopo, 2001)

	DRASTIC Qualitative Category			
	LOW	MODERATE	HIGH	VERY HIGH
DRASTIC INDEX (DI)	1 – 100	101 – 140	141 – 200	>200

2.13 GOD Model

This method has a simple and pragmatic structure (Foster 1987). It is an empirical system for quick assessment of the aquifer vulnerability to pollution. Three main parameters are considered: the groundwater occurrence, the lithology of the overlying layers, and the depth to groundwater (in unconfined or confined conditions). The vulnerability index (Figure 2.13) is the result of the values assigned to these three parameters. Following the GOD flowchart, the area vulnerability index is computed by choosing first the rating of groundwater occurrence parameter and then multiplying by the overlying lithology rating as well as with the depth to water parameter rating. The overlying lithology parameter contributes to the vulnerability index only in the case of unconfined aquifers.

Because the parameters can only take values from 0 to 1, the computation result is usually a value less than the score assigned to each parameter. In the particular case where two parameters have a value equal to 1, the vulnerability index is equal to the score of the third parameter.



- (i) Degree of Consolidation AA
- (ii) Lithological Character A
- F Degree of Fissuring
- A Relative Attention Capacity

Figure. 2.9: The GOD Parameters Rating Method (After Foster, 1987)

2.14 Dar- Zarrouk Parameter

The apparent resistivity (ρ_a) function of current passed into the ground, measured by potential electrodes as potential difference (Voltage) is given as

$$\rho_a = \frac{\pi \left(\frac{AB}{2}\right)^2 - \left(\frac{MN}{2}\right)^2 \times R}{MN} \quad (2.49)$$

Where R is the resistance, AB and MN are current and potential electrodes respectively. A multilayer resistivity interpreted model consists of layer apparent resistivities, thickness and depth. Further derivatives are convolved to generate the geoelectric parameters. These show electric boundaries separating layers of different resistivities (Zohdy, *et al*, 1990).

A geoelectric layer is described by two fundamental parameters: its layer apparent resistivity (ρ_a) and its thickness (h). The geoelectric parameters derived based apparent resistivity and thickness, longitudinal conductance (S)

$$S = h/\rho_a \quad (2.50)$$

Where S is the longitudinal conductance, h is thickness and ρ_a is apparent resistivity of the aquiferous layer.

Transverse resistance (T)

$$T = h.\rho_a \quad (2.51)$$

Where T is the transverse resistance, h is thickness and ρ_a is apparent resistivity of the aquiferous layer. The parameters T and S were named the “Dar –Zarrouk Parameters “by Maillet (1947).

2.14.1 Longitudinal Conductance

The longitudinal conductance (S) is the geoelectric parameter used to define target areas of groundwater potential. High S values usually indicate relatively thick succession and should be accorded the highest priority in terms of groundwater potential.

2.14.2 Transverse Resistance

The transverse resistance (T) is one of the parameters used to define target areas of good groundwater potential. It has a direct relation with transmissivity and the highest T values reflect most likely the highest transmissivity values of the aquifers or aquiferous zones

2.15 Heigold Method

Heigold et al. (1979) combined Darcy's equation and Archie's equation to relate intrinsic permeability and porosity with limited success. However, Heigold et al., (1979) showed a negative relationship between hydraulic conductivity (K) and aquifer resistivity (ρ) in Niantic-Illiopolis aquifer, a Wisconsinan outwash deposit by meltwater from a glacier in Central Illinois.

$$(K = 386.4\rho^{-0.93283}) \quad (2.52)$$

The aquifer resistivity (ρ) is obtained using vertical electric sounding (VES). The device used for the vertical electric soundings (VES) is of the Wenner type. This method makes it possible to obtain, according to the depth, the apparent resistivity of a certain volume of ground (Ghosh, 1971, Banerjee et al., 1980). Field data are interpreted through the following steps:

- (a) Matching the field curve with the standard curves of the auxiliary method (Marsden, 1973),
- (b) Preparing an initial geoelectrical model (thicknesses and corresponding resistivities) for a limited number of layers depending on the geological background as well as the borehole information in the study area.
- (c) Entering the initial geoelectrical model into the geoelectric modelling package. Each VES was subjected to 1D-forward modelling, in which the iterative procedure was applied. Iterations were carried out to reach the best fit between the smoothed field curve and the calculated one.

2.16 Qualitative Analysis of Sounding Curves

Sounding curves obtained over a horizontally stratified medium is a function of the resistivities and thicknesses of the layers as well as the electrode configuration (Zohdy, 1976). The calculated apparent resistivity is plotted against the corresponding half the electrode separation ($AB/2$) to construct the VES curves.

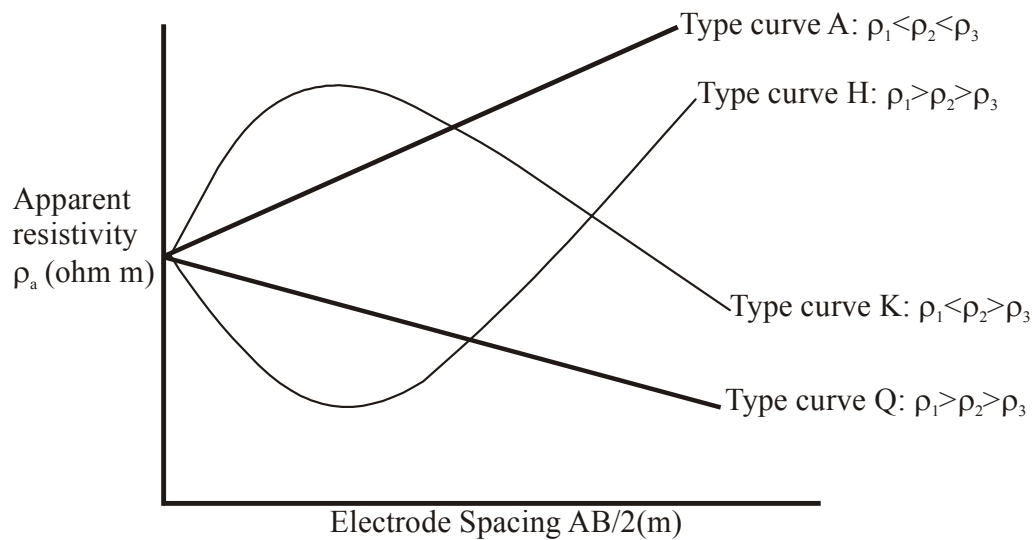


Figure 2.10: Schematic Diagram of Resistivity Type Curves for Layered Structures

The interpretation of the apparent resistivity curve began by the entering of a model represented by the apparent resistivity and thickness of each layer of the curve. Theoretical curve is drawn automatically with these two parameters as shown in figure 2.14 above. The theoretical curve may not match the field curve and other models are tried until the curves match.

Generally, the apparent resistivity curve for a three-layer structure has one or four typical shapes determined by the vertical sequences of the resistivity of the layers. Theoretically, these curves include, H-type, A-type, K-type and Q-type curves.

2.16.1 H-type Curve:

This curve shows the opposite effect of the K-type curve; it falls to a minimum, then increases again, due to an intermediate layer that is a better conductor than the top and bottom layers (Lowrie, 1997). The type curve is mainly found in two environments like

granitic to weathered layer or shale underlaid by gravel or sandstones. H-type curve is a type of basement area.

2.16.2 A-type Curve:

Here the apparent resistivity of the upper layer is the highest. In this curve type, the apparent resistivity generally increases continuously with increasing electrode separation, indicating that the true resistivity increases with depth from layer to layer. The environment is mainly granitic environment or in a culvert area. The apparent resistivity approaches to infinity (∞). It is the opposite of shale environment. A-type of curve is very common in dry deltaic planes.

2.16.3 K-type Curve:

This curve type rises to a maximum and then decreases, indicating that the intermediate layer has higher resistivity than the top and bottom layers. It is predominantly found in the environment of sedimentary basin like (Benin formation) and in alluvial sedimentary environment that ranges from topsoil to lateritic soil to sand and gravel. K-type curve is very common in deltaic non-wet areas.

2.16.4 Q-type Curve:

This curve type exhibit the opposite effect to A-type. It decreases continuously along with a progressive decrease of resistivity with depth. This characterizes a high conductivity with low resistivity unless there is an underlying layer. There is an increase in electrode separation but a decrease in resistivity. It is mainly found in shale environment. Q-type curve is common in salty areas.

2.16.5 Others:

In practice, curves of the single nature are rare. These include the multi-layer medium consisting more than 3 layers or a combination of the types of the listed curves above. They include HA, HK, AA, AK, KH, KQ, QH, AQ, HH, KK, etc.

2.17 Vertical Electrical Sounding Data Analysis

Quantitative interpretations of vertical electrical sounding data often lead to the generation of geoelectric layers. The information from these geo-electric layers enhances the identification and interpretation of layer parameters which includes aquifer depth, thickness, and frequency. These layer parameters thus obtained together with existing pumping test information in drilled wells were then used to calculate the longitudinal conductance (S) and the transverse resistance (T) distribution. The transverse resistance is the product of the aquifer apparent resistivity and aquifer thickness while the longitudinal conductance is the ratio of the aquifer thickness to the aquifer apparent resistivity. These parameters (Da-Zurrock Parameters) were further applied in the estimation of hydraulic conductivity and transmissivity of the aquifers in the study areas. In trying to establish the relationship between the Da-Zurrock parameters and the layer parameters from the VES interpretations, aquifer materials (prospective sand/sandstone units) above the identified water table in the area were not considered in the calculation as this often constitutes a high degree of error in the estimation of the hydraulic parameters.

In areas of similar geologic setting, the product $K\sigma$ (diagnostic parameter) remains fairly constant (Niswas and Singhal, 1981, Onuoha and Mbazi, 1988). Thus knowing K values for existing boreholes and σ values extracted from the sounding interpretation for the aquifer at borehole locations, it has been possible to determine transmissivity and its variations from place to place, including those areas without boreholes. Hydraulic conductivity and transmissivity of the aquifers within the study area were determined using the established relationships between aquifer hydraulic parameters and electrical resistivity sounding data.

In the analysis of data, the apparent resistivity which is not a physical constant and which reflects the distribution of resistivities in the subsurface is usually plotted against half current electrode spacing on log-log graph for each sounding station and then joining points (contours) of equal apparent resistivity, leading to the development of an *Iso-resistivity* map. If there is a close similarity among the contour maps, it indicates that near-surface inhomogeneity is not significantly present in the area (Onuoha & Mbazi, 1988).

Errors may manifest during the interpretation of resistivity field data which will greatly influence the shape of resistivity diagrams, thereby causing difficulties in interpretation. The

influence on the shape of resistivity diagrams is as a result of smaller spacing of current electrodes. It is therefore proper that before quantitative interpretation, the interpreter should have in his mind the kind of results being expected which I observed. The quantitative interpretation is a curve matching technique which is used to determine the thickness and depth of the formation as well as establish the apparent resistivity of the layers. The use of computer programs in interpretation is made possible by the introduction of these model parameters (thickness and resistivity). The result obtained from the computer is then compared with the observed curve which determines the acceptance or rejection of the model parameters depending on the degree of comparison. On the other hand, qualitative interpretation of resistivity field data includes; the study of the type of field curves, study of their real distribution on the map of the area, development of the apparent resistivity values for particular electrode spacing. Qualitative interpretation is performed before quantitative interpretation.

Borehole logs (electric logs and litho-logs within VES locations in the study area were used to correlate with the geoelectric sections of those locations. Also, geoelectric cross-sections along chosen profiles were interpreted.

2.18 Location, Geology and Hydrogeology of the Study Area

The Imo River Basin lies between Latitudes $4^{\circ} 38'N$ and $6^{\circ} 01'N$ and between Longitudes $6^{\circ} 53'E$ and $7^{\circ} 32'E$ and covers an area of about 9100 km^2 . The boundaries are defined by its surface drainage divides. There are two main sub-basins within the basin: The Oramirukwa-Otamiri sub-basin and the Aba River sub-basin. The estuary of the Imo River at the Atlantic Ocean forms the southern boundary. There are two prominent features at north-eastern and north-western boundaries; these are the Udi-Okigwe-Arochukwu and the Awka-Umuchu-Umuduru sedimentary cuestas, respectively (Uma, 1989).

The Imo River Basin is based on bedrock of a sequence of sedimentary rocks of about 5480 m thick and with ages ranging from Upper Cretaceous to Recent (Uma, 1986). The deposition of these sedimentary rocks is related to the opening of the South Atlantic Ocean and the formation of the rift-like Benue Trough of Nigeria in the Mesozoic (Schlumberger, 1985).

Generally, there are two different classes of formations underlying the Imo River Basin. About 80% of the basin consists in Coastal Plain Sand, which is composed of nonintegrated sediments represented by the Benin and Ogwashi-Asaba Formations, and alluvial deposits at the estuary at the Southern end of the Imo River Basin. The remaining 20% is underlain by a series of sedimentary rock units that get younger southwestward, a direction that is parallel to the regional dip of the formations.

The location, geologic and elevation maps of the study area is shown in Figures 2.11, 2.12 and 2.13 below respectively.

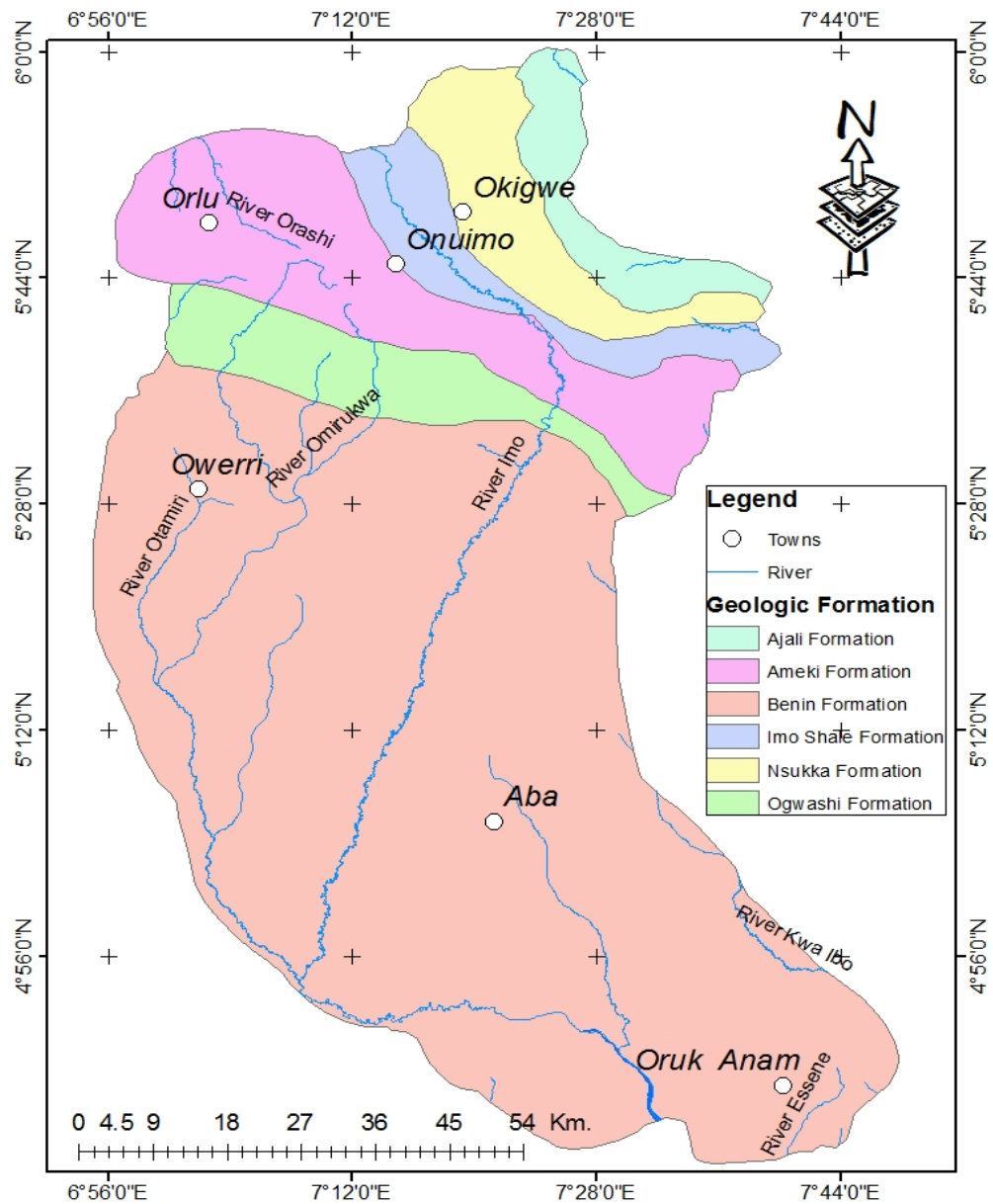


Figure 2.12: Geologic map of Imo River Basin (Modified by Uma, 1989)

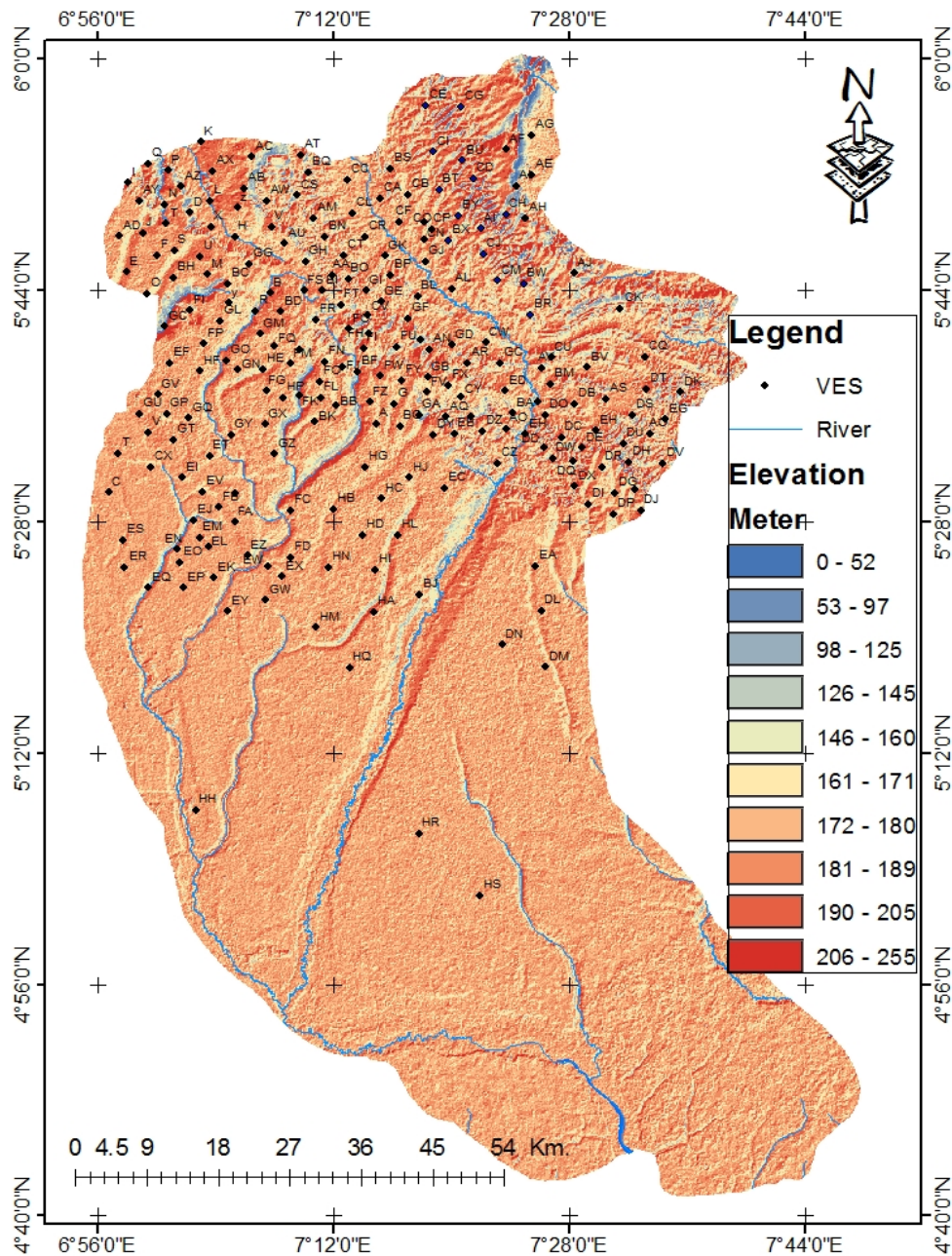


Figure 2.13: Digital Elevation Map of the Study Area (Modified by Uma, 1989)

The proper modelling of groundwater flow and subsurface transport requires assimilation of data on hydraulic parameters which are representative of scales that are relevant for the problem analyzed. Commonly used measurement and interpretation techniques are based on pumping tests. These typically provide equivalent or interpreted hydraulic parameters that are somehow integrated values within a given volume around the pumping and observation wells

(Sanchez-Vila et al., 2006). While most of these interpreted values can be used to estimate the average flow behaviour at some large scale; they can be of limited use for local-scale models, when a detailed characterization of spatial variability is needed. In particular, intermediate-scale models (*i.e.*, models involving horizontal length scales of the order of a few hundreds of meters) need a detailed knowledge of the architecture of the groundwater system together with the description of the small scale variability of parameters such as hydraulic conductivity, K , at scales ranging from the order of 10^{-1} to 100 m. In this context, Riva et al. (2008, 2010) showed that a detailed geostatistical characterization based on sedimentological data collected at the centimetre scale was essential to provide a proper stochastically based interpretation of the salient features of depth-averaged and multilevel breakthrough curves measured within an alluvial aquifer during a forced-gradient tracer test performed on a scale of about 50 m.

2.18.1 Ajali Sandstone

The Ajali Sandstone (Maestrichtian) is the oldest exposed geologic formation in the Imo River Basin. It outcrops along an NW-SE (2 to 4 Km wide) band at the northwestern margin of the basin. Ajali Sandstone has its type locality along the Valley of Ajali River near Enugu. This Sandstone was previously known as the False Bedded Sandstone (Uma, 1989). It consists of thick friable, poorly sorted sandstones typically whitish in colour but sometimes iron-stained; a marked banding of coarse and fine layers is displayed (Uma, 1989). The sand grains and larger fragments are sub-angular with a sparse cement of white clay. Large-scale, cross-bedding is characteristic of this formation. Thin bands of white mudstone and shale occur at intervals and increasing number towards the base.

The Ajalli Formation is often overlain by a considerable thickness of red-earth which consists of red earthy sands, formed by the weathering and ferruginisation of the formation (Uma, 1989). On the Udi Plateau, the red earth may be as much as thirty metres thick. At the north of the Oji River, the higher slopes of the Enugu escarpment are underlain by the Ajalli Formation with an average thickness of about 450 meters (Uma, 1989). Good exposures of the sandstones occur in the deep gullies incised along the higher slopes of the scarp. The main lithologic units include sand, sandstone, clays, etc. The Ajali Sandstone is good for groundwater exploitation.

2.18.2 Nsukka Formation

The Nsukka Formation conformably overlies the Ajali Sandstone and occupies a relatively broader stretch of land west of the area. The average dip is 6° southwestward but may decrease to about 1° to 2° especially in areas north of the Imo Basin (Uma, 1989). Nsukka Formation was formerly known as the Upper Coal measures (Tattam, 1944; Simpson, 1948). The new name was formalized by Reyment (1964, 1965). The lithology consists of alternating sequences of sandstone, dark shale with thin coal seams at various horizons. The Nsukka Formation is said to rest conformably on the Ajalli Sandstone (Reyment, 1965). The microfossils identified from the Nsukka Formation are *Afrobolivina* *Afra*, *Bulimina*, etc. (Reyment, 1969). The formation ranges from the Maestrichtian to probably lower Paleocene. Lithologically, the Nsukka Formation consists of alternating sequences of sandstone, dark shale, sand, and thin coal seams. The groundwater is freshwater. The wells in this formation are usually deep with fresh groundwater (Uma, 1989).

2.18.3 Imo Shale Formation

The Imo Shale overlies the Nsukka Formation. This Formation was previously known as Imo Rivers Shales (Tattam, 1944), Imo Anambra (Tattam, 1944) and Imo Clay-shales (Grove 1951, Simpson 1955, Reyment & Barber, 1956). It was formalized by Reyment (1956). The Imo Shale consists of well-laminated clayey shales with a grey to light green colour, fine-textured, dark grey to bluish-grey with occasional admixture of clay ironstone and thin sandstone bands. The shales contain occasional intercalations of thin bands of calcareous sandstones, marls and limestones. The type area is along the Imo River, between Umuahia and Okigwe in Southeastern Nigeria where it attains a thickness of about 500 metres (Simpson, 1954; Wilson & Bain 1928). It rests conformably on the Nsukka Formation. The Imo Formation continues laterally into Western Nigeria and Dahomey (now Benin Republic). Local conditions in the latter areas temporarily favoured the deposition of biogenic limestones of the Ewekoro Formation which extends from South-Western Nigeria into Dahomey (Jones & Hockey, 1964).

The subsurface Akata Formation described by Short and Stauble (1967) is a down-dip continuation of the outcropping Imo Shale. In Southeastern Nigeria, the Imo Formation shows lateral variation into sandstones in places. The lateral equivalents of the formation are

the Igbabu Sandstone, Ebenebe Sandstone and Umunna Sandstone (Reyment, 1965). The Imo Formation is of Paleocene age and is characterized by *Eponides Elevatus* (Plummer), *Frondicularia Phosphatica*, Russo, etc.(Reyment, 1965). Lithologically, the Imo Shale is composed mainly of shales and clay. However, in some places, sandstones and limestones may be present. The formation is not good for groundwater exploitation except in places with sandstone intercalations

2.18.4 Ameki Formation

The Lithologic units of the Ameki Formation fall into two general groups (Reyment, 1965; Whiteman, 1982 & Arua, 1986); the upper grey-green sandstones and sandy clay and a lower fine to coarse sandstones, with intercalations of calcareous shales and thin shelly limestones. This formation extends westwards into Benin Republic and Togo (Antolini, 1968). In southeastern Nigeria, the formation displays rapid lateral facies changes and may locally show shaly inclusions of white and mottled claystone. Amber carbonaceous plant remains or rarely lignified wood may be present (Wilson & Bain, 1928). The Nanka sand is a lateral equivalent of the Ameki Formation. The type locality of the sand is Nanka where gully erosion has carved the landscape into beautiful geomorphic scenery. The 3,350 meters thick subsurface marine sequence of alternating sandstones and shales described by Short and Stauble (1967) and named by them as the Agbada Formation are down-dip continuation of the outcropping Ameki and Ogwasi Asaba Formations. In southwestern Nigeria however, Ameki sediments form a thin veneer above the phosphate-bearing beds of the Oshosun Formation (Adegoke, 1969). Generally, the Ameki Formation has a series of highly fossiliferous greyish-green sandy-clay with calcareous concretions and white clayey sandstones. The thickness may attain as much as 1,400 metres in places (Reyment, 1965). This Formation is divisible into two lithologic units; Upper and Lower Ameki.

The upper beds of the Ameki Formation contain coarse-grained, cross-bedded sandstone, bands of fine, grey-green sandstone and sandy clay. It is sandier than the lower Ameki. However, the lower beds consist of massive dark grey to brownish sandy mudstone, fine to coarse-grained sandstones, intercalations of calcareous shale and thin shelly limestone. Shales are more prominent in the lower Ameki section. The lithologic units are made up of sands, sandy shales, mudstone, clayey sandstone, argillaceous sandstone with thin limestone

bands, calcareous shale, thin shelly limestone and clay stones. The formation is good for groundwater exploitation.

2.18.5 The Ogwashi/Asaba Formation

The Ogwashi/Asaba Formation (Oligocene to Miocene) is generally made up of clays, sands, grits and seams of lignite, alternating with gritty clay (Dessanvague, 1974).

2.18.6 Benin Formation

The Benin Formation is the youngest formation in the Imo River Basin. Lithologically, the formation is dominated by sands and minor intercalation of clays. It is mostly coarse-grained, pebbly, poorly sorted and contains pods and lenses of fine-grained sands, sandy clays and clays (Whiteman, 1982; Uma & Egboka, 1985). The formation is in part cross-stratified and the fore-set beds alternate between coarse and fine-grained sands. Petrographic study on several thin sections (Onyeagocha, 1980) shows that quartz makes up more than 95% of all grains, but Asseez (1975) & Avbovbo (1978) indicated a possible presence of more percentage of other skeletal materials including feldspar. The formation is a prolific aquifer with a porosity value ranging from 10-40% and permeability of 1-2 Darcy (Onyeagocha, 1980).

CHAPTER III

MATERIALS AND METHODS

3.1 Materials

The materials used in this work are categorized into the geophysical and geological materials as described below.

The materials utilized for the geophysical survey include:

- (i) Resistivity meter (Terrameter SAS 4000)
- (i) A power source (12.5 volts battery)
- (ii) Four treated stainless steel electrodes
- (iii) Four reels of cable (2 current of 500m length, and 2 potentials of 300m length)
- (iv) Three hammers
- (v) Clips
- (vi) Tapes and plugs
- (vii) Forty wooden pegs to facilitate the mapping of the area
- (viii) Umbrella (giant size) for improvising shade to the Terrameter
- (ix) Calculator
- (x) (K) log-log graph.

The four metal stakes used as electrodes are treated stainless steel. They are about 0.7m long and have pointed ends for easy penetration into the earth. Four clips are used to hold the uncoated cable ends to the electrodes for contact. For good contacts with the earth and to eliminate resistance at the electrodes, non-polarization electrodes were used for this work.

However, the ABEM Terrameter is capable of compensating the effect of polarization automatically.

The wooden pegs were used to mark out half current electrode spacing ($AB/2$) for both sides of the sounding point. The giant size umbrella was used to provide shade to the Terrameter to avoid direct sun heating. Other accessories include GPS, cell phone, compasses, recording sheets, tracing papers, maps (geological and topographic map).

Similarly, the geological material used for sieve analysis include:

- (i) Hydrometer
- (ii) Glass measuring cylinder
- (iii) Thermometer
- (iv) Water bath
- (v) Stirring apparatus
- (vi) I.S Sieve apparatus
- (vii) Weighing balance
- (viii) Oven
- (ix) Stopwatch
- (x) Thick funnel
- (xi) Filter flask
- (xii) Measuring cylinder
- (xiii) Wash bottle
- (xiv) Filter paper
- (xv) Evaporation dish

Representative weighed samples of each of the twenty (20) samples were poured into the top sieve which has the largest screen openings. Each lower sieve in the column has smaller openings than the one above. At the base is a round pan, called the receiver.

The column is typically placed in an Electronic shaker. The shaker shakes the column, usually for 15 minutes. After the shaking was completed, the material on each sieve was weighed. The mass of the sample of each sieve is then divided by the total mass to give a

percentage retained on each sieve. The size of the average particle on each sieve is then analyzed to get a cut-off point or specific size range.

The results are presented in a semi-log graph of percent passing versus the sieve size. The results of this test are used to estimate the hydraulic conductivities using empirical formulae.

3.2 Methods

The figure 3.1 below is a flow chart showing clearly, the various methods and techniques used in this work.

3.2.1 Estimation of the aquifer layer and geometrical parameters

The ABEM SAS 4000 model was used. Signal Averaging System (SAS) is a system whereby a series of readings are taken automatically and the results are averaged continuously.

The Terameter SAS 4000 can operate in two modes. First, in the resistivity survey mode, it comprises of a battery powering deep penetration resistivity meter with an output sufficient for a current electrode separation of 2000meters under good surveying conditions. Secondly in the voltage measuring mode, the SAS 4000 comprises of a self-potential instrument that measures natural DC potentials. The result is displayed in Volts (V) or millivolts (mV). The overall range extends from 0.01mV to 500V.

The transmitter, receiver and microprocessor which are the three main units of the Terameter SAS 4000 are all housed in a single casing. The electrically insulated transmitter sends in well defined and regulated signal currents. The receiver discriminates noise and measures voltage correlated with transmitted signal current and also measures uncorrelated DC potential with the same discrimination and noise rejection. The microprocessor monitors and controls operation and calculates the final resistivity result of interest. The equipment permits natural or induced signal to be measured at extremely low levels with excellent penetration and low power consumption. Moreover, it can be used in a wide variety of application where effective signal/noise discrimination is needed.

The developments of multi-electrode resistivity equipment and data acquisition technique have made electrical resistivity imaging a standard tool in near-surface geophysical surveys. Electrical resistivity is measured in Ωm (ohm·m) and represented by ρ . This physical property represents the difficulty in passing an electric current through a volume of materials with a given length and cross-sectional area as expressed below:

$$\rho = \frac{RA}{L} \quad (3.1)$$

where ρ is the resistivity, R is the electrical resistance, A is the cross-sectional area, and L is the length.

The resistivity of a volume of material can be calculated by multiplying the electrical resistance with the cross-sectional area and divided by the length. The electrical imaging system is normally carried out with a multi-electrode resistivity meter system.

3.2.2 Hydrogeophysical interpretation of the area

The Schlumberger configuration was used in the resistivity survey. The ABEM Terrameter SAS 4000 was used to obtain VES data from the field. SAS stands for Signal Averaging System – a method whereby consecutive readings are taken automatically and the results are averaged continuously. The ABEM Terrameter SAS 4000 delivers high voltages and currents. In the resistivity surveying mode, the Terrameter SAS 4000 operates with a battery-powered, deep-penetration resistivity meter with an output sufficient for a current electrode separation of 2000 meters under good surveying conditions. A maximum current electrode separation of 1000m was used in this research. The SAS 4000 is equipped with a PC – compatible microcomputer and controlled by four knobs, and the results of measurements and calculations are digitally displayed on a liquid crystal display on its panel. The program allows the user to specify the measuring parameters in detail. A total of 569 VES data set were obtained in the various locations. Modeling of VES results was done using the RESIST software, which is an iterative inversion modeling program. Analysis of the resulting apparent resistivity versus the half-current electrode separations yielded layered earth models composed of individual layers of specified thickness and apparent resistivity. The VES results were further processed with the Arch-View 3.2a GIS software to obtain Iso-Resistivity maps at different levels of sounding at the various points.

3.2.3 Hydrostratigraphical interpretation of the study area

In an attempt to demonstrate the hydrostratigraphical interpretation of the study area, five (5) of the Vertical Electrical Sounding (VES) points across the study area with existing electric and lithology data are presented for correlation purposes as shown in chapter four.

3.2.4 Estimation of aquifer vulnerability using geologic methods (DRASTIC, GOD).

The acronym DRASTIC corresponds to the initials of the seven parameters used in the model which are: Depth to water; Net Recharge; Aquifer media; Soil media; Topography; Impact of the vadose zone and Hydraulic Conductivity. The significant media types of each of these

parameters are assigned a subjective rating varying from 1 to 10, based on their relative effect on the aquifer vulnerability. Every parameter in the model has a fixed weight multiplier indicating the relative influence of the parameter to contaminant transport. The final DRASTIC index (D_i) is the weighted sum overlay of the seven parameters using the following equation:

$$D_i = D_r D_w + R_r R_w + A_r A_w + S_r S_w + T_r T_w + I_r I_w + C_r C_w \quad (3.2)$$

Where D, R, A, S, T, I, C are the seven parameters, and the subscripts r and w are the corresponding ratings and weights respectively. The parameter D, represents the depth to the water table. The depth to water level used in this work was estimated from information from pumping test data, well logs and VES data. The Net Recharge(R) represents the amount of water per unit area that penetrates the ground surface and percolates down to the water table. The Net Recharge is as a rule of thumb taken as 12% of the average annual rainfall. The parameter A represents the Aquifer media while S connotes the Soil media. The topography (T) refers to the slope or steepness of the land surface. It dictates whether the runoff will remain on the surface to allow contaminant percolation to the saturated zone or not. Flat areas are therefore assigned higher rates because the runoff tends to be less. The study area was found to be relatively flat with a slope ranging from 0-2%. The impact of the vadose zone (I) refers to the part of the earth surface found between the aquifer and the soil cover in which pores and joints are unsaturated or partially saturated. The influence of the Vadose zone on aquifer vulnerability depends on its permeability and the attenuation characteristics of the media. Finally, the hydraulic conductivity is the ability of the aquifer to transmit water. An aquifer with high hydraulic conductivity will be more vulnerable to contamination as a contaminant plume will easily pass through the aquifer.

3.2.5 Estimation of aquifer vulnerability using geophysical methods (IEC)

Kirsch et al. (2003) demonstrated that the protection degree of an aquifer or vulnerability may be considered directly proportional to the longitudinal conductance (S) of the overburden materials. This means that the higher the longitudinal conductance of overburden, the higher the degree of aquifer protection and vice versa. Aquifer vulnerability by electrical parameters can, therefore, be expressed as

$$IEC = \sum_i \sigma_i h_i \quad (3.3)$$

Where IEC = Integrated electrical conductivity, h_i = i th layer thickness and σ = i th layer electrical conductivity or reciprocal of resistivity

3.2.6 Estimation of aquifer hydraulic parameters from grain-size data

Hydraulic conductivity (K) can be estimated by particle size analysis of the sediment of interest, using empirical equations relating either K to some size property of the sediment. Vukovic and Soro (1992) summarized several empirical methods presented a general formula:

$$K = (g/v) \cdot C \cdot f(n) \cdot d_e^2 \quad (3.4)$$

Where K = hydraulic conductivity; g = acceleration due to gravity;

v = kinematic viscosity; C = sorting coefficient; $f(n)$ = porosity function, and d_e = effective grain diameter.

3.2.7 Estimate aquifer hydraulic parameters from geophysical data

The intuitive relationship between aquifer hydraulic conductivity and the Dar-Zarrouk parameters namely, Transverse Resistance (R), Longitudinal Conductance (C) has been derived analytically from a combination of Darcy's Law and Ohm's Law by Niwas & Singhal (1981) who established the following relationships:

$$R = h \rho = h / \sigma \quad (3.5)$$

$$C = h / \rho = h \sigma \quad (3.6)$$

$$T = K \sigma R, \text{ where } T \text{ is the aquifer transmissivity} \quad (3.7)$$

and

$$T = \frac{KC}{\sigma} \quad (3.8)$$

where h and ρ are the thickness and resistivity of individual aquifer layers in meters and ohmmeters respectively. In areas of similar geologic setting and water quality, the product

$K\sigma$ remains fairly constant. Thus as shown by Ekwe et al (2006) for some Imo River Basin aquifers and Ajali Sandstone respectively, if hydraulic conductivity K values are known from specific well locations, possibly from pump tests and σ values are obtained from electrical sounding interpretations, transmissivity and its area-wide spatial variation may be estimated from the relationships and extrapolated into areas where K values are not available. These relationships have been employed in this study to derive area-wide transmissivity and hydraulic conductivity values for the area.

3.2.8 Comparative analysis of model and techniques used for aquifer hydraulic characteristic and vulnerability estimations.

The techniques and models for estimating aquifer hydraulic characteristics and vulnerability are classified into geophysical and geological models.

The geophysical model includes the following: Niwas and Singhals (1981), Heigold et al (1979) and the proposed new Model which will be compared to the acquired pumping test data in the study area. In terms of vulnerability, the Integrated Electrical Conductivity (IEC) was used, which takes into accounts the aquifer thickness and conductivity of the overburden.

The geological approach of estimating aquifer hydraulic conductivity was achieved by using the Sieve analysis of the twenty (20) aquifer samples collected across the study area. This was done using five empirical formulae such as Kozeny –Carman, Hazen, Brayer, Slitcher and USBR. On the other hand, aquifer vulnerability will be estimated geologically using DRASTIC and GOD models.

3.2.9 Validation and optimization of results of the models using artificial neural network (ANN)

The results of aquifer hydraulic conductivity estimated from grain size analysis were optimized and validated using Artificial Neural Network (ANN) concerning the acquired pumping test data

3.3 Geophysical Data Acquisition

A total of 569 vertical electrical soundings (VES) were used, out of which 20 VES data were primary (parametric sounding) acquired close to the monitoring wells in the study area using the Schlumberger electrode configuration and a maximum electrode spacing of 1000m. Four stainless non-polarizable electrodes were used, two current electrodes and two potential electrodes. A freshly charged 12V dc supply was used to supply current. The current electrode spacing was increased symmetrically about the station point, keeping the potential electrode constant until it became necessary to increase the potential electrode as the recorded signal diminished.

Garmin GPS 72 was used in determining the coordinates in longitude and latitude and elevation height above mean sea level of the locations of sounding points. The injected current developed a ground potential difference whose voltage was determined using the potential electrodes which were kept in line with the pair of current electrodes.

The observed field data which is the ratio of the resulting voltage to the imposed current is only a measure of resistance of the subsurface (ground resistance). This is read off directly from the tetrameter and is used to compute the corresponding apparent resistivity in Ωm by multiplying with the geometric factor ‘values as functions of electrode spacing’, which then gives the required apparent resistivity results as functions of depths of individual layers:

$$\rho_a = \pi R \left[\frac{a^2}{b} - \frac{b}{4} \right] \quad (3.10)$$

Where

ρ_a = apparent resistivity

R = resistance in ohm

$a = AB/2$ = half current electrode spacing (m)

$b = MN$ = potential electrode spacing (m)

$$\pi \left[\frac{a^2}{b} - \frac{b}{4} \right] = \text{geometric factor } (K)$$

The apparent resistivity values computed were plotted against half of the current electrode spacing ($AB/2$) on a log-log graph scale. The sounding curves obtained were subjected to conventional partial curve matching using the Rijks Waterstaat (1988) master curves to obtain the initial model parameters (resistivity and thickness) of the various geoelectric layers.

A useful approximation is that the depth of the interface is equal to two thirds ($2/3$) of the electrode spacing at which the point of inflexion occurs (Vingoe, 1972). This approximation has found useful applications in computer iterative modelling. Parameters such as apparent resistivity and thickness obtained from both partial curve matching were used as input data for computer iterative modelling (Zohdy, 1976; Koefoed, 1977). Detailed quantitative interpretation was done using the OFFIX 3.1 software.

3.4 Geological Data Acquisition

Twenty (20) different representative samples were collected as drill cuttings from boreholes during a borehole drilling project aimed at establishing the geological profile of an aquifer system. Samples from the cuttings were collected in containers and taken to the Geology laboratory, Federal University of Technology Owerri, Nigeria (FUTO) for further analysis. Detailed grain-size analysis was carried out on the samples in accordance with the standard procedures of BS1377. The grain-size diameters d_{10} , d_{20} , d_{30} , d_{50} and d_{60} were read off from the grain-size distribution curves. The statistical grain-size methods were employed to determine the hydraulic conductivity values.

CHAPTER IV

RESULTS AND DISCUSSION

4.1 Results Presentation

4.1.1 Geophysical Field Data Results

The configuration of the curve for each electrical resistivity sounding gave an understanding of the character of the beds or layers between the surface and the maximum depth of penetration. This is because the configuration of a VES curve is a function of the number of layers in the subsurface, the thickness of each layer, and the ratio of the resistivity of the layers.

Qualitative curve interpretation of the resistivity curves revealed several curve types which ranged from A, AH, AHA, AK, AKH, HKA, KHA etc with the dominant curve type identified as the AKH. The various curve types which reflect facies or lithological variations in the study area and their percentage of occurrence are shown in figure 4.1& Table 4.1.

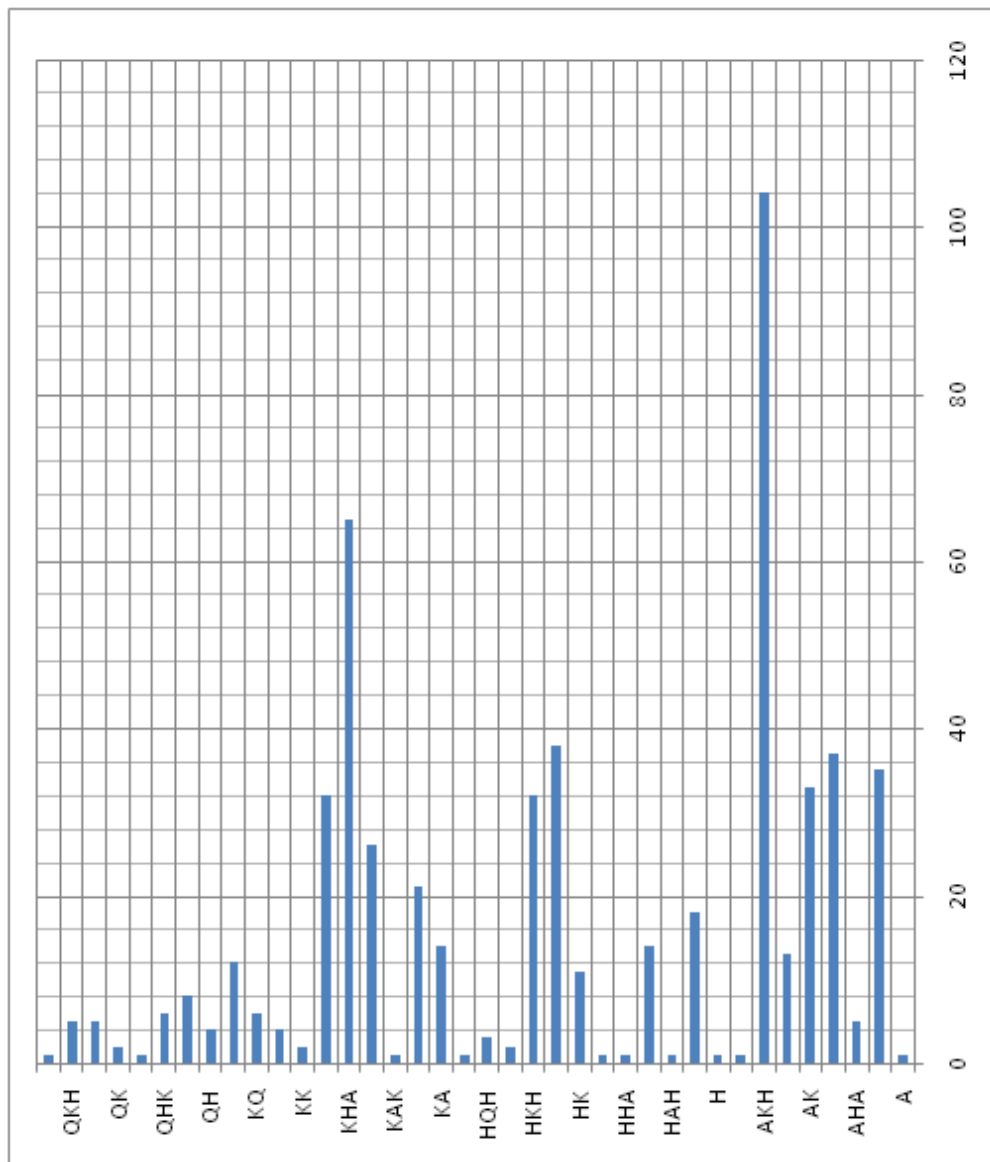


Figure 4.1: Bar Chart showing various curve types in the study area.

Table 4.1 Statistical representation of curve type in the study area

S/N	Curve Type	Frequency	Percentage (%)
1	A	1	0.17574692
2	AH	35	6.15114236
3	AHA	5	0.87873462
4	AHK	37	6.5026362
5	AK	33	5.79964851
6	AKA	13	2.28471002
7	AKH	104	18.2776801
8	AQ	1	0.17574692
9	H	1	0.17574692
10	HA	18	3.16344464
11	HAH	1	0.17574692
12	HAK	14	2.46045694
13	HHA	1	0.17574692
14	HHQ	1	0.17574692
15	HK	11	1.93321617
16	HKA	38	6.67838313
17	HKH	32	5.62390158
18	HQ	2	0.35149385
19	HQH	3	0.52724077
20	K	1	0.17574692
21	KA	14	2.46045694
22	KAH	21	3.69068541

23	KAK	1	0.17574692
24	KH	26	4.56942004
25	KHA	65	11.4235501
26	KHK	32	5.62390158
27	KK	2	0.35149385
28	KKH	4	0.7029877
29	KQ	6	1.05448155
30	KQK	12	2.10896309
31	QH	4	0.7029877
32	QHA	8	1.4059754
33	QHK	6	1.05448155
34	QJK	1	0.17574692
35	QK	2	0.35149385
36	QKA	5	0.87873462
37	QKH	5	0.87873462
38	QKK	1	0.17574692

The AKH-type curves are the most prevailing in the study area representing about 18.28% of the total number of curve types. This is followed by the KHA-type (11.42%). The overall signature of the curves intimate and evoke alternating sequences of resistive-conductive layers.

4.1.2 Estimation of the aquifer layer and geometrical parameters.

Resistivity across the study area has been estimated from geoelectric section generated from the sounding results. The eastern axis, and some parts in the southern flank of the study area represented by green colour appear to have resistivity values ranging from 16.38 - 967.51 Ωm . The red colour indicates an area of high resistivity ranging from 7625 - 8576 Ωm while

the yellow colour indicates resistivity ranging from 3820 - 4772 Ωm . Resistivity for all the sounding locations and interpreted layer parameters as seen in appendix A was mapped as shown in figure 4.2 below.

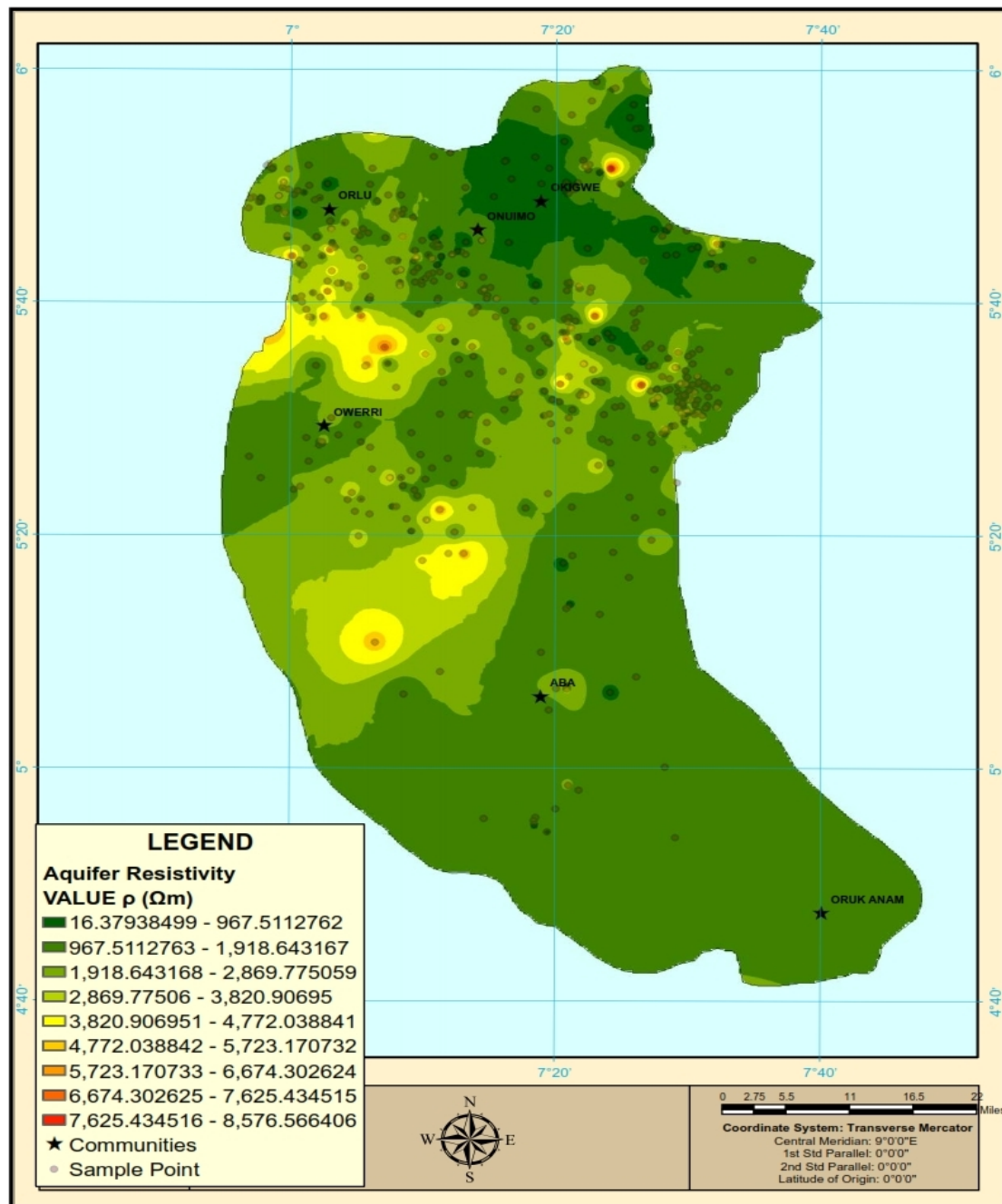


Figure 4.2: Map of Aquifer Resistivity of the Study Area

4.1.3 Hydrogeophysical interpretation of the area

With the assumption that the effective depth of transmission is $2/3$ of the current electrode separation, $AB/2$, the downward continuation of the resistivity value of the sounding points across the study area gave rise to Iso-resistivity map which shows variations of resistivity at specified intervals of $AB/2$ at 5m, 10 m, 15 m, 40m, 60 m, 100m, 150m, 200m, 250m, 300m, 350 m 400 m 450 m and 500m (appendix B). This displayed a progressive decrease in resistivity with depth, suggesting a highly resistive overburden or upper layer to less resistive (or conductive) layer. However, an iso-resistivity map is a qualitative interpretation tool which shows possible variations in resistivity at the given electrode spacing and does not give the true resistivities of a definite geo-electric layer (Mbonu et al., 1991).

4.1.3.1 Iso –Resistivity at $AB/2 = 5$ m

The iso-resistivity map for $AB/2 = 5$ m in figure 4.3a below shows that some parts of the study area within the northern, eastern, southwestern and the central axes are underlain by relatively low resistive material. The colour codes in figure 4.3a below show that colours up to $200\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 3.33 m shows that the resistivity of sounding points increase from $200\Omega\text{m}$ (purple) to $5400\Omega\text{m}$ (red). The range of the purple colour (up to $200\Omega\text{m}$) might be an indication of shale units while the other colours up to the yellow colour correspond to sandy unit.

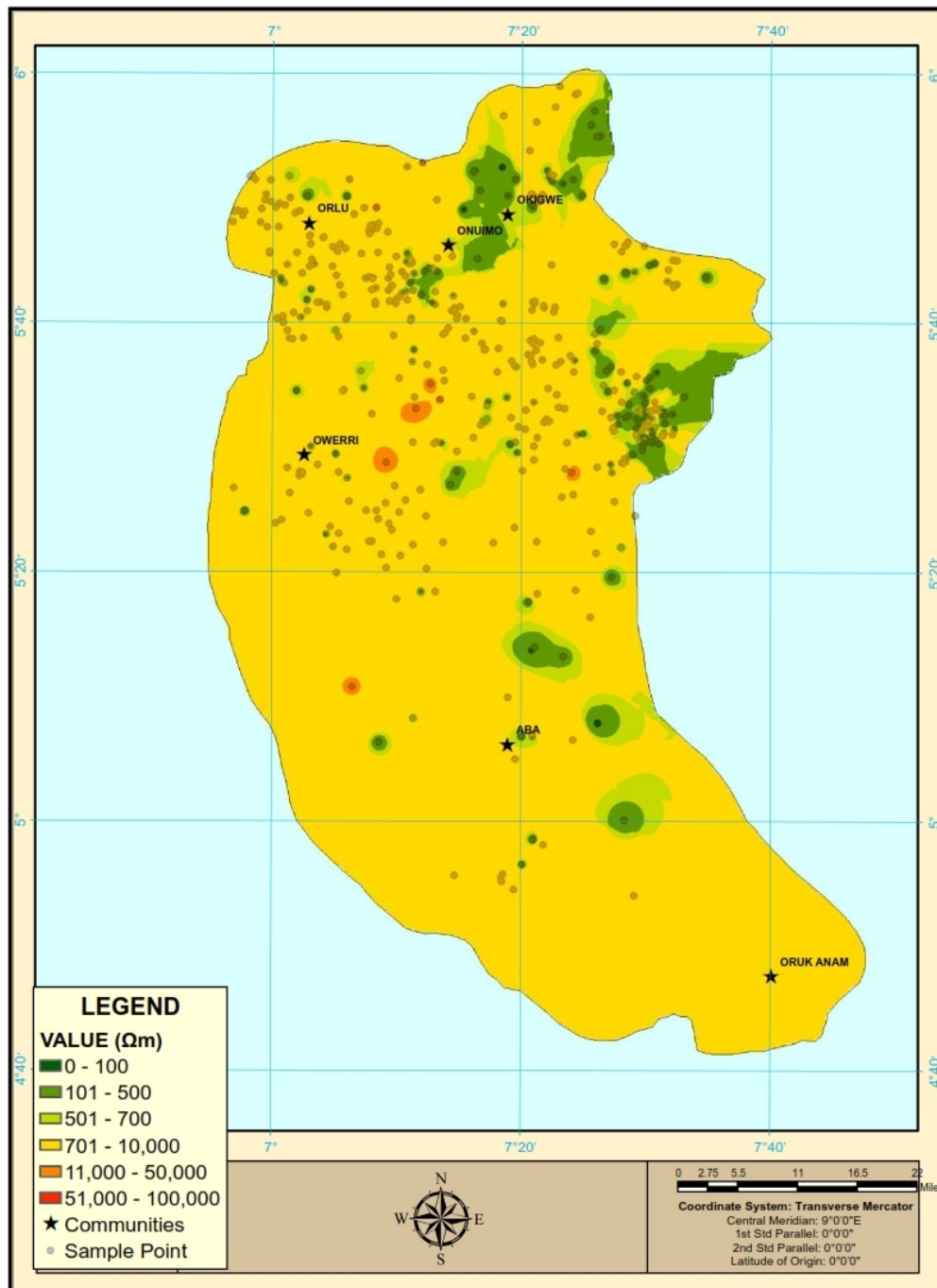


Figure 4.3a: Map of Iso-Resistivity of $AB/2 = 5$ m of the Study Area

4.1.3.2 Iso –Resistivity at $AB/2 = 10$ m

The iso-resistivity map for $AB/2 = 10$ m in figure 4.3b below shows that some parts of the study area within the Northern, and Southwestern axes are underlain by relatively low resistive material. The colour codes in figure 4.3b below shows that colours up to $200\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 6.67 m shows that the resistivity of sounding points increase from value > 0 (yellow) to $4200\Omega\text{m}$ (red). The range of the yellow colour (up to $200\Omega\text{m}$) might be an indication of shale units while the other colours up to the orange colour suggest sandy unit.

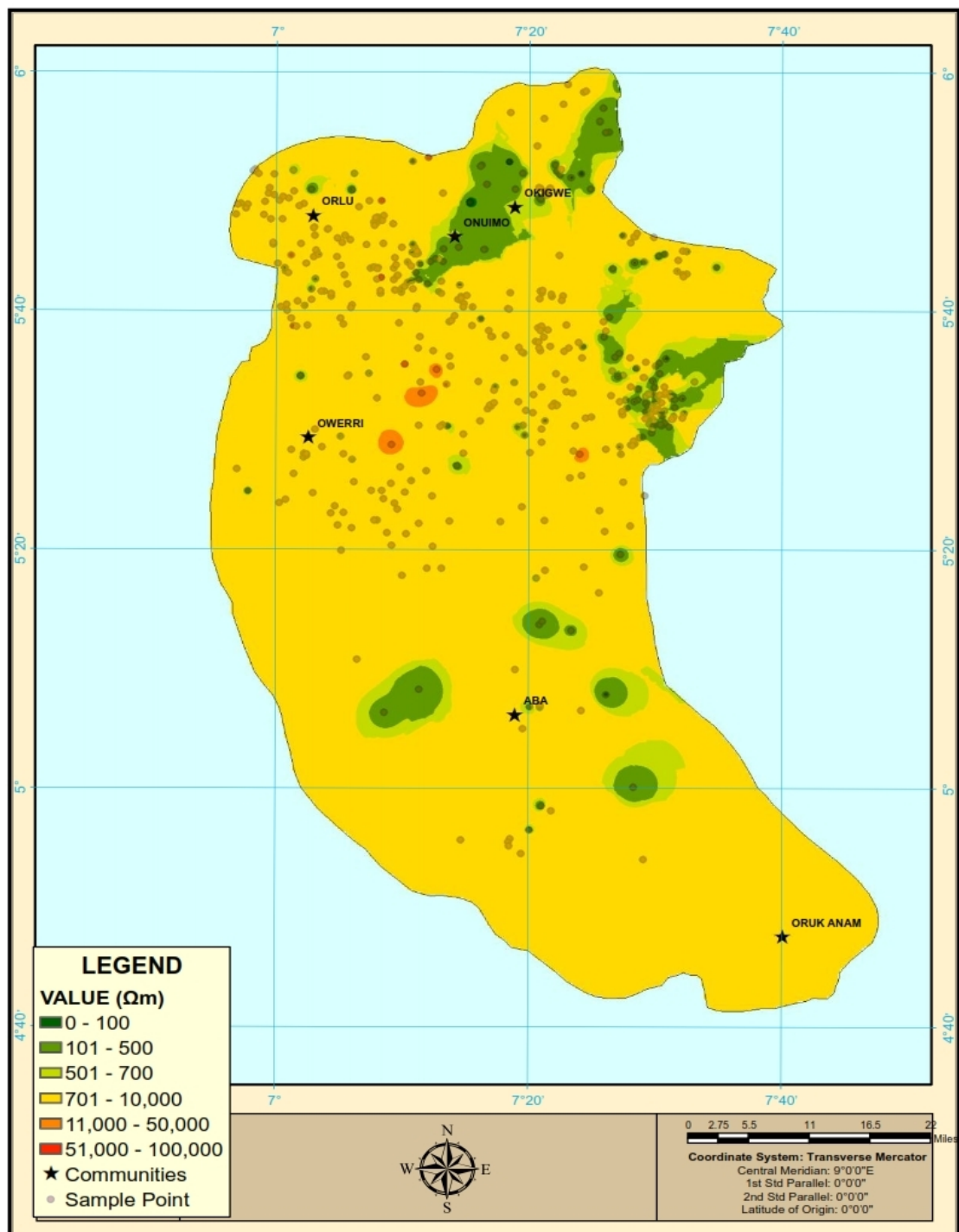


Figure 4.3b: Contour Map of Iso-Resistivity of $AB/2 = 10$ m of the Study Area

4.1.3.3 Iso –Resistivity at $AB/2 = 15$ m

The iso-resistivity map for $AB/2 = 15$ m in figure 4.3c below shows that some parts of the study area within the northern and eastern axes are underlain by relatively low resistive material. The color codes in figure 4.3c above show that colors between up to 0 - 200 Ω m correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 10 m shows that the resistivity of sounding points increase from value $>$ (purple) to 3800 Ω m (red).

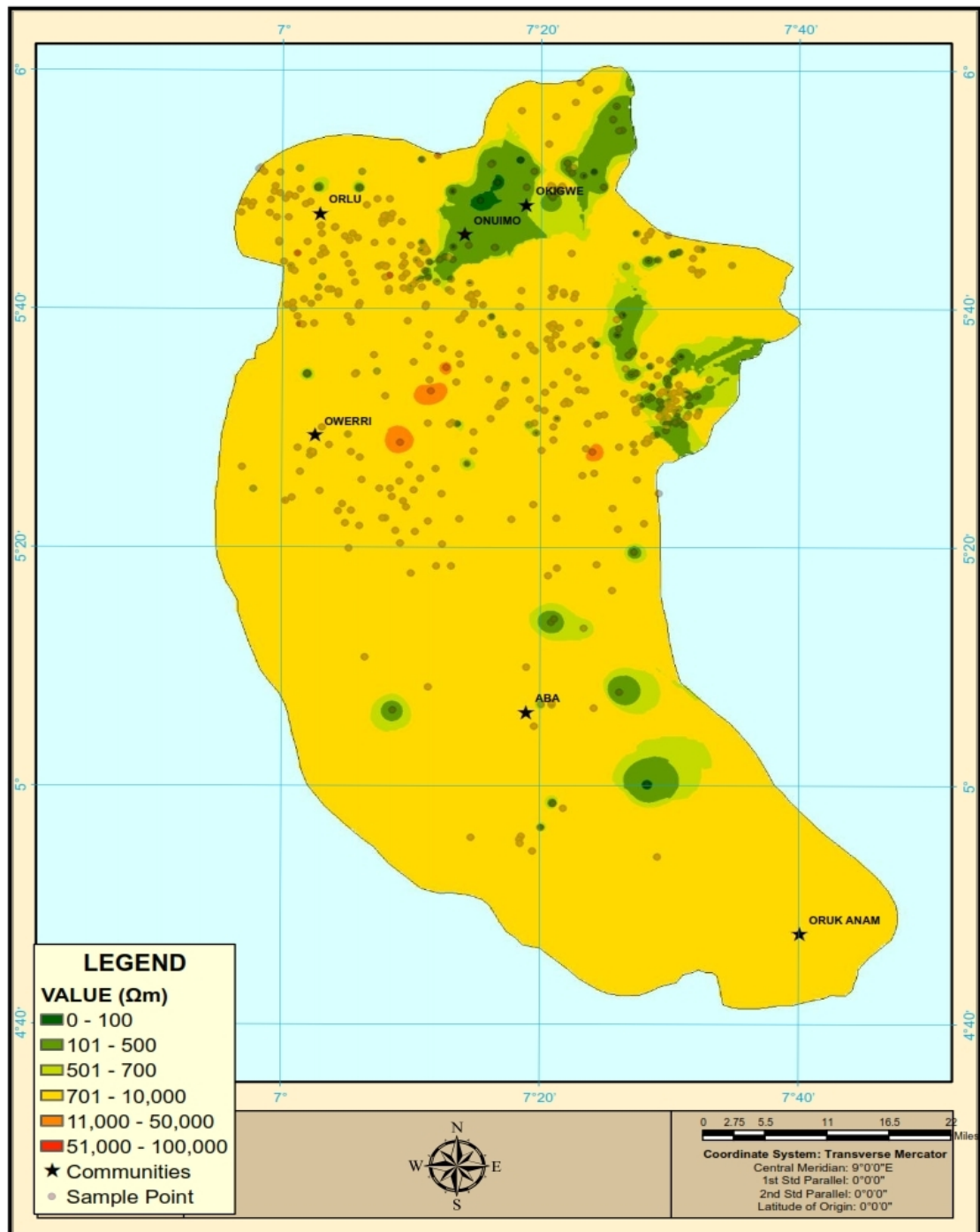


Figure 4.3c: Contour Map of Iso-Resistivity of $AB/2 = 15$ m of the Study Are

4.1.3.4 Iso –Resistivity at $AB/2 = 40$ m

The iso-resistivity map for $AB/2 = 40$ m in figure 4.3d below shows that some parts of the study area within the northern, eastern and southwestern axes are underlain by relatively low resistive material. The colour codes in figure 4.3d below show that colours up to $200\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 26.67 m shows that the resistivity of sounding points increase from value > 0 (purple) to $4600\Omega\text{m}$ (red).

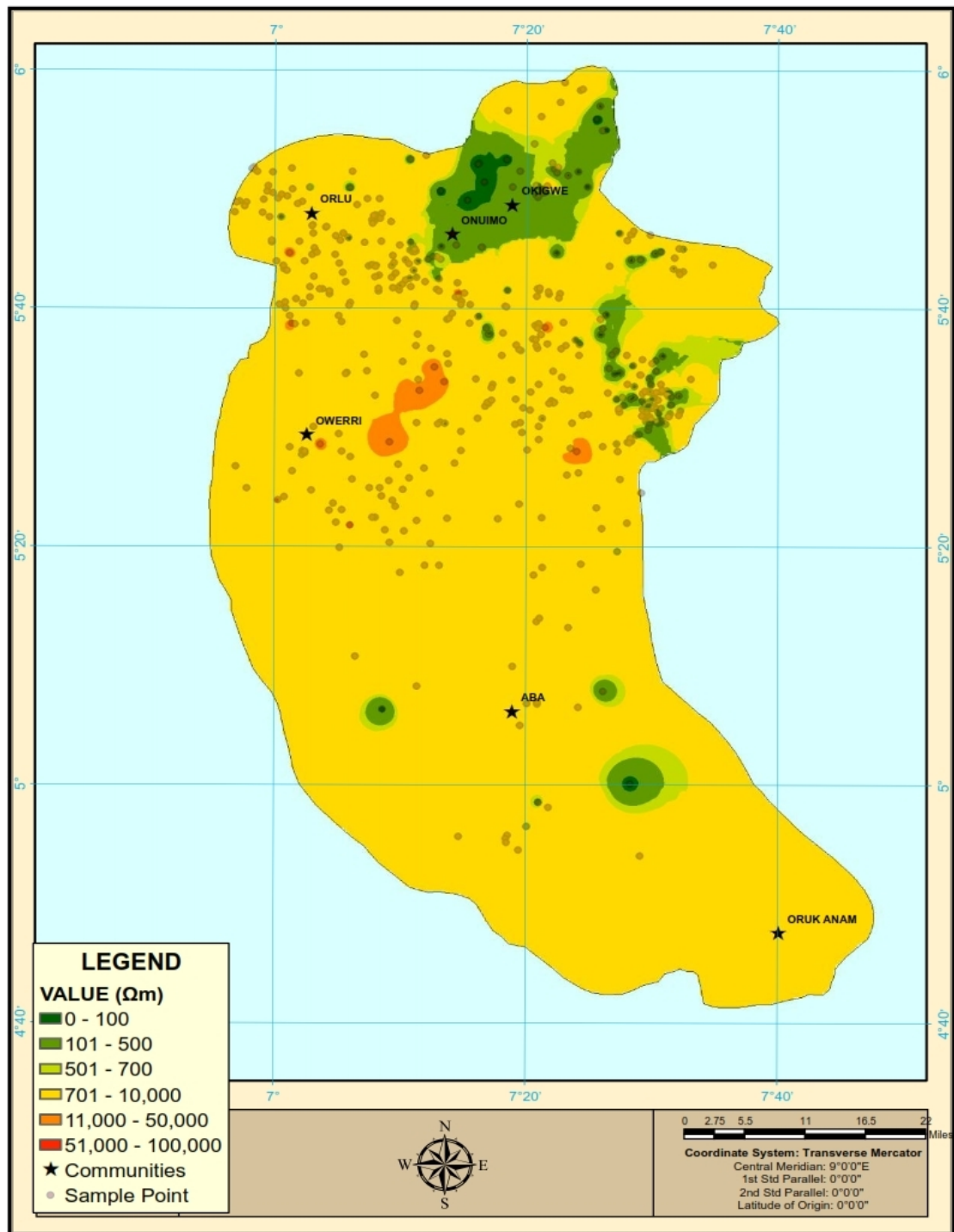


Figure 4.3d: Map of Iso-Resistivity of $AB/2 = 40$ m of the Study Area

3.1.3.5 Iso –Resistivity at $AB/2 = 60$ m

The iso-resistivity map for $AB/2 = 60$ m in figure 4.3e below shows that some parts of the study area within the northern, eastern and southwestern axes are underlain by relatively low resistive material. The colour codes in figure 4.3e below show that colors up to $200\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 40 m shows that the resistivity of sounding points increase from value > 0 (purple) to $50000\Omega\text{m}$ (red). The range of colour from purple to light green (up to $200\Omega\text{m}$) suggests shale units while the other colors up to the red color suggest sandy units.

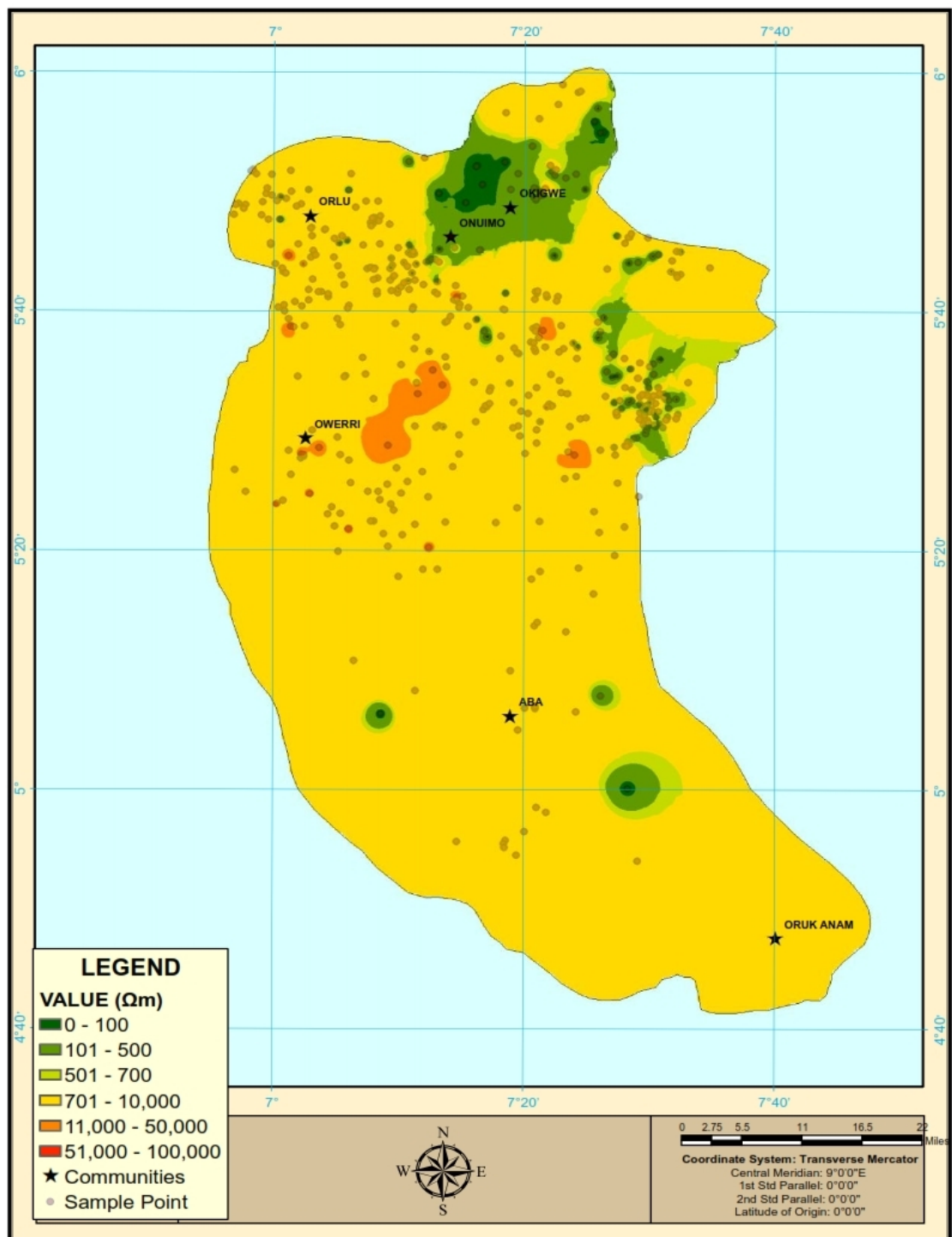


Figure 4.3e: Map of Iso-Resistivity of $AB/2 = 60$ m of the Study Area

4.1.3.6 Iso –Resistivity at $AB/2 = 100$ m

The iso-resistivity map for $AB/2 = 100$ m in figure 4.3f below shows that some parts of the study area within the northern, eastern and southwestern axes are underlain by relatively low resistive material. The colour codes in figure 4.3f below show that colours up to $500\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 66.67m shows that the resistivity of sounding points increase from value > 0 (purple) to $6000\Omega\text{m}$ (red). The range of colours from purple to light blue (up to $500\Omega\text{m}$), suggest shale units while the other colours up to the yellow colour suggest sandy units.

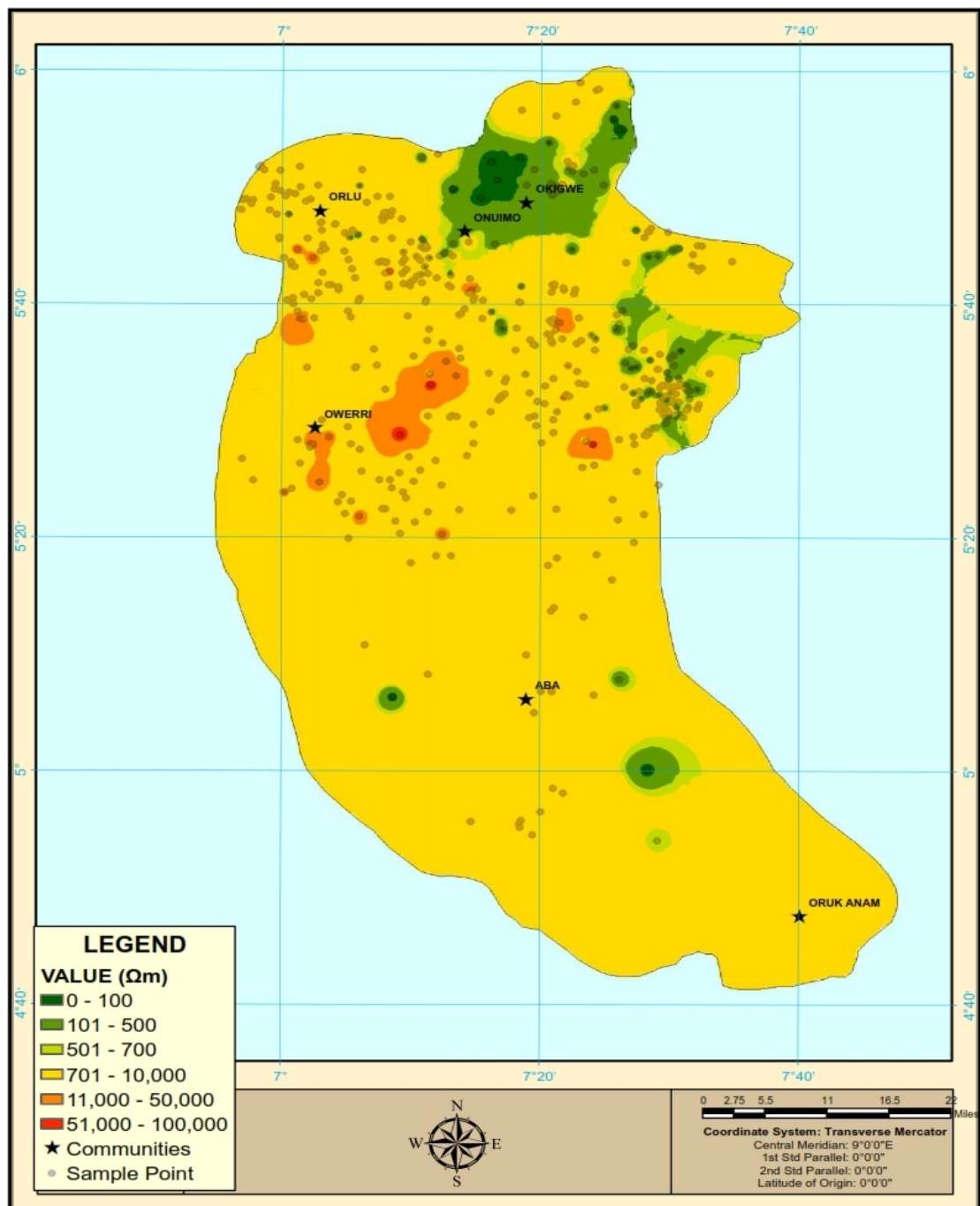


Figure 4.3 f: Map of Iso-Resistivity of $AB/2 = 100$ m of the Study Area

4.1.3.7 Iso –Resistivity at $AB/2 = 150$ m

The iso-resistivity map for $AB/2 = 150$ m in figure 4.3g below shows that some parts of the study area within the northern, eastern and southwestern axes are underlain by relatively low resistive material. The colour codes in the figure below show that colours up to $500\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 100 m shows that the resistivity of sounding points increase from value > 0 (purple) to $8000\Omega\text{m}$ (red). The range of colours from purple to light blue (up to $500\Omega\text{m}$), suggest shale units while the other colours up to the lemon green colour suggest sandy units.

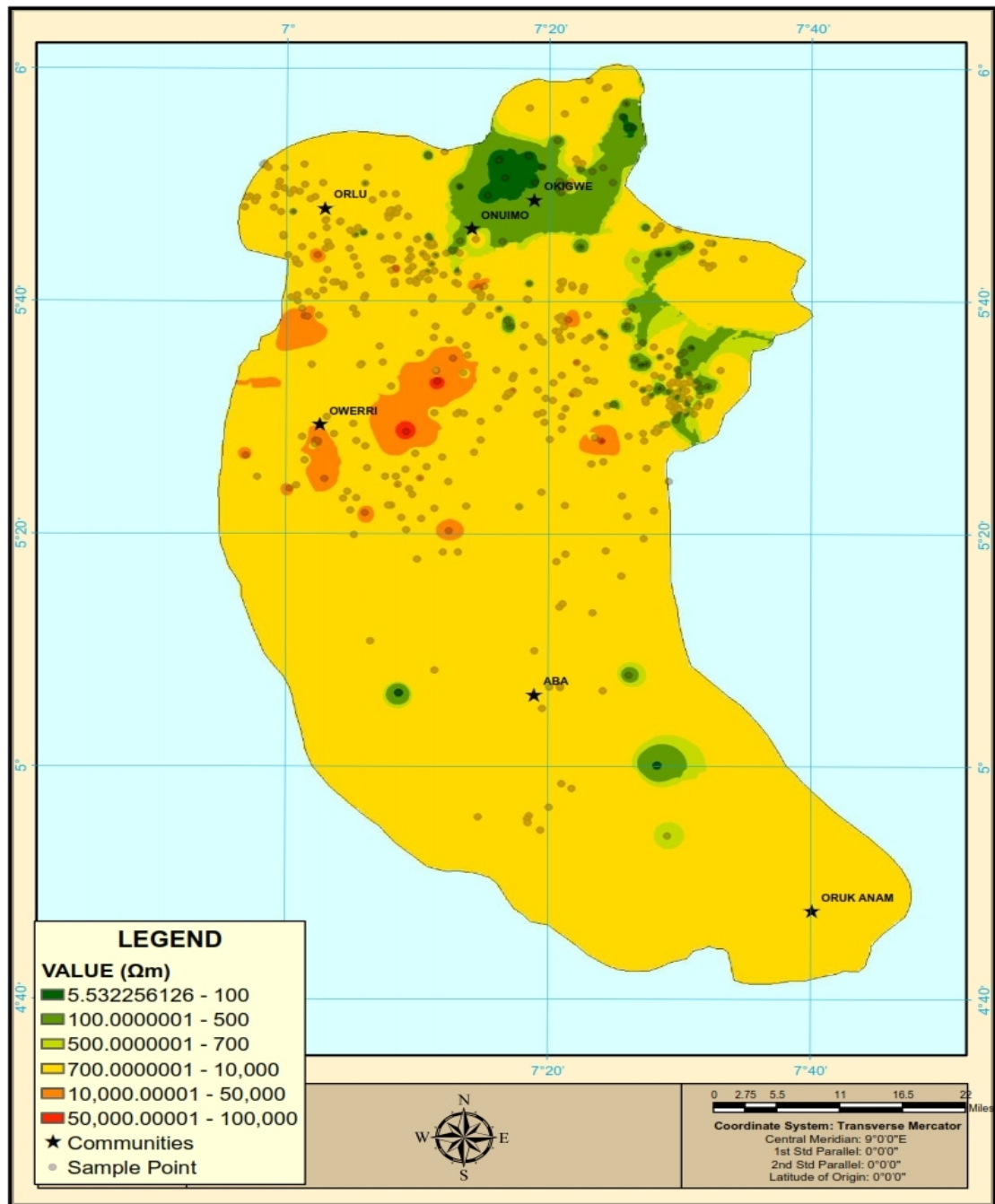


Figure 4.3g: Contour Map of Iso-Resistivity of $AB/2 = 150$ m of the Study Area

4.1.3.8 Iso –Resistivity at $AB/2 = 200$ m

The iso-resistivity map for $AB/2 = 200$ m in figure 4.3h below shows that some parts of the study area within the northern, eastern and southwestern axes are underlain by relatively low resistive material. The colour codes in figure 4.3h below show that colour up to $500\Omega m$ correspond to areas with relatively low resistivity. The resistivity of the study area at

this spacing with effective depth of transmission 133.33 m shows that the resistivity of sounding points increase from value > 0 (purple) to $8000\Omega\text{m}$ (red). The range of colours from purple to light green (up to $500\Omega\text{m}$) is suspected to be shale units while the other colours up to the lemon green colour suggest sandy units.

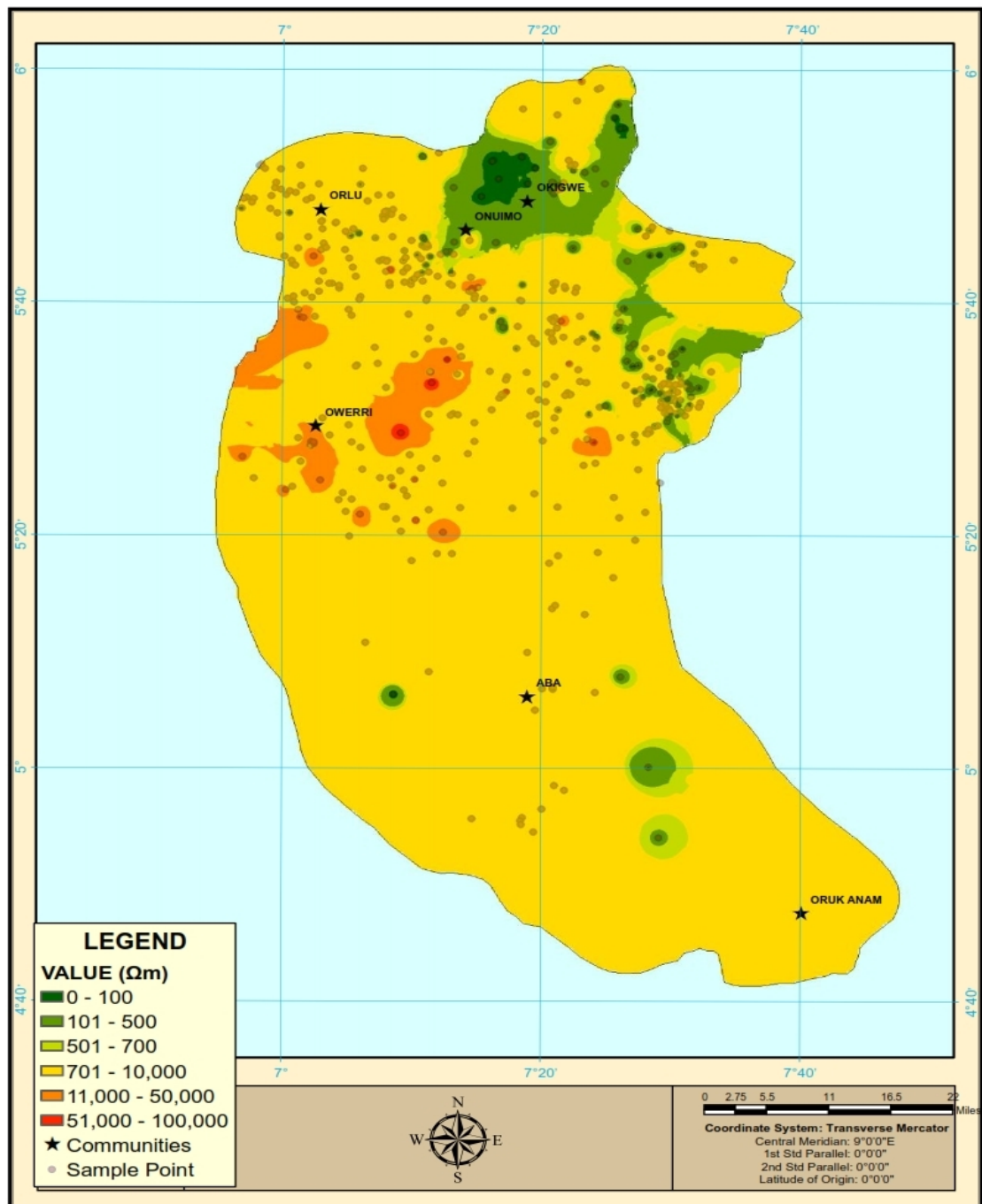


Figure 4.3h: Map of Iso-Resistivity of $AB/2 = 200$ m of the Study Area

4.1.3.9 Iso –Resistivity at $AB/2 = 250$ m

The iso-resistivity map for $AB/2 = 250$ m in figure 4.3i below shows that some parts of the study area within the northern, southeastern and extreme of southwestern axes are underlain by relatively low resistive material. The colour codes in figure 4.3i below show that colours up to $500\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 166.67 m shows that the resistivity of sounding points increase from value > 0 (purple) to $8500\Omega\text{m}$ (red). The range of colours from purple to light blue (up to $500\Omega\text{m}$) is suspected to be shale units while the other colours up to the lemon green colour suggest sandy units.

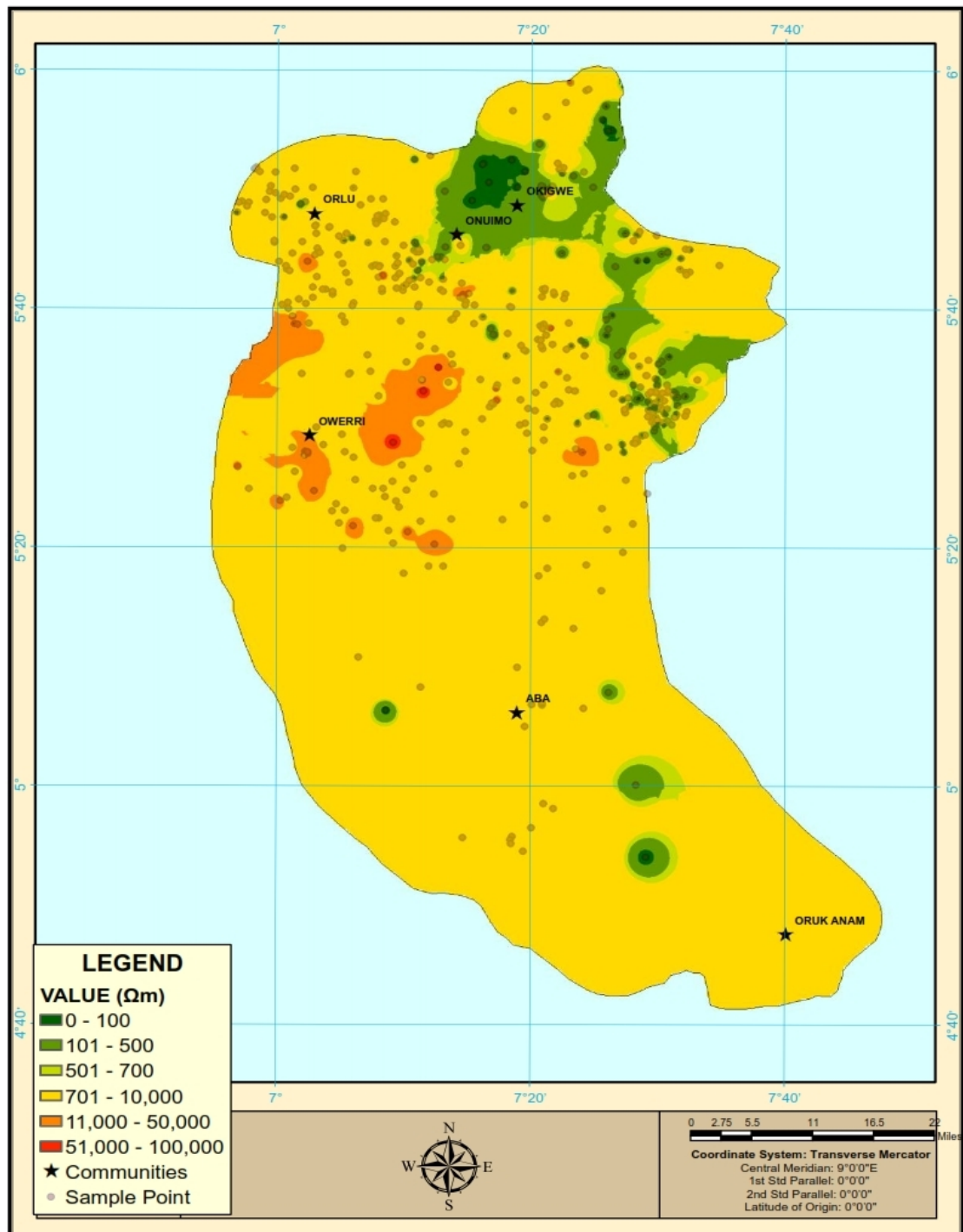


Figure 4.3i: Contour Map of Iso-Resistivity of $AB/2 = 250$ m of the Study Area

4.1.3.10 Iso –Resistivity at $AB/2 = 300$ m

The iso-resistivity map for $AB/2 = 300$ m in figure 4.3j below shows that some parts of the study area within the northern, southeastern and extreme of southwestern axes are underlain by relatively low resistive material. The colour codes in figure 4.3j below show that colours up to $500\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 200 m shows that the resistivity of sounding points increase from value > 0 (purple) to $8500\Omega\text{m}$ (red). The range of colour within the purple family (up to $500\Omega\text{m}$) suggests shale units while the other colours up to the light green colour suggest sandy units.

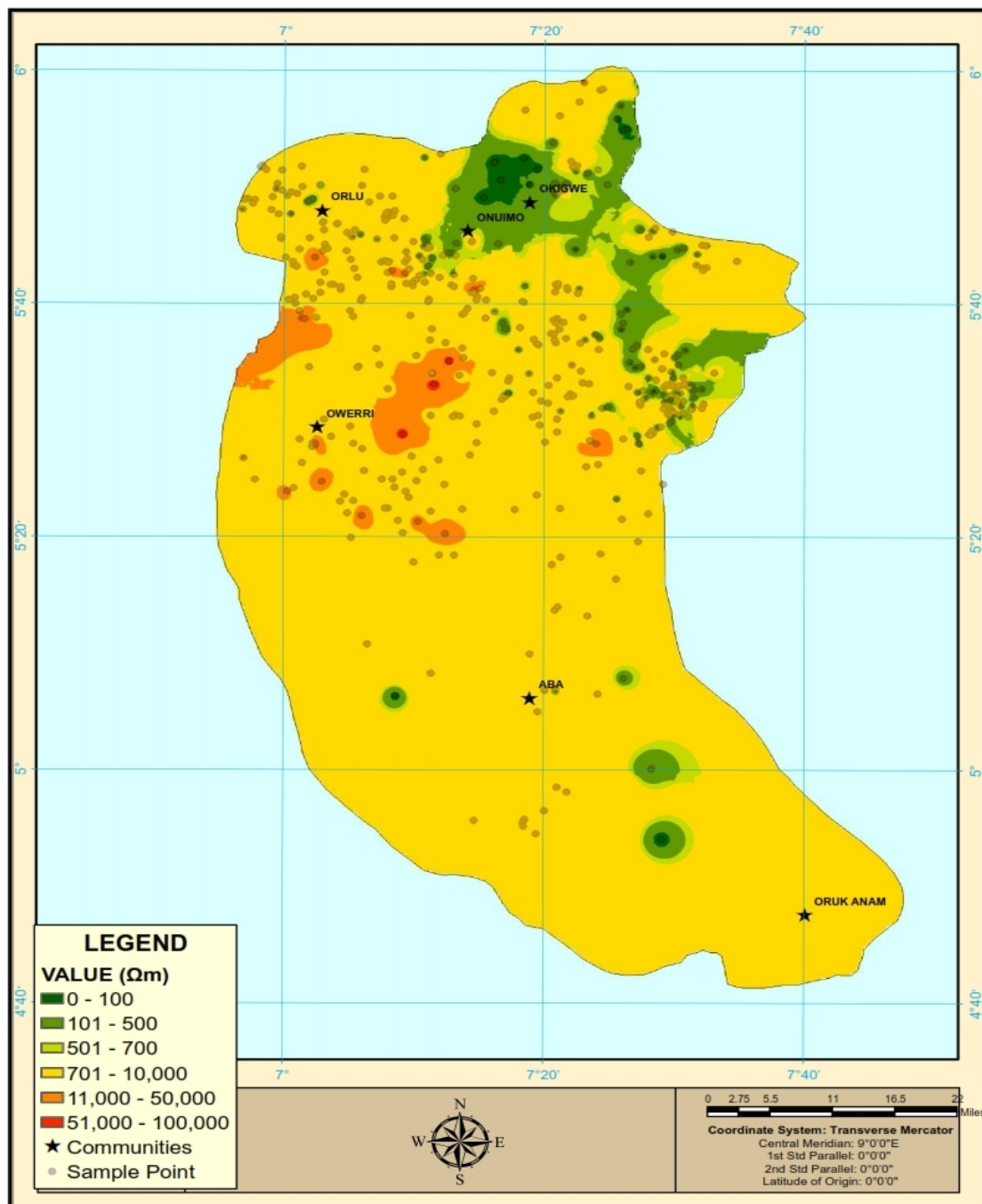


Figure 4.3j: Map of Iso-Resistivity of $AB/2 = 300$ m of the Study Area

4.1.3.11 Iso –Resistivity at $AB/2 = 350$ m

The iso-resistivity map for $AB/2 = 350$ m in figure 4.3k below shows that some parts of the study area within the northern axes are underlain by relatively low resistive material. The colour codes in figure 4.3k below show that colours up to $500\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 233.33 m shows that the resistivity of sounding points increase from value > 0 (purple) to $9000\Omega\text{m}$ (red). The range of colour within the purple family (up to $500\Omega\text{m}$) suggests shale units while the other colours up to the light green colour suggest sandy units.

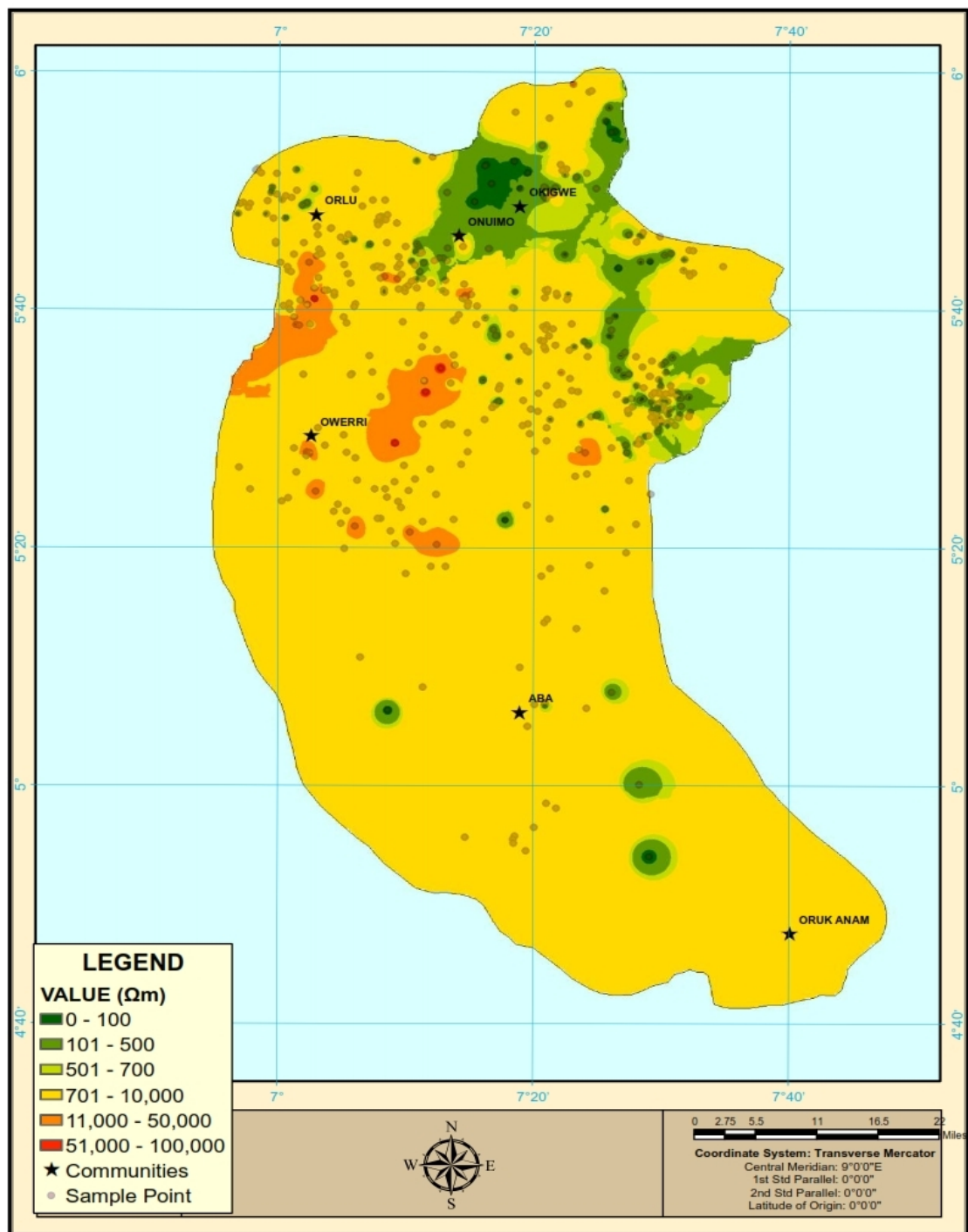


Figure 4.3k: Contour Map of Iso-Resistivity of $AB/2 = 350$ m of the Study Area

4.1.3.12 Iso –Resistivity at $AB/2 = 400$ m

The iso-resistivity map for $AB/2 = 400$ m in figure 4.31 below shows that some parts of the study area within the northern axes are underlain by relatively low resistive material. The colour codes in figure 4.31 below show that colours up to $500\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 266.67 m shows that the resistivity of sounding points increase from value > 0 (purple) to $9000\Omega\text{m}$ (red). The range of colour within the purple family (up to $500\Omega\text{m}$) suggests shale units while the other colours up to the light green colour suggest sandy units.

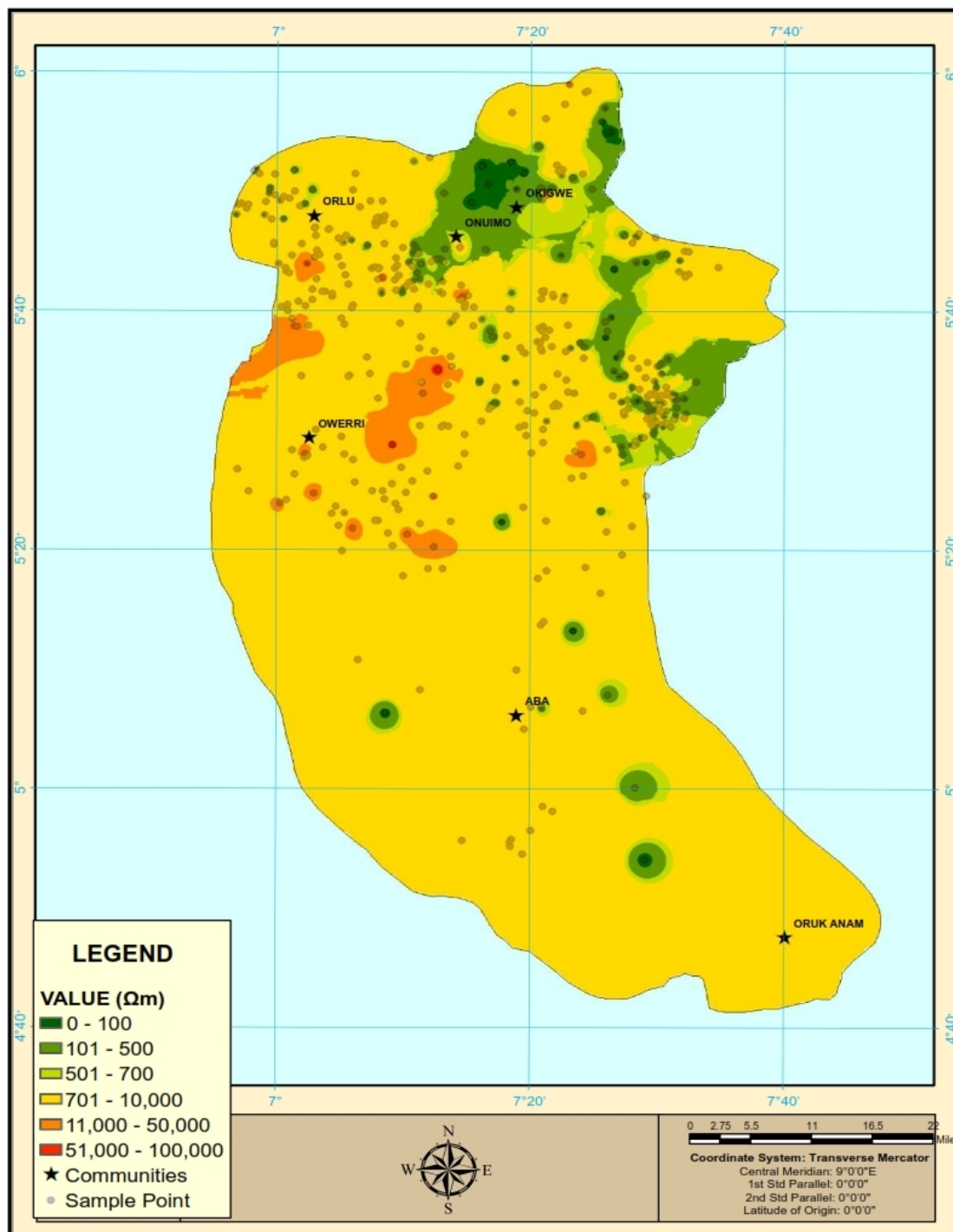


Figure 4.3l: Map of Iso-Resistivity of $AB/2 = 400$ m of the Study Area

4.1.3.13 Iso –Resistivity at $AB/2 = 450$ m

The iso-resistivity map for $AB/2 = 450$ m in figure 4.3m below shows that some parts of the study area within the northern axes are underlain by relatively low resistive material. The colour codes in figure 4.3m below show those colours between value >0 up to $400\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 300 m shows that the resistivity of sounding points increase from value >0 (purple) to $4600\Omega\text{m}$ (red). The range of colour within the purple family (up to $400\Omega\text{m}$) suggests shale units while the other colours up to the orange colour suggest sandy units.

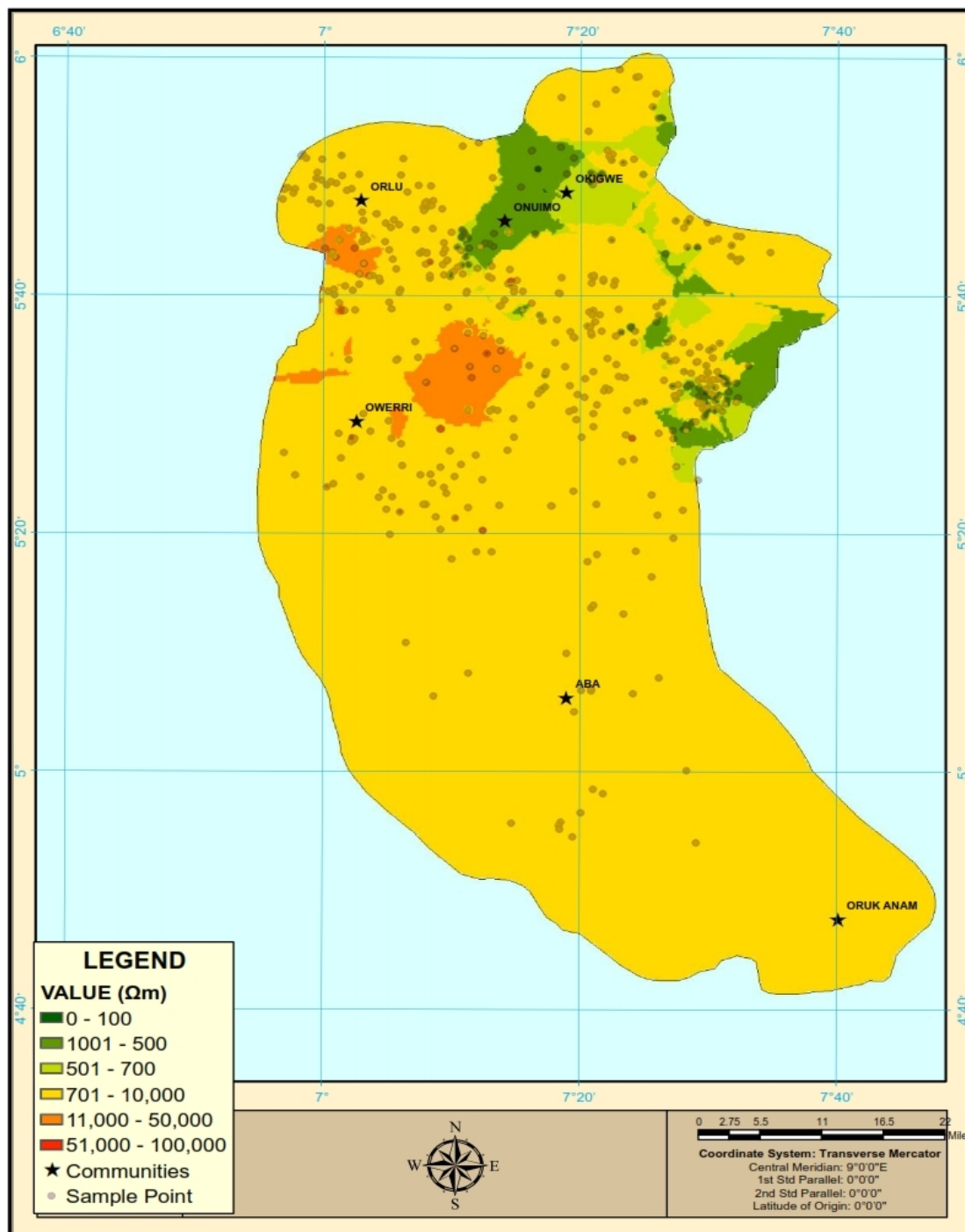


Figure 4.3m: Contour Map of Iso-Resistivity of $AB/2 = 450$ m of the Study Area

4.1.3.14 Iso –Resistivity at $AB/2 = 500$ m

The iso-resistivity map for $AB/2 = 500$ m in figure 4.3n below shows that some parts of the study area within the extreme northwestern axes are underlain by relatively low resistive material. The colour codes in figure 4.3n below indicate that colours between value >0 and $200\Omega\text{m}$ correspond to areas with relatively low resistivity. The resistivity of the study area at this spacing with effective depth of transmission 333.33 m shows that the resistivity of sounding points increase from value > 0 (purple) to $2000\Omega\text{m}$ (red). The range of colour within the purple family (up to $200\Omega\text{m}$) suggests shale units while the other colours up to the red colour suggest sandy units.

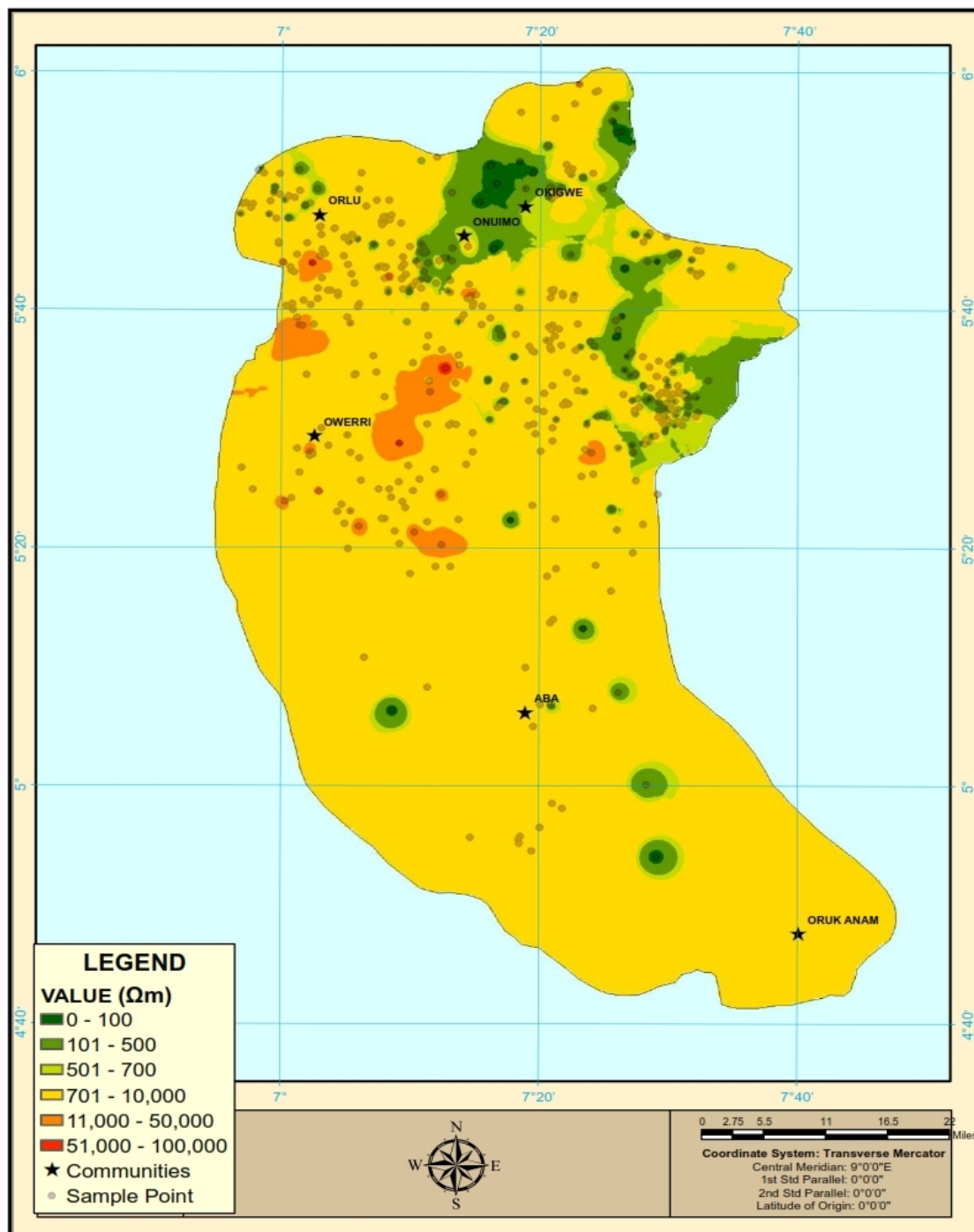


Figure 4.3n: Map of Iso-Resistivity of $AB/2 = 500$ m of the Study Area

4.1.4 Hydrostratigraphical interpretation of the study area

Three electric logs and litho-logs were used to correlate with geo-electric sections of Nkwofada, Umuechi Ogbor Ugiri and Umukabia in the study area while two litho-logs were used to correlate with the geoelectric sections of Amaraku and Umuelemai in the study area.

4.1.4.1 Nkwofada, Arondizogu (AM 165): The correlation of the geoelectric section and the borehole sections revealed an aquiferous layer of thickness 75 m (99-175 m) for the geoelectric section, 18 m (72-90 m) for the strata-log section and 36m (52-88 m) for the electric-log section (Figure 4.4a). The borehole logs identify its aquiferous units as whitish and greyish mixture of clay and sand while the geoelectric section identifies its aquiferous unit as white sand of resistivity 2080 Ω m. The borehole logs and the geoelectric section did not display good correlation. The borehole logs revealed its aquiferous units as confined while the geoelectric section revealed its aquiferous unit as unconfined.

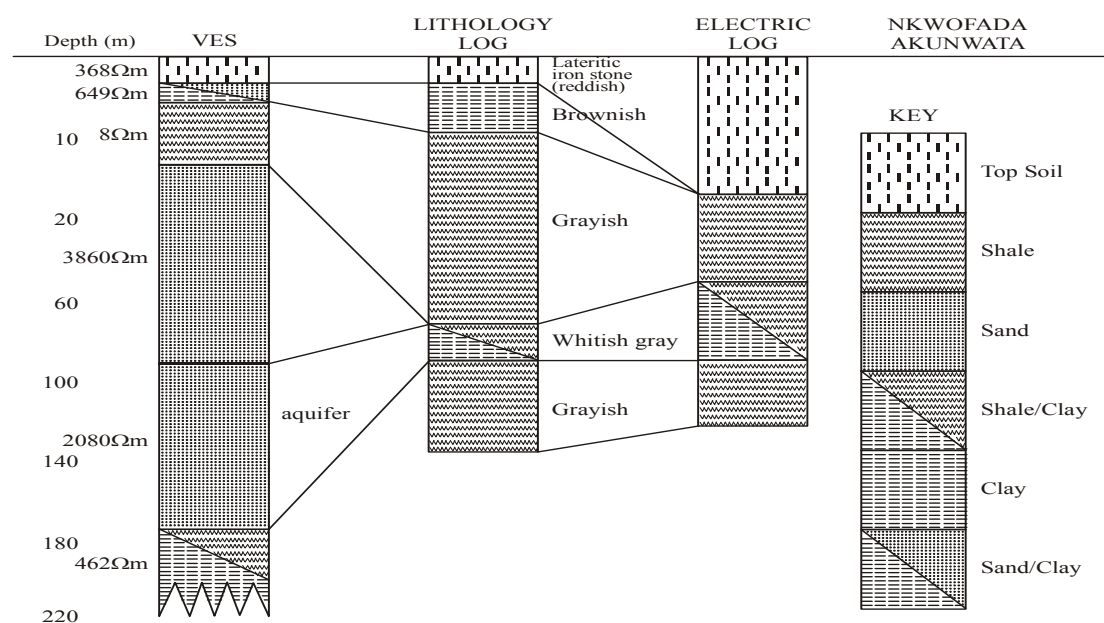


Figure 4.4a: Correlation of Geoelectric Section, Litho-Log Section and Electric Log Section of Nkwofada

4.1.4.2 Umuehie Ogbor Ugiri (IS 507): The first layer in the geoelectric section is lateritic soil with apparent resistivity of 380 Ωm . The geoelectric section revealed its aquiferous unit as a mixture of sand and sandstone of thickness 48 m (76-124m) and resistivity of 2050 Ωm while the litho-log and the electric-log sections revealed aquiferous units as brownish mixture of clay and sand of thickness 6 m (75-88 m) and 16 m (88-104m) respectively. The borehole logs did not correlate well with the geoelectric section (Figure 4.4b).

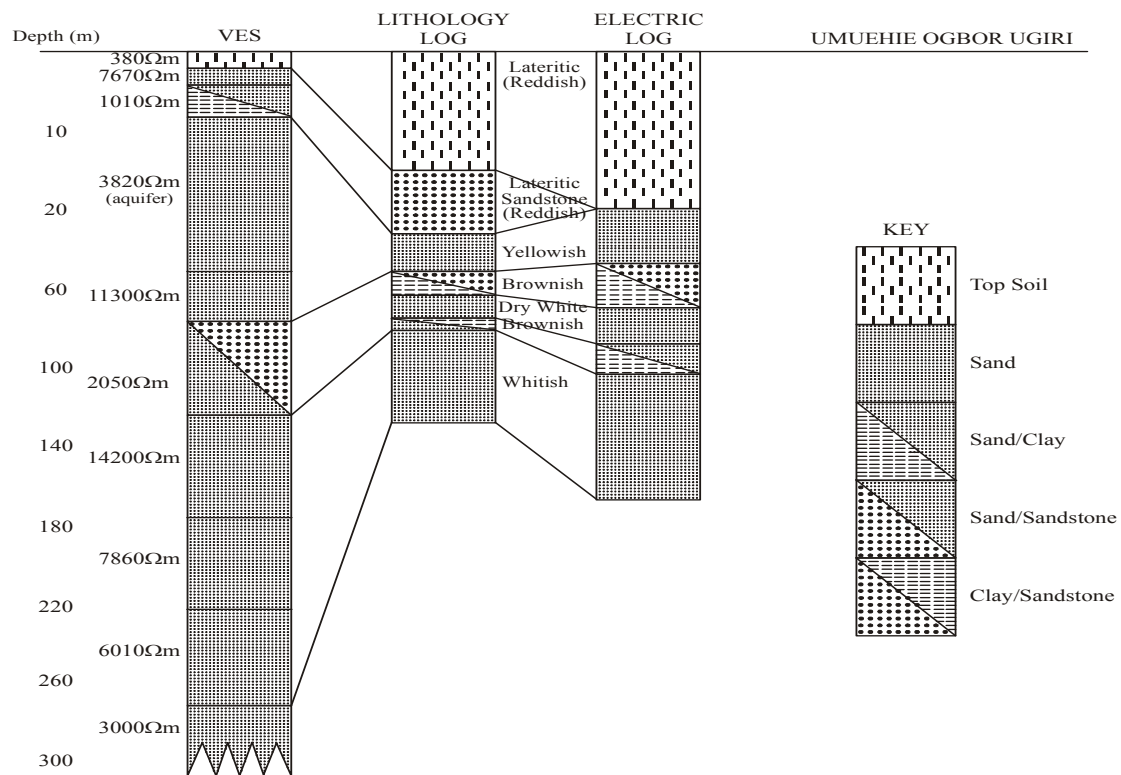


Figure 4.4b: Correlation of Geoelectric Section, Litho-Log Section and Electric Log Section of Umuehie Ogbor Ugiri

4.1.4.3 Umukabia, Ohuhu (BN226): The geoelectric section identifies its aquiferous unit as a mixture of sand and shale of thickness 59 m (29-88 m) and resistivity of 1250 Ωm . The borehole logs identify its aquiferous units as whitish sand of thickness 12 m (26-38 m) for the strata-log and 18 m (20-38 m) for the electric-log. The borehole log sections and the geoelectric section displayed a fairly good correlation (Figure 4.4c). The borehole logs and the geoelectric sections revealed that the identified aquiferous units are confined aquifers bounded by shaly layers.

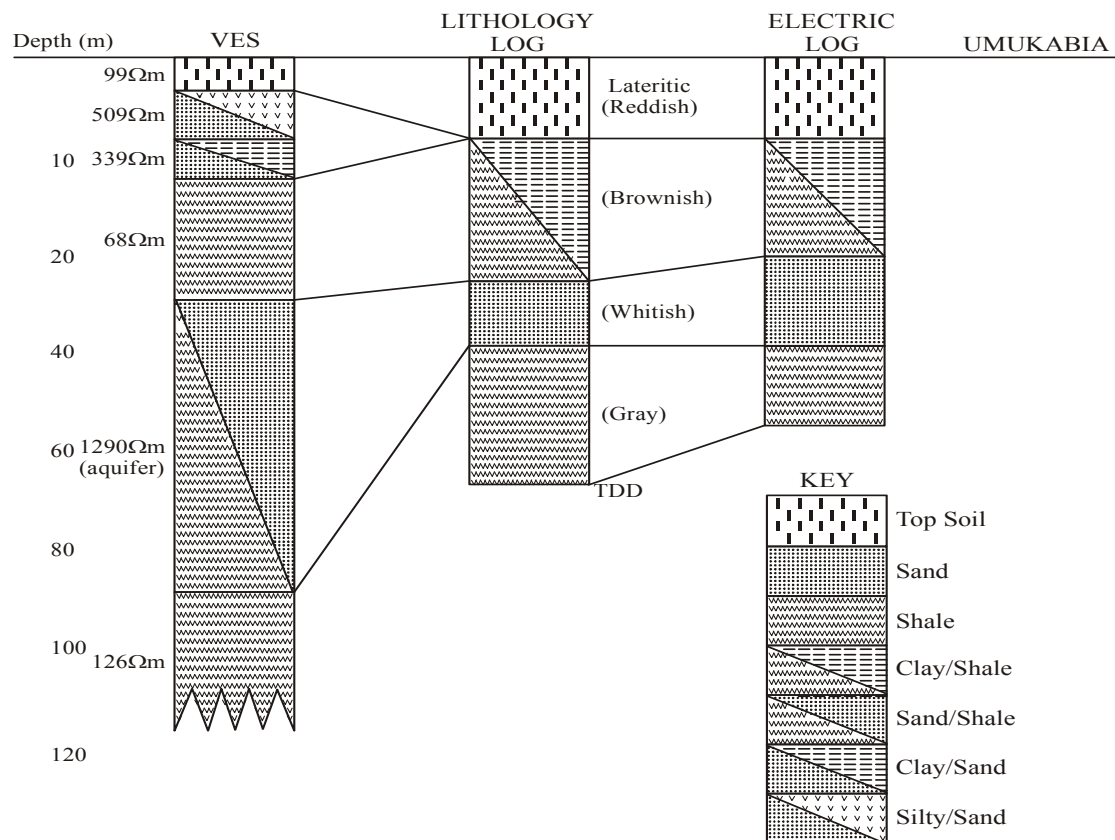


Figure 4.4c: Correlation of Geoelectric Section, Litho-Log Section and Electric-Log Section of Umukabia

4.1.4.4 Amaraku, Isiala Mbanu (AM 80): The first layer on the geo-electric section with resistivity 212 Ωm is reddish lateritic sand (figure 4.4d). The aquiferous layer as identified by the geoelectric section is sand of thickness 45 m (62-107 m) and resistivity of 1360 Ωm . The strata-log identified its aquiferous unit as fine-grained whitish sand of thickness 30 m (78-108 m). The geoelectric section correlated well with that of the strata-log. The aquifer units as indicated by both sections are underlain by an electrically conductive layer of shale.

Amaraku and its environments, by this correlation, could be prolific in terms of groundwater exploitation and good for sitting productive boreholes.

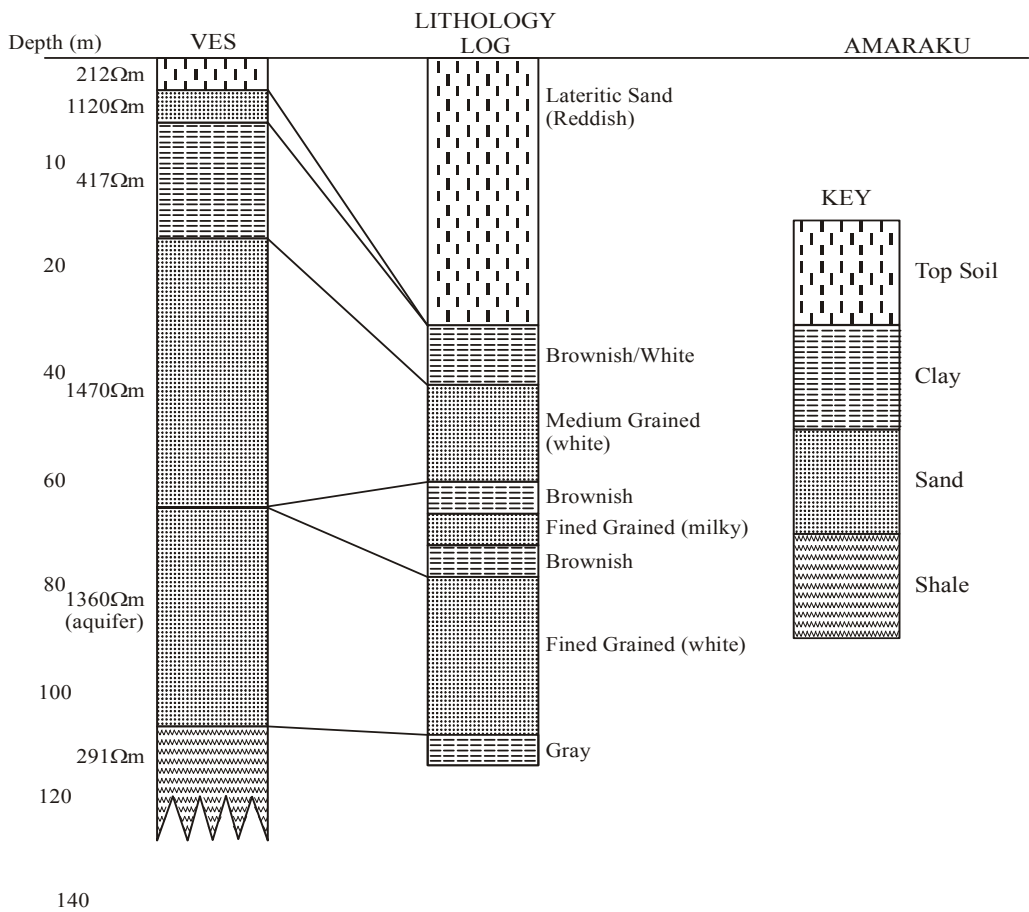


Figure 4.4d: Correlation of Geoelectric Section and Litho-Log Section of Amaraku

4.1.4.5 Umuelemai, Mbano (BN 391): The geoelectric section identified its aquiferous unit as sandstone of thickness 28 m (78-106 m) and resistivity of 1760 Ωm. The strata-log also identified its aquiferous unit as sandstone of thickness 16 m (30-46 m). This is a good correlation between the geo-electric section and the strata-log (Figure 4.4e). The aquiferous unit as revealed by the geo-electric section is underlain by an electrically conductive layer of shale.

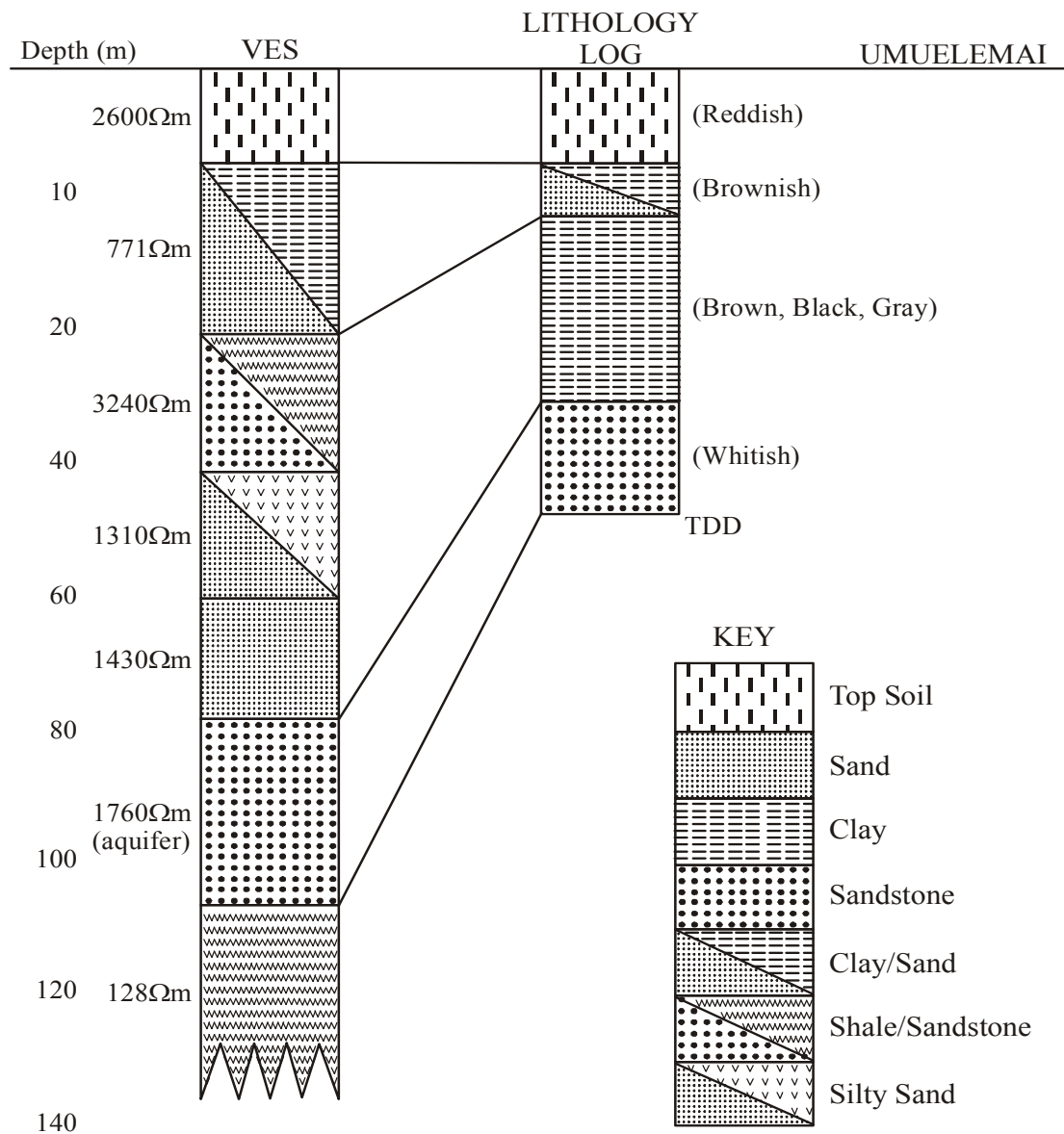


Figure 4.4e: Correlation of Geoelectric Section and Litho-Log Section of Umuelemai, Mbano.

4.1.4 Estimate aquifer hydraulic parameters from geophysical data

Application of the Da-Zarrock parameters of transverse resistance and longitudinal conductance as well as K values (pumping test data) for existing boreholes and σ value (diagnostic constant), extracted from the sounding interpretation for the aquifer at boreholes location, has made it possible to estimate the aquifer hydraulic parameters as: Aquifer depth, Aquifer thickness, Aquifer resistance, Aquifer conductivity, Transverse resistance, Longitudinal conductance, Pumping test (K) values, Transmissivity, Storativity, Diffusivity,

Hydraulic conductivity (Niwas & Singhals), Hydraulic conductivity (New Model), Hydraulic conductivity (Heigold Model) as shown in the table 4.4 below:

4.1.6 Distribution of Aquifer Parameters across the Study Area

The map of the aquifer depth shown in the figure above displays the distribution of variance in the depth of aquifer within the study area. The aquifer depth ranges from 10m in Benin Formation to 310m in Ameki, Nsukka, Ogwasi/Asaba and Ajali Formations respectively with a mean value of 89.3m. These areas with high aquifer depth indicating red colour in the map might not be good for citing boreholes.

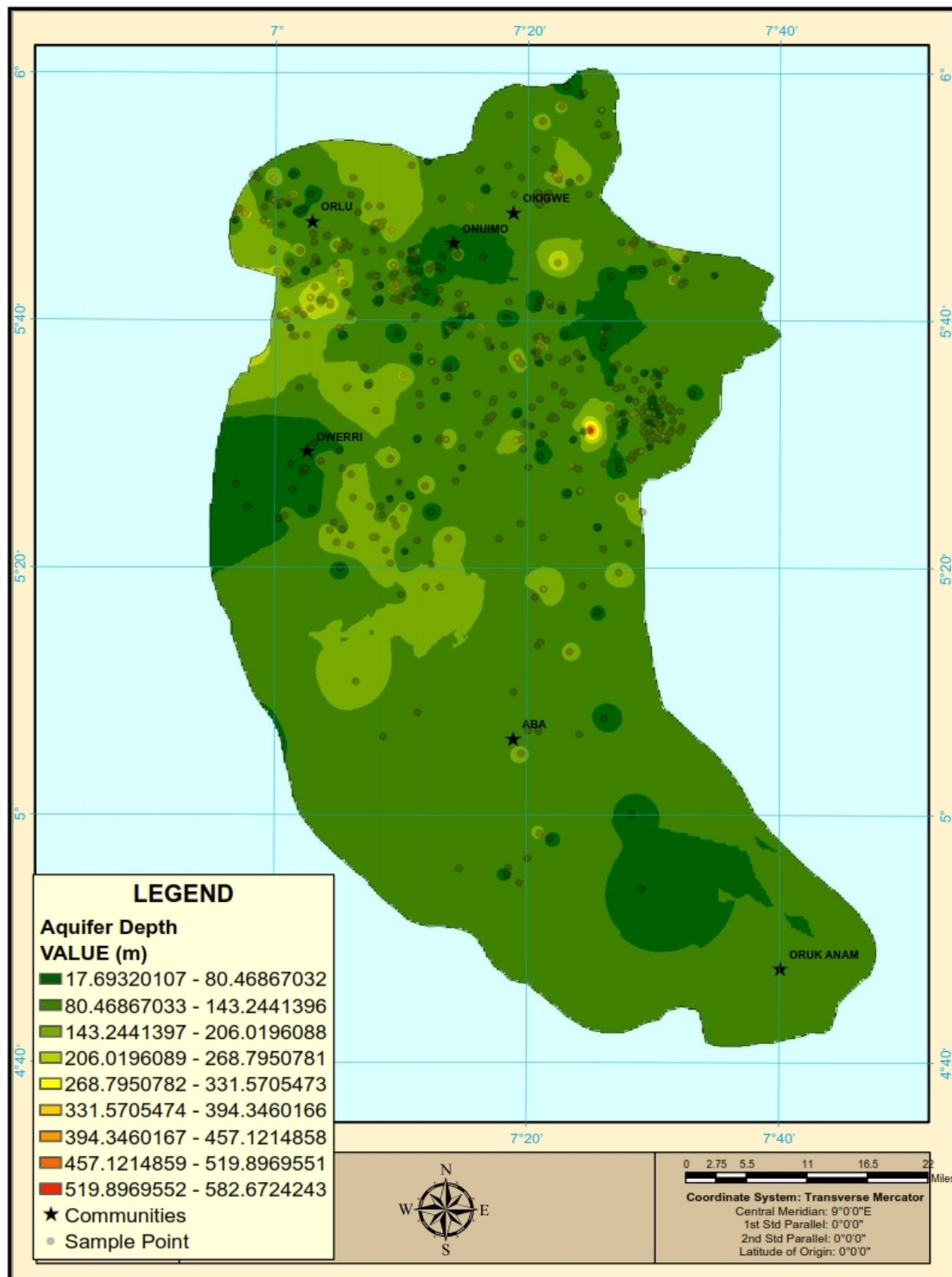


Figure 4.5: Aquifer depth map of the study area

4.1.6.1 Aquifer Thickness

The map of the aquifer thickness shown in figure 4.5 below, displays the distribution of variance in the thickness of aquifer within the study area. The northwestern and some parts within the northeastern and northern axes of the study area exhibit high aquifer thickness with Aguneze areas having the highest value as high as 121.5m to 136.4 m. Some parts within the central, Northeastern, Southeastern and Northern flank of the study area display low aquifers thickness (dark green colour) with Maranatha Secondary School Umuezealama areas having the least thickness value as low as 2.6 m to 17.5m. These areas might not be good for citing boreholes. Aquifer thickness for all the sounding locations calculated by taking the difference between the lower and the upper aquiferous layer from the various curves shown in appendix C

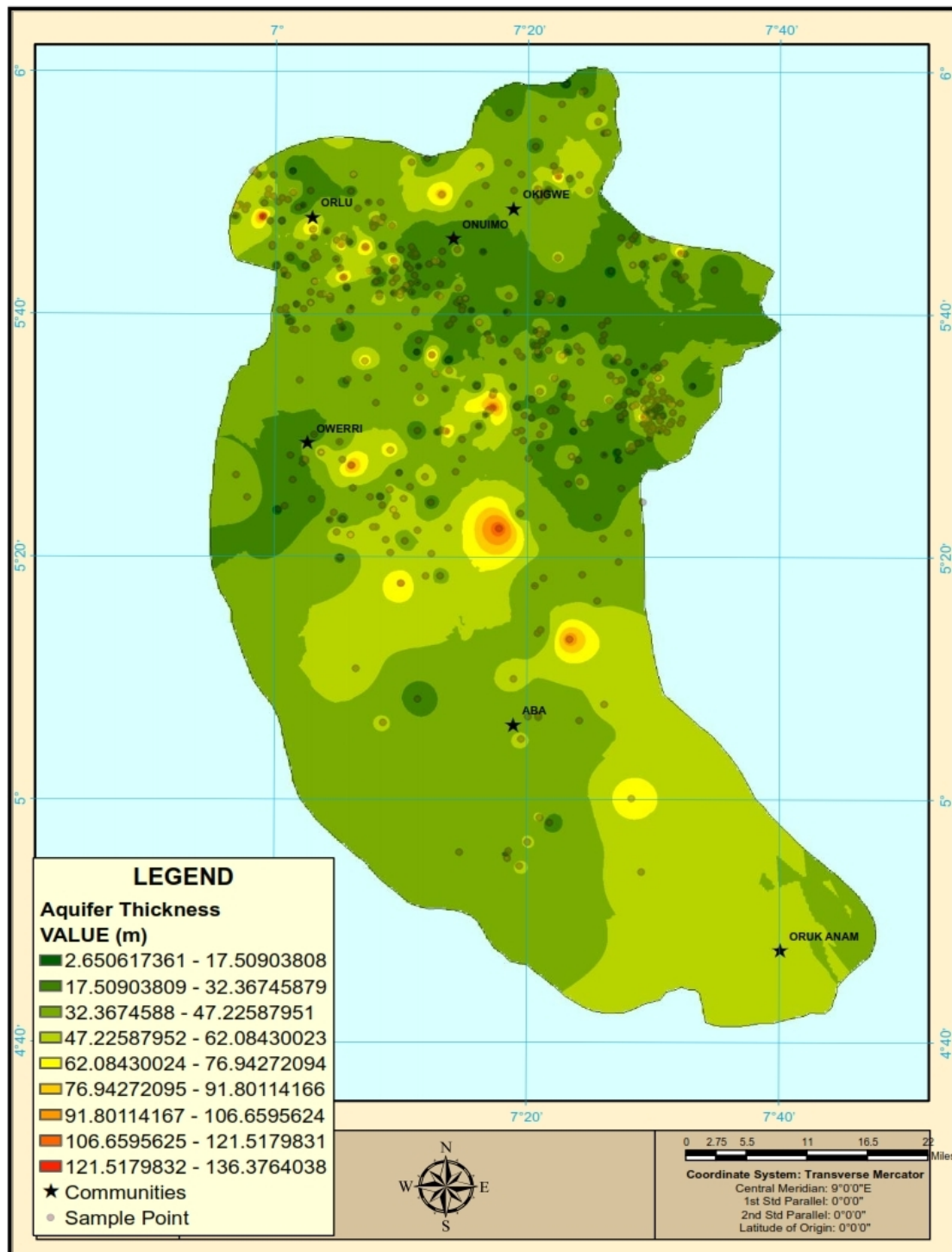


Figure 4.6: Aquifer Thickness map of the Study Area

4.1.6.2 Aquifer Conductivity

Aquifer conductivity across the study area was estimated by taking the inverse of the aquifer resistivity. The northern flank of the study area appears to have high aquifer conductivity with Eluama Lokpoukwu areas having the highest value of 0.0629 Sm^{-1} to 0.07072 Sm^{-1} , which corresponds to the red-coloured region. The southern and some parts within the northern and northwestern axes of the study area appear to have low aquifer conductivity with Nkwogu Amuda -Isuochi areas having the lowest value of 0.000149 Sm^{-1} to $0.0007990 \text{ Sm}^{-1}$ which corresponds to the green-coloured region.

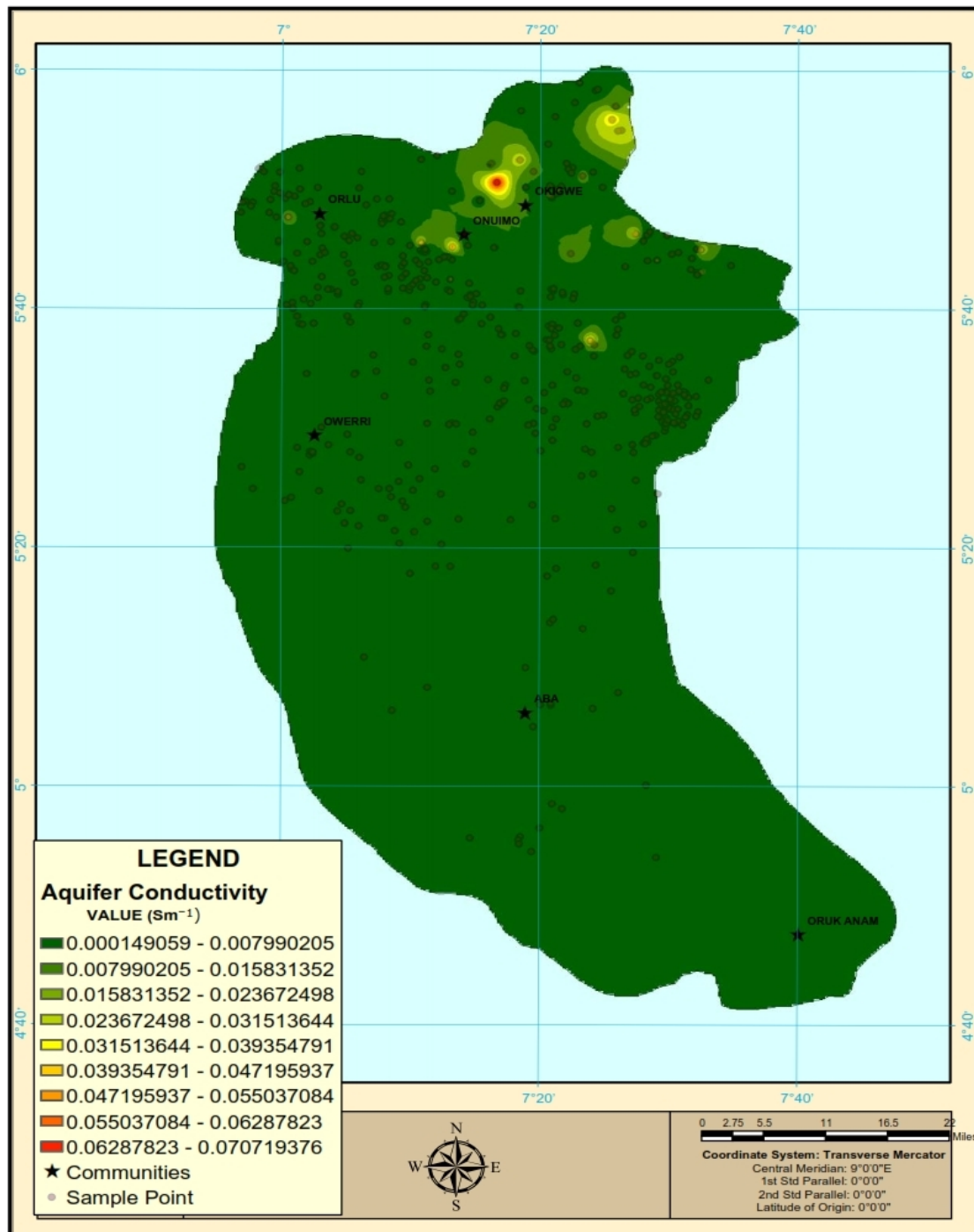


Figure 4.7: Aquifer Conductivity map of the Study Area

4.1.6.3 Transverse Resistance

Transverse resistance across the study area was estimated by taking the product of aquifer resistivity (Ωm) and aquifer thickness (m). The eastern and the northern part of the study area appear to have low transverse resistance with Okigwe town and Onuimo areas having the

least value of $6006 \Omega\text{m}^2$ to $30000 \Omega\text{m}^2$ which corresponds to the green-coloured region as shown in Figure 4.5 below. The Northwestern axes of the study area appear to have high transverse resistance with Nwoagwu Amuda -Isuochi having the highest transverse resistance value of $201437.4 \Omega\text{m}^2$ to $225866.4 \Omega\text{m}^2$ which corresponds to the region having red colour. The purple area (up to $80000 \Omega\text{m}^2$) may not be productive since the transverse resistance value is low. Transverse resistance for all the sounding locations was contoured as shown in figure 4.7 below.

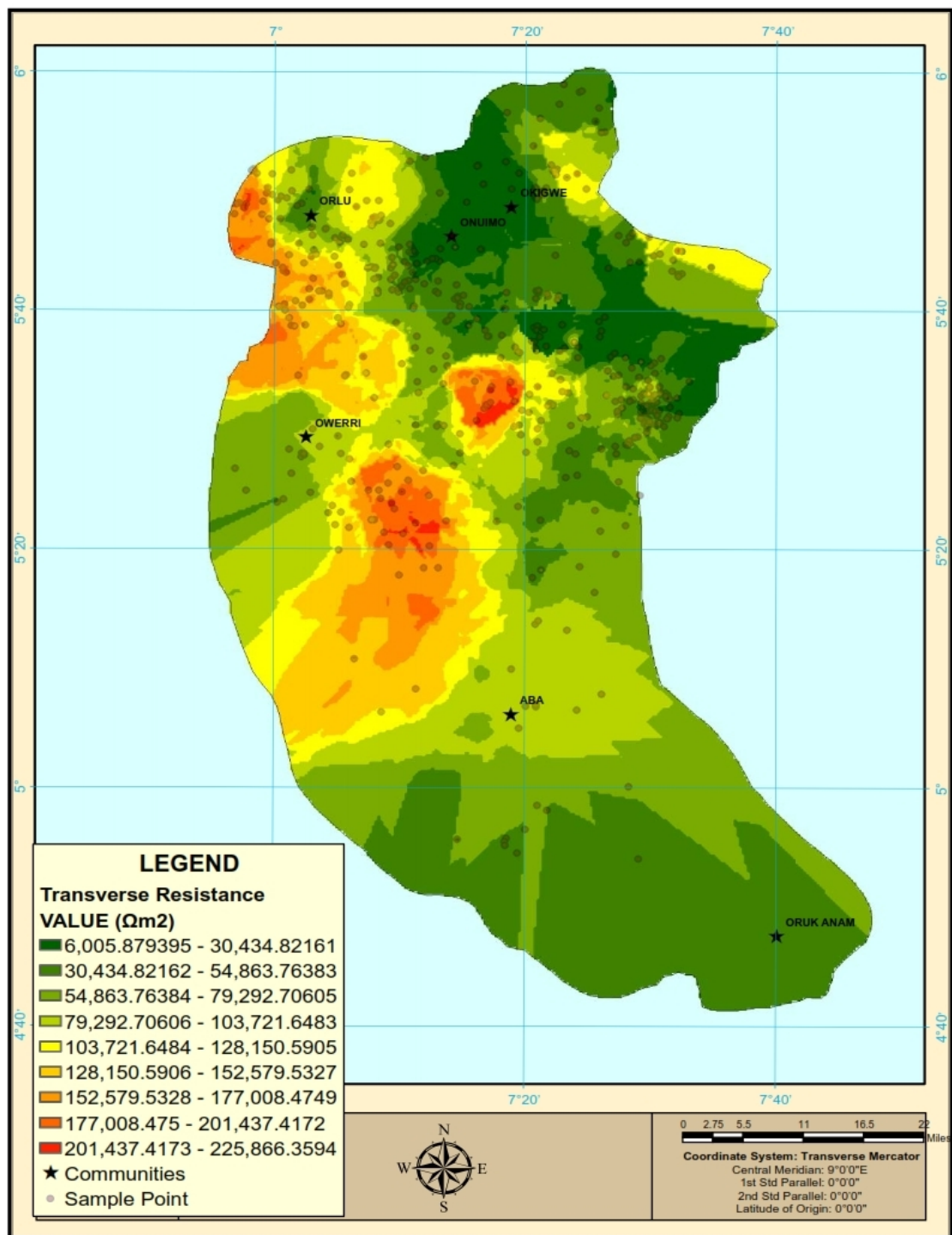


Figure 4.7: Transverse Resistance map of the Study Area

4.1.6.4 Longitudinal Conductance

Longitudinal conductance across the study area was estimated by taking the ratio of aquifer thickness (m) to aquifer resistivity (Ωm). The distribution of longitudinal conductance values across the study area (figure 4.8) shows that the northern axes of the study area appear to have high longitudinal conductance with Okigwe axis and Aba axis having the highest value of $3.3550 \Omega^{-1}$ to $3.7743 \Omega^{-1}$. This corresponds to the red-coloured region. The southern axes of the study area appear to have low longitudinal conductance with Umuokwara - Ihebinowerre having the lowest value of $0.00096 \Omega^{-1}$ to $0.4202 \Omega^{-1}$. This corresponds to the green-coloured region. Other parts of the study area are expected to be underlain by thick and conductive aquifer materials having relatively higher longitudinal conductance thus making the area good for groundwater prospection. Longitudinal conductance for all the sounding locations was contoured as shown in figure 4.8 below.

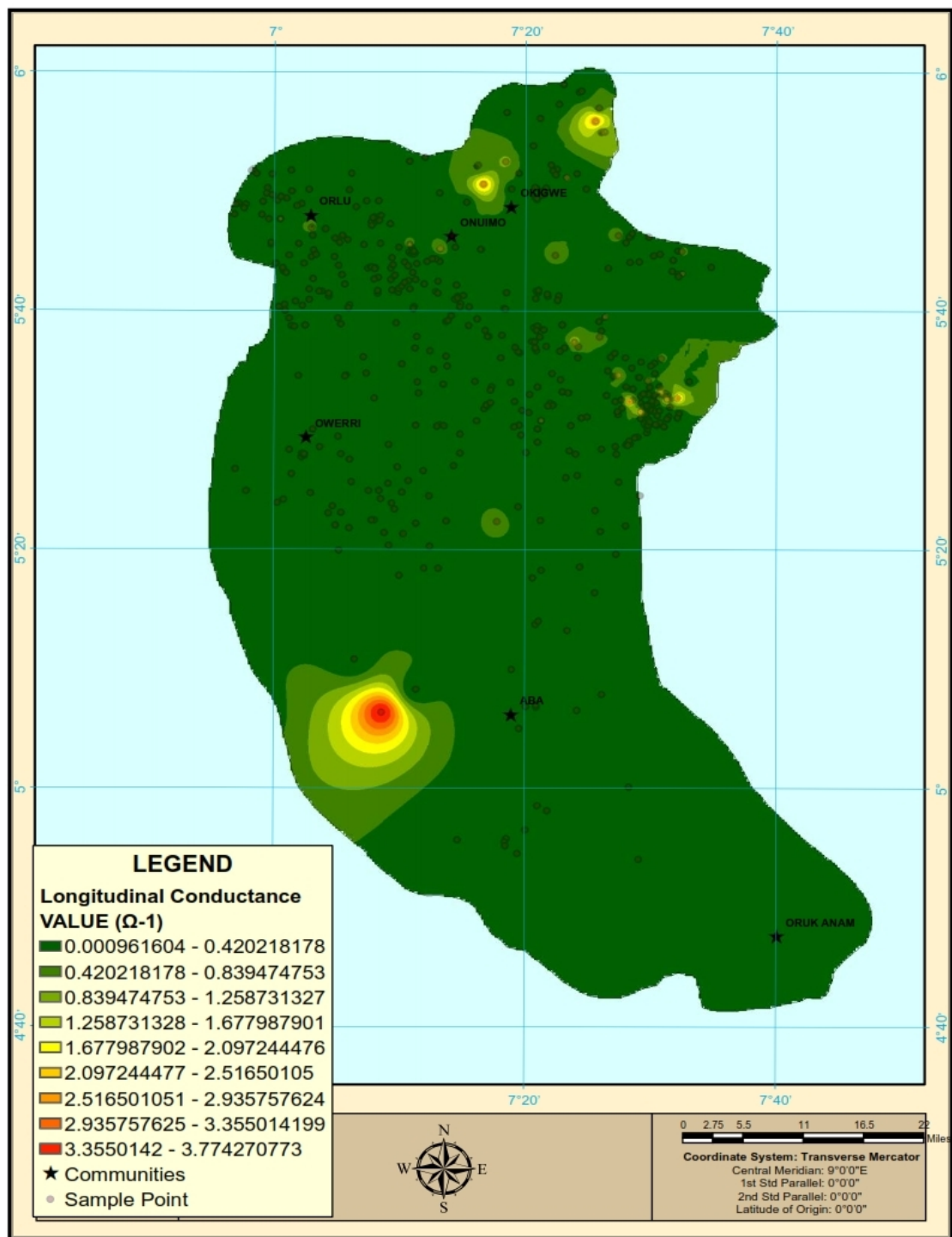


Figure 4.8: Longitudinal Conductance map of the Study Area.

4.1.6.6 Aquifer Hydraulic parameters:

Aquifer hydraulic conductivity, transmissivity, storativity and hydraulic diffusivity are very useful means of confirming zones of prolific aquifers. Hydraulic conductivity refers to the ability of a material to conduct fluids under a unit hydraulic gradient (Fetter, 1994). This is designated by K and measured in m/day. In this study, K was estimated from the product of diagnostic constant $K\sigma$ and the aquifer apparent resistivity.

The hydraulic conductivity values estimated from Heigold model, 1979 using the formula

$KH = 386.40\rho^{-0.93283}$ varies from 0.0745 m/day to 37.467 m/day with a mean value of 1.736 m/day as shown in Appendix C and figure 4.9.

Alternatively, the hydraulic conductivity values estimated from Niwas & Singhal, 1982 varies from 0.55 m/day to 125.84 m/day with a mean value of 13.19 m/day as shown in Appendix C and figure 4.9

In this study, the hydraulic conductivity values have been estimated using a new model that is Formation sensitive via the following model equations: equ.4.1 (Ajali Formation), equ.4.2 (Ameki Formation), equ.4.3 (Benin Formation), equ.4.4 (Imo Shale Formation, equ.4.5 (Nsukka Formation) and equ.4.6 (Ogwasi/Asaba) respectively as shown is shown in figure 4.10

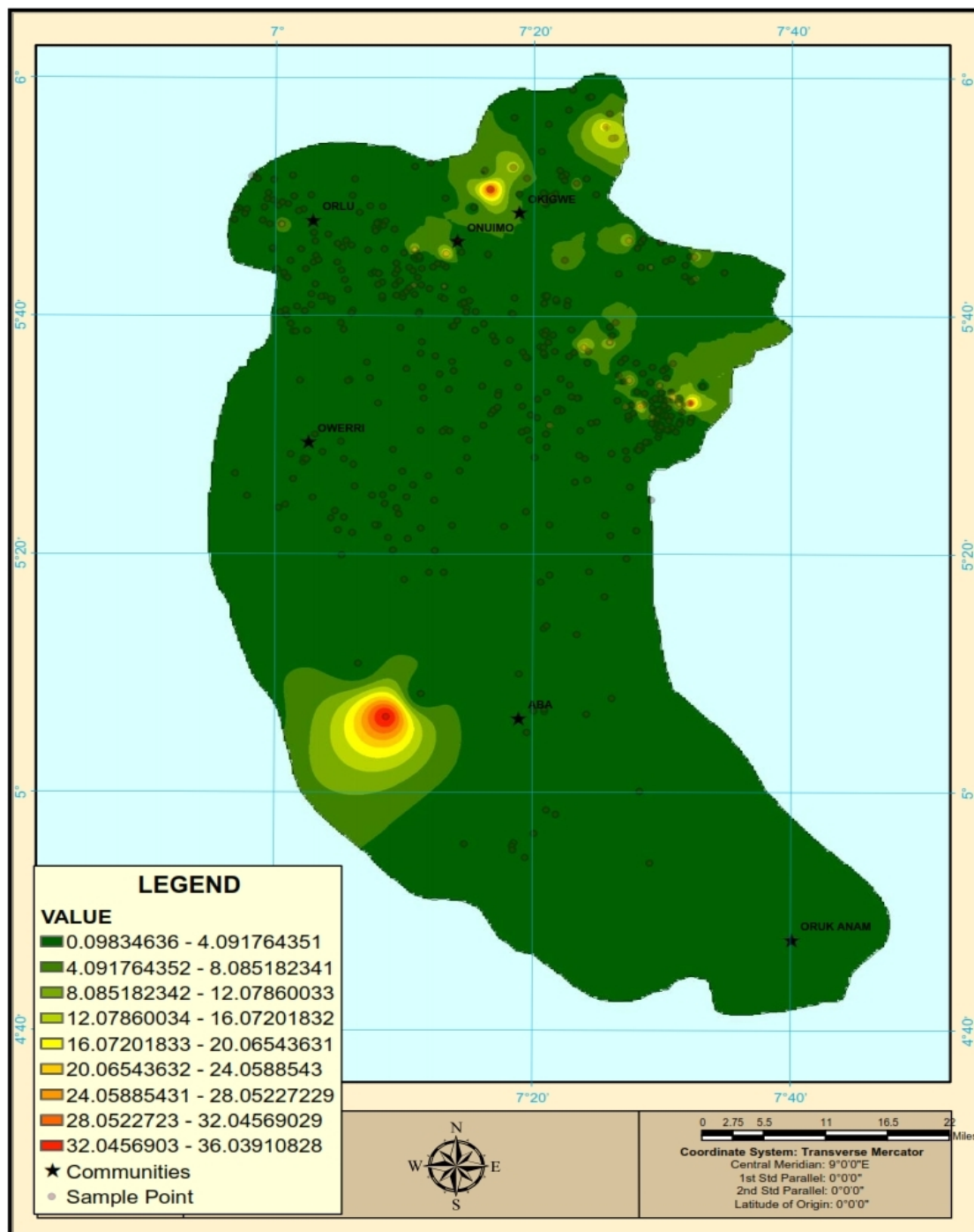


Figure 4.9: Map of Hydraulic Conductivity Estimated from Heigold Model (1979) in the study area

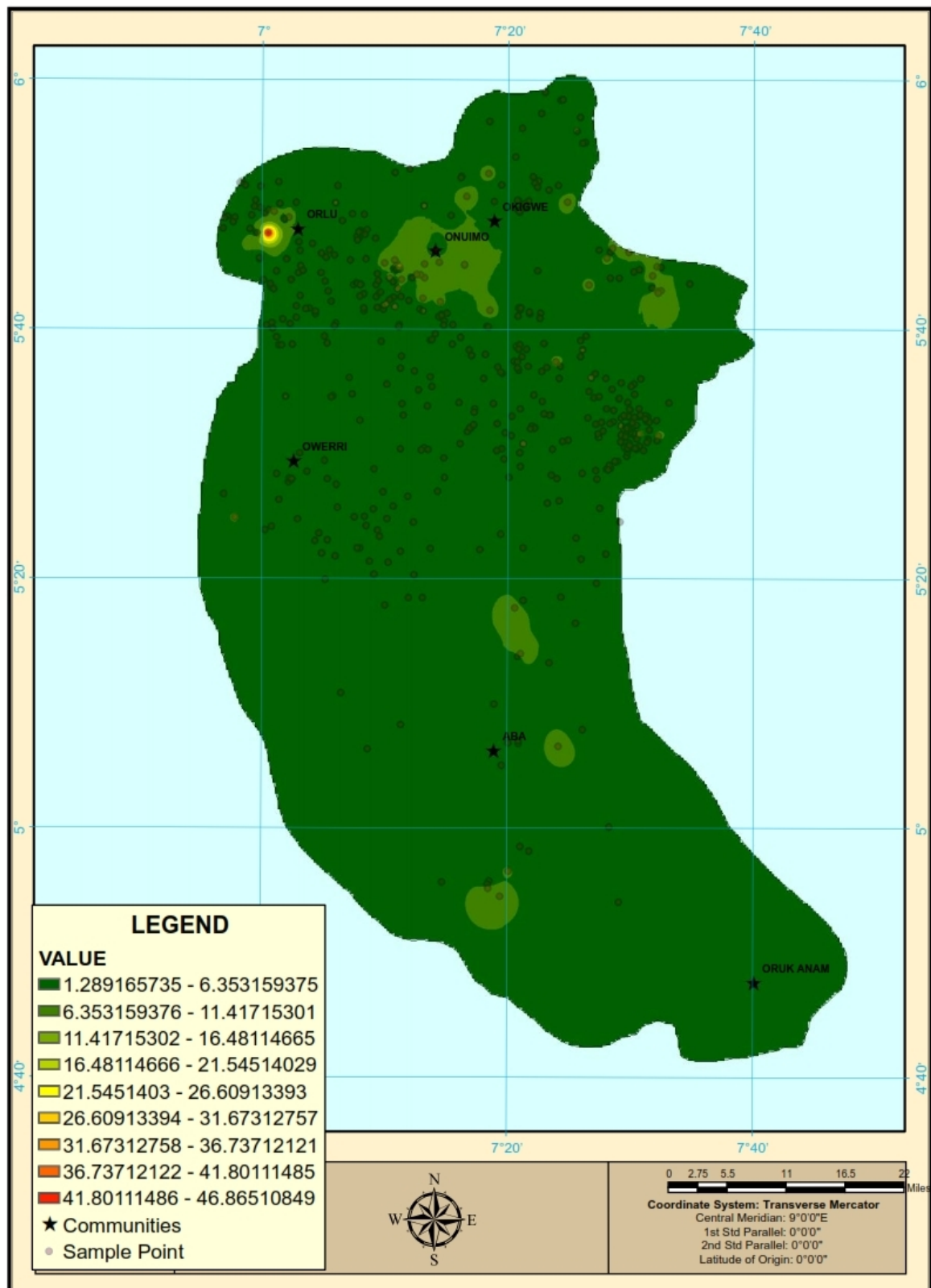


Figure 4.10: Map of Hydraulic Conductivity Estimated from New Model in the study area

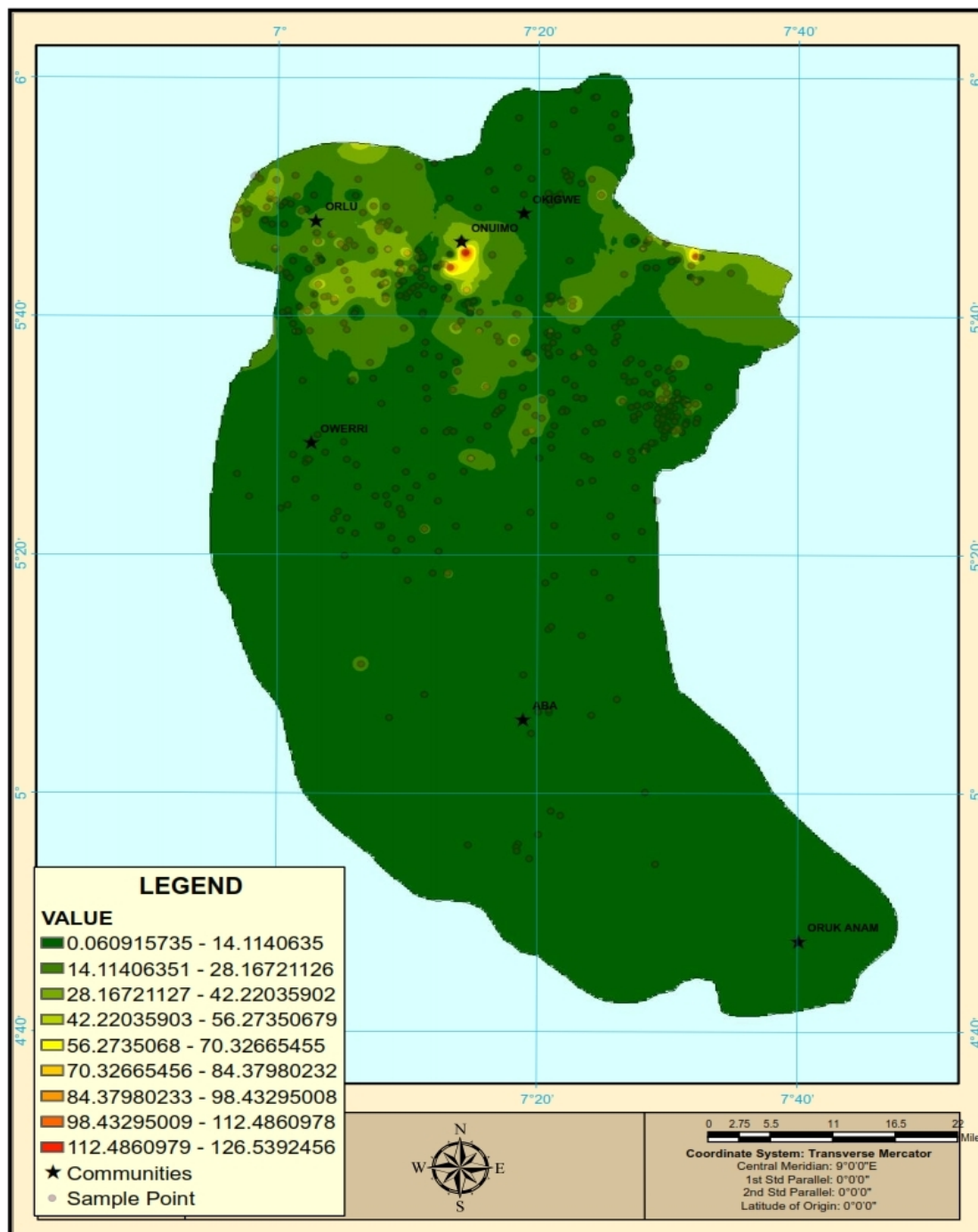


Figure 4.11: Map of Aquifer Hydraulic Conductivity estimated from Niwas & Singhal (1981) of the Study Area.

4.1.6.7 Aquifer Transmissivity

Aquifer transmissivity measured in m^2/day is defined as the product of the hydraulic conductivity (or permeability) and thickness of the aquifer unit. With hydraulic conductivity K value estimated from the pumping tests in some boreholes within the study area were acquired from AIRBA, which makes it possible to estimate the transmissivity of the aquiferous zone and its variation from place to place, including those areas where borehole data are not available. In this study, the transmissivity from VES was estimated by using the formula $T=Kh$ (i.e taking the product of the hydraulic conductivity and the thickness of the aquifer) . The transmissivity value has a mean value of $504.374\text{m}^2/\text{day}$ as shown in Appendix C.

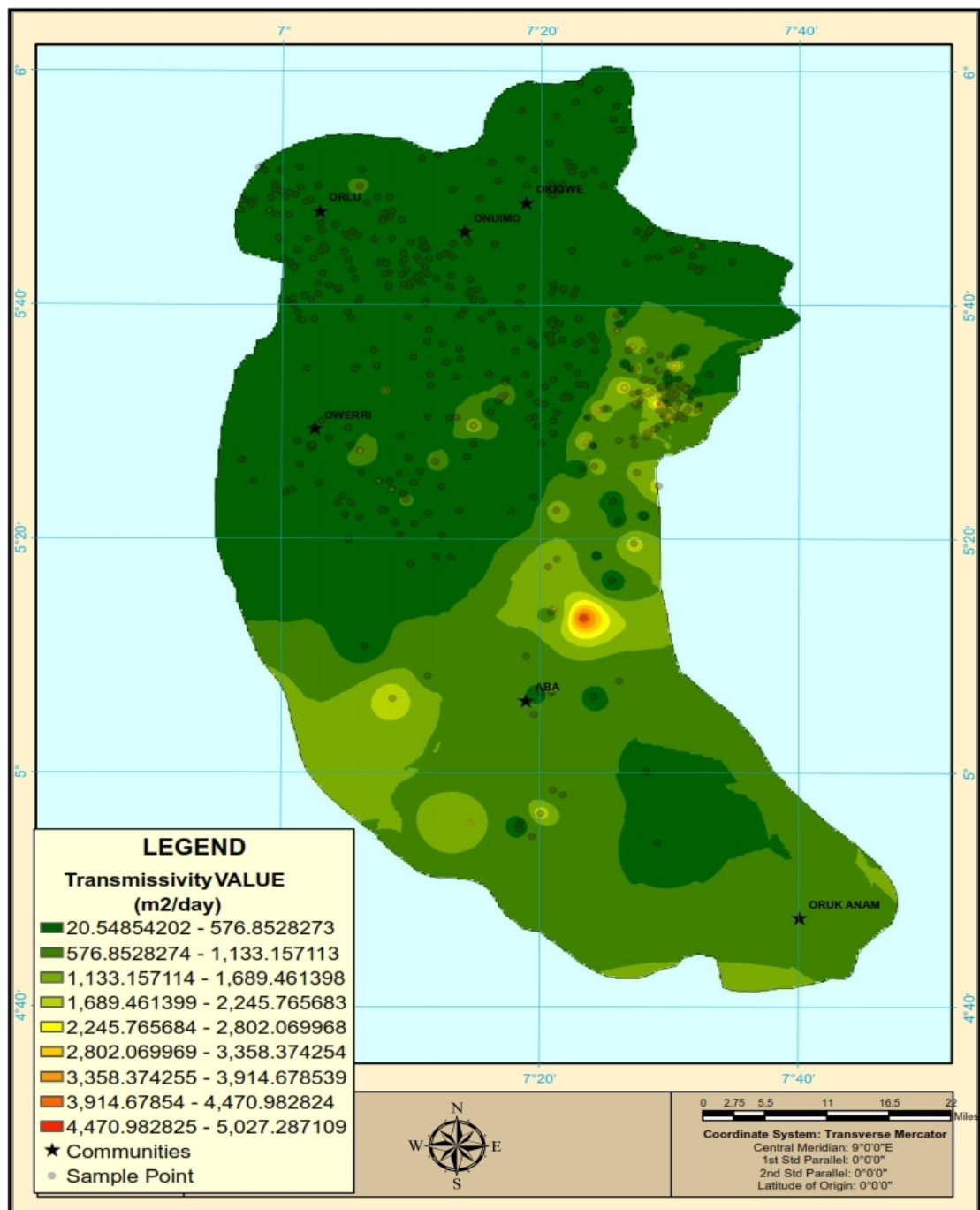


Figure 4.12: Transmissivity map of the Study Area

4.1.6.8 Aquifer Storativity

The volume of water an aquifer releases or takes into storage is known as the storage coefficient. The numerical value assigned to an aquifer is the storativity, a dimensionless value. In this study, storativity is determined from the rule of thumb by Lohman (1972). The storativity of the various Formations were calculated as shown in table 4.3 using the formula $S=1.3h/10^6$ as thus:

(Ajali Formation, the average storativity is about 5.3×10^{-5} whereas for (Ameki Formation, the average storativity is about 5.54×10^{-5} . For Benin Formation, the average storativity is about 5.11×10^{-5} while for Imo Shale Formation has a mean storativity of 3.48×10^{-5} . For Nsukka Formation, the average storativity is about 4.8×10^{-5} while the average storativity for Ogwuasi/Asaba is about 4.86×10^{-5} The average storativity for entire study area is about 5.176×10^{-5} as shown in Appendix C and figure 4.13 below

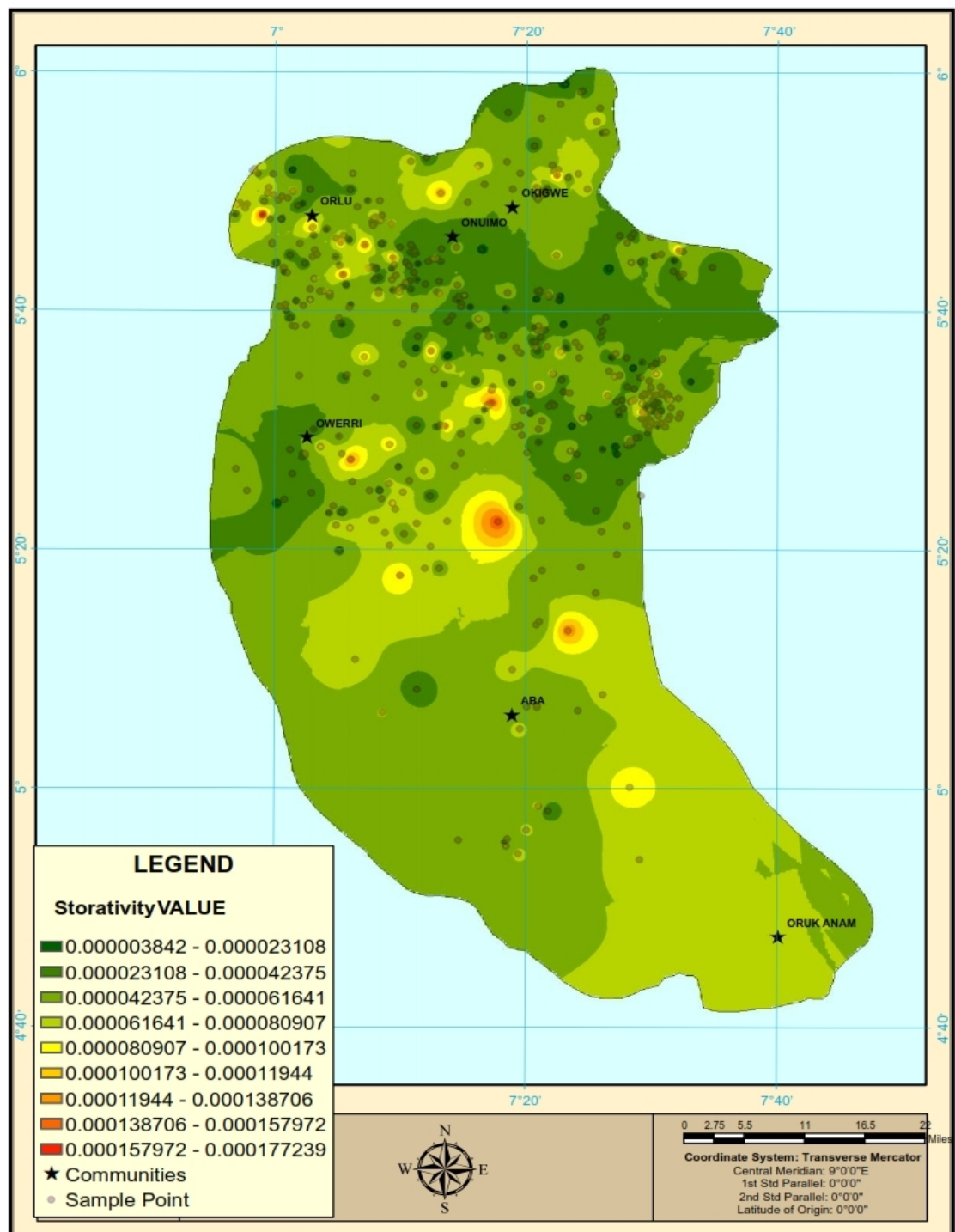


Figure 4.13: Map of Aquifer Storativity of the Study Area

4.1.6.9 Aquifer Diffusivity

Hiscock, 2005 noted that by combining the aquifer properties of transmissivity and storativity, it is possible to define a single formation parameter, the hydraulic diffusivity. Aquifer formations with a large hydraulic diffusivity respond quickly in transmitting changed hydraulic conditions at one location to other regions in an aquifer (Hiscock, 2005). The diffusivity of the various Formations were calculated as shown in table 4.4 using the formula $D = TS^{-1}$ as thus:

For Ajali Formation, the average hydraulic diffusivity is about 2828205.13 m²/day whereas, for Ameki Formation, the average diffusivity is about 3598858.56 m²/day. For Benin Formation, the average diffusivity is about 16001282 m²/day while for Imo Shale Formation, the average diffusivity is about 5828365.38 m²/day .For Nsukka Formation, the average diffusivity is about 4378062.68 m²/day while for Ogwasi/Asaba Formation, and the average hydraulic diffusivity is about 2081065.09 m²/day as shown in Appendix C and the figure 4.14 below.

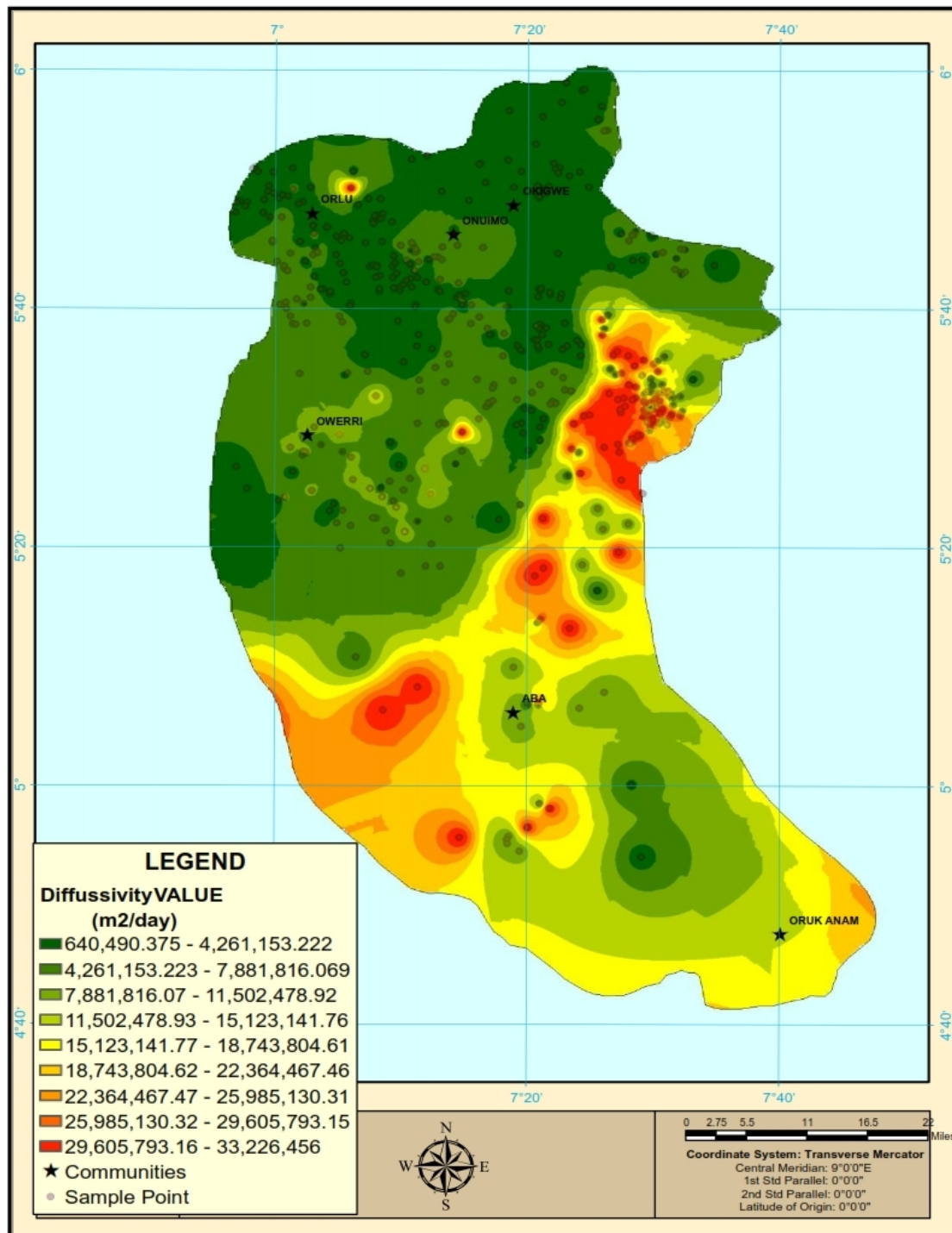


Figure 4.14: Diffusivity map of the Study Area

4.1.7 The Proposed New Model Equation for Estimating Hydraulic Conductivity from Geophysical Approach

The table 4.5 below shows aquifer conductivity and the pumping test data of Ajali Formation. The available hydraulic conductivity (pumping test) values are plotted against the aquifer conductivity where a model equation (equ.4.1) is generated. A correlation coefficient of 1.0 is obtained which shows a good relationship between the parameters. As shown in equation.4.1 below, the hydraulic conductivity of Ajali Formation can easily be computed if the aquifer conductivity is known.

Table 4.5: Ajali Formation: Resistivity, Conductivity and Pumping test values

Location	Resistivity (Ωm)	Conductivity (sm^{-1})	Hydraulic conductivity (m/day)
AJ 26	1230	0.000813008	5.1
AJ 16	2080	0.000480769	4.9
AJ 35	1200	0.000641026	5.3

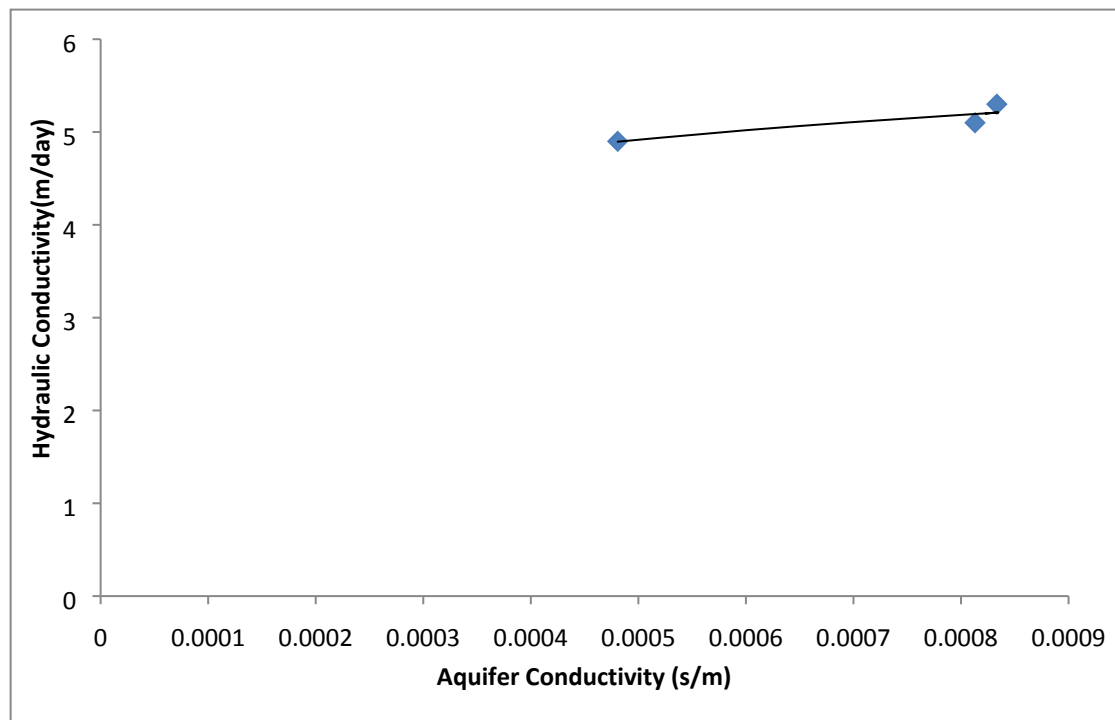


Figure 4.16: A plot of Aquifer Hydraulic Conductivity against Aquifer Conductivity in Ajali Formation.

Model equation for Ajali Formation:

$$K_{\text{NM-AJ}} = 8.767\sigma^{0.076} \quad (4.1)$$

The table 4.6 below shows aquifer conductivity and the pumping test data of Ajali Formation. The available hydraulic conductivity (pumping test) values are plotted against the aquifer conductivity where a model equation (equ.4.2) is generated. A correlation coefficient of 0.872 is obtained, which shows a good relationship between the parameters. As shown in equation.4.2 below, the hydraulic conductivity of Ameki Formation can easily be computed if the aquifer conductivity is known.

Table 4.6: Ameki Formation: Resistivity, Conductivity and Pumping test values

Location	Resistivity (Ωm)	Conductivity (S/m)	Hydraulic conductivity (m/day)
AM 91	1260	0.000793651	4.53
AM 123	1880	0.000531915	3.2
AM 73	1080	0.000819672	5.83

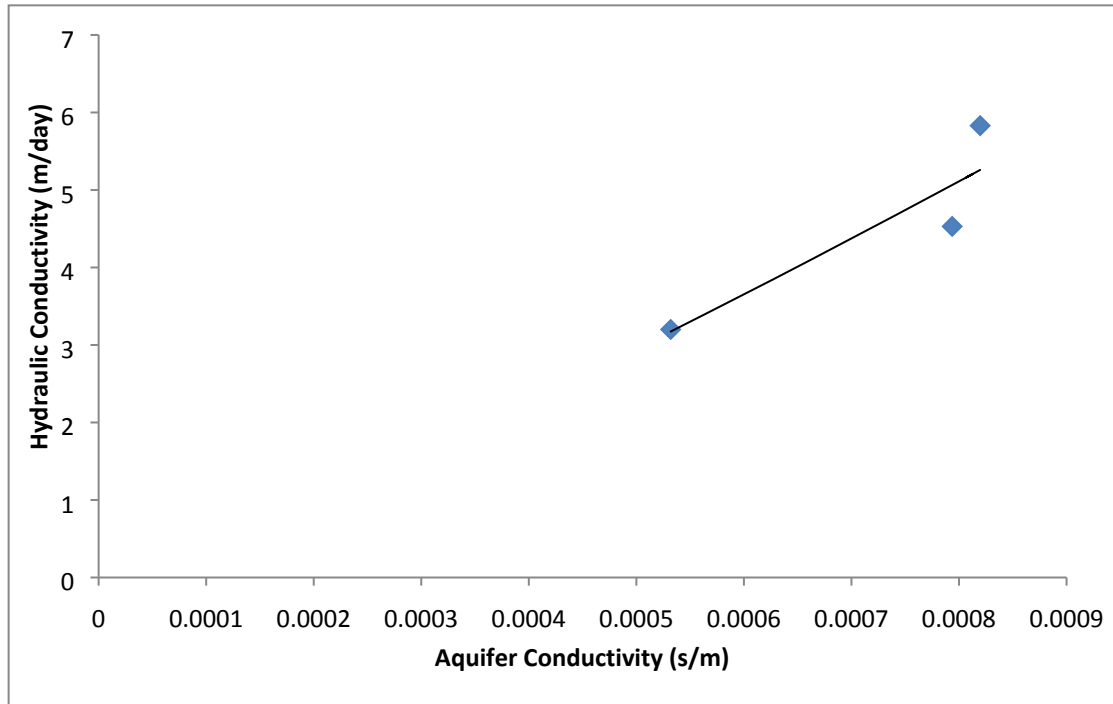


Figure 4.17: A plot of Aquifer Hydraulic Conductivity against Aquifer Conductivity in Ameki Formation

Model equation for Ameki Formation:

$$K_{NM-AM} = 21155\sigma^{1.167} \quad (4.2)$$

The table 4.7 below shows aquifer conductivity and the pumping test data of Ajali Formation. The available hydraulic conductivity (pumping test) values are plotted against the aquifer conductivity where a model equation (equ.4.3) is generated. A correlation coefficient of 0.914 is obtained which shows a good relationship between the parameters. As shown in equation.4.3 below, the hydraulic conductivity of Benin Formation can easily be computed if the aquifer conductivity is known.

Table 4.7: Benin Formation: Resistivity, Conductivity and Pumping test values

Location	Resistivity (Ωm)	Conductivity (S/m)	Hydraulic conductivity (m/day)
BN 196	1810	0.000552486	4.75
BN 4.9	5650	0.000867257	4.9
BN 363	1700	0.000588824	4.8
BN 369	1180	0.000847458	6.57
BN 378	1970	0.000507614	4.06
BN 443	1120	0.000892857	7
BN 492	6820	0.000146628	1.99
BN 2.39	3410	0.000293255	2.39
BN495	1160	0.000862069	5.62

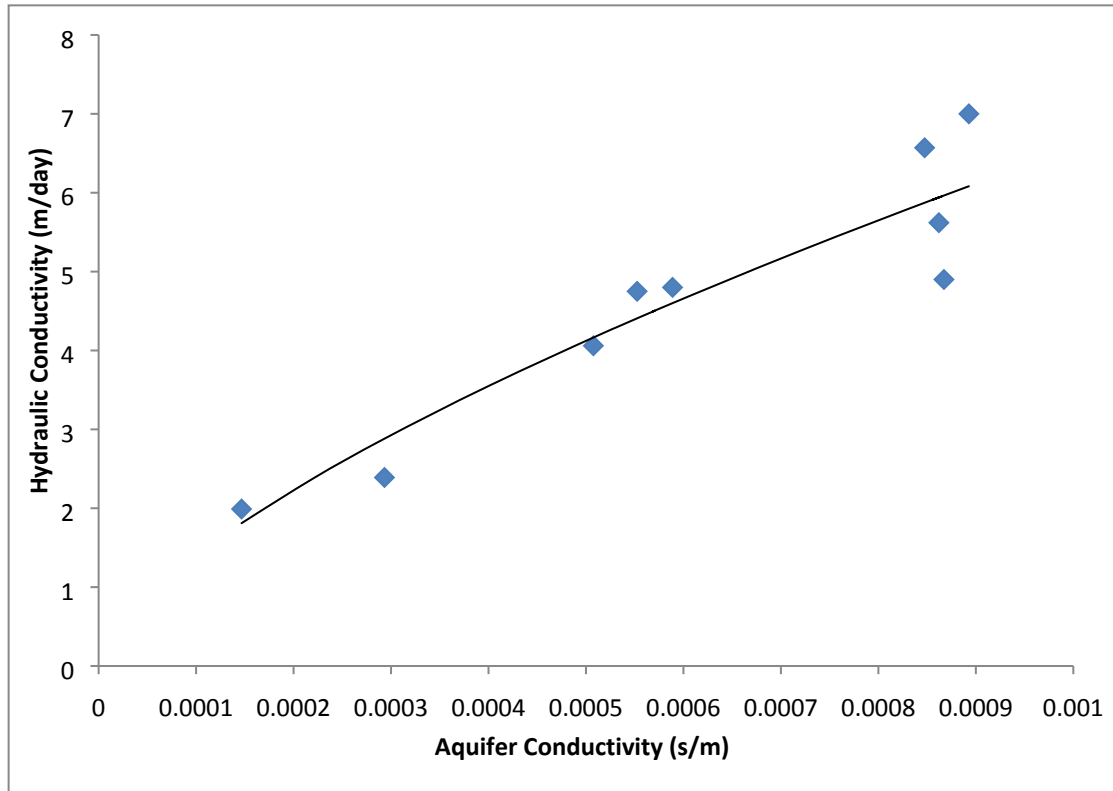


Figure 4.18: A plot of Aquifer Hydraulic Conductivity against Aquifer Conductivity in Benin Formation

The model equation for Benin Formation:

$$K_{NM-BN} = 675.3\sigma^{0.670} \quad (4.3)$$

The table 4.8 below shows aquifer conductivity and the pumping test data of Imo Shale Formation. The available hydraulic conductivity (pumping test) values are plotted against the aquifer conductivity where a model equation (equ.4.4) is generated. A correlation coefficient of 1.0 is obtained which shows a good relationship between the parameters. As shown in equation.4.4 below, the hydraulic conductivity of Imo Shale Formation can easily be computed if the aquifer conductivity is known.

Table 4.8: Imo Shale Formation: Resistivity, Conductivity and Pumping test values.

Location	Resistivity (Ωm)	Conductivity (S/m)	Hydraulic conductivity (m/day)
IS 507	142	0.000704225	8.16
IS 514	130	0.007692308	7.89
IS 505	150	0.006666667	7.6

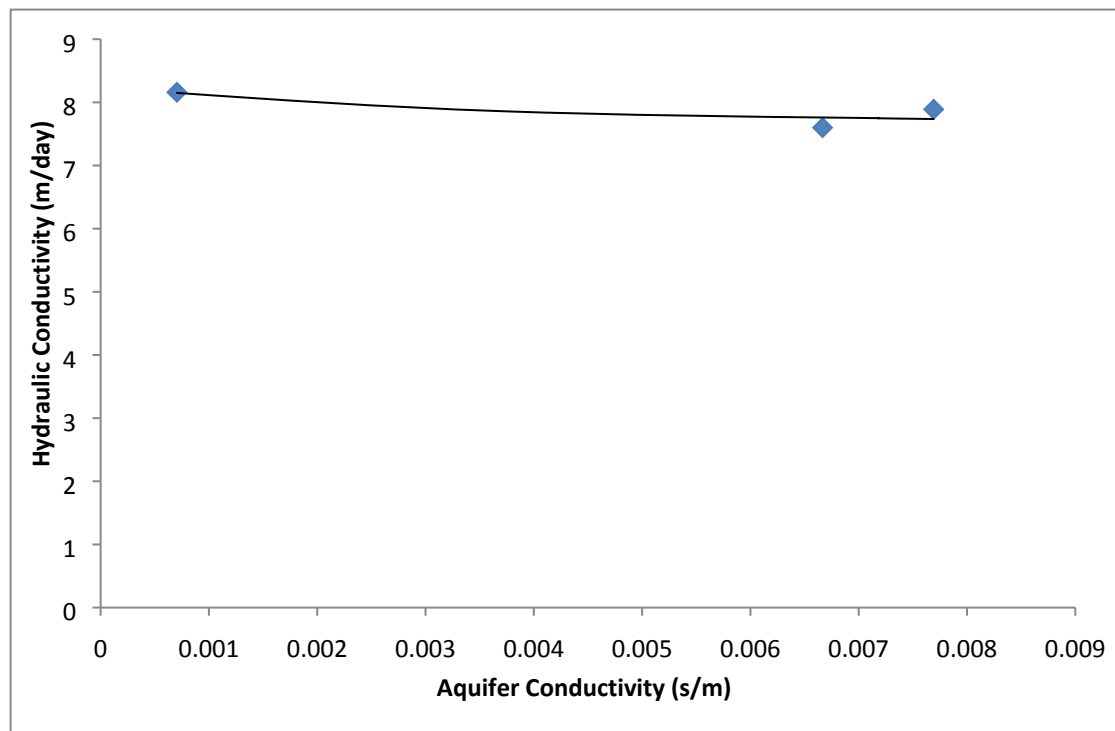


Figure 4.19: A plot of Aquifer Hydraulic Conductivity against Aquifer Conductivity in Imo Shale Formation.

The model equation for Imo Shale Formation:

$$K_{\text{NM-IM}} = 7.367\sigma^{0.01} \quad (4.4)$$

The table 4.9 below shows aquifer conductivity and the pumping test data of Nsukka Formation. The available hydraulic conductivity (pumping test) values are plotted against the aquifer conductivity where a model equation (equ.4.5) is generated. A correlation coefficient of 1.0 is obtained which shows a good relationship between the parameters. As shown in equation.4.5 below, the hydraulic conductivity of Nsukka Formation can easily be computed if the aquifer conductivity is known.

Table 4.9: Nsukka Formation: Resistivity, Conductivity and Pumping test values

Location	Resistivity (Ωm)	Conductivity (S/m)	Hydraulic conductivity (m/day)
NS 524	343	0.002915494	5.01
NS 542	173	0.005780347	4.13
NS 536	202	0.004950495	4.6

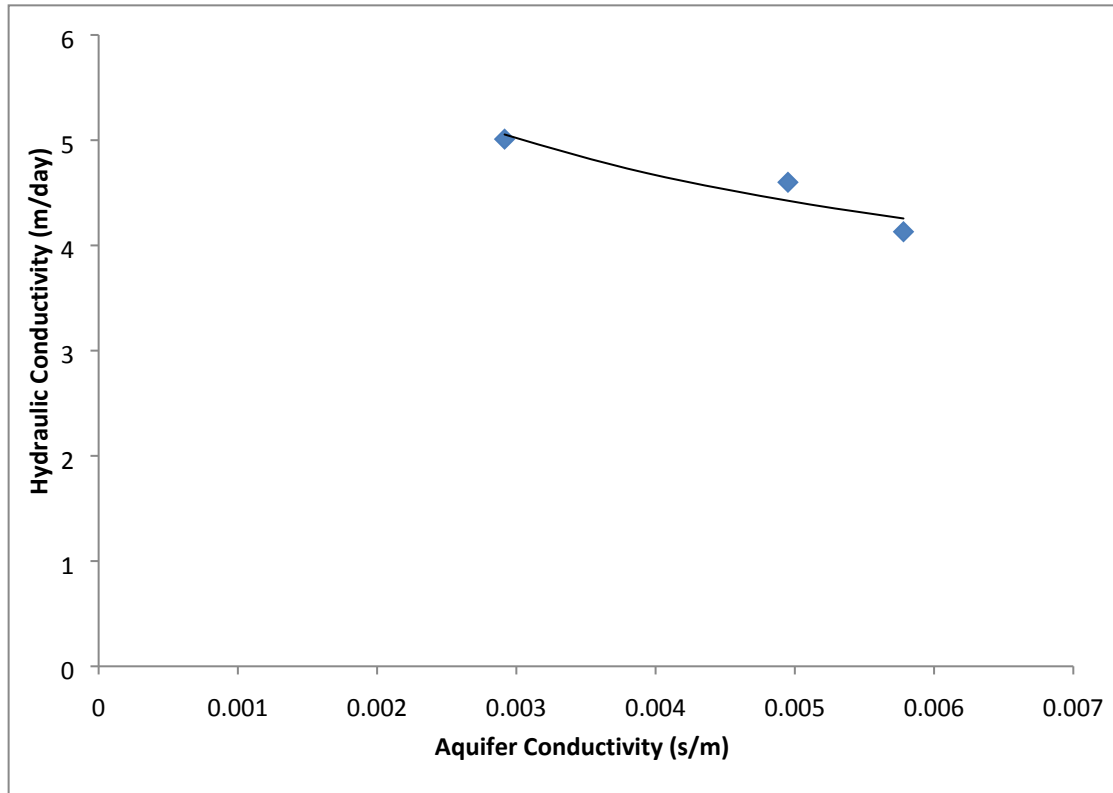


Figure 4.20: A plot of Aquifer Hydraulic Conductivity against Aquifer Conductivity in Nsukka Formation.

The model equation for Nsukka Formation:

$$K_{NM-NS} = 0.964\sigma^{0.28} \quad (4.5)$$

The table 4.10 below shows aquifer conductivity and the pumping test data of Ogwasi/Asaba Formation. The available hydraulic conductivity (pumping test) values are plotted against the aquifer conductivity where a model equation (equ.4.6) is generated. A correlation coefficient of 1.0 is obtained which shows a good relationship between the parameters. As shown in equation.4.6 below, the hydraulic conductivity of Ogwasi/Asaba Formation can easily be computed if the aquifer conductivity is known.

Table 4.10: Ogwasi/Asaba Formation: Resistivity, Conductivity and Pumping test values

Location	Resistivity (Ωm)	Conductivity (S/m)	Hydraulic conductivity (m/day)
OG 545	1700	0.000588235	2.39
OG 553	1040	0.000961538	2.77
OG 566	1560	0.000641026	2.5

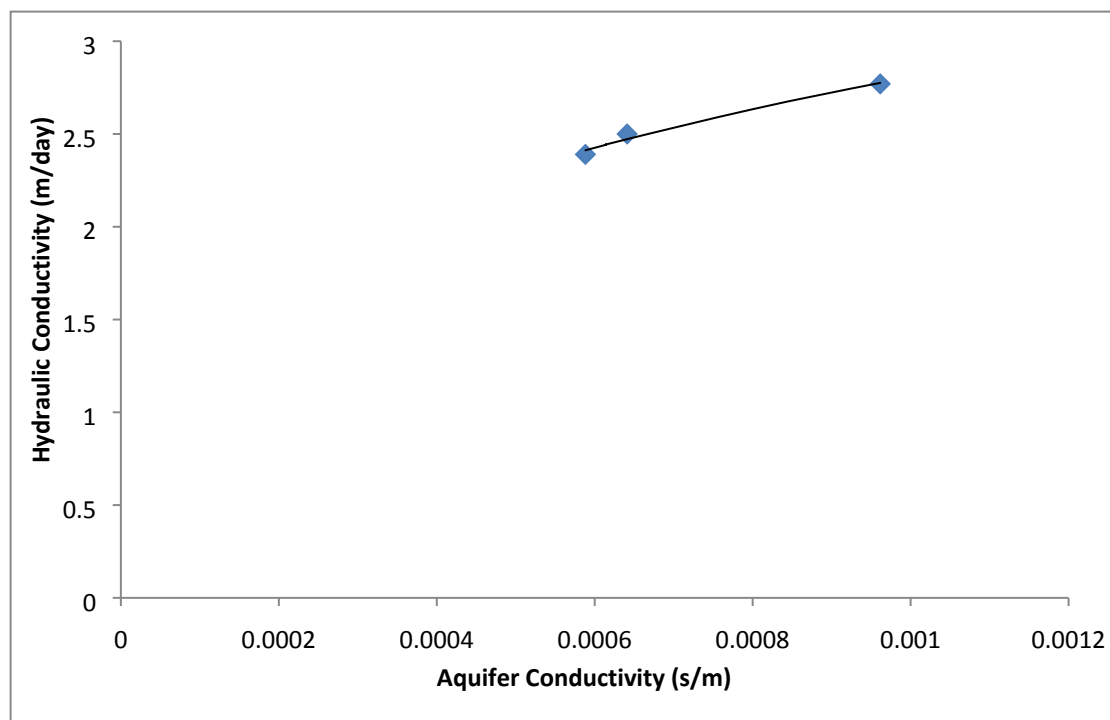


Figure 4.21: A plot of Aquifer Hydraulic Conductivity against Aquifer Conductivity in Ogwasi/Asaba Formation.

The model equation for Ogwasi/Asaba Formation:

$$K_{\text{NM-OG}} = 22.30\sigma^{0.300} \quad (4.6)$$

4.1.8 Estimation of aquifer vulnerability using geologic methods (DRASTIC, GOD).

The table 4.11 above displays the summarized results of the DRASTIC model across the study area. In this study, only the DRASTIC and GOD methods used for groundwater vulnerability assessment was used. Most often they are based on overlay and index techniques. Once DRASTIC indices have been computed, it is possible to identify areas that are more susceptible to groundwater contamination than others. The higher the DRASTIC index the greater the groundwater contamination potential. To facilitate interpretation, the final index was divided into vulnerability classes such as low, moderate, high, and very high potential categories as shown in table 4.12 (Aller, 1987, modified Piscopo, 2001)

The Vulnerability Contour Map of the study area in figure 4.22 below displays areas of low, moderate and high vulnerability. The northwestern axes of the study area appears to have areas of low vulnerability with Okwelle-Onuimo areas of VES IS 510 in Imo Shale having DRASTIC index $D_i = 76$ and Afor Ikpem areas of VES AM 190 in Ameki Formation having the same DRASTIC index $D_i = 139$. The extreme Northeastern part and some parts within the Northern flank of the study area appear to have moderate vulnerability with Ihube areas of VES AJ 39 in Ajali Formation having DRASTIC index $D_i = 110$ and Ihiagwa-Owerri areas of VES BN 414 in Benin Formation having DRASTIC index $D_i = 162$ respectively.

Table 4.12: DRASTIC index ranges for qualitative risk categories (Aller, 1987, modified Piscopo, 2001)

	DRASTIC Qualitative Category			
	LOW	MODERATE	HIGH	VERY HIGH
DRASTIC INDEX (DI)	1 – 100	101 – 140	141 – 200	>200

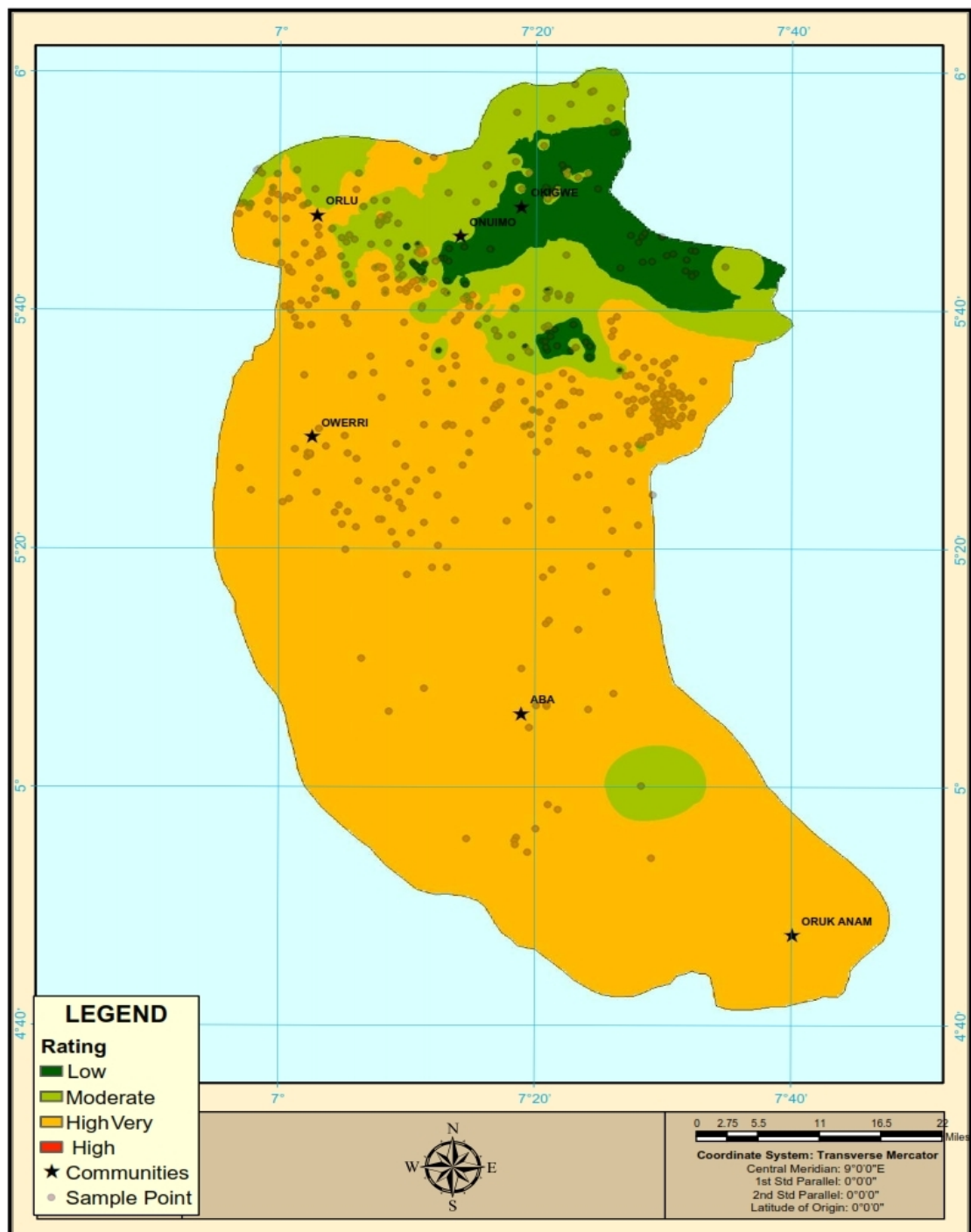


Figure 4.22: Vulnerability (DRASTIC Model) Map of the Study Area

The table 4.13 above displays the summarized results of the GOD model across the study area. The Ajali Formation with an average vulnerability index 0.084 is said to be negligible while the Ameki and Benin Formations with a mean index of 0.112 and 0.504 are said to be low and high respectively. The Imo Shale, Nsukka and Ogwasi/Asaba Formations with an average index of 0.125, 0.1 and 0.123 respectively and are said to be below.

The vulnerability of the study area was evaluated using Geologic (**DRASTIC** and **GOD**) and Geophysical (Integrated Electrical Conductivity, **IEC**) models. The vulnerability contour maps (Figures. 4.22, 4.23 and 4.24) show that some parts within the northern axes of the study area are of high vulnerability while every other part of the study area is of low to moderate vulnerability. Areas of low vulnerability are found in Ameki and Imo Shale Formations which could be due to their low permeability and high depths to water table. Most of the areas in the Benin Formation have high vulnerability. This could be attributed to the overburden made up of largely fine, medium to coarse grain sand and depth to water table which is less than those found in some areas of low vulnerability. However, the Ajali and Nsukka Formations are made up of areas of low vulnerability due to the nature of their lithologic units. The low vulnerability of Ajali Formation could be attributed to lithology (all other factors remain constant) while that of Nsukka Formation could be attributed to the position of the areas within the transition zone between Ajali sandstone and Nsukka Formation.

The vulnerability indices as interpreted from the GOD Model for all the locations was contoured as shown in figure 4.16 below. The areas of low and high vulnerability within the study area as interpreted from the DRASTIC Model tie with those as interpreted from the GOD Model.

Table 4.14: Vulnerability assessment criteria using GOD Method (After Foster, 1987)

Range	0-0.1	0.2 -0.3	0.4-0.5	0.6-0.7	0.8- 1.0
Rating	Negligible	Low	Moderate	High	Extreme

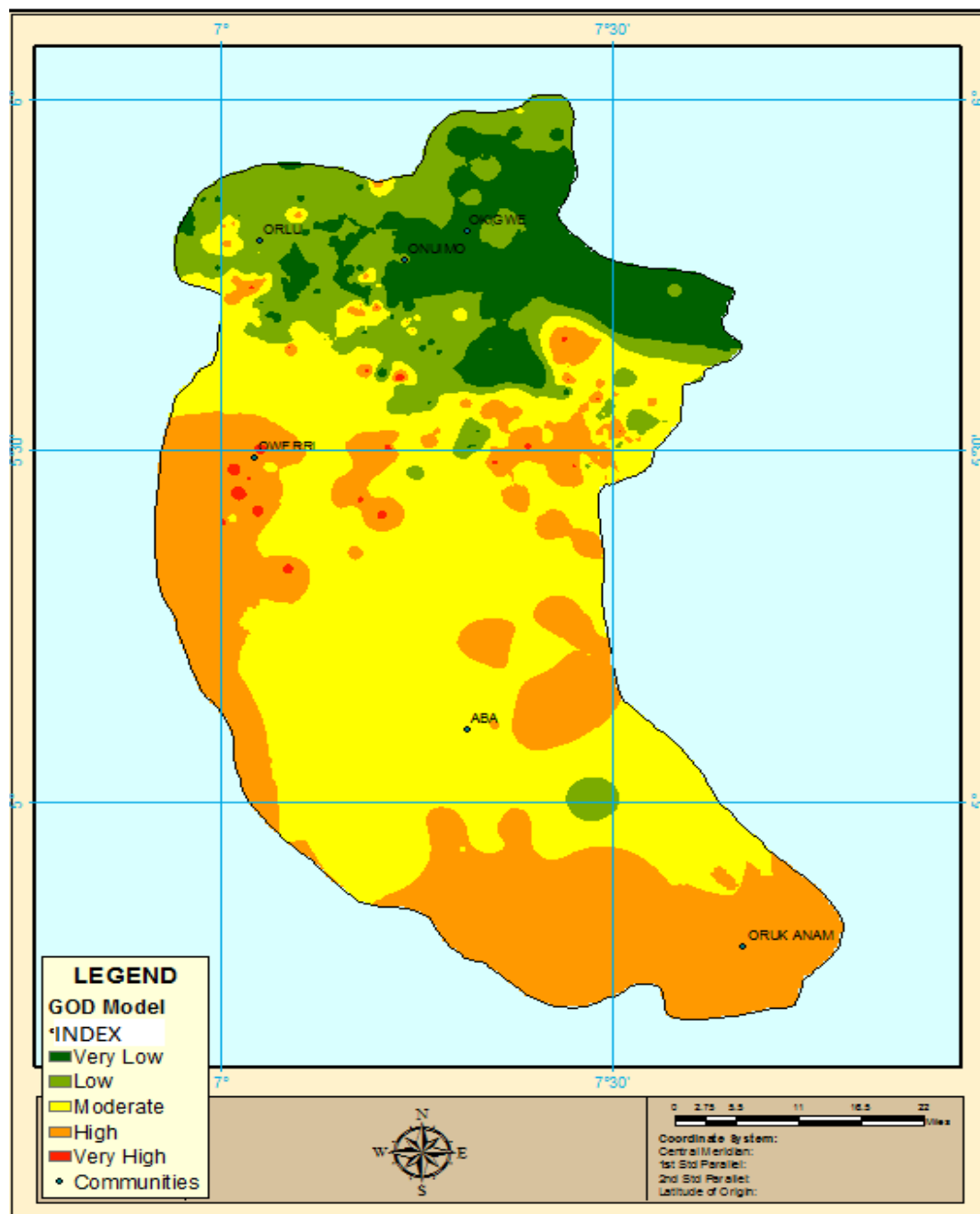


Figure 4.23: Vulnerability (GOD Model) Map of the Study Area

4.1.9 Estimation of aquifer vulnerability using geophysical methods (IEC)

The table 4.16 below shows the criteria for assessing vulnerability and the percolation time using the Geophysical approach i.e. Integrated Electrical Conductivity (IEC) or Geophysical Protective Index (GPI)

Table 4.16: Criteria for assessing vulnerability with IEC or GPI method (Henriet, 1976; Oladapo., 2004)

Degree of vulnerability	Vulnerability Index (mS)	Percolation Time
Extremely High	500	Several Month
High	500 -1000	Several month – 3 years
Moderate	1000 -2000	3 – 10 years
Low	2000-4000	10 – 25 years
Extremely low	4000	25 years

Five classes of vulnerability were established from the vulnerability map of the area shown in figure 4.24, namely: Extremely high, High, Moderate, Low and Extremely low as shown in table 4.16 above with the corresponding vulnerability index and the percolation time. The Southern parts of the area are inferred to be extremely high as indicated by deep green colour. This implies that the aquifer is shallow or the overburden is not thick enough with a percolation time lag for contaminant of several months. The Northern parts of the study area with light green, yellow, purple and red colours shows high, moderate, low and extremely low degree of vulnerabilities with the vulnerability index and percolation time respectively.

The possibilities of contaminant loads are possible in the study area because the area is characterized by leachate from dumpsites and other human activities like poor septic tank disposal systems close to the wells.

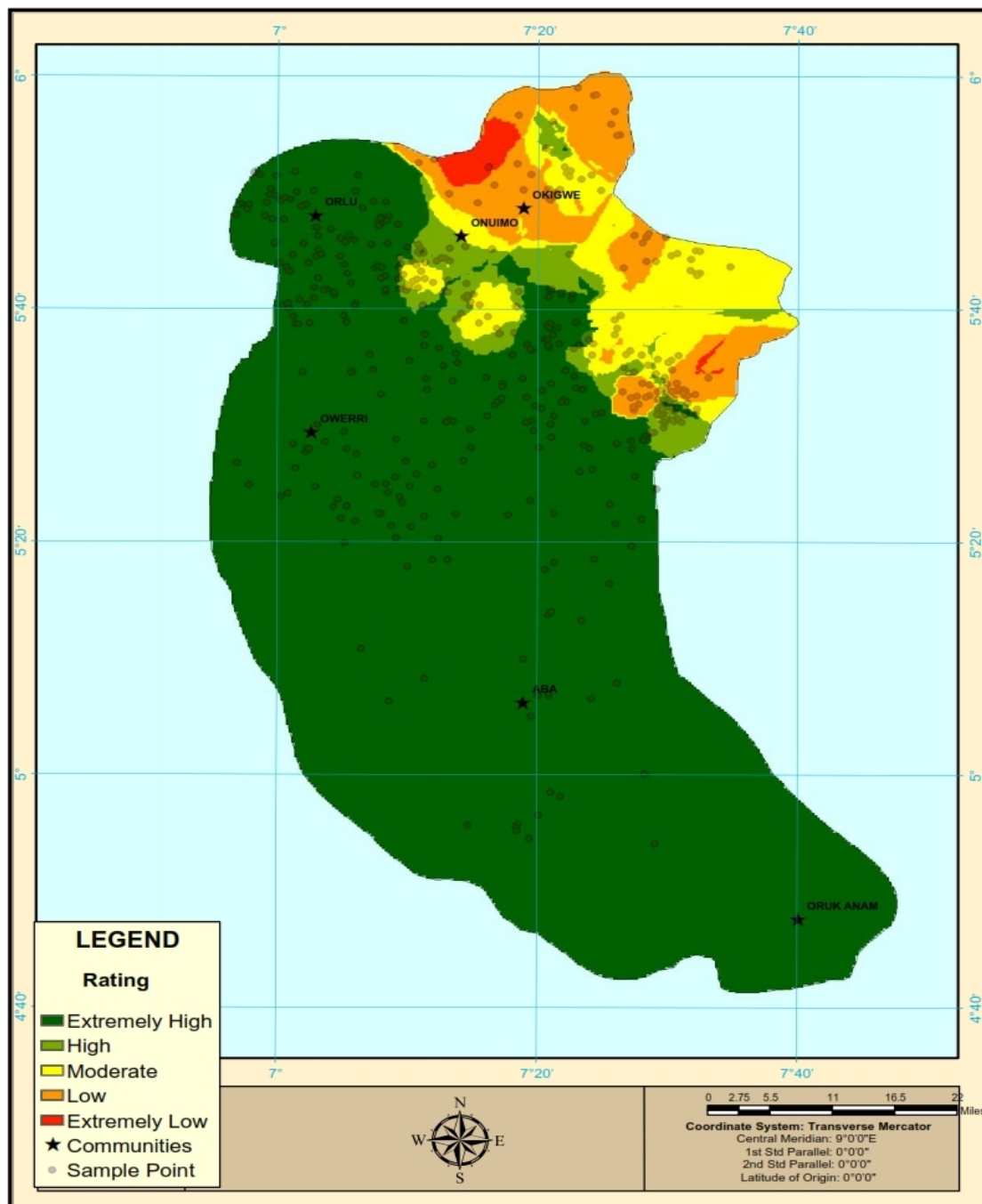


Figure 4.24: Integrated Electrical Conductivity model map of the study area

4.1.10 Estimation of aquifer hydraulic parameters from grain-size data

From the grain-size distribution curves, as seen in figures 4.25 (Sample 1-10) and figure 4.26 (Sample 11-20), Samples are classified according to particle size using the Soil Classification System. The samples are classified into named basic sample-type groups according to size, namely: sediment type and textural group. The groups were further divided into coarse, medium and fine sub-groups as seen in table 17a.

Using the grain-size distribution curves, the samples were classified with regards to the diameters of samples particles at 10%, 20% and 60%, hence the cumulative weight determined, the coefficients of uniformity (U), intercepts and porosity values were calculated. The hydraulic conductivities were calculated using the five empirical formulae discussed above. The results are presented in table 4.17b below. The quantitative analysis of grading curves using certain geometric values known as grading characteristics, i.e. d_{10} , d_{20} , d_{30} , d_{60} etc. from these characteristic sizes the effective size ($d_e = d_{10}$), uniformity coefficient ($U = d_{60}/d_{10}$), and coefficient of gradation or curvature [$C_c = (d_{30})^2/(d_{60} \times d_{10})$]. The details of the sample classification is show in appendix

Table 4.17a: Description of samples

Sample nu	Sample type	Sediment type	Textural group
Sample 1	Trimodal, moderately well sort	Very coarse sand	Gravelly sand
Sample 2	Trimodal, moderately well sort	Medium sand	sand
Sample 3	Bimodal, very well sorted	Fine gravel	Sandy gravel
Sample 4	Polymodal, moderately well so	Fine gravel	Sandy gravel
Sample 5	Bimodal, moderately well sorte	Fine gravel	Sandy gravel
Sample 6	Bimodal, moderately well sorte	Fine gravel	Sandy gravel
Sample 7	Polymodal, moderately well so	Fine gravel	Sandy gravel
Sample 8	Polymodal, moderately well so	Slightly very fine g coarse sand	Slightly gravelly sand
Sample 9	Bimodal, very well sorted	Fine gravel	Sandy gravel
Sample 10	Polymodal, poorly sorted	Very fine gravelly sand	Gravelly sand
Sample 11	Polymodal, moderately well so	Slightly very fine g coarse sand	Slightly gravelly sand
Sample 12	Bimodal, moderately well sorte	Fine gravel	Gravelly sand
Sample 13	Polymodal, moderately well so	Coarse sand	Gravelly sand
Sample 14	Trimodal, moderately well sort	Coarse sand	Sand
Sample 15	Polymodal, moderately well so	Slightly very fine g sand	Gravelly sand

Sample 16	Trimodal, moderately well sort	Moderately well medium sand	sand
Sample 17	Polymodal, moderately well so	Very fine gravelly sand	Gravelly sand
Sample 18	Polymodal, moderately well so	Slightly very fine g coarse sand	Gravelly sand
Sample 19	Bimodal, moderately well sorte	Fine gravel	Sandy gravel
Sample 20	Polymodal, moderately well so	Very coarse sand	Gravelly sand

Table 4.17b: Aquifer particle size distribution and hydraulic conductivity computed using statistical grain size methods

Project No	Aquifer	d10	d20	d60	U = d60/d10	n = 0.25	Hazen	Kozeny	Brayer	Slitcher	USBR	Specific Yield
	Thickness (m)	(m)	(m)	(m)		(1+0.83) ^{0.75}	(m/day)	(m/day)	(m/day)	(m/day)	(m/day)	(S = 3 x 10 ⁻⁶)*b
Sample 1-OKWUFURAKU IDEMILI	47	0.0009	0.0012	0.0018	1.8947	0.80134	1.87606	52.7600	0.70832	2.35424	0.04965	0.00014
Sample 2-AGBAGHARA NS	40.1	0.00018	0.0002	0.0004	2.2222	0.97671	0.08577	249.500	0.02470	0.16198	0.00111	0.00012
Sample 3-AKWAKUMA	56.8	0.0015	0.0019	0.0024	1.6333	0.68424	3.82319	32.4149	1.81291	3.49204	0.14287	0.00017
Sample 4-OBOUGORAYI	28.1	0.0009	0.0011	0.0017	1.8889	0.79851	1.67635	45.5476	0.63607	2.08854	0.04064	0.00008
Sample 5-UMOWA	131.8	0.001	0.0017	0.0024	2.4000	1.08748	3.00620	753.444	0.75157	7.11675	0.11062	0.00040
Sample 6-MBIERI (UMULU ACHI)	45	0.0008	0.0015	0.0024	3.0000	1.56276	2.90989	34.5816	0.46090	14.9991	0.08295	0.00014
Sample 7-UMUKIRIKI(ENOKIRIKANWAEKE)	43.9	0.0007	0.0009	0.0018	2.4000	1.08748	1.69099	423.812	0.42276	4.00317	0.02901	0.00013
Sample 8-UZUAGBA	71.9	0.0002	0.0003	0.0007	3.0435	1.60437	0.24765	2.68165	0.03799	1.35161	0.00273	0.00022
Sample 9-AMUZARI	69.8	0.0015	0.0018	0.0024	1.6000	0.67060	3.72368	28.0383	1.81944	3.26831	0.12616	0.00021
Sample 10-EMII	65.1	0.0003	0.0004	0.001	2.7778	1.36638	0.50676	11.0432	0.09474	1.95338	0.00520	0.00020
Sample 11-AMIRI	12.7	0.0003	0.0004	0.0008	2.4000	1.08748	0.36826	92.2969	0.09207	0.87180	0.00520	0.00004
Sample 12-UMUAKA (UMUAKA)	47	0.0009	0.0015	0.0018	1.9474	0.82724	1.95181	76.7473	0.70484	2.61369	0.08295	0.00014
Sample 13-UMUEKWUNE	60	0.0006	0.0008	0.0014	2.1875	0.95643	1.05735	846.298	0.31319	1.91127	0.01954	0.00018
Sample 14-UMUOZU DURU	27	0.0003	0.0003	0.0006	2.0667	0.88908	0.21268	23.0489	0.06954	0.33034	0.00292	0.00008
Sample 15-EWURU UMUNA	25.1	0.0002	0.0003	0.0006	2.2963	1.02142	0.20354	758.963	0.05524	0.42223	0.00255	0.00008
Sample 16-OKWU URATTA	39.8	0.00015	0.0002	0.0003	2.0526	0.88157	0.08443	7.90624	0.02793	0.12886	0.00123	0.00012
Sample 17-OKPUALA AMA	40.2	0.0009	0.0011	0.0017	1.8889	0.79851	1.67635	45.5476	0.63607	2.08854	0.04064	0.00012
Sample 18-UMULU EZIUDO	16.4	0.0003	0.0004	0.0007	2.2286	0.98046	0.32577	1356.27	0.09334	0.62020	0.00520	0.00005
Sample 19-UMUEZE UMUEKWERE AZU	19.7	0.0017	0.0019	0.0024	1.4118	0.59849	4.10745	17.2317	2.38789	2.88836	0.14287	0.00006
Sample 20-UMUAWUCHI IHITTE UBO	10	0.0007	0.001	0.0017	2.4286	1.10642	1.50312	262.738	0.36745	3.69084	0.03264	0.00003

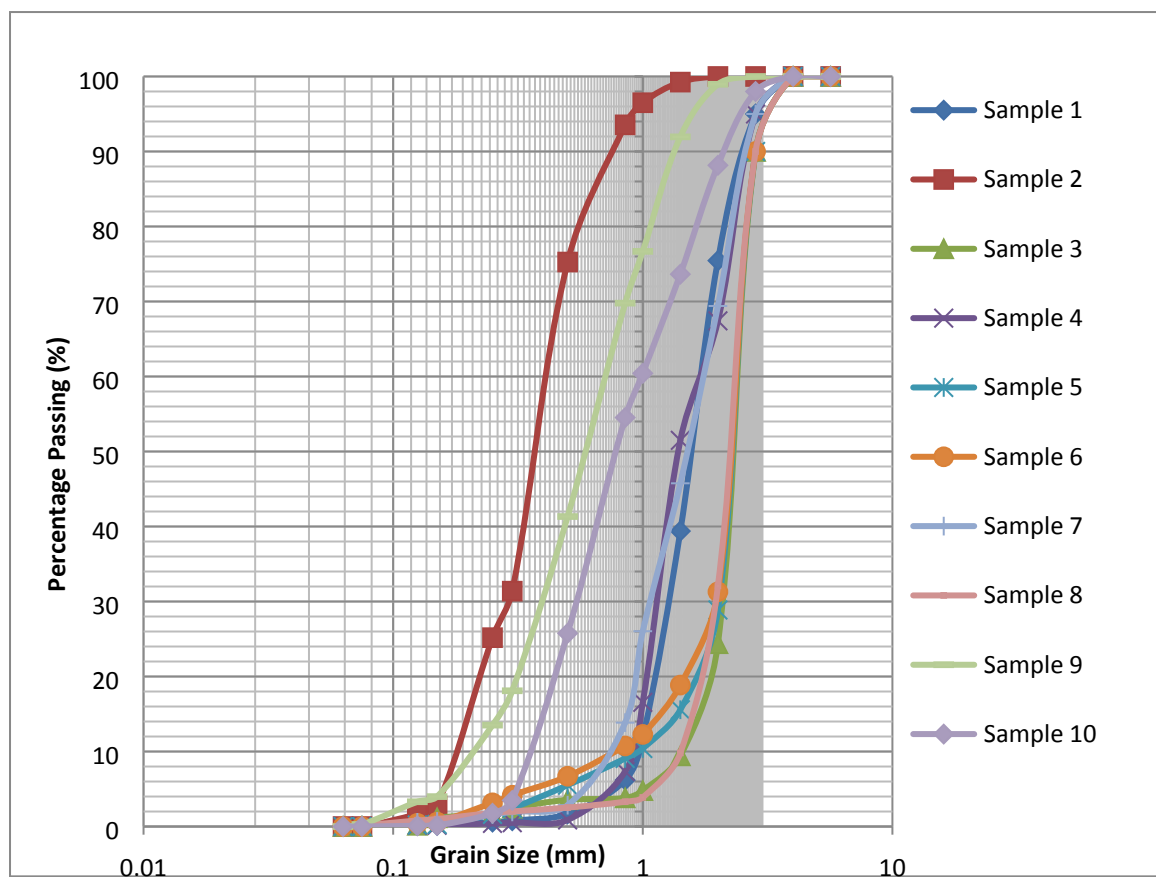


Figure.4.25: Percentage passing against particle grain size for samples 1-10

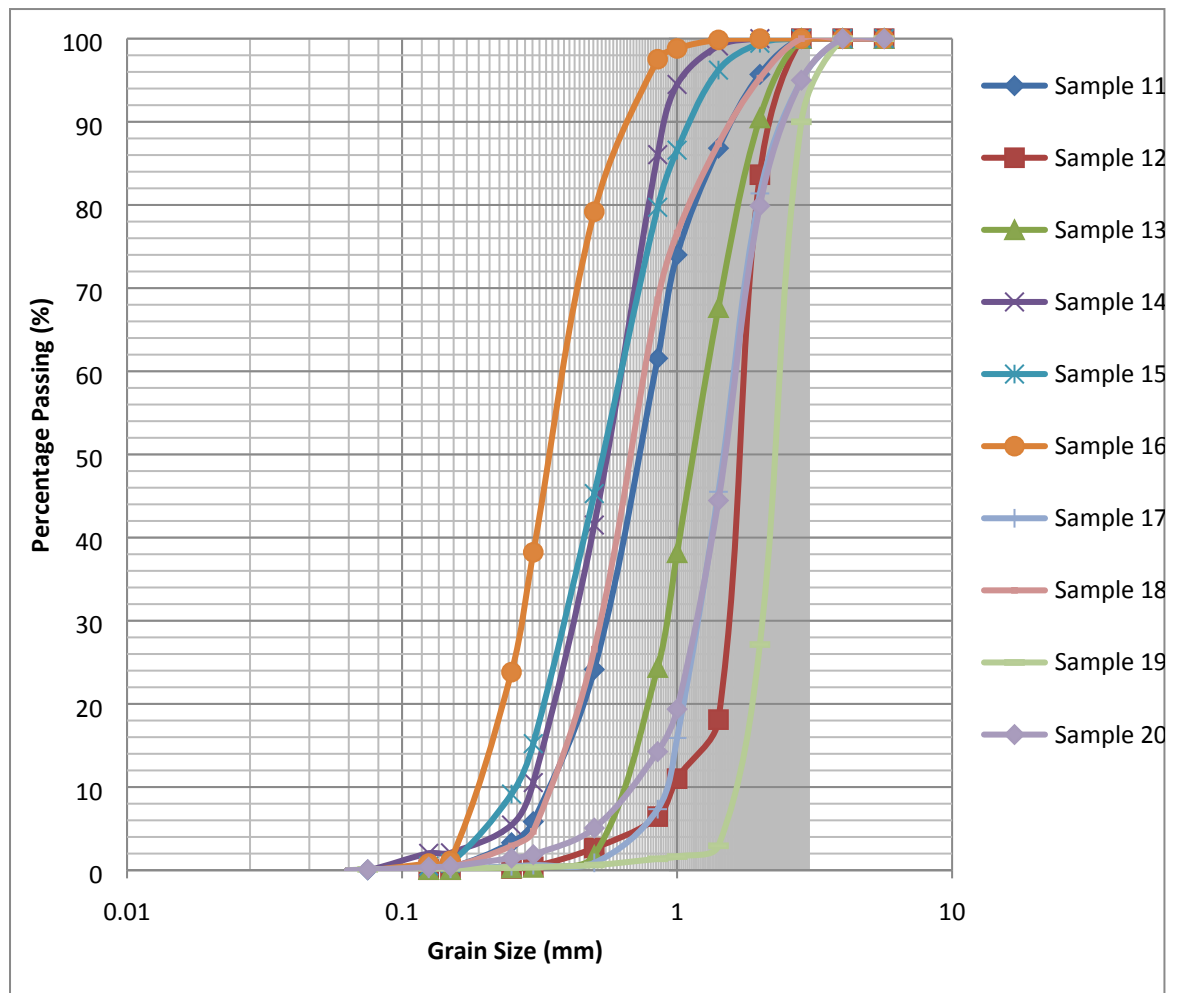


Figure 4.26: Percentage passing against particle grain size for samples 11-20

The hydraulic conductivity values computed from the different statistical grain size methods are presented in Table 4.17b. Hazen method reveal hydraulic conductivity values ranging from 0.084 to 4.10 m/day with an average of 1.55 m/day. Kozey-Carman gave values between 7.0 to 1356 m/day and average of 256.8 m/day. Breyer gave values ranging from 0.025 to 0.58. Slitcher gave values from 0.13 to 14.9 m/day with mean values of 2.82 and USBR reveal values from 0.0011 to 0.142 m/day and averages of 0.046m/day, respectively.

The overall results showed that the hydraulic conductivities calculated using the USBR and Breyer methods are in all cases lower than for other methods which is consistent with the findings of Vukovic & Soro (1992), Cheng & Chen (2007). These methods are always considered inaccurate (Odong, 2007). Average conductivity values by Hazen and Slitcher gave similar values. USBR and Kozey-Carman method may be unsuitable for the determination of hydraulic conductivity of aquifer materials in the study area. The USBR method may have underestimated the hydraulic conductivities of the aquifer materials whereas Kozey-Carman may have overestimated the hydraulic conductivity of the aquifer.

The overall results showed that the hydraulic conductivities calculated by the USBR and Breyer methods are in all cases lower than for the other methods, which is consistent with the conclusions by (Vukovic and Soro 1992) and (Cheng and Chen 2007). These two methods are always considered inaccurate. Slitcher method is most useful for analyzing heterogeneous sample with poorly sorted (well-graded) grains (Pinder and Celia 2006). It was, therefore, the best estimator for all the samples. Hazen formula which is based only on the d_{10} particle size is less accurate than the Kozeny- Carman formula which is based on the entire particle size distribution and particle shape (Carrier 2003).

4.1.11 Comparative analysis of model and techniques used for aquifer characteristics and vulnerability estimations.

The comparative analysis of model and techniques used for aquifer characteristics and vulnerability estimations were achieved through the geophysical model which includes the following: Niwas and Singhals (1981), Heigold et al (1979) and the proposed new Model. The proposed new model estimated best values which were compared to the acquired pumping test data in the study area as seen in section 4.4.6.

The geological approach of estimating aquifer hydraulic conductivity was achieved by using the Sieve analysis of the twenty (20) aquifer samples collected across the study area. This was done using five empirical formulae such as Kozeny –Carman, Hazen, Brayer, Slitcher and USBR as seen in section 4.10. The result shows that Slitcher estimated values close to the pumping test data.

The vulnerability was estimated from the geological (i.e DRASTIC and GOD) and geophysical (Integrated Electrical Conductivity, IEC) models as seen in sections 4.8 and 4.9. The results show that the three models for estimating vulnerability correlated well with each other.

4.1.12 Validation and optimization of results of the models using artificial neural network (ANN)

The linear regression model used in Predicting the pump test is given below.

$$PT = k_0 + k_1U + k_2U^2 + k_3U^3 + k_4U^4 + k_5U^5 + k_6U^6 + k_7U^7 + k_8U^8 \quad (4.7)$$

Where PT is the pump test, U is the particle size of the ratio of 60mm to 10 mm ($U = \frac{d_{60}}{d_{10}}$) and k_0 to k_8 are the regression coefficient which obtained via simulation with MATLAB.

The pump test experimental, pump test regression predicted data with U independent variable data are presented in Table 4.18

Table 4.18; Actual and Regression model Predicted dependent with independent variable data

Coefficient of uniformity (U)	Pumping Test data	
	Experimental data (m/day)	Regression predicted data (m/day)
1.8947	3.2000	5.1039
2.2222	6.7400	6.0157
1.6333	4.0600	4.9238
1.8889	7.0000	5.1775
2.4000	4.7500	4.3981
3.0000	4.9000	4.9601
2.4000	6.5700	4.3981
3.0435	1.9000	1.8631
1.6000	4.0600	3.3601
2.7778	7.0000	6.9341
2.4000	3.2000	4.3981
1.9474	4.9000	4.6206
2.1875	7.0000	5.8830
2.0667	4.5300	4.8620
2.2963	5.6200	5.7952
2.0526	4.0600	4.7549
1.8889	5.6200	5.1775
2.2286	4.7500	6.0250
1.4118	6.7400	6.7589
2.4286	2.7100	3.9003

The plot of the relationship between the experimental pump test and the regression model predicted pump test with prediction accuracy are shown in figure 4.26

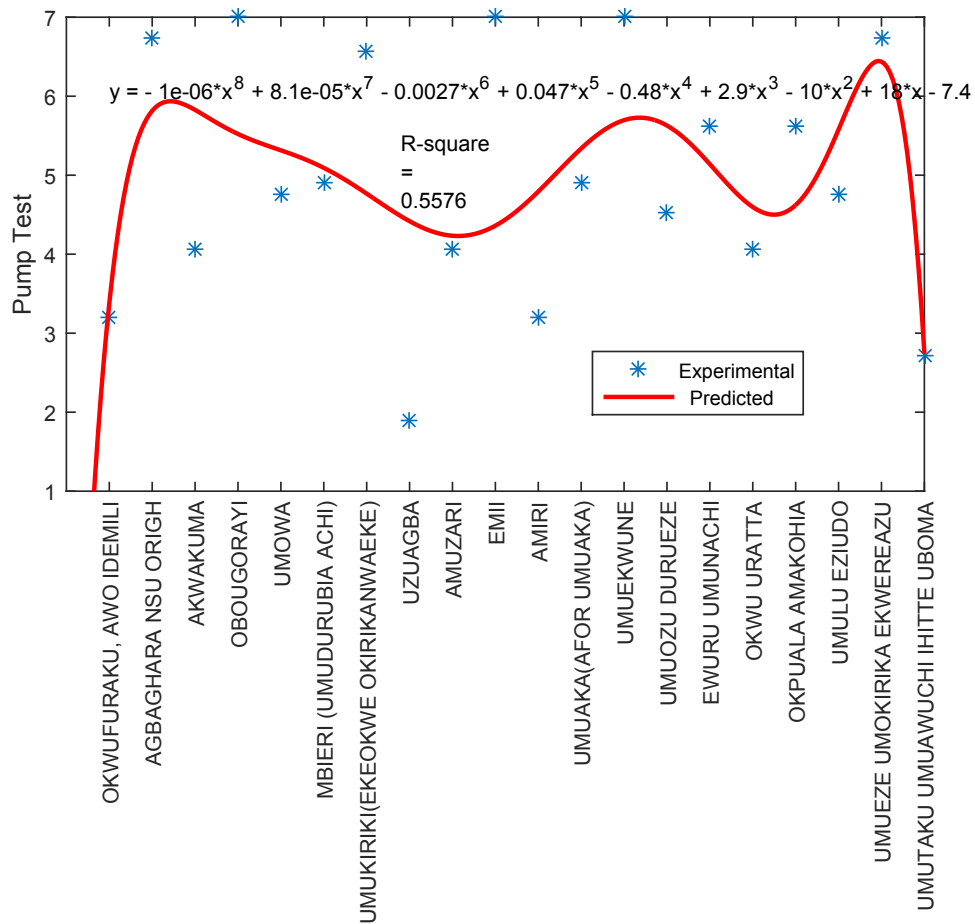


Figure 4.27; Plot of Experimental and predicted Pump Test against the sample location

From figure 4.27, the Regression model indicating the values of the regression coefficient and the R-square are shown in equation 4.8

$$PT = -7.4 + 18U - 10U^2 + 2.9U^3 - 0.48U^4 + 0.047U^5 - 0.0027U^6 + 0.000081U^7 - 0.000001U^8 \quad R\text{-square} = 0.5576 \quad (4.8)$$

Equation 4.8 signifies that the regression model accuracy of predicting pump test is 55.76%. at the later stage of this study, the regression model will be compared with other empirical models to the best model for predicting the pump test for each location.

4.1.13 Prediction of Pumping Test with Artificial Neural Network (ANN) Model for Sieve Analysis

The schematic model for the ANN used in this study is shown in figure 4.28;

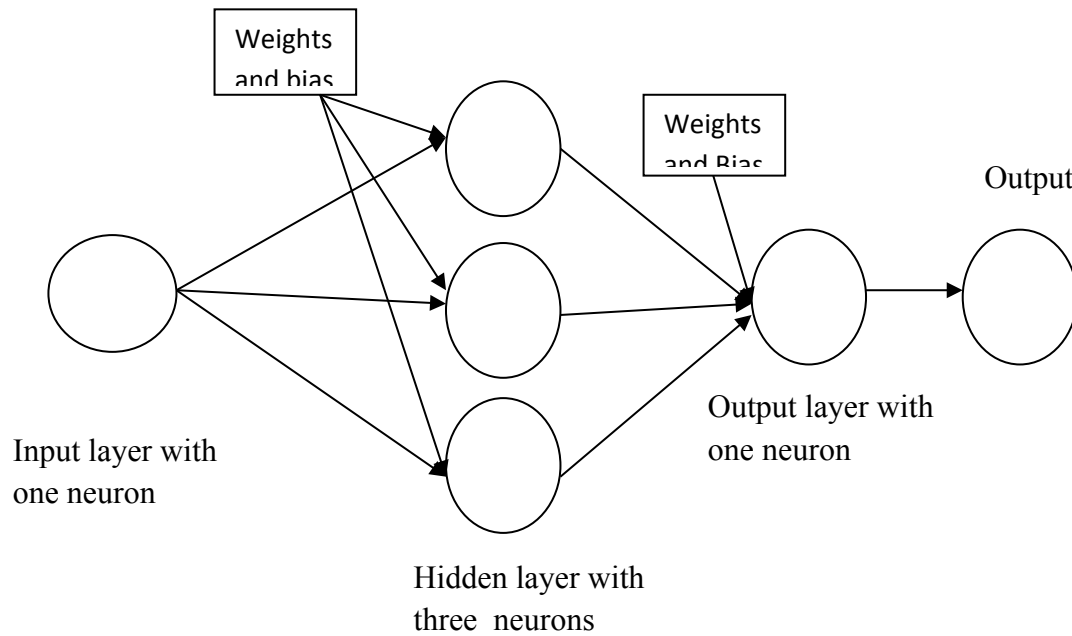


Figure 4.28; ANN Architecture

From figure 4.28, the input neuron contains the particle size (U) which is the input to the ANN; the output is the pump test though the experimental pump test data was used as a target, while the hidden layer contains three (3) neurons with each neuron operating under log-sigmoid model which is shown in equation 4.9

$$\log - \text{sigmoid}(n) = \frac{1}{1 + e^{-n}} \quad (4.9)$$

Where n is the input data (particle size).

The results generated by ANN after simulations are shown below.

Results			
	Samples	MSE	R
Training:	12	3.03909e-1	9.23787e-1
Validation:	4	1.11976e-0	8.72229e-1
Testing:	4	10.50628e-0	9.01669e-1

Figure 4.29; mean squared error analysis with R-square statistics for training, testing and validation

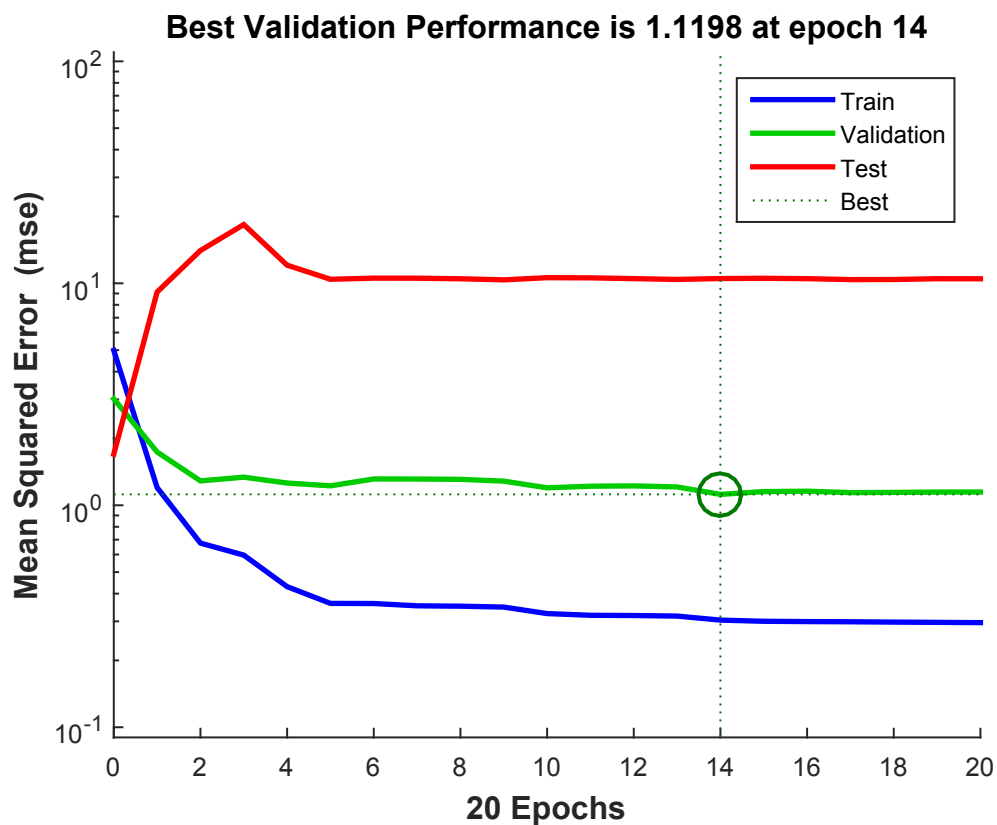


Figure 4.30; Best MSE validation performance

Figure 4.30 shows the MSE between the experimental and predicted pump test at 20 iterations (epochs) for train, validation and test, stating that the best performance was at the 14th iteration at mse of 1.1198.

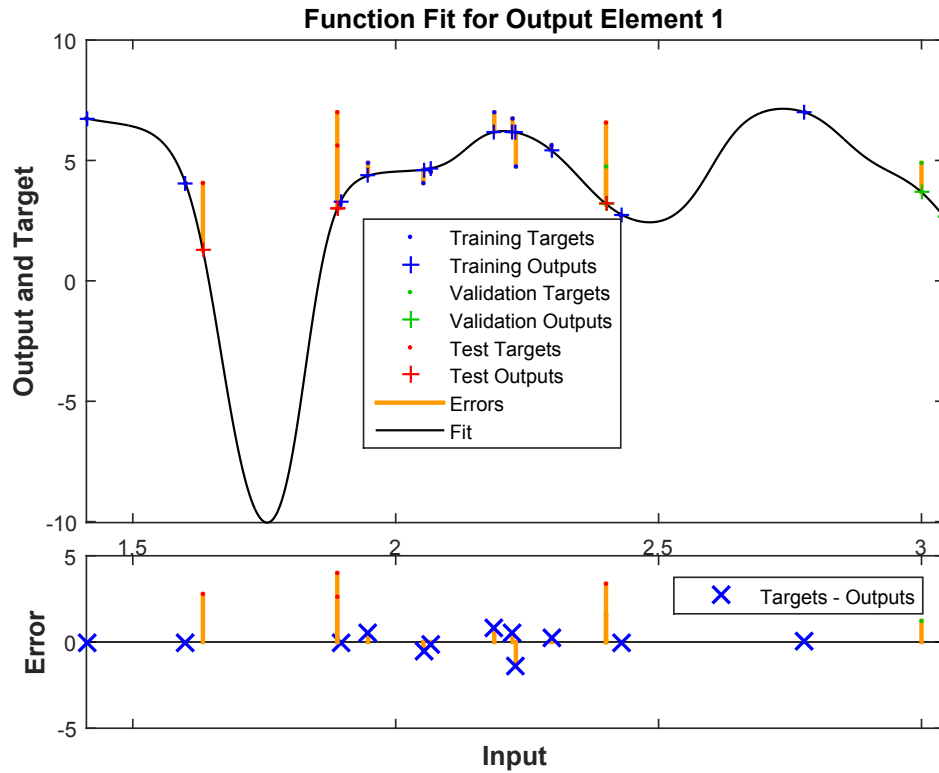


Figure 4.31; plot of Error Analysis

Figure 4.31 shows the difference between the targets (Experimental pump test data) and the output (Predicted pump test data). The maximum error occurred at sample 3 with a value of 2.7836 (table 4.19). The samples with their locations, experimental data and ANN predicted data with the particle size data (U) are presented in Table 4.19

Table 4.19; Experimental and predicted pump test using ANN with error Analysis

Samples	Coefficient uniformity (U)	Experimental (pumping test data)	ANN Predicted pu test data	Error = experi data-Predicted data
1a	1.8947	3.2000	3.2799	-0.0799
2a	2.2222	6.7400	6.1901	0.5499
3a	1.6333	4.0600	1.2764	2.7836
4b	1.8889	7.0000	2.9990	4.0010
5c	2.4000	4.7500	3.1938	1.5562
6a	3.0000	4.9000	3.6787	1.2213
7a	2.4000	6.5700	3.1938	3.3762
8a	3.0435	1.9000	2.6521	-0.7521
9b	1.6000	4.0600	4.0623	-0.0023
10c	2.7778	7.0000	6.9989	0.0011
11a	2.4000	3.2000	3.1938	0.0062
12a	1.9474	4.9000	4.3643	0.5357
13a	2.1875	7.0000	6.1787	0.8213
14b	2.0667	4.5300	4.6703	-0.1403
15c	2.2963	5.6200	5.4134	0.2066
16a	2.0526	4.0600	4.6196	-0.5596
17a	1.8889	5.6200	2.9990	2.6210
18a	2.2286	4.7500	6.1636	-1.4136
19b	1.4118	6.7400	6.7402	-0.0002
20c	2.4286	2.7100	2.7637	-0.0537

For ANN to occur, the input data was divided into training (12 samples), validation (4 samples) and testing (4 samples) which is a ratio in percentage of 60:20:20. From table 4.19, the codlings a. b and c indicates training, validation and test samples respectively.

4.1.14 Comparative Analysis of the Regression model, ANN and other Empirical models for sieve Analysis.

A comparative analysis was performed for all the models used in this study to determine the appropriate model for determining the pump test of a particular location under Review.

Table 4.20 shows the pump test predictions for each of these models under consideration for sieve analysis.

Table 4.20: Prediction of pumping test.

Sample	Experimental	Regression	ANN	Hazen	Kozeny Carr	Brayer	Slitcher	USBR
1	3.2000	5.1039	3.2799	1.8761	0.0528	0.7083	2.3542	0.0496
2	6.7400	6.0157	6.1901	0.0858	0.2495	0.0247	0.1620	0.0011
3	4.0600	4.9238	1.2764	3.8232	0.0324	1.8129	3.4920	0.1429
4	7.0000	5.1775	2.9990	1.6764	0.0455	0.6361	2.0885	0.0406
5	4.7500	4.3981	3.1938	3.0062	0.7534	0.7516	7.1167	0.1106
6	4.9000	4.9601	3.6787	2.9099	0.0346	0.4609	14.9992	0.0829
7	6.5700	4.3981	3.1938	1.6910	0.4238	0.4228	4.0032	0.0290
8	1.9000	1.8631	2.6521	0.2477	0.0027	0.0380	1.3516	0.0027
9	4.0600	3.3601	4.0623	3.7237	0.0280	1.8194	3.2683	0.1262
10	7.0000	6.9341	6.9989	0.5068	0.0110	0.0947	1.9534	0.0052
11	3.2000	4.3981	3.1938	0.3683	0.0923	0.0921	0.8718	0.0052
12	4.9000	4.6206	4.3643	1.9518	0.0767	0.7048	2.6137	0.0829
13	7.0000	5.8830	6.1787	1.0573	0.8463	0.3132	1.9113	0.0195
14	4.5300	4.8620	4.6703	0.2127	0.0230	0.0695	0.3303	0.0029
15	5.6200	5.7952	5.4134	0.2035	0.7590	0.0552	0.4222	0.0025
16	4.0600	4.7549	4.6196	0.0844	0.0079	0.0279	0.1289	0.0012
17	5.6200	5.1775	2.9990	1.6764	0.0455	0.6361	2.0885	0.0406
18	4.7500	6.0250	6.1636	0.3258	1.3563	0.0933	0.6202	0.0052
19	6.7400	6.7589	6.7402	4.1074	0.0172	2.3879	2.8884	0.1429
20	2.7100	3.9003	2.7637	1.5031	0.2627	0.3675	3.6908	0.0326

To determine the best model for prediction, summation of the error, mean squared error and root mean square error were used. Table 4.21 shows the error analysis of the model used. The error models were shown in equations 4.10, 4.11 and 4.12

$$error = \sum (experimental\ data - predicted\ data\ by\ each\ model) \quad (4.10)$$

$$MSE = \sum (experimental\ data - predicted\ data\ by\ each\ model)^2 / n \quad (4.11)$$

$$RMSE = \sqrt{MSE} \quad (4.12)$$

Table 4.21; Error analysis at different models

Sample	Regression	ANN	Hazen	Kozeny Carman	Brayer	Slitcher	USBR
1	-1.9039	-0.0799	1.3239	-49.56	2.4917	0.8458	3.1504
2	0.7243	0.5499	6.6542	-242.76	6.7153	6.5780	6.7389
3	-0.8638	2.7836	0.2368	-28.355	2.2471	0.5680	3.9171
4	1.8225	4.0010	5.3236	-38.548	6.3639	4.9115	6.9594
5	0.3519	1.5562	1.7438	-748.69	3.9984	-2.3667	4.6394
6	-0.0601	1.2213	1.9901	-29.682	4.4391	-10.099	4.8171
7	2.1719	3.3762	4.8790	-417.24	6.1472	2.5668	6.5410
8	0.0369	-0.7521	1.6523	-0.78165	1.8620	0.5484	1.8973
9	0.6999	-0.0023	0.3363	-23.978	2.2406	0.7917	3.9338
10	0.0659	0.0011	6.4932	-4.0432	6.9053	5.0466	6.9948
11	-1.1981	0.0062	2.8317	-89.097	3.1079	2.3282	3.1948
12	0.2794	0.5357	2.9482	-71.847	4.1952	2.2863	4.8171
13	1.1170	0.8213	5.9427	-839.3	6.6868	5.0887	6.9805
14	-0.3320	-0.1403	4.3173	-18.519	4.4605	4.1997	4.5271
15	-0.1752	0.2066	5.4165	-753.34	5.5648	5.1978	5.6175
16	-0.6949	-0.5596	3.9756	-3.8462	4.0321	3.9311	4.0588
17	0.4425	2.6210	3.9436	-39.928	4.9839	3.5315	5.5794
18	-1.2750	-1.4136	4.4242	-1351.5	4.6567	4.1298	4.7448
19	-0.0189	-0.0002	2.6326	-10.492	4.3521	3.8516	6.5971
20	-1.1903	-0.0537	1.2069	-260.03	2.3425	-0.9808	2.6774
total	2.4716×10^{-7}	14.6784	68.2727	-5021.6	87.793	42.955	98.383
MSE	1.0091	6.6327	22.8017	1.9906×10^5	21.827	17.549	26.481
RMSE	1.0045	2.5754	4.7751	446.16	4.672	4.1892	5.146

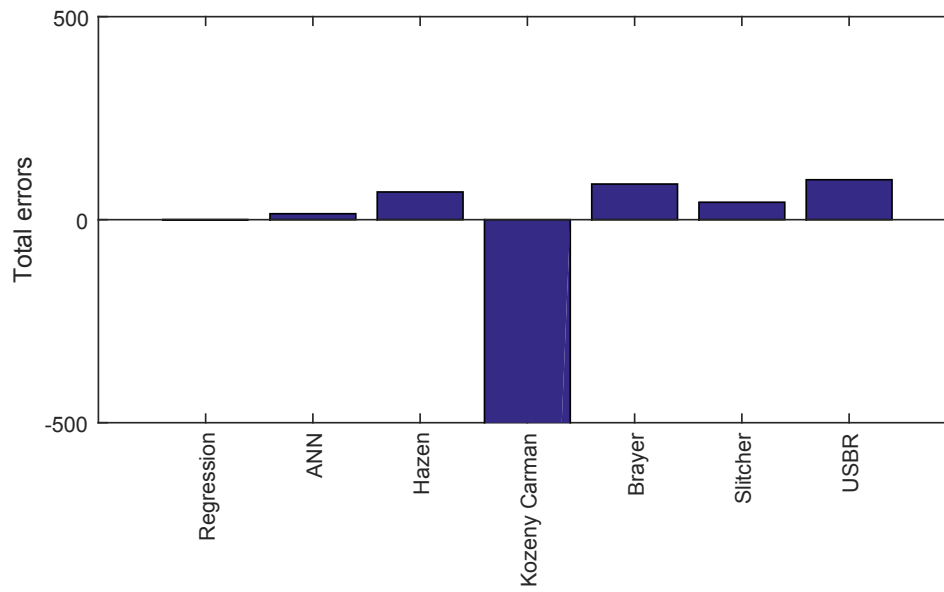


Figure 4.32: Sum of errors at different models

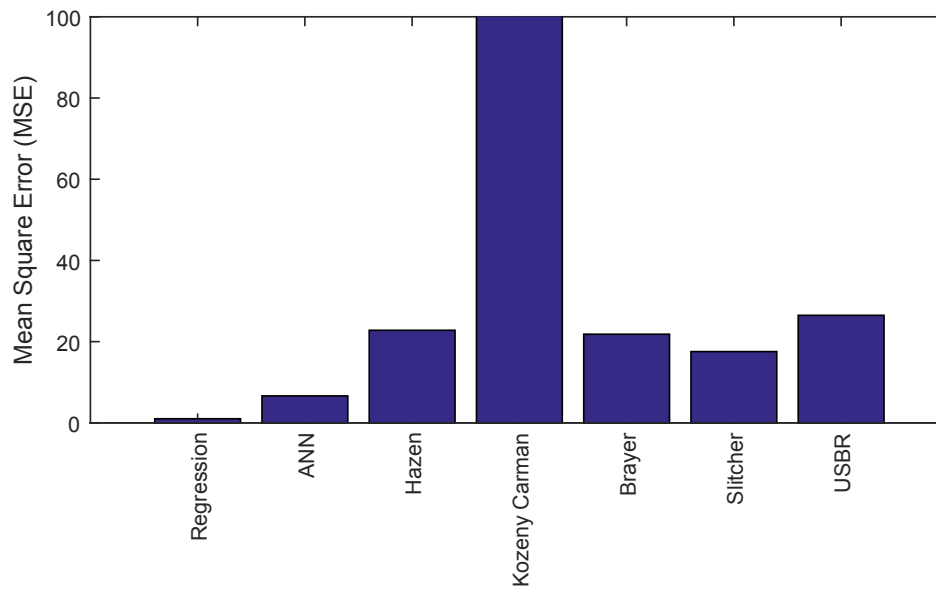


Figure 4.33: Mean square errors at different model

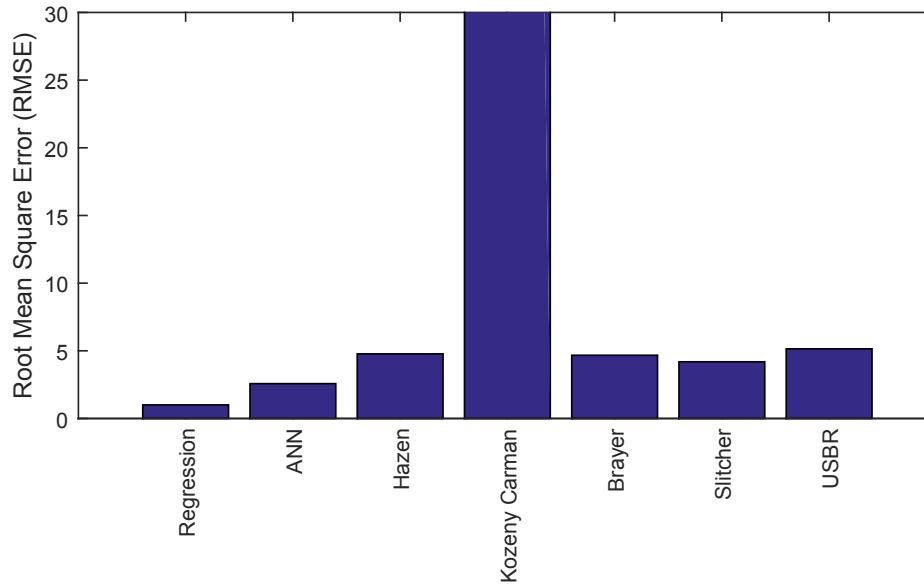


Figure 4.34: Root Mean square errors at different model

From figures 4.32, 4.33 and 4.34, it can be seen that the new model (Linear Regression model) is the best model for predicting the pump test of the sample locations under review.

4.2 Discussion

The analysis of the geo-electric curves helped in determining aquifer layer parameters which includes resistivity, depth to water table and aquifer thickness of the study area. The close agreement of the interpretation of geo-sounding data with geological information from available boreholes indicated the usefulness of the present study in characterizing aquifer geo-materials (Ekwe et al., 2012. Eke et al, 2015, Ejiogu et al, 2019). The vertical electrical resistivity sounding method is widely used for groundwater exploration and has been applied in many areas with a re-sounding success (Onuoha, K.M. & Mbazi, F.C.C., 1988). Despite the widespread applications, two common limitations are however associated with this technique which includes the problems of equivalence and suppression (Zohdy A.A.R., 1976). However, computer-oriented direct interpretation techniques commonly used in this study are capable of resolving the thickness and resistivities of the various subsurface layers from the surface resistivity measurements. In addition, computer iterative modelling techniques are generally technically free from human bias which is always present in the conventional curve matching techniques (Sandberg, S.K., 1993).

The analysis of the aquifer electrical and geometrical parameters revealed that the aquifer resistivity ranges from 16.38 Ωm to 4772 Ωm with a mean of 1963 Ωm . The depth to the water table ranges between 10m to 310 m with a mean value of 89.3 m, while aquifer thickness ranges from 5.7 m to 123 m with a mean value of 47.3 m. The present study has helped to map out zones for the drilling of productive boreholes in the study area and these findings are in close agreements with earlier studies carried out in the area (Uma., 1989; Opara et al., 2012; Ekwe and Opara., 2012; Ugada et al., 2013; Ejiogu et al., 2019).

The aquifer hydraulic conductivity in the study area estimated using Niwas & Singhal, 1981, Heigold 1979, and the New model proposed and used in the present study gave average values of 13.19 m/day, 1.74 m/day and 4.62 m/day respectively. The maximum hydraulic conductivity value was recorded within the Benin Formation while the least aquifer hydraulic conductivity was recorded within the Imo Formation (Opara et al., 2012) reported that the Benin Formation is characterized by high aquifer potentials with an estimated high aquifer hydraulic conductivity value that ranged between 5.49 and 6.63 m/day. Estimated hydraulic conductivity values in the study area are also similar to the results of earlier studies carried out close to the study area (Fatoba et al. 2014; Ebong et al. 2014; Ibout et al. 2017).

The results of hydraulic conductivities from the grain-size analyses were compared to those obtained by pumping test. Though grain-size methods mainly rely on particle size, which is considered the most important parameter for the determination of K (Song J. et al, 2009), the however yielded much lower values of hydraulic conductivity in this study, with differences of up to approximately two orders of magnitude. The main reason for such poor predictions may be associated with the domain of applicability of grain-size methods. The use of the USBR and Hazen techniques has been considered as inaccurate due to their failure to reproduce low values of K (Vukovic M. & Soro A., 1992). There may be several reasons for this behavior including the fact that the USBR technique uses a different estimation of effective grain diameter of (d_{20}) instead of d_{10}) in addition to its assumption of value of porosity to be one (1). This similar attributes are also associated with the Breyer technique which gave similar results to USBR. Based on the results of this study, the usage of the USBR method in the study area is therefore not advisable.

The Slichter method is the only valid method for the domain of applicability, as it gives the values of estimated K similar to the pumping test data (Dodds, A.R. & Ivic, D 1988). Theoretical assumptions for the grain size and the coefficient of grain uniformity were satisfied most often for the Slichter method and sometimes for the Beyer method but not at all for the others. The only advisable method for the estimation of K from grain-size analyses in this study would be the Slichter method due to its applicability domain

Results of the estimates of hydraulic parameters from resistivity data revealed a mean transmissivity $T_{\text{mean}} = 140.8 \text{ m}^2/\text{day}$ and a mean storativity of 5.3×10^{-5} for the aquiferous units in the Ajali Formation. A mean transmissivity $T_{\text{mean}} = 193.5 \text{ m}^2/\text{day}$ and mean storativity 5.54×10^{-5} were estimated in Ameki Formation. The Benin formation revealed a mean Transmissivity T_{mean} of $784 \text{ m}^2/\text{day}$ and a mean storativity of 5.11×10^{-5} . The aquifers in the Imo Formation have a mean transmissivity $T_{\text{mean}} = 205.2 \text{ m}^2/\text{day}$ with a mean storativity of 3.48×10^{-5} . The aquifers in the Nsukka Formation have a mean transmissivity $T_{\text{mean}} = 211.5 \text{ m}^2/\text{day}$ with a mean storativity of 4.8×10^{-4} while the aquifers in the Ogwasi/Asaba Formation have a mean transmissivity $T_{\text{mean}} = 100.2 \text{ m}^2/\text{day}$ with a mean storativity of 4.86×10^{-5} . The highest transmissivity value was recorded within the Benin Formation while the lowest value was estimated within the Imo Shale Formation. The results of this study are similar to the findings in other studies carried out worldwide (Fatoba et al. 2014; Ebong et al. 2014; Kazakis et al. 2016; Joel et al. 2016; Hasan et al. 2018; Ibout et al. 2017; Oyeyemi et al. 2018; Rabeh et al. 2019). Akhter and Hassan (2016) revealed that low values of hydraulic conductivity and transmissivity values are generally indicative of clay/shale aquifer materials while high values are generally due to the presence of sand/gravel aquifer materials. According to Ijeh and Onu (2012), the groundwater potential in the Imo Shale Formation is low and this agrees to the low aquifer hydraulic conductivity and transmissivity values revealed by the result of the present study. The typical storativity of a confined aquifer, which most often generally varies with specific storage and aquifer thickness ranges from 5×10^{-5} to 5×10^{-3} (Todd 1980). The results of the present study are in agreement with the findings of Ugada et al. (2013) carried out in the upper part of the Imo River Basin.

The result of the aquifer vulnerability assessment using DRASTIC and GOD model revealed that the area is generally highly vulnerable to groundwater contamination with the depth to water table and vadose zone having the highest impact on the intrinsic vulnerability of the

aquifer systems in the area. Intrinsic aquifer vulnerability study using the DRASTIC technique revealed that the DRASTIC Index ranged between high, low and moderate vulnerability. The DRASTIC Index estimated within the study area ranged from a minimum value of 76 to a maximum value of 156 with a mean value of 116. A large portion of the study area estimated at 53.6% was classified as high vulnerability areas while about 34.5% of the study area was identified as moderate aquifer vulnerability areas and 11.9% was classified as low aquifer vulnerability using the DRASTIC Index. These results estimated from DRASTIC Index are in agreement with similar results from other parts of the Imo River Basin (Ugada et al. 2013; Eke et al. 2015). Eke et al. (2015) estimated a DRASTIC Index of 85–99 (low vulnerability), 102–140 (moderate vulnerability) and DI values > 140 (high vulnerability).

Similarly, the aquifer vulnerability estimated using GOD revealed a range of 0.125 to 0.504 with a mean of 0.315. In addition, results using DRASTIC Index and GOD worldwide have been previously established by several authors (Babiker et al. 2005; Atiqur 2008; Lathamani et al. 2015; Jang et al. 2017; Mondal et al. 2017; Oni and Akinlatu 2017; Falowo et al. 2017; Aweto and Ohwoghere-Asuma 2018; Oroji 2018).

The IEC values ranged from 0.32 to 8343 mS with a mean value of 403 mS. Extremely high/high vulnerability areas with IEC values ranging between 28.4 and 1000 mS were interpreted in parts of the study area. Similarly, moderate vulnerability areas with IEC values between 1000 and 2000 mS and low vulnerability areas with IEC values greater than 2000 mS were also delineated within various parts of the study area. The degrees of vulnerability and percolation time of the contaminants from anthropogenic sources were estimated from the IEC method based on the method adopted by Madi et al. (2016). The results of this study are similar to IEC values estimated in other parts of Nigeria (Obiora et al. 2016a, b; Terhemba et al. 2016). The present results of aquifer vulnerability are similar to the findings of George et al. (2017) in the surficial aquifer units of the coastal regions of Akwa Ibom State, Southeastern Nigeria. Extremely high vulnerability index values less than 500 mS, having a percolation time of several months were revealed in most parts of the study area.

Most parts of the study area (80%) are within this class of extreme high vulnerability. This indicates that it will take surficial effluents or any other liquid waste in the study area some months to get into the groundwater; this is really worrisome in view of the huge and active sources of pollution like e-wastes, auto-mobile and motor scrap workshops, unprotected

shallow municipal dumpsites and the general poor waste management in the study area (Ejiogu et al. 2017). The high aquifer vulnerability of the study area especially within the Benin Formation (which is prone to leachate infiltration into the groundwater) has been previously established by Akankpo and Igbokwe (2011). Generally, the intrinsic aquifer vulnerability of the study area estimated from the DRASTIC method agreed reasonably well with the results of the GOD and IEC method.

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Geo-electric curve types interpreted from the study area revealed a predominance of the AKH-type with about 3-10 geo-electric layers identified from the various formations as shown in appendix A. The mean values of aquifer resistivity and conductivity were $1963.2\Omega\text{m}$ and 0.00186sm^{-1} respectively as shown in figures 4.2 and 4.7 with the aquifer materials mainly made up silt, sand and coarse sandstones. Similarly, the mean depth to the aquifers across the study area is 115.5 m as shown in figure 4.5 while the mean aquifer thickness is 39.8 m as shown in 4.6. The findings of these results revealed that the shale/clay across the entire area increased with depth. Also, the aquifer potentials of the study area were revealed to be variable with the aquifer type, nature and characteristics generally controlled by the underlying geology as show from figures 4.3a – 4.3n. It was therefore concluded that the southern part of the study area which is Benin Formation has a high aquifer potential when compared to the northern part which comprises of Imo Shale, Nsukka, Ameki, Ajali and Ogwasi/Asaba Formations respectively.

Figures 4.2, 4.5, 4.6, 4.7, 4.8, 4.12, 4.13 and 4.14 show contour maps of the apparent resistivity, aquifer depth, aquifer thickness, transverse resistance, longitudinal conductance transmissivity, storativity and diffusivity of the aquiferous layer constructed from the results of the vertical electric sounding interpretation. The resistivity map that shows the potentials of the aquifer in the whole study area. The distribution of resistivity values indicates that six distinct zones can be identified within the study area as shown in figure 1.2 (Uma,1989).

There is also a correlation between depth to water table and the thickness of the weathered red earth and lateritic overburden. Deeper water tables are found where thick layers of the weathered zone occur (Figure 4.4a -4.4e)

The deduced DRASTIC, GOD and IEC parameters were used to compute the DRASTIC Index, GOD index and IEC index respectively at the various 569 VES points as shown in Appendixes D, E and F. These were then used to generate the Groundwater Vulnerability Map (GVM) for the study area. Figures 4.22, 4.23, 4.24 show the vulnerability maps of DRASTIC,

GOD and IEC of the study area. The maps show that most of the areas in Benin Formation have high vulnerability because the overburden is largely fine, medium and coarse-grained sand. The maps also show the vulnerability map of Imo River Basin covering Imo Shale, Ameki Formation, Nsukka, Ajali and Ogwashi-Asaba Formations.

The vulnerability analysis for DRASTIC model reveals a mean index of 101 and 139 which indicate moderate vulnerability in Ajali and Ameki Formations, 162 in Benin Formation which indicate high vulnerability, 76, 85 and 77 in Imo Shale Formation, Nsukka Formation and Ogwashi/Asaba Formation respectively which indicate a correspondence low vulnerability. Analysis from GOD also reveals a mean index of 0.105, 0.112 in Ajali and Ameki Formations which indicate low vulnerability, 0.504 in Benin Formation which indicate high vulnerability, 0.15, 0.125 and 0.1 in Imo Shale, Nsukka and Ogwashi/Asaba Formations with low vulnerability respectively. IEC shows that some parts within the Northern axes of the study area are of low and moderate vulnerability while the southern part of the study area is of high vulnerability. The estimated percolation time of contaminants using IEC model reveals the time of several months to about 25 years in the study area. The information layers for models were provided via geographic information system and techniques were used to provide and produce the vulnerability maps of the study area considering weight coefficients of each layer.

The hydraulic conductivity values estimated from sieve analysis using empirical formulae: Hazen, Kozeny-Carman, Breyer, Slitcher and USBR with mean values of 1.55m/day, 256.8m/day, 0.58m/day, 2.82m/day and 0.046m/day respectively

Comparison of the estimates of hydraulic conductivity obtained through the different methods i.e Niwas and Singhal (1981), Heigold et al (1979) and generated new model as shown in Appendix C shows that the New Model values are very similar to the existing pumping test data. The hydraulic conductivity in the study area reveals an average of 13.19 m/day, 1.74 m/day and 4.62 m/day respectively

Our results also confirm that estimates of K from empirical methods based on grain-size analysis as shown in table 4.17b are not in good agreement with those obtained from pumping test data except that of the Slitcher. This indicates that empirical methods may not be reliable within non-homogenous granular aquifers. However hydraulic information may be obtained

from a greater concentration of sites within the study area using Slitcher method thereby enriching regional groundwater database.

This approach requires an input of a high density of K estimates for the aquifers to ensure a good calibration and accuracy of the model for accurately predicting groundwater flow. If the models are built for homogenous aquifers, it could be expected that no scale effects should be observed thereby allowing the use of K information from hydraulic tests, empirical methods or both.

The results of the hydraulic conductivity obtained from the grain size analysis using the empirical formulae were optimized and validated using artificial neural networks (ANNs) as shown in table 4.18 using a model regression equation as stated in equation 4.7. A comparative analysis was performed for all the models used in this study to determine the appropriate model for determining the pumping test of a particular location under Review. The results show that ANN model shows a close relationship with the existing pumping test data as shown in table 4.20

On the other hand, the error due to the prediction shows that Kozeny –Carman has the highest which implies that it is not suitable for estimation of hydraulic conductivity in the study area rather ANN and Slitcher as seen in figure 4.32 and 4.33.

Portable water is relatively scarce in the study area owing to increased demand and deteriorating quality due to pollution. This is compounded by the gradual increase in the rate of industrial and commercial activities in the study area. This study therefore aimed at delineating sites for both productive and unproductive boreholes, delineating areas that are vulnerable to pollutants and revealing their origin. To achieve this aim, 569 Vertical Electrical Soundings (VES) were studied within the study area. Twenty of the VES stations were sited near existing boreholes to enhance interpretation (parametric sounding). Twenty aquifer samples were also collected in different locations within the areas of the study area for sieve analysis.

From the analysis of the VES data (table 4.2), nine (9) layers on the average were determined for most of the study area. This study had provided information on the aquifer properties and the Dar-Zarrock parameters of the aquiferous zones in the study area. The estimated aquifer

parameters revealed aquifer thickness and depth to water table varying from 16.7m - 263 m and 7.1m - 119m respectively with an average value of 39.8 m for aquifer thickness and 115.5m for depth to water table. The resistivity of the aquiferous zones within the study area varied from 13.5- 8700 Ω m with an average resistivity value of 1963 Ω m. Adopting an average transmissivity of 504.4 m²/day, determined from pumping test, a mean hydraulic conductivity value of 7.73 m/day was obtained for the area. Hydraulic conductivity (*K*) values estimated using Niwas & Singhal, 1982, Heigold, 1979 and the New Model generated from geophysical approach in this study. Hydraulic conductivity values using Niwas & Singhal varied from 0.55- 125.8m/day. The hydraulic conductivity values obtained using Heigold, 1979 varied from 0.0745-37.5m/day and those from the New Model varied from 1.4 to 47.2m/day. our new model generated from geophysical approach correlated well with the existing pumping test data

Groundwater occurs in unconfined condition mostly in the Benin Formation but becomes semi-confined to confine in Ajali, Ameki and Nsukka Formations. Aquifer materials are highly permeable and enhance lateral spreading of contaminants in the ground system. Subsequently, areas that are predominantly underlain by sandy facies and have considerable depth to water table enhance contaminant attenuation and retardation.

Depth to water table is a significant parameter of the IEC controlling the ability of contaminants to reach the aquifer media, depending on its permeability and on the attenuation characteristics of the media (Added & Hamza, 2000). If the vadose zone is highly permeable, then this leads to a highly vulnerable (Corwin et al. 1997). The vadose zone has been identified from available geological map and hydrogeological cross-sections of the study area. The vadose zone is composed of heterogeneous coarse materials presented essentially by alluvium.

According to the IEC index, the aquifer vulnerability ranges from 0.32 to 8343 mS (Figure 4.9), the values were categorized into five classes. They are extremely low (>4000), low (2000–4000), moderate (1000–2000), high (500–1000), and extremely high (<500) groundwater vulnerability.

A vulnerability map is shown (Fig. 4.17) in which the electrical conductivity index is calculated down to a depth of 115 m below the surface. As the groundwater level is high, the

concept of the electrical conductivity index for the saturated zone was extended. The electrical conductivity values in the saturated zone are much higher than the values in the unsaturated zone. As the conductivity of the saturated zone is high, the influence on the electrical conductivity index is also low.

Vulnerability assessment based on hydraulic conductivity can be backed by measured electrical conductivities. In a first approach, the vulnerability maps based on the electrical conductivity have to make some assumptions about the distribution of different degree of vulnerability. While the most dominant class is the moderate class, then the electrical calibration curves identified resistivity intervals true characteristics for each type of surficial encountered. The sandy inclusions in clayey environment increased the aquifer vulnerability.

The concept of vulnerability is originally restricted to the unsaturated zone covering the first groundwater layer. However, as our main interest is to the deeper groundwater layers actually in use for water supply, the concept of vulnerability is extended to the saturated zone. The top of the groundwater layer used for water supply then gives the reference depth for the calculation of the electrical conductivity index.

The vulnerability map (Figure 4.17) and vulnerability indices based on resistivity data provide a good tool to assess and quantify the protection of the groundwater resources.

Conclusively, the calculated aquifer parameters are consistent and well defined within the range of observed aquifer parameters as obtained from the works of Uma, 1989 and other related works carried out within the study area. The new method generated in this study also compared favourably well with the available pumping test data. Based on borehole hydro-geological information, it is revealed that the Southern part of the study area recorded the highest values of groundwater yield and is, therefore, could be regarded as the most prolific in terms of groundwater exploitation and thus the most promising in sitting productive boreholes. From the available data, used in this study, the Benin Formation is found to be more productive in terms of hydraulic conductivity and transmissivity values. Some parts within the Northern axes of the study area are of low vulnerability while southern parts of the study area are of high vulnerability as a result of poor protective capacity. Aquifer vulnerability to pollution is not an absolute function of litho-stratigraphy and topography alone, but also on geological structures.

In this research work, we have been able to favourably compare the DRASTIC, GOD and IEC models to evaluate the regional aquifer vulnerability of the study area and have used geographic information to present spatial distribution of aquifer geometry, aquifer parameters and vulnerability indices of the study area.

Artificial Neural Network (ANN) used in this study is a very key statistical tool that was used for validation, optimization and also as a model as seen in section 4, 9, 4.10 and 4.11 of Chapter four. The results of the hydraulic conductivities estimated using Hazen, Kozey-Carman, Breyer, Slitcher and USBR were validated and optimized concerning the pumping test data using ANN (Graves, 2012)

5.2 Contribution to Knowledge

1. New predictive models for the estimation of hydraulic conductivity using Novel resistivity data and Formation specific were proposed, used and validated in this work. We, therefore, recommend the use of these models in area with similar Formation/Geology worldwide
2. We also generated a model equation used for estimating hydraulic conductivity from grain size using artificial Neural Networks (ANN)
3. We have successfully estimated the percolation time (period of infiltration of contaminant) from anthropogenic sources using Integrated Electrical Conductivity (IEC) or Geophysical Protective Index (GPI).

5.3 Recommendations

1. The Model Equations generated in this study according to the different Formations namely: Ajali Formation, Ameki Formation, Nsukka Formation, Imo Shale Formation and Ogwasi/Asaba Formation respectively, should be adopted for the estimation of hydraulic conductivities.
2. Regular program of groundwater monitoring should be practised by government agencies.
3. Existing open dump waste disposal sites in the Southern axes of the study area should be harnessed and controlled to mitigate groundwater degradation.

4. Contaminant impact assessment should be tackled to assess the degree of contamination of the groundwater system such as may have come up from existing waste disposal sites.

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APPENDICES

A: Summary of Results of Interpreted Layer Parameters from the Study Area.

VES No.	No. of Layers	Layer Resistivity ρ (Ωm)										Layer Depth d (m)										Layer Thickness h (m)									Curve Type
		ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8	ρ_9	ρ_{10}	d1	d2	d3	d4	d5	d6	d7	d8	d9	h1	h2	h3	h4	h5	h6	h7	h8	h9		
AJ 01	10	133	422	82	9.2	84	388	2780	2390	2140	3540	1.3	6.4	9.4	20	28.5	41.1	89	136	198	1.3	5.1	3	11	8.1	12.6	48.2	48	62	KHK	
AJ 02	10	64.7	263	34.1	4.6	230	81	28.6	38.6	51.1	48.2	0.9	3	4.4	7.4	19	35.4	71	115	167	0.9	2.1	1.4	3	11.6	16.4	35.4	44	52	KHK	
AJ 03	10	260	1030	451	8100	4790	667	667	1330	2220	3240	0.7	8.2	19	37	59.1	81.7	106	142	172	0.7	7.5	11	18	22.4	22.6	24.3	36	30	AHK	
AJ 04	10	184	284	12.4	70	20600	13100	11900	8700	6740	5810	0.9	2	7.3	17	77.6	118	114	174	235	0.9	1.1	5.3	9.6	60.7	40.4	-	60	61	HKA	
AJ 05	10	45.7	463	4	4.1	43.4	208	303	227	174	211	0.6	2.4	6.3	13	21.9	46.5	89	138	186	0.6	1.8	3.9	6.8	8.8	24.6	42.7	49	48	KHK	
AJ 06	10	636	103	25.9	297	10.5	7.1	21.3	97	218	377	1.3	8.6	25	31	53.9	83.5	110	140	194	1.3	7.3	17	5.9	22.9	29.6	26.5	30	50	QHK	
AJ 07	10	32.8	304	487	48.2	11.7	46.3	10.9	13.5	27.6	50.3	0.4	3.5	7.3	9.8	28.3	50.1	82	126	192	0.4	3.1	3.8	2.5	18.5	21.8	31.4	45	66	KHA	
AJ 08	10	308	1650	708	4320	18800	23200	10300	9600	8800	25.9	0.4	1.4	3.6	50	73.4	118	144	163	192	0.4	1	2.2	46	23.4	44.6	26	19	29	AKH	
AJ 09	10	956	2590	1050	4080	21600	5730	3130	2480	2430	726	0.4	1.7	20	32	68.1	96.5	128	162	197	0.4	1.3	19	11	36.4	28.4	31.5	34	35	AKH	
AJ 10	10	63.9	1080	30.9	9.9	66.3	1150	777	458	247	559	0.4	2	16	33	45.5	71.6	143	176	208	0.4	1.6	14	17	13.4	25.7	71.4	33	32	KHA	
AJ 11	10	283	5760	550	4740	1630	10800	7720	6260	4630	2040	0.9	2.5	6.9	21	47	87.9	128	172	219	0.9	1.6	4.4	14	26.5	40.9	40.1	44	47	AKH	
AJ 12	10	375	2890	1520	9700	29700	58300	54900	44900	32300	102000	0.5	5.5	17	28	45.8	78.5	117	158	195	0.5	5	11	11	18.2	32.7	38.5	41	37	AHK	
AJ 13	10	556	2040	1020	7010	19000	6850	3230	2670	860	213	0.4	1.5	15	20	36.3	56.2	85	109	128	0.4	1.1	13	5.9	15.9	19.9	28.9	24	19	AKH	
AJ 14	10	266	1640	468	1840	23700	3910	2620	2780	3360	1570	0.4	1.1	3	28	70.2	109	154	199	242	0.4	0.7	1.9	25	42.4	38.8	45	45	43	AKH	

AJ 15	5	29.2	19.2	21.4	365	-	-	-	-	-	-	0.8	11	26	49	-	-	-	-	-	0.8	10	15	23	-	-	-	-	-	HA
AJ 16	5	1960	3270	3750	2080	511	-	-	-	-	-	5.4	53	98	109	-	-	-	-	-	5.4	48	45	11	-	-	-	-	-	KH
AJ 17	10	68.5	220	627	50.9	6.9	34.1	116	168	292	830	3.4	5.4	11	19	45.2	67.5	97	129	170	3.4	2	6	7.6	26.2	22.3	29	33	41	KHA
AJ 18	10	820	3890	655	153	43.5	34.4	48.9	49.4	40.9	28.2	0.4	1.2	1.9	9.7	47.2	91.5	138	188	238	0.4	0.8	0.7	7.8	37.5	44.3	46.5	50	50	QHA
AJ 19	10	112	171	6.7	239	56.1	31.7	11	21.5	34	500	0.5	2	6	24	34.6	46.7	104	136	157	0.5	1.5	4	18	10.9	12.1	56.9	32	21	HAK
AJ 20	7	248	6220	79	1900	1550	2770	8500	-	-	-	0.4	2.1	11	36	55	89.6	-	-	-	0.4	1.7	9	24	19.5	34.6	-	-	-	KHA
AJ 21	10	60.4	8.7	82	88	476	810	900	1250	1670	1800	0.9	2.5	8.7	22	43.5	74.7	109	154	208	0.9	1.6	6.2	13	21.4	31.2	34.3	45	54	HAK
AJ 22	10	161	513	35.7	900	10800	2720	638	322	190	32.6	0.5	1.2	3.3	4.7	12.6	28.8	47	82.7	126	0.5	0.7	2.1	1.4	7.6	16.2	18.2	36	43	HKA
AJ 23	7	61.1	12.1	35.2	4.7	38.6	59.5	49.3	-	-	-	0.6	1.8	17	36	47	73.1	-	-	-	0.6	1.2	15	19	11.4	26.1	-	-	-	HKH
AJ 24	10	699	182	920	518	73.2	530	840	280	165	58.7	0.6	1.6	7.7	11	27.3	42.7	82	118	158	0.6	1	6.1	2.9	16.7	15.4	39.5	36	40	HHQ
AJ 25	8	116	1750	34.2	11.2	3.6	14	2.2	5.3	-	-	0.4	1.6	4.9	15	33.7	69.1	134	-	-	0.4	1.2	3.3	10	18.5	27.4	72.9	-	-	QH
AJ 26	10	930	2520	1110	4750	1130	1230	714	520	250	6.4	0.6	2.5	6.3	22	53.4	80.9	101	126	158	0.6	1.9	3.8	16	31.1	27.5	20.1	25	27	QHA
AJ 27	10	684	8200	1100	61.1	15	49.5	180	405	635	1660	0.9	5.3	8.4	15	31.8	43.5	58	76.1	98.9	0.9	4.4	3.1	6.4	17	11.7	14.6	18	23	KHA
AJ 28	10	304	4130	373	1650	2460	3900	1200	9700	2440	4670	0.4	2.4	11	34	75.7	126	153	214	262	0.4	2	8.7	23	42	50.3	27	61	48	KHA
AJ 29	10	1060	3820	397	7.7	206	33	30.6	58	75.1	102.6	1	4.2	6	20	57.4	103	161	212	263	1	3.2	1.8	14	37.8	45.6	58	59	51	KHA
AJ 30	10	279	500	36.1	178	1020	8300	29600	6770	3440	5030	1.1	5	16	22	30.3	53.9	143	202	253	1.1	3.9	11	5.8	14.6	17.6	89.1	60	51	AHK
AJ 31	7	113	790	192	20900	6700	7270	1520	-	-	-----	0.4	11	31	123	182	231	-	-	-	0.4	10	20	92	151	49.9	-	-	-	AHK
AJ 32	10	249	229	10.7	4.4	20	50.1	166	129	212	666	1	1.9	23	44	55.6	67.1	95	115	152	1	0.9	21	22	11.4	11.5	28	20	37	HAK
AJ 33	9	370	1550	101	24.1	24.7	2.4	13.7	49.2	335	-----	0.6	2.4	4.4	19	26.7	48.8	66	91.4	-	0.6	1.8	2	14	7.9	22.1	17.5	25	-----	HAK
AJ 34	8	154	3510	325	89	4.8	54.9	238	1700	-	-	0.3	1.7	3.7	6	19.6	32.5	53	-	-	0.3	1.4	2	2.3	13.6	12.9	20.8	-	-	HA

AJ 35	7	44.2	22.9	131	440	103	59	22.1	-	-	-	0.9	3.3	21	58	87.2	122	-	-	-	0.9	2.4	18	38	28.8	34.9	-	-	-	AK
AJ 36	6	126	219	278	108	23.3	29.6	-	-	-	-	0.8	1.8	34	79	279	-	-	-	-	0.8	1	33	45	200	-	-	-	-	KA
AJ 37	7	73.1	174	44.5	4.5	42	75	175	-	-	-	1.1	6.5	10	28	52.4	94.2	-	-	-	1.1	5.4	3.7	17	24.9	41.8	-	-	-	KH
AJ 38	8	230	500	62.5	25.3	4	296	84	74.3	-	-	1.3	4.2	6.4	9.3	21.7	100	148	-	-	1.3	2.9	2.2	2.9	12.4	78.3	48	-	-	KH
AJ 39	9	103	191	698	64	13.3	135	1420	268	209	-	0.6	2.9	6.6	9.5	23	34.8	146	182	-	0.6	2.3	3.7	2.9	13.5	11.8	111	36	-	KH
AM 40	5	698	450	682	6988	1345	-	-	-	-	-	0.7	3	6.5	145	-	-	-	-	-	0.7	2.7	3.5	139	-	-	-	-	-	AH
AM 41	9	880	2620	14100	1620	2450	4110	6590	3690	1360	-	0.4	8.8	17	39	60.5	88.4	138	184	-	0.4	8.4	8.2	22	21.5	27.9	49.6	46	-	AKH
AM 42	6	3510	8300	1180	840	3560	8000	-	-	-	-	11	20	34	58	83.5	-	-	-	-	11	8.7	14	24	25.5	-	-	-	-	HA
AM 43	6	598	7360	598	3060	1400	1070	-	-	-	-	8.7	38	103	131	187	-	-	-	-	8.7	29	65	28	56	-	-	-	-	AKH
AM 44	10	3860	2330	406	3020	12100	11800	1700	9200	6430	5000	0.5	2.9	9.9	27	66.3	102	154	204	256	0.5	2.4	7	17	36.4	38.7	52	50	52	AHK
AM 45	10	411	4060	1270	1230	22800	13500	4780	4700	5080	5770	0.5	1.7	14	20	42.8	75.5	125	175	226	0.5	1.2	12	6.5	22.4	32.7	49.5	50	51	AHK
AM 46	10	514	6130	578	2440	8800	2700	5800	5300	5950	6190	0.5	1.3	5.3	27	62.5	110	161	210	260	0.5	0.8	4	22	35.1	47.5	50	50	50	AHK
AM 47	10	178	761	1730	19600	4020	3020	2700	2780	2410	1170	1.1	16	23	63	101	141	184	228	273	1.1	15	6.4	40	38	40	43	44	45	AKH
AM 48	10	373	1500	641	7400	8800	28700	69500	42500	29700	22300	1	3.8	8.9	29	55.3	84	140	191	244	1	2.8	5.1	20	26.3	28.7	56	51	53	AHK
AM 49	10	73.4	1980	222	1070	224	784	1211	15500	7420	4000	0.5	2	6.1	17	32.1	43.3	136	196	241	0.5	1.5	4.1	11	15.5	11.2	92.7	60	45	HKA
AM 50	10	268	75.9	675	75	810	6170	3120	2200	1620	2250	2.4	5.5	13	31	48.2	117	167	219	269	2.4	3.1	7.9	17	17.7	68.8	50	52	50	KHA
AM 51	10	387	3900	5860	2940	2180	1410	8600	6140	4550	6600	0.4	3.2	12	22	39.9	81.5	128	179	236	0.4	2.8	8.5	9.8	18.4	41.6	46.5	51	57	AHK
AM 52	10	30.7	279	14	1234	145	94	95	83	75.9	36	0.5	2.3	13	40	72.7	116	160	206	254	0.5	1.8	11	27	32.9	43.3	44	46	48	KHA
AM 53	10	158	10.2	1.2	45	152	1263	72.2	76.5	73.9	14.9	1.1	2.6	6.4	12	22.1	53.3	85	119	154	1.1	1.5	3.8	5.4	10.3	31.2	31.5	34	35	HQH
AM 54	10	372	870	129	9.2	23.6	1290	525	206	292	46.9	0.8	2.7	4.5	9.5	13.9	43.4	62	99.6	130	0.8	1.9	1.8	5	4.4	29.5	18.1	38	30	HQH

AM 55	10	109	19.2	168	3870	373	121.6	1215	11.7	46.2	141	0.6	1.7	2.6	11	17.9	26.1	53	119	170	0.6	1.1	0.9	8.4	6.9	8.2	26.7	66	51	HKA
AM 56	10	404	1670	1260	2410	1600	381	125	657	686	487	0.8	3.2	6.7	18	26.1	41	90	154	216	0.8	2.4	3.5	11	8.6	14.9	49.4	64	62	AKH
AM 57	8	155	371	33.7	184	9000	11500	2790	2060	1580	516	0.8	2	4.9	7.8	20.5	54.9	94	135	180	0.8	1.2	2.9	2.9	12.7	34.4	39	41	45	HKH
AM 58	10	376	201	90	13.1	13.5	46.1	241	316	779	2810	0.8	7.8	31	43	64.3	86.3	111	135	175	0.8	7	23	12	21.2	22	24.7	24	40	QHA
AM 59	10	870	1510	212	5.5	36.4	82	313	1626	81	82	0.8	1.8	8.7	23	33	47.5	88	131	179	0.8	1	6.9	14	10.5	14.5	40.4	43	48	HKA
AM 60	10	260	1110	23	2.8	25.8	57.7	1395	17	11.9	5.6	0.6	2.6	16	28	45.3	73.7	110	152	198	0.6	2	13	12	17.4	28.4	36.3	42	46	QKA
AM 61	10	1170	251	15200	10200	668	686	226	1270	1000	2700	1.6	4	10	19	31.7	40.6	87	126	167	1.6	2.4	6.4	8.5	12.8	8.9	46	39	41	HKH
AM 62	9	516	679	294	658	1390	285	159	96	54.2	-	1.1	2.1	13	31	59.7	81.2	105	140	-	1.1	1	11	17	28.9	21.5	23.8	35	-	HKH
AM 63	10	47	51.1	32.8	4.6	15.3	26.7	33.3	1396	72.3	475	1	2	5.7	16	21	42.3	70	98.3	134	1	1	3.7	10	11.3	15.2	27.4	29	36	HKA
AM 64	8	66	140	223	1390	1283	171	146	50	-	-	3	5.3	27	64	90.3	121	156	-	-	3	2.3	21	37	26.6	30.7	35	-	-	AKH
AM 65	9	45.3	7.9	3.6	8.4	30.9	1220	8.6	6.2	1.7	-	2.1	19	42	55	100	133	167	204	-	2.1	17	23	13	45.2	33	34	37	-	QKA
AM 66	10	231	291	11200	870	374	2300	6130	6790	7860	11600	0.9	3.6	12	21	47	72.5	111	154	203	0.9	2.7	8.7	9	25.7	25.5	38.5	43	49	AHK
AM 67	10	68.3	170	498	830	1760	800	220	250	254	145	1.1	2.3	22	35	52.6	75.5	116	156	200	1.1	1.2	20	13	17.5	22.9	40.5	40	44	KHA
AM 68	9	435	75.1	2640	3020	1746	95	137	178	91	-	1.6	9.7	19	40	76.3	124	165	205	-	1.6	8.1	9.5	21	36.1	47.7	41	40	-	HKH
AM 69	10	40.8	162	850	105	11.9	53.2	54.5	1336	55.3	42.6	0.8	2.5	7.1	13	39.6	58.4	76	143	196	0.8	1.7	4.6	5.5	27	18.8	17.1	68	53	KHA
AM 70	10	400	103	1.2	18.4	16.4	1430	24.5	63.1	76.3	262	0.8	1	3.3	20	30.7	60.4	76	109	146	0.8	0.2	2.3	16	11.2	29.7	15.6	33	37	HKH
AM 71	8	101	2770	287	960	13300	31700	17300	1420	-	-	0.5	3	7.6	13	22.7	69.9	136	-	-	0.5	2.5	4.6	5	10.1	47.2	66.2	-	-	AH
AM 72	10	297	11400	1030	720	1450	121	800	223	174	175	0.3	1.4	20	58	89.5	165	177	219	274	0.3	1.1	19	37	31.9	75.5	12	42	55	KQA
AM 73	6	270	1940	406	315	633	583	-	-	-	-	3.7	123	240	328	550	620	-	-	-	3.7	119	117	88	222	70	-	-	-	KH
AM 74	10	452	11600	960	1160	1670	2380	4360	7260	9400	60400	0.4	1.9	13	28	44.8	69.8	94	121	150	0.4	1.5	11	15	16.7	25	24.5	27	29	KHA

AM 75	8	3250	71900	2140	85000	27900	4530	1160	713	-	-	0.3	1.3	4.8	14	22.5	34.7	66	-	-	0.3	1	3.5	9.5	8.2	12.2	31	-	-	KK
AM 76	6	1950	2740	4040	4620	2530	4620	-	-	-	-	8.7	37	65	86	106	-	-	-	-	8.7	28	29	21	19.7	-	-	-	-	HA
AM 77	10	1630	537	13.9	11	337	790	1020	1240	2120	890	1.4	3.9	8.7	61	90.5	119	174	219	297	1.4	2.5	4.8	52	29.6	28.5	55	45	78	HKH
AM 78	10	643	7370	2490	47.9	236	1010	11800	1460	870	209	0.5	4	12	28	38.9	55.6	221	280	335	0.5	3.5	7.8	16	10.9	16.7	165	59	55	KHA
AM 79	10	2210	12600	76	104	990	66.4	1170	17.1	399	1080	0.7	2.4	11	16	25.2	52.4	60	107	137	0.7	1.7	8.4	5.3	9.1	27.2	7.1	48	30	KHA
AM 80	10	120	1880	213	5280	880	800	177	790	1600	349	0.3	2.1	12	37	77.4	118	167	261	257	0.3	1.8	9.5	26	40.1	40.6	49	49	41	KHA
AM 81	10	117	2690	289	1020	20	81	1550	144	235	830	0.4	1.9	6.6	19	46.4	78.6	112	142	181	0.4	1.5	4.7	12	27.5	32.2	33.4	30	39	KHA
AM 82	10	169	491	117	37	2100	112	177	1090	159	749	0.9	5.4	39	53	64.8	72.7	126	187	230	0.9	4.5	34	14	11.9	7.9	53.3	61	43	KHA
AM 83	10	269	1180	24.2	129	42.3	55.5	177	1880	324	1210	0.8	5.9	22	39	56.8	76.5	101	132	170	0.8	5.1	16	18	17.6	19.7	24.5	31	38	KHA
AM 84	10	222	41100	5610	1090	4070	12900	177	2450	2270	176	0.3	2.6	5.9	20	30.5	59.1	79	96.5	113	0.3	2.3	3.3	14	10.9	28.6	20.3	17	17	KHA
AM85	10	344	5840	22000	2200	1380	1070	177	5330	5530	82000	0.3	0.6	2.1	31	58.3	75.1	96	118	136	0.3	0.3	1.5	29	27.5	16.8	21.1	22	18	KHA
AM 86	6	3690	7040	1720	3520	6400	5550	177	-	-	-	9.2	23	44	60	80.7	-	-	-	-	9.2	14	12	16	20.5	-	-	-	-	KH
AM 87	8	840	18500	1710	6520	2820	750	177	960	-	-	0.6	2.7	8.4	24	37.2	68.4	132	-	-	0.6	2.1	5.7	16	13.1	31.2	63.6	-	-	KHA
AM 88	10	1900	7030	2000	2100	3580	3780	177	4070	2010	84	0.7	4	8.5	18	37.6	67.5	106	143	-	0.7	3.3	4.5	9.3	19.8	29.9	38.5	37	-	KHA
AM 89	9	215	3700	258	110	67	17.3	177	2400	1311	-	0.5	2.3	4.2	11	25.7	52.7	98	154	-	0.5	1.8	1.9	6.9	14.6	27	45.3	56	-	KHA
AM 90	8	130	8700	13200	442	142	1740	177	1950	-	-	0.4	1.2	3.9	7.7	22	37.9	95	-	-	0.4	0.8	2.7	3.8	14.3	15.9	57.1	-	-	KHA
AM 91	8	647	29100	20700	2910	9800	2690	177	166	-	-	0.6	2.4	6.1	20	40.6	57.6	75	-	-	0.6	1.8	3.7	14	20.9	17	17.7	-	-	KH
AM 92	8	372	25000	1780	660	3800	2340	177	223	-	-	0.1	2.1	4.5	15	39.8	65.9	103	-	-	2	0.1	2.4	11	24.7	26.1	37.1	-	-	KQ
AM 93	5	234	8000	18850	4200	6960	177	-	-	-	-	0.4	2.1	42	78	-	-	-	-	-	0.4	1.7	39	36	-	-	-	-	-	KA

AM 94	9	67.8	7900	4080	178	900	2690	177	303	352	-	0.4	2.8	6.2	14	29.1	56.1	93	117	-	0.4	2.4	3.4	7.3	15.6	27	37.1	24	-	KH
AM 95	9	215	3700	258	110	12	17	177	1320	1311	-	0.5	2.3	4.2	11	25.7	52.7	990	154	-	0.5	1.8	1.9	6.9	14.6	27	37.3	64	-	KHA
AM 96	10	334	141	1330	20600	6050	3200	177	573	528	83	1.3	4.2	6.2	25	37.6	54	76	93.9	114	1.3	2.9	2	19	12.6	16.4	21.7	18	20	HKA
AM 97	10	102	29200	6270	721	1720	3950	177	5330	5190	9950	0.5	5.5	12	39	68	103	138	176	215	0.5	5	6.3	27	28.8	35	35	38	39	AHA
AM 98	10	295	779	642	3830	28000	7060	177	2620	2630	666	1.2	6.2	16	25	59.2	86.5	118	151	184	1.2	5	9.8	8.6	34.6	27.3	31.5	33	33	AKH
AM 99	8	233	696	5460	19500	1800	9700	177	4570	-	-	3	29	56	85	160	195	245	-	-	3	26	27	29	74.9	35	50	-	-	AH
AM 100	6	7700	17600	1130	17000	7620	1190	177	-	-	-	1.1	4.6	12	36	52	81.3	-	-	-	1.1	3.5	7	24	16.4	29.3	-	-	-	KHA
AM 101	9	137	2460	1140	6290	14200	1670	177	3150	1310	-	0.6	3.3	9.8	24	67.2	106	147	191	-	0.6	2.7	6.5	14	43.5	38.8	41	44	-	AKH
AM 102	10	1920	5340	830	25.4	117	1680	177	5.7	134	506	1	7.8	57	101	113	123	169	211	261	1	6.8	49	44	12	10	46	42	50	KHA
AM 103	9	623	1530	6280	1170	2090	2640	177	126	7010	-	4.7	6.2	12	36	53	61.2	70	95.4	-	4.7	1.5	5.9	24	16.6	8.2	8.8	25	-	AHK
AM 104	5	850	250	1784	9862	21214	177	-	-	-	-	0.8	3.5	18	50	-	-	-	-	-	0.8	2.7	15	32	-	-	-	-	-	KA
AM 105	5	768	1654	774	5466	3055	177	-	-	-	-	0.8	3	14	145	-	-	-	-	-	0.8	2.2	11	131	-	-	-	-	-	KA
AM 106	10	244	12900	1700	410	2880	2740	177	14000	16100	25700	0.4	2.5	29	57	66	80.7	102	145	201	0.4	2.1	26	28	9.5	14.7	21.3	43	56	KAH
AM 107	10	28.3	2410	193	161	184	288	177	35.8	60.1	19.3	0.3	2.5	7.7	34	54.9	68.4	110	198	239	0.3	2.2	5.2	26	21.1	13.5	41.6	88	41	KQH

AM 108	10	282	3070	366	12000	5620	4020	177	3240	1890	1000	1.1	3.6	11	40	65.3	96.1	149	182	226	1.1	2.5	7.8	28	25.8	30.8	52.9	33	44	AKH
AM 109	10	197	554	1280	1070	3750	2080	177	1690	1960	1090	0.6	7	20	38	67.5	88.4	128	176	222	0.6	6.4	13	19	29.1	20.9	39.6	48	46	AKH
AM 110	10	173	545	53.7	7.9	52.6	384	177	211	129	68.3	0.9	5.4	9	20	25.8	46.7	153	207	261	0.9	4.5	3.6	11	6.1	20.9	106	54	54	KHA
AM 111	10	611	787	11.9	1040	37.7	45.9	177	184	82	353	1.7	3.8	24	108	120	133	177	227	267	1.7	2.1	20	24	12	13	44	50	40	HKA
AM 112	7	153	765	382	28.1	141	1491	177	-	-	-	0.7	8.1	18	26	38	57.8	-	-	-	0.7	7.4	10	7.4	12.3	19.8	-	-	-	KHA
AM 113	8	360	625	2630	2410	293	1594	177	1316	-	-	0.5	4.4	7.8	13	20	56.5	143	-	-	0.5	3.9	3.4	5.2	7	36.5	86.5	-	-	KHA
AM 114	8	930	173	22.6	31.8	1594	88	177	16.5	-	-	0.6	1.8	5.6	9.6	30.5	59.4	292	-	-	0.6	0.8	3.8	4	20.9	28.9	233	-	-	HKA
AM 115	8	360	625	2630	2410	994	54.5	177	1316	-	-	0.5	4.4	7.8	13	20	56.5	143	-	-	0.5	3.9	3.4	5.2	7	36.5	86.5	-	-	HKA
AM 116	10	115	1740	1830	1970	14200	4700	177	2670	2660	1190	0.3	0.8	9.6	36	87.9	124	163	204	246	0.3	0.5	8.8	27	51.7	36.1	39	41	42	AKH
AM 117	10	289	7500	1360	2630	2060	4820	177	5290	4040	2540	0.5	3.7	14	38	85.5	133	181	228	277	0.5	3.2	11	24	47.1	47.5	48	47	49	AKA
AM 118	10	1510	26000	1860	1970	3120	2230	177	2940	2670	7700	0.4	1.7	13	41	84.6	131	178	224	268	0.4	1.3	11	28	44	46.4	47	46	44	KAH

AM 119			1030	267	3400	24000	3070	177	2790	3610	1730	0.8	3.4	8.7	15	53.2	97	149	196	240	0.8	2.6	5.3	6.5	38	43.8	52	47	46	AKA
AM 120	10	136	542	2040	17400	5320	3520	177	4030	3650	1570	1	14	22	70	110	155	201	245	291	1	13	8.1	48	40.1	45	46	44	46	AKA
AM 121	10	121	454	1090	22200	7820	5560	177	4370	4580	3350	1	14	24	78	117	163	212	261	311	1	13	10	54	39.4	46	49	49	50	AKA
AM 122	10	543	5100	330	20200	66800	15300	177	4150	3480	700	0.8	2.4	7	16	42.7	65.8	92	123	155	0.8	1.6	4.6	8.9	26.8	23.1	26.2	31	32	KHA
AM 123	9	94	880	240	14600	1420	690	177	1880	2780	-	0.5	2.4	6.7	25	52.6	107	161	210	----	0.5	1.9	4.3	18	27.6	54.4	54	49	-	AKA
AM 124	5	940	6620	6648	3.00E+05	8526	177	-	-	-	-	0.8	8	46	125	-	-	-	-	-	0.8	7.2	38	790	-	-	-	-	-	AH
AM 125	5	1185	4629	2462	9886	358	177	-	-	-	-	0.8	6	32	135	-	-	-	-	-	0.8	5.2	26	103	-	-	-	-	-	AH
AM 126	6	682	2160	1426	1426	36528	2536	177	-	-	-	1	6	14	115	-	-	-	-	-	1	5	8	101	-	-	-	-	-	AH
AM 127	8	410	870	70.5	9300	176	762	177	830	-	-	0.8	23	38	57	68.9	129	232	-	-	0.8	22	15	20	11.8	60.1	103	-	-	KAH
AM 128	10	210	5080	380	2600	655	1241	177	4500	4600	105000	0.3	2	7.4	21	51.2	71	88	103	119	0.3	1.7	5.4	14	29.9	19.8	16.9	15	16	KAH
AM 129	9	67.5	44	377	374	234	241	177	298	46.5	-	0.8	1.7	13	27	44.7	67	174	226	266	0.8	0.9	12	14	17.4	22.3	107	52	40	AHA
AM 130	8	1030	93000	3870	8900	25400	1.00E+05	177	99000	-	-	0.3	3.4	18.1	31	60.8	130	216	-	-	0.3	3.1	15	13	29.6	69.2	86	-	-	KAH

AM 131	8	291	2140	207	23200	7300	11500	177	4540	-	-	0.9	3	8.5	39	59.7	128	230	-	-	0.9	2.1	5.5	30	21.1	68.3	102	-	-	KAH
AM 132	10	154	9200	1970	106	476	168	177	12800	4690	1930	0.3	2.4	5	10	16.2	18.3	40	90.1	140	0.3	2.1	2.6	5.3	5.9	2.1	21.5	50	50	KAH
AM 133	10	219	298	1350	184	2370	15200	177	1230	1860	930	0.6	3.9	7.3	17	27.7	96.7	138	188	234	0.6	3.3	3.4	9.7	10.7	69	41.3	50	50	AKH
AM 134	4	52	1245	4522	3425	-	-	177	-	-	-	0.2	1.2	25	-	-	-	-	-	-	0.2	1	24	-	-	-	-	-	-	AH
AM 135	4	188	56	3345	2234	-	-	177	-	-	-	1.2	4.2	105	-	-	-	-	-	-	1.2	3	101	-	-	-	-	-	-	HA
AM 136	9	2310	18900	1740	1520	8600	1790	177	1430	197	-	1.3	3.3	6	11	27.5	108	135	-	-	1.3	2	2.7	5	16.5	80.5	27	-	-	KQA
AM 137	5	1200	3245	1453	487	3564	-	177	-	-	-	0.8	4.5	9	75	-	-	-	-	-	0.8	3.7	4.5	66	-	-	-	-	-	KH
AM 138	5	612	2122	634	1456	56443	-	177	-	-	-	0.8	3	9	50	-	-	-	-	-	0.8	2.2	6	41	-	-	-	-	-	KA
AM 139	6	1990	607	657	1840	1640	2470	177	-	-	-	28	66	84	133	154	-	-	-	-	28	38	18	49	20.6	-	-	-	-	HK
AM 140	8	322	850	3690	6740	8500	4860	177	540	-	-	0.9	12	21	32	67.8	110	125	-	-	0.9	11	9.2	11	35.7	42.2	15.4	-	-	AKH
AM 141	8	571	9200	1010	12800	10200	4110	177	980	-	-	0.6	3.2	11	37	55.9	75.2	92	-	-	0.6	2.6	7.8	26	19.3	19.3	16.9	-	-	KH
AM 142	8	578	18500	2510	1520	14700	25000	177	900	-	-	0.5	2	7.7	33	65	112	150	-	-	0.5	1.5	5.7	25	31.9	47	38	-	-	KA

AM 143	10	616	4260	970	9300	960	3290	177	7150	8000	6370	0.4	2.6	9.7	27	59.2	91	131	170	215	0.4	2.2	7.1	17	32.4	31.8	40	39	45	KAH
AM 144	10	649	181	386	4530	940	1710	177	6060	5900	3310	0.7	3	11	36	70	103	137	188	240	0.7	2.3	8.3	24	34.3	33	34	51	52	HAK
AM 145	10	1590	5130	1980	900	2440	126	177	576	2690	7900	0.8	2	6.4	17	37	81.3	105	116	171	0.8	1.2	4.4	11	20.1	44	23.7	11	55	KHA
AM 146	10	117	164	1000	498	5270	23500	177	3810	4320	2870	1	2.3	9.7	29	46.2	108	164	211	261	1	1.3	7.4	19	17.3	61.8	56	47	50	AHK
AM 147	10	1070	96	980	416	41800	60300	177	6440	1530	4250	0.3	1.4	6.1	19	73.8	156	214	237	263	0.3	1.1	4.7	13	54.7	82.2	58	23	26	KAH
AM 148	10	1670	260	940	11700	40600	7760	177	1790	1170	77.4	0.6	1.7	5.1	10	26	87	47	59	75	0.6	1.1	3.4	5.1	15.8	11	10.1	12	16	HKA
AM 149	10	960	3910	1180	5800	42400	20100	177	6980	1610	3480	0.6	6.3	23	32	65.9	99.2	139	185	231	0.6	5.7	17	9	33.5	33.3	39.8	46	46	KHA
AM 150	10	2130	4890	676	6240	1790	9300	177	8800	1800	6110	0.8	2.2	5.7	23	61.6	104	151	202	253	0.8	1.4	3.5	18	38.4	42.4	47	51	51	HAK
AM 151	10	736	1030	5020	920	3500	9500	177	3750	2770	1350	0.8	8.8	21	44	67	111	155	201	248	0.8	8	12	23	22.9	44	44	46	47	AKH
AM 152	6	1460	641	742	990	1540	2140	177	-	-	-	30	54	85	113	147	-	-	-	-	30	24	31	28	34	-	-	-	-	HKA
AM 153	6	1580	1110	315	1130	830	3680	177	-	-	-	43	62	95	112	139	-	-	-	-	43	19	33	17	27	-	-	-	-	HA
AM 154	9	74.4	1890	321	870	1630	5890	177	1560	461	-	0.4	1.9	6.5	48	72.1	124	171	218	-	0.4	1.5	4.6	42	23.9	51.9	47	47	-	AKA

AM 155	5	292	1342	914	2098	10982	-	177	-	-	-	0.8	3	15	118	-	-	-	-	-	0.8	2.2	12	103	-	-	-	-	-	AH
AM 156	5	325	1534	1345	15424	2245	-	177	-	-	-	0.8	5	25	115	-	-	-	-	-	0.8	4.2	20	90	-	-	-	-	-	AH
AM 157	5	324	1535	1340	1275	2245						0.8	5	24	116													-	AH	
AM 158	6	1510	1420	138	209	275	5150	-	-	-	-	30	41	64	79	129	-	-	-	-	30	12	23	16	49.6	-	-	-	-	HA
AM 159	5	822	2354	1478	1756	9856	-	-	-	-	-	1.5	2	10	80	-	-	-	-	-	1.5	0.5	8	70	-	-	-	-	-	AH
AM 160	6	1458	2334	1312	8898	2156	9868	-	-	-	-	1.2	1.8	14	20	86	-	-	-	-	1.2	0.6	12	6.5	66	-	-	-	-	AH
AM 161	4	402	650	1712	105	-	-	-	-	-	-	1.2	9	65	-	-	-	-	-	-	1.2	7.8	56	-	-	-	-	-	-	AK
AM 162	4	264	876	7128	108	-	-	-	-	-	-	1.2	8	63	-	-	-	-	-	-	1.2	6.8	55	-	-	-	-	-	-	AK
AM 163	10	656	4030	7660	1870	8400	6420	5060	5220	8100	16900	0.5	3.3	11	30	73.1	117	162	207	254	0.5	2.8	7.4	19	43.3	43.9	45	45	47	KAK
AM 164	6	2090	900	1530	2890	3680	6860	-	-	-	-	40	74	138	182	229	-	-	-	-	40	34	64	44	47	-	-	-	-	HA
AM 165	10	206	96	12.7	4.3	8.9	35	13.2	5.1	1	0.5	0.8	2.1	12	22	29.6	48.4	63	80.5	118	0.8	1.3	10	9.3	8	18.8	14.3	18	38	QKA

AM 166	9	111	1650	30.2	175	438	980	970	1410	1060	-	0.3	1.4	7.5	51	75.7	106	139	191	-	0.3	1.1	6.1	43	25	30.3	33	52	-	KAH
AM 167	6	970	521	11600	3710	7330	25500	-	-	-	-	4.7	11	37	65	107	-	-	-	-	4.7	5.9	26	28	42.1	-	-	-	-	AH
AM 168	10	198	1660	133	4350	17100	2870	2110	2070	2420	1420	0.8	2.5	7.3	16	52.6	94.5	141	189	236	0.8	1.7	4.8	8.2	37.1	47.9	46.5	48	47	KAH
AM 169	4	650	5460	2870	910	-	-	-	-	-	-	4.8	35	62	-	-	-	-	-	-	4.8	30	27	-	-	-	-	-	-	AKH
AM 170	5	643	11200	2210	3700	11000	-	-	-	-	-	2.5	25	67	110	-	-	-	-	-	2.5	22	42	43	-	-	-	-	-	AHK
AM 171	10	127	1570	663	3150	10600	3920	2880	1730	2380	509	0.5	2.4	13	28	58.3	74.3	106	142	170	0.5	1.9	11	14	30.6	16	31.7	36	28	AKH
AM 172	10	193	1260	1050	345	549	6620	3450	3770	1900	1760	0.5	3.3	15	30	34.3	86.8	137	189	240	0.5	2.8	12	15	4.7	52.5	50.2	52	51	KAH
AM 173	7	108	4240	1060	5410	15700	10500	8500	-	-	-	0.5	11	39	80	164	216	-	-	-	0.5	10	28	41	34.4	52	-	-	-	AH
AM 174	10	692	1890	439	4930	5230	536	3290	2390	2220	1060	0.8	3.5	9.6	25	81.5	155	199	246	294	0.8	2.7	6.1	16	56.4	73.5	44	47	48	KHK
AM 175	8	242	14300	1150	1540	2460	1645	3100	2060	-	-	0.3	2.2	16	53	73.5	149	277	-	-	0.3	1.9	14	37	20.2	75.5	128	-	-	KA'H
AM 176	10	651	21000	663	4080	3370	14400	9800	6750	5480	5280	0.3	1.5	6.6	41	77.2	139	195	247	298	0.3	1.2	5.1	35	36	61.8	56	52	51	KAH
AM 177	10	1940	85000	3490	3830	15800	7280	10800	7330	7540	2610	0.3	1.6	23	43	75.6	91.2	132	174	215	0.3	1.3	21	20	33.1	15.6	40.8	42	41	KHA

AM 178	9	188	790	760	6110	1759	26200	6890	2950	320	-	0.9	8.3	17	26	46.2	76.6	115	145	-	0.9	7.4	9	8.6	20.3	30.4	38.4	30	-	AKA
AM 179	7	850	2300	1010	14600	21800	1590	2870	-	-	-	1.2	5.8	13	45	98.2	142	-	-	-	1.2	4.6	6.9	33	53	43.8	-	-	-	AKA
AM 180	10	211	940	3220	16300	820	383	157	597	990	1610	0.3	6.4	8	16	25.1	35.7	85	134	184	0.3	6.1	1.6	8	9.1	10.6	48.8	50	50	KHA
AM 181	10	154	15900	632	10500	8000	4330	8100	2840	3880	4700	0.4	3.3	18	56	79.1	117	167	218	262	0.4	2.9	15	38	23.4	37.9	50	51	44	KAH
AM 182	5	2050	840	1080	573	4060	-	-	-	-	-	6.2	21	43	89	-	-	-	-	-	6.2	14	23	45	-	-	-	-	-	HA
AM 183	8	2050	970	549	83	110	1230	107	50.9	-	-	1.3	3.7	7	17	35.5	229	277	-	-	1.3	2.4	3.3	9.7	18.8	194	48	-	-	QK
AM 184	9	348	790	235	121	10.1	9.7	73.3	123	247	-	0.7	4.4	7.8	18	36.3	58	88	107	-	0.7	3.7	3.4	10	18.1	21.7	30.4	19	-	KH
AM 185	7	1980	4860	800	2780	2200	1930	2020	-	-	-	8.8	22	52	81	113	143	-	-	-	8.8	13	30	30	32	30	-	-	-	KA
AM 186	6	2110	2670	4480	3910	3270	1650	-	-	-	-	8.9	28	52	73	92.6	-	-	-	-	8.9	19	24	20	20.1	-	-	-	-	KA
AM 187	5	2098	1098	2256	1405	1220	-	-	-	-	-	0.8	5	17	112	-	-	-	-	-	0.8	4.2	12	95	-	-	-	-	-	KH
AM 188	9	1385	930	1860	16400	5630	3280	2270	1820	591	-	1	9.6	36	78	106	136	170	208	-	1	8.6	26	42	27.9	30	34	38	-	AKH
AM 189	10	494	248	1250	367	8800	3400	1080	571	319	38.3	1.7	2.8	5.5	14	31.8	44.6	57	71.7	91.3	1.7	1.1	2.7	8	18.3	12.8	12.3	15	20	AKH

AM 190	10	223	1150	226	6190	37100	2260	1060	1400	1720	574	0.5	1.3	3.4	5.9	23.6	48.6	89	124	158	0.5	0.8	2.1	2.5	17.7	25	40.2	35	34	AKH
AM 191	9	263	1790	970	1370	5820	2780	900	448	202	-	0.7	5.2	17	27	42.9	56.4	69	84.2	107	0.7	4.5	12	10	15.6	13.5	12.4	15	23	AKH
AM 192	10	183	2140	499	2060	3630	3470	1760	1290	1250	578	0.7	2.9	7.9	53	85.3	124	162	202	242	0.7	2.2	5	45	32.4	38.7	38	40	40	AKH
AM 193	6	6890	1770	2140	1318	4430	1560	-	-	-	-	0.7	5.4	9.3	25	48	66.2	-	-	-	0.7	4.7	3.9	16	23.1	18.2	-	-	-	QKA
AM 194	9	82	980	575	2320	9500	10800	8000	3180	355	-	0.9	6.2	15	24	41.3	62.4	99	118	-	0.9	5.3	8.3	9	17.8	21.1	37	19	-	AKH
BN 195	10	574	2660	1520	7200	11300	2590	2100	1970	820	696	0.6	5.7	15	---	63.1	104	137	171	209	0.6	5.1	9.1	12	36.4	40.9	33	34	38	AKH
BN 196	6	1030	637	2590	7320	8100	5060	-	-	-	-	9.6	19	35	61	96.4	-	-	-	-	9.6	9.2	16	26	36.3	-	-	-	-	HA
BN 197	5	3470	2120	3920	5820	311	-	-	-	-	-	13	51	60	121	-	-	-	-	-	13	39	38	32	-	-	-	-	-	QH
BN 198	8	193	4210	1040	1950	2900	1810	645	300	-	-	0.6	3.5	10	23	44.4	60.7	79	-	-	0.6	2.9	6.9	13	21.5	16.3	17.9	-	-	AKH
BN 199	9	193	5260	550	732	9000	3480	1890	1400	222	-	0.6	2.5	5	13	38.4	59.9	80	102	-	0.6	1.9	2.5	8	25.4	21.5	20.4	22	-	AKH
BN 200	9	151	211	1790	218	3060	20700	1640	980	846	-	0.9	1.3	3.3	8	12.9	38.5	60	83.1	107	0.9	0.4	2	4.7	4.9	25.6	21.6	23	24	AKH
BN 201	6	3620	478	12500	1140	2050	664	-	-	-	-	8.4	18	47	80	180	-	-	-	-	8.4	9.7	28	34	99.6	-	-	-	-	HK

BN 202	6	1690	3100	560	748	620	7460	-	-	-	-	1.3	4.1	24	66	113	-	-	-	-	1.3	2.8	20	41	47.5	-	-	-	-	KH
BN 203	6	383	940	1810	1152	528	38.9	-	-	-	-	1.1	15	33	68	104	-	-	-	-	1.1	14	18	35	36.5	-	-	-	-	KA
BN 204	5	213	3040	76.2	152	1660	-	-	-	-	-	1.6	9.9	64	106	-	-	-	-	-	1.6	8.3	54	42	-	-	-	-	-	KHA
BN 205	8	191	5060	640	626	3410	1230	1530	9400	-	-	0.5	4	8.8	19	54.5	78.8	127	-	-	0.5	3.5	4.8	9.8	35.9	24.3	48.2	-	-	KAH
BN 206	5	982	1543	688	7562	1254	-	-	-	-	-	0.8	3	10	142	-	-	-	-	-	0.8	2.2	7.2	132	-	-	-	-	-	AH
BN 207	5	186	850	1090	9500	44800	-	-	-	-	-	1.6	8.7	34	65	-	-	-	-	-	1.6	7.1	25	31	-	-	-	-	-	AH
BN 208	10	234	743	860	870	3050	3940	3080	1490	1070	412	0.5	7.7	20	36	58.1	82.3	118	155	194	0.5	7.2	12	16	22.4	24.2	35.7	37	39	AKH
BN 209	10	559	1840	604	5350	12700	3250	2290	1650	2010	356	0.8	4.8	13	27	75.5	92.2	122	152	179	0.8	4	8.2	14	48.2	16.7	29.8	30	27	AKH
BN 210	10	112	1660	86	6380	24400	1010	1050	1290	1570	608	0.4	1.5	4.5	9.6	35.7	85.6	130	172	211	0.4	1.1	3	5.1	26.1	49.9	44.4	42	39	AKH
BN 211	10	187	2250	423	2470	6170	23900	31900	16800	12200	7850	0.4	1.9	6.8	16	30.1	58.2	105	153	204	0.4	1.5	4.9	9.3	14	28.1	46.8	48	51	AHK
BN 212	9	1040	2790	482	16000	7050	4050	2960	1070	-	-	0.8	2.6	7.3	30	70	108	149	-	-	0.8	1.8	4.7	23	40.2	38	41	-	-	KHA
BN 213	10	106	762	556	1000	15000	9800	5720	4760	4570	3700	0.4	2.1	9.9	29	73.9	119	165	214	265	0.4	1.7	7.8	19	45.4	45.1	46	49	51	AHK

BN 214	10	1540	3240	1590	1090	11800	9300	9500	7060	5970	2910	0.6	10	48	24	133	182	232	281	331	0.6	9.8	38	37	48.6	49	50	49	50	AKH
BN 215	10	470	21600	1410	3830	552	850	2420	3910	2530	26900	0.3	1.8	8.5	24	48.1	64.7	91	119	136	0.3	1.5	6.7	15	24.4	16.6	25.9	28	17	KHA
BN 216	9	69.4	2070	1630	610	768	479	334	222	96	-	1.1	5.2	13	31	70.3	106	144	188	-	1.1	4.1	7.6	18	39.8	35.7	38	44	-	AKH
BN 217	7	96.7	139	244.1	440.5	732.1	594.9	533.8	-	-	-	0.9	1.8	3.9	8.5	39.3	57.2	-	-	-	0.9	1	2.1	4.5	30.8	18.4	-	-	-	AK
BN 218	10	31.2	1570	245	19.3	78.3	417	1380	2530	1870	7640	0.6	3.6	6.5	17	24.8	35.6	58	85.8	110	0.6	3	2.9	11	7.5	10.8	22.2	28	24	KHK
BN 219	10	166	830	709	2750	1320	820	1450	626	472	179	0.7	3.3	7.5	16	28	55.7	76	107	134	0.7	2.6	4.2	8	12.5	27.7	20.5	31	27	AKH
BN 220	10	532	76.1	3410	26600	6440	2670	1180	534	355	96	0.5	1.4	3.5	14	21.9	31.1	44	63.3	88.2	0.5	0.9	2.1	11	7.9	9.2	12.9	19	25	HKH
BN 221	7	158	23	8700	18100	5620	2790	1520	-	-	-	0.9	1.9	6	17	28.4	42.1	78	-	-	0.9	1	4.1	11	11.2	13.7	35.8	-	-	HKH
BN 222	8	42	2180	350	2600	717	910	960	1130	-	-	0.5	2.7	8.9	38	83.6	131	180	-	-	0.5	2.2	6.2	29	45.5	47.4	49	-	-	AKH
BN 223	9	176	270	355	9800	2100	840	724	697	212		0.9	10	21	53	80.3	112	144	179		0.9	9.3	11	31	27.8	31.7	32	35		HKA
BN 224	8	1000	960	1630	1360	1590	235	26.6	328	-	-	1	4.8	9	41	61.1	78.9	146	-	-	1	3.8	4.2	32	20.2	17.8	67.1	-	-	KHA
BN 225	9	109	143	1250	4990	18.8	62.6	1237	352	2480		1.2	2.1	3.5	11	51.2	83.6	108	140		1.2	0.9	1.4	7.1	40.6	32.4	24.4	32		KHA

BN 226	10	940	86	5.5	38.4	85	305	590	765	4600	1810	1	3.4	9	17	24.1	61.7	108	157	239	1	2.4	5.6	8.1	7	37.6	46.3	49	82	QHA
BN 227	10	134	3540	1630	314	97	468	2800	2650	1400	737	0.4	2.8	15	22	38.6	51.5	92	139	187	0.4	2.4	13	6.8	16.4	12.9	40.6	47	48	KQA
BN 228	10	756	5600	457	118	1060	1500	1020	608	231	41.9	0.5	1.6	9.5	19	34.7	52	77	109	147	0.5	1.1	7.9	9.7	15.5	17.3	25.2	32	38	QKH
BN 229	10	57.1	204	52.2	2.7	1.9	475	425	1450	1470	8200	0.8	2.8	4.6	8.1	11.6	18.1	25	40.2	64.9	0.8	2	1.8	3.5	3.5	6.5	7.2	15	25	HAH
BN 230	10	175	432	9700	790	5800	18000	42300	15500	9000	2690	1.2	1.7	6.1	15	24.4	40.9	101	134	159	1.2	0.5	4.4	9.3	9	16.5	60.1	33	25	AKA
BN 231	10	57.1	40.9	100	11.7	4.5	1670	47	10.1	16.8	5.4	0.8	1.7	4.6	8.4	18.3	42.7	75	122	153	0.8	0.9	2.9	3.8	9.9	24.4	32.4	47	31	HKH
BN 232	10	365	264	4.1	10.7	1.9	16.8	1290	56.3	38.8	38.2	0.9	1.9	5.6	15	23.4	38.6	145	198	249	0.9	1	3.7	9.4	8.4	15.2	106	53	51	QHA
BN 233	10	488	2270	263	970	2540	226	1435	590	730	6270	0.7	4	10	18	36	69.8	94	118	146	0.7	3.3	6	8.1	17.9	33.8	24	24	28	KHA
BN 234	10	545	129	761	55.4	19.9	41.2	170	435	656	8400	0.8	2.3	5.9	10	23	31.9	43	56.7	73.3	0.8	1.5	3.6	4.3	12.8	8.9	11	14	17	HKA
BN 235	9	49.1	52.1	557	1500	60	155	120	137	116	-	0.8	6.4	9.7	23	67	84.6	129	178	-	0.8	5.6	3.3	13	44.2	17.6	44.4	49	-	AHK
BN 236	5	1324	4567	1300	15	198	-	-	-	-	-	1	7	35	75	-	-	-	-	-	1	6	28	40	-	-	-	-	-	KQ
BN 237	5	534	1998	432	1435	211	-	-	-	-	-	0.8	17	36	52	-	-	-	-	-	0.8	16	19	16	-	-	-	-	-	KQ

BN 238	9	4520	4630	12600	354	830	3630	3600	10900	73200	-	1.2	9.6	18	37	50.4	65.7	88	109	-	1.2	8.4	8.8	19	13.3	15.3	21.9	21	-	AH
BN 239	10	168	9300	362	2170	19600	4080	1240	1260	2380	1860	0.3	1.6	5	8.1	22.9	36.1	68	115	163	0.3	1.3	3.4	3.1	14.8	13.2	32.1	47	48	AKH
BN 240	10	1950	525	2600	930	2940	1500	870	760	747	286	0.4	1.1	4.8	14	98.7	131	165	201	239	0.4	0.7	3.7	8.8	85.1	32.3	34	36	38	AKH
BN 241	10	40	1130	472	2870	199	758	1990	1610	1580	3330	0.5	3.5	9.4	26	63.5	96.5	97	143	182	0.5	3	5.9	16	37.7	33	-	47	39	AHK
BN 242	9	35.8	38.5	336	172	1610	3080	777	401	90	-	0.9	4.5	15	37	68.7	119	149	191	-	0.9	3.6	11	21	32.1	50.3	30	42	-	AKH
BN 243	6	230	1600	752	739	2270	9100	-	-	-	-	7.6	44	72	92	126	-	-	-	-	7.6	36	28	20	34.2	-	-	-	-	HA
BN 244	7	1010	1210	9541	3020	1060	425	25	-	-	-	1.4	12	36	55	74.1	97.9	-	-	-	1.4	10	25	18	19.6	23.8	-	-	-	HQH
BN 245	9	195	1040	1130	4390	1550	702	765	767	597	-	0.8	5	22	54	78.9	118	160	207	-	0.8	4.2	17	32	25.3	39.1	42	47	-	AKH
BN 246	7	166	1280	3690	3670	3124	3001	1247	987	514	-	0.8	2.2	7.1	28	52.6	90.6	124	158	-	0.8	1.4	4.9	20	25.1	38	33.4	34	-	AKH
BN 247	10	2100	3270	930	19400	2050	940	647	440	1950	6360	0.8	3.5	8.6	20	32.9	56.9	97	136	177	0.8	2.7	5.1	12	12.5	24	40.2	39	41	HKH
BN 248	10	1210	496	950	5320	12800	1360	562	1100	1680	1990	0.6	1.9	12	19	37.5	59.8	107	153	200	0.6	1.3	9.6	7.2	18.8	22.3	47.2	46	47	HKH
BN 249	10	719	22300	1940	1850	8000	86000	56400	20500	19500	17900	0.3	2.9	10	26	41.1	122	192	243	294	0.3	2.6	7.1	16	15.2	80.9	70	51	51	KHK

BN 250	10	360	80	342	2490	16300	1650	2130	2110	1670	1610	0.9	5.5	7.6	13	54.8	73.3	121	170	221	0.9	4.6	2.1	5	42.2	18.5	47.7	49	51	HKA
BN 251	10	742	3460	1510	3600	950	2270	2430	2180	2170	3160	0.5	3.8	13	32	97.3	148	196	244	292	0.5	3.3	8.9	20	65	50.7	48	48	48	HKA
BN 252	10	523	8000	5720	699	5710	3350	673	272	439	521	0.4	2.8	7.7	23	37.9	56.3	80	130	176	0.4	2.4	4.9	15	15.1	18.4	23.3	50	46	KQK
BN 253	7	135	22.3	24475	18256	14231	966	874	-	-	-	0.6	4	10	48	80	112	-	-	-	0.6	3.4	6	38	32	32	-	-	-	HKH
BN 254	8	576	5950	1500	9400	5520	1601	5260	4130	-	-	0.4	2.4	11	36	81.2	142	193	-	-	0.4	2	8.2	25	53.2	52.8	51	-	-	KHA
BN 255	9	513	2570	820	8400	1370	520	1270	1590	1830	-	1.9	5.4	14	33	56.4	106	152	202	-	1.9	3.5	8.5	19	23.5	49.6	46	50	-	AKH
BN 256	10	40	1130	472	2870	199	758	1990	1610	1580	3330	0.5	3.5	9.4	26	63.5	96.5	143	182	224	0.5	3	5.9	16	37.7	33	46.5	39	42	AHK
BN 257	10	850	1910	776	25400	2860	1130	1440	1750	1080	810	0.4	4.1	9.3	33	59.2	101	141	182	220	0.4	3.7	5.2	23	26.7	41.8	40	41	48	HKA
BN 258	10	283	72.6	548	1450	1730	1030	1160	1250	1330	1080	0.6	1.7	11	28	85.5	136	186	236	286	0.6	1.1	9.4	17	57.3	50.5	50	50	50	HAK
BN 259	10	1890	5010	1190	3600	1460	1400	2730	5770	9900	18000	1	2.2	5.9	14	33.6	505	71	92.8	118	1	1.2	3.7	8.3	19.4	16.9	20.7	22	25	HAK
BN 260	7	168	412	6940	800	1100	1050	1180	-	-	-	0.7	7.8	28	109	157	258	-	-	-	0.7	7.1	20	81	48	101	-	-	-	AKH
BN 261	10	121	366	32100	5000	2440	980	666	860	1060	308	0.9	4.8	24	34	50.9	771	113	145	175	0.9	3.9	19	11	16.5	26.2	35.9	32	30	AKH

BN 262	10	1380	1640	1040	22100	5860	800	1680	2350	5230	7260	1.2	2.3	9.5	25	39.6	81.8	118	152	183	1.2	1.1	7.2	16	14.5	42.2	36.2	34	31	AKH
BN 263	10	394	2040	1340	12300	3760	2060	1820	2150	2070	744	0.7	3.3	43	93	128	169	211	250	291	0.7	2.6	40	50	35.2	41	42	39	41	AKH
BN 264	10	73.2	226	1500	4550	25300	10000	3670	2430	2270	1190	0.4	11	15	21	49.1	83.3	124	169	215	0.4	10	3.9	5.8	28.6	34.2	40.7	45	46	AKH
BN 265	10	641	15300	626	1920	3870	5210	2220	1240	940	252	0.4	2.2	8.1	50	71.5	103	129	158	189	0.4	1.8	5.9	42	21.6	31.5	26	29	31	KHA
BN 266	10	538	11400	18900	2040	10500	3650	2060	1330	850	288	0.4	0.9	2.8	38	75.2	98.1	122	150	188	0.4	0.5	1.9	35	37.3	22.9	23.9	28	38	KHA
BN 267	10	146	513	1390	2060	12000	7680	3610	3040	3100	1800	0.3	4.5	25	41	74.1	115	159	206	253	0.3	4.2	20	16	33.5	40.9	44	47	47	AKH
BN 268	10	628	2140	870	6550	4100	2090	1100	1040	1090	492	1.2	5.3	14	32	49.8	784	115	155	196	1.2	4.1	8.4	18	17.8	28.6	36.6	40	41	AKH
BN 269	10	61.3	15.2	2.8	41.2	910	150	109	1567	1980	2640	1.2	4	7.9	13	57.3	85.9	100	139	190	1.2	2.8	3.9	4.7	44.7	28.6	14.1	39	51	HKA
BN 270	10	93	110	1710	171	2920	860	421	291	199	46.5	1	1.8	7.8	24	56.3	76.4	96	117	144	1	0.8	6	16	32.7	20.1	19.7	21	27	AKH
BN 271	10	134	604	5.5	5	7.3	16.7	38.7	1790	74.4	19.9	0.4	9.9	29	43	59	73.8	99	147	202	0.4	9.5	19	14	16.2	14.8	26	48	55	KHA
BN 272	10	97	15	221	1030	143	22.8	73	1870	80	166	0.5	1.5	2.9	10	21.1	60.7	105	151	197	0.5	1	1.4	7.3	10.9	39.6	44.3	46	46	HKA
BN 273	10	134	8300	578	129	1030	107	285	669	1010	3810	0.3	1.4	2.6	7.7	24.9	56.5	82	110	143	0.3	1.1	1.2	5.1	17.2	31.6	25.4	28	33	KHA

BN 274	10	386	333	54	5580	2080	409	104	39.5	30.7	1300	0.9	1.8	4.6	13	21.7	28.1	47	81.9	203	0.9	0.9	2.8	8.4	8.7	6.4	19	35	121	KHA
BN 275	10	311	980	488	1590	1270	1680	548	325	249	109	0.9	15	30	50	58.4	86.2	112	141	175	0.9	14	16	19	8.8	27.7	25.9	29	34	AHK
BN 276	10	161	1210	5440	268	121	86	22.9	2320	87	15.5	0.9	1.6	5.1	7.9	11.5	15.2	38	89.6	130	0.9	0.7	3.5	2.8	3.6	3.7	22.3	52	40	HKA
BN 277	10	94	723	268	1830	528	1406	280	406	668	1040	1	5.2	13	29	42.8	91.7	108	139	171	1	4.2	7.3	16	14.1	48.9	16.3	31	32	AHA
BN 278	10	158	10.4	475	137	99	154	84	128	1126	41.6	1.3	3	12	33	51.4	88	136	177	220	1.3	1.7	8.9	21	18.8	36.6	48	41	43	HKA
BN 279	10	54.7	196	474	50.2	860	30	1820	2440	553	463	0.7	1.2	3.1	7.6	18.4	50.9	74	148	204	0.7	0.5	1.9	4.5	10.8	32.5	23	74	56	KKH
BN 280	9	55.8	3.7	650	1250	2114	1897	1354	1021	587	-	1.1	3	11	34	67.9	94	116	123	-	1.1	1.9	7.6	33	24	26.1	22	7	-	HAK
BN 281	10	270	3310	910	4560	378	670	1510	1980	2810	10000	0.3	1.9	8.6	30	68	96	124	153	189	0.3	1.6	6.7	22	37.6	28	28	29	36	KKH
BN 282	8	399	44.3	104	9.8	3.8	35.7	1100	2	-	-	0.6	2.2	5.2	9.9	26.5	57.5	89	-	-	0.6	1.6	3	4.7	16.6	31	31.1	-	-	QKA
BN 283	10	82	830	405	79	1407	50	1200	13.5	14.1	19	0.8	3.5	9.8	21	33.5	73.6	121	169	217	0.8	2.7	6.3	11	12.4	40.1	47.4	48	48	KH
BN 284	8	356	681	28.7	8.2	12.2	1240	255	850	-	-	0.9	2.7	9.2	20	30	46.5	73	-	-	0.9	1.8	6.5	11	9.7	16.5	26.4	-	-	HKA
BN 285	9	176	270	354	3800	2200	860	736	707	218	-	0.9	10	21	33	80.4	112	145	180	-	0.9	9.1	11	11	47.9	31.6	33	35	-	AKA

BN 286	9	177	1270	171	1300	10400	950	95	464	2210	-	0.5	1.7	4.1	6.2	17.3	29	89	151	-	0.5	1.2	2.4	2.1	11.1	11.7	59.5	63	-	AKH
BN 287	8	347	89	243	4510	980	324	180	9.8	-	-	1.8	4.9	8.7	23	32.7	43.5	59	-	-	1.8	3.1	3.8	14	10	10.8	15.9	-	-	HQ
BN 288	8	239	72	14.2	5.1	9.6	1600	12.6	4.7	-	-	1.3	3.1	6.4	98	144	200	252	-	-	1.3	1.8	3.3	92	46	56	52	-	-	QH
BN 289	9	167	326	1150	106	1237	357	396	320	141	-	2.5	11	41	79	126	175	228	278	-	2.5	8.9	29	38	47	49	53	50	-	AQ
BN 290	10	178	138	1070	1760	1236	61	40.5	46.1	342	175	1.2	5.7	12	26	38.2	59.6	91	129	170	1.2	4.5	5.8	14	12.5	21.4	31	38	41	KHA
BN 291	10	296	1190	1420	159	1140	2170	1237	258	250	118	1.6	3	5.9	14	23.9	52.5	87	120	159	1.6	1.4	2.9	8.3	9.7	28.6	34.3	33	39	KHA
BN 292	10	87	569	51.6	55.1	5.2	9.7	61.8	1170	196	689	1.1	3.5	12	20	37.1	50.6	68	881	118	1.1	2.4	8.4	8	17.2	13.5	17.2	20	30	KHA
BN 293	10	607	30	2640	223	1300	787	325	162	85	26.7	0.3	0.9	3.5	14	46	66	78	106	150	0.3	0.6	2.6	11	31.9	20	11.9	28	44	AKH
BN 294	10	475	68.2	642	273	2500	2480	2080	1190	602	366	0.9	4.9	19	52	70.2	93.4	117	140	162	0.9	4	14	34	18	23.2	23.6	23	22	HKA
BN 295	9	622	285	48.8	1690	21100	9800	5620	5720	21300	-	0.8	5.5	12	19	67.2	97.4	122	151	-	0.8	4.7	6.4	7.5	47.8	30.2	24.6	29	-	HHA
BN 296	10	109	26.8	323	2390	44.5	60.8	250	650	1100	2900	0.7	1.8	2.9	8.1	25.7	48.7	75	109	148	0.7	1.1	1.1	5.2	17.6	23	26.1	34	39	HKA
BN 297	10	84	371	348	66.2	133	423	431	1425	407	840	1.4	17	32	60	84.6	127	167	209	252	1.4	15	15	28	25	42.4	40	42	43	AHK

BN 298	10	53.2	297	10300	210	212	2360	3770	4340	2940	8700	0.9	1.5	7.2	21	44.1	73.2	107	149	184	0.9	0.6	5.7	14	23.2	29.1	33.8	42	35	AHK
BN 299	10	554	34.1	2690	470	7150	1213	1000	1325	1110	767	0.3	0.8	3.3	11	41.5	73	100	130	165	0.3	0.5	2.5	7.8	30.4	31.5	27	30	35	AKH
BN 300	8	184	36	123	32.4	372	1214	124	115	-	-	0.5	1.6	9.9	29	71.1	120	170	-	-	0.5	1.1	8.3	19	41.9	48.9	50	-	-	HKA
BN 301	9	89	96	19.7	13.4	4.7	1200	2.7	5.5	26	-	1.1	3.3	4.8	6.1	31	48.8	138	206	-	1.1	2.2	1.5	1.3	24.9	17.8	89.2	68	-	QHA
BN 302	9	79	3060	189	900	1180	1680	1260	1090	365	-	0.5	2.5	11	27	85.1	135	182	229	-	0.5	2	8.4	17	57.7	49.9	47	47	-	KHAH
BN 303	10	147	768	2580	4460	910	1140	3570	1770	3040	5760	0.5	15	24	41	80.6	119	171	206	252	0.5	14	9.1	17	39.5	38.4	52	35	46	AHA
BN 304	10	103	205	94	44	6.9	2.3	5.1	1100	18.4	76.7	0.9	1.9	4.4	7.3	26.5	54	70	99.4	134	0.9	1	2.5	2.9	19.2	27.5	15.8	30	35	QHA
BN 305	9	124	4120	9400	1680	343	1140	2980	5180	74700	-	0.4	1.1	5	20	44.4	56.5	74	94.6	-	0.4	0.7	3.9	15	24.4	12.1	17.2	21	-	AHK
BN 306	10	371	4670	420	136	22.3	1.6	1270	15.3	18.3	33.3	0.7	2.7	5.5	19	26.2	57.5	115	157	204	0.7	2	2.8	13	7.7	31.3	57.5	42	47	KHA
BN 307	10	131	674	4500	9700	1300	302	1470	423	204	43.9	1.4	2	3.4	8	12.9	29.5	53	83.4	118	1.4	0.6	1.4	4.6	4.9	16.6	23.2	31	35	KHK
BN 308	8	51.7	445	210	1520	655	424	273	120	-	-	3.4	8.3	26	62	96.1	132	174	-	-	3.4	4.9	18	35	34.6	35.9	42	-	-	AKH
BN 309	9	2118	10300	5480	1000	23500	5170	2600	1510	375	-	0.4	2.2	5	16	50	72.4	97	129	-	0.4	1.8	2.8	11	34.4	22.4	24.9	32	-	AKH

BN 310	9	187	6530	2520	664	1960	2610	394	177	24.1	-	0.6	3.1	7.7	17	31.6	52.5	73	98.8	-	0.6	2.5	4.6	9.6	14.3	20.9	20.3	26	-	KHK
BN 311	10	102	2550	1040	5180	5550	1950	1120	661	344	13.4	0.6	3.4	19	31	40.4	574	73	81.1	113	0.6	2.8	15	12	9.9	17	15.1	8.6	32	KHK
BN 312	8	118	1110	99	784	3450	591	675	237	-	-	0.5	2	5.6	9	26.4	49.2	65	-	-	0.5	1.5	3.6	3.4	17.4	22.8	16.1	-	-	KH
BN 313	10	2100	3740	2550	1180	1630	1520	1140	920	910	590	1	2.1	8.5	42	61.9	101	147	194	240	1	1.1	6.4	33	20.2	39.1	46	47	46	QHK
BN 314	10	70.9	283	28	33	90	278	574	1000	1130	3570	1.2	13	23	33	40.1	49.9	61	76.4	121	1.2	12	10	9.6	7.6	9.8	11.1	15	44	KHK
BN 315	10	149	2340	658	1650	3790	7490	23800	5270	3230	700	0.4	1.8	7.6	18	25.6	55	103	117	156	0.4	1.4	5.8	9.8	8.1	29.4	48	14	39	AKH
BN 316	9	218	615	1160	187	715	2530	820	256	9	-	0.6	3.3	11	25	36.2	58	76	99.9	-	0.6	2.7	8.1	14	10.9	21.8	18.4	24	-	KQK
BN 317	10	117	33.8	166	226	344	278	910	5340	1330	960	0.7	1.8	4.4	9.6	20.3	27.7	40	116	166	0.7	1.1	2.6	5.2	10.7	7.4	12.6	76	50	HKH
BN 318	10	108	52.7	11.7	608	2330	2310	1650	1000	565	100	1.4	3.6	7.5	19	28.8	39.4	67	93.2	119	1.4	2.2	3.9	11	10.3	10.6	27.7	26	26	HKA
BN 319	9	5140	1430	6120	42900	5280	2170	2110	2240	694	-	0.6	7.3	11	28	45.9	72.8	102	132	-	0.6	6.7	3.2	18	17.8	26.9	29.2	30		HKA
BN 320	9	395	1080	1830	2860	429	166	820	1540	5421	-	0.8	3.6	8.9	27	43.1	81.2	103	154	-	0.8	2.8	5.3	18	16.2	38.1	21.8	51		KHK
BN 321	9	217	5230	1590	4730	5690	5700	7510	3510	2410	-	0.4	2.4	22	47	73.3	146	205	257	-	0.4	2	19	25	26.7	72.7	59	52		KHA

BN 322	8	771	970	6312	4260	7520	3900	860	53	-	-	1.4	2.7	19	27	37.5	48.9	63	82.9	-	1.4	1.3	16	8.6	10.4	11.4	14.3	20		KHA
BN 323	9	1920	330	7020	739	187	3310	4160	3580	8600	-	1.1	2.3	5.4	6.3	20.7	58.5	93	133	-	1.1	1.2	3.1	0.9	14.4	37.8	34.7	40		HKH
BN 324	10	488	111	4100	850	367	1270	1380	595	152	335	0.5	1.3	5.5	12	27.6	45.4	77	112	281	0.5	0.8	4.2	6	16.1	17.8	32	35	169	KHK
BN 325	10	286	166	481	233	4710	1010	320	105	267	398	0.7	1.5	6.7	14	38.5	59.4	86	182	236	0.7	0.8	5.2	7.1	24.7	20.9	26.1	67	54	AKA
BN 326	10	870	83	3360	880	457	1240	28.2	67.2	103	107	0.5	1.6	5.9	12	39.4	58.9	110	155	203	0.5	1.1	4.3	5.6	27.9	19.5	20.4	51	48	HKH
BN 327	9	131	368	678	1340	1170	3160	1356	76.7	18.7	-	1.1	9.7	14	18	21.5	35.4	50	70.9	-	1.1	8.6	3.8	4.6	3.4	13.9	14.5	21		KQH
BN 328	10	970	4390	4450	2380	1300	1429	23.9	62.8	461	45.6	0.5	1.5	13	21	41	52.5	123	152	251	0.5	1	12	8.3	19.6	11.5	70.5	29	99	KHK
BN 329	10	520	35.4	1070	105	2240	1280	408	120	49.8	6.4	0.3	1	3	8.8	19.5	37.2	54	73.3	39.2	0.3	0.7	2	5.8	10.7	17.7	16.6	20	159	HKH
BN 330	7	429	117	3360	424	1330	231	276	-	-	-	0'5	1.3	7.9	33	86.6	181	-	-	-	0.5	0.8	6.6	25	54	94.4	-	-	-	HKH
BN 331	10	1380	736	1580	200	438	41	1870	51.2	38	6.7	1.7	2.9	6.5	10	21.5	50.4	78	106	137	1.7	1.2	3.6	3.7	11.3	28.9	27.1	29	31	QHK
BN 332	9	453	4580	2510	4270	5730	1850	820	375	122		0.6	7.4	17	41	66.8	83.6	105	134		0.6	6.8	9.9	24	25.6	16.8	21.4	29	-	KQH
BN 333	10	197	68.4	1430	3890	9300	6520	5410	3520	2620	1990	4	9.8	24	44	93.7	137	182	213	234	4	5.8	14	21	49.4	43.3	45	31	21	HAK

BN 334	9	237	1060	1170	160	297	507	609	990	2990	-	1.8	8.9	48	95	125	154	184	223	-	1.8	7.1	39	47	30	29	30	39	-	AHK
BN 335	10	46.2	80	3160	232	77	840	4780	1170	5160	1050	1.1	1.6	6.4	19	33	39.3	55	88	136	1.1	0.5	4.8	12	14.2	6.3	15.3	33	48	AHK
BN 336	10	360	150	131	1960	3510	1020	552	238	168	12.1	0.7	5.3	8.8	15	28.7	40.1	50	65	84.3	0.7	4.6	3.5	6.4	13.5	11.4	10.1	15	19	HKA
BN 337	8	95	3840	207	273	990	1260	146	47.4	-	-	0.5	2	9	31	50.1	87.6	119	-	-	0.5	1.5	7	22	19.1	37.5	31.4	-	-	KHA
BN 338	10	192	669	312	503	2020	4030	515	572	559	199	0.8	5.6	14	19	26.6	58.6	97	131	168	0.8	4.8	8	5.1	7.9	32	38.4	34	37	AKH
BN 339	6	5560	1490	42200	354	2240	1230	-	-	-	-	0.9	1.7	5.7	31	67.7	-	-	-	-	0.9	0.8	4	25	37.1	-	-	-	-	HKA
BN 340	5	3500	584	10800	3210	4600		-	-	-	-	3.3	6.5	24	95	-	-	-	-	-	3.3	3.2	17	71	-	-	-	-	-	HKA
BN 341	9	4520	4520	12600	354	830	3830	8600	10800	28200		1.2	4.6	18	37	50.4	65.7	88	108		1.2	3.4	14	19	13.3	15.3	21.9	20	-	HKH
BN 342	5	1324	4576	1334	15	198	-	-	-	-	-	1	7	35	75	-	-	-	-	-	1	8	28	40	-	-	-	-	-	HA
BN 343	10	554	285	11600	758	4560	19100	5560	2120	1930	128	0.9	2	7.8	22	35.8	70.2	93	118	139	0.9	1.1	5.8	14	13.9	34.4	22.9	19	21	AKH
BN 344	10	164	517	1810	689	2470	1120	696	800	760	332	0.5	3.9	13	31	69.4	88.1	133	174	218	0.5	3.4	9.4	18	38.6	18.7	44.9	41	44	AKH
BN 345	10	86	9200	3360	263	1170	3020	3290	2590	2200	3960	0.6	3.3	6.7	29	59.2	104	154	201	246	0.6	2.7	3.4	22	30.7	44.8	50	47	45	KHA

BN 346	10	3350	431	3690	890	11700	3010	3600	3150	2810	1080	0.4	1.1	3.2	6.8	27.1	46.1	81	122	164	0.4	0.7	2.1	3.6	20.3	19	34.4	42	42	AKH
BN 347	10	123	528	1140	312	970	810	1650	2270	2230	6280	0.7	7.9	37	64	84.4	98.7	128	164	201	0.7	7.2	29	28	20	14.3	29.3	36	37	AHK
BN 348	10	100	185	65.6	128	28	200	484	628	1020	3620	0.7	2.2	6.8	14	31.3	47.3	70	95	141	0.7	1.5	4.6	7	17.5	16	22.9	25	46	KHA
BN 349	9	40.2	68.5	1340	4650	5220	2560	1020	920	880	-	0.6	13	26	57	115	142	170	195	-	0.6	12	14	31	57.9	27	28	25	-	AHK
BN 350	10	1410	990	525	12600	5680	2650	2000	2160	2080	850	1.7	16	33	74	110	150	193	235	278	1.7	15	17	41	35.8	40	43	142	43	HKA
BN 351	9	77.6	1170	2820	20300	4940	15900	9200	3880	1420	-	0.4	5.8	9.6	27	126	233	312	371	-	0.4	5.4	3.8	18	98.6	107	79	59	-	AKH
BN 352	9	704	3040	890	529	7500	5960	2310	1670	463	-	1.1	3.3	5.6	12	28.3	69.7	104	139	-	1.1	2.2	2.3	6.1	16.6	41.4	34.3	35	-	KHA
BN 353	6	132	453	17700	3920	960	85	-	-	-	-	0.4	7.9	25	41	63.9	-	-	-	-	0.4	7.5	17	18	22.9	-	-	-	-	AKH
BN 354	8	215	616	790	3710	3860	2850	1690	870	-	-	0.7	12	39	72	119	168	217	-	-	0.7	11	27	33	47.3	49	49	-	-	AKH
BN 355	8	198	381	723	6570	4600	4670	3120	1730	-	-	0.4	3.8	24	72	120	171	221	-	-	0.4	3.4	20	48	47.8	50	50	-	-	AKH
BN356	10	930	26400	1370	8100	2040	5860	20300	10900	9400	11100	0.4	1.9	9.5	27	53.5	80.8	145	194	243	0.4	1.5	7.6	18	26.2	27.3	64.2	49	49	KAH
BN 357	10	739	2090	311	1780	1610	6540	4230	1390	800	177	0.5	1.2	3.1	8.1	25.1	49.1	72	93.7	121	0.5	0.7	1.9	5	17	24	22.5	22	27	HKH

BN 358	9	1060	5370	1190	4960	2500	860	1450	1950	4510	-	0.4	1.6	5.1	55	82.3	125	169	215	-	0.4	1.2	3.5	50	27.6	42.7	44	46	-	HKH
BN 359	8	830	1990	744	4770	2000	2690	2710	4210	-	-	0.5	2.1	5.4	35	84.1	134	183	-	-	0.5	1.6	3.3	30	49.2	49.9	49	-	-	HKA
BN 360	9	367	1210	3290	6710	1950	3800	2620	1750	667	-	0.4	4	7.6	16	35.7	83.1	123	150	-	0.4	3.6	3.6	8.7	19.4	47.4	39.9	27		AKH
BN 361	10	286	448	2140	4570	7300	5690	4180	4810	4090	2760	0.7	3.4	17	50	88.1	135	183	230	279	0.7	2.7	13	33	38	46.9	48	47	49	AKH
BN 362	9	306	1910	425	2600	452	2480	2210	2900	1850	-	0.4	1.5	4.2	11	30.9	80.6	122	157		0.4	1.1	2.7	6.4	20.3	49.7	41.4	35		AHA
BN 363	10	43.7	1180	136	5676	2220	5240	2360	1700	1660	584	0.4	1.8	5.5	12	35.7	55.4	86	122	159	0.4	1.4	4.7	6.1	24.1	17.7	31	36	37	AKH
BN 364	6	170	198	400	615	1900	589	-	-	-	-	3.5	113	270	323	450	520	-	-	-	3.5	110	157	53	127	70	-	-	-	KH
BN 365	6	170	188	402	615	1800	689	-	-	-	-	4.5	123	280	310	430	610	-	-	-	4.5	119	157	130	120	180	-	-	-	HKA
BN 366	8	139	600	384	1540	3860	11800	17600	405	-	-	0.4	3.3	9.9	13	20.5	35.6	84	-	-	0.4	2.9	6.6	3.3	7.3	15.1	48	-	-	AKH
BN 367	9	354	1730	696	4010	6740	11400	3830	1530	110	-	0.5	2.4	6.5	26	40.7	69.7	93	120	-	0.5	1.9	4.1	19	15	29	23.2	27	-	AKH
BN 368	10	1050	3630	268	5540	14400	1100	1430	1670	1770	1100	1	2.8	18	16	46.7	99	143	187	232	1	1.8	16	-2.4	30.8	52.3	44	44	45	KHA
BN 369	10	434	572	1810	543	24900	1550	751	1180	84	1430	0.8	1.4	3.9	8.8	25.9	35.8	47	61.5	220	0.8	0.6	2.5	4.9	17.1	9.9	11.5	14	159	AKH

BN 370	10	25.5	11.4	125	2260	11500	2950	2380	2110	890	767	0.7	2.9	4.7	21	75	123	174	226	276	0.7	2.2	1.8	16	54.2	48	51	52	50	HAK
BN 371	10	194	4660	970	5830	14800	2880	1520	1120	790	128	0.5	4.1	14	27	52.5	67.5	81	95.6	113	0.5	3.6	9.7	13	25.8	15	13.9	14	17	AKH
BN 372	10	165	543	236	5010	13900	18800	9900	7640	7350	6440	0.5	1.7	11	18	36.7	99.3	139	170	203	0.5	1.2	8.8	7.8	18.4	62.6	39.7	31	33	AHK
BN 373	10	456	423	483	820	4310	1260	940	1100	880	699	1.1	2.2	12	36	87.1	131	178	223	274	1.1	1.1	10	23	51.6	43.9	47	45	51	AKH
BN 374	5	292	706	498	23568	6589	-	-	-	-	-	1	6	6	122	-	-	-	-	-	1	5	0	116	-	-	-	-	-	AH
BN 375	5	235	1026	2162	27854	258	-	-	-	-	-	1	4	7.5	138	-	-	-	-	-	1	3	3.5	131	-	-	-	-	-	AH
BN 376	4	255	3985	11254	22598	-	-	-	-	-	-	0.8	13	125	-	-	-	-	-	-	0.8	12	112	-	-	-	-	-	-	AH
BN 377	4	255	1125	1885	250	-	-	-	-	-	-	0.8	15	94	-	-	-	-	-	-	0.8	14	79	-	-	-	-	-	-	AH
BN 378	10	1080	2310	1300	420	2090	5880	1970	950	420	268	0.6	3.1	12	38	55.8	93.8	121	153	184	0.6	2.5	8.5	27	17.4	38	27.2	32	31	KQA
BN 379	10	445	634	270	1320	5350	1670	2140	2050	3150	223	0.9	3.2	8.4	18	58.2	128	178	228	278	0.9	2.3	5.2	9.2	40.6	69.8	50	50	50	HAK
BN 380	8	111	1060	186	30.6	3.6	32	1690	670	-	-	0.4	2	12	17	41.4	61.7	85	-	-	0.4	1.6	10	5.2	24.2	20.3	22.8	-	-	HKA
BN 381	7	351	52.1	5450	23600	1210	701	244	-	-	-	0.9	2.2	4.3	18	38.1	66.4	-	-	-	0.9	1.3	2.1	13	20.5	28.3	-	-	-	HKA

BN 382	7	758	150	6180	2700	683	508	297	-	-	-	1.3	4.8	20	54	112	196	-	-	-	1.3	3.5	16	34	58	84	-	-	-	HKA
BN 383	8	251	4010	970	12800	10300	1700	7280	1190	-	-	0.8	4.2	13	39	79.6	139	174	-	-	0.8	3.4	8.7	26	40.4	59.4	35	-	-	AKA
BN 384	10	237	704	1120	112	106	38.3	14.6	71	1630	2770	0.6	1.6	5.5	12	25.5	36.2	59	76.7	98.3	0.6	1	3.9	6.4	13.6	10.7	22.9	18	22	KHK
BN 385	10	250	1310	440	28	16.3	113	820	732	424	435	1	2	9.8	16	26.4	42.5	97	157	208	1	1	7.8	5.8	10.8	16.1	54	61	51	QHA
BN 386	7	68.6	1010	10800	2110	753	5030	3675	-	-	-	0.5	3	16	27	80.8	140	-	-	-	0.5	2.5	13	11	10.8	59.2	-	-	-	AH
BN 387	10	386	1800	1500	4650	5340	4960	3020	1620	1090	213	0.8	5.4	22	62	77.1	92.7	115	137	163	0.8	4.6	17	40	14.9	15.6	22.3	22	26	AKH
BN 388	10	4160	1340	1380	7660	1730	2780	2160	1970	4270	2370	0.6	5.4	15	42	93	139	188	236	289	0.6	4.8	9.3	28	50.7	46	49	48	53	HKA
BN 389	10	605	232	1340	358	950	21200	2870	1480	2130	1240	1.1	2.1	3.8	8.2	10.4	34.7	70	118	162	1.1	1	1.7	4.4	2.2	24.3	34.8	49	44	AKH
BN 390	10	3260	7100	1670	2920	13100	950	147	358	724	2160	0.7	2.8	8.8	15	31.5	45.3	90	128	171	0.7	2.1	6	6.4	16.3	13.8	44.7	38	43	KKH
BN 391	10	164	85	5480	20100	2230	1820	2160	2400	2400	1190	1.1	4.9	10	44	86.5	135	181	227	273	1.1	3.8	5.3	33	43	48.5	46	46	46	AKH
BN 392	10	164	219	1870	4170	1520	1450	1420	1470	1460	920	0.9	1.7	12	47	83.4	128	174	222	270	0.9	0.8	10	35	36.2	44.6	46	48	48	AKH
BN 393	10	1780	72100	3620	509	8600	4450	2570	2270	3080	167	0.6	3.7	8.4	24	67.9	90.5	110	128	141	0.6	3.1	4.7	16	43.7	22.6	19.5	18	13	KHA

BN 394	10	2340	88200	4080	27600	3000	1300	551	900	1410	14802	88	16	36	50	70.4	124	124	178	230	2.2	5.9	7.5	20	14.3	20.4	53.6	54	52	AKH
BN 395	10	469	1660	641	12800	32600	1060	930	790	2811	2018	0.8	4	10	31	46.2	61.4	74	88	103	0.8	3.2	6.2	21	15.1	15.2	12.6	14	15	AKH
BN 396	5	1920	5880	4750	4280	2980	-	-	-	-	-	14	39	88	110	-	-	-	-	-	14	25	49	22	-	-	-	-	-	AH
BN 397	9	654	11900	1180	3090	7270	1790	2280	2430	788	-	1	3	7.6	13	28	54.5	83	132	-	1	2	4.6	5.4	15	26.5	28.7	49	-	KHA
BN 398	9	47.6	2060	254	41.2	374	234	36.8	551	1250	-	0.6	3.5	7	21	54.9	83.6	129	179	-	0.6	2.9	3.5	14	33.6	28.7	45.4	50	-	KAH
BN 399	10	2620	673	109	23.9	531	49.6	40.5	870	93	56.8	0.5	3.8	5.1	10	27.4	47.8	85	129	178	0.5	3.3	1.3	5.1	17.2	20.4	36.8	44	49	QKH
BN 400	10	156	638	1480	11600	4040	1490	636	541	411	111	0.9	7.1	12	28	40.5	54.6	71	86	105	0.9	6.2	4.7	17	12.2	14.1	16.2	15	19	AKH
BN 401	9	850	7340	1380	4950	20200	8800	5140	3460	1000	-	0.4	1.9	7.4	41	85.9	114	143	176	-	0.4	1.5	5.5	34	44.8	28.1	29	33	-	KHA
BN 402	7	298	345	3000	22400	4990	2220	381	-	-	-	0.7	16	26	55	84.3	116	-	-	-	0.7	16	10	29	29.1	31.7	-	-	-	AKH
BN 403	10	615	3210	1250	25400	31400	9400	4130	2870	2670	560	0.4	4.4	24	42	65.6	89.4	116	146	177	0.4	4	20	18	23.7	23.8	26.6	30	31	KHK
BN 404	10	727	1000	1950	2880	5050	3330	2570	1810	1080	337	0.5	4.2	25	31	63.7	77.6	95	117	143	0.5	3.7	21	6.3	32.5	13.9	17.6	22	26	AKH
BN 405	10	325	3390	381	5770	14300	1350	1920	1930	1930	266	0.9	3.3	9.3	18	14.8	77.9	108	137	170	0.9	2.4	6	8.6	30.9	29.1	30.1	29	33	KHA

BN 406	6	370	940	2600	7800	1632	810	-	-	-	-	0.6	5.1	6.9	24	44.6	-	-	-	-	0.6	4.5	1.8	17	21	-	-	-	-	AK
BN 407	7	105	34.4	490	28300	5130	1020	190	-	-	-	0.8	1.7	2.6	12	22.5	68.6	-	-	-	0.8	0.9	0.9	9.1	10.8	46.1	-	-	-	AK
BN 408	6	4070	1030	5570	25600	82000	1500	-	-	-	-	5.9	13	18	30	65.4	-	-	-	-	5.9	7	5.3	12	35.6	-	-	-	-	QK
BN 409	5	4470	19500	31600	65800	57900	-	-	-	-	-	3	19	43	71	-	-	-	-	-	3	16	24	28	-	-	-	-	-	AH
BN 410	7	4000	1250	5470	1520	47400	11600	755	-	-	-	0.7	2.3	11	24	59.6	95.4	-	-	-	0.7	1.6	8.4	13	36.1	35.8	-	-	-	HK
BN 411	4	1660	3270	49100	2.00E+05	-	-	-	-	-	-	2.5	13	33	-	-	-	-	-	-	2.5	11	20	-	-	-	-	-	-	AH
BN 412	6	198	910	184	6100	1400	339	-	-	-	-	0.7	3.4	9	30	58.5	-	-	-	-	0.7	2.7	5.6	21	28.6	-	-	-	-	KH
BN 413	7	3900	1660	9700	1150	12600	2600	290	-	-	-	2	5.5	15	38	96.8	124	-	-	-	2	3.5	9.3	23	28.6	-	-	-	-	QKH
BN 414	6	8900	1660	9500	114	12200	241	-	-	-	-	2	5.5	15	38	106	-	-	-	-	2	3.5	9.6	23	68.2	-	-	-	-	QKK
BN 415	8	209	2310	2180	1080	5240	7790	15600	1100	-	-	0.5	3.9	15	33	57	73.3	132	-	-	0.5	3.4	12	18	23.7	16.3	58.7	-	-	AKH
BN 416	5	3400	930	22000	20600	42500	-	-	-	-	-	0.7	2.5	26	52	-	-	-	-	-	0.7	1.8	23	26	-	-	-	-	-	HA
BN 417	4	1050	5060	44300	10300	-	-	-	-	-	-	1.1	15	58	-	-	-	-	-	-	1.1	14	43	-	-	-	-	-	-	AK

BN 418	4	1230	850	32000	3.00E+05	-	-	-	-	-	-	1.3	4.9	55	-	-	-	-	-	-	1.3	3.6	50	-	-	-	-	-	HA	
BN 419	6	1188	2890	14100	23400	34100	9100	-	-	-	-	0.7	5.9	29	50	109	-	-	-	-	0.7	4.6	23	20	59.5	-	-	-	-	AK
BN 420	8	246	1400	266	7451	1670	1870	1080	-	-	-	0.5	2.4	7.2	82	65.8	70.6	110	-	-	0.5	1.9	4.8	75	-16.2	4.8	39.4	-	-	KH
BN 421	4	69.5	680	2420	17100	-	-	-	-	-	-	0.6	0.8	38	-	-	-	-	-	0.6	0.2	37	-	-	-	-	-	-	-	AH
BN 422	7	1020	144	30800	6400	2750	5560	-	-	-	-	1.5	3.7	30	77	180	223	-	-	-	1.5	2.2	26	47	103	43	-	-	-	HA
BN 423	9	492	2300	759	298	4350	7900	5980	1900	490	-	1.1	5.3	10	25	60.3	140	196	-	-	1.1	4.2	5.1	15	35.2	79.7	56	-	-	KH
BN 424	7	2870	664	6740	44800	10000	3810	420	-	-	-	1.9	5.2	24	60	82.3	118	-	-	-	1.9	3.3	18	37	22	35.7	-	-	-	HKH
BN 425	8	568	13500	1310	5670	13200	58400	5690	3610	-	-	0.6	3.5	10	19	44.7	83.3	133	-	-	0.6	2.9	6.9	8.3	26	38.6	49.7	-	-	KHA
BN 426	6	496	860	2470	7860	5180	1750	-	-	-	-	1.1	15	34	87	143	-	-	-	-	1.1	13	19	53	55.8	-	-	-	-	AK
BN 427	6	1200	21200	14500	1.00E+05	68100	33800	-	-	-	-	1.8	13	46	101	171	-	-	-	-	1.8	11	32	56	70	-	-	-	-	AK
BN 428	6	5010	39200	5260	1590	5670	8300	-	-	-	-	7.5	31	50	115	155	-	-	-	-	7.5	23	19	65	40	-	-	-	-	KH
BN 429	5	3560	15000	5400	6870	28600	-	-	-	-	-	5.5	19	27	63	-	-	-	-	-	5.5	14	7.9	36	-	-	-	-	-	AH

BN 430	7	1430	1090	3200	9300	6740	4260	660	-	-	-	0.8	2.3	54	102	141	180	-	-	-	0.8	1.5	52	48	39	39	-	-	-	AK
BN 431	7	136	317	960	9200	1150	404	223	-	-	-	1.4	5.2	14	41	73	119	-	-	-	1.4	3.8	8.5	28	31.7	36	-	-	-	AK
BN 432	7	97	2050	536	83000	22300	1682	2110	-	-	-	0.4	1.6	6	36	76.2	116	-	-	-	0.4	1.2	4.4	30	40.4	39.8	-	-	-	AK
BN 433	6	162	1150	453	1870	4600	1410	---	-	-	-	0.9	4.3	11	31	106	157	-	-	-	0.9	3.4	6.5	21	74.6	51	-	-	-	AK
BN 434	7	1350	263	6640	4410	2300	1750	940	-	-	-	3.4	8.4	37	86	134	193	-	-	-	3.4	5	29	49	47.8	59	-	-	-	HK
BN 435	7	228	7120	1500	19200	10700	21300	9400	-	-	-	0.5	5.1	27	57	104	89	-	-	-	0.5	4.6	22	30	46.7	85	-	-	-	AH
BN 436	6	3140	1640	1160	742	1790	6040	-	-	-	-	7.4	52	85	109	132	-	-	-	-	7.4	45	33	24	23	-	-	-	-	H
BN 437	6	3350	14000	19100	51900	28100	7900	-	-	-	-	2.3	19	69	129	194	-	-	-	-	2.3	17	50	60	65	-	-	-	-	AH
BN 438	6	2500	1790	3010	24600	6100	642	-	-	-	-	0.8	6	35	96	141	-	-	-	-	0.8	5.2	29	61	45.1	-	-	-	-	AK
BN 439	6	730	4460	2940	6730	6060	547	-	-	-	-	3	9.3	61	113	173	-	-	-	-	3	6	52	52	60	-	-	-	-	AK
BN 440	6	4170	7500	14700	16400	1706	1540	-	-	-	-	3	38	92	144	207	-	-	-	-	3	35	54	52	63	-	-	-	-	AK
BN 441	7	1120	1580	2420	6480	1790	4110	890	-	-	-	0.6	16	34	104	172	219	-	-	-	0.6	15	19	70	68	47	-	-	-	AK

BN 442	6	548	900	3140	11300	5110	525	-	-	-	-	1.4	4.1	32	122	165	-	-	-	-	1.4	2.7	28	90	43	-	-	-	-	AK
BN 443	5	2120	1100	407	1120	2590	-	-	-	-	-	0.7	2.8	12	49	-	-	-	-	-	0.7	2.1	9	37	-	-	-	-	-	HA
BN 444	6	1530	3740	7250	26400	1.00E+05	42000	-	-	-	-	0.8	7.7	15	92	43	-	-	-	-	0.8	6.9	7.1	77	51.2	-	-	-	-	AH
BN 445	6	5800	2040	850	3110	3970	7260	-	-	-	-	0.6	3.5	18	59	139	-	-	-	-	0.6	2.9	15	41	80.1	-	-	-	-	HA
BN 446	6	583	2150	3750	4890	2890	830	-	-	-	-	1	34	93	151	201	-	-	-	-	1	33	59	58	50	-	-	-	-	AK
BN 447	7	1750	323	800	7150	5760	4460	-	-	-	-	0.7	2.1	17	88	143	193	-	-	-	0.7	1.4	14	71	55.4	50	-	-	-	HK
BN 448	6	477	1780	3940	3580	2610	830	-	-	-	-	1.8	30	83	135	183	-	-	-	-	1.8	28	54	52	48	-	-	-	-	AK
BN 449	6	2900	1180	4330	28800	2600	1720	-	-	-	-	1	4.2	34	87	148	-	-	-	-	1	3.2	30	53	61.1	-	-	-	-	HK
BN 450	6	3580	1970	4300	21400	1.00E+05	785	-	-	-	-	2.6	11	46	89	139	-	-	-	-	2.6	8.8	35	43	49.6	-	-	-	-	HK
BN 451	6	940	1930	4140	5900	5040	601	-	-	-	-	0.9	9.6	54	116	167	-	-	-	-	0.9	8.7	45	62	51	-	-	-	-	AK
BN 452	6	271	8300	2750	7720	3800	749	-	-	-	-	2.2	4.6	57	120	180	-	-	-	-	2.2	2.4	53	63	60	-	-	-	-	AK
BN 453	6	377	1910	1530	4140	2640	870	-	-	-	-	2.7	8.8	63	113	175	-	-	-	-	2.7	6.1	54	71	62	-	-	-	-	A

BN 454	6	300	92	3220	3790	4910	333	-	-	-	-	0.9	2.2	31	95	157	-	-	-	-	0.9	1.3	29	64	62.3	-	-	-	-	AK
BN 455	10	267	287	1060	278	1280	860	1160	519	68.8	156	0.9	1.8	11	34	50.4	62.5	89	117	182	0.9	0.9	8.8	23	16.8	12.1	26.4	28	65	KHK
BN 456	6	1520	561	6270	860	4210	684	-	-	-	-	6.7	13	31	80	102	-	-	-	-	6.1	6.5	19	49	21.9	-	-	-	-	KA
BN 457	8	328	8600	1360	7420	2470	980	3570	37200	-	-	0.5	2.5	6.5	16	30.7	59.4	91	-	-	0.5	2	4.1	9.8	14.3	28.7	31.6	-	-	KA
BN 458	9	366	15300	5490	980	1720	12500	48600	3810	53800	-	0.5	4	8.7	20	32.3	54.3	121	151	-	0.5	3.5	4.7	11	12.3	22	66.7	30	-	KA
BN 459	8	92	22100	1380	611	5770	1730	749	214	-	-	0.3	2	5.1	17	46.7	71.9	96	-	-	0.3	1.7	3.1	12	29.3	25.2	24.4	-	-	KK
BN 460	8	677	55300	3620	1880	5250	2100	1310	448	-	-	0.3	2.1	5.3	22	61.6	101	120	-	-	0.3	1.8	3.2	17	39.4	39.4	19	-	-	KQ
BN 461	8	616	4830	1650	4660	410	358	900	158	-	-	0.7	2.6	7.1	15	24.6	55.4	124	-	-	0.7	1.9	4.5	7.9	9.6	30.8	68.6	-	-	KQ
BN 462	8	139	14500	2170	607	5120	3240	557	89	-	-	0.3	2.3	5	13	30	46.3	70	-	-	0.3	2	2.7	8.2	16.8	16.3	23.8	-	-	K
BN 463	10	253	5660	10000	12800	4770	4080	2920	2210	2080	1100	0.9	1.8	6	15	30.2	47.5	77	117	160	0.9	0.9	4.2	8.6	15.6	17.3	29.4	40	43	AKH
BN 464	6	1980	6990	2540	21100	25400	4000	-	-	-	-	0.6	21	34	70	125	-	-	-	-	0.6	21	13	36	55.4	-	-	-	-	AK
BN 465	6	1670	6960	614	980	5520	9320	-	-	-	-	1.6	19	39	62	89.8	-	-	-	-	1.6	18	19	23	28.1	-	-	-	-	KA

BN 466	7	850	8700	860	8200	1390	2720	186	-	-	-	1.5	8	27	64	82	103	-	-	-	1.5	6.5	19	38	18	21	-	-	-	KH
BN 467	6	1840	1370	8500	25600	1880	237	-	-	-	-	0.6	13	34	50	69.3	-	-	-	-	0.6	13	21	16	19.2	-	-	-	-	AK
BN 468	7	714	1830	980	9100	2680	1600	102	-	-	-	0.7	5.9	29	64	85	109	-	-	-	0.7	5.2	23	35	21.2	24	-	-	-	AK
BN 469	8	251	6610	200	487	300	150	25	2500	-	-	0.4	2.1	5.1	13	19.8	40	64	-	-	0.4	1.7	3	7.6	7.1	20.2	24.1	-	-	KHK
BN 470	9	675	2080	6090	1550	231	25.5	53	22	1.9	-	0.8	2.9	7.5	11	16.4	50.2	75	105	-	0.8	2.1	4.6	3.1	5.8	33.8	24.8	30	-	KQH
BN 471	5	458	1544	1867	406	428	-	-	-	-	-	0.8	5	38	135	-	-	-	-	-	0.8	4.2	33	97	-	-	-	-	-	KA
BN 472	10	203	2100	260	9600	12600	2500	5700	5850	6450	3290	0.5	2.2	6.2	22	62.5	107	153	201	248	0.5	1.7	4	16	40.7	44.5	46	48	47	AHK
BN 473	6	3510	16700	2.00E+05	89000	2520	54400	-	-	-	-	0.6	25	58	108	155	-	-	-	-	0.6	24	33	50	47	-	-	-	-	AH
BN 474	5	5790	12800	24900	6520	1020	-	-	-	-	-	0.9	17	54	79	-	-	-	-	-	0.9	16	37	25	-	-	-	-	-	AK
BN 475	10	321	3200	316	27500	14000	4770	3240	2870	2030	718	0.4	2	9.2	33	57	86	119	153	193	0.4	1.6	7.8	24	23.8	29	33	34	40	KHA
BN 476	10	182	1210	709	12200	9600	4430	4030	2320	1930	860	1.8	8.3	24	67	115	161	208	256	305	1.8	6.5	15	43	48.4	46	47	48	49	AKH
BN 477	10	1000	2790	1260	17200	25000	18200	12900	9400	8200	472	0.5	7.1	15	38	72.3	114	157	236	281	0.5	6.6	8.3	23	34.3	4.7	43	79	45	AKH

BN 478	10	154	3160	249	7750	58300	10100	2720	3370	2850	479	0.4	1.4	5.9	11	37.9	63.1	90	117	146	0.4	1	4.5	5.5	26.5	25.2	26.9	27	29	AKH
BN 479	10	495	2150	733	19800	24000	12100	7560	6160	5650	3660	3	8.1	23	48	83	125	172	220	269	3	5.1	14	25	35.5	42	47	48	49	AKH
BN 480	9	218	2970	240	3000	19100	10500	5000	3500	620	-	0.4	1.8	6	12	38.5	62	99	120	-	0.4	1.4	4.2	6	26.5	23.5	36.5	22	----	AKH
BN 481	10	2800	7290	1370	4520	7260	7550	5580	4550	5210	3250	0.9	2.4	6.3	37	75.2	138	185	235	283	0.9	1.5	3.9	31	37.8	62.8	47	50	48	AHK
BN 482	10	583	2930	1260	11600	38100	8200	3800	2910	2600	444	0.8	10	23	37	72.6	96	120	145	172	0.8	9.3	13	14	36	23.4	24	25	27	AKH
BN 483	10	78.5	255	10900	4150	4170	2410	34600	3620	3480	2780	0.5	6.7	37	77	115	166	191	246	286	0.5	6.5	30	40	37.5	1	25	55	40	AHK
BN 484	10	500	820	1590	3310	19700	7210	4110	3900	3920	1730	0.6	2.6	8.8	38	83.7	120	161	202	245	0.6	2	6.2	29	46.2	36.3	41	41	43	AKH
BN 485	10	246	7500	713	8700	20600	1.00E+05	15100	9200	6150	2310	0.5	2.5	7.4	12	17.4	48.2	78	110	150	0.5	2	4.9	4.2	5.8	30.8	29.7	32	40	AKH
BN 486	10	281	1340	411	4370	49300	27900	5467	9100	6780	5310	1	3.4	9	16	71.5	122	170	217	243	1	2.4	5.6	7.4	55.1	50.5	48	47	26	AKH
BN 487	10	850	3330	1400	2780	8300	5400	5970	5390	3690	2520	0.5	1.6	9.2	35	77.6	113	154	200	245	0.5	1.1	7.6	26	42.6	35.4	41	46	45	AKH
BN 488	10	157	484	1260	8000	20500	3700	3900	3790	3170	2970	1.1	2.8	5.1	12	59	106	156	205	255	1.1	1.7	2.3	6.7	47.2	47	50	49	50	AKH
BN 489	10	1300	5520	2180	14700	6930	7470	7520	7750	9000	5640	0.9	3.8	13	52	91.9	121	153	184	202	0.9	2.9	8.7	39	40	29.1	32	31	18	AKH

BN 490	10	199	59.9	3370	17000	2550	7770	8200	6000	5130	4150	1.4	3.1	5.5	23	63.9	100	153	225	276	1.4	1.7	2.4	18	40.5	36.1	53	72	51	AHK
BN 491	6	21000	1570000	58600	13900	83000	36100	-	-	-	-	13	40	79	102	134	-	-	-	-	13	27	39	23	32	-	-	-	-	AK
BN 492	10	405	1870	667	10700	32800	7850	4110	3220	3070	778	0.9	4.5	15	26	55.5	82.2	114	148	182	0.9	6.5	30	40	37.5	1	25	55	40	AKH
BN 493	6	5931	522	1340	11400	6820	2840					1.4	7	25	69	141	-	-	-	-	1.4	0.6	24	33	50	47	-	-		AH
BN 494	10	414	1330	620	2150	4740	5390	4830	4160	3610	3330	0.7	6	18	72	116	167	192	231	260	0.7	6.6	8.3	23	34.3	4.7	43	79	45	AHK
BN 495	9	90	13100	3150	800	2000	3410	3700	7000	69300		0.3	2	16	37	75.9	97.5	117	135		0.3	6.5	30	40	37.5	1	25	55	40	KAH
BN 496	10	840	2730	2330	920	3400	25000	3730	1160	8000	225	0.5	1.3	6.5	12	17.6	36.4	50	70.1	93.5	0.5	1.6	7.8	24	23.8	29	33	34	40	AKH
BN 497	10	185	664	236	2900	26400	3190	1930	1630	1770	461	0.7	2.8	7.5	14	47.7	75.5	106	139	171	0.5	1.1	7.6	26	42.6	35.4	41	46	45	AK
BN 498	6	16500	12600	47800	85000	22700	161000	-	-	-	-	1.4	18	30	71	125	-	-	-	-	0.6	24	33	50	47	-	-	-	-	AH
BN 499	6	8500	9500	72400	162000	11800	33300	-	-	-	-	3.7	15	31	70	104	-	-	-	-	3.7	0.6	24	33	50	-	-	-	-	AH
BN 500	7	765	1650	750	860	1230	2199	-	-	-	-	3.6	14	30	69	102	-	-	-	-	0.7	5.2	23	35	21.2	24	-	-	-	AH
IS 501	10	604	502	29.8	4.9	71	236	260	1250	1650	2100	0.9	1.9	4.9	9.8	18.9	32	54	91	125	0.9	1	3	4.9	9.1	13.1	21.5	38	34	HKA

IS 502	8	61	186	1570	8300	2130	382	298	87	-	-	0.4	7.2	13	30	44.5	64	91	-	-	0.4	6.8	5.3	18	14.2	19.5	26.9	-	-	AKH
IS 503	10	146	3080	102	171	53.2	49.8	111	249	232	5140	0.4	1.9	14	36	53.9	70.6	91	114	129	0.4	1.5	12	22	17.9	16.7	20.6	23	15	KHK
IS 504	10	101	2640	23.5	7.4	291	69.2	29.2	23	30.2	9	0.4	1.1	2.6	11	42.7	66.6	96	128	163	0.4	0.7	1.5	8	32.1	23.9	29.1	32	35	KHK
IS 505	10	445	423	5	124	364	511	478	437	520	3190	0.9	7.1	21	35	55.5	80.6	105	128	156	0.9	6.2	14	14	20.8	25.1	24.4	23	28	HKH
IS 506	10	289	69	7.5	42.2	12.6	27	100	200	486	1610	1.3	4.7	12	26	41.7	61.2	80	105	144	1.3	3.4	7.1	14	15.6	19.5	18.8	25	39	HKH
IS 507	10	146	289	2010	3030	770	248	142	4.0	13	18.8	0.8	4.3	11	22	30	36.9	48	152	201	0.8	3.5	7	11	8.1	6.9	11.1	108	49	KQH
IS 508	9	82	356	92	30.8	5.8	22.6	2.3	1.5	34.6	-	0.5	2.3	6.9	12	25.6	51.8	84	1499	-	0.5	1.8	4.6	4.8	13.9	26.2	32.2	65	-	KHK
IS 509	6	2470	3280	2620	2890	1290	1970	-	-	-	-	4.5	51	79	98	121	-	-	-	-	4.5	47	28	19	22.8	-	-	-	-	KH
IS 510	8	890	1550	149	422	8500	2150	1120	324	-	-	0.9	3.3	8.6	16	61.7	104	162	-	-	0.9	2.4	5.3	7.6	45.5	42.3	58	-	-	HKH
IS 511	8	990	32.6	564	2110	401	213	117	44.4	-	-	0.9	3.7	7.9	28	51.7	81.3	142	-	-	0.9	2.8	4.2	20	24.2	29.6	60.7	-	-	HK
IS 512	9	82	356	92	30.8	5	22.6	2.3	1.5	34	-	0.5	2.3	6.9	12	25.6	51.8	84	149	-	0.5	1.8	4.6	4.8	13.9	26.2	32.2	65	-	QH
IS 513	6	1170	735	1140	450	118	24.5	-	-	-	-	1	2.5	41	59	215	-	-	-	-	1	1.5	39	18	156	-	-	-	-	HQ
IS 514	7	45.7	10.1	3.5	25.5	85	130	170	-	-	-	0.7	4	11	21	61.6	102	-	-	-	0.7	3.3	6.6	10	40.7	40.4	-	-	-	HA
IS 515	8	60.3	28.3	4.5	17.1	255	22.9	18.7	3.6	-	-	0.7	1.4	3.4	5.9	22.2	47.2	75	-	-	0.7	0.7	2	2.5	16.3	25	29.9	-	-	HK
IS 516	7	313	6.7	371	42.5	74.6	106	197	-	-	-	1	5.8	30	81	131	180	-	-	-	1	4.8	25	51	50.1	49	-	-	-	HA
NS 517	7	582	31400	1860	1380	686	207	13.5	-	-	-	0.7	4.1	8.2	78	93.4	113	-	-	-	0.7	3.4	4.1	69	15.9	19.6	-	-	-	KQ

NS 518	10	165	513	1000	1190	49.1	1.8	13.4	40.1	47.8	190	0.6	4.1	6	10	15.3	37	54	77.1	102	0.6	3.5	1.9	4.2	5.1	21.7	17.1	23	25	KHK
NS 519	9	223	3460	471	7850	1600	3540	2070	1390	860	53	0.5	2.9	10	23	51.1	71.1	93	118	-	0.5	2.4	7.1	13	28.4	20.6	21.1	25		KH
NS 520	10	1550	9500	1010	4010	1820	860	1650	2460	2680	7620	0.5	1.9	7	52	79.5	125	164	204	244	0.5	1.4	5.1	45	27.9	45.5	39	40	40	KKH
NS 521	10	2320	688	4880	267	714	8600	34600	13700	6520	4930	0.6	1.7	4.2	12	21.9	41.6	117	186	291	0.6	1.1	2.5	8.1	9.6	19.7	75.4	69	105	HKH
NS 522	10	537	362	91	9.3	11.2	43.4	313	490	87	168	1	1.6	14	24	31.4	50.8	97	142	194	1	0.6	13	9.8	7.3	19.4	46.2	45	52	QHK
NS 523	10	334	251	37.9	11.7	30.3	336	4060	4250	250	540	1	14	21	29	38.9	57.8	127	176	201	1	13	7.4	8.3	9.6	18.9	69.2	49	25	HKH
NS 524	10	163	5500	392	780	129	21.2	110	260	343	940	0.7	4.1	14	31	42.8	78.5	105	139	178	0.7	3.4	10	16	12.1	35.7	26.5	34	39	KHK
NS 525		386	74.9	1690	3.9	27	14100	10100	8800	6230	3370	1.3	2.5	3.6	21	34.8	61.3	95	166	223	1.3	1.2	1.1	17	14.2	26.5	33.2	72	57	HAK
NS 526	10	157	54.8	11.9	2400	4890	5.4	14.7	31.6	46.5	187	0.3	3.7	7.3	18	39.7	73.6	100	128	162	0.3	3.4	3.6	11	21.5	33.9	26.2	28	34	QHK
NS 527	10	1790	2350	17200	2400	4890	749	179	1070	1610	3650	1.1	2.8	8.2	21	37	53.1	96	133	175	1.1	1.7	5.4	13	16	16.1	43.1	37	42	AHK
NS 528	10	416	2140	183	46	16.3	4.5	76.7	177	164	527	0.4	1.2	3.1	4.8	20.6	39.3	60	89.2	119	0.4	0.8	2	1.7	15.8	18.7	20.2	30	30	HKH
NS 529	10	5200	460	127	52	1430	778	33.6	4.7	44	-	0.8	2	4.7	8.1	19.2	37.8	32	185	-	0.8	1.2	2.7	4.6	11.6	18.1	6	153	-	QKH

NS 530	9	157	153	31.7	2.3	267	146	130	114	198	-	1	3.5	5.2	13	62.5	102	146	192	-	1	2.5	1.7	8.2	49.1	39.5	44	46	-	HKH
NS 531	9	2240	549	8700	4250	21700	5590	2920	2180	2170	850	0.4	1	5.1	25	68.3	92.3	119	148	176	0.4	0.6	4.1	19	43.8	24	23.7	29	28	AKH
NS 532	10	106	9100	4220	2940	1080	7060	224	323	221	3.1	0.5	2.6	7.5	13	22	41.9	48	59	72	0.5	2.1	4.9	5.6	8.9	19.9	6.2	11	17	QHK
NS 533	10	106	74.4	44.7	7	150	990	1830	960	443	243	0.6	7	9.3	17	24.5	43.5	96	156	208	0.6	6.4	2.3	7.9	7.3	19	52.7	60	52	HKH
NS 534	9	295	840	231	767	16.4	118	25.2	14.4	5.2	-	1.1	3.1	6.7	13	29.5	58.1	85	16.7	-	1.1	2	3.6	5.8	17	28.6	26.6	68	-	QJK
N S 535	10	270	639	9300	920	120	601	1360	2630	3770	27200	0.7	3.5	11	17	40.5	54.5	71	91.7	116	0.7	2.8	6.8	6.5	23.7	14	16.7	21	24	AHK
NS 536	9	1010	14500	4980	1470	8900	2020	779	181	95	-	0.9	3.2	6.2	14	30.6	40.1	50	67.2	-	0.9	2.3	3	7.5	16.9	9.5	10.1	17	-	KQH
NS 537	10	211	378	2230	2930	2930	739	1060	307	87	67.3	1	6.1	16	26	31.4	44.2	61	78.7	100	1	5.1	9.4	10	5.5	12.8	16.5	18	21	AHK
NS 538	10	389	1040	1070	3250	4170	2100	900	870	850	584	0.6	5.3	12	26	57.8	88	122	157	196	0.6	4.7	6.5	14	31.8	30.2	34	35	39	AHK
NS 539	10	447	153	960	211	18.1	132	15.1	25.1	29.5	8.6	0.4	1.1	13	20	44.2	86.5	114	155	198	0.4	0.7	12	6.3	24.5	42.3	27.1	41	43	KHK
NS 540	8	1660	1880	50	298	13300	745	290	87	-	-	1.2	1.8	4.8	7.5	37.7	71.8	128	-	-	1.2	0.4	3	3.3	30.2	34.1	56.2	-	-	HKH
NS 541	6	73	222	478	17.5	63.7	228	-	-	-	-	0.5	4.5	9.7	23	33.1	124	-	-	-	0.5	4	5.2	13	10	90.9	-	-	-	KHK

NS 542	8	521	20100	2910	425	642	89	173	339	-	-	0.4	2	3.3	14	30.2	72.9	110	-	-	0.4	1.6	1.3	10	16.3	42.7	37.1	-	-	KHK
NS 543	8	114	4000	674	93	470	1460	1380	358	-	-	1	3.7	6.8	18	28.4	46.1	107	-	-	1	2.7	3.1	11	10.2	17.7	60.7	-	-	KHK
OG 544	10	1650	714	5760	340	71.2	24.1	71.8	147	220	1880	1	2.9	8.7	42	60.1	92	117	143	173	1	1.9	5.8	33	18.2	31.9	25	26	30	HKH
OG 545	10	271	52.1	435	1180	5410	1700	679	421	305	49.3	0.8	4.5	6.8	10	29.3	44.8	61	79	99.6	0.8	3.7	2.3	3.5	19	15.5	16.5	18	21	HKH
OG 546	10	295	27100	4840	632	2640	3190	4130	10900	4280	7390	0.4	3.1	8	33	60.1	86.4	121	179	226	0.4	2.7	4.9	25	26.7	26.3	34.6	58	47	KHK
OG 547	7	741	1660	2620	32200	7200	3040	733	-	-	-	0.6	3.2	6.1	20	39.7	74.3	-	-	-	0.6	2.6	2.9	14	19.5	34.6	-	-	-	AKH
OG 548	8	502	4410	1030	40.8	232	1720	170	101	-	-	0.5	2	19	42	62.1	152	243	-	-	0.5	1.5	17	24	19.8	89.9	91	-	-	KHK
OG 549	10	147	3750	268	5390	779	184	470	2060	960	5750	0.3	1.4	5.6	20	33.2	65.1	99	145	171	0.3	1.1	4.2	15	12.8	31.9	34.3	46	26	KHK
OG 550	8	195	652	5780	11600	2210	1490	482	111	-	-	0.6	7.3	13	26	34.5	63.2	93	-	-	0.6	6.7	5.8	13	8.3	28.7	30	-	-	AKH
OG 551	10	391	406	101	3000	19800	12000	27300	6320	4190	4010	1	5.2	11	17	36.3	49.1	121	175	226	1	4.2	5.5	6	19.6	12.8	71.9	54	51	HAK
OG 552	10	126	612	342	1080	738	391	139	131	292	134	1.4	6.7	23	43	52.7	79.1	113	158	189	1.4	5.3	16	21	9.5	26.4	33.9	45	31	AKA
OG 553	8	1450	3000	13100	7820	1280	1040	575	293	-	-	0.9	7.2	16	29	53.2	82	123	-	-	0.9	6.3	9.2	12	24.4	28.8	41	-	-	KH

OG 554	10	5106	4540	14900	588	6340	8600	30500	20100	12700	15800	0.3	0.9	3.7	18	30.9	42.6	93	148	198	0.3	0.6	2.8	14	13.4	11.7	50.5	55	50	AHK
OG 555	10	313	46300	486	2630	9900	6320	5380	10400	7380	3490	0.3	2	12	22	57.2	106	158	207	257	0.3	1.7	10	10	35	48.8	52	49	50	KAH
OG 556	10	742	10900	1620	4060	4510	7240	13100	12100	4350	15600	0.4	2	17.9	43	75.5	113	160	204	226	0.4	1.6	15.9	25.1	32.5	37.5	47	44	22	KAH
OG 557	6	247	454	8100	2530	1050	1080	-	-	-	-	1.1	13	39	64	101	-	-	-	-	1.1	12	26	25	37.5	-	-	-	-	AK
OG 558	6	1860	3130	1060	2706	1900	12700	-	-	-	-	1.8	5	10	19	43	80.7	-	-	-	1.8	3.2	5.1	8.8	24.1	37.7	-	-	-	AK
OG 559	5	1960	19500	11700	8200	960	-	-	-	-	-	1.8	15	62	107	-	-	-	-	-	1.8	13	48	45	-	-	-	-	-	KH
OG 560	9	1150	3610	8000	4070	2020	4070	3350	2050	960	-	0.8	4.1	9	30	66.6	87	138	188	-	0.8	3.3	4.9	21	36.5	20.4	51	50	-	KHK
OG 561	10	1910	5340	1810	5350	5310	2760	1930	315	94	340	0.6	2.6	12	26	40.4	55.3	68	115	203	0.6	2	9.7	13	14.7	14.9	13.1	47	88	KHK
OG 562	7	622	3280	6030	430	1360	1570	262	-	-	-	0.8	1.6	4.5	12	63.2	129	-	-	-	0.8	0.8	2.9	7.3	51.4	65.8	-	-	-	KHK
OG 563	10	282	3070	366	12000	5620	4020	1460	3240	1890	1000	1.1	3.6	11	40	65.3	96.1	149	182	226	1.1	2.5	7.8	28	53.9	30.8	52.9	33	44	AKH
OG 564	5	193	8100	11200	180	3860	-	-	-	-	-	0.6	10	27	11	-	-	-	-	-	0.6	9.4	17	79	-	-	-	-	-	KH
OG 565	5	5730	13400	2.00E+05	23800	11100	-	-	-	-	-	1	6.5	39	70	-	-	-	-	-	1	5.5	32	43	-	-	-	-	-	AK

OG 566	5	1570	546	12.1	27.6	290	-	-	-	-	-	6.7	12	74	111	-	-	-	-	-	6.7	5.7	61	37	-	-	-	-	-	HK
OG 567	5	352	13.4	4.3	73.7	250	-	-	-	-	-	4	11	23	70	-	-	-	-	-	4	6.5	12	48	-	-	-	-	-	HK
OG 568	8	2410	127	7120	8300	17500	4170	1380	790	-	-	0.4	1	1.8	15	26	69.9	109	-	-	0.4	0.6	0.8	13	10.9	43.9	39.1	-	-	AKH
OG 569	10	503	589	88	6.1	66.9	146	27.8	21.3	22.2	9.9	1.5	2.9	5.4	15	28.6	64.8	105	146	187	1.5	1.4	2.5	9.4	13.8	36.2	40.2	41	41	QKH

B: Depth Slicing of Resistivity across the Study Area

VES. No.	AB/2 (m)													
	5	10	15	40	60	100	150	200	250	300	350	400	450	500
AJ 01	210	200	140	40	50	70	100	140	145	170	180	220	260	300
AJ 02	130	80	45	50	60	65	62	61	58	56	55	-	-	-
AJ 03	700	800	850	1000	1400	1800	2000	2100	2200	2300	2400	2450	2500	2600
AJ 04	70	30	35	60	90	190	200	300	600	650	700	800	900	1000
AJ 05	170	100	40	12	18	30	35	40	60	70	80	95	100	110
AJ 06	105	95	80	60	55	30	25	23	27	33	35	40	42	46
AJ 07	200	210	230	40	28	25	26	27	28	29	30	32	33	35
AJ 08	1100	1400	1600	3000	3500	5000	6000	6100	5900	5800	5800	5700	5500	5200
AJ 09	1300	1200	1150	1500	2500	3000	3100	3200	3200	2800	2780	2760	2750	2700
AJ 10	300	200	70	30	31	40	70	95	100	110	120	130	135	140
AJ 11	1000	1400	1450	1800	2000	2500	2700	2800	2850	2900	2860	2840	2820	2790
AJ 12	2000	2200	2300	3100	3500	6000	10000	10500	10600	10700	10800	10850	10860	10900
AJ 13	1200	1100	1150	2000	2800	3000	3100	3050	2850	2500	1800	1400	1000	900
AJ 14	800	1000	1400	2100	2600	4000	6000	6200	6100	6050	5950	5900	5800	5700
AJ 15	11	12	13	20	25	28	30	31	32	33	34	35	36	37
AJ 16	2000	2100	2200	2400	2500	2600	2050	1800	1400	1200	900	800	700	650
AJ17	70	120	150	180	175	100	30	35	40	50	60	70	75	80
AJ 18	1000	200	100	40	35	32	30	30	29	28	28	27	26	25
AJ 19	35	20	22	40	55	60	57	60	60	63	70	80	85	90
AJ 20	1300	1200	500	300	350	500	600	900	1100	1200	1400	1600	1800	2000
AJ 21	20	35	45	70	100	160	250	300	400	450	500	550	600	650
AJ 22	120	130	200	500	600	1000	1000	1000	700	500	400	300	200	120
AJ 23	21	28	27	21	13	14	27	30	35	40	45	50	55	60
AJ 24	400	500	550	250	230	280	290	300	295	240	230	220	170	120
AJ 25	300	180	30	5	5	6	5	4	3	3.5	2.5	2.4	2.3	2.1
AJ 26	1700	1800	2000	2500	2600	1600	1300	1000	700	300	200	50	25	20
AJ 27	2200	3000	2900	500	180	50	70	100	140	160	200	220	240	260

AJ 28	1600	1200	800	1000	1200	1300	1500	2000	2200	2600	2800	2900	3000	3200
AJ 29	2000	1400	860	30	32	40	50	60	62	64	66	70	74	78
AJ 30	320	240	150	110	140	300	500	550	600	650	700	750	1000	1100
AJ 31	500	600	600	400	500	800	1300	1800	2200	2600	2800	3000	3200	3400
AJ 32	27	12	10	9	9	13	18	20	22	24	26	28	40	42
AJ 33	600	200	70	13	10	11	12	13	15	25	30	40	42	43
AJ 34	1000	700	200	14	18	30	50	55	60	65	110	120	150	170
AJ 35	32	50	60	70	140	200	201	195	110	95	75	60	65	50
AJ 36	200	220	240	230	200	150	70	50	35	25	24	24	-	-
AJ 37	120	110	90	13	14	17	30	35	40	50	60	65	70	80
AJ 38	250	200	100	12	16	25	35	50	60	65	70	80	85	90
AJ 39	200	350	260	70	50	80	110	180	200	210	250	280	290	300
AM 40	2200	2800	3200	4000	3100	3000	2900	3050	3150	3170	3130	3120	3000	2950
AM 41	3500	3500	3600	3400	3300	3200	3250	3600	3650	3700	3800	3900	4000	4100
AM 42	610	800	1000	1900	2200	2800	2500	2400	2300	2200	1300	1600	1550	1400
AM 43	800	700	750	1500	2500	4000	4500	5000	5500	6000	5950	5850	5750	5500
AM 44	1100	1300	1350	2400	3000	5000	5500	6000	6500	7000	7100	7200	7300	7400
AM 45	1500	1200	1150	2000	2500	4000	5000	5500	6000	7000	7500	7700	7750	7800
AM 46	400	600	700	1300	1800	3000	4000	5000	6000	6200	5900	5800	5500	5000
AM 47	800	1000	1200	3000	3500	6000	7000	9000	10000	11000	13000	14000	15000	16000
AM 48	550	700	720	800	1100	1400	1700	1800	1850	1810	1780	1750	1650	1600
AM 49	470	500	1000	700	750	800	1500	2000	2100	2500	2600	2600	3000	4000
AM 50	190	180	250	280	290	300	400	600	700	800	900	1000	1050	1200
AM 51	5000	6000	8000	7000	6000	4000	3500	3400	5000	5500	6000	6500	7000	8000
AM 52	90	50	40	30	50	80	90	100	100	90	80	70	60	50
AM 53	5	2.7	3	10	18	22	26	30	40	38	35	40	39	38
AM 54	350	190	40	38	55	100	160	180	170	160	150	145	140	135
AM 55	60	140	200	300	500	300	250	150	80	70	60	65	70	75
AM 56	1650	1500	1700	2000	2900	1800	800	500	400	450	460	480	490	500
AM 57	170	130	150	300	500	1000	1100	1200	1300	1400	1500	1450	1400	1350

AM 58	200	190	170	60	40	35	50	55	60	65	70	80	100	170
AM 59	400	200	120	14	16	22	30	35	40	70	90	100	105	110
AM 60	500	220	45	10	12	17	19	20	21	17	16	15	14	11
AM 61	700	800	1100	2000	2500	2400	1800	1400	1000	900	950	1050	1100	1200
AM 62	400	380	385	490	500	510	495	350	345	340	110	105	104	100
AM 63	30	25	13	9	12	19	30	40	45	60	65	70	75	80
AM 64	65	105	125	220	300	310	309	306	210	200	185	180	170	165
AM 65	29	10	8	7	6.5	8	9	9.5	10	10.1	7.2	7.1	6.5	6
AM 66	350	700	1000	1900	1950	2000	1970	2100	2150	2170	2180	2200	2210	2220
AM 67	170	230	270	310	450	600	550	540	530	520	250	240	235	230
AM 68	120	110	115	200	270	500	510	520	410	370	250	230	220	210
AM 69	140	200	150	50	40	35	37	40	43	44	45	-	-	-
AM 70	5	4	4.5	10	14	19	21	22	24	30	32	34	36	38
AM 71	500	900	950	1200	2000	3200	3800	4000	5000	6000	5800	5500	5400	5200
AM 72	2600	2200	1700	1200	900	700	500	400	350	280	250	240	220	200
AM 73	1200	1300	1400	1500	1450	900	600	550	500	480	460	-	-	-
AM 74	2600	2400	1800	1500	1400	2000	2600	2800	3000	3100	4000	5000	6000	7000
AM 75	10600	10200	10000	10400	10300	10200	6000	5000	2000	1300	1100	900	850	800
AM 76	2600	2600	2400	2000	1800	1700	1950	2500	2550	2600	-	-	-	-
AM 77	400	110	50	95	120	190	300	310	350	400	420	430	700	750
AM 78	4000	4100	3000	200	210	220	350	400	500	600	700	800	900	1100
AM 79	4500	1600	200	170	180	165	100	80	85	100	110	120	125	130
AM 80	800	700	600	800	900	1200	1300	1250	1150	1100	1000	900	800	750
AM 81	800	700	550	400	220	100	80	85	90	95	110	120	125	130
AM 82	300	290	220	120	120	125	160	200	220	300	350	400	500	550
AM 83	600	700	500	60	65	70	80	90	110	115	120	130	135	140
AM 84	3000	4000	5000	4500	4300	4200	4000	4000	3500	2000	1800	1000	950	900
AM85	4000	3800	3700	2500	2200	2000	2500	2600	2700	2750	2800	3000	3500	4000
AM 86	3800	3800	4000	4100	3900	3600	3400	4050	4150	4160	4170	4180	4190	4200
AM 87	4500	5000	4600	3000	3200	2800	1400	1200	-	-	-	-	-	-
AM 88	4000	3000	3200	2800	2700	2600	2500	2100	2000	1400	1300	400	350	200

AM 89	1000	800	350	60	40	45	55	70	95	100	110	120	130	140
AM 90	1700	1800	1900	1000	700	600	990	1000	1050	1100	1200	1250	1300	1350
AM 91	3200	3900	3800	2300	2800	2000	1400	1200	1000	400	350	300	250	200
AM 92	2000	2400	2400	2400	2500	2800	3000	3100	3500	3800	4000	4300	4500	5000
AM 93	800	1100	1300	1200	1150	1100	1000	950	900	850	800	750	700	600
AM 94	1000	900	400	50	40	40	50	70	100	110	120	130	140	150
AM 95	1100	800	500	70	50	55	58	80	110	120	125	135	140	148
AM 96	270	400	650	1200	2000	3000	3100	3050	1800	1500	1000	900	700	500
AM 97	1100	2000	2500	4000	3800	3000	2800	2400	2500	2600	2650	2700	2750	2800
AM 98	550	600	650	1200	1400	2300	3000	3600	2800	2750	2600	2400	1500	1400
AM 99	290	400	450	700	900	1800	2100	2300	2500	4000	4100	5000	5200	5300
AM 100	10400	10000	9000	8000	8500	7000	2500	2300	2100	2000	1800	1730	1760	1740
AM 101	700	1100	1200	2500	3000	4000	4500	4600	4400	4200	4000	3800	3600	3400
AM 102	3500	3800	2800	1000	700	450	130	90	70	70	71	72	80	82
AM 103	700	1000	1200	1800	1750	1600	1100	1050	1060	1080	1200	1250	1270	1300
AM 104	400	600	800	2000	2100	4000	5000	6000	8000	-	-	-	-	-
AM 105	1200	1100	1150	1800	2000	3000	4000	4500	4600	-	-	-	-	-
AM 106	2300	2800	2800	2000	1300	1100	1150	1300	1800	2000	2800	3000	3100	3200
AM 107	300	400	410	220	210	180	120	95	75	70	65	60	30	25
AM 108	800	1000	1200	1300	1500	2300	3000	3100	3150	3050	2800	2600	2000	1800
AM 109	400	600	700	1100	1800	2000	2150	2200	2100	2000	1800	1750	1720	1700
AM 110	300	290	180	30	34	50	90	100	120	160	210	280	300	320
AM 111	7000	2000	50	17	26	50	70	100	110	130	135	140	450	150
AM 112	500	550	400	100	100	130	200	210	300	400	450	500	550	600
AM 113	600	1000	1000	1100	900	160	120	130	170	185	200	210	215	220
AM 114	40	30	40	120	140	160	130	100	60	40	30	25	22	20

AM 115	600	1000	1100	500	280	130	150	155	160	170	171	172	174	176
AM 116	900	1150	1300	1800	2100	3000	3500	4000	5000	5100	4600	4200	3300	2400
AM 117	800	1000	2000	1800	1750	2300	2500	3000	3200	3600	3800	4000	4500	5000
AM 118	8000	4000	3000	2000	2500	2400	2600	3000	3500	3800	4000	4200	4500	5200
AM 119	450	600	700	1000	2000	3500	4000	4500	5000	5200	5100	4900	4200	3800
AM 120	300	400	500	1000	1800	2500	3500	4000	4500	5000	5200	4800	4200	3700
AM 121	280	400	450	900	1100	2200	3000	4000	4500	5000	5500	6000	5800	5600
AM 122	1600	1400	1200	1900	3000	7000	7500	8000	8500	9000	8800	8600	7100	7000
AM 123	400	500	600	1200	2000	2500	3000	3100	2900	2800	2600	2500	2650	2700
AM 124	3000	5000	5200	5500	6000	8000	1000	1100	1200	1300	-	-	-	-
AM 125	3000	3500	3700	4000	4700	5000	6000	-	-	-	-	-	-	-
AM 126	1600	2000	2200	5000	6000	8000	10200	10400	-	-	-	-	-	-
AM 127	600	700	710	620	400	350	420	440	460	480	520	560	580	600
AM 128	1400	1300	1100	1050	1250	1280	1400	1450	2000	3000	4000	5000	6000	7000
AM 129	120	180	200	300	280	260	160	115	110	118	120	122	126	128
AM 130	12000	20000	20500	11000	11000	26000	27000	27500	28000	28500	29000	29500	29600	29800
AM 131	800	700	690	1200	2000	3000	4000	5000	6000	7000	7500	7800	8000	8200
AM 132	2000	2200	2000	600	500	1000	1300	1600	2000	2300	2500	3000	3100	3200
AM 133	200	400	500	700	900	1100	1700	2000	2500	26000	26800	3000	3200	3300
AM 134	120	250	300	700	1000	1700	1800	2000	2200	2500	-	-	-	-
AM 135	100	180	250	500	700	1100	1400	1600	1800	200	-	-	-	-
AM 136	6000	5800	5700	5500	4000	3700	3600	3500	1100	700	600	500	450	400
AM 137	2000	1900	1600	600	550	580	610	800	900	1100	-	-	-	-

AM 138	1200	1100	1000	1300	1400	2000	2500	3000	3500	5000	-	-	-	-
AM 139	2000	3000	1900	1700	1300	1000	950	1050	1100	1150	1200	1250	1300	1400
AM 140	600	800	1000	1600	2000	2800	3000	2950	2900	2700	2600	1800	1700	1600
AM 141	2800	3000	2900	3100	3200	4000	3800	2600	2400	2000	1400	1300	1200	1100
AM 142	3500	4000	3800	2300	2400	3000	4000	4200	4300	4400	4200	4100	3200	2500
AM 143	2400	2000	1900	2500	2800	3000	2950	3100	3200	3800	4000	4200	4600	4800
AM 144	250	280	400	1000	1100	1600	1900	2000	2200	2500	2800	3000	3100	3250
AM 145	2500	2000	1500	1200	1100	700	600	650	680	700	750	800	900	950
AM 146	200	400	500	700	900	1200	1700	2500	2800	3000	3500	4000	4100	4500
AM 147	300	450	500	700	1000	2000	3000	3500	4000	5000	5500	6000	7000	8000
AM 148	600	1000	1400	4500	5000	6000	5400	5200	4000	3800	3600	3200	1000	200
AM 149	2600	3000	2500	2200	3500	4500	6000	7000	850	9000	950	920	900	870
AM 150	2500	1800	1900	3000	3400	3600	3800	4000	5000	6000	6500	7000	7500	8000
AM 151	950	1100	1400	2200	2300	2700	3000	3500	4000	4200	3700	3500	3000	2100
AM 152	1500	1500	1400	1200	1100	1000	1000	1050	1200	1250	1300	1400	1550	1600
AM 153	1600	1600	1550	1530	1300	1100	1000	1060	1150	1200	1250	1300	1350	1400
AM 154	450	500	530	600	700	1100	1300	1350	1400	1450	1500	1550	1480	1420
AM 155	800	900	1000	1300	1600	2000	2100	2200	2500	2560	3000	-	-	-
AM 156	1000	1200	1250	1600	2000	3000	4000	5000	5500	-	-	-	-	-
AM 157	1500	1500	1450	1300	800	500	580	600	650	700	750	800	900	950
AM 158	1100	1250	1400	1500	1600	2000	2500	3000	3200	3500	4000	-	-	-
AM 159	1600	1450	1500	2100	2300	2600	2800	3000	3200	5000	5400	-	-	-
AM 160	500	700	800	1800	2200	2400	2350	2250	900	500	-	-	-	-

AM 161	600	750	820	2800	2900	3000	2850	2700	1000	-	-	-	-	-
AM 162	2800	4000	4100	3500	3200	4500	5000	5500	6000	7000	7500	8000	8500	9000
AM 163	2000	2100	2200	1850	1500	1450	1400	1420	1480	1520	1200	1750	1800	1850
AM 164	40	13	11	9	10	11	8	7	6	3	2	1.5	1	0.9
AM 165	400	180	70	100	130	180	200	220	300	350	400	450	500	550
AM 166	1000	900	1050	1800	2500	3000	4000	4500	5000	5500	6000	6500	7000	750
AM 167	600	550	580	700	1000	2000	2500	3000	3500	4000	4200	4100	3900	3700
AM 168	750	1100	1700	3000	3500	3400	2900	2700	1900	1200	1100	1000	-	-
AM 169	1100	2100	2500	4000	5000	4900	4800	4700	4650	5200	5400	5800	6000	6500
AM 170	600	700	750	1200	1700	2200	2500	3000	3500	4000	3800	3600	3400	3200
AM 171	700	900	850	800	870	1200	2000	2200	2500	3000	3200	3500	4000	4100
AM 172	800	1300	1800	2000	2300	2350	3000	3100	3500	3900	3950	4500	5000	5500
AM 173	1200	1150	1000	1800	2600	3000	3200	3100	3000	2800	2750	2700	2600	2500
AM 174	2800	3000	2950	2400	2500	2900	3100	3200	3300	3250	3200	3100	3000	2800
AM 175	4000	3000	2000	2000	2700	3500	3700	5000	6000	6500	6500	7000	7500	8000
AM 176	1400 0	1300 0	1000 0	4000	5000	6000	6500	7000	6900	6800	6500	6300	6100	5000
AM 177	400	600	800	1200	1700	3200	4000	4500	6000	7500	8000	6200	6100	5900
AM 178	1400	1500	1800	3000	4000	6000	8000	8500	8600	8500	8400	8200	8000	7900
AM 179	900	1100	2300	2800	2000	1000	700	650	680	700	700	800	850	860
AM 180	1900	2800	3000	2200	2100	3000	3500	4000	4500	4800	5000	6000	6800	6900
AM 181	2100	1800	1600	1400	1200	1250	1450	1500	1550	1800	1900	2200	2400	2600
AM 182	1000	500	250	105	120	140	160	170	175	180	178	172	160	155
AM 183	1000	900	500	70	80	110	140	150	155	149	145	135	130	120

AM 184	2000	2000	2200	2150	1900	1700	1500	1450	1430	1420	1400	1380	1350	1320
AM 185	2000	2000	2000	2000	2000	2100	2200	2400	2000	1800	1750	1720	1600	1550
AM 186	1200	1400	1450	700	25	20	25	30	35	40	-	-	-	-
AM 187	1100	1450	1500	1600	1400	900	500	450	400	350	-	-	-	-
AM 188	490	550	600	1000	1100	1700	1680	1500	1000	700	350	250	160	130
AM 189	500	700	1150	2600	3200	4500	5000	4950	4000	2900	4000	2500	2000	1200
AM 190	1000	1200	1300	1350	1600	1700	1300	800	550	210	170	110	900	600
AM 191	700	950	1000	1300	2000	2200	2400	2450	2150	2050	1400	1200	1150	1000
AM 192	2000	1900	2200	1500	1600	1650	1200	1000	4	3	250	900	2100	105
AM 193	350	500	600	1100	1300	2000	2500	2600	2650	2610	1900	1700	1500	1300
AM 194	1300	1800	1600	1400	1500	1550	1600	1700	1800	1900	2000	2700	3000	3500
BN 195	1300	2000	2500	3000	3500	5000	5500	5300	3000	3500	2000	1800	1700	1000
BN 196	1000	1000	1050	1200	1500	2100	3000	3500	4000	4500	5000	5100	5400	5500
BN 197	3200	3200	3100	3000	2800	2700	2750	2500	2000	1800	1600	1500	1400	1000
BN 198	1100	1600	1700	1800	2000	2200	2100	1200	1100	950	900	500	400	300
BN 199	1200	1400	1500	2000	2700	2800	3000	2900	2850	1700	700	600	550	500
BN 200	3700	3000	2500	1500	1800	2600	3000	2900	2800	2700	1850	1500	1400	1350
BN 201	1700	1600	950	600	650	700	800	1100	1200	1300	1400	1500	1600	1700
BN 202	800	900	1050	1200	1300	1000	700	350	250	170	150	50	40	30
BN 203	500	800	1050	1600	200-	3000	4000	4200	4250	4100	3900	3800	2800	1800
BN 204	700	950	1000	1600	2000	3000	4000	4200	4250	4100	3900	3800	2800	1800
BN 205	1200	1100	1150	2000	3500	4000	4500	5000	5200	4500	-	-	-	-
BN 206	600	800	1200	2500	3000	4000	5000	5200	5100	4900	-	-	-	-

BN 207	1100 0	1600 0	1700 0	2400 0	3000 0	5000 0	6000 0	6500 0	6600 0	6400 0	6300 0	6200 0	6100 0	6000 0
BN 208	1300	1200	1100	2000	2600	2700	4000	4500	4200	3500	3000	2700	2500	2000
BN 209	400	350	300	1000	1250	2000	2500	3000	2800	2750	2700	2650	2600	2500
BN 210	800	850	870	1300	2200	4000	5000	7000	8000	9000	9500	1000 0	1050 0	1100 0
BN 211	1500	1200	1250	3000	3500	4000	4500	5000	4900	4600	4000	3800	3500	5000
BN 212	450	500	800	1000	1300	2400	3000	3500	4000	4500	5000	6000	6200	6400
BN 213	2000	2400	2600	4500	5000	6000	7000	8000	8500	8300	7800	7400	7000	6500
BN 214	2000 0	2000 0	2300 0	4000 0	5000 0	7000 0	6000 0	5800 0	5500 0	5200 0	5000 0	4800 0	4500 0	4000 0
BN 215	4500	4000	5000	2500	2000	1800	2100	2200	2400	2600	2700	4000	5000	5200
BN 216	300	400	500	900	800	700	500	400	350	220	170	160	155	150
BN 217	1100	1200	1500	1500	1100	900	700	550	500	450	450	450	450	-
BN 218	250	260	270	110	105	120	200	210	270	280	500	520	520	800
BN 219	500	700	900	1000	1300	1000	800	700	350	350	320	250	240	240
BN 220	300	700	1000	1200	2000	1800	2000	1700	1750	300	250	200	110	110
BN 221	100	200	350	800	1000	1100	1100	1200	1100	1050	1000	1100	1100	1000
BN 222	300	500	500	1000	1000	1100	1100	1050	1050	1000	900	900	900	900
BN 223	290	280	200	240	900	1000	1100	1050	1100	1070	1100	1200	1000	900
BN 224	1000	1100	1150	1200	1180	900	700	300	150	130	120	110	115	120
BN 225	210	400	900	800	750	110	105	90	95	100	105	107	110	1040
BN 226	45	19	14	20	30	70	100	160	180	190	200	220	230	240
BN 227	1100	1400	1600	800	500	300	400	450	500	570	590	700	800	900
BN 228	1500	900	400	400	500	550	600	620	500	450	430	250	150	100
BN 229	90	50	19	16	20	30	40	50	55	70	75	80	100	130

BN 230	400	1000	1400	1900	2000	3000	4000	4500	5000	7000	7500	8000	7500	7000
BN 231	60	45	25	13	19	28	30	28	27	26	18	16	10	9
BN 232	40	9	8	8	9	11	13	15	20	23	29	30	35	38
BN 233	1100	1050	800	700	900	800	700	650	700	750	800	900	1000	1100
BN 234	250	300	200	40	45	50	70	120	130	170	190	200	250	300
BN 235	55	80	100	200	290	250	240	200	190	180	170	160	150	140
BN 236	2300	3000	2000	400	200	100	10	15	16	20	-	-	-	-
BN 237	1600	1700	1600	1000	800	600	500	450	-	-	-	-	-	-
BN 238	4500	4500	4600	4700	2700	1800	1600	2000	2500	2700	3000	3500	3700	3800
BN 239	1600	1800	1700	2000	2100	3000	2900	2800	2700	2600	2550	2500	2500	2450
BN 240	1500	1700	1400	1800	1900	2000	1900	1800	1600	1400	900	800	700	600
BN 241	350	400	500	800	900	800	700	750	800	850	900	1000	1050	1100
BN 242	50	80	100	170	180	290	300	320	310	300	290	285	280	270
BN 243	2000	1800	1700	1600	1500	1450	1550	1600	1650	2000	2100	2200	2300	2400
BN 244	1200	1300	1350	2000	2100	2800	2500	1300	800	300	190	90	80	40
BN 245	600	800	900	1000	1500	1700	2000	2100	2000	1950	1900	1100	900	950
BN 246	700	1400	1500	2700	2900	3000	2800	2700	2000	1200	900	800	700	650
BN 247	2400	2000	2300	2900	3000	3100	3000	2800	2700	2700	2750	2800	2850	2900
BN 248	700	900	1200	2000	2100	3000	2900	2800	2700	2650	2600	2700	2850	2900
BN 249	7000	6500	6000	3500	3000	5000	9000	1100	1150 0	1160 0	1170 0	1180 0	1190 0	1200 0
BN 250	110	150	200	300	700	1100	1800	1900	2000	2100	2100	2000	2000	1950
BN 251	2000	2100	2000	1800	1850	1700	1650	1700	1650	1700	1750	1800	1900	2000
BN 252	4000	4100	3900	1800	1900	2000	1950	1100	950	800	600	550	-	-

BN 253	35	50	160	1000	1800	1500	1000	1050	1100	1200	1250	1300	1350	1400
BN 254	2900	2800	2700	2900	4000	5000	5000	5000	5000	4570	4560	4550	4540	4530
BN 255	900	1200	1400	1700	1900	2000	1950	1940	1930	1700	1750	1600	1650	1700
BN 256	300	400	500	900	950	900	850	800	850	900	920	940	960	980
BN 257	1800	1700	1900	3000	4000	4450	4480	3500	2500	2100	1800	1850	1600	1500
BN 258	200	260	300	500	900	1000	1100	1200	1220	1240	1260	1280	1260	1250
BN 259	2100	2000	1800	1750	1700	2000	2200	2400	2700	3000	5000	5100	5300	5500
BN 260	370	450	600	1900	1950	2000	1950	1900	1850	1800	1750	-	-	-
BN 261	300	600	800	2400	2900	3600	3650	3600	2800	2700	2600	1700	900	700
BN 262	1500	1450	1600	3000	4000	5000	4500	4540	4520	4000	4100	4200	4400	4600
BN 263	1600	1500	1560	1570	1700	2100	2200	2500	2600	2550	2500	2460	2420	2420
BN 264	230	240	280	600	700	1600	2100	2300	2350	2360	2370	2360	2350	2340
BN 265	4900	4000	2100	2300	2500	3000	3200	3300	3000	2700	2500	1100	900	700
BN 266	4500	4600	4000	2300	2400	2500	2600	2510	1900	1100	1150	1000	950	900
BN 267	500	600	800	1300	1500	2000	2200	2300	2400	2400	2350	2300	2280	2270
BN 268	1300	1500	1550	2000	2200	2300	2280	2260	2240	1400	1000	800	850	700
BN 269	14	8	9	20	30	60	80	100	190	200	210	250	300	350
BN 270	250	300	450	460	460	470	480	485	280	230	220	170	160	155
BN 271	450	460	350	25	9	10	13	15	18	22	24	26	27	28
BN 272	70	120	140	240	190	120	90	60	65	68	70	75	80	90
BN 273	1200	1100	700	500	450	400	390	410	415	430	450	470	500	510
BN 274	130	140	160	600	650	800	780	400	190	140	90	80	75	70
BN 275	600	900	850	900	960	970	980	700	500	450	440	410	400	350

BN 276	500	1100	1150	550	90	85	85	90	85	70	60	50	40	35
BN 277	280	300	310	500	700	650	600	570	590	600	640	680	710	720
BN 278	40	50	70	200	210	209	208	204	100	90	85	83	81	80
BN 279	200	190	185	200	195	170	150	160	165	180	280	290	300	320
BN 280	10	19	25	60	105	110	200	300	320	350	380	500	520	550
BN 281	1500	1400	1550	1600	1570	1400	1300	1320	1350	1370	1400	1420	1450	1500
BN 282	60	45	22	8	9	10	11	10	7	6	5.5	5	4	4.5
BN 283	300	400	380	70	19	10	9	10	11	11.5	13	14	14.5	15
BN 284	330	100	30	20	25	30	60	65	70	75	105	115	120	125
BN 285	180	190	200	400	600	1100	1300	1350	1340	1330	1200	1150	1100	1000
BN 286	550	400	1300	1350	1400	1370	900	850	800	700	770	800	850	900
BN 287	180	190	220	400	700	800	750	400	350	100	40	3.5	34	30
BN 288	35	15	8	6	6	7	8	8.5	9	9.5	9.6	9.7	10	10.5
BN 289	210	250	270	900	950	1000	900	850	830	820	700	750	600	550
BN 290	180	280	300	500	600	580	300	280	2.7	265	260	250	245	240
BN 291	500	700	550	400	560	720	710	690	300	290	280	230	220	200
BN 292	200	210	170	26	20	19	22	30	3.2	40	70	75	80	95
BN 293	180	400	450	600	650	800	790	770	750	740	720	200	150	130
BN 294	100	140	150	270	400	450	460	470	490	700	750	800	790	780
BN 295	300	200	160	300	400	700	900	1100	1300	2000	2800	3000	3500	3600
BN 296	80	140	210	300	310	200	210	220	225	230	250	260	340	360
BN 297	190	250	290	295	280	220	190	205	215	230	260	310	330	350
BN 298	180	400	700	1100	900	950	940	960	1010	1100	1200	1300	1350	1370

BN 299	240	400	500	900	1100	1400	1450	1500	1460	1440	1420	1300	1280	1250
BN 300	60	100	101	80	70	100	120	125	140	145	150	151	152	153
BN 301	80	30	11	4	4.1	4.1	3.9	3.8	4.2	4.4	4.5	4.6	5	5.2
BN 302	600	650	580	570	585	590	595	597	600	601	605	594	593	592
BN 303	800	900	950	1100	1500	1800	1850	1900	2000	2100	2200	2300	2400	2450
BN 304	105	60	12	6	7	4	5	6	6.5	7	11	13	14	18
BN 305	1200	2000	2100	2400	1400	1100	1250	1300	1350	2000	2100	2300	2350	2400
BN 306	1300	600	400	20	9	6	7	7.5	8	8.5	9	11	11.6	12
BN 307	350	800	1000	1300	1250	1000	500	450	110	95	94	92	85	83
BN 308	60	110	125	240	280	400	500	495	480	475	470	350	300	290
BN 309	2100	2500	2700	2750	2800	4000	4500	4400	4200	3000	1700	1300	1250	1200
BN 310	1300	1400	1450	1350	1340	1200	700	650	250	240	230	90	85	80
BN 311	700	900	1050	1200	1300	1400	1350	1330	1000	900	650	600	550	500
BN 312	450	350	330	650	750	800	750	700	650	600	400	350	340	300
BN 313	2000	2100	1800	1750	1300	1200	1100	1050	1000	1100	950	940	920	910
BN 314	160	200	210	105	95	100	130	135	140	210	230	235	240	250
BN 315	950	1000	1000	1300	1700	3000	3500	3500	3200	3100	2700	2500	2400	2300
BN 316	550	600	580	450	440	500	510	480	160	150	140	135	130	125
BN 317	80	100	110	112	115	200	300	320	350	400	420	450	470	490
BN 318	50	40	42	80	120	200	210	300	400	410	420	405	395	380
BN 319	1200	1250	1300	3200	6000	8000	7800	7000	6500	6300	6200	3000	2500	2400
BN 320	800	1100	1200	1400	1350	800	750	700	650	710	730	745	750	760
BN 321	1900	2000	2100	2200	2400	3100	3800	4500	5000	4600	4550	4530	4100	4200

BN 322	750	700	690	1000	1100	1200	1150	900	700	500	300	360	340	150
BN 323	1000	1600	1650	900	800	1400	1450	1420	2000	2100	2200	2500	2600	2700
BN 324	450	900	1000	950	800	750	700	680	650	350	300	270	250	230
BN 325	270	450	470	700	900	1000	1050	950	780	650	600	680	650	640
BN 326	280	600	700	800	750	400	140	90	85	88	92	95	100	110
BN 327	350	450	470	630	700	680	670	500	200	100	70	60	65	50
BN 328	3000	4000	3800	2500	1000	100	60	55	50	55	75	80	82	85
BN 329	150	200	350	400	500	550	530	520	200	60	20	15	10	9
BN 330	400	900	1100	980	800	750	600	650	630	500	550	530	520	300
BN 331	1100	1000	700	200	100	80	50	40	35	30	25	20	25	20
BN 332	2000	3000	3500	3600	3700	3650	1300	1200	1000	600	550	500	350	300
BN 333	200	180	160	300	400	800	1000	1100	1200	1300	1350	1400	1450	2000
BN 334	500	600	700	1000	800	700	450	440	255	260	400	450	500	600
BN 335	170	230	300	450	440	400	460	700	750	800	850	900	100	1100
BN 336	180	200	230	400	500	700	650	600	250	130	80	40	25	20
BN 337	600	700	650	300	320	350	330	335	325	290	285	280	120	100
BN 338	400	500	450	460	300	1100	1200	1150	900	850	830	820	350	300
BN 339	6000	9000	10000	5000	1100	1000	1200	1250	1300	1350	-	-	-	-
BN 340	2800	1900	2100	4000	4500	5000	5200	5300	-	-	-	-	-	-
BN 341	4500	4600	4650	4000	2100	1800	1850	1900	2100	2400	4500	4600	4800	5000
BN 342	2500	3000	2000	300	190	100	10	8	11	12	-	-	-	-
BN 343	650	110	1200	2700	3000	3100	3200	3300	3250	3240	2250	1800	1600	1400
BN 344	600	1000	900	1200	1250	1300	1350	1340	1280	1180	750	700	600	500

BN 345	600	1200	1400	1300	950	900	1000	1050	1200	1300	1350	1400	1500	1600
BN 346	1500	1800	2000	3000	4000	4200	4100	4000	3500	3000	2800	2000	1800	1600
BN 347	350	450	600	650	800	750	740	900	1000	1200	1250	1300	1400	1500
BN 348	110	90	60	50	75	100	130	200	220	250	260	300	350	400
BN 349	70	75	100	180	230	400	600	800	1000	1050	1200	1250	1300	1350
BN 350	1100	1000	950	900	1200	1900	2500	2600	3000	3100	3050	2900	2850	2800
BN 351	500	900	1100	2500	4000	5000	6000	6100	6150	7000	6900	6500	6400	6300
BN 352	1500	1400	1300	2000	3000	3100	3200	3100	2800	2000	1800	1600	950	900
BN 353	400	500	800	1800	2500	2900	2850	2800	1800	1000	600	200	150	100
BN 354	500	600	610	800	1000	1800	1900	1950	2000	2050	1980	1800	1750	1700
BN 355	400	500	600	1000	1500	1900	2400	2600	2800	2900	2850	2820	2700	2650
BN356	6000	5000	4000	3500	3800	4000	4500	5000	5500	6000	6500	6600	6800	7000
BN 357	800	900	1100	1800	2000	2400	2380	2050	1500	1200	1000	600	550	500
BN 358	2500	2400	2800	2000	2400	2300	2700	2400	2500	2550	2580	2600	2650	2680
BN 359	1400	1500	1800	2400	2800	3000	2500	2600	2700	2800	2850	2900	2950	3000
BN 360	1100	1600	1800	2500	2900	3100	2600	2650	2400	2200	1600	1300	1200	1100
BN 361	480	800	1050	1600	2000	2800	3000	3200	4000	4100	4500	4400	4200	4100
BN 362	900	950	1100	1050	1000	1200	1300	1400	1500	2000	2100	2150	2200	2300
BN 363	350	400	450	1000	1400	2300	3100	3600	3700	3650	3500	3450	3440	3420
BN 364	1100	1500	1600	1700	900	600	500	450	440	420	-	-	-	-
BN 365	1800	1800	1750	1500	1400	800	750	850	1050	1300	-	-	-	-
BN 366	800	850	850	1300	1800	3000	3700	4100	4800	3800	3500	2600	2400	2200
BN 367	1200	1300	1600	2800	3000	4000	3800	3600	2300	1800	1300	1100	900	400

BN 368	1500	1100	800	1600	1800	2800	3000	3000	2950	2860	2600	2300	2000	1950
BN 369	900	1000	1100	2000	2700	3000	2950	2200	1900	1700	900	600	550	500
BN 370	22	45	70	180	220	500	700	900	1000	1050	1100	1200	1250	1300
BN 371	1200	2000	2050	2100	2600	3200	3500	3450	3400	2400	1300	950	800	750
BN 372	300	310	350	800	1200	1900	2600	3000	4000	5000	6000	6500	6600	6700
BN 373	470	490	500	700	900	1300	1500	1600	1590	1570	1400	1300	1250	1200
BN 374	500	700	800	1800	1900	4000	5000	6000	7000	-	-	-	-	-
BN 375	600	1100	1400	4000	5000	8000	1100 0	1200 0	1300 0	-	-	-	-	-
BN 376	700	1300	1500	5000	5500	7500	1250 0	1300 0	1350 0	-	-	-	-	-
BN 377	650	1000	1200	3000	4000	6000	1000 0	1100 0	1250 0	-	-	-	-	-
BN 378	2200	3200	4500	3000	1700	1400	1450	1460	1480	1490	1200	1100	1000	800
BN 379	510	500	520	1100	1400	1900	2000	2100	2150	2200	2300	-	-	-
BN 380	350	300	180	30	11	12	16	20	30	40	50	60	70	80
BN 381	190	300	450	1200	1800	2000	1950	1900	1700	1600	1100	900	800	700
BN 382	280	360	500	1200	1300	1800	1750	1600	1100	1000	70	80	50	40
BN 383	1200	1700	1900	2800	3500	4000	5000	6000	5980	5700	4500	4000	4400	4000
BN 384	600	550	500	100	50	40	50	60	70	80	85	160	170	175
BN 385	500	400	220	45	50	100	120	150	170	180	220	240	260	280
BN 386	400	900	1200	1500	1700	2500	2100	1900	1900	1950	2000	2100	2200	2300
BN 387	1100	1400	1700	2000	2100	2900	3000	2950	2900	1900	1550	1100	900	800
BN 388	1500	1550	1570	2600	3000	3100	2900	2800	2750	2500	2500	2450	2460	2470
BN 389	500	600	700	1900	2800	3200	3500	3550	3540	3520	3300	3200	2100	2000
BN 390	4100	2000	1900	3800	4000	3500	1800	1400	900	700	750	800	850	900

BN 391	110	200	300	600	800	1300	1600	1800	1850	2000	1950	1900	1850	1800
BN 392	400	700	1000	1700	2000	2500	2000	1850	1800	1750	1700	1650	1600	1500
BN 393	380	400	200	170	350	500	700	800	900	1000	1100	1200	1300	1400
BN 394	10600	10700	10400	5000	2000	1900	2300	2400	2450	2430	1800	1700	1300	1100
BN 395	2000	4500	5000	6000	8000	8500	4000	3000	2000	1600	1400	1200	1250	1240
BN 396	300	1000	1100	2100	2300	3000	3200	3100	2950	2900	2880	2850	2700	2650
BN 397	2000	2000	2100	2600	2800	3000	3200	3150	3100	3050	2900	2850	2800	2700
BN 398	400	600	700	250	200	300	350	370	390	400	420	430	440	450
BN 399	410	190	100	120	130	135	110	100	95	90	85	80	75	70
BN 400	400	600	650	1400	1800	2000	1850	1200	1100	1000	950	400	200	180
BN 401	3000	2500	2300	4000	4500	5000	5500	6000	5400	5200	3500	3200	2200	2000
BN 402	350	360	365	600	1000	1800	2000	2200	2200	2100	2000	1800	1600	1400
BN 403	210	2000	1800	2000	3000	4000	5000	5500	5000	4800	4000	3800	3000	2000
BN 404	1000	1200	1300	1900	2100	2500	2400	1350	1800	1600	1500	800	750	700
BN 405	1100	1200	1200	1400	2200	3000	3200	3100	2950	2500	1500	1300	1100	900
BN 406	900	1300	1900	4000	7000	8000	9000	8500	7000	6000	4500	2000	1980	1600
BN 407	120	270	450	1100	1300	1900	2000	1950	1800	1750	1150	800	700	650
BN 408	4900	3000	2500	4000	5000	8000	10400	10600	10150	10100	9000	9500	8000	7500
BN 409	4500	10000	10500	11000	11500	12000	13000	13000	14000	14500	4600	14700	14800	15000
BN 410	2600	3000	3100	3800	4500	6000	8000	8100	8000	7800	5000	4800	4000	3000
BN 411	2100	2600	3000	8000	11000	19000	20500	30000	30600	40000	50000	60000	70000	70500
BN 412	450	440	430	1000	1400	1800	1750	1350	1200	1100	1050	900	850	800
BN 413	4000	3500	3000	2800	2750	2600	2550	2300	2150	2050	2000	1950	1900	1800

BN 414	4500	3500	4000	4300	3900	4000	4200	4250	4000	2500	2400	2200	2000	1900
BN 415	1200	1500	1900	2000	2100	2600	2900	3000	3200	3200	3050	3000	2800	2600
BN 416	2000	4000	5000	1040 0	2000 0	2050 0	2080 0	3000 0	3050 0	3100	3200 0	3300 0	3400 0	3500 0
BN 417	2900	4000	5000	9000	1000 0	1800 0	2000 0	2100 0	2200 0	2100 0	2000 0	1400 0	1200 0	1100 0
BN 418	1300	2000	2500	6000	9000	1100 0	1500 0	1600 0	1700 0	2000 0	-	-	-	-
BN 419	3000	3500	4500	9000	1100 0	1500 0	1800 0	1750 0	1600 0	1500 0	1450 0	1400 0	1200 0	1100 0
BN 420	700	600	550	1500	2000	2500	2600	2650	2520	1700	1600	1550	1400	1200
BN 421	350	700	850	1200	1400	2000	2100	2200	2500	3000	3200	3250	3270	3300
BN 422	400	500	900	2800	3200	4500	6000	6500	6400	6200	5900	5000	4900	4500
BN 423	1200	1300	1000	700	900	1250	1400	1700	2000	2100	1900	1800	1600	1400
BN 424	1500	1400	1900	3500	5000	8000	1000 0	1000 0	7000	5000	4000	3500	3000	2800
BN 425	2000	4000	4000	3900	4500	5000	5550	5600	5400	5200	5000	4000	4000	3900
BN 426	700	1200	1400	2900	3000	3100	4000	4100	4100	4000	3500	3300	3100	3000
BN 427	2000 0	2000 0	2200 0	3500 0	5000 0	7000 0	8000 0	7500 0	7100 0	6000 0	5700 0	5600 0	5500 0	5400 0
BN 428	5000	7000	9000	1500 0	1600 0	1300 0	8000	5000	4800	4700	4900	5000	5100	5200
BN 429	3800	4900	5500	8000	7500	7900	9000	1100 0	1300 0	1400 0	1500 0	1600 0	1700 0	1800 0
BN 430	1500	2600	2800	3000	3100	3800	4000	4100	4000	3900	3700	2100	2000	1800
BN 431	240	450	500	1100	1200	1800	1750	1700	1650	1250	700	500	450	400
BN 432	600	1000	1100	2000	3000	7000	11000	12000	10000	9000	850	800	750	700
BN 433	400	600	700	1000	1200	2000	2100	2100	2000	2900	2700	2500	2400	2200
BN 434	1100	600	600	1800	2000	2100	2200	2300	2150	2050	2000	1800	1700	1600
BN 435	1600	2500	2900	2950	3000	4000	5000	7000	9000	9500	10000	11000	12000	13000
BN 436	3000	3000	2400	2000	1900	1800	1750	1850	1900	9500	10000	10500	10600	10700

BN 437	4500	8000	10000	12000	13000	17000	18000	20000	21000	22000	21500	20900	20000	19000
BN 438	2000	2200	2400	3000	3700	6500	7000	8000	7500	7000	6500	6000	5000	4000
BN 439	1000	1800	2200	3000	3500	4000	4500	4600	4400	4100	2500	2400	2000	1600
BN 440	5000	5500	6000	6200	6800	10000	11000	11500	9000	8000	7500	7000	4000	3500
BN 441	10500	10600	10650	2000	2500	3000	3500	5000	4700	4600	3500	3000	2800	2500
BN 442	900	1300	1600	2800	3500	4000	6000	6500	6300	6100	2700	2400	2100	1800
BN 443	600	500	550	800	1000	1200	1600	1800	1900	2000	2100	2200	2300	2400
BN 444	2800	3800	4100	10000	12000	13000	18000	20000	21000	22000	28000	30000	31000	33000
BN 445	2000	1200	1000	1400	1800	2400	3000	3100	4000	5000	6000	6500	7000	7500
BN 446	1300	1800	1900	2100	2200	2700	3000	3100	2300	2000	1950	1900	1860	1800
BN 447	400	700	750	1600	2000	2600	3500	3800	4000	4000	3950	3900	3800	3500
BN 448	900	1200	1400	2100	2200	2300	2800	3000	2950	2900	2850	2800	1700	1500
BN 449	1400	2000	2900	4000	5000	6000	9000	10000	9500	9000	7000	6000	4500	4000
BN 450	3500	2500	2400	3000	4000	4500	5000	6000	6100	6000	5500	5000	3000	2800
BN 451	10800	1000	1500	2000	3000	4000	6000	6100	6050	5900	5700	4000	3500	3000
BN 452	700	1300	1800	2800	3000	3100	4000	4050	4020	3950	3900	2800	2500	2100
BN 453	450	900	1050	1400	1500	1800	2000	2200	2100	2000	1950	1900	1800	1700
BN 454	280	500	700	1300	1800	2200	2100	2000	1950	1920	1800	1700	1200	1100
BN 455	400	550	600	500	480	400	430	450	400	360	300	250	200	190
BN 456	1500	1400	1350	1800	2600	3500	4000	4000	3000	2500	2000	1500	1400	1200
BN 457	1800	2700	3000	3100	3100	2800	2900	3600	3800	4000	4500	5000	5500	6000
BN 458	3000	4000	4100	3000	2900	3200	4000	4500	5000	8000	9000	10000	11000	12000
BN 459	1200	2000	2600	1900	1800	2000	2200	2100	1100	800	750	700	300	250

BN 460	7000	1000 0	9000	3000	3100	2700	2500	2000	1800	1100	800	700	600	500
BN 461	2000	2400	2500	1700	1100	600	500	450	400	350	300	280	200	150
BN 462	1800	2100	2150	2000	1900	1800	1300	1050	500	180	120	110	105	100
BN 463	1200	2000	2600	4000	4200	4000	3500	3000	2200	1800	1600	1500	1300	1200
BN 464	5000	6000	6500	7000	9000	1100 0	1200 0	1200 0	1150 0	1120 0	1100 0	8000	7000	6000
BN 465	3000	4000	4500	4000	2500	1800	2100	2800	3000	3500	4000	4500	5000	5500
BN 466	2000	3000	3500	2500	2200	2600	2100	2150	1800	1300	1100	800	700	600
BN 467	3500	4200	5000	1100 0	1400 0	1800 0	1700 0	8000	4500	4000	3000	2000	1100	1000
BN 468	900	1000	1100	1200	1700	2000	2100	2050	2000	1300	1200	1100	700	600
BN 469	1400	1300	1000	220	170	120	130	135	140	250	280	320	360	380
BN 470	1900	2100	2200	300	50	30	20	10	9	8	7	4	3	2
BN 471	350	500	600	1000	1200	2000	3000	3200	3100	3000	1800	1500	1450	1400
BN 472	500	1000	1300	2000	2500	3000	4000	4500	5000	5500	6000	8000	9000	1000 0
BN 473	1100 0	1200 0	1300 0	1800 0	2000 0	1600 0	1000 0	5000	3000	2000	1500	1300	1200	1100
BN 474	1300	900	800	1200	2400	3500	4500	5000	5500	5300	5100	5000	2000	1700
BN 475	400	500	700	1000	1400	2300	3500	4000	4200	4500	4600	4000	3800	3600
BN 476	2400	2850	2500	3000	4000	7000	1000 0	1100 0	1150 0	1090 0	900	700	600	500
BN 477	800	700	750	2000	2500	4000	4500	5000	6000	6500	6200	6100	5900	4000
BN 478	750	1000	1100	1400	1900	3000	5000	6000	7000	8000	8500 8	8200	8000	7700
BN 479	1000	800	750	2600	2100	3100	4000	5600	5500	5100	5200	4800	4600	4000
BN 480	3000	2600	2400	3100	3500	4000	4500	5000	5500	6000	6100	5900	5800	5700
BN 481	2000	2200	2400	3000	3500	4000	4500	5000	7000	7200	6200	5500	5400	5000
BN 482	250	350	500	1100	1600	2500	3000	4000	4500	5000	5500	5300	5200	5000

BN 483	1000	1300	2000	3000	3500	4000	5000	7000	7500	7000	6600	6400	6200	6000
BN 484	1800	2200	2300	4000	5000	1000 0	1100 0	1200 0	1300 0	1280 0	1240 0	1200 0	1180 0	1100 0
BN 485	700	800	900	2000	3000	4000	5000	7000	8000	9000	1000 0	1100 0	1200 0	1300 0
BN 486	2000	1700	1800	1600	3000	4000	4500	5000	5500	6000	5800	5600	5200	4000
BN 487	100	300	350	800	1100	2000	3000	3500	4000	4200	4500	5000	5200	5400
BN 488	3000	3500	3800	5000	6000	8000	8500	8600	8400	8200	8000	7500	7200	7000
BN 489	130	210	400	900	1300	1900	3000	3500	4000	4500	5000	5500	6000	6500
BN 490	1200	1100	900	1300	1700	3000	4000	5000	6000	7000	7500	8000	8200	8300
BN 491	1100	1200	1300	1400	2500	4000	5500	6000	6500	6200	5000	5500	5200	4800
BN 492	600	700	800	1400	2000	3000	5600	5500	6000	6500	6600	6400	6200	5900
BN 493	1000	1100 0	1000	1100	1400	2000	2500	2800	3000	3500	3800	4000	4500	5000
BN 494	1200	2000	2100	1900	1800	1700	1950	2200	2500	2800	3000	3600	3800	4000
BN 495	2000	2100	1950	3100	3500	4500	5600	4200	4000	3800	3600	3400	3000	2800
BN 496	400	450	500	1100	1800	3000	4000	4500	5000	5500	5200	4800	4400	4000
BN 497	2500 0	2500 0	2600 0	4000 0	5000 0	7000 0	8000 0	7900 0	7500 0	7200 0	6500 0	5000 0	4500 0	4000 0
BN 498	420	470	2000	3500	3800	4900	5100	4700	5200	6000	6200	5800	5500	5000
BN 499	1700 0	1600 0	1500 0	2300 0	3000 0	4000 0	5000 0	6000 0	6500 0	7000 0	8000 0	8500 0	9000 0	9500 0
BN 500	1000 0	1400 0	1600 0	4000 0	5000 0	7000 0	7500 0	7600 0	7400 0	7300 0	7000 0	6900 0	6700 0	6600 0
IS 501	100	9	8	25	40	70	100	105	120	125	200	250	300	350
IS 502	190	200	250	700	1000	1100	1100	1050	1000	950	700	650	200	140
IS 503	800	700	400	150	140	130	135	140	200	250	300	350	400	450
IS 504	400	200	40	25	40	70	80	75	60	55	50	30	25	20
IS 505	450	350	180	16	18	28	40	70	80	100	120	140	160	200
IS 506	100	45	14	16	20	35	50	55	75	80	100	110	120	130

IS 507	300	400	700	1000	960	800	500	70	8	9	9	11	12	13
IS 508	1900	105	14	11	12	90	85	80	75	80	85	90	95	96
IS 509	2500	2600	2650	2700	2750	2900	2800	2760	2740	2720	2680	2660	2400	2300
IS 510	1000	450	350	500	600	1300	1350	1400	1450	1420	1360	1340	1300	1250
IS 511	55	100	130	300	400	410	500	420	400	380	340	300	120	100
IS 512	170	100	45	10	11	9	6	5	4	5	5.5	6	6.5	7
IS 513	950	1000	1050	1100	800	600	300	120	100	80	50	35	30	25
IS 514	8	6	7	11	19	30	40	50	60	65	70	75	80	85
IS 515	10	14	20	40	60	65	60	30	12	11	6	4	3	2
IS 516	11	12	13	40	50	70	80	90	100	105	110	115	17	18
NS 517	2700	5000	5500	4000	2000	1100	900	500	300	200	40	35	30	20
NS 518	450	510	510	190	11	8	9	12	13	16	17	20	25	30
NS 519	1200	1250	1150	1600	2100	3000	3400	3500	3300	2900	2700	1700	1600	1500
NS 520	4200	3000	2200	3000	3200	3300	3250	2500	2400	3100	3300	3800	4000	4500
NS 521	1500	1800	1100	800	1000	2000	2500	2800	3000	4000	5000	5500	6000	6500
NS 522	130	100	80	30	40	50	55	60	70	80	100	105	108	110
NS 523	250	260	2700	97	40	75	100	110	210	250	250	280	290	300
NS 524	700	1200	1250	900	400	250	90	85	100	110	130	140	150	160
NS 525	300	500	700	1800	3000	3500	4000	5000	5200	5100	5050	5000	4900	4980
NS 526	4020	20	9	8	10	12	13	15	18	20	22	25	30	35
NS 527	2000	5000	5500	4000	2000	1800	700	650	680	700	750	1000	1100	1200
NS 528	300	100	18	12	13	20	24	30	40	50	60	80	85	90
NS 529	1000	200	180	300	280	270	100	80	20	22	18	17	18	19
NS 530	100	40	12	8	13	20	30	40	45	50	55	60	65	70
NS 531	3800	5000	5200	7000	8000	9000	8900	8500	7000	6500	6300	6000	3500	3000

NS 532	5000	4900	4000	2500	2400	2000	1200	700	100	30	15	12	8	6
NS 533	90	80	70	30	40	80	100	130	150	180	300	320	340	360
NS 534	450	400	380	100	70	45	40	35	30	20	13	11	10	8
NS 535	650	1100	1600	1800	1400	700	650	800	1000	1100	1300	1400	1500	1600
NS 536	4000	5000	4800	4600	4400	4000	1100	400	200	100	98	-	-	-
NS 537	300	400	500	1100	1050	900	500	230	170	90	40	35	-	-
NS 538	700	1000	1100	1800	2000	2100	1850	1750	1400	1200	1050	950	800	750
NS 539	600	700	750	300	70	50	52	52	45	40	35	25	20	15
NS 540	300	150	170	700	900	1000	1500	1550	1450	1200	1100	1000	950	900
NS 541	200	220	230	95	70	80	105	110	140	170	200	220	250	280
NS 542	3800	4000	3000	1000	350	200	180	190	195	200	230	240	280	300
NS 543	500	700	800	600	450	460	600	620	610	605	600	590	570	
OG 544	1200	1500	1050	1000	450	160	90	95	100	120	140	160	190	200
OG 545	650	110	150	400	600	800	850	840	830	700	650	400	250	200
OG 546	3500	4000	4500	3000	1900	1600	1700	2100	2200	2700	2800	2900	3000	4000
OG 547	1500	2500	3500	8000	8500	7000	5500	3000	1500	1300	1100	1000	950	900
OG 548	1700	1600	1100	600	200	150	160	170	180	200	250	300	350	400
OG 549	900	950	950	1200	1500	1300	1000	800	800	850	1000	1050	1200	1250
OG 550	500	600	1000	1900	2000	2100	2000	1200	1000	500	450	200	150	120
OG 551	400	300	295	500	800	1300	2000	2200	2500	3000	3100	3500	4000	4500
OG 552	350	450	470	510	600	700	650	380	350	320	300	280	260	200
OG 553	2400	3000	3500	5000	4900	2800	1300	700	400	350	300	270	260	250
OG 554	800	1200	1400	2000	2100	2500	3500	5000	5500	6000	6500	7000	7500	8000

OG 555	4500	5000	5500	2000	2100	3500	4000	4500	5000	5500	6000	6500	7000	7500
OG 556	4000	3800	3600	3200	4000	5000	6500	7000	7500	8000	8500	9000	9600	9700
OG 557	300	460	480	1000	1200	2000	2100	2050	1950	1800	1750	1700	1650	1600
OG 558	1900	2000	1800	1700	1850	3000	3100	3200	3050	3000	2100	1800	1750	1700
OG 559	4500	7000	1100 0	1200 0	1250 0	1000 0	7000	6500	6000	5500	5000	2000	1800	1000
OG 560	2800	3500	3600	4000	3000	2800	2700	2500	2400	2300	2200	2100	2000	1800
OG 561	3000	2200	2100	3000	3100	3000	1400	700	400	300	280	290	300	310
OG 562	2000	2100	1800	1100	1200	1250	1260	1000	850	800	500	550	450	400
OG 563	800	1000	1050	1300	1900	2500	3000	3100	3200	2900	2700	2000	1800	1500
OG 564	1600	2500	3200	5000	4900	3000	1000	700	710	730	760	780	790	800
OG 565	1000	1500 0	2000 0	3500 0	7000 0	8000 0	5000 0	3500 0	2500 0	2000 0	1900 0	1800 0	1600 0	1500 0
OG 566	1500	1200	700	19	16	14	20	25	30	35	40	45	50	60
OG 567	280	100	25	11	14	20	28	40	50	55	60	70	75	80
OG 568	1000	2000	2200	7000	9000	1000 0	1000 0	9500	6000	6500	5000	2500	1700	1200
OG 569	250	100	40	20	28	30	50	51	40	35	30	25	20	18

C: Results of Aquifer Hydraulic parameter in the study area

VES No.	Aquifer Depth	Aquifer Thickness (m)	Aquifer Resistivity ρ (Ωm)	Aquifer Conductivity $\sigma = \rho^{-1}$ (Sm^{-1})	Transverse Resistance $R = h\rho$ (Ωm^2)	Longitudinal Conductance $C = h\rho^{-1}$ (Ω^{-1})	Hydraulic Conductivity from Pumping Test K (m/day)	Diagnostic Constant $K\sigma$	Average Diagnostic Constant $K\sigma(\text{ave})$	Transmissivity $T = Kh$ (m^2/day)	Storage $S = 1.3h/106$	Diffusivity $D = TS^{-1}$ (m^2/day)	Hydraulic Conductivity from N&S Model (K_{NSM}) $KNS = K\sigma\rho$	Hydraulic Conductivity from New Model (K_{NM})	Hydraulic Conductivity from Heigold Model (K_{HM}) $H = 386.40\sigma - 0.93283$
AJ 01	89.3	46.7	2780	0.0004	129826.00	0.0168	-	-	-	238.17	0.00006	3923076.92	9.04	4.80	0.24
AJ 02	115	52	38.6	0.0259	2007.20	1.3472	-	-	-	265.2	0.00007	3923076.92	0.13	6.64	12.79
AJ 03	142	30	1330	0.0008	39900.00	0.0226	-	-	-	153	0.00004	3923076.92	4.32	5.08	0.47
AJ 04	174	61	8700	0.0001	530700.00	0.0070	-	-	-	311.1	0.00008	3923076.92	28.28	4.40	0.08
AJ 05	89.2	48.8	303	0.0033	14786.40	0.1611	-	-	-	248.88	0.00006	3923076.92	0.99	5.68	1.87
AJ 06	148	46	97	0.0103	4462.00	0.4742	-	-	-	234.6	0.00006	3923076.92	0.32	6.19	5.42
AJ 07	126	66	13.5	0.0741	891.00	4.8889	-	-	-	336.6	0.00009	3923076.92	0.04	7.19	34.09
AJ 08	163	29	9600	0.0001	278400.00	0.0030	-	-	-	147.9	0.00004	3923076.92	31.21	4.37	0.07
AJ 09	162	35	2480	0.0004	86800.00	0.0141	-	-	-	178.5	0.00005	3923076.92	8.06	4.84	0.26
AJ 10	71.6	71.4	1150	0.0009	82110.00	0.0621	-	-	-	364.14	0.00009	3923076.92	3.74	5.13	0.54
AJ 11	47	40	1630	0.0006	65200.00	0.0245	-	-	-	204	0.00005	3923076.92	5.30	5.00	0.39
AJ 12	16.7	10.9	1520	0.0007	16568.00	0.0072	-	-	-	55.59	0.00001	3923076.92	4.94	5.02	0.42
AJ 13	109	19	2670	0.0004	50730.00	0.0071	-	-	-	96.9	0.00002	3923076.92	8.68	4.81	0.25
AJ 14	154	45	2620	0.0004	117900.00	0.0172	-	-	-	229.5	0.00006	3923076.92	8.52	4.82	0.25
AJ 15	49.2	23.2	37.4	0.0267	867.68	0.6203	-	-	-	118.32	0.00003	3923076.92	0.12	6.66	13.18
AJ 16	109	11.1	2080	0.0005	23088.00	0.0053	4.9	0.0024	0.0033	56.61	0.00001	3923076.92	6.76	4.91	0.31
AJ 17	129	32.5	168	0.0060	5460.00	0.1935	-	-	-	165.75	0.00004	3923076.92	0.55	5.94	3.24
AJ 18	188	50	49.4	0.0202	2470.00	1.0121	-	-	-	255	0.00007	3923076.92	0.16	6.52	10.16
AJ 19	136	33	34	0.0294	1122.00	0.9706	-	-	-	168.3	0.00004	3923076.92	0.11	6.71	14.40

AJ 20	89.6	34.6	2700	0.0004	93420.00	0.0128	-	-	-	176.46	0.00004	3923076.92	8.78	4.81	0.24
AJ 21	154	45	1250	0.0008	56250.00	0.0360	-	-	-	229.5	0.00006	3923076.92	4.06	5.10	0.50
AJ 22	47	18.2	638	0.0016	11611.60	0.0285	-	-	-	92.82	0.00002	3923076.92	2.07	5.37	0.93
AJ 23	73.1	26.1	59.5	0.0168	1552.95	0.4387	-	-	-	133.11	0.00003	3923076.92	0.19	6.43	8.55
AJ 24	82.2	39.5	840	0.0012	33180.00	0.0470	-	-	-	201.45	0.00005	3923076.92	2.73	5.26	0.72
AJ 25	69.1	35.4	14	0.0714	495.60	2.5286	-	-	-	180.54	0.00005	3923076.92	0.05	7.17	32.95
AJ 26	80.9	27.5	1230	0.0008	33825.00	0.0224	5.1	0.0041	-	140.25	0.00004	3923076.92	4.00	5.11	0.51
AJ 27	98.9	22.8	635	0.0016	14478.00	0.0359	-	-	-	18.924	0.00003	638461.54	2.06	5.37	0.94
AJ 28	262	48	2440	0.0004	117120.00	0.0197	-	-	-	39.84	0.00006	638461.54	7.93	4.85	0.27
AJ 29	263	51	75	0.0133	3825.00	0.6800	-	-	-	42.33	0.00007	638461.54	0.24	6.31	6.89
AJ 30	253	51	3440	0.0003	175440.00	0.0148	-	-	-	42.33	0.00007	638461.54	11.18	4.72	0.19
AJ 31	231	49	1520	0.0007	74480.00	0.0322	-	-	-	40.67	0.00006	638461.54	4.94	5.02	0.42
AJ 32	152	37	212	0.0047	7844.00	0.1745	-	-	-	30.71	0.00005	638461.54	0.69	5.84	2.61
AJ 33	91.4	25.1	49.4	0.0202	1239.94	0.5081	-	-	-	20.833	0.00003	638461.54	0.16	6.52	10.16
AJ 34	53.3	20.8	238	0.0042	4950.40	0.0874	-	-	-	17.264	0.00003	638461.54	0.77	5.78	2.34
AJ 35	122	34.8	1200	0.0008	2074.08	0.5839	5.3	0.0044	-	28.884	0.00005	638461.54	0.19	6.43	8.53
AJ 36	79	44.6	108	0.0093	4816.80	0.4130	-	-	-	37.018	0.00006	638461.54	0.35	6.14	4.90
AJ 37	94.2	41.8	75	0.0133	3135.00	0.5573	-	-	-	34.694	0.00005	638461.54	0.24	6.31	6.89
AJ 38	100	78.3	296	0.0034	23176.80	0.2645	-	-	-	64.989	0.00010	638461.54	0.96	5.69	1.91
AJ 39	146	111.2	1420	0.0007	157904.00	0.0783	-	-	-	92.296	0.00014	638461.54	4.62	5.05	0.44
AM 40	184	46	3690	0.0003	169740.00	0.0125	-	-	-	310.04	0.00006	5184615.39	49.61	1.45	0.18
AM 41	83.5	25.5	3560	0.0003	90780.00	0.0072	-	-	-	171.87	0.00003	5184615.39	47.86	1.52	0.19
AM 42	187	56	1330	0.0008	74480.00	0.0421	-	-	-	377.44	0.00007	5184615.39	17.88	4.79	0.47
AM 43	153	46	1400	0.0007	262200.00	0.0081	-	-	-	310.04	0.00006	5184615.39	18.82	4.51	0.12
AM 44	175	50	1700	0.0006	235000.00	0.0106	-	-	-	337	0.00007	5184615.39	22.86	3.59	0.15
AM 45	160	49	1230	0.0008	259700.00	0.0092	-	-	-	330.26	0.00006	5184615.39	16.54	5.24	0.13

AM 46	184	43	2700	0.0004	116100.00	0.0159	-	-	-	289.82	0.00006	5184615.39	36.30	2.09	0.24
AM 47	55.3	26.3	2500	0.0004	231440.00	0.0030	-	-	-	177.262	0.00003	5184615.39	33.61	2.29	0.08
AM 48	155	37	1490	0.0007	55130.00	0.0248	-	-	-	249.38	0.00005	5184615.39	20.03	4.19	0.42
AM 49	43.3	92.7	1211	0.0008	362549.70	0.0237	-	-	-	624.798	0.00012	5184615.39	16.28	5.34	0.17
AM 50	219	50	2200	0.0005	110000.00	0.0227	-	-	-	337	0.00007	5184615.39	29.58	2.66	0.29
AM 51	81.5	46.5	1410	0.0007	298065.00	0.0073	-	-	-	313.41	0.00006	5184615.39	18.96	4.47	0.11
AM 52	39.8	32.9	1234	0.0008	7698.60	0.1406	-	-	-	221.746	0.00004	5184615.39	16.59	5.22	2.38
AM 53	53.3	31.5	1263	0.0008	8253.00	0.1202	-	-	-	212.31	0.00004	5184615.39	16.98	5.08	2.14
AM 54	43.4	18.1	1290	0.0008	23349.00	0.0140	-	-	-	121.994	0.00002	5184615.39	17.34	4.96	0.48
AM 55	52.8	66.2	1215	0.0008	1423.30	3.0791	-	-	-	446.188	0.00009	5184615.39	16.34	5.32	22.09
AM 56	26.1	14.9	1600	0.0006	23840.00	0.0093	-	-	-	100.426	0.00002	5184615.39	21.51	3.86	0.40
AM 57	93.9	41.1	2790	0.0004	114669.00	0.0147	-	-	-	277.014	0.00005	5184615.39	37.51	2.02	0.24
AM 58	111	24	2410	0.0004	5784.00	0.0996	-	-	-	161.76	0.00003	5184615.39	32.40	2.39	2.32
AM 59	131	48	1626	0.0006	30048.00	0.0767	-	-	-	323.52	0.00006	5184615.39	21.86	3.79	0.95
AM 60	110	42	1393	0.0007	1659.00	1.0633	-	-	-	283.08	0.00005	5184615.39	18.73	4.53	12.52
AM 61	126	41	1270	0.0008	52070.00	0.0323	-	-	-	276.34	0.00005	5184615.39	17.07	5.05	0.49
AM 62	59.7	21.5	1390	0.0007	29885.00	0.0155	-	-	-	144.91	0.00003	5184615.39	18.69	4.55	0.45
AM 63	98.3	32.7	1396	0.0007	1294.92	0.8258	-	-	-	220.398	0.00004	5184615.39	18.77	4.52	12.49
AM 64	90.2	30.8	1283	0.0008	8716.40	0.1088	-	-	-	207.592	0.00004	5184615.39	17.25	4.99	1.99
AM 65	133	34	1220	0.0008	414.80	2.7869	-	-	-	229.16	0.00004	5184615.39	16.40	5.29	37.47
AM 66	72.5	38.5	2300	0.0004	88550.00	0.0167	-	-	-	259.49	0.00005	5184615.39	30.92	2.53	0.28
AM 67	75.5	40.5	800	0.0013	32400.00	0.0506	-	-	-	272.97	0.00005	5184615.39	10.76	8.66	0.76
AM 68	76.3	48	1746	0.0006	7008.00	0.3288	-	-	-	323.52	0.00006	5184615.39	23.47	3.48	3.70
AM 69	143	53	1136	0.0009	7208.00	0.3897	-	-	-	357.22	0.00007	5184615.39	15.27	5.75	3.95
AM 70	109	37	1430	0.0007	2334.70	0.5864	-	-	-	249.38	0.00005	5184615.39	19.23	4.40	8.09
AM 71	132	62	1420	0.0007	88040.00	0.0437	-	-	-	417.88	0.00008	5184615.39	19.09	4.43	0.44

AM 72	89.5	31	1450	0.0007	44950.00	0.0214	-	-	-	208.94	0.00004	5184615.39	19.50	4.33	0.43
AM 73	123	119	1940	0.0005	23087.19	0.6134	5.83	0.0030	0.0021	802.06	0.00015	5184615.39	26.08	3.08	2.84
AM 74	44.8	16.7	1670	0.0006	27889.00	0.0100	-	-	-	112.558	0.00002	5184615.39	22.45	3.67	0.38
AM 75	65.7	31	1160	0.0009	35960.00	0.0267	-	-	-	208.94	0.00004	5184615.39	15.60	5.61	0.54
AM 76	106	19.7	2530	0.0004	49841.00	0.0078	-	-	-	132.778	0.00003	5184615.39	34.02	2.26	0.26
AM 77	174	55	1020	0.0010	56100.00	0.0539	-	-	-	370.7	0.00007	5184615.39	13.71	6.52	0.60
AM 78	55.6	16.7	1010	0.0010	16867.00	0.0165	-	-	-	112.558	0.00002	5184615.39	13.58	6.60	0.61
AM 79	59.5	7.1	1177	0.0008	1256.70	0.0401	-	-	-	47.854	0.00001	5184615.39	15.82	5.52	3.09
AM 80	77.4	40.1	880	0.0011	35288.00	0.0456	-	-	-	270.274	0.00005	5184615.39	11.83	7.75	0.69
AM 81	112	34	1550	0.0006	5270.00	0.2194	-	-	-	229.16	0.00004	5184615.39	20.84	4.00	3.50
AM 82	64.8	11.9	2100	0.0005	24990.00	0.0057	-	-	-	80.206	0.00002	5184615.39	28.23	2.81	0.31
AM 83	132	31	1880	0.0005	5828.00	0.1649	-	-	-	208.94	0.00004	5184615.39	25.28	3.20	2.92
AM 84	113	16.5	2270	0.0004	37455.00	0.0073	-	-	-	111.21	0.00002	5184615.39	30.52	2.56	0.29
AM85	96.2	21.1	2700	0.0004	56970.00	0.0078	-	-	-	142.214	0.00003	5184615.39	36.30	2.09	0.24
AM 86	44.1	21.2	1720	0.0006	36464.00	0.0123	-	-	-	142.888	0.00003	5184615.39	23.13	3.54	0.37
AM 87	37.2	13.1	2820	0.0004	36942.00	0.0046	-	-	-	88.294	0.00002	5184615.39	37.91	1.99	0.23
AM 88	143	37	2010	0.0005	74370.00	0.0184	-	-	-	249.38	0.00005	5184615.39	27.02	2.96	0.32
AM 89	154	56	2400	0.0004	13440.00	0.2333	-	-	-	377.44	0.00007	5184615.39	32.27	2.40	2.33
AM 90	37.9	15.9	1740	0.0006	27666.00	0.0091	-	-	-	107.166	0.00002	5184615.39	23.39	3.50	0.37
AM 91	75.3	17.7	1260	0.0008	22302.00	0.0140	4.53	0.0036		80.181	0.00002	3484615.39	16.94	5.10	0.50
AM 92	65.9	26.4	2340	0.0004	61776.00	0.0113	-	-	-	119.592	0.00003	3484615.39	31.46	2.48	0.28
AM 93	41.5	39.4	1850	0.0005	72890.00	0.0213	-	-	-	178.482	0.00005	3484615.39	24.87	3.26	0.35
AM 94	56.1	27	2390	0.0004	64530.00	0.0113	-	-	-	122.31	0.00004	3484615.39	32.13	2.41	0.27
AM 95	98	45.3	1320	0.0008	5979.60	0.3432	-	-	-	205.209	0.00006	3484615.39	17.75	4.83	4.06
AM 96	75.7	21.7	1773	0.0006	38474.10	0.0122	-	-	-	98.301	0.00003	3484615.39	23.84	3.42	0.36
AM 97	68	28.9	1720	0.0006	49708.00	0.0168	-	-	-	130.917	0.00004	3484615.39	23.13	3.54	0.37

AM 98	151	33	2620	0.0004	86460.00	0.0126	-	-	-	149.49	0.00004	3484615.39	35.23	2.17	0.25
AM 99	245	50	1800	0.0006	340000.00	0.0074	-	-	-	226.5	0.00007	3484615.39	24.20	3.36	0.10
AM 100	81	29	1190	0.0008	34510.00	0.0244	-	-	-	131.37	0.00004	3484615.39	16.00	5.45	0.52
AM 101	147	41	1670	0.0006	150470.00	0.0112	-	-	-	185.73	0.00005	3484615.39	22.45	3.67	0.18
AM 102	123	10	1682	0.0006	6820.00	0.0147	-	-	-	45.3	0.00001	3484615.39	22.61	3.64	0.88
AM 103	70	8.8	1220	0.0008	10736.00	0.0072	-	-	-	39.864	0.00001	3484615.39	16.40	5.29	0.51
AM 104	50	32	1784	0.0006	57088.00	0.0179	-	-	-	144.96	0.00004	3484615.39	23.99	3.40	0.36
AM 105	80.7	14.7	2740	0.0004	40278.00	0.0054	-	-	-	66.591	0.00002	3484615.39	36.84	2.06	0.24
AM 106	68.4	13.5	2880	0.0003	3888.00	0.0469	-	-	-	61.155	0.00002	3484615.39	38.72	1.94	1.96
AM 107	149	52.9	1460	0.0007	77234.00	0.0362	-	-	-	239.637	0.00007	3484615.39	19.63	4.29	0.43
AM 108	176	48	1690	0.0006	81120.00	0.0284	-	-	-	217.44	0.00006	3484615.39	22.72	3.62	0.38
AM 109	156	42	1720	0.0006	72240.00	0.0244	-	-	-	190.26	0.00005	3484615.39	23.13	3.54	0.37
AM 110	153	106	1630	0.0006	172780.00	0.0650	-	-	-	480.18	0.00014	3484615.39	21.92	3.77	0.39
AM 111	108	83.8	1040	0.0010	87152.00	0.0806	-	-	-	379.614	0.00011	3484615.39	13.98	6.38	0.59
AM 112	57.8	19.8	1491	0.0007	9721.80	0.0403	-	-	-	89.694	0.00003	3484615.39	20.05	4.19	1.19
AM 113	143	87	1316	0.0008	27492.00	0.2753	-	-	-	394.11	0.00011	3484615.39	17.69	4.85	1.80
AM 114	30.5	20.9	1594	0.0006	12414.60	0.0352	-	-	-	94.677	0.00003	3484615.39	21.43	3.87	1.00
AM 115	143	36.5	1316	0.0008	11534.00	0.1155	-	-	-	165.345	0.00005	3484615.39	17.69	4.85	1.80
AM 116	246	42	2660	0.0004	111720.00	0.0158	-	-	-	190.26	0.00005	3484615.39	35.76	2.13	0.25
AM 117	277	49	4040	0.0002	197960.00	0.0121	-	-	-	221.97	0.00006	3484615.39	54.32	1.31	0.17
AM 118	224	46	2940	0.0003	135240.00	0.0156	-	-	-	208.38	0.00006	3484615.39	39.53	1.90	0.22
AM 119	149	52	2130	0.0005	110760.00	0.0244	-	-	-	235.56	0.00007	3484615.39	28.64	2.76	0.30
AM 120	201	46	3310	0.0003	152260.00	0.0139	-	-	-	208.38	0.00006	3484615.39	44.50	1.65	0.20
AM 121	261	49	4370	0.0002	214130.00	0.0112	-	-	-	221.97	0.00006	3484615.39	58.75	1.19	0.16

AM 122	155	32	3480	0.0003	111360.00	0.0092	-	-	-	144.96	0.00004	3484615.39	46.79	1.56	0.19
AM 123	210	49	1880	0.0005	92120.00	0.0261	3.2	0.0017	-	156.8	0.00006	2461538.46	25.28	3.20	0.34
AM 124	125	79	2656	0.0004	209824.00	0.0297	-	-	-	252.8	0.00010	2461538.46	35.71	2.14	0.25
AM 125	32	26	2462	0.0004	64012.00	0.0106	-	-	-	83.2	0.00003	2461538.46	33.10	2.33	0.27
AM 126	115	101	2536	0.0004	256136.00	0.0398	-	-	-	323.2	0.00013	2461538.46	34.10	2.25	0.26
AM 127	232	103	1090	0.0009	112270.00	0.0945	-	-	-	329.6	0.00013	2461538.46	14.65	6.04	0.57
AM 128	71	19.8	2600	0.0004	51480.00	0.0076	-	-	-	63.36	0.00003	2461538.46	34.96	2.19	0.25
AM 129	67	22.3	1241	0.0008	5374.30	0.0925	-	-	-	71.36	0.00003	2461538.46	16.69	5.19	2.32
AM 130	18.1	14.7	3870	0.0003	56889.00	0.0038	-	-	-	47.04	0.00002	2461538.46	52.03	1.38	0.17
AM 131	230	102	3150	0.0003	321300.00	0.0324	-	-	-	326.4	0.00013	2461538.46	42.35	1.75	0.21
AM 132	140	49.9	4690	0.0002	234031.00	0.0106	-	-	-	159.68	0.00006	2461538.46	63.06	1.10	0.15
AM 133	188	50	1230	0.0008	61500.00	0.0407	-	-	-	160	0.00007	2461538.46	16.54	5.24	0.51
AM 134	102	80	3425	0.0003	274000.00	0.0234	-	-	-	256	0.00010	2461538.46	46.05	1.59	0.19
AM 135	105	100.8	2234	0.0004	225187.20	0.0451	-	-	-	322.56	0.00013	2461538.46	30.04	2.61	0.29
AM 136	135	27	1430	0.0007	38610.00	0.0189	-	-	-	86.4	0.00004	2461538.46	19.23	4.40	0.44
AM 137	75	66	3564	0.0003	235224.00	0.0185	-	-	-	211.2	0.00009	2461538.46	47.92	1.51	0.19
AM 138	50	41	1456	0.0007	59696.00	0.0282	-	-	-	131.2	0.00005	2461538.46	19.58	4.31	0.43
AM 139	153	20	1640	0.0006	32800.00	0.0122	-	-	-	64	0.00003	2461538.46	22.05	3.75	0.39
AM 140	124	14	2400	0.0004	33600.00	0.0058	-	-	-	44.8	0.00002	2461538.46	32.27	2.40	0.27
AM 141	92.1	16.9	2000	0.0005	33800.00	0.0085	-	-	-	54.08	0.00002	2461538.46	26.89	2.97	0.32
AM 142	33	25.3	1520	0.0007	38456.00	0.0166	-	-	-	80.96	0.00003	2461538.46	20.44	4.10	0.42
AM 143	91	31.8	3290	0.0003	104622.00	0.0097	-	-	-	101.76	0.00004	2461538.46	44.23	1.66	0.20
AM 144	103	33	1790	0.0006	59070.00	0.0184	-	-	-	105.6	0.00004	2461538.46	24.07	3.38	0.36
AM 145	171	55	2690	0.0004	147950.00	0.0204	-	-	-	176	0.00007	2461538.46	36.17	2.10	0.24

AM 146	211	47	3810	0.0003	179070.00	0.0123	-	-	-	150.4	0.00006	2461538.46	51.22	1.40	0.18
AM 147	262	24	1530	0.0007	132720.00	0.0043	-	-	-	76.8	0.00003	2461538.46	20.57	4.06	0.12
AM 148	59.8	12.7	1790	0.0006	22733.00	0.0071	-	-	-	40.64	0.00002	2461538.46	24.07	3.38	0.36
AM 149	231	46	1610	0.0006	304060.00	0.0070	-	-	-	147.2	0.00006	2461538.46	21.65	3.83	0.11
AM 150	253	51	1800	0.0006	408000.00	0.0064	-	-	-	163.2	0.00007	2461538.46	24.20	3.36	0.09
AM 151	248	47	2770	0.0004	130190.00	0.0170	-	-	-	150.4	0.00006	2461538.46	37.24	2.03	0.24
AM 152	147	34	1540	0.0006	52360.00	0.0221	-	-	-	108.8	0.00004	2461538.46	20.71	4.03	0.41
AM 153	112	27	1130	0.0009	30510.00	0.0239	-	-	-	86.4	0.00004	2461538.46	15.19	5.79	0.55
AM 154	218	47	1560	0.0006	73320.00	0.0301	-	-	-	150.4	0.00006	2461538.46	20.97	3.97	0.41
AM 155	118	103	2098	0.0005	216094.00	0.0491	-	-	-	329.6	0.00013	2461538.46	28.21	2.81	0.31
AM 156	115	90	1542	0.0006	138780.00	0.0584	-	-	-	288	0.00012	2461538.46	20.73	4.03	0.41
AM 157	129	49.6	1275	0.0008	13640.00	0.1804	-	-	-	158.72	0.00006	2461538.46	17.14	5.03	2.05
AM 158	80	70	1756	0.0006	122920.00	0.0399	-	-	-	224	0.00009	2461538.46	23.61	3.46	0.36
AM 159	86	66	2156	0.0005	142296.00	0.0306	-	-	-	211.2	0.00009	2461538.46	28.99	2.72	0.30
AM 160	65	56	4258	0.0002	238448.00	0.0132	-	-	-	179.2	0.00007	2461538.46	57.25	1.23	0.16
AM 161	55	48.2	1712	0.0006	343569.60	0.0068	-	-	-	154.24	0.00006	2461538.46	23.02	3.56	0.10
AM 162	162	45	5060	0.0002	227700.00	0.0089	-	-	-	144	0.00006	2461538.46	68.03	1.01	0.14
AM 163	188	64	1310	0.0008	83840.00	0.0489	-	-	-	204.8	0.00008	2461538.46	17.61	4.87	0.48
AM 164	48.4	18.8	1530	0.0007	996.40	0.3547	-	-	-	60.16	0.00002	2461538.46	20.57	4.06	9.52
AM 165	191	52	1410	0.0007	73320.00	0.0369	-	-	-	166.4	0.00007	2461538.46	18.96	4.47	0.45
AM 166	64.9	28.1	3710	0.0003	104251.00	0.0076	-	-	-	89.92	0.00004	2461538.46	49.88	1.45	0.18
AM 167	189	48	2070	0.0005	99360.00	0.0232	-	-	-	153.6	0.00006	2461538.46	27.83	2.86	0.31
AM 168	61.8	27.3	2870	0.0003	78351.00	0.0095	-	-	-	87.36	0.00004	2461538.46	38.59	1.95	0.23
AM 169	66.7	41.9	2210	0.0005	92599.00	0.0190	-	-	-	134.08	0.00005	2461538.46	29.71	2.65	0.29

AM 170	142	36	1730	0.0006	62280.00	0.0208	-	-	-	115.2	0.00005	2461538.46	23.26	3.52	0.37
AM 171	240	51	1900	0.0005	96900.00	0.0268	-	-	-	163.2	0.00007	2461538.46	25.55	3.16	0.34
AM 172	216	52	1050	0.0010	54600.00	0.0495	-	-	-	166.4	0.00007	2461538.46	14.12	6.31	0.59
AM 173	246	47	2370	0.0004	111390.00	0.0198	-	-	-	150.4	0.00006	2461538.46	31.86	2.44	0.27
AM 174	49	75.5	1645	0.0006	124197.50	0.0459	-	-	-	241.6	0.00010	2461538.46	22.12	3.73	0.39
AM 175	298	52	1540	0.0006	280800.00	0.0096	-	-	-	166.4	0.00007	2461538.46	20.71	4.03	0.13
AM 176	174	42	1340	0.0007	56280.00	0.0313	-	-	-	134.4	0.00005	2461538.46	18.02	4.74	0.47
AM 177	145	30	2950	0.0003	88500.00	0.0102	-	-	-	96	0.00004	2461538.46	39.66	1.89	0.22
AM 178	142	44	1759	0.0006	333960.00	0.0058	-	-	-	140.8	0.00006	2461538.46	23.65	3.45	0.09
AM 179	134	49.7	1590	0.0006	29670.90	0.0832	-	-	-	159.04	0.00006	2461538.46	21.38	3.89	0.99
AM 180	218	51	2840	0.0004	144840.00	0.0180	-	-	-	163.2	0.00007	2461538.46	38.18	1.97	0.23
AM 181	43.3	22.7	1490	0.0007	33823.00	0.0152	-	-	-	72.64	0.00003	2461538.46	20.03	4.19	0.42
AM 182	229	194	1080	0.0009	20952.00	1.7963	-	-	-	620.8	0.00025	2461538.46	14.52	6.10	4.90
AM 183	107	18.6	1230	0.0008	2287.80	0.1512	-	-	-	59.52	0.00002	2461538.46	16.54	5.24	4.34
AM 184	143	30	1930	0.0005	57900.00	0.0155	-	-	-	96	0.00004	2461538.46	25.95	3.10	0.33
AM 185	92.6	20.1	3270	0.0003	65727.00	0.0061	-	-	-	64.32	0.00003	2461538.46	43.96	1.67	0.20
AM 186	112	95	1220	0.0008	115900.00	0.0779	-	-	-	553.85	0.00012	4484615.39	16.40	5.29	0.51
AM 187	135	97	1405	0.0007	39285.00	0.2395	-	-	-	352.11	0.00013	2792307.69	18.89	4.49	1.43
AM 188	56.9	12.3	1080	0.0009	13284.00	0.0114	-	-	-	44.649	0.00002	2792307.69	14.52	6.10	0.57
AM 189	88.8	40.2	1000	0.0010	40200.00	0.0402	-	-	-	145.926	0.00005	2792307.69	13.44	6.68	0.61
AM 190	68.8	12.4	900	0.0011	11160.00	0.0138	-	-	-	45.012	0.00002	2792307.69	12.10	7.55	0.68
AM 191	202	40	1290	0.0008	51600.00	0.0310	-	-	-	145.2	0.00005	2792307.69	17.34	4.96	0.48
AM 192	66.2	18.2	1560	0.0006	28392.00	0.0117	-	-	-	66.066	0.00002	2792307.69	20.97	3.97	0.41
AM 193	118	18.6	1318	0.0008	59148.00	0.0058	-	-	-	67.518	0.00002	2792307.69	17.72	4.84	0.21

AM 194	78.8	24.3	1230	0.0008	29889.00	0.0198	-	-	-	88.209	0.00003	2792307.69	16.54	5.24	0.51
BN 195	137	33	2100	0.0005	69300.00	0.0157	-	-	-	156.75	0.00004	3653846.15	6.07	4.01	0.31
BN 196	35.2	16.4	2590	0.0004	42476.00	0.0063	-	-	-	77.9	0.00002	3653846.15	7.49	3.49	0.25
BN 197	51.2	39.2	2120	0.0005	83104.00	0.0185	-	-	-	186.2	0.00005	3653846.15	6.13	3.99	0.30
BN 198	60.7	16.3	1810	0.0006	29503.00	0.0090	4.75	0.0026	0.0029	77.425	0.00002	3653846.15	5.24	4.43	0.35
BN 199	80.3	20.4	1890	0.0005	38556.00	0.0108	-	-	-	96.9	0.00003	3653846.15	5.47	4.31	0.34
BN 200	80.4	33.9	1140	0.0009	38646.00	0.0297	-	-	-	161.025	0.00004	3653846.15	3.30	6.04	0.54
BN 201	65.5	41.2	748	0.0013	30817.60	0.0551	-	-	-	195.7	0.00005	3653846.15	2.16	8.02	0.81
BN 202	67.5	34.5	1190	0.0008	41055.00	0.0290	-	-	-	163.875	0.00004	3653846.15	3.44	5.87	0.52
BN 203	106	41.8	1152	0.0009	6353.60	0.2750	-	-	-	198.55	0.00005	3653846.15	3.33	6.00	3.56
BN 204	170	34	2270	0.0004	77180.00	0.0150	-	-	-	161.5	0.00004	3653846.15	6.57	3.81	0.29
BN 205	142	131.8	1254	0.0008	165277.20	0.1051	-	-	-	626.05	0.00017	3653846.15	3.63	5.67	0.50
BN 206	145	138.5	1345	0.0007	186282.50	0.1030	-	-	-	657.875	0.00018	3653846.15	3.89	5.41	0.47
BN 207	155	47	5650	0.0002	265550.00	0.0083	4.9	0.0009	-	230.3	0.00006	3769230.77	16.34	2.07	0.12
BN 208	152	30	1650	0.0006	49500.00	0.0182	-	-	-	251.4	0.00004	6446153.85	4.77	4.72	0.39
BN 209	130	45	1050	0.0010	47250.00	0.0429	-	-	-	377.1	0.00006	6446153.85	3.04	6.39	0.59
BN 210	30.1	14	6170	0.0002	86380.00	0.0023	-	-	-	117.32	0.00002	6446153.85	17.85	1.95	0.11
BN 211	149	41	2960	0.0003	121360.00	0.0139	-	-	-	343.58	0.00005	6446153.85	8.56	3.19	0.22
BN 212	165	46	5720	0.0002	263120.00	0.0080	-	-	-	385.48	0.00006	6446153.85	16.54	2.05	0.12
BN 213	281	49	7060	0.0001	345940.00	0.0069	-	-	-	410.62	0.00006	6446153.85	20.42	1.78	0.10
BN 214	102	22.7	1390	0.0007	31553.00	0.0163	-	-	-	190.226	0.00003	6446153.85	4.02	5.29	0.45
BN 215	119	17	3910	0.0003	66470.00	0.0043	-	-	-	142.46	0.00002	6446153.85	11.31	2.65	0.17
BN 216	70.3	35.7	3912	0.0003	139658.40	0.0091	-	-	-	299.166	0.00005	6446153.85	11.31	2.65	0.17
BN 217	39.3	18.4	3913	0.0003	71999.20	0.0047	-	-	-	694.784	0.00002	29046153.85	11.32	2.65	0.17

BN 218	57	28	3914	0.0003	109592.00	0.0072	-	-	-	1057.28	0.00004	29046153.85	11.32	2.65	0.17
BN 219	76.2	30.8	1450	0.0007	44660.00	0.0212	-	-	-	1163.008	0.00004	29046153.85	4.19	5.14	0.43
BN 220	31.1	12.9	2670	0.0004	34443.00	0.0048	-	-	-	487.104	0.00002	29046153.85	7.72	3.42	0.25
BN 221	42.1	35.8	2790	0.0004	99882.00	0.0128	-	-	-	1351.808	0.00005	29046153.85	8.07	3.32	0.24
BN 222	131	49	910	0.0011	44590.00	0.0538	-	-	-	1850.24	0.00006	29046153.85	2.63	7.03	0.67
BN 223	80.3	31.7	2100	0.0005	66570.00	0.0151	-	-	-	1196.992	0.00004	29046153.85	6.07	4.01	0.31
BN 224	61.1	17.8	1590	0.0006	28302.00	0.0112	-	-	-	672.128	0.00002	29046153.85	4.60	4.84	0.40
BN 225	108	32	1237	0.0008	7584.00	0.1350	-	-	-	1208.32	0.00004	29046153.85	3.58	5.72	2.35
BN 226	157	82	765	0.0013	62730.00	0.1072	-	-	-	3096.32	0.00011	29046153.85	2.21	7.90	0.79
BN 227	139	40	2650	0.0004	106000.00	0.0151	-	-	-	155.6	0.00005	2992307.69	7.66	3.43	0.25
BN 228	77.2	31.8	1020	0.0010	32436.00	0.0312	-	-	-	123.702	0.00004	2992307.69	2.95	6.51	0.60
BN 229	40.2	24.7	1450	0.0007	35815.00	0.0170	-	-	-	96.083	0.00003	2992307.69	4.19	5.14	0.43
BN 230	24.4	16.5	5800	0.0002	95700.00	0.0028	-	-	-	64.185	0.00002	2992307.69	16.78	2.03	0.12
BN 231	42.7	32.4	1670	0.0006	2170.80	0.4836	-	-	-	126.036	0.00004	2992307.69	4.83	4.68	7.65
BN 232	145	53	1290	0.0008	15370.00	0.1828	-	-	-	206.17	0.00007	2992307.69	3.73	5.56	1.95
BN 233	36	33.8	2540	0.0004	85852.00	0.0133	-	-	-	131.482	0.00004	2992307.69	7.35	3.53	0.26
BN 234	56.7	16.6	1435	0.0007	7221.00	0.0382	-	-	-	64.574	0.00002	2992307.69	4.15	5.18	1.34
BN 235	22.8	44.2	1500	0.0007	66300.00	0.0295	-	-	-	171.938	0.00006	2992307.69	4.34	5.03	0.42
BN 236	43	75	1300	0.0008	25050.00	0.2246	-	-	-	291.75	0.00010	2992307.69	3.76	5.54	1.71
BN 237	54	52	1432	0.0007	22464.00	0.1204	-	-	-	202.28	0.00007	2992307.69	4.14	5.19	1.34
BN 238	63.7	21.9	3830	0.0003	83877.00	0.0057	-	-	-	85.191	0.00003	2992307.69	11.08	2.68	0.18
BN 239	68.3	46.8	1240	0.0008	58032.00	0.0377	-	-	-	182.052	0.00006	2992307.69	3.59	5.71	0.50
BN 240	131	34	1500	0.0007	51000.00	0.0227	-	-	-	132.26	0.00004	2992307.69	4.34	5.03	0.42
BN 241	143	39	1990	0.0005	77610.00	0.0196	-	-	-	151.71	0.00005	2992307.69	5.76	4.16	0.32

BN 242	66.7	52.3	1610	0.0006	84203.00	0.0325	-	-	-	623.416	0.00007	9169230.77	4.66	4.80	0.39
BN 243	91.8	34.2	739	0.0014	25273.80	0.0463	-	-	-	407.664	0.00004	9169230.77	2.14	8.08	0.81
BN 244	74.1	23.8	1060	0.0009	25228.00	0.0225	-	-	-	283.696	0.00003	9169230.77	3.07	6.35	0.58
BN 245	78.9	40	1550	0.0006	62000.00	0.0258	-	-	-	476.8	0.00005	9169230.77	4.48	4.92	0.41
BN 246	124	34	1247	0.0008	42398.00	0.0273	-	-	-	405.28	0.00004	9169230.77	3.61	5.69	0.50
BN 247	136	41	1440	0.0007	59040.00	0.0285	-	-	-	488.72	0.00005	9169230.77	4.17	5.17	0.44
BN 248	153	47	1100	0.0009	51700.00	0.0427	-	-	-	560.24	0.00006	9169230.77	3.18	6.19	0.56
BN 249	25.9	15.9	1850	0.0005	29415.00	0.0086	-	-	-	189.528	0.00002	9169230.77	5.35	4.37	0.35
BN 250	170	51	2110	0.0005	107610.00	0.0242	-	-	-	607.92	0.00007	9169230.77	6.10	4.00	0.31
BN 251	97.3	50.7	950	0.0011	48165.00	0.0534	-	-	-	604.344	0.00007	9169230.77	2.75	6.83	0.64
BN 252	79.6	50.4	673	0.0015	33919.20	0.0749	-	-	-	600.768	0.00007	9169230.77	1.95	8.60	0.89
BN 253	80	32	1423	0.0007	45536.00	0.0225	-	-	-	381.44	0.00004	9169230.77	4.12	5.21	0.44
BN 254	142	51	1601	0.0006	306510.00	0.0085	-	-	-	607.92	0.00007	9169230.77	4.63	4.81	0.12
BN 255	152	50	1270	0.0008	63500.00	0.0394	-	-	-	596	0.00007	9169230.77	3.67	5.62	0.49
BN 256	96.5	46.5	758	0.0013	35247.00	0.0613	-	-	-	2008.8	0.00006	33230769.23	2.19	7.95	0.80
BN 257	101	40	1130	0.0009	45200.00	0.0354	-	-	-	1728	0.00005	33230769.23	3.27	6.08	0.55
BN 258	136	50	1030	0.0010	51500.00	0.0485	-	-	-	2160	0.00007	33230769.23	2.98	6.47	0.60
BN 259	50.5	20.7	1400	0.0007	28980.00	0.0148	-	-	-	894.24	0.00003	33230769.23	4.05	5.27	0.45
BN 260	157	101	1100	0.0009	111100.00	0.0918	-	-	-	4363.2	0.00013	33230769.23	3.18	6.19	0.56
BN 261	113	32	660	0.0015	21120.00	0.0485	-	-	-	1382.4	0.00004	33230769.23	1.91	8.72	0.91
BN 262	118	34	1680	0.0006	57120.00	0.0202	-	-	-	1468.8	0.00004	33230769.23	4.86	4.66	0.38
BN 263	211	39	1820	0.0005	70980.00	0.0214	-	-	-	1684.8	0.00005	33230769.23	5.26	4.42	0.35
BN 264	169	46	2430	0.0004	111780.00	0.0189	-	-	-	1987.2	0.00006	33230769.23	7.03	3.64	0.27
BN 265	158	31	1240	0.0008	38440.00	0.0250	-	-	-	1339.2	0.00004	33230769.23	3.59	5.71	0.50

BN 266	150	38	1330	0.0008	50540.00	0.0286	-	-	-	1641.6	0.00005	33230769.23	3.85	5.45	0.47
BN 267	206	47	3040	0.0003	142880.00	0.0155	-	-	-	2030.4	0.00006	33230769.23	8.79	3.13	0.22
BN 268	155	41	1040	0.0010	42640.00	0.0394	-	-	-	1771.2	0.00005	33230769.23	3.01	6.43	0.59
BN 269	139	51	1567	0.0006	28917.00	0.0899	-	-	-	2203.2	0.00007	33230769.23	4.53	4.88	1.04
BN 270	76.4	19.7	860	0.0012	16942.00	0.0229	-	-	-	851.04	0.00003	33230769.23	2.49	7.30	0.71
BN 271	147	55	1790	0.0006	4345.00	0.6962	-	-	-	2376	0.00007	33230769.23	5.18	4.47	6.56
BN 272	151	46	1870	0.0005	4002.00	0.5287	-	-	-	1987.2	0.00006	33230769.23	5.41	4.34	6.00
BN 273	110	33	669	0.0015	22077.00	0.0493	-	-	-	1425.6	0.00004	33230769.23	1.93	8.64	0.89
BN 274	81.9	121	1300	0.0008	4779.50	3.0633	-	-	-	5227.2	0.00016	33230769.23	3.76	5.54	12.52
BN 275	86.1	25.9	1640	0.0006	42476.00	0.0158	-	-	-	1118.88	0.00003	33230769.23	4.74	4.74	0.39
BN 276	89.6	40.4	2320	0.0004	9372.80	0.1741	-	-	-	1745.28	0.00005	33230769.23	6.71	3.76	2.40
BN 277	139	32	1406	0.0007	12992.00	0.0788	-	-	-	1382.4	0.00004	33230769.23	4.07	5.25	1.42
BN 278	177	43	1128	0.0009	5504.00	0.3359	-	-	-	1857.6	0.00006	33230769.23	3.26	6.09	4.18
BN 279	73.9	74.1	1820	0.0005	13486.20	0.4071	-	-	-	3201.12	0.00010	33230769.23	5.26	4.42	3.01
BN 280	116	7	1354	0.0007	9478.00	0.0052	-	-	-	302.4	0.00001	33230769.23	3.92	5.39	0.46
BN 281	124	29	1510	0.0007	43790.00	0.0192	-	-	-	1252.8	0.00004	33230769.23	4.37	5.01	0.42
BN 282	57.5	30.5	1100	0.0009	1088.85	0.8543	-	-	-	1317.6	0.00004	33230769.23	3.18	6.19	13.76
BN 283	121	48	1200	0.0008	609.60	3.7795	-	-	-	2073.6	0.00006	33230769.23	3.47	5.84	36.09
BN 284	46.5	26.4	1240	0.0008	3273.60	0.2129	-	-	-	1140.48	0.00003	33230769.23	3.59	5.71	4.31
BN 285	80.4	32	2200	0.0005	70400.00	0.0145	-	-	-	1382.4	0.00004	33230769.23	6.36	3.89	0.29
BN 286	88.5	62.5	950	0.0011	5937.50	0.6579	-	-	-	2700	0.00008	33230769.23	2.75	6.83	5.52
BN 287	32.7	10.8	980	0.0010	10584.00	0.0110	-	-	-	466.56	0.00001	33230769.23	2.83	6.69	0.63
BN 288	200	52	1600	0.0006	852.80	3.1707	-	-	-	2246.4	0.00007	33230769.23	4.63	4.82	28.43
BN 289	86.8	33.2	1237	0.0008	7868.40	0.1401	-	-	-	1434.24	0.00004	33230769.23	3.58	5.72	2.35

BN 290	28.2	21.4	1236	0.0008	5050.40	0.0907	-	-	-	924.48	0.00003	33230769.23	3.57	5.73	2.36
BN 291	86.8	33.2	1237	0.0008	7868.40	0.1401	-	-	-	1434.24	0.00004	33230769.23	3.58	5.72	2.35
BN 292	88.1	29.9	1170	0.0009	3498.30	0.2556	-	-	-	1291.68	0.00004	33230769.23	3.38	5.94	4.55
BN 293	66	11.9	1300	0.0008	9365.30	0.0151	-	-	-	514.08	0.00002	33230769.23	3.76	5.54	0.77
BN 294	117	23	2080	0.0005	47840.00	0.0111	-	-	-	993.6	0.00003	33230769.23	6.02	4.04	0.31
BN 295	122	29	5620	0.0002	162980.00	0.0052	-	-	-	1252.8	0.00004	33230769.23	16.26	2.08	0.12
BN 296	109	39	650	0.0015	25350.00	0.0600	-	-	-	1684.8	0.00005	33230769.23	1.88	8.81	0.92
BN 297	209	43	1425	0.0007	18275.00	0.1012	-	-	-	1857.6	0.00006	33230769.23	4.12	5.21	1.37
BN 298	149	35	4340	0.0002	151900.00	0.0081	-	-	-	1512	0.00005	33230769.23	12.55	2.47	0.16
BN 299	130	35	1325	0.0008	46375.00	0.0264	-	-	-	1512	0.00005	33230769.23	3.83	5.47	0.47
BN 300	120	50	1214	0.0008	10700.00	0.2336	-	-	-	2160	0.00007	33230769.23	3.51	5.80	2.59
BN 301	48.8	89.2	1200	0.0008	1097.16	7.2520	-	-	-	3853.44	0.00012	33230769.23	3.47	5.84	37.18
BN 302	182	47	1260	0.0008	59220.00	0.0373	-	-	-	2030.4	0.00006	33230769.23	3.64	5.65	0.50
BN 303	206	46	1770	0.0006	81420.00	0.0260	-	-	-	1987.2	0.00006	33230769.23	5.12	4.50	0.36
BN 304	99.4	34.6	1100	0.0009	380.60	3.1455	-	-	-	1494.72	0.00004	33230769.23	3.18	6.19	41.27
BN 305	56.5	17.2	1140	0.0009	19608.00	0.0151	-	-	-	743.04	0.00002	33230769.23	3.30	6.04	0.54
BN 306	115	42	1270	0.0008	1171.80	1.5054	-	-	-	1814.4	0.00005	33230769.23	3.67	5.62	17.32
BN 307	52.7	30.7	1470	0.0007	14429.00	0.0653	-	-	-	1326.24	0.00004	33230769.23	4.25	5.10	1.24
BN 308	61.5	34.6	1520	0.0007	52592.00	0.0228	-	-	-	1494.72	0.00004	33230769.23	4.40	4.98	0.42
BN 309	97.3	31.7	2600	0.0004	82420.00	0.0122	-	-	-	1369.44	0.00004	33230769.23	7.52	3.48	0.25
BN 310	52.5	20.3	2610	0.0004	52983.00	0.0078	-	-	-	876.96	0.00003	33230769.23	7.55	3.47	0.25
BN 311	72.5	8.6	1120	0.0009	9632.00	0.0077	-	-	-	371.52	0.00001	33230769.23	3.24	6.12	0.55
BN 312	49.2	16.1	591	0.0017	9515.10	0.0272	-	-	-	695.52	0.00002	33230769.23	1.71	9.39	1.00
BN 313	147	47	1140	0.0009	53580.00	0.0412	-	-	-	2030.4	0.00006	33230769.23	3.30	6.04	0.54

BN 314	76.4	43.6	1000	0.0010	43600.00	0.0436	-	-	-	1883.52	0.00006	33230769.23	2.89	6.60	0.61
BN 315	117	39	5270	0.0002	205530.00	0.0074	-	-	-	1684.8	0.00005	33230769.23	15.24	2.17	0.13
BN 316	58	18.4	2530	0.0004	46552.00	0.0073	-	-	-	794.88	0.00002	33230769.23	7.32	3.54	0.26
BN 317	166	50	1330	0.0008	66500.00	0.0376	-	-	-	2160	0.00007	33230769.23	3.85	5.45	0.47
BN 318	93.2	26.1	1000	0.0010	26100.00	0.0261	-	-	-	1127.52	0.00003	33230769.23	2.89	6.60	0.61
BN 319	102	29.2	2100	0.0005	61320.00	0.0139	-	-	-	1261.44	0.00004	33230769.23	6.07	4.01	0.31
BN 320	154	51	1540	0.0006	78540.00	0.0331	-	-	-	2203.2	0.00007	33230769.23	4.45	4.94	0.41
BN 321	205	59	7510	0.0001	443090.00	0.0079	-	-	-	2548.8	0.00008	33230769.23	21.72	1.71	0.09
BN 322	63.2	14.3	860	0.0012	12298.00	0.0166	-	-	-	617.76	0.00002	33230769.23	2.49	7.30	0.71
BN 323	93.2	34.7	4160	0.0002	144352.00	0.0083	-	-	-	1499.04	0.00005	33230769.23	12.03	2.54	0.16
BN 324	77.4	32	1380	0.0007	44160.00	0.0232	-	-	-	1382.4	0.00004	33230769.23	3.99	5.32	0.46
BN 325	59.4	21.1	1010	0.0010	21311.00	0.0209	-	-	-	911.52	0.00003	33230769.23	2.92	6.56	0.61
BN 326	589	19.5	1240	0.0008	4680.00	0.0813	-	-	-	842.4	0.00003	33230769.23	3.59	5.71	2.33
BN 327	49.9	14.5	1356	0.0007	5162.00	0.0407	-	-	-	626.4	0.00002	33230769.23	3.92	5.38	1.61
BN 328	52.5	11.5	1429	0.0007	4933.50	0.0268	-	-	-	496.8	0.00001	33230769.23	4.13	5.20	1.35
BN 329	37.2	16.6	1280	0.0008	21248.00	0.0130	-	-	-	717.12	0.00002	33230769.23	3.70	5.59	0.49
BN 330	86.6	54	1330	0.0008	71820.00	0.0406	-	-	-	2332.8	0.00007	33230769.23	3.85	5.45	0.47
BN 331	77.5	27.1	1870	0.0005	2357.70	0.3115	-	-	-	1170.72	0.00004	33230769.23	5.41	4.34	6.00
BN 332	83.6	16.8	1850	0.0005	31080.00	0.0091	-	-	-	725.76	0.00002	33230769.23	5.35	4.37	0.35
BN 333	234	21	2620	0.0004	55020.00	0.0080	-	-	-	907.2	0.00003	33230769.23	7.58	3.46	0.25
BN 334	223	39	990	0.0010	38610.00	0.0394	-	-	-	1684.8	0.00005	33230769.23	2.86	6.64	0.62
BN 335	136	48	5160	0.0002	247680.00	0.0093	-	-	-	2073.6	0.00006	33230769.23	14.92	2.20	0.13
BN 336	40.1	11.4	1020	0.0010	11628.00	0.0112	-	-	-	492.48	0.00001	33230769.23	2.95	6.51	0.60
BN 337	87.6	37.5	1260	0.0008	47250.00	0.0298	-	-	-	1620	0.00005	33230769.23	3.64	5.65	0.50

BN 338	131	34	572	0.0017	19448.00	0.0594	-	-	-	1468.8	0.00004	33230769.23	1.65	9.59	1.03
BN 339	67.7	37.1	2240	0.0004	83104.00	0.0166	-	-	-	1602.72	0.00005	33230769.23	6.48	3.84	0.29
BN 340	95	71.4	3710	0.0003	264894.00	0.0192	-	-	-	3084.48	0.00009	33230769.23	10.73	2.74	0.18
BN 341	65.7	15.3	3830	0.0003	58599.00	0.0040	-	-	-	660.96	0.00002	33230769.23	11.08	2.68	0.18
BN 342	43	35	1334	0.0007	11690.00	0.1048	-	-	-	1512	0.00005	33230769.23	3.86	5.44	1.71
BN 343	118	24.9	2120	0.0005	52788.00	0.0117	-	-	-	1075.68	0.00003	33230769.23	6.13	3.99	0.30
BN 344	88.1	18.7	1120	0.0009	20944.00	0.0167	-	-	-	807.84	0.00002	33230769.23	3.24	6.12	0.55
BN 345	59.2	30.7	1170	0.0009	35919.00	0.0262	-	-	-	1326.24	0.00004	33230769.23	3.38	5.94	0.53
BN 346	46.1	19	3010	0.0003	57190.00	0.0063	-	-	-	820.8	0.00002	33230769.23	8.71	3.15	0.22
BN 347	128	29.3	1650	0.0006	48345.00	0.0178	-	-	-	1265.76	0.00004	33230769.23	4.77	4.72	0.39
BN 348	141	96	1020	0.0010	97920.00	0.0941	-	-	-	4147.2	0.00012	33230769.23	2.95	6.51	0.60
BN 349	172	30	1090	0.0009	32700.00	0.0275	-	-	-	1296	0.00004	33230769.23	3.15	6.23	0.57
BN 350	150	40	2650	0.0004	106000.00	0.0151	-	-	-	1728	0.00005	33230769.23	7.66	3.43	0.25
BN 351	126	98	4940	0.0002	484120.00	0.0198	-	-	-	4233.6	0.00013	33230769.23	14.29	2.26	0.14
BN 352	139	35	1670	0.0006	58450.00	0.0210	-	-	-	1512	0.00005	33230769.23	4.83	4.68	0.38
BN 353	63.9	22	960	0.0010	21120.00	0.0229	-	-	-	950.4	0.00003	33230769.23	2.78	6.78	0.64
BN 354	168	49	2850	0.0004	139650.00	0.0172	-	-	-	2116.8	0.00006	33230769.23	8.24	3.27	0.23
BN 355	221	50	3120	0.0003	156000.00	0.0160	-	-	-	2160	0.00007	33230769.23	9.02	3.08	0.21
BN35 6	53.5	26	2040	0.0005	53040.00	0.0127	-	-	-	1123.2	0.00003	33230769.23	5.90	4.09	0.32
BN 357	93.5	22	1390	0.0007	30580.00	0.0158	-	-	-	950.4	0.00003	33230769.23	4.02	5.29	0.45
BN 358	169	44	1450	0.0007	63800.00	0.0303	-	-	-	1900.8	0.00006	33230769.23	4.19	5.14	0.43
BN 359	34	50	2690	0.0004	134500.00	0.0186	-	-	-	2160	0.00007	33230769.23	7.78	3.40	0.24
BN 360	150	27	1750	0.0006	47250.00	0.0154	-	-	-	1166.4	0.00004	33230769.23	5.06	4.54	0.36
BN 361	183	40	4180	0.0002	167200.00	0.0096	-	-	-	1728	0.00005	33230769.23	12.09	2.53	0.16

BN 362	122	41	2210	0.0005	90610.00	0.0186	-	-	-	1771.2	0.00005	33230769.23	6.39	3.88	0.29
BN 363	122	35	1700	0.0006	59500.00	0.0206	4.8	0.0028	-	168	0.00005	3692307.69	4.92	4.62	0.37
BN 364	113	109	1900	0.0005	21583.09	0.5505	-	-	-	109	0.00014	769230.77	5.50	4.29	2.78
BN 365	123	118	1800	0.0006	22186.36	0.6276	-	-	-	118	0.00015	769230.77	5.21	4.45	2.92
BN 366	20.5	2	3860	0.0003	7720.00	0.0005	-	-	-	20.4	0.00000	7846153.85	11.16	2.67	0.17
BN 367	120	27	1530	0.0007	41310.00	0.0176	-	-	-	275.4	0.00004	7846153.85	4.43	4.96	0.41
BN 368	143	44	1430	0.0007	62920.00	0.0308	-	-	-	448.8	0.00006	7846153.85	4.14	5.19	0.44
BN 369	61.5	14	1180	0.0008	16520.00	0.0119	6.57	0.0056	-	91.98	0.00002	5053846.15	3.41	5.91	0.53
BN 370	226	102	2110	0.0005	215220.00	0.0483	-	-	-	978.18	0.00013	7376923.08	6.10	4.00	0.31
BN 371	81.4	13	1520	0.0007	19760.00	0.0086	-	-	-	124.67	0.00002	7376923.08	4.40	4.98	0.42
BN 372	139	39	2900	0.0003	113100.00	0.0134	-	-	-	374.01	0.00005	7376923.08	8.39	3.23	0.23
BN 373	131	43.9	1260	0.0008	55314.00	0.0348	-	-	-	421.001	0.00006	7376923.08	3.64	5.65	0.50
BN 374	138	130.5	2785	0.0004	363442.50	0.0469	-	-	-	1251.495	0.00017	7376923.08	8.06	3.32	0.24
BN 375	135	122	2356	0.0004	287432.00	0.0518	-	-	-	833.26	0.00016	5253846.15	6.81	3.72	0.28
BN 376	125	112	2259	0.0004	253008.00	0.0496	-	-	-	764.96	0.00015	5253846.15	6.53	3.82	0.29
BN 377	110	94	1885	0.0005	832088.00	0.0106	-	-	-	642.02	0.00012	5253846.15	5.45	4.32	0.08
BN 378	121	27.2	1970	0.0005	53584.00	0.0138	4.06	0.0021	-	110.432	0.00004	3123076.92	5.70	4.19	0.33
BN 379	128	69.8	1670	0.0006	116566.00	0.0418	-	-	-	283.388	0.00009	3123076.92	4.83	4.68	0.38
BN 380	84.5	22.8	1690	0.0006	1573.20	0.3304	-	-	-	92.568	0.00003	3123076.92	4.89	4.64	7.44
BN 381	38.1	20.5	1210	0.0008	24805.00	0.0169	-	-	-	83.23	0.00003	3123076.92	3.50	5.81	0.51
BN 382	54	33.7	2700	0.0004	90990.00	0.012481 481	-	-	-	136.822	0.00004	3123076.92	7.81	3.39	0.24
BN 383	174	35	1190	0.0008	41650.00	0.0294	-	-	-	142.1	0.00005	3123076.92	3.44	5.87	0.52
BN 384	98.3	21.6	1630	0.0006	3650.40	0.1278	-	-	-	87.696	0.00003	3123076.92	4.71	4.76	3.23
BN 385	96.5	54	820	0.0012	44280.00	0.0659	-	-	-	219.24	0.00007	3123076.92	2.37	7.54	0.74

BN 386	27.2	11	2110	0.0005	23210.00	0.0052	-	-	-	44.66	0.00001	3123076.92	6.10	4.00	0.31
BN 387	137	22	1620	0.0006	35640.00	0.0136	-	-	-	89.32	0.00003	3123076.92	4.69	4.78	0.39
BN 388	188	49	2160	0.0005	105840.00	0.0227	-	-	-	198.94	0.00006	3123076.92	6.25	3.94	0.30
BN 389	118	48.5	1480	0.0007	71780.00	0.0328	-	-	-	196.91	0.00006	3123076.92	4.28	5.07	0.43
BN 390	45.3	13.8	950	0.0011	13110.00	0.0145	-	-	-	34.638	0.00002	1930769.23	2.75	6.83	0.64
BN 391	135	48.5	1820	0.0005	88270.00	0.0266	-	-	-	100.395	0.00006	1592307.69	5.26	4.42	0.35
BN 392	174	46	1420	0.0007	65320.00	0.0324	-	-	-	95.22	0.00006	1592307.69	4.11	5.22	0.44
BN 393	128	18	2270	0.0004	40860.00	0.0079	-	-	-	37.26	0.00002	1592307.69	6.57	3.81	0.29
BN 394	70.4	20.4	1300	0.0008	26520.00	0.0157	-	-	-	42.228	0.00003	1592307.69	3.76	5.54	0.48
BN 395	74.4	13	910	0.0011	11830.00	0.0143	-	-	-	26.91	0.00002	1592307.69	2.63	7.03	0.67
BN 396	110	21.6	4280	0.0002	92448.00	0.0050	-	-	-	44.712	0.00003	1592307.69	12.38	2.49	0.16
BN 397	54.5	26.5	1790	0.0006	47435.00	0.0148	-	-	-	54.855	0.00003	1592307.69	5.18	4.47	0.36
BN 398	129	46	554	0.0018	25484.00	0.0830	-	-	-	95.22	0.00006	1592307.69	1.60	9.80	1.07
BN 399	129	44.4	870	0.0011	3862.80	0.5103	-	-	-	91.908	0.00006	1592307.69	2.52	7.24	6.00
BN 400	54.6	14.1	1490	0.0007	21009.00	0.0095	-	-	-	29.187	0.00002	1592307.69	4.31	5.05	0.42
BN 401	176	33	3460	0.0003	114180.00	0.0095	-	-	-	68.31	0.00004	1592307.69	10.01	2.87	0.19
BN 402	118	33.7	2220	0.0005	74814.00	0.0152	-	-	-	69.759	0.00004	1592307.69	6.42	3.87	0.29
BN 403	177	31	2670	0.0004	82770.00	0.0116	-	-	-	64.17	0.00004	1592307.69	7.72	3.42	0.25
BN 404	117	21.8	1810	0.0006	39458.00	0.0120	-	-	-	45.126	0.00003	1592307.69	5.24	4.43	0.35
BN 405	77.9	29.1	1350	0.0007	39285.00	0.0216	-	-	-	60.237	0.00004	1592307.69	3.90	5.40	0.46
BN 406	44.6	21	1632	0.0006	132720.00	0.0033	-	-	-	43.47	0.00003	1592307.69	4.72	4.75	0.11
BN 407	68.6	46.1	1020	0.0010	47022.00	0.0452	-	-	-	95.427	0.00006	1592307.69	2.95	6.51	0.60
BN 408	65.4	42.6	1500	0.0007	63900.00	0.0284	-	-	-	88.182	0.00006	1592307.69	4.34	5.03	0.42
BN 409	23.5	12.8	1520	0.0007	19456.00	0.0084	-	-	-	26.496	0.00002	1592307.69	4.40	4.98	0.42

BN 410	32.7	20	1620	0.0006	32400.00	0.0123	-	-	-	41.4	0.00003	1592307.69	4.69	4.78	0.39
BN 411	42.7	25	1560	0.0006	39000.00	0.0160	-	-	-	51.75	0.00003	1592307.69	4.51	4.90	0.41
BN 412	58.5	28.6	1400	0.0007	40040.00	0.0204	-	-	-	340.912	0.00004	9169230.77	4.05	5.27	0.45
BN 413	124	27.2	2600	0.0004	70720.00	0.0105	-	-	-	324.224	0.00004	9169230.77	7.52	3.48	0.25
BN															
BN 415	37.8	22.7	1140	0.0009	25878.00	0.0199	-	-	-	270.584	0.00003	9169230.77	3.30	6.04	0.54
BN 416	33.3	17.9	1080	0.0009	19332.00	0.0166	-	-	-	213.368	0.00002	9169230.77	3.12	6.27	0.57
BN 417	51.7	26.1	2060	0.0005	53766.00	0.0127	-	-	-	311.112	0.00003	9169230.77	5.96	4.07	0.31
BN 418	58.4	43	1030	0.0010	44290.00	0.0417	-	-	-	512.56	0.00006	9169230.77	2.98	6.47	0.60
BN 419	55.3	50.4	3200	BN 419	49.50	20.3000	-	-	-	600.768	0.00007	9169230.77	9.2555744	241.98	0.00
BN 420	49.5	20.3	2340	0.0004	47502.00	0.0087	-	-	-	241.976	0.00003	9169230.77	6.77	3.73	0.28
BN 421	65.8	33.8	1670	0.0006	56446.00	0.0202	-	-	-	402.896	0.00004	9169230.00	4.83	3.65	0.27
BN 422	37.5	16.7	2420	BN 420	65.80	33.8000	-	-	-	199.094	0.00002	9169230.77	6.995281	3.65	0.00
BN 423	180	103.6	2750	0.0004	284900.00	0.0377	-	-	-	1234.912	0.00013	9169230.77	7.95	3.35	0.24
BN 424	186	46	1900	0.0005	87400.00	0.0242	-	-	-	548.32	0.00006	9169230.77	5.50	4.29	0.34
BN 425	118	35.7	3810	0.0003	136017.00	0.0094	-	-	-	182.07	0.00005	3923076.92	11.02	2.69	0.18
BN 426	133	49.7	5690	0.0002	282793.00	0.0087	-	-	-	253.47	0.00006	3923076.92	16.46	2.06	0.12
BN 427	143	55.8	1750	0.0006	97650.00	0.0319	-	-	-	284.58	0.00007	3923076.92	5.06	4.54	0.36
BN 428	171	70	1681	0.0006	117670.00	0.0416	-	-	-	357	0.00009	3923076.92	4.86	4.66	0.38
BN 429	115	65.1	1590	0.0006	103509.00	0.0409	-	-	-	332.01	0.00008	3923076.92	4.60	4.84	0.40
BN 430	62.9	35.6	3870	0.0003	137772.00	0.0092	-	-	-	559.632	0.00005	12092307.69	11.19	2.67	0.17
BN 431	180	39	4260	0.0002	166140.00	0.0092	-	-	-	613.08	0.00005	12092307.69	12.32	2.50	0.16
BN 432	73	31.7	1150	0.0009	36455.00	0.0276	-	-	-	514.808	0.00004	12492307.69	3.33	6.01	0.54
BN 433	116	39.8	1682	0.0006	271436.00	0.0058	-	-	-	646.352	0.00005	12492307.69	4.86	4.66	0.10

BN 433	157	51	1410	0.0007	71910.00	0.0362	-	-	-	828.24	0.00007	12492307.69	4.08	5.24	0.45
BN 434	193	59	1750	0.0006	103250.00	0.0337	-	-	-	958.16	0.00008	12492307.69	5.06	4.54	0.36
BN 435	27.3	22.2	1500	0.0007	33300.00	0.0148	-	-	-	360.528	0.00003	12492307.69	4.34	5.03	0.42
BN 436	132	23	1790	0.0006	41170.00	0.0128	-	-	-	133.17	0.00003	4453846.15	5.18	4.47	0.36
BN 437	194	65	2810	0.0004	182650.00	0.0231	-	-	-	376.35	0.00008	4453846.15	8.13	3.30	0.23
BN 438	34.9	28.9	3010	0.0003	86989.00	0.0096	-	-	-	167.331	0.00004	4453846.15	8.71	3.15	0.22
BN 439	61.1	51.8	2940	0.0003	152292.00	0.0176	-	-	-	299.922	0.00007	4453846.15	8.50	3.20	0.22
BN 440	207	63	1706	0.0006	444780.00	0.0089	-	-	-	364.77	0.00008	4453846.15	4.93	4.61	0.10
BN 441	172	68	1790	0.0006	502520.00	0.0092	-	-	-	393.72	0.00009	4453846.15	5.18	4.47	0.10
BN 442	165	43	5110	0.0002	219730.00	0.0084	-	-	-	248.97	0.00006	4453846.15	14.78	2.21	0.13
BN 443	48.9	36.9	1120	0.0009	41328.00	0.0329	7	0.0063	-	258.3	0.00005	5384615.39	3.24	6.12	0.55
BN 444	143	51.2	1950	0.0005	99840.00	0.0263	-	-	-	358.4	0.00007	5384615.39	5.64	4.22	0.33
BN 445	139	80.1	3970	0.0003	317997.00	0.0202	-	-	-	560.7	0.00010	5384615.39	11.48	2.62	0.17
BN 446	201	50	2890	0.0003	144500.00	0.0173	-	-	-	350	0.00007	5384615.39	8.36	3.24	0.23
BN 447	193	50	4460	0.0002	223000.00	0.0112	-	-	-	350	0.00007	5384615.39	12.90	2.42	0.15
BN 448	183	48	2610	0.0004	125280.00	0.0184	-	-	-	336	0.00006	5384615.39	7.55	3.47	0.25
BN 449	148	61.1	1720	0.0006	105092.00	0.0355	-	-	-	427.7	0.00008	5384615.39	4.97	4.59	0.37
BN 450	139	49.6	1380	0.0007	68448.00	0.0359	-	-	-	300.08	0.00006	4653846.15	3.99	5.32	0.46
BN 451	167	51	5040	0.0002	257040.00	0.0101	-	-	-	308.55	0.00007	4653846.15	14.58	2.23	0.14
BN 452	180	60	3800	0.0003	228000.00	0.0158	-	-	-	363	0.00008	4653846.15	10.99	2.70	0.18
BN 453	175	62	2640	0.0004	163680.00	0.0235	-	-	-	375.1	0.00008	4653846.15	7.64	3.44	0.25
BN 454	94.7	63.9	3790	0.0003	242181.00	0.0169	-	-	-	386.595	0.00008	4653846.15	10.96	2.70	0.18
BN 455	88.9	26.4	1160	0.0009	30624.00	0.0228	-	-	-	159.72	0.00003	4653846.15	3.36	5.97	0.54
BN 456	102	21.9	4210	0.0002	92199.00	0.0052	-	-	-	132.495	0.00003	4653846.15	12.18	2.52	0.16

BN 457	91	31.6	3570	0.0003	112812.00	0.0089	-	-	-	191.18	0.00004	4653846.15	10.33	2.81	0.19
BN 458	151	30	3810	0.0003	114300.00	0.0079	-	-	-	181.5	0.00004	4653846.15	11.02	2.69	0.18
BN 459	71.9	25.2	1730	0.0006	43596.00	0.0146	-	-	-	243.936	0.00003	7446153.85	5.00	4.57	0.37
BN 460	120	19	1310	0.0008	24890.00	0.0145	-	-	-	183.92	0.00002	7446153.85	3.79	5.51	0.48
BN 461	124	68.6	900	0.0011	61740.00	0.0762	-	-	-	664.048	0.00009	7446153.85	2.60	7.08	0.68
BN 462	70.1	23.8	5570	0.0002	132566.00	0.0043	-	-	-	230.384	0.00003	7446153.85	16.11	2.09	0.12
BN 463	117	40.1	2210	0.0005	88621.00	0.0181	-	-	-	388.168	0.00005	7446153.85	6.39	3.88	0.29
BN 464	123	53.4	4000	0.0003	213600.00	0.0134	-	-	-	516.912	0.00007	7446153.85	11.57	2.61	0.17
BN 465	89.8	28.1	5520	0.0002	155112.00	0.0051	-	-	-	272.008	0.00004	7446153.85	15.97	2.10	0.12
BN 466	82.9	18.9	1390	0.0007	26271.00	0.0136	-	-	-	182.952	0.00002	7446153.85	4.02	5.29	0.45
BN 467	69.3	19.2	1880	0.0005	168960.00	0.0022	-	-	-	185.856	0.00002	7446153.85	5.44	4.32	0.08
BN 468	109	23.1	1600	0.0006	36960.00	0.0144	-	-	-	223.608	0.00003	7446153.85	4.63	4.82	0.40
BN 469	40	20.2	150	0.0067	3030.00	0.1347	-	-	-	195.536	0.00003	7446153.85	0.43	23.52	3.61
BN 470	75	24.8	53	0.0189	1314.40	0.4679	-	-	-	240.064	0.00003	7446153.85	0.15	47.23	9.52
BN 471	83.1	23	980	0.0010	22540.00	0.0235	-	-	-	222.64	0.00003	7446153.85	2.83	6.69	0.63
BN 472	65	33.6	2500	0.0004	319200.00	0.0035	-	-	-	325.248	0.00004	7446153.85	7.23	3.57	0.08
BN 473	78.7	25.1	2520	0.0004	163652.00	0.0038	-	-	-	242.968	0.00003	7446153.85	7.29	3.55	0.11
BN 474	193	40	2030	0.0005	81200.00	0.0197	-	-	-	387.2	0.00005	7446153.85	5.87	4.11	0.32
BN 475	256	48	2890	0.0003	138720.00	0.0166	-	-	-	464.64	0.00006	7446153.85	8.36	3.24	0.23
BN 476	281	45	2320	0.0004	369000.00	0.0055	-	-	-	435.6	0.00006	7446153.85	6.71	3.76	0.09
BN 477	146	29	2850	0.0004	82650.00	0.0102	-	-	-	280.72	0.00004	7446153.85	8.24	3.27	0.23
BN 478	269	49	5650	0.0002	276850.00	0.0087	-	-	-	474.32	0.00006	7446153.85	16.34	2.07	0.12
BN 479	120	21.5	3500	0.0003	75250.00	0.0061	-	-	-	208.12	0.00003	7446153.85	10.12	2.85	0.19
BN 480	235	50	4450	0.0002	222500.00	0.0112	-	-	-	484	0.00007	7446153.85	12.87	2.43	0.15

BN 481	172	27	2600	0.0004	70200.00	0.0104	-	-	-	261.36	0.00004	7446153.85	7.52	3.48	0.25
BN 482	286	40	3480	0.0003	139200.00	0.0115	-	-	-	387.2	0.00005	7446153.85	10.07	2.86	0.19
BN 483	202	41	3900	0.0003	159900.00	0.0105	-	-	-	396.88	0.00005	7446153.85	11.28	2.65	0.17
BN 484	150	40	6150	0.0002	246000.00	0.0065	-	-	-	387.2	0.00005	7446153.85	17.79	1.95	0.11
BN 485	247	26	6780	0.0001	176280.00	0.0038	-	-	-	251.68	0.00003	7446153.85	19.61	1.83	0.10
BN 486	245	45	3690	0.0003	166050.00	0.0122	-	-	-	435.6	0.00006	7446153.85	10.67	2.75	0.18
BN 487	255	50	3170	0.0003	158500.00	0.0158	-	-	-	484	0.00007	7446153.85	9.17	3.05	0.21
BN 488	91.9	40	6930	0.0001	277200.00	0.0058	-	-	-	387.2	0.00005	7446153.85	20.04	1.80	0.10
BN 489	63.9	40.5	2550	0.0004	103275.00	0.0159	-	-	-	392.04	0.00005	7446153.85	7.38	3.52	0.26
BN 490	250	46	6430	0.0002	295780.00	0.0072	-	-	-	445.28	0.00006	7446153.85	18.60	1.90	0.11
BN 491	182	34	3070	0.0003	104380.00	0.0111	-	-	-	625.6	0.00004	14153846.15	8.88	3.11	0.22
BN 492	141	71.9	6820	0.0001	490358.00	0.0105	1.99	0.0003		143.081	0.00009	1530769.23	19.73	1.82	0.10
BN 493	231	39	4160	0.0002	162240.00	0.0094	-	-	-	77.61	0.00005	1530769.23	12.03	2.54	0.16
BN 494	117	19.5	3410	0.0003	66495.00	0.0057	2.39	0.0007		46.605	0.00003	1838461.54	9.86	2.90	0.20
BN 495	70.1	19.7	1160	0.0009	22852.00	0.0170	5.62	0.0048		110.714	0.00003	4323076.92	3.36	5.97	0.54
BN 496	139	33	1630	0.0006	53790.00	0.0202	-	-	-	185.46	0.00004	4323076.92	4.71	4.76	0.39
BN 497	125	53.7	1420	0.0007	76254.00	0.0378	-	-	-	301.794	0.00007	4323076.92	4.11	5.22	0.44
BN 498	104	33.7	2270	0.0004	76499.00	0.0148	-	-	-	189.394	0.00004	4323076.92	6.57	3.81	0.29
BN 499	126	48.8	1180	0.0008	57584.00	0.0414	-	-	-	328.912	0.00006	5184615.39	3.41	5.91	0.53
BN 500	134	40.2	1630	0.0006	65526.00	0.0247	-	-	-	270.948	0.00005	5184615.39	4.71	4.76	0.39
IS 501	91	37.5	1250	0.0008	46875.00	0.0300	-	-	-	252.75	0.00005	5184615.39	73.85	7.91	0.50
IS 502	44.5	14.2	2130	0.0005	30246.00	0.0067	-	-	-	95.708	0.00002	5184615.39	125.84	7.95	0.30
IS 503	91.2	20.6	111	0.0090	2286.60	0.1856	-	-	-	138.844	0.00003	5184615.39	6.56	7.72	4.78
IS 504	42.7	14.1	291	0.0034	4103.10	0.0485	-	-	-	95.034	0.00002	5184615.39	17.19	7.80	1.94

IS 505	80.6	25.1	150	0.0067	12826.10	0.0491	7.6	0.0502	-	169.174	0.00003	5184615.39	30.19	7.84	1.15
IS 506	105	18.8	200	0.0050	3760.00	0.0940				126.712	0.00002	5184615.39	11.82	7.77	2.76
IS 507	48	11.1	142	0.0070	1576.20	0.0782	8.16	0.0575	0.0591	90.576	0.00001	6276923.08	8.39	7.74	3.80
IS 508	51.8	26.2	22.6	0.0442	592.12	1.1593	-	-	-	213.792	0.00003	6276923.08	1.34	7.60	21.08
IS 509	121	22.8	1290	0.0008	29412.00	0.0177	-	-	-	186.048	0.00003	6276923.08	76.21	7.91	0.48
IS 510	104	42.3	2150	0.0005	90945.00	0.0197	-	-	-	345.168	0.00005	6276923.08	127.02	7.95	0.30
IS 511	51.7	24.2	401	0.0025	9704.20	0.0603	-	-	-	197.472	0.00003	6276923.08	23.69	7.82	1.44
IS 512	51.8	26.2	22.6	0.0442	592.12	1.1593	-	-	-	213.792	0.00003	6276923.08	1.34	7.60	21.08
IS 513	41.1	38.6	1140	0.0009	44004.00	0.0339	-	-	-	314.976	0.00005	6276923.08	67.35	7.90	0.54
IS 514	102	40.4	130	0.0077	5252.00	0.3108	7.89	0.0607	-	318.756	0.00005	6069230.77	7.68	7.73	4.12
IS 515	22.2	16.3	255	0.0039	4156.50	0.0639	-	-	-	128.607	0.00002	6069230.77	15.07	7.79	2.20
IS 516	131	50.1	74.6	0.0134	3737.46	0.6716	-	-	-	395.289	0.00007	6069230.77	4.41	7.69	6.92
NS 517	93.4	15.9	686	0.0015	10907.40	0.0232	-	-	-	125.451	0.00002	6069230.77	13.20	6.00	0.87
NS 518	77.1	23	40.1	0.0249	922.30	0.5736	-	-	-	181.47	0.00003	6069230.77	0.77	2.71	12.35
NS 519	118	25.2	1390	0.0007	35028.00	0.0181	-	-	-	198.828	0.00003	6069230.77	26.74	7.31	0.45
NS 520	164	39	1650	0.0006	64350.00	0.0236	-	-	-	307.71	0.00005	6069230.77	31.75	7.67	0.39
NS 521	291	105	6520	0.0002	684600.00	0.0161	-	-	-	828.45	0.00014	6069230.77	125.44	11.27	0.11
NS 522	142	44.9	490	0.0020	22001.00	0.0916	-	-	-	354.261	0.00006	6069230.77	9.43	5.46	1.20
NS 523	201	25	250	0.0040	6250.00	0.1000	-	-	-	197.25	0.00003	6069230.77	4.81	4.52	2.24
NS 524	178	39	343	0.0029	13377.00	0.1137	5.01	0.0146	0.0192	195.39	0.00005	3853846.15	6.60	4.94	1.67
NS 525	223	57	6230	0.0002	355110.00	0.0091	-	-	-	285.57	0.00007	3853846.15	119.86	11.13	0.11
NS 526	128	28.2	31.6	0.0316	891.12	0.8924	-	-	-	141.282	0.00004	3853846.15	0.61	2.54	15.42
NS 527	133	36.8	1070	0.0009	39376.00	0.0344	-	-	-	184.368	0.00005	3853846.15	20.59	6.80	0.58
NS 528	89.2	29.7	177	0.0056	5256.90	0.1678	-	-	-	148.797	0.00004	3853846.15	3.41	4.11	3.09
NS 529	61.6	23.8	33.5	0.0299	797.30	0.7104	-	-	-	119.238	0.00003	3853846.15	0.64	2.58	14.60

NS 530	62.5	49.1	267	0.0037	13109.70	0.1839	-	-	-	245.991	0.00006	3853846.15	5.14	4.61	2.11
NS 531	148	29	2180	0.0005	63220.00	0.0133	-	-	-	145.29	0.00004	3853846.15	41.94	8.30	0.30
NS 532	59	10.9	323	0.0031	3520.70	0.0337	-	-	-	54.609	0.00001	3853846.15	6.21	4.86	1.76
NS 533	96.2	52.7	1830	0.0005	96441.00	0.0288	-	-	-	264.027	0.00007	3853846.15	35.21	7.90	0.35
NS 534	58.1	28.6	118	0.0085	3374.80	0.2424	-	-	-	143.286	0.00004	3853846.15	2.27	3.67	4.51
NS 535	71.2	16.7	1360	0.0007	22712.00	0.0123	-	-	-	83.667	0.00002	3853846.15	26.17	7.27	0.46
NS 536	40.1	9.5	202	0.0050	19190.00	0.0047	4.6	0.0228	-	47.595	0.00001	3853846.15	38.86	8.12	0.32
NS 537	44.2	12.8	1060	0.0009	13568.00	0.0121	-	-	-	64.128	0.00002	3853846.15	20.39	6.78	0.58
NS 538	88	30.2	2100	0.0005	63420.00	0.0144	-	-	-	151.302	0.00004	3853846.15	40.40	8.21	0.31
NS 539	56.5	42.3	132	0.0076	5583.60	0.3205	-	-	-	211.923	0.00005	3853846.15	2.54	3.78	4.06
NS 540	71.8	34.1	745	0.0013	25404.50	0.0458	-	-	-	170.841	0.00004	3853846.15	14.33	6.14	0.81
NS 541	124	90.9	228	0.0044	20725.20	0.3987	-	-	-	455.409	0.00012	3853846.15	4.39	4.41	2.44
NS 542	110	37.1	173	0.0058	6418.30	0.2145	4.13	0.0239	-	153.223	0.00005	3176923.08	3.33	4.08	3.16
NS 543	106.8	60.7	1320	0.0008	80124.00	0.0460	-	-	-	250.691	0.00008	3176923.08	25.40	7.21	0.47
OG 544	143	26	147	0.0068	3822.00	0.1769	-	-	-	107.38	0.00003	3176923.08	0.30	4.99	3.68
OG 545	44.8	15.5	1700	0.0006	26350.00	0.0091	2.39	0.0014	0.0020	37.045	0.00002	1838461.54	3.46	2.39	0.37
OG 546	60.1	26.7	2640	0.0004	70488.00	0.0101	-	-	-	63.813	0.00003	1838461.54	5.37	2.10	0.25
OG 547	74.3	34.6	3040	0.0003	105184.00	0.0114	-	-	-	82.694	0.00004	1838461.54	6.19	2.01	0.22
OG 548	152	89.9	1720	0.0006	154628.00	0.0523	-	-	-	214.861	0.00012	1838461.54	3.50	2.39	0.37
OG 549	145	45.6	2060	0.0005	93936.00	0.0221	-	-	-	108.984	0.00006	1838461.54	4.19	2.26	0.31
OG 550	63.2	28.7	1470	0.0007	42189.00	0.0195	-	-	-	68.593	0.00004	1838461.54	2.99	2.50	0.43
OG 551	226	51	4190	0.0002	213690.00	0.0122	-	-	-	121.89	0.00007	1838461.54	8.53	1.83	0.16
OG 552	189	31	292	0.0034	9052.00	0.1062	-	-	-	74.09	0.00004	1838461.54	0.59	4.06	1.94
OG 553	82	28.8	1040	0.0010	29952.00	0.0277	2.77	0.0027	-	79.776	0.00004	2130769.23	2.12	2.77	0.59

OG 554	30.9	13.4	6340	0.0002	84956.00	0.0021	-	-	-	37.118	0.00002	2130769.23	12.90	1.61	0.11
OG 555	22.2	10	2630	0.0004	26300.00	0.0038	-	-	-	27.7	0.00001	2130769.23	5.35	2.10	0.25
OG 556	226	22	4350	0.0002	95700.00	0.0051	-	-	-	60.94	0.00003	2130769.23	8.85	1.81	0.16
OG 557	101	37.5	1050	0.0010	39375.00	0.0357	-	-	-	103.875	0.00005	2130769.23	2.14	2.77	0.59
OG 558	43	24.1	1900	0.0005	45790.00	0.0127	-	-	-	66.757	0.00003	2130769.23	3.87	2.32	0.34
OG 559	107	44.7	8200	0.0001	366540.00	0.0055	-	-	-	123.819	0.00006	2130769.23	16.68	1.49	0.09
OG 560	188	50	2050	0.0005	102500.00	0.0244	-	-	-	138.5	0.00007	2130769.23	4.17	2.26	0.31
OG 561	68.4	13	1930	0.0005	25090.00	0.0067	-	-	-	36.01	0.00002	2130769.23	3.93	2.30	0.33
OG 562	129	65.8	1570	0.0006	103306.00	0.0419	-	-	-	182.266	0.00009	2130769.23	3.19	2.45	0.40
OG 563	226	44	1390	0.0007	61160.00	0.0317	-	-	-	121.88	0.00006	2130769.23	2.83	2.54	0.45
OG 564	106	79.3	180	0.0056	14274.00	0.4406	-	-	-	219.661	0.00010	2130769.23	0.37	4.70	3.04
OG 565	69.7	31	2380	0.0004	73780.00	0.0130	-	-	-	85.87	0.00004	2130769.23	4.84	2.16	0.27
OG 566	111	36.8	1560	0.0006	993.60	1.3630	2.5	0.0016	-	101.936	0.00005	2130769.23	0.05	8.30	17.86
OG 567	69.7	47	73.7	0.0136	3463.90	0.6377	-	-	-	130.19	0.00006	2130769.23	0.15	6.14	7.00
OG 568	109	39.6	1380	0.0007	54648.00	0.0287	-	-	-	109.692	0.00005	2130769.23	2.81	2.55	0.46
OG 569	64.8	36.2	146	0.0068	5285.20	0.2479	-	-	-	100.274	0.00005	2130769.23	0.30	5.00	3.70

D: Summarized Result of the DRASTIC Model

ES NO	Aquifer Depth	D		R		A		S		T		I		C		DI	Vulnerability
		D_r	D_w	R_r	R_w	A_r	A_w	S_r	S_w	T_r	T_w	I_r	I_w	C_r	C_w		
AJ 01	89.3	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 02	115	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 03	142	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 04	174	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 05	89.2	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 06	148	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 07	126	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 08	163	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 09	162	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 10	71.6	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 11	47	2	5	7	4	5	3	10	2	2	1	5	5	2	3	106	Moderate
AJ 12	16.7	8	5	7	4	5	3	10	2	2	1	5	5	2	3	136	Moderate
AJ 13	109	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 14	154	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 15	49.2	2	5	7	4	5	3	10	2	2	1	5	5	2	3	106	Moderate
AJ 16	109	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 17	129	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 18	188	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 19	136	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 20	89.6	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 21	154	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 22	47	2	5	7	4	5	3	10	2	2	1	5	5	2	3	106	Moderate
AJ 23	73.1	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 24	82.2	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 25	69.1	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 26	80.9	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 27	98.9	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 28	262	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 29	263	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 30	253	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 31	231	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 32	152	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 33	91.4	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 34	53.3	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 35	122	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 36	79	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 37	94.2	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 38	100	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AJ 39	146	1	5	7	4	5	3	10	2	2	1	5	5	2	3	101	Moderate
AM 40	184	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 41	83.5	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 42	187	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 43	153	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 44	175	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 45	160	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 46	184	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate

AM 47	55.3	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 48	155	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 49	43.3	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 50	219	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 51	81.5	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 52	39.8	5	5	8	4	8	3	8	2	10	1	8	5	4	3	159	High
AM 53	53.3	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 54	43.4	3	5	8	4	8	3	8	2	10	1	8	5	4	3	149	High
AM 55	52.8	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 56	26.1	7	5	8	4	8	3	8	2	10	1	8	5	4	3	169	High
AM 57	93.9	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 58	111	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 59	131	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 60	110	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 61	126	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 62	59.7	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 63	98.3	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 64	90.2	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 65	133	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 66	72.5	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 67	75.5	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 68	76.3	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 69	143	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 70	109	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 71	132	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 72	89.5	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 73	123	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 74	44.8	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 75	65.7	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 76	106	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 77	174	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 78	55.6	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 79	59.5	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 80	77.4	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 81	112	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 82	64.8	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 83	132	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 84	113	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM85	96.2	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 86	44.1	2	5	8	4	8	3	8	2	10	1	8	5	4	3	144	High
AM 87	37.2	4	5	8	4	8	3	8	2	10	1	8	5	4	3	154	High
AM 88	143	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 89	154	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 90	37.9	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 91	75.3	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 92	65.9	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 93	41.5	3	5	8	4	8	3	8	2	10	1	8	5	4	3	149	High
AM 94	56.1	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 95	98	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 96	75.7	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate

AM 97	68	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 98	151	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 99	245	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 100	81	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 101	147	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 102	123	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 103	70	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 104	50	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 105	80.7	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 106	68.4	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 107	149	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 108	176	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 109	156	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 110	153	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 111	108	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 112	57.8	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 113	143	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 114	30.5	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 115	143	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 116	246	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 117	277	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 118	224	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 119	149	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 120	201	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 121	261	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 122	155	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 123	210	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 124	125	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 125	32	5	5	8	4	8	3	8	2	10	1	8	5	4	3	159	High
AM 126	115	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 127	232	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 128	71	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 129	67	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 130	18.1	8	5	8	4	8	3	8	2	10	1	8	5	4	3	174	High
AM 131	230	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 132	140	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 133	188	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 134	102	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 135	105	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 136	135	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 137	75	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 138	50	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 139	153	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 140	124	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 141	92.1	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 142	33	5	5	8	4	8	3	8	2	10	1	8	5	4	3	159	High
AM 143	91	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 144	103	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 145	171	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 146	211	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate

AM 147	262	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 148	59.8	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 149	231	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 150	253	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 151	248	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 152	147	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 153	112	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 154	218	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 155	118	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 156	115	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 157	129	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 158	80	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 159	86	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 160	65	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 161	55	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 162	162	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 163	188	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 164	48.4	2	5	8	4	8	3	8	2	10	1	8	5	4	3	144	High
AM 165	191	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 166	64.9	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 167	189	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 168	61.8	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 169	66.7	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 170	142	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 171	240	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 172	216	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 173	246	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 174	49	2	5	8	4	8	3	8	2	10	1	8	5	4	3	144	High
AM 175	298	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 176	174	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 177	145	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 178	142	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 179	134	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 180	218	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 181	43.3	3	5	8	4	8	3	8	2	10	1	8	5	4	3	149	High
AM 182	229	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 183	107	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 184	143	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 185	92.6	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 186	112	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 187	135	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 188	56.9	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 189	88.8	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 190	68.8	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 191	202	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 192	66.2	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 193	118	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
AM 194	78.8	1	5	8	4	8	3	8	2	10	1	8	5	4	3	139	Moderate
BN 195	137	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 196	35.2	4	5	9	4	9	3	8	2	9	1	9	5	8	3	177	High

BN 197	51.2	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 198	60.7	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 199	80.3	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 200	80.4	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 201	65.5	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 202	67.5	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
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BN 204	170	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
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BN 209	130	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
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BN 211	149	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 212	165	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 213	281	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 214	102	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 215	119	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 216	70.3	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 217	39.3	4	5	9	4	9	3	8	2	9	1	9	5	8	3	177	High
BN 218	57	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 219	76.2	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 220	31.1	4	5	9	4	9	3	8	2	9	1	9	5	8	3	177	High
BN 221	42.1	3	5	9	4	9	3	8	2	9	1	9	5	8	3	172	High
BN 222	131	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 223	80.3	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 224	61.1	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 225	108	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 226	157	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 227	139	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 228	77.2	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 229	40.2	3	5	9	4	9	3	8	2	9	1	9	5	8	3	172	High
BN 230	24.4	7	5	9	4	9	3	8	2	9	1	9	5	8	3	192	High
BN 231	42.7	2	5	9	4	9	3	8	2	9	1	9	5	8	3	167	High
BN 232	145	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 233	36	5	5	9	4	9	3	8	2	9	1	9	5	8	3	182	High
BN 234	56.7	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 235	22.8	7	5	9	4	9	3	8	2	9	1	9	5	8	3	192	High
BN 236	43	3	5	9	4	9	3	8	2	9	1	9	5	8	3	172	High
BN 237	54	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
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BN 245	78.9	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 246	124	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High

BN 247	136	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
BN 248	153	1	5	9	4	9	3	8	2	9	1	9	5	8	3	162	High
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BN 250	170	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
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BN 269	139	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
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BN 274	81.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 275	86.1	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 276	89.6	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 277	139	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
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BN 295	122	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
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BN 297	209	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
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BN 300	120	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 301	48.8	2	5	9	4	9	3	8	2	9	1	9	5	6	3	161	High
BN 302	182	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 303	206	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 304	99.4	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 305	56.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 306	115	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 307	52.7	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 308	61.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 309	97.3	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
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BN 311	72.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 312	49.2	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 313	147	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 314	76.4	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 315	117	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 316	58	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 317	166	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 318	93.2	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
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BN 322	63.2	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 323	93.2	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 324	77.4	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 325	59.4	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 326	589	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 327	49.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 328	52.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 329	37.2	4	5	9	4	9	3	8	2	9	1	9	5	6	3	171	High
BN 330	86.6	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 331	77.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 332	83.6	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 333	234	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 334	223	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 335	136	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 336	40.1	2	5	9	4	9	3	8	2	9	1	9	5	6	3	161	High
BN 337	87.6	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 338	131	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 339	67.7	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 340	95	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 341	65.7	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 342	43	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 343	118	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 344	88.1	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 345	59.2	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 346	46.1	2	5	9	4	9	3	8	2	9	1	9	5	6	3	161	High

BN 347	128	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 348	141	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 349	172	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 350	150	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 351	126	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 352	139	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 353	63.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 354	168	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 355	221	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN356	53.5	2	5	9	4	9	3	8	2	9	1	9	5	6	3	161	High
BN 357	93.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 358	169	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 359	34	4	5	9	4	9	3	8	2	9	1	9	5	6	3	171	High
BN 360	150	7	5	9	4	9	3	8	2	9	1	9	5	6	3	186	High
BN 361	183	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 362	122	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 363	122	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 364	113	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 365	123	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 366	20.5	7	5	9	4	9	3	8	2	9	1	9	5	6	3	186	High
BN 367	120	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 368	143	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 369	61.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 370	226	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 371	81.4	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 372	139	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 373	131	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 374	138	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 375	135	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 376	125	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 377	110	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 378	121	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 379	128	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 380	84.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 381	38.1	5	5	9	4	9	3	8	2	9	1	9	5	6	3	176	High
BN 382	54	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 383	174	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 384	98.3	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 385	96.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 386	27.2	7	5	9	4	9	3	8	2	9	1	9	5	6	3	186	High
BN 387	137	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 388	188	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 389	118	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 390	45.3	2	5	9	4	9	3	8	2	9	1	9	5	6	3	161	High
BN 391	135	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 392	174	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 393	128	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 394	70.4	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 395	74.4	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 396	110	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High

BN 397	54.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 398	129	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 399	129	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 400	54.6	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 401	176	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 402	118	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 403	177	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 404	117	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 405	77.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 406	44.6	2	5	9	4	9	3	8	2	9	1	9	5	6	3	161	High
BN 407	68.6	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 408	65.4	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 409	23.5	5	5	9	4	9	3	8	2	9	1	9	5	6	3	176	High
BN 410	32.7	5	5	9	4	9	3	8	2	9	1	9	5	6	3	176	High
BN 411	42.7	5	5	9	4	9	3	8	2	9	1	9	5	6	3	176	High
BN 412	58.5	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 413	124	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
	37.8	5	5	9	4	9	3	8	2	9	1	9	5	6	3	176	High
BN 415	33.3	4	5	9	4	9	3	8	2	9	1	9	5	6	3	171	High
BN 416	51.7	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 417	58.4	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 418	55.3	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 419	49.5	4	5	9	4	9	3	8	2	9	1	9	5	6	3	171	High
BN 420	65.8	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 421	37.5	2	5	9	4	9	3	8	2	9	1	9	5	6	3	161	High
BN 422	180	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 423	186	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 424	118	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 425	133	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 426	143	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 427	171	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 428	115	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 429	62.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 430	180	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 431	73	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 432	116	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 433	157	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 434	193	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 435	27.3	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 436	132	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 437	194	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 438	34.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 439	61.1	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 440	207	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 441	172	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 442	165	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 443	48.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 444	143	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 445	139	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 446	201	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High

BN 447	193	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 448	183	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 449	148	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 450	139	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 451	167	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 452	180	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 453	175	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 454	94.7	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 455	88.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 456	102	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 457	91	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 458	151	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 459	71.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 460	120	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 461	124	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 462	70.1	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 463	117	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 464	123	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 465	89.8	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 466	82.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 467	69.3	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 468	109	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 469	40	3	5	9	4	9	3	8	2	9	1	9	5	6	3	166	High
BN 470	75	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 471	83.1	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 472	65	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 473	78.7	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 474	193	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 475	256	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 476	281	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 477	146	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 478	269	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 479	120	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 480	235	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 481	172	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 482	286	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 483	202	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 484	150	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 485	247	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 486	245	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 487	255	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 488	91.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 489	63.9	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 490	250	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 491	182	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 492	141	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 493	231	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 494	117	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 495	70.1	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 496	139	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High

BN 497	125	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 498	104	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 499	126	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
BN 500	134	1	5	9	4	9	3	8	2	9	1	9	5	6	3	156	High
IS 501	91	1	5	8	4	1	3	4	2	10	1	3	5	1	3	76	Low
IS 502	44.5	3	5	8	4	1	3	4	2	10	1	3	5	1	3	86	Low
IS 503	91.2	1	5	8	4	1	3	4	2	10	1	3	5	1	3	76	Low
IS 504	42.7	2	5	8	4	1	3	4	2	10	1	3	5	1	3	81	Low
IS 505	80.6	1	5	8	4	1	3	4	2	10	1	3	5	1	3	76	Low
IS 506	105	1	5	8	4	1	3	4	2	10	1	3	5	1	3	76	Low
IS 507	48	2	5	8	4	1	3	4	2	10	1	3	5	1	3	81	Low
IS 508	51.8	1	5	8	4	1	3	4	2	10	1	3	5	1	3	76	Low
IS 509	121	1	5	8	4	1	3	4	2	10	1	3	5	1	3	76	Low
IS 510	104	1	5	8	4	1	3	4	2	10	1	3	5	1	3	76	Low
IS 511	51.7	1	5	8	4	1	3	4	2	10	1	3	5	1	3	76	Low
IS 512	51.8	1	5	8	4	1	3	4	2	10	1	3	5	1	3	76	Low
IS 513	41.1	1	5	8	4	1	3	4	2	10	1	3	5	1	3	76	Low
IS 514	102	1	5	8	4	1	3	4	2	10	1	3	5	2	3	79	Low
IS 515	22.2	1	5	8	4	1	3	4	2	10	1	3	5	2	3	79	Low
IS 516	131	1	5	8	4	1	3	4	2	10	1	3	5	2	3	79	Low
NS 517	93.4	1	5	8	4	5	3	5	2	1	1	2	5	2	3	79	Low
NS 518	77.1	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 519	118	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 520	164	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 521	291	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 522	142	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 523	201	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 524	178	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 525	223	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 526	128	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 527	133	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 528	89.2	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 529	61.6	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 530	62.5	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 531	148	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 532	59	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 533	96.2	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 534	58.1	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 535	71.2	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 536	40.1	2	5	8	4	5	3	5	2	1	1	2	5	4	3	90	Low
NS 537	44.2	2	5	8	4	5	3	5	2	1	1	2	5	4	3	90	Low
NS 538	88	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 539	56.5	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 540	71.8	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 541	124	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 542	110	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
NS 543	106.8	1	5	8	4	5	3	5	2	1	1	2	5	4	3	85	Low
OG 544	143	1	5	9	4	3	3	4	2	4	1	2	5	2	3	78	Low
OG 545	44.8	2	5	9	4	3	3	4	2	4	1	4	5	2	3	93	Low
OG 546	60.1	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low

OG 547	74.3	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 548	152	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 549	145	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 550	63.2	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 551	226	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 552	189	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 553	82	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 554	30.9	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 555	22.2	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 556	226	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 557	101	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 558	43	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 559	107	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 560	188	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 561	68.4	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 562	129	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 563	226	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 564	106	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 565	69.7	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 566	111	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 567	69.7	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 568	109	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low
OG 569	64.8	1	5	9	4	3	3	4	2	4	1	4	5	2	3	88	Low

E: Summarized Result of the GOD Model

Formation	VES	Parameter			Rating			Total	Vulnerability
	No.	G	O	D	G	O	D	Score	
AJALI FM	AJ 01	SCF	SST	89.3	0	1	1	0.105	Low
AJALI FM	AJ 02	SCF	SST	115	0	1	0	0.112	Low
AJALI FM	AJ 03	SCF	SST	142	0	1	0	0.112	Low
AJALI FM	AJ 04	SCF	SST	174	0	1	0	0.112	Low
AJALI FM	AJ 05	SCF	SST	89.2	0	1	1	0.105	Low
AJALI FM	AJ 06	SCF	SST	148	0	1	0	0.112	Low
AJALI FM	AJ 07	SCF	SST	126	0	1	0	0.112	Low
AJALI FM	AJ 08	SCF	SST	163	0	1	0	0.112	Low
AJALI FM	AJ 09	SCF	SST	162	0	1	0	0.112	Low
AJALI FM	AJ 10	SCF	SST	71.6	0	1	1	0.105	Low
AJALI FM	AJ 11	SCF	SST	47	0	1	1	0.126	Low
AJALI FM	AJ 12	SCF	SST	16.7	0	1	1	0.147	Low
AJALI FM	AJ 13	SCF	SST	109	0	1	0	0.112	Low
AJALI FM	AJ 14	SCF	SST	154	0	1	0	0.112	Low
AJALI FM	AJ 15	SCF	SST	49.2	0	1	1	0.126	Low
AJALI FM	AJ 16	SCF	SST	109	0	1	0	0.112	Low
AJALI FM	AJ17	SCF	SST	129	0	1	0	0.112	Low
AJALI FM	AJ 18	SCF	SST	188	0	1	0	0.112	Low
AJALI FM	AJ 19	SCF	SST	136	0	1	0	0.112	Low
AJALI FM	AJ 20	SCF	SST	89.6	0	1	1	0.14	Low
AJALI FM	AJ 21	SCF	SST	154	0	1	0	0.112	Low
AJALI FM	AJ 22	SCF	SST	47	0	1	1	0.168	Low
AJALI FM	AJ 23	SCF	SST	73.1	0	1	1	0.14	Low
AJALI FM	AJ 24	SCF	SST	82.2	0	1	1	0.14	Low
AJALI FM	AJ 25	SCF	SST	69.1	0	1	1	0.14	Low
AJALI FM	AJ 26	SCF	SST	80.9	0	1	1	0.14	Low
AJALI FM	AJ 27	SCF	SST	98.9	0	1	1	0.14	Low
AJALI FM	AJ 28	SCF	SST	262	0	1	0	0.112	Low
AJALI FM	AJ 29	SCF	SST	263	0	1	0	0.112	Low
AJALI FM	AJ 30	SCF	SST	253	0	1	0	0.112	Low
AJALI FM	AJ 31	SCF	SST	231	0	1	0	0.112	Low
AJALI FM	AJ 32	SCF	SST	152	0	1	0	0.112	Low
AJALI FM	AJ 33	SCF	SST	91.4	0	1	1	0.14	Low
AJALI FM	AJ 34	SCF	SST	53.3	0	1	1	0.14	Low
AJALI FM	AJ 35	SCF	SST	122	0	1	0	0.112	Low
AJALI FM	AJ 36	SCF	SST	79	0	1	1	0.14	Low
AJALI FM	AJ 37	SCF	SST	94.2	0	1	1	0.14	Low
AJALI FM	AJ 38	SCF	SST	100	0	1	0	0.112	Low
AJALI FM	AJ 39	SCF	SST	146	0	1	0	0.112	Low

AMEKI FM	AM 40	SCF	SD	184	0	1	0	0.112	Low
AMEKI FM	AM 41	SCF	SD	83.5	0	1	1	0.14	Low
AMEKI FM	AM 42	SCF	SD	187	0	1	0	0.112	Low
AMEKI FM	AM 43	SCF	SD	153	0	1	0	0.112	Low
AMEKI FM	AM 44	SCF	SD	175	0	1	0	0.112	Low
AMEKI FM	AM 45	SCF	SD	160	0	1	0	0.112	Low
AMEKI FM	AM 46	SCF	SD	184	0	1	0	0.112	Low
AMEKI FM	AM 47	SCF	SD	55.3	0	1	0	0.112	Low
AMEKI FM	AM 48	SCF	SD	155	0	1	0	0.112	Low
AMEKI FM	AM 49	SCF	SD	43.3	0	1	1	0.168	Low
AMEKI FM	AM 50	SCF	SD	219	0	1	0	0.112	Low
AMEKI FM	AM 51	SCF	SD	81.5	0	1	1	0.14	Low
AMEKI FM	AM 52	SCF	SD	39.8	0	1	1	0.168	Low
AMEKI FM	AM 53	SCF	SD	53.3	0	1	1	0.14	Low
AMEKI FM	AM 54	SCF	SD	43.4	0	1	1	0.168	Low
AMEKI FM	AM 55	SCF	SD	52.8	0	1	1	0.14	Low
AMEKI FM	AM 56	SCF	SD	26.1	0	1	1	0.168	Low
AMEKI FM	AM 57	SCF	SD	93.9	0	1	1	0.14	Low
AMEKI FM	AM 58	SCF	SD	111	0	1	0	0.112	Low
AMEKI FM	AM 59	SCF	SD	131	0	1	0	0.112	Low
AMEKI FM	AM 60	SCF	SD	110	0	1	0	0.112	Low
AMEKI FM	AM 61	SCF	SD	126	0	1	0	0.112	Low
AMEKI FM	AM 62	SCF	SD	59.7	0	1	1	0.14	Low
AMEKI FM	AM 63	SCF	SD	98.3	0	1	1	0.14	Low
AMEKI FM	AM 64	SCF	SD	90.2	0	1	1	0.14	Low
AMEKI FM	AM 65	SCF	SD	133	0	1	1	0.14	Low
AMEKI FM	AM 66	SCF	SD	72.5	0	1	1	0.14	Low
AMEKI FM	AM 67	SCF	SD	75.5	0	1	1	0.14	Low
AMEKI FM	AM 68	SCF	SD	76.3	0	1	1	0.14	Low
AMEKI FM	AM 69	SCF	SD	143	0	1	0	0.112	Low
AMEKI FM	AM 70	SCF	SD	109	0	1	0	0.112	Low
AMEKI FM	AM 71	SCF	SD	132	0	1	0	0.112	Low
AMEKI FM	AM 72	SCF	SD	89.5	0	1	1	0.14	Low
AMEKI FM	AM 73	SCF	SD	123	0	1	0	0.112	Low
AMEKI FM	AM 74	SCF	SD	44.8	0	1	1	0.168	Low
AMEKI FM	AM 75	SCF	SD	65.7	0	1	1	0.14	Low
AMEKI FM	AM 76	SCF	SD	106	0	1	0	0.112	Low
AMEKI FM	AM 77	SCF	SD	174	0	1	0	0.112	Low
AMEKI FM	AM 78	SCF	SD	55.6	0	1	1	0.14	Low
AMEKI FM	AM 79	SCF	SD	59.5	0	1	1	0.14	Low
AMEKI FM	AM 80	SCF	SD	77.4	0	1	1	0.14	Low
AMEKI FM	AM 81	SCF	SD	112	0	1	0	0.112	Low
AMEKI FM	AM 82	SCF	SD	64.8	0	1	1	0.14	Low

AMEKI FM	AM 83	SCF	SD	132	0	1	0	0.112	Low
AMEKI FM	AM 84	SCF	SD	113	0	1	0	0.112	Low
AMEKI FM	AM85	SCF	SD	96.2	0	1	1	0.14	Low
AMEKI FM	AM 86	SCF	SD	44.1	0	1	1	0.168	Low
AMEKI FM	AM 87	SCF	SD	37.2	0	1	1	0.168	Low
AMEKI FM	AM 88	SCF	SD	143	0	1	0	0.112	Low
AMEKI FM	AM 89	SCF	SD	154	0	1	0	0.112	Low
AMEKI FM	AM 90	SCF	SD	37.9	0	1	1	0.168	Low
AMEKI FM	AM 91	SCF	SD	75.3	0	1	1	0.14	Low
AMEKI FM	AM 92	SCF	SD	65.9	0	1	1	0.14	Low
AMEKI FM	AM 93	SCF	SD	41.5	0	1	1	0.168	Low
AMEKI FM	AM 94	SCF	SD	56.1	0	1	1	0.14	Low
AMEKI FM	AM 95	SCF	SD	98	0	1	1	0.14	Low
AMEKI FM	AM 96	SCF	SD	75.7	0	1	1	0.14	Low
AMEKI FM	AM 97	SCF	SD	68	0	1	1	0.14	Low
AMEKI FM	AM 98	SCF	SD	151	0	1	0	0.112	Low
AMEKI FM	AM 99	SCF	SD	245	0	1	0	0.112	Low
AMEKI FM	AM 100	SCF	SD	81	0	1	1	0.14	Low
AMEKI FM	AM 101	SCF	SD	147	0	1	0	0.112	Low
AMEKI FM	AM 102	SCF	SD	123	0	1	0	0.112	Low
AMEKI FM	AM 103	SCF	SD	70	0	1	1	0.14	Low
AMEKI FM	AM 104	SCF	SD	50	0	1	1	0.14	Low
AMEKI FM	AM 105	SCF	SD	80.7	0	1	1	0.14	Low
AMEKI FM	AM 106	SCF	SD	68.4	0	1	1	0.14	Low
AMEKI FM	AM 107	SCF	SD	149	0	1	0	0.112	Low
AMEKI FM	AM 108	SCF	SD	176	0	1	0	0.112	Low
AMEKI FM	AM 109	SCF	SD	156	0	1	0	0.112	Low
AMEKI FM	AM 110	SCF	SD	153	0	1	0	0.112	Low
AMEKI FM	AM 111	SCF	SD	108	0	1	0	0.112	Low
AMEKI FM	AM 112	SCF	SD	57.8	0	1	1	0.14	Low
AMEKI FM	AM 113	SCF	SD	143	0	1	0	0.112	Low
AMEKI FM	AM 114	SCF	SD	30.5	0	1	1	0.168	Low
AMEKI FM	AM 115	SCF	SD	143	0	1	0	0.112	Low
AMEKI FM	AM 116	SCF	SD	246	0	1	0	0.112	Low
AMEKI FM	AM 117	SCF	SD	277	0	1	0	0.112	Low
AMEKI FM	AM 118	SCF	SD	224	0	1	0	0.112	Low
AMEKI FM	AM 119	SCF	SD	149	0	1	0	0.112	Low
AMEKI FM	AM 120	SCF	SD	201	0	1	0	0.112	Low
AMEKI FM	AM 121	SCF	SD	261	0	1	0	0.112	Low
AMEKI FM	AM 122	SCF	SD	155	0	1	0	0.112	Low
AMEKI FM	AM 123	SCF	SD	210	0	1	0	0.112	Low
AMEKI FM	AM 124	SCF	SD	125	0	1	0	0.112	Low
AMEKI FM	AM 125	SCF	SD	32	0	1	1	0.168	Low

AMEKI FM	AM 126	SCF	SD	115	0	1	0	0.112	Low
AMEKI FM	AM 127	SCF	SD	232	0	1	0	0.112	Low
AMEKI FM	AM 128	SCF	SD	71	0	1	1	0.14	Low
AMEKI FM	AM 129	SCF	SD	67	0	1	1	0.14	Low
AMEKI FM	AM 130	SCF	SD	18.1	0	1	1	0.196	Low
AMEKI FM	AM 131	SCF	SD	230	0	1	0	0.112	Low
AMEKI FM	AM 132	SCF	SD	140	0	1	0	0.112	Low
AMEKI FM	AM 133	SCF	SD	188	0	1	0	0.112	Low
AMEKI FM	AM 134	SCF	SD	102	0	1	0	0.112	Low
AMEKI FM	AM 135	SCF	SD	105	0	1	0	0.112	Low
AMEKI FM	AM 136	SCF	SD	135	0	1	0	0.112	Low
AMEKI FM	AM 137	SCF	SD	75	0	1	1	0.14	Low
AMEKI FM	AM 138	SCF	SD	50	0	1	1	0.14	Low
AMEKI FM	AM 139	SCF	SD	153	0	1	0	0.112	Low
AMEKI FM	AM 140	SCF	SD	124	0	1	0	0.112	Low
AMEKI FM	AM 141	SCF	SD	92.1	0	1	1	0.14	Low
AMEKI FM	AM 142	SCF	SD	33	0	1	1	0.168	Low
AMEKI FM	AM 143	SCF	SD	91	0	1	1	0.14	Low
AMEKI FM	AM 144	SCF	SD	103	0	1	0	0.112	Low
AMEKI FM	AM 145	SCF	SD	171	0	1	0	0.112	Low
AMEKI FM	AM 146	SCF	SD	211	0	1	0	0.112	Low
AMEKI FM	AM 147	SCF	SD	262	0	1	0	0.112	Low
AMEKI FM	AM 148	SCF	SD	59.8	0	1	1	0.14	Low
AMEKI FM	AM 149	SCF	SD	231	0	1	0	0.112	Low
AMEKI FM	AM 150	SCF	SD	253	0	1	0	0.112	Low
AMEKI FM	AM 151	SCF	SD	248	0	1	0	0.112	Low
AMEKI FM	AM 152	SCF	SD	147	0	1	0	0.112	Low
AMEKI FM	AM 153	SCF	SD	112	0	1	0	0.112	Low
AMEKI FM	AM 154	SCF	SD	218	0	1	0	0.112	Low
AMEKI FM	AM 155	SCF	SD	118	0	1	0	0.112	Low
AMEKI FM	AM 156	SCF	SD	115	0	1	0	0.112	Low
AMEKI FM	AM 157	SCF	SD	129	0	1	0	0.112	Low
AMEKI FM	AM 158	SCF	SD	80	0	1	1	0.14	Low
AMEKI FM	AM 159	SCF	SD	86	0	1	1	0.14	Low
AMEKI FM	AM 160	SCF	SD	65	0	1	1	0.14	Low
AMEKI FM	AM 161	SCF	SD	55	0	1	1	0.14	Low
AMEKI FM	AM 162	SCF	SD	162	0	1	0	0.112	Low
AMEKI FM	AM 163	SCF	SD	188	0	1	0	0.112	Low
AMEKI FM	AM 164	SCF	SD	48.4	0	1	1	0.168	Low
AMEKI FM	AM 165	SCF	SD	191	0	1	0	0.112	Low
AMEKI FM	AM 166	SCF	SD	64.9	0	1	1	0.14	Low
AMEKI FM	AM 167	SCF	SD	189	0	1	0	0.112	Low
AMEKI FM	AM 168	SCF	SD	61.8	0	1	1	0.14	Low

AMEKI FM	AM 169	SCF	SD	66.7	0	1	1	0.14	Low
AMEKI FM	AM 170	SCF	SD	142	0	1	0	0.112	Low
AMEKI FM	AM 171	SCF	SD	240	0	1	0	0.112	Low
AMEKI FM	AM 172	SCF	SD	216	0	1	0	0.112	Low
AMEKI FM	AM 173	SCF	SD	246	0	1	0	0.112	Low
AMEKI FM	AM 174	SCF	SD	49	0	1	1	0.168	Low
AMEKI FM	AM 175	SCF	SD	298	0	1	0	0.112	Low
AMEKI FM	AM 176	SCF	SD	174	0	1	0	0.112	Low
AMEKI FM	AM 177	SCF	SD	145	0	1	0	0.112	Low
AMEKI FM	AM 178	SCF	SD	142	0	1	0	0.112	Low
AMEKI FM	AM 179	SCF	SD	134	0	1	0	0.112	Low
AMEKI FM	AM 180	SCF	SD	218	0	1	0	0.112	Low
AMEKI FM	AM 181	SCF	SD	43.3	0	1	1	0.168	Low
AMEKI FM	AM 182	SCF	SD	229	0	1	0	0.112	Low
AMEKI FM	AM 183	SCF	SD	107	0	1	0	0.112	Low
AMEKI FM	AM 184	SCF	SD	143	0	1	0	0.112	Low
AMEKI FM	AM 185	SCF	SD	92.6	0	1	1	0.14	Low
AMEKI FM	AM 186	SCF	SD	112	0	1	0	0.112	Low
AMEKI FM	AM 187	SCF	SD	135	0	1	0	0.112	Low
AMEKI FM	AM 188	SCF	SD	56.9	0	1	1	0.14	Low
AMEKI FM	AM 189	SCF	SD	88.8	0	1	1	0.14	Low
AMEKI FM	AM 190	SCF	SD	68.8	0	1	1	0.14	Low
AMEKI FM	AM 191	SCF	SD	202	0	1	0	0.112	Low
AMEKI FM	AM 192	SCF	SD	66.2	0	1	1	0.14	Low
AMEKI FM	AM 193	SCF	SD	118	0	1	0	0.112	Low
AMEKI FM	AM 194	SCF	SD	78.8	0	1	1	0.14	Low
BENIN FM	BN 195	UCF	SD/SST	137	1	1	0	0.168	Low
BENIN FM	BN 196	UCF	SD/SST	35.2	1	1	1	0.504	High
BENIN FM	BN 197	UCF	SD/SST	51.2	1	1	1	0.504	High
BENIN FM	BN 198	UCF	SD/SST	60.7	1	1	1	0.504	High
BENIN FM	BN 199	UCF	SD/SST	80.3	1	1	1	0.504	High
BENIN FM	BN 200	UCF	SD/SST	80.4	1	1	1	0.504	High
BENIN FM	BN 201	UCF	SD/SST	65.5	1	1	1	0.504	High
BENIN FM	BN 202	UCF	SD/SST	67.5	1	1	1	0.504	High
BENIN FM	BN 203	UCF	SD/SST	106	1	1	1	0.504	High
BENIN FM	BN 204	UCF	SD/SST	170	1	1	1	0.504	High
BENIN FM	BN 205	UCF	SD/SST	142	1	1	1	0.504	High
BENIN FM	BN 206	UCF	SD/SST	145	1	1	1	0.504	High
BENIN FM	BN 207	UCF	SD/SST	155	1	1	1	0.504	High
BENIN FM	BN 208	UCF	SD/SST	152	1	1	1	0.504	High
BENIN FM	BN 209	UCF	SD/SST	130	1	1	1	0.504	High
BENIN FM	BN 210	UCF	SD/SST	30.1	1	1	1	0.504	High
BENIN FM	BN 211	UCF	SD/SST	149	1	1	1	0.504	High

BENIN FM	BN 212	UCF	SD/SST	165	1	1	1	0.504	High
BENIN FM	BN 213	UCF	SD/SST	281	1	1	1	0.504	High
BENIN FM	BN 214	UCF	SD/SST	102	1	1	1	0.504	High
BENIN FM	BN 215	UCF	SD/SST	119	1	1	1	0.504	High
BENIN FM	BN 216	UCF	SD/SST	70.3	1	1	1	0.504	High
BENIN FM	BN 217	UCF	SD/SST	39.3	1	1	1	0.504	High
BENIN FM	BN 218	UCF	SD/SST	57	1	1	1	0.504	High
BENIN FM	BN 219	UCF	SD/SST	76.2	1	1	1	0.504	High
BENIN FM	BN 220	UCF	SD/SST	31.1	1	1	1	0.504	High
BENIN FM	BN 221	UCF	SD/SST	42.1	1	1	1	0.504	High
BENIN FM	BN 222	UCF	SD/SST	131	1	1	1	0.504	High
BENIN FM	BN 223	UCF	SD/SST	80.3	1	1	1	0.504	High
BENIN FM	BN 224	UCF	SD/SST	61.1	1	1	1	0.504	High
BENIN FM	BN 225	UCF	SD/SST	108	1	1	1	0.504	High
BENIN FM	BN 226	UCF	SD/SST	157	1	1	1	0.504	High
BENIN FM	BN 227	UCF	SD/SST	139	1	1	1	0.504	High
BENIN FM	BN 228	UCF	SD/SST	77.2	1	1	1	0.504	High
BENIN FM	BN 229	UCF	SD/SST	40.2	1	1	1	0.504	High
BENIN FM	BN 230	UCF	SD/SST	24.4	1	1	1	0.504	High
BENIN FM	BN 231	UCF	SD/SST	42.7	1	1	1	0.504	High
BENIN FM	BN 232	UCF	SD/SST	145	1	1	1	0.504	High
BENIN FM	BN 233	UCF	SD/SST	36	1	1	1	0.504	High
BENIN FM	BN 234	UCF	SD/SST	56.7	1	1	1	0.504	High
BENIN FM	BN 235	UCF	SD/SST	22.8	1	1	1	0.504	High
BENIN FM	BN 236	UCF	SD/SST	43	1	1	1	0.504	High
BENIN FM	BN 237	UCF	SD/SST	54	1	1	1	0.504	High
BENIN FM	BN 238	UCF	SD/SST	63.7	1	1	1	0.504	High
BENIN FM	BN 239	UCF	SD/SST	68.3	1	1	1	0.504	High
BENIN FM	BN 240	UCF	SD/SST	131	1	1	1	0.504	High
BENIN FM	BN 241	UCF	SD/SST	143	1	1	1	0.504	High
BENIN FM	BN 242	UCF	SD/SST	66.7	1	1	1	0.504	High
BENIN FM	BN 243	UCF	SD/SST	91.8	1	1	1	0.504	High
BENIN FM	BN 244	UCF	SD/SST	74.1	1	1	1	0.504	High
BENIN FM	BN 245	UCF	SD/SST	78.9	1	1	1	0.504	High
BENIN FM	BN 246	UCF	SD/SST	124	1	1	1	0.504	High
BENIN FM	BN 247	UCF	SD/SST	136	1	1	1	0.504	High
BENIN FM	BN 248	UCF	SD/SST	153	1	1	1	0.504	High
BENIN FM	BN 249	UCF	SD/SST	25.9	1	1	1	0.504	High
BENIN FM	BN 250	UCF	SD/SST	170	1	1	1	0.504	High
BENIN FM	BN 251	UCF	SD/SST	97.3	1	1	1	0.504	High
BENIN FM	BN 252	UCF	SD/SST	79.6	1	1	1	0.504	High
BENIN FM	BN 253	UCF	SD/SST	80	1	1	1	0.504	High
BENIN FM	BN 254	UCF	SD/SST	142	1	1	1	0.504	High

BENIN FM	BN 255	UCF	SD/SST	152	1	1	1	0.504	High
BENIN FM	BN 256	UCF	SD/SST	96.5	1	1	1	0.504	High
BENIN FM	BN 257	UCF	SD/SST	101	1	1	1	0.504	High
BENIN FM	BN 258	UCF	SD/SST	136	1	1	1	0.504	High
BENIN FM	BN 259	UCF	SD/SST	50.5	1	1	1	0.504	High
BENIN FM	BN 260	UCF	SD/SST	157	1	1	1	0.504	High
BENIN FM	BN 261	UCF	SD/SST	113	1	1	1	0.504	High
BENIN FM	BN 262	UCF	SD/SST	118	1	1	1	0.504	High
BENIN FM	BN 263	UCF	SD/SST	211	1	1	1	0.504	High
BENIN FM	BN 264	UCF	SD/SST	169	1	1	1	0.504	High
BENIN FM	BN 265	UCF	SD/SST	158	1	1	1	0.504	High
BENIN FM	BN 266	UCF	SD/SST	150	1	1	1	0.504	High
BENIN FM	BN 267	UCF	SD/SST	206	1	1	1	0.504	High
BENIN FM	BN 268	UCF	SD/SST	155	1	1	1	0.504	High
BENIN FM	BN 269	UCF	SD/SST	139	1	1	1	0.504	High
BENIN FM	BN 270	UCF	SD/SST	76.4	1	1	1	0.504	High
BENIN FM	BN 271	UCF	SD/SST	147	1	1	1	0.504	High
BENIN FM	BN 272	UCF	SD/SST	151	1	1	1	0.504	High
BENIN FM	BN 273	UCF	SD/SST	110	1	1	1	0.504	High
BENIN FM	BN 274	UCF	SD/SST	81.9	1	1	1	0.504	High
BENIN FM	BN 275	UCF	SD/SST	86.1	1	1	1	0.504	High
BENIN FM	BN 276	UCF	SD/SST	89.6	1	1	1	0.504	High
BENIN FM	BN 277	UCF	SD/SST	139	1	1	1	0.504	High
BENIN FM	BN 278	UCF	SD/SST	177	1	1	1	0.504	High
BENIN FM	BN 279	UCF	SD/SST	73.9	1	1	1	0.504	High
BENIN FM	BN 280	UCF	SD/SST	116	1	1	1	0.504	High
BENIN FM	BN 281	UCF	SD/SST	124	1	1	1	0.504	High
BENIN FM	BN 282	UCF	SD/SST	57.5	1	1	1	0.504	High
BENIN FM	BN 283	UCF	SD/SST	121	1	1	1	0.504	High
BENIN FM	BN 284	UCF	SD/SST	46.5	1	1	1	0.504	High
BENIN FM	BN 285	UCF	SD/SST	80.4	1	1	1	0.504	High
BENIN FM	BN 286	UCF	SD/SST	88.5	1	1	1	0.504	High
BENIN FM	BN 287	UCF	SD/SST	32.7	1	1	1	0.504	High
BENIN FM	BN 288	UCF	SD/SST	200	1	1	1	0.504	High
BENIN FM	BN 289	UCF	SD/SST	86.8	1	1	1	0.504	High
BENIN FM	BN 290	UCF	SD/SST	28.2	1	1	1	0.504	High
BENIN FM	BN 291	UCF	SD/SST	86.8	1	1	1	0.504	High
BENIN FM	BN 292	UCF	SD/SST	88.1	1	1	1	0.504	High
BENIN FM	BN 293	UCF	SD/SST	66	1	1	1	0.504	High
BENIN FM	BN 294	UCF	SD/SST	117	1	1	1	0.504	High
BENIN FM	BN 295	UCF	SD/SST	122	1	1	1	0.504	High
BENIN FM	BN 296	UCF	SD/SST	109	1	1	1	0.504	High
BENIN FM	BN 297	UCF	SD/SST	209	1	1	1	0.504	High

BENIN FM	BN 298	UCF	SD/SST	149	1	1	1	0.504	High
BENIN FM	BN 299	UCF	SD/SST	130	1	1	1	0.504	High
BENIN FM	BN 300	UCF	SD/SST	120	1	1	1	0.504	High
BENIN FM	BN 301	UCF	SD/SST	48.8	1	1	1	0.504	High
BENIN FM	BN 302	UCF	SD/SST	182	1	1	1	0.504	High
BENIN FM	BN 303	UCF	SD/SST	206	1	1	1	0.504	High
BENIN FM	BN 304	UCF	SD/SST	99.4	1	1	1	0.504	High
BENIN FM	BN 305	UCF	SD/SST	56.5	1	1	1	0.504	High
BENIN FM	BN 306	UCF	SD/SST	115	1	1	1	0.504	High
BENIN FM	BN 307	UCF	SD/SST	52.7	1	1	1	0.504	High
BENIN FM	BN 308	UCF	SD/SST	61.5	1	1	1	0.504	High
BENIN FM	BN 309	UCF	SD/SST	97.3	1	1	1	0.504	High
BENIN FM	BN 310	UCF	SD/SST	52.5	1	1	1	0.504	High
BENIN FM	BN 311	UCF	SD/SST	72.5	1	1	1	0.504	High
BENIN FM	BN 312	UCF	SD/SST	49.2	1	1	1	0.504	High
BENIN FM	BN 313	UCF	SD/SST	147	1	1	1	0.504	High
BENIN FM	BN 314	UCF	SD/SST	76.4	1	1	1	0.504	High
BENIN FM	BN 315	UCF	SD/SST	117	1	1	1	0.504	High
BENIN FM	BN 316	UCF	SD/SST	58	1	1	1	0.504	High
BENIN FM	BN 317	UCF	SD/SST	166	1	1	1	0.504	High
BENIN FM	BN 318	UCF	SD/SST	93.2	1	1	1	0.504	High
BENIN FM	BN 319	UCF	SD/SST	102	1	1	1	0.504	High
BENIN FM	BN 320	UCF	SD/SST	154	1	1	1	0.504	High
BENIN FM	BN 321	UCF	SD/SST	205	1	1	1	0.504	High
BENIN FM	BN 322	UCF	SD/SST	63.2	1	1	1	0.504	High
BENIN FM	BN 323	UCF	SD/SST	93.2	1	1	1	0.504	High
BENIN FM	BN 324	UCF	SD/SST	77.4	1	1	1	0.504	High
BENIN FM	BN 325	UCF	SD/SST	59.4	1	1	1	0.504	High
BENIN FM	BN 326	UCF	SD/SST	234	1	1	1	0.504	High
BENIN FM	BN 327	UCF	SD/SST	49.9	1	1	1	0.504	High
BENIN FM	BN 328	UCF	SD/SST	52.5	1	1	1	0.504	High
BENIN FM	BN 329	UCF	SD/SST	37.2	1	1	1	0.504	High
BENIN FM	BN 330	UCF	SD/SST	86.6	1	1	1	0.504	High
BENIN FM	BN 331	UCF	SD/SST	77.5	1	1	1	0.504	High
BENIN FM	BN 332	UCF	SD/SST	83.6	1	1	1	0.504	High
BENIN FM	BN 333	UCF	SD/SST	234	1	1	1	0.504	High
BENIN FM	BN 334	UCF	SD/SST	223	1	1	1	0.504	High
BENIN FM	BN 335	UCF	SD/SST	136	1	1	1	0.504	High
BENIN FM	BN 336	UCF	SD/SST	40.1	1	1	1	0.504	High
BENIN FM	BN 337	UCF	SD/SST	87.6	1	1	1	0.504	High
BENIN FM	BN 338	UCF	SD/SST	131	1	1	1	0.504	High
BENIN FM	BN 339	UCF	SD/SST	67.7	1	1	1	0.504	High
BENIN FM	BN 340	UCF	SD/SST	95	1	1	1	0.504	High

BENIN FM	BN 341	UCF	SD/SST	65.7	1	1	1	0.504	High
BENIN FM	BN 342	UCF	SD/SST	43	1	1	1	0.504	High
BENIN FM	BN 343	UCF	SD/SST	118	1	1	1	0.504	High
BENIN FM	BN 344	UCF	SD/SST	88.1	1	1	1	0.504	High
BENIN FM	BN 345	UCF	SD/SST	59.2	1	1	1	0.504	High
BENIN FM	BN 346	UCF	SD/SST	46.1	1	1	1	0.504	High
BENIN FM	BN 347	UCF	SD/SST	128	1	1	1	0.504	High
BENIN FM	BN 348	UCF	SD/SST	141	1	1	1	0.504	High
BENIN FM	BN 349	UCF	SD/SST	172	1	1	1	0.504	High
BENIN FM	BN 350	UCF	SD/SST	150	1	1	1	0.504	High
BENIN FM	BN 351	UCF	SD/SST	126	1	1	1	0.504	High
BENIN FM	BN 352	UCF	SD/SST	139	1	1	1	0.504	High
BENIN FM	BN 353	UCF	SD/SST	63.9	1	1	1	0.504	High
BENIN FM	BN 354	UCF	SD/SST	168	1	1	1	0.504	High
BENIN FM	BN 355	UCF	SD/SST	221	1	1	1	0.504	High
BENIN FM	BN356	UCF	SD/SST	53.5	1	1	1	0.504	High
BENIN FM	BN 357	UCF	SD/SST	93.5	1	1	1	0.504	High
BENIN FM	BN 358	UCF	SD/SST	169	1	1	1	0.504	High
BENIN FM	BN 359	UCF	SD/SST	34	1	1	1	0.504	High
BENIN FM	BN 360	UCF	SD/SST	150	1	1	1	0.504	High
BENIN FM	BN 361	UCF	SD/SST	183	1	1	1	0.504	High
BENIN FM	BN 362	UCF	SD/SST	122	1	1	1	0.504	High
BENIN FM	BN 363	UCF	SD/SST	122	1	1	1	0.504	High
BENIN FM	BN 364	UCF	SD/SST	113	1	1	1	0.504	High
BENIN FM	BN 365	UCF	SD/SST	123	1	1	1	0.504	High
BENIN FM	BN 366	UCF	SD/SST	20.5	1	1	1	0.504	High
BENIN FM	BN 367	UCF	SD/SST	120	1	1	1	0.504	High
BENIN FM	BN 368	UCF	SD/SST	143	1	1	1	0.504	High
BENIN FM	BN 369	UCF	SD/SST	61.5	1	1	1	0.504	High
BENIN FM	BN 370	UCF	SD/SST	226	1	1	1	0.504	High
BENIN FM	BN 371	UCF	SD/SST	81.4	1	1	1	0.504	High
BENIN FM	BN 372	UCF	SD/SST	139	1	1	1	0.504	High
BENIN FM	BN 373	UCF	SD/SST	131	1	1	1	0.504	High
BENIN FM	BN 374	UCF	SD/SST	138	1	1	1	0.504	High
BENIN FM	BN 375	UCF	SD/SST	135	1	1	1	0.504	High
BENIN FM	BN 376	UCF	SD/SST	125	1	1	1	0.504	High
BENIN FM	BN 377	UCF	SD/SST	110	1	1	1	0.504	High
BENIN FM	BN 378	UCF	SD/SST	121	1	1	1	0.504	High
BENIN FM	BN 379	UCF	SD/SST	128	1	1	1	0.504	High
BENIN FM	BN 380	UCF	SD/SST	84.5	1	1	1	0.504	High
BENIN FM	BN 381	UCF	SD/SST	38.1	1	1	1	0.504	High
BENIN FM	BN 382	UCF	SD/SST	54	1	1	1	0.504	High
BENIN FM	BN 383	UCF	SD/SST	174	1	1	1	0.504	High

BENIN FM	BN 384	UCF	SD/SST	98.3	1	1	1	0.504	High
BENIN FM	BN 385	UCF	SD/SST	96.5	1	1	1	0.504	High
BENIN FM	BN 386	UCF	SD/SST	27.2	1	1	1	0.504	High
BENIN FM	BN 387	UCF	SD/SST	137	1	1	1	0.504	High
BENIN FM	BN 388	UCF	SD/SST	188	1	1	1	0.504	High
BENIN FM	BN 389	UCF	SD/SST	118	1	1	1	0.504	High
BENIN FM	BN 390	UCF	SD/SST	45.3	1	1	1	0.504	High
BENIN FM	BN 391	UCF	SD/SST	135	1	1	1	0.504	High
BENIN FM	BN 392	UCF	SD/SST	174	1	1	1	0.504	High
BENIN FM	BN 393	UCF	SD/SST	128	1	1	1	0.504	High
BENIN FM	BN 394	UCF	SD/SST	70.4	1	1	1	0.504	High
BENIN FM	BN 395	UCF	SD/SST	74.4	1	1	1	0.504	High
BENIN FM	BN 396	UCF	SD/SST	110	1	1	1	0.504	High
BENIN FM	BN 397	UCF	SD/SST	54.5	1	1	1	0.504	High
BENIN FM	BN 398	UCF	SD/SST	129	1	1	1	0.504	High
BENIN FM	BN 399	UCF	SD/SST	129	1	1	1	0.504	High
BENIN FM	BN 400	UCF	SD/SST	54.6	1	1	1	0.504	High
BENIN FM	BN 401	UCF	SD/SST	176	1	1	1	0.504	High
BENIN FM	BN 402	UCF	SD/SST	118	1	1	1	0.504	High
BENIN FM	BN 403	UCF	SD/SST	177	1	1	1	0.504	High
BENIN FM	BN 404	UCF	SD/SST	117	1	1	1	0.504	High
BENIN FM	BN 405	UCF	SD/SST	77.9	1	1	1	0.504	High
BENIN FM	BN 406	UCF	SD/SST	44.6	1	1	1	0.504	High
BENIN FM	BN 407	UCF	SD/SST	68.6	1	1	1	0.504	High
BENIN FM	BN 408	UCF	SD/SST	65.4	1	1	1	0.504	High
BENIN FM	BN 409	UCF	SD/SST	23.5	1	1	1	0.504	High
BENIN FM	BN 410	UCF	SD/SST	32.7	1	1	1	0.504	High
BENIN FM	BN 411	UCF	SD/SST	42.7	1	1	1	0.504	High
BENIN FM	BN 412	UCF	SD/SST	58.5	1	1	1	0.504	High
BENIN FM	BN 413	UCF	SD/SST	124	1	1	1	0.504	High
BENIN FM	BN 414	UCF	SD/SST	37.8	1	1	1	0.504	High
BENIN FM	BN 415	UCF	SD/SST	33.3	1	1	1	0.504	High
BENIN FM	BN 416	UCF	SD/SST	51.7	1	1	1	0.504	High
BENIN FM	BN 417	UCF	SD/SST	58.4	1	1	1	0.504	High
BENIN FM	BN 418	UCF	SD/SST	55.3	1	1	1	0.504	High
BENIN FM	BN 419	UCF	SD/SST	49.5	1	1	1	0.504	High
BENIN FM	BN 420	UCF	SD/SST	65.8	1	1	1	0.504	High
BENIN FM	BN 421	UCF	SD/SST	37.5	1	1	1	0.504	High
BENIN FM	BN 422	UCF	SD/SST	180	1	1	1	0.504	High
BENIN FM	BN 423	UCF	SD/SST	186	1	1	1	0.504	High
BENIN FM	BN 424	UCF	SD/SST	118	1	1	1	0.504	High
BENIN FM	BN 425	UCF	SD/SST	133	1	1	1	0.504	High
BENIN FM	BN 426	UCF	SD/SST	143	1	1	1	0.504	High

BENIN FM	BN 427	UCF	SD/SST	171	1	1	1	0.504	High
BENIN FM	BN 428	UCF	SD/SST	115	1	1	1	0.504	High
BENIN FM	BN 429	UCF	SD/SST	62.9	1	1	1	0.504	High
BENIN FM	BN 430	UCF	SD/SST	180	1	1	1	0.504	High
BENIN FM	BN 431	UCF	SD/SST	73	1	1	1	0.504	High
BENIN FM	BN 432	UCF	SD/SST	116	1	1	1	0.504	High
BENIN FM	BN 433	UCF	SD/SST	157	1	1	1	0.504	High
BENIN FM	BN 434	UCF	SD/SST	193	1	1	1	0.504	High
BENIN FM	BN 435	UCF	SD/SST	27.3	1	1	1	0.504	High
BENIN FM	BN 436	UCF	SD/SST	132	1	1	1	0.504	High
BENIN FM	BN 437	UCF	SD/SST	194	1	1	1	0.504	High
BENIN FM	BN 438	UCF	SD/SST	34.9	1	1	1	0.504	High
BENIN FM	BN 439	UCF	SD/SST	61.1	1	1	1	0.504	High
BENIN FM	BN 440	UCF	SD/SST	207	1	1	1	0.504	High
BENIN FM	BN 441	UCF	SD/SST	172	1	1	1	0.504	High
BENIN FM	BN 442	UCF	SD/SST	165	1	1	1	0.504	High
BENIN FM	BN 443	UCF	SD/SST	48.9	1	1	1	0.504	High
BENIN FM	BN 444	UCF	SD/SST	143	1	1	1	0.504	High
BENIN FM	BN 445	UCF	SD/SST	139	1	1	1	0.504	High
BENIN FM	BN 446	UCF	SD/SST	201	1	1	1	0.504	High
BENIN FM	BN 447	UCF	SD/SST	193	1	1	1	0.504	High
BENIN FM	BN 448	UCF	SD/SST	183	1	1	1	0.504	High
BENIN FM	BN 449	UCF	SD/SST	148	1	1	1	0.504	High
BENIN FM	BN 450	UCF	SD/SST	139	1	1	1	0.504	High
BENIN FM	BN 451	UCF	SD/SST	167	1	1	1	0.504	High
BENIN FM	BN 452	UCF	SD/SST	180	1	1	1	0.504	High
BENIN FM	BN 453	UCF	SD/SST	175	1	1	1	0.504	High
BENIN FM	BN 454	UCF	SD/SST	94.7	1	1	1	0.504	High
BENIN FM	BN 455	UCF	SD/SST	88.9	1	1	1	0.504	High
BENIN FM	BN 456	UCF	SD/SST	102	1	1	1	0.504	High
BENIN FM	BN 457	UCF	SD/SST	91	1	1	1	0.504	High
BENIN FM	BN 458	UCF	SD/SST	151	1	1	1	0.504	High
BENIN FM	BN 459	UCF	SD/SST	71.9	1	1	1	0.504	High
BENIN FM	BN 460	UCF	SD/SST	120	1	1	1	0.504	High
BENIN FM	BN 461	UCF	SD/SST	124	1	1	1	0.504	High
BENIN FM	BN 462	UCF	SD/SST	70.1	1	1	1	0.504	High
BENIN FM	BN 463	UCF	SD/SST	117	1	1	1	0.504	High
BENIN FM	BN 464	UCF	SD/SST	123	1	1	1	0.504	High
BENIN FM	BN 465	UCF	SD/SST	89.8	1	1	1	0.504	High
BENIN FM	BN 466	UCF	SD/SST	82.9	1	1	1	0.504	High
BENIN FM	BN 467	UCF	SD/SST	69.3	1	1	1	0.504	High
BENIN FM	BN 468	UCF	SD/SST	109	1	1	1	0.504	High
BENIN FM	BN 469	UCF	SD/SST	40	1	1	1	0.504	High

BENIN FM	BN 470	UCF	SD/SST	75	1	1	1	0.504	High
BENIN FM	BN 471	UCF	SD/SST	83.1	1	1	1	0.504	High
BENIN FM	BN 472	UCF	SD/SST	65	1	1	1	0.504	High
BENIN FM	BN 473	UCF	SD/SST	78.7	1	1	1	0.504	High
BENIN FM	BN 474	UCF	SD/SST	193	1	1	1	0.504	High
BENIN FM	BN 475	UCF	SD/SST	256	1	1	1	0.504	High
BENIN FM	BN 476	UCF	SD/SST	281	1	1	1	0.504	High
BENIN FM	BN 477	UCF	SD/SST	146	1	1	1	0.504	High
BENIN FM	BN 478	UCF	SD/SST	269	1	1	1	0.504	High
BENIN FM	BN 479	UCF	SD/SST	120	1	1	1	0.504	High
BENIN FM	BN 480	UCF	SD/SST	235	1	1	1	0.504	High
BENIN FM	BN 481	UCF	SD/SST	172	1	1	1	0.504	High
BENIN FM	BN 482	UCF	SD/SST	286	1	1	1	0.504	High
BENIN FM	BN 483	UCF	SD/SST	202	1	1	1	0.504	High
BENIN FM	BN 484	UCF	SD/SST	150	1	1	1	0.504	High
BENIN FM	BN 485	UCF	SD/SST	247	1	1	1	0.504	High
BENIN FM	BN 486	UCF	SD/SST	245	1	1	1	0.504	High
BENIN FM	BN 487	UCF	SD/SST	255	1	1	1	0.504	High
BENIN FM	BN 488	UCF	SD/SST	91.9	1	1	1	0.504	High
BENIN FM	BN 489	UCF	SD/SST	63.9	1	1	1	0.504	High
BENIN FM	BN 490	UCF	SD/SST	250	1	1	1	0.504	High
BENIN FM	BN 491	UCF	SD/SST	182	1	1	1	0.504	High
BENIN FM	BN 492	UCF	SD/SST	141	1	1	1	0.504	High
BENIN FM	BN 493	UCF	SD/SST	231	1	1	1	0.504	High
BENIN FM	BN 494	UCF	SD/SST	117	1	1	1	0.504	High
BENIN FM	BN 495	UCF	SD/SST	70.1	1	1	1	0.504	High
BENIN FM	BN 496	UCF	SD/SST	139	1	1	1	0.504	High
BENIN FM	BN 497	UCF	SD/SST	125	1	1	1	0.504	High
BENIN FM	BN 498	UCF	SD/SST	104	1	1	1	0.504	High
BENIN FM	BN 499	UCF	SD/SST	126	1	1	1	0.504	High
BENIN FM	BN 500	UCF	SD/SST	134	1	1	1	0.504	High
IMO SHALE FM	IS 501	CF	SH	91	1	1	1	0.504	High
IMO SHALE FM	IS 502	CF	SH	44.5	1	1	1	0.15	Low
IMO SHALE FM	IS 503	CF	SH	91.2	1	1	1	0.125	Low
IMO SHALE FM	IS 504	CF	SH	42.7	1	1	1	0.15	Low
IMO SHALE FM	IS 505	CF	SH	80.6	1	1	1	0.125	Low
IMO SHALE FM	IS 506	CF	SH	105	1	1	0	0.1	Low
IMO SHALE FM	IS 507	CF	SH	48	1	1	1	0.15	Low
IMO SHALE FM	IS 508	CF	SH	51.8	1	1	1	0.125	Low

IMO SHALE FM	IS 509	CF	SH	121	1	1	0	0.1	Low
IMO SHALE FM	IS 510	CF	SH	104	1	1	0	0.1	Low
IMO SHALE FM	IS 511	CF	SH	51.7	1	1	1	0.125	Low
IMO SHALE FM	IS 512	CF	SH	51.8	1	1	1	0.125	Low
IMO SHALE FM	IS 513	CF	SH	41.1	1	1	1	0.15	Low
IMO SHALE FM	IS 514	CF	SH	102	1	1	0	0.1	Low
IMO SHALE FM	IS 515	CF	SH	22.2	1	1	1	0.15	Low
IMO SHALE FM	IS 516	CF	SH	131	1	1	0	0.1	Low
NSUKKA FM	NS 517	CF	SST/SH	93.4	1	1	1	0.125	Low
NSUKKA FM	NS 518	CF	SST/SH	77.1	1	1	1	0.125	Low
NSUKKA FM	NS 519	CF	SST/SH	118	1	1	0	0.1	Low
NSUKKA FM	NS 520	CF	SST/SH	164	1	1	0	0.1	Low
NSUKKA FM	NS 521	CF	SST/SH	291	1	1	0	0.1	Low
NSUKKA FM	NS 522	CF	SST/SH	142	1	1	0	0.1	Low
NSUKKA FM	NS 523	CF	SST/SH	201	1	1	0	0.1	Low
NSUKKA FM	NS 524	CF	SST/SH	178	1	1	0	0.1	Low
NSUKKA FM	NS 525	CF	SST/SH	223	1	1	0	0.1	Low
NSUKKA FM	NS 526	CF	SST/SH	128	1	1	0	0.1	Low
NSUKKA FM	NS 527	CF	SST/SH	133	1	1	0	0.1	Low
NSUKKA FM	NS 528	CF	SST/SH	89.2	1	1	1	0.125	Low
NSUKKA FM	NS 529	CF	SST/SH	61.6	1	1	1	0.125	Low
NSUKKA FM	NS 530	CF	SST/SH	62.5	1	1	1	0.125	Low
NSUKKA FM	NS 531	CF	SST/SH	148	1	1	0	0.1	Low
NSUKKA FM	NS 532	CF	SST/SH	59	1	1	1	0.125	Low
NSUKKA FM	NS 533	CF	SST/SH	96.2	1	1	1	0.125	Low
NSUKKA FM	NS 534	CF	SST/SH	58.1	1	1	1	0.125	Low
NSUKKA FM	NS 535	CF	SST/SH	71.2	1	1	1	0.125	Low
NSUKKA FM	NS 536	CF	SST/SH	40.1	1	1	1	0.15	Low
NSUKKA FM	NS 537	CF	SST/SH	44.2	1	1	1	0.15	Low
NSUKKA FM	NS 538	CF	SST/SH	88	1	1	1	0.125	Low
NSUKKA FM	NS 539	CF	SST/SH	56.5	1	1	1	0.125	Low
NSUKKA FM	NS 540	CF	SST/SH	71.8	1	1	1	0.125	Low
NSUKKA FM	NS 541	CF	SST/SH	124	1	1	0	0.1	Low
NSUKKA FM	NS 542	CF	SST/SH	110	1	1	0	0.1	Low
NSUKKA FM	NS 543	CF	SST/SH	107	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 544	CF	CL/SD	143	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 545	CF	CL/SD	44.8	1	1	1	0.15	Low
OGWASI/ASABA FM	OG 546	CF	CL/SD	60.1	1	1	1	0.125	Low

OGWASI/ASABA FM	OG 547	CF	CL/SD	74.3	1	1	1	0.125	Low
OGWASI/ASABA FM	OG 548	CF	CL/SD	152	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 549	CF	CL/SD	145	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 550	CF	CL/SD	63.2	1	1	1	0.125	Low
OGWASI/ASABA FM	OG 551	CF	CL/SD	226	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 552	CF	CL/SD	189	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 553	CF	CL/SD	82	1	1	1	0.125	Low
OGWASI/ASABA FM	OG 554	CF	CL/SD	30.9	1	1	1	0.15	Low
OGWASI/ASABA FM	OG 555	CF	CL/SD	22.2	1	1	1	0.15	Low
OGWASI/ASABA FM	OG 556	CF	CL/SD	226	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 557	CF	CL/SD	101	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 558	CF	CL/SD	43	1	1	1	0.15	Low
OGWASI/ASABA FM	OG 559	CF	CL/SD	107	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 560	CF	CL/SD	188	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 561	CF	CL/SD	68.4	1	1	1	0.125	Low
OGWASI/ASABA FM	OG 562	CF	CL/SD	129	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 563	CF	CL/SD	226	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 564	CF	CL/SD	106	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 565	CF	CL/SD	69.7	1	1	1	0.125	Low
OGWASI/ASABA FM	OG 566	CF	CL/SD	111	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 567	CF	CL/SD	69.7	1	1	1	0.125	Low
OGWASI/ASABA FM	OG 568	CF	CL/SD	109	1	1	0	0.1	Low
OGWASI/ASABA FM	OG 569	CF	CL/SD	64.8	1	1	1	0.125	Low

F: Aquifer Vulnerability and Percolation time estimated using Integrated Electrical Conductivity in Imo River Basin

ES NO	Aquifer			Layer Resistivity ρ (Ωm)																Layer Thickness h (m)								IEC = $\frac{\rho h}{\sigma}$ (Sie mens)	Degree of Vulnerability	Percolation Time
	Dep th (m)	Thick ness h (m)	Resisti vity ρ (Ωm)	ρ_1	s_1	ρ_2	s_2	ρ_3	s_3	ρ_4	s_4	ρ_5	s_5	ρ_6	s_6	ρ_7	s_7	ρ_8	ρ_9	h 1	h 2	h3	h4	h5	h6	h7	h 8			
AJ 01	89.3	46.7	2780	133	0.0075	422	0.0024	82	0.0122	9.2	0.1087	84	0.0119	388	0.00258					1.3	5.1	3	11	8.1	12.6			1383.00	Moderate	3 to 10 yrs
AJ 02	115	52	38.6	64.7	0.0155	263	0.0038	34.1	0.0293	4.6	0.2174	230	0.0043	81	0.01235	28.6	0.03497			0.9	2.1	1.4	3	11	16.4	35.4		2205.79	Low	10 to 25 yrs
AJ 03	142	30	1330	260	0.0038	1030	0.0010	451	0.0022	8100	0.0001	4790	0.0002	667	0.0015	667	0.0015			0.7	7.5	11	18	22.4	22.6	24.3		111.58	Extremely high	Several months
AJ 04	174	61	8700	184	0.0054	284	0.0035	12.4	0.0806	70	0.0143	20600	5.00E-05	13100	7.60E-05					0.9	1.1	5.3	9.6	60.7	40.4			579.36	High	Several months to 3 yrs
AJ 05	89.2	48.8	303	45.7	0.0219	463	0.0022	4	0.2500	4.1	0.2439	43.4	0.023	208	0.00481					0.6	1.8	3.9	6.8	8.8	24.6			2971.59	Low	10 to 25 yrs
AJ 06	148	46	97	636	0.0016	103	0.0097	25.9	0.0386	297	0.0034	10.5	0.0952	7.1	0.14085	21.3	0.04695			1.3	7.3	17	5.9	22.9	29.6	26.5		8343.25	Extremely low	More than 25 yrs
AJ 07	126	66	13.5	32.8	0.0305	304	0.0033	487	0.0021	48.2	0.0208	11.7	0.0855	46.3	0.0216	10.9	0.09174			0.4	3.1	3.8	2.5	18.5	21.8	31.4		5014.84	Extremely low	More than 25 yrs
AJ 08	163	29	9600	308	0.0032	1650	0.0006	708	0.0014	4320	0.0002	18800	5.00E-05	23200	4.30E-05	10300	9.70E-05			0.4	1.2	2.46	23.4	44.6	26			21.35	Extremely high	Several months
AJ 09	162	35	2480	956	0.0010	2590	0.0004	1050	0.0010	4080	0.0003	21600	5.00E-05	5730	0.00017	3130	0.00032			0.4	1.3	19	11	36.4	28.4	31.5		38.42	Extremely high	Several months
AJ 10	71.6	71.4	1150	63.9	0.0156	1080	0.0009	30.9	0.0324	9.9	0.1010	66.3	0.0151							0.4	1.6	14	17	13.4				2380.10	Low	10 to 25 yrs
AJ 11	47	40	1630	283	0.0035	5760	0.0002	550	0.0018	4740	0.0002									0.9	1.6	4.4	14					14.41	Extremely high	Several months
AJ 12	16.7	10.9	1520	375	0.0027	2890	0.0003													0.5	5							3.06	Extremely high	Several months
AJ 13	109	19	2670	556	0.0018	2040	0.0005	1020	0.0010	7010	0.0001	19000	5.00E-05	6850	0.00015	3230	0.00031			0.4	1.1	13	5.9	15.9	19.9	28.9		27.53	Extremely high	Several months
AJ 14	154	45	2620	266	0.0038	1640	0.0006	468	0.0021	1840	0.0005	23700	4.00E-05							0.4	0.7	1.9	25	42.4				21.37	Extremely high	Several months
AJ 15	49.2	23.2	37.4	29.2	0.0342	19.2	0.0521	21.4	0.0467											0.8	1.0	15						1249.17	Moderate	3 to 10 yrs
AJ 16	109	11.1	2080	1960	0.0005	3270	0.0003	3750	0.0003											5.4	4.8	45						29.43	Extremely high	Several months
AJ17	129	32.5	168	68.5	0.0146	220	0.0045	627	0.0016	50.9	0.0197	6.9	0.1449	34.1	0.02933	116	0.00862			3.4	2	6	7.6	26.2	22.3	29		4918.67	Extremely low	More than 25 yrs
AJ 18	188	50	49.4	820	0.0012	3890	0.0003	655	0.0015	153	0.0065	43.5	0.023	34.4	0.02907	48.9	0.02045			0.4	0.8	0.7	7.8	37.5	44.3	46.5		3153.52	Low	10 to 25 yrs
AJ 19	136	33	34	112	0.0089	171	0.0058	6.7	0.1493	239	0.0042	56.1	0.0178	31.7	0.03155	11	0.09091	21.5	0.04651	0.5	1.5	4	18	10.9	12.1	56.9	32	6434.29	Extremely low	More than 25 yrs
AJ 20	89.6	34.6	2700	248	0.0040	6220	0.0002	79	0.0127	1900	0.0005	1550	0.0006							0.4	1.7	9	24	19.5				141.02	Extremely high	Several months
AJ 21	154	45	1250	60.4	0.0166	8.7	0.1149	82	0.0122	88	0.0114	476	0.0021	810	0.00123	900	0.00111			0.9	1.6	6.2	13	21.4	31.2	34.3		543.73	High	Several months to 3 yrs

AJ 22	47	18.2	638	161	0.0062	513	0.0019	35.7	0.0280	900	0.0011	10800	9.00E-05	2720	0.00037					0.5	0.7	2.1	1.4	7.6	16.2				71.51	Extremely high	Several months
AJ 23	73.1	26.1	59.5	61.1	0.0164	12.1	0.0826	35.2	0.0284	4.7	0.2128	38.6	0.0259							0.6	1.2	15	19	11.4					4873.02	Extremely low	More than 25 yrs
AJ 24	82.2	39.5	840	699	0.0014	182	0.0055	920	0.0011	518	0.0019	73.2	0.0137	530	0.00189					0.6	1	6.1	2.9	16.7	15.4				275.78	Extremely high	Several months
AJ 25	69.1	35.4	14	116	0.0086	1750	0.0006	34.2	0.0292	11.2	0.0893	3.6	0.2778							0.4	1.2	3.3	10	18.5					6132.37	Extremely low	More than 25 yrs
AJ 26	80.9	27.5	1230	930	0.0011	2520	0.0004	1110	0.0009	4750	0.0002	1130	0.0009							0.6	1.9	3.8	16	31.1					35.71	Extremely high	Several months
AJ 27	98.9	22.8	635	684	0.0015	8200	0.0001	1100	0.0009	61.1	0.0164	15	0.0667	49.5	0.0202	180	0.00556	405	0.00247	0.9	4.4	3.1	4	17	11.7	14.6	1	8	1560.22	Moderate	3 to 10 yrs
AJ 28	262	48	2440	304	0.0033	4130	0.0002	373	0.0027	1650	0.0006	2460	0.0004	3900	0.00026	1200	0.00083	9700	0.0001	0.4	2	8.7	23	42	50.3	27	6	1	91.53	Extremely high	Several months
AJ 29	263	51	75	1060	0.0009	3820	0.0003	397	0.0025	7.7	0.1299	206	0.0049	33	0.0303	30.6	0.03268	58	0.01724	1	3.2	1.8	14	37.8	45.6	58	5	9	5285.24	Extremely low	More than 25 yrs
AJ 30	253	51	3440	279	0.0036	500	0.0020	36.1	0.0277	178	0.0056	1020	0.001	8300	0.00012	29600	3.40E-05	6770	0.00015	1.3	3.9	11	5.8	14.6	17.6	89.1	6	0	368.48	Extremely high	Several months
AJ 31	231	49	1520	113	0.0088	790	0.0013	192	0.0052	20900	0.0000	6700	0.0001	7270	0.00014					0.4	10	20	92	15	49.9				154.17	Extremely high	Several months
AJ 32	152	37	212	249	0.0040	229	0.0044	10.7	0.0935	4.4	0.2273	20	0.05	50.1	0.01996	166	0.00602	129	0.00775	1	0.9	21	22	11.4	11.5	28	2	0	7938.78	Extremely low	More than 25 yrs
AJ 33	91.4	25.1	49.4	370	0.0027	1550	0.0006	101	0.0099	24.1	0.0415	24.7	0.0405	2.4	0.41667	13.7	0.07299			0.6	1.8	2	14	7.9	22.1	17.5			11409.04	Extremely low	More than 25 yrs
AJ 34	53.3	20.8	238	154	0.0065	3510	0.0003	325	0.0031	89	0.0112	4.8	0.2083	54.9	0.01821					0.3	1.4	2	2.3	13.6	12.9				3102.65	Low	10 to 25 yrs
AJ 35	122	34.8	59.6	44.2	0.0226	22.9	0.0437	131	0.0076	440	0.0023	103	0.0097							0.9	2.4	18	38	28.8					628.55	High	Several months to 3 yrs
AJ 36	79	44.6	108	126	0.0079	219	0.004566	278	0.0036											0.8	1	33							129.62	Extremely high	Several months
AJ 37	94.2	41.8	75	73.1	0.0137	174	0.0057	44.5	0.0225	4.5	0.2222	42	0.0238							1.3	5.4	3.7	17	24.9					4499.86	Extremely low	More than 25 yrs
AJ 38	100	78.3	296	230	0.0043	500	0.0020	62.5	0.0160	25.3	0.0395	4	0.25							1.3	2.9	2.2	2.9	12.4					3261.28	Low	10 to 25 yrs
AJ 39	146	111.2	1420	103	0.0097	191	0.0052	698	0.0014	64	0.0156	13.3	0.0752	135	0.00741					0.6	2.3	3.7	2.9	13.5	11.8				1170.93	Moderate	3 to 10 yrs
AM 40	184	46	3690	880	0.0011	2620	0.0004	14100	0.0001	1620	0.0006									0.7	2.7	3.5	13.9						87.88	Extremely high	Several months
AM 41	83.5	25.5	3560	3510	0.0003	8300	0.0012	1180	0.0008	840	0.0012									0.4	8.4	8.2	22						34.27	Extremely high	Several months
AM 42	187	56	1330	598	0.0017	7360	0.0001	598	0.0017	3060	0.0003									1	8.7	14	24						50.83	Extremely high	Several months
AM 43	153	46	5700	203	0.0049	2100	0.0005	260	0.0038	9600	0.0001	12600	8.00E-05							8.7	2.9	65	28	56					314.03	Extremely high	Several months
AM 44	175	50	4700	411	0.0024	4060	0.0002	1270	0.0008	1890	0.0005	22800	4.00E-05	13500	7.40E-05	4780	0.00021			0.5	2.4	7	17	36.4	38.7	52			31.66	Extremely high	Several months
AM 45	160	49	5300	514	0.0019	6130	0.0002	578	0.0017	2440	0.0004	8800	0.0001	6060	0.00017	5800	0.00017			0.5	1.2	12	6.5	22.4	32.7	49.5			31.95	Extremely high	Several months
AM 46	184	43	2700	178	0.0056	761	0.0013	1730	0.0006	19600	0.0001	4020	0.0002	3020	0.00033					0.5	0.8	4	22	35.1	47.5				31.75	Extremely high	Several months

AM 47	55.3	26.3	8800	373	0.0027	1500	0.0007	641	0.0016	7400	0.0001									1.1	1.5	6.4	40							19.34	Extremely high	Several months
AM 48	155	37	1490	234	0.0043	743	0.0013	860	0.0012	870	0.0012	3050	0.0003	3940	0.00025	3080	0.00032			1	2.8	5.1	20	26.3	28.7	56				71.05	Extremely high	Several months
AM 49	43.3	92.7	3911	73.4	0.0136	1980	0.0005	222	0.0045	1070	0.0009	224	0.0005	784	0.00128	31100	3.20E-05			0.5	1.5	4.1	11	15.5	11.2	92.7				122.78	Extremely high	Several months
AM 50	219	50	2200	268	0.0037	75.9	0.0132	675	0.0015	75	0.0133	810	0.0012	6170	0.00016	3120	0.00032			2.4	3.1	7.9	17							288.17	Extremely high	Several months
AM 51	81.5	46.5	6410	387	0.0026	3900	0.0003	5860	0.0002	2940	0.0003	2180	0.0005							0.4	2.8	8.5	9.8	18.4						14.98	Extremely high	Several months
AM 52	39.8	32.9	234	30.7	0.0326	279	0.0036	14	0.0714	234	0.0043									0.5	1.8	11	27							923.84	High	Several months to 3 yrs
AM 53	53.3	31.5	262	158	0.0063	10.2	0.0980	1.2	0.8333	45	0.0222	152	0.0066							1.1	1.5	3.8	5.4	10.3	31.2					3508.45	Low	10 to 25 yrs
AM 54	43.4	18.1	1290	372	0.0027	870	0.0011	129	0.0078	9.2	0.1087	23.6	0.0424							0.8	1.9	1.8	5	4.4	29.5					748.21	High	Several months to 3 yrs
AM 55	52.8	66.2	21.5	109	0.0092	19.2	0.0521	168	0.0060	3870	0.0003	373	0.0027	121.6	0.00822					0.6	1.1	0.9	8.4	6.9	8.2	26.7				156.26	Extremely high	Several months
AM 56	26.1	14.9	1600	404	0.0025	1670	0.0006	1260	0.0008	12500	0.0001									0.8	2.4	3.5	11							7.08	Extremely high	Several months
AM 57	93.9	41.1	2790	155	0.0065	371	0.0027	33.7	0.0297	184	0.0054	9000	0.0001	11500	8.70E-05					0.8	1.2	2.9	2.9	12.7						111.62	Extremely high	Several months
AM 58	111	24	241	376	0.0027	201	0.0050	90	0.0111	13.1	0.0763	13.5	0.0741	46.1	0.02169					0.8	7	23	12	21.2						2778.91	Low	10 to 25 yrs
AM 59	131	48	626	870	0.0011	1510	0.0007	212	0.0047	5.5	0.1818	36.4	0.0275	82	0.0122	313	0.00319			0.8	1	6.9	14	10.5	14.5	40.4				3173.95	Low	10 to 25 yrs
AM 60	110	42	39.5	260	0.0038	1110	0.0009	23	0.0435	2.8	0.3571	25.8	0.0388	57.7	0.01733					0.6	2	13	12	17.4	28.4					6021.66	Extremely low	More than 25 yrs
AM 61	126	41	1270	1170	0.0009	251	0.0040	15200	0.0001	10200	0.0001	668	0.0015	686	0.00146	226	0.00442			1.6	2.4	6.4	8.5	12.8	8.9	46				247.86	Extremely high	Several months
AM 62	59.7	21.5	1390	516	0.0019	679	0.0015	294	0.0034	658	0.0015									1.1	1	11	17							66.86	Extremely high	Several months
AM 63	98.3	32.7	39.6	47	0.0213	51.1	0.0196	32.8	0.0305	4.6	0.2174	15.3	0.0654	26.7	0.03745	33.3	0.03003			1	1	3.7	10	11.3	15.2	27.4				4458.24	Extremely low	More than 25 yrs
AM 64	90.2	30.8	283	66	0.0152	140	0.0071	223	0.0045	1390	0.0007									3	2.3	21	37	26.6						182.67	Extremely high	Several months
AM 65	133	34	12.2	45.3	0.0221	7.9	0.1266	3.6	0.2778	8.4	0.1191	30.9	0.0324							2.1	1.7	23	13	45.2						11597.55	Extremely low	More than 25 yrs
AM 66	72.5	38.5	2300	231	0.0043	291	0.0034	11200	0.0001	870	0.0012	374	0.0027							0.9	2.7	8.7	9	25.7						93.01	Extremely high	Several months
AM 67	75.5	40.5	800	68.3	0.0146	170	0.0059	498	0.0020	830	0.0012	1760	0.0006							1.1	1.2	20	13	17.5						88.93	Extremely high	Several months
AM 68	76.3	48	146	435	0.0023	75.1	0.0133	2640	0.0004	3020	0.0003									1.6	8.1	9.5	21							122.09	Extremely high	Several months
AM 69	143	53	136	40.8	0.0245	162	0.0062	850	0.0012	105	0.0095	11.9	0.084	53.2	0.0188	54.5	0.01835			0.8	1.7	4.6	5.5	27	18.8	17.1				3023.95	Low	10 to 25 yrs
AM 70	109	37	63.1	400	0.0025	103	0.0097	1.2	0.8333	18.4	0.0544	16.4	0.061	50.2	0.01992	24.5	0.04082			0.8	0.2	2.3	16	11.2	29.7	15.6				4701.47	Extremely low	More than 25 yrs
AM 71	132	62	1420	101	0.0099	2770	0.0004	287	0.0035	960	0.0010	13300	8.00E-05	31700	3.20E-05	17300	5.80E-05			0.5	2.5	4.6	5	10.1	47.2	66.2				33.16	Extremely high	Several months

AM 72	89.5	31	1450	297	0.0034	11400	0.0001	1030	0.0010	720	0.0014									0.3	1.1	19	37						70.94	Extremely high	Several months
AM 73	123	119	194.01	270	0.0037															3.7									13.70	Extremely high	Several months
AM 74	44.8	16.7	1670	452	0.0022	11600	0.0001	960	0.0010	1160	0.0009									0.4	1.5	11	15						25.40	Extremely high	Several months
AM 75	65.7	31	1160	3250	0.0003	71900	0.0000	2140	0.0005	85000	0.0000	27900	4.00E-05	4530	0.00022					0.3	1	3.5	9.5	8.2	12.2				4.84	Extremely high	Several months
AM 76	106	19.7	2530	1950	0.0005	2740	0.0004	4040	0.0002	4620	0.0002									8.7	2.8	29	21						26.40	Extremely high	Several months
AM 77	174	55	1020	1630	0.0006	537	0.0019	13.9	0.0719	11	0.0909	337	0.003	790	0.00127					1.4	2.5	4.8	52	29.6	28.5				5202.02	Extremely low	More than 25 yrs
AM 78	55.6	16.7	1010	643	0.0016	7370	0.0001	2490	0.0004	47.9	0.0209	236	0.0042							0.5	3.5	7.8	16	10.9					384.60	Extremely high	Several months
AM 79	59.5	7.1	177	2210	0.0005	12600	0.0001	76	0.0132	104	0.0096	990	0.001	66.4	0.01506					0.7	1.7	8.4	5.3	9.1	27.2				580.77	High	Several months to 3 yrs
AM 80	77.4	40.1	880	120	0.0083	1880	0.0005	213	0.0047	5280	0.0002									0.3	1.8	9.5	26						52.98	Extremely high	Several months
AM 81	112	34	155	117	0.0085	2690	0.0004	289	0.0035	1020	0.0010	20	0.05	81	0.01235					0.4	1.5	4.7	12	27.5	32.2				1804.53	Moderate	3 to 10 yrs
AM 82	64.8	11.9	2100	169	0.0059	491	0.0020	117	0.0085	37	0.0270									0.9	4.5	34	14						683.47	High	Several months to 3 yrs
AM 83	132	31	188	269	0.0037	1180	0.0008	24.2	0.0413	129	0.0078	42.3	0.0236	55.5	0.01802	98				0.8	5.1	16	18	17.6	19.7	24.5			1579.02	Moderate	3 to 10 yrs
AM 84	113	16.5	2270	222	0.0045	41100	0.0000	5610	0.0002	1090	0.0009	4070	0.0002	12900	7.80E-05	3580	0.00028	2450	0.00357	0.3	2.3	3.3	14	10.9	28.6	20.3	17		25.41	Extremely high	Several months
AM 85	96.2	21.1	2700	344	0.0029	5840	0.0002	22000	0.0000	2200	0.0005	1380	0.0007	1070	0.00093					0.3	0.3	1.5	29	27.5	16.8				49.80	Extremely high	Several months
AM 86	44.1	21.2	1720	3690	0.0003	7040	0.0001													9.2	1.4								4.48	Extremely high	Several months
AM 87	37.2	13.1	2820	840	0.0012	18500	0.0001	1710	0.0006	6520	0.0002									0.6	2.1	5.7	16						6.62	Extremely high	Several months
AM 88	143	37	2010	1900	0.0005	7030	0.0001	2000	0.0005	2100	0.0005	3580	0.0003	3780	0.00026	3760	0.00027	4070		0.7	3.3	4.5	9.3	19.8	29.9	38.5	37		31.20	Extremely high	Several months
AM 89	154	56	240	215	0.0047	3700	0.0003	258	0.0039	110	0.0091	67	0.0149	17.3	0.0578	112	0.00893			0.5	1.8	1.9	6.9	14.6	27	45.3			2255.97	Low	10 to 25 yrs
AM 90	37.9	15.9	1740	130	0.0077	8700	0.0001	13200	0.0001	442	0.0023	142	0.007							0.4	0.8	2.7	3.8	14.3					112.67	Extremely high	Several months
AM 91	75.3	17.7	1260	647	0.0015	29100	0.0000	20700	0.0000	2910	0.0003	9800	0.0001	2690	0.00037					0.6	1.8	3.7	14	20.9	17				14.43	Extremely high	Several months
AM 92	65.9	26.4	2340	372	0.0027	25000	0.0000	1780	0.0006	660	0.0015	3800	0.0003							2	0.1	2.4	11	24.7					29.90	Extremely high	Several months
AM 93	41.5	39.4	1850	234	0.0043	8000	0.0001													0.4	1.7								1.92	Extremely high	Several months
AM 94	56.1	27	2390	67.8	0.0147	7900	0.0001	4080	0.0002	178	0.0056	900	0.0011							0.4	2.4	3.4	7.3	15.6					65.38	Extremely high	Several months
AM 95	98	45.3	132	215	0.0047	3700	0.0003	258	0.0039	110	0.0091	12	0.0833	17	0.05882					0.5	1.8	1.9	6.9	14.6	27				2877.81	Low	10 to 25 yrs
AM 96	75.7	21.7	1773	334	0.0030	141	0.00071	1330	0.0008	20600	0.0000	6050	0.0002	3200	0.00031					1.3	2.9	2	19	12.6	16.4				34.09	Extremely high	Several months

AM 97	68	28.9	1720	102	0.00 98	29200	0.000 0	6270	0.00 02	721	0.00 14								0. 5	5	6. 3	27					43.53	Extremely high	Several months	
AM 98	151	33	2620	295	0.00 34	779	0.001 3	642	0.00 16	3830	0.00 03	28000	4.00E -05	7060	0.000 14	3250	0.000 31		1. 2	5	9. 8	8. 6	34 .6	27 .3	31 .5		42.79	Extremely high	Several months	
AM 99	245	50	6800	233	0.00 43	696	0.001 4	5460	0.00 02	19500	0.00 01	22700	4.00E -05	9700	0.000 1				3	2 6	27	29	74 .9	35			63.57	Extremely high	Several months	
AM 100	81	29	1190	770 0	0.00 01	17600	0.000 1	1130	0.00 09	17000	0.00 01	7620	0.000 1						1. 1	3. 5	7	24	16 .4				10.10	Extremely high	Several months	
AM 101	147	41	3670	137	0.00 73	2460	0.000 4	1140	0.00 09	6290	0.00 02	14200	7.00E -05	5000	0.000 2				0. 6	2. 7	6. 5	14	43 .5	38 .8			24.23	Extremely high	Several months	
AM 102	123	10	682	192 0	0.00 05	5340	0.000 2	830	0.00 12	25.4	0.03 94	117	0.008 5						1	6. 8	49	44	12				1895.68	Moderate	3 to 10 yrs	
AM 103	70	8.8	1220	623	0.00 16	1530	0.000 7	6280	0.00 02	1170	0.00 09	2090	0.000 5	2640	0.000 38				4. 7	1. 5	5. 9	24	16 .6	8. 2			41.03	Extremely high	Several months	
AM 104	50	32	1784	850	0.00 12	250	0.004 0												0. 8	2. 7							11.74	Extremely high	Several months	
AM 105	80. 7	14.7	2740	768	0.00 13	1654	0.000 6	774	0.00 13	5466	0.00 02								0. 8	2. 2	11	13 1					40.55	Extremely high	Several months	
AM 106	68. 4	13.5	288	244	0.00 41	12900	0.000 1	1700	0.00 06	410	0.00 24								0. 4	2. 1	26	28					85.39	Extremely high	Several months	
AM 107	149	52.9	1460	28.3	0.03 53	2410	0.000 4	193	0.00 52	161	0.00 62	184	0.005 4	288	0.003 47				0. 3	2. 2	5. 2	26	21 .1	13 .5			361.50	Extremely high	Several months	
AM 108	176	48	1690	282	0.00 35	3070	0.000 3	366	0.00 27	12000	0.00 01	5620	0.000 2	4020	0.000 25				1. 1	2. 5	7. 8	28	25 .8	30 .8			40.61	Extremely high	Several months	
AM 109	156	42	1720	197	0.00 51	554	0.001 8	1280	0.00 08	1070	0.00 09	3750	0.000 3	2080	0.000 48				0. 6	6. 4	13	19	29 .1	20 .9			60.32	Extremely high	Several months	
AM 110	153	106	1630	173	0.00 58	545	0.001 8	53.7	0.01 86	7.9	0.12 66	52.6	0.019	384	0.002 6				0. 9	4. 5	3. 6	11	6. 1	20 .9			1643.30	Moderate	3 to 10 yrs	
AM 111	108	83.8	1040	611	0.00 16	787	0.001 3	11.9	0.08 40										1. 7	2. 1	20						1686.12	Moderate	3 to 10 yrs	
AM 112	57. 8	19.8	491	153	0.00 65	765	0.001 3	382	0.00 26	28.1	0.03 56	141	0.007 1						0. 7	7. 4	10	7. 4	12 .3				391.01	Extremely high	Several months	
AM 113	143	87	316	360	0.00 28	625	0.001 6	2630	0.00 04	2410	0.00 04	293	0.003 4	54.5	0.018 35				0. 5	3. 9	3. 4	5. 2	7	36 .5			704.69	High	Several months to 3 yrs	
AM 114	30. 5	20.9	594	930	0.00 11	173	0.005 8	22.6	0.04 42	31.8	0.03 15								0. 6	0. 8	3. 8	4					299.20	Extremely high	Several months	
AM 115	143	36.5	316	360	0.00 28	625	0.001 6	2630	0.00 04	2410	0.00 04	994	0.001	54.5	0.018 35				0. 5	3. 9	3. 4	5. 2	7	36 .5			687.85	High	Several months to 3 yrs	
AM 116	246	42	2660	115	0.00 87	1740	0.000 6	1830	0.00 05	1970	0.00 05	14200	7.00E -05	4700	0.000 21	3040	0.000 33	267 0	0.000 37	0. 3	0. 5	8. 8	27	51 .7	36 .1	39	4 1	45.56	Extremely high	Several months
AM 117	277	49	4040	289	0.00 35	7500	0.000 1	1360	0.00 07	2630	0.00 04	2060	0.000 5	4820	0.000 21	4310	0.000 23	529 0	0.000 19	0. 5	3. 2	11	24	47 .1	47 .5	48	4 7	63.23	Extremely high	Several months
AM 118	224	46	2940	151 0	0.00 07	26000	0.000 0	1860	0.00 05	1970	0.00 05	3120	0.000 3	2230	0.000 45	3420	0.000 29		0. 4	1. 3	11	28	44	46 .4	47		69.09	Extremely high	Several months	
AM 119	149	52	2130	247	0.00 40	1030	0.001 0	267	0.00 37	3400	0.00 03	24000	4.00E -05	3070	0.000 33				0. 8	2. 6	5. 3	6. 5					27.53	Extremely high	Several months	
AM 120	201	46	3310	136	0.00 74	542	0.001 8	2040	0.00 05	17400	0.00 01	5320	0.000 2	3520	0.000 28				1	1 3	8. 1	48	40 .1	45			58.39	Extremely high	Several months	
AM 121	261	49	4370	121	0.00 83	454	0.002 2	1090	0.00 09	22200	0.00 00	7820	0.000 1	5560	0.000 18	4760	0.000 21		1	1 3	10	54	39 .4	46	49		72.11	Extremely high	Several months	

AM 122	155	32	3480	543	0.0018	5100	0.0002	330	0.0030	20200	0.0001	66800	1.00E-05	15300	6.50E-05	6700	0.00015	4150	0.00024	0.8	1.6	4.6	8.9	26.8	23.1	26.2	31	21.99	Extremely high	Several months
AM 123	210	49	1880	94	0.0106	880	0.0011	240	0.0042	14600	0.0001	1420	0.0007	690	0.00145	1290	0.00078			0.5	1.9	4.3	18	27.6	54.4	54		166.77	Extremely high	Several months
AM 124	125	79	2656	940	0.0011	6620	0.0002	6648	0.0002											0.8	7.2	38						7.65	Extremely high	Several months
AM 125	32	26	2462	1185	0.0008	4629	0.0002													0.8	5.2							1.80	Extremely high	Several months
AM 126	115	101	2536	682	0.0015	2160	0.0005	1426	0.0007	1426	0.0007									1	5	8	101					80.22	Extremely high	Several months
AM 127	232	103	1090	410	0.0024	870	0.0011	70.5	0.0142	9300	0.0001	176	0.0007	762	0.00131					0.8	2.2	15	20	11.8	60.1			388.07	Extremely high	Several months
AM 128	71	19.8	2600	210	0.0048	5080	0.0002	380	0.0026	2600	0.0004	655	0.0015							0.3	1.7	5.4	14	29.9				67.01	Extremely high	Several months
AM 129	67	22.3	241	67.5	0.0148	44	0.0227	377	0.0027	374	0.0027	234	0.0043							0.8	0.9	12	14	17.4				175.93	Extremely high	Several months
AM 130	18.1	14.7	3870	1030	0.0010	93000	0.0000													0.3	3.1							0.32	Extremely high	Several months
AM 131	230	102	3150	291	0.0034	2140	0.0005	207	0.0048	23200	0.0000	7300	0.0001	11500	8.70E-05					0.9	2.1	5.5	30	21.1				34.83	Extremely high	Several months
AM 132	140	49.9	4690	154	0.0065	9200	0.0001	1970	0.0005	106	0.0094	476	0.0021	168	0.00095	3270	0.00031	12800	7.80E-05	0.3	2.1	2.6	5.3	5.9	2.1	21.5	50	84.97	Extremely high	Several months
AM 133	188	50	1230	219	0.0046	298	0.0034	1350	0.0007	184	0.0054	2370	0.0004	15200	6.60E-05	2580	0.00039			0.6	3.3	3.4	9.7	10.7	69	41		94.11	Extremely high	Several months
AM 134	102	80	3425	52	0.0192	1245	0.0008	4522	0.0002											0.2	1	24						9.96	Extremely high	Several months
AM 135	105	100.8	2234	188	0.0053	56	0.0179	3345	0.0003											1.2	3	101						90.15	Extremely high	Several months
AM 136	135	27	1430	2310	0.0004	18900	0.0001	1740	0.0006	1520	0.0007	8600	0.0001	1790	0.00056	8250	0.00012			1.3	2	2.7	5	16.5	80.5	27		55.67	Extremely high	Several months
AM 137	75	66	3564	1200	0.0008	3245	0.0003	1453	0.0007	487	0.0021									0.8	3.7	4.5	66					140.43	Extremely high	Several months
AM 138	50	41	1456	612	0.0016	2122	0.0005	634	0.0016											0.8	2.2	6						11.81	Extremely high	Several months
AM 139	153	20	1640	1990	0.0005	607	0.0016	657	0.0015	1840	0.0005									2.8	3	18	49					130.70	Extremely high	Several months
AM 140	124	14	2400	322	0.0031	850	0.0012	3690	0.0003	6740	0.0002	8500	0.0001	4860	0.00021					0.9	1.1	9.2	11	35.7	42.2			32.74	Extremely high	Several months
AM 141	92.1	16.9	2000	571	0.0018	9200	0.0001	1010	0.0010	12800	0.0001	10200	1.00E-04	4110	0.00024					0.6	2.6	7.8	26	19.3	19.3			17.68	Extremely high	Several months
AM 142	33	25.3	1520	578	0.0017	18500	0.0001	2510	0.0004											0.5	1.5	5.7						3.22	Extremely high	Several months
AM 143	91	31.8	3290	616	0.0016	4260	0.0002	970	0.0010	9300	0.0001	960	0.001							0.4	2.2	7.1	17	32.4				44.06	Extremely high	Several months
AM 144	103	33	1790	649	0.0015	181	0.0005	386	0.0026	4530	0.0002	940	0.0011							0.7	2.3	8.3	24	34.3				77.08	Extremely high	Several months
AM 145	171	55	2690	1590	0.0006	5130	0.0002	1980	0.0005	900	0.0011	2440	0.0004	126	0.000794	769	0.0003	576	0.00174	0.8	1.2	4.4	11	20.1	44	23.7	11	403.44	Extremely high	Several months
AM 146	211	47	3810	117	0.0085	164	0.0061	1000	0.0010	498	0.0020	5270	0.0002	23500	4.30E-05	9300	0.00011			1	3	7.4	19	17.3	61.8	56		73.96	Extremely high	Several months

AM 147	262	24	5530	107 0	0.00 09	96	0.010 4	980	0.00 10	416	0.00 24	41800	2.00E -05	60300	1.70E -05	9800	0.000 1	644 0	0.000 16	0. 3	1. 1	4. 7	13	54 .7	82 .2	58	2 3	56.37	Extremely high	Several months
AM 148	59. 8	12.7	1790	167 0	0.00 06	260	0.003 8	940	0.00 11	11700	0.00 01	40600	2.00E -05	7760	0.000 13	3000	0.000 33			0. 6	1. 1	3. 4	5. 1	15 .8	11	10 .1		13.82	Extremely high	Several months
AM 149	231	46	6610	960	0.00 10	3910	0.000 3	1180	0.00 08	5800	0.00 02	42400	2.00E -05	20100	5.00E -05	11100	9.00E -05	698 0	0.000 14	0. 6	5. 7	17	9	33 .5	33 .3	39 .8	4 6	24.07	Extremely high	Several months
AM 150	253	51	8000	213 0	0.00 05	4890	0.000 2	676	0.00 15	6240	0.00 02	1790	0.000 6	9300	0.000 11	9900	0.000 1	880 0	0.000 11	0. 8	1. 4	3. 5	18	38 .4	42 .4	47	5 1	39.48	Extremely high	Several months
AM 151	248	47	2770	736	0.00 14	1030	0.001 0	5020	0.00 02	920	0.00 11	3500	0.000 3	9500	0.000 11	5340	0.000 19	375 0	0.000 27	0. 8	8	12	23	22 .9	44	44	4 6	55.66	Extremely high	Several months
AM 152	147	34	1540	146 0	0.00 07	641	0.001 6	742	0.00 13	990	0.00 10									3 0	2 4	31	28					128.05	Extremely high	Several months
AM 153	112	27	1130	158 0	0.00 06	1110	0.000 9	315	0.00 32											4 3	1 9	33						149.09	Extremely high	Several months
AM 154	218	47	1560	74.4	0.01 34	1890	0.000 5	321	0.00 31	870	0.00 12	1630	0.000 6	5890	0.000 17	3270	0.000 31			0. 4	1. 5	4. 6	42	23 .9	51 .9	47		106.62	Extremely high	Several months
AM 155	118	103	2098	292	0.00 34	1342	0.000 7	914	0.00 11											0. 8	2. 2	12						17.51	Extremely high	Several months
AM 156	115	90	1542	325	0.00 31	1534	0.000 7	1345	0.00 07											0. 8	4. 2	20						20.07	Extremely high	Several months
AM 157	129	49.6	275	151 0	0.00 07	1420	0.000 7	138	0.00 72	209	0.00 48									0. 6	5. 2	25	28					319.19	Extremely high	Several months
AM 158	80	70	1756	822	0.00 12	2354	0.000 4	1478	0.00 07											3 0	1 2	23						57.16	Extremely high	Several months
AM 159	86	66	2156	145 8	0.00 07	2334	0.000 4	1312	0.00 08	8898	0.00 01									1. 5	0. 5	8	70					15.21	Extremely high	Several months
AM 160	65	56	4258	402	0.00 25	650	0.001 5													1. 2	0. 6							3.91	Extremely high	Several months
AM 161	55	48.2	7128	264	0.00 38	876	0.001 1													1. 2	7. 8							13.45	Extremely high	Several months
AM 162	162	45	5060	656	0.00 15	4030	0.000 2	7660	0.00 01											1. 2	6. 8	55						10.70	Extremely high	Several months
AM 163	188	64	1310	209 0	0.00 05	900	0.001 1													0. 5	2. 8							3.35	Extremely high	Several months
AM 164	48. 4	18.8	53	206	0.00 49	96	0.010 4	12.7	0.07 87	4.3	0.23 26	8.9	0.112 4							4 0	3 4	64	44	47				21101.1 7	Extremely low	More than 25 yrs
AM 165	191	52	1410	111	0.00 90	1650	0.000 6	30.2	0.03 31	175	0.00 57	438	0.002 3	980	0.001 02	970	0.001 03			0. 8	1. 3	10	9. 3	8	18 .8	14 .3		444.45	Extremely high	Several months
AM 166	64. 9	28.1	3710	970	0.00 10	521	0.001 9	11600	0.00 01											0. 3	1. 1	6. 1						2.95	Extremely high	Several months
AM 167	189	48	2070	198	0.00 51	1660	0.000 6	133	0.00 75	4350	0.00 02	17100	6.00E -05							4. 7	5. 9	26	28	42 .1				231.68	Extremely high	Several months
AM 168	61. 8	27.3	2870	650	0.00 15	5460	0.000 2													0. 8	1. 7							1.54	Extremely high	Several months
AM 169	66. 7	41.9	2210	643	0.00 16	11200	0.000 1	2210	0.00 05											4. 8	3 0	27						22.36	Extremely high	Several months
AM 170	142	36	1730	127	0.00 79	1570	0.000 6	663	0.00 15	3150	0.00 03									2. 5	2 2	42	43					110.70	Extremely high	Several months
AM 171	240	51	1900	193	0.00 52	1260	0.000 8	1050	0.00 10	345	0.00 29	549	0.001 8	6620	0.000 15	3450	0.000 29	377 0	0.000 27	0. 5	1. 9	11	14	30 .6	16	31 .7	3 6	122.50	Extremely high	Several months

AM 172	216	52	1050	108	0.00 93	4240	0.000 2	1060	0.00 09	5410	0.00 02	15700	6.00E -05							0. 5	2. 8	12	15	4. 7					19.68	Extremely high	Several months
AM 173	246	47	2370	692	0.00 14	1890	0.000 5	439	0.00 23	4930	0.00 02	5230	0.000 2	536	0.001 87	3290	0.000 3			0. 5	1. 0	28	41	34 .4	52				181.70	Extremely high	Several months
AM 174	49	75.5	1645	242	0.00 41	14300	0.000 1	1150	0.00 09	5540	0.00 02	2460	0.000 4							0. 8	2. 7	6. 1	16	56 .4					34.61	Extremely high	Several months
AM 175	298	52	5400	651	0.00 15	21000	0.000 0	663	0.00 15	4080	0.00 03	3370	0.000 3	14400	6.90E -05	9800	0.000 1			0. 3	1. 9	14	37	20 .2	75 .5	12 8			55.03	Extremely high	Several months
AM 176	174	42	1340	194 0	0.00 05	85000	0.000 0	3490	0.00 03	3830	0.00 03	15800	6.00E -05	7280	0.000 14	10800	9.30E -05			0. 3	1. 2	5. 1	35	36	61 .8	56			26.72	Extremely high	Several months
AM 177	145	30	2950	188	0.00 53	790	0.001 3	760	0.00 13	6110	0.00 02	28800	3.00E -05	26200	3.80E -05	6890	0.000 15			0. 3	1. 3	21	20	33 .1	15 .6				35.89	Extremely high	Several months
AM 178	142	44	7590	850	0.00 12	2300	0.000 4	1010	0.00 10	14600	0.00 01	21800	5.00E -05							0. 9	7. 4	9	8. 6	20 .3					14.71	Extremely high	Several months
AM 179	134	49.7	597	211	0.00 47	940	0.001 1	3220	0.00 03	16300	0.00 01	820	0.001 2	383	0.002 61	157	0.006 37			1. 2	4. 6	6. 9	33	53	43 .8				193.74	Extremely high	Several months
AM 180	218	51	2840	154	0.00 65	15900	0.000 1	632	0.00 16	10500	0.00 01	8000	0.000 1	4330	0.000 23	8100	0.000 12			0. 3	6. 1	1. 6	8	9. 1	10 .6	48 .8			15.24	Extremely high	Several months
AM 181	43. 3	22.7	1490	205 0	0.00 05	840	0.001 2													0. 4	2. 9								3.65	Extremely high	Several months
AM 182	229	194	108	205 0	0.00 05	970	0.001 0	549	0.00 18	83	0.01 21									6. 2	1. 4	23	45						601.52	High	Several months to 3 yrs
AM 183	107	18.6	123	348	0.00 29	790	0.001 3	235	0.00 43	121	0.00 83	10.1	0.099	9.7		73.3				1. 3	2. 4	3. 3	9. 7	18 .8	19 4	48			1962.37	Moderate	3 to 10 yrs
AM 184	143	30	1930	198 0	0.00 05	4860	0.000 2	800	0.00 13	2780	0.00 04	2200	0.000 5							0. 7	3. 7	3. 4	10	18 .1					17.19	Extremely high	Several months
AM 185	92. 6	20.1	3270	211 0	0.00 05	2670	0.000 4	4480	0.00 02	3910	0.00 03									8. 8	1. 3	30	30						23.41	Extremely high	Several months
AM 186	112	95	1220	209 8	0.00 05	1098	0.000 9	2256	0.00 04	145	0.00 69									8. 9	1. 9	24	20						170.12	Extremely high	Several months
AM 187	135	97	405	458	0.00 22	1544	0.000 6	1867	0.00 05											0. 8	4. 2	12							10.89	Extremely high	Several months
AM 188	56. 9	12.3	1080	494	0.00 20	248	0.004 0	1250	0.00 08	367	0.00 27	8800	0.000 1	3400	0.000 29					1	8. 6	26	42	27 .9	30				183.94	Extremely high	Several months
AM 189	88. 8	40.2	1000	223	0.00 45	1150	0.000 9	226	0.00 44	6190	0.00 02	37100	3.00E -05	2260	0.000 44					1. 7	1. 1	2. 7	8	18 .3	12 .8				27.98	Extremely high	Several months
AM 190	68. 8	12.4	900	263	0.00 38	1790	0.000 6	970	0.00 10	1370	0.00 07	5820	0.000 2	2780	0.000 36					0. 5	0. 8	2. 1	2. 5	17 .7	25				18.37	Extremely high	Several months
AM 191	202	40	1290	183	0.00 55	2140	0.000 5	499	0.00 20	2060	0.00 05	3630	0.000 3	3470	0.000 29	1760	0.000 57			0. 7	4. 5	12	10	15 .6	13 .5	12 .4			50.06	Extremely high	Several months
AM 192	66. 2	18.2	1560	689 0	0.00 01	1770	0.000 6	2140	0.00 05	1820	0.00 06	4430	0.000 2							0. 7	2. 2	5	45	32 .4					35.72	Extremely high	Several months
AM 193	118	18.6	3180	82	0.01 22	980	0.001 0	575	0.00 17	2320	0.00 04	9500	0.000 1	10800	9.30E -05					0. 7	4. 7	3. 9	16	23 .1	18 .2				31.13	Extremely high	Several months
AM 194	78. 8	24.3	1230	191	0.00 52	5060	0.000 2	640	0.00 16	626	0.00 16	3410	0.000 3							0. 9	5. 3	8. 3	9	17 .8					38.33	Extremely high	Several months
BN 195	137	33	2100	574	0.00 17	2660	0.000 4	1520	0.00 07	7200	0.00 01	11300	9.00E -05	2590	0.000 39					0. 6	5. 1	9. 1	12	36 .4	40 .9				29.63	Extremely high	Several months
BN 196	35. 2	16.4	2590	103 0	0.00 10	637	0.001 6													9. 6	9. 2								23.76	Extremely high	Several months

BN 197	51.2	39.2	2120	3470	0.0003															13										3.75	Extremely high	Several months
BN 198	60.7	16.3	1810	193	0.0052	4210	0.0002	1040	0.0010	1950	0.0005	2900	0.0003							0.6	2.9	6.9	13	21.5					24.51	Extremely high	Several months	
BN 199	80.3	20.4	1890	193	0.0052	5260	0.0002	550	0.0018	732	0.0014	9000	0.0001	3480	0.00029					0.6	1.9	2.5	8	25.4	21.5				27.94	Extremely high	Several months	
BN 200	80.4	33.9	1140	3620	0.0003	478	0.0021	12500	0.0001											0.9	0.4	2							1.25	Extremely high	Several months	
BN 201	65.5	41.2	748	1690	0.0006	3100	0.0003	560	0.0018											8.4	9.7	28							58.10	Extremely high	Several months	
BN 202	67.5	34.5	1190	383	0.0026	940	0.0011	1810	0.0006											1.3	2.8	20							17.42	Extremely high	Several months	
BN 203	106	41.8	152	213	0.0047	3040	0.0003	76.2	0.0131											1.1	1.4	18							245.99	Extremely high	Several months	
BN 204	170	34	2270	1385	0.0007	930	0.0011	1860	0.0005	16400	0.0001									1.6	8.3	54	42						41.67	Extremely high	Several months	
BN 205	142	131.8	1254	982	0.0010	1543	0.0006	688	0.0015	7562	0.0001									0.5	3.5	4.8	9.8						11.05	Extremely high	Several months	
BN 206	145	138.5	1345	698	0.0014	450	0.0022	682	0.0015	6988	0.0001									0.8	2.2	7.2	13.2						35.48	Extremely high	Several months	
BN 207	155	47	5650	3510	0.0003	16700	0.0001	2.00E+05	0.0000	89000	0.0000									1.6	7.1	25	31						1.35	Extremely high	Several months	
BN 208	152	30	1650	559	0.0018	1840	0.0005	604	0.0017	5350	0.0002	12700	8.00E-05	3250	0.00031	2290	0.00044			0.5	7.2	12	16	22.4	24.2	35.7			52.47	Extremely high	Several months	
BN 209	130	45	1050	112	0.0089	1660	0.0006	86	0.0116	6380	0.0002	24400	4.00E-05	1010	0.00099					0.8	4	8.2	14	48.2	16.7				125.61	Extremely high	Several months	
BN 210	30.1	14	6170	187	0.0053	2250	0.0004	423	0.0024	2470	0.0004									0.4	1.1	3	5.1						11.78	Extremely high	Several months	
BN 211	149	41	2960	1040	0.0010	2790	0.0004	482	0.0021	16000	0.0001	7050	0.0001	4050	0.00025					0.4	1.5	4.9	9.3	14	28.1				20.59	Extremely high	Several months	
BN 212	165	46	5720	106	0.0094	762	0.0013	556	0.0018	1000	0.0010	15000	7.00E-05	9800	0.0001					0.8	1.8	4.7	23	40.2	38				47.92	Extremely high	Several months	
BN 213	281	49	7060	1540	0.0006	3240	0.0003	1590	0.0006	1090	0.0009	11800	8.00E-05	9300	0.00011	9500	0.00011			0.4	1.7	7.8	19	45.4	45.1	46			36.66	Extremely high	Several months	
BN 214	102	22.7	1390	2100	0.0000	15700	0.0000	58600	0.0000											0.6	9.8	38							0.68	Extremely high	Several months	
BN 215	119	17	3910	470	0.0021	21600	0.0000	1410	0.0007	3830	0.0003	552	0.0018	850	0.00118	2420	0.00041			0.3	1.5	6.7	15	24.4	16.6	25.9			83.81	Extremely high	Several months	
BN 216	70.3	35.7	3912	69.4	0.0144	2070	0.0005	1630	0.0006	610	0.0016									1.1	4.1	7.6	18						52.00	Extremely high	Several months	
BN 217	39.3	18.4	3913	96.7	0.0103	139	0.0072	244.1	0.0041	440.5	0.0023	732.1	0.0014	594.9	0.00168					0.9	1	2.1	4.5	30.8	18.4				108.32	Extremely high	Several months	
BN 218	57	28	3914	31.2	0.0321	1570	0.0006	245	0.0041	19.3	0.0518	78.3	0.0128	417	0.0024	1380	0.00072			0.6	3	2.9	11	7.5	10.8	22.2			740.70	High	Several months to 3 yrs	
BN 219	76.2	30.8	1450	166	0.0060	830	0.0012	709	0.0014	2750	0.0004	1320	0.0008	820	0.00122					0.7	2.6	4.2	8	12.5	27.7				59.43	Extremely high	Several months	
BN 220	31.1	12.9	2670	532	0.0019	76.1	0.0131	3410	0.0003	26600	0.0000	6440	0.0002							0.5	0.9	2.1	11	7.9					15.02	Extremely high	Several months	

BN 221	42. 1	35.8	2790	158	0.00 63	23	0.043 5	8700	0.00 01	18100	0.00 01	5620	0.000 2							0. 9	1	4. 1	11	11 .2				52.25	Extremely high	Several months
BN 222	131	49	910	42	0.02 38	2180	0.000 5	350	0.00 29	2600	0.00 04	717	0.001 4							0. 5	2. 2	6. 2	29	45 .5				105.24	Extremely high	Several months
BN 223	80. 3	31.7	2100	176	0.00 57	270	0.003 7	355	0.00 28	9800	0.00 01									0. 9	9. 3	11	31					73.71	Extremely high	Several months
BN 224	61. 1	17.8	1590	100 0	0.00 10	960	0.001 0	1630	0.00 06	1360	0.00 07									1	3. 8	4. 2	32					31.06	Extremely high	Several months
BN 225	108	32	237	109	0.00 92	143	0.007 0	1250	0.00 08	4990	0.00 02	18.8	0.053 2	62.6	0.015 97					1. 2	0. 9	1. 4	7. 1	40 .6	32 .4			2696.99	Low	10 to 25 yrs
BN 226	157	82	765	940	0.00 11	86	0.011 6	5.5	0.18 18	38.4	0.02 60	85	0.011 8	305	0.003 28	590	0.001 69			1	2. 4	5. 6	8. 1	7	37 .6	46 .3		1542.20	Moderate	3 to 10 yrs
BN 227	139	40	2650	134	0.00 75	3540	0.000 3	1630	0.00 06	314	0.00 32	97	0.010 3	468	0.002 14	2800	0.000 36			0. 4	2. 4	13	6. 8	16 .4	12 .9	40 .6		244.43	Extremely high	Several months
BN 228	77. 2	31.8	1020	756	0.00 13	5600	0.000 2	457	0.00 22	118	0.00 85	1060	0.000 9	1500	0.000 67					0. 5	1. 1	7. 9	9. 7	15 .5	17 .3			126.50	Extremely high	Several months
BN 229	40. 2	24.7	1450	57.1	0.01 75	204	0.004 9	52.2	0.01 92	2.7	0.37 04	1.9	0.526 3	475	0.002 11	425	0.002 35			0. 8	2	1. 8	3. 5	3. 5	6. 5	7. 2		3227.32	Low	10 to 25 yrs
BN 230	24. 4	16.5	5800	175	0.00 57	432	0.002 3	9700	0.00 01	790	0.00 13									1. 2	0. 5	4. 4	9. 3					20.24	Extremely high	Several months
BN 231	42. 7	32.4	67	57.1	0.01 75	40.9	0.024 5	100	0.01 00	11.7	0.08 55	4.5	0.222 2							0. 8	0. 9	2. 9	3. 8	9. 9				2589.80	Low	10 to 25 yrs
BN 232	145	53	290	365	0.00 27	264	0.003 8	4.1	0.24 39	10.7	0.09 35	1.9	0.526 3	16.8	0.059 52					0. 9	1	3. 7	9. 4	8. 4	15 .2	10 .6		7113.01	Extremely low	More than 25 yrs
BN 233	36	33.8	2540	488	0.00 20	2270	0.000 4	263	0.00 38	970	0.00 10									0. 7	3. 3	6	8. 1					34.05	Extremely high	Several months
BN 234	56. 7	16.6	435	545	0.00 18	129	0.007 8	761	0.00 13	55.4	0.01 81	19.9	0.050 3	41.2	0.024 27	170	0.005 88			0. 8	1. 5	3. 6	4. 3	12 .8	8. 9	11		1019.39	Moderate	3 to 10 yrs
BN 235	22. 8	44.2	1500	49.1	0.02 04	52.1	0.019 2	557	0.00 18											0. 8	5. 6	3. 3	13					129.70	Extremely high	Several months
BN 236	43	75	334	132 4	0.00 08	4567	0.000 2													1	6							2.07	Extremely high	Several months
BN 237	54	52	432	534	0.00 19	1998	0.000 5													0. 8	1 6							9.51	Extremely high	Several months
BN 238	63. 7	21.9	3830	452 0	0.00 02	4630	0.000 2	12600	0.00 01	354	0.00 28	830	0.001 2							1. 2	8. 4	8. 8	19	13 .3				72.47	Extremely high	Several months
BN 239	68. 3	46.8	1240	168	0.00 60	9300	0.000 1	362	0.00 28	2170	0.00 05	19600	5.00E -05	4080	0.000 25					0. 3	1. 3	3. 4	3. 1	14 .8	13 .2			16.74	Extremely high	Several months
BN 240	131	34	1500	195 0	0.00 05	525	0.001 9	2600	0.00 04	930	0.00 11	2940	0.000 3							0. 4	0. 7	3. 7	8. 8	85 .1				41.37	Extremely high	Several months
BN 241	143	39	1990	40	0.02 50	1130	0.000 9	472	0.00 21	2870	0.00 04	199	0.005	758	0.001 32					0. 5	3	5. 9	16	37 .7	33			266.21	Extremely high	Several months
BN 242	66. 7	52.3	1610	35.8	0.02 79	38.5	0.026 0	336	0.00 30	172	0.00 58									0. 9	3. 6	11	21					273.48	Extremely high	Several months
BN 243	91. 8	34.2	739	230	0.00 43	1600	0.000 6	752	0.00 13											7. 6	3 6	28						92.78	Extremely high	Several months
BN 244	74. 1	23.8	1060	101 0	0.00 10	1210	0.000 8	9541	0.00 01	3020	0.00 03									1. 4	1 0	25	18					18.23	Extremely high	Several months
BN 245	78. 9	40	1550	195	0.00 51	1040	0.001 0	1130	0.00 09	4390	0.00 02									0. 8	4. 2	17	32					30.47	Extremely high	Several months

BN 246	124	34	1247	166	0.00 60	1280	0.000 8	3690	0.00 03	3670	0.00 03	3124	0.000 3	3001	0.000 33					0. 8	1. 4	4. 9	20	25 .1	38			33.39	Extremely high	Several months
BN 247	136	41	1440	210 0	0.00 05	3270	0.000 3	930	0.00 11	19400	0.00 01	2050	0.000 5	940	0.001 06	647	0.001 55			0. 8	2. 7	5. 1	12	12 .5	24	40 .2		101.07	Extremely high	Several months
BN 248	153	47	1100	121 0	0.00 08	496	0.002 0	950	0.00 11	5320	0.00 02	12800	8.00E -05	1360	0.000 74	562	0.001 78			0. 6	1. 3	9. 6	7. 2	18 .8	22 .3	47 .2		116.43	Extremely high	Several months
BN 249	25. 9	15.9	1850	719	0.00 14	22300	0.000 0	1940	0.00 05											0. 3	2. 6	7. 1						4.19	Extremely high	Several months
BN 250	170	51	2110	360	0.00 28	80	0.012 5	342	0.00 29	2490	0.00 04	16300	6.00E -05	1650	0.000 61	2130	0.000 47			0. 9	4. 6	2. 1	5	42 .2	18 .5	47 .7		104.34	Extremely high	Several months
BN 251	97. 3	50.7	950	742	0.00 13	3460	0.000 3	1510	0.00 07	3600	0.00 03									0. 5	3. 3	8. 9	20					13.08	Extremely high	Several months
BN 252	79. 6	50.4	673	523	0.00 19	8000	0.000 1	5720	0.00 02	699	0.00 14	5710	0.000 2	3350	0.000 3	673	0.001 49			0. 4	2. 4	4. 9	15	15 .1	18 .4	23 .3		66.14	Extremely high	Several months
BN 253	80	32	1423	135	0.00 74	22.3	0.044 8	24475	0.00 00	18256	0.00 01									0. 6	3. 4	6	38					159.24	Extremely high	Several months
BN 254	142	51	6010	576	0.00 17	5950	0.000 2	1500	0.00 07	9400	0.00 01	5520	0.000 2							0. 4	2	8. 2	25	53 .2				18.79	Extremely high	Several months
BN 255	152	50	1270	513	0.00 19	2570	0.000 4	820	0.00 12	8400	0.00 01	1370	0.000 7	520	0.001 92					1. 9	3. 5	8. 5	19	23 .5	49 .6			130.23	Extremely high	Several months
BN 256	96. 5	46.5	758	40	0.02 50	1130	0.000 9	472	0.00 21	2870	0.00 04	199	0.005							0. 5	3	5. 9	16	37 .7				222.68	Extremely high	Several months
BN 257	101	40	1130	850	0.00 12	1910	0.000 5	776	0.00 13	25400	0.00 00	2860	0.000 3							0. 4	3. 7	5. 2	23	26 .7				19.35	Extremely high	Several months
BN 258	136	50	1030	283	0.00 35	72.6	0.013 8	548	0.00 18	1450	0.00 07	1730	0.000 6							0. 6	1. 4	9. 4	17	57 .3				79.27	Extremely high	Several months
BN 259	50. 5	20.7	1400	189 0	0.00 05	5010	0.000 2	1190	0.00 08	3600	0.00 03	1460	0.000 7							1	1. 2	3. 7	8. 3	19 .4				19.47	Extremely high	Several months
BN 260	157	101	1100	168	0.00 60	412	0.002 4	6940	0.00 01	800	0.00 13									0. 7	7. 1	20	81					125.53	Extremely high	Several months
BN 261	113	32	660	121	0.00 83	366	0.002 7	32100	0.00 00	5000	0.00 02	2440	0.000 4	980	0.001 02					0. 9	3. 9	19	11	16 .5	26 .2			54.38	Extremely high	Several months
BN 262	118	34	1680	138 0	0.00 07	1640	0.000 6	1040	0.00 10	22100	0.00 00	5860	0.000 2	800	0.001 25					1. 2	1. 1	7. 2	16	14 .5	42 .2			64.41	Extremely high	Several months
BN 263	211	39	1820	394	0.00 25	2040	0.000 5	1340	0.00 07	12300	0.00 01	3760	0.000 3	2060	0.000 49					0. 7	2. 6	40	50	35 .2	41			66.23	Extremely high	Several months
BN 264	169	46	2430	73.2	0.01 37	226	0.004 4	1500	0.00 07	4550	0.00 02	25300	4.00E -05	10000	0.000 1	3670	0.000 27			0. 4	1. 0	3. 9	5. 8	28 .6	34 .2	40 .7		69.23	Extremely high	Several months
BN 265	158	31	1240	641	0.00 16	15300	0.000 1	626	0.00 16	1920	0.00 05	3870	0.000 3	5210	0.000 19	2220	0.000 45			0. 4	8	5. 9	42	21 .6	31 .5	26		55.38	Extremely high	Several months
BN 266	150	38	1330	538	0.00 19	11400	0.000 1	18900	0.00 01	2040	0.00 05	10500	1.00E -04	3650	0.000 27	2060	0.000 49			0. 4	0. 5	1. 9	35	37 .3	22 .9	23 .9		39.47	Extremely high	Several months
BN 267	206	47	3040	146	0.00 68	513	0.001 9	1390	0.00 07	2060	0.00 05	12000	8.00E -05	7680	0.000 13	3610	0.000 28			0. 3	4. 2	20	16	33 .5	40 .9	44		52.70	Extremely high	Several months
BN 268	155	41	1040	628	0.00 16	2140	0.000 5	870	0.00 11	6550	0.00 02	4100	0.000 2	2090	0.000 48	1100	0.000 91			1. 2	4. 1	8. 4	18	17 .8	28 .6	36 .6		67.53	Extremely high	Several months
BN 269	139	51	567	61.3	0.01 63	15.2	0.065 8	2.8	0.35 71	41.2	0.02 43	910	0.001 1	150	0.006 67	109	0.009 17			1. 2	2. 8	3. 9	4. 7	44 .7	28 .6	14 .1		2079.87	Low	10 to 25 yrs
BN 270	76. 4	19.7	860	93	0.01 08	110	0.009 1	1710	0.00 06	171	0.00 59	2920	0.000 3							1	0. 8	6	16	32 .7				126.30	Extremely high	Several months

BN 271	147	55	79	134	0.0075	604	0.0017	5.5	0.1818	5	0.2000	7.3	0.137	16.7	0.05988	38.7	0.02584			0.4	9.5	19	14	16.2	14.8	26		10050.50	Extremely low	More than 25 yrs
BN 272	151	46	87	97	0.0103	15	0.0667	221	0.0045	1030	0.0010	143	0.007	22.8	0.04386	73	0.0137			0.5	1	1.4	7.3	10.9	39.6	44.3		2505.16	Low	10 to 25 yrs
BN 273	110	33	669	134	0.0075	8300	0.0001	578	0.0017	129	0.0078	1030	0.001	107	0.00935	285	0.00351			0.3	1.1	1.2	5.1	17.2	31.6	25.4		445.13	Extremely high	Several months
BN 274	81.9	121	39.5	386	0.0026	333	0.0030	54	0.0185	5580	0.0002	2080	0.0005	409	0.00244	104	0.00962			0.9	0.9	2.8	8.4	8.7	6.4	19		260.91	Extremely high	Several months
BN 275	86.1	25.9	1640	311	0.0032	980	0.0010	488	0.0020	1590	0.0006	1270	0.0008							0.9	1.4	16	19	8.8				68.85	Extremely high	Several months
BN 276	89.6	40.4	232	161	0.0062	1210	0.0008	5440	0.0002	268	0.0037	121	0.0083	86	0.01163	22.9	0.04367			0.9	0.7	3.5	2.8	3.6	3.7	22.3		1063.83	Moderate	3 to 10 yrs
BN 277	139	32	406	94	0.0106	723	0.0014	268	0.0037	1830	0.0006	528	0.0019	149	0.00671	280	0.00357			1	4.2	7.3	16	14.1	48.9	16.3		465.54	Extremely high	Several months
BN 278	177	43	128	158	0.0063	10.4	0.0962	475	0.0021	137	0.0073	99	0.0101	154	0.00649	84	0.0119			1.3	1.7	8.9	21	18.8	36.6	48		1342.70	Moderate	3 to 10 yrs
BN 279	73.9	74.1	182	54.7	0.0183	196	0.0051	474	0.0021	50.2	0.0199	860	0.0012	30	0.03333					0.7	0.5	1.9	4.5	10.8	32.5			1204.89	Moderate	3 to 10 yrs
BN 280	116	7	1354	55.8	0.0179	3.7	0.2703	650	0.0015	1250	0.0008	2114	0.0005	1897	0.00053					1.1	1.9	7.6	33	24	26.1			596.43	High	Several months to 3 yrs
BN 281	124	29	1510	270	0.0037	3310	0.0003	910	0.0011	4560	0.0002	378	0.0026	670	0.00149					0.3	1.6	6.7	22	37.6	28			155.04	Extremely high	Several months
BN 282	57.5	30.5	35.7	399	0.0025	44.3	0.0226	104	0.0096	9.8	0.1020	3.8	0.2632							0.6	1.6	3	4.7	16.6				4914.48	Extremely low	More than 25 yrs
BN 283	121	48	12.7	82	0.0122	830	0.0012	405	0.0025	79	0.0127	1407	0.0007	50	0.02					0.8	2.7	6.3	11	12.4	40.1			978.62	High	Several months to 3 yrs
BN 284	46.5	26.4	124	356	0.0028	681	0.0015	28.7	0.0348	8.2	0.1220	12.2	0.082							0.9	1.8	6.5	11	9.7				2368.20	Low	10 to 25 yrs
BN 285	80.4	32	2200	176	0.0057	270	0.0037	354	0.0028	3800	0.0003									0.9	9.1	11	11					72.79	Extremely high	Several months
BN 286	88.5	62.5	95	177	0.0056	1270	0.0008	171	0.0058	1300	0.0008	10400	1.00E-04	950	0.00105					0.5	1.2	2.4	2.1	11.1	11.7			32.80	Extremely high	Several months
BN 287	32.7	10.8	980	347	0.0029	89	0.0112	243	0.0041	4510	0.0002									1.8	3.1	3.8	14					58.76	Extremely high	Several months
BN 288	200	52	16.4	239	0.0042	72	0.0139	14.2	0.0704	5.1	0.1961	9.6	0.1042							1.3	1.8	3.3	92	46				23093.72	Extremely low	More than 25 yrs
BN 289	86.8	33.2	237	167	0.0060	326	0.0031	1150	0.0009	106	0.0094	126	0.0079							2.5	8.9	29	38	47				798.99	High	Several months to 3 yrs
BN 290	28.2	21.4	236	178	0.0056	138	0.0072	1070	0.0009	1760	0.0006									1.2	4.5	5.8	14					52.73	Extremely high	Several months
BN 291	86.8	33.2	237	296	0.0034	1190	0.0008	1420	0.0007	159	0.0063	1140	0.0009	2170	0.00046					1.6	1.4	2.9	8.3	9.7	28.6			82.51	Extremely high	Several months
BN 292	88.1	29.9	117	87	0.0115	569	0.0018	51.6	0.0194	55.1	0.0182	5.2	0.1923	9.7	0.10309	61.8	0.01618			1.1	2.4	8.4	8	17.2	13.5	17.2		5302.60	Extremely low	More than 25 yrs
BN 293	66	11.9	787	607	0.0016	30	0.0333	2640	0.0004	223	0.0045	3610	0.0003							0.3	0.6	2.6	11	31.9				79.64	Extremely high	Several months
BN 294	117	23	2080	475	0.0021	68.2	0.0147	642	0.0016	273	0.0037	2500	0.0004	2480	0.0004					0.9	4	14	34	18	23.2			223.45	Extremely high	Several months
BN 295	122	29	5620	622	0.0016	285	0.0035	48.8	0.0205	1690	0.0006	21100	5.00E-05	9800	0.0001					0.8	4.7	6.4	7.5	47.8	30.2			158.71	Extremely high	Several months

BN 296	109	39	650	109	0.0092	26.8	0.0373	323	0.0031	2390	0.0004	44.5	0.0225	60.8	0.01645	250	0.004			0.7	1.1	1.1	5.2	17.6	23	26.1		931.24	High	Several months to 3 yrs
BN 297	209	43	425	84	0.0119	371	0.0027	348	0.0029	66.2	0.0151	133	0.0075	423	0.00236	431	0.00232			1.4	1.5	15	28	25	42.4	40		904.18	High	Several months to 3 yrs
BN 298	149	35	4340	53.2	0.0188	297	0.0034	10300	0.0001	210	0.0048	212	0.0047	2360	0.00042	3770	0.00027			0.9	0.6	5.7	14	23.2	29.1	33.8		216.89	Extremely high	Several months
BN 299	130	35	1325	554	0.0018	34.1	0.0293	2690	0.0004	470	0.0021	7150	0.0001	1213	0.00082	1000	0.001			0.3	0.5	2.5	7.8	30.4	31.5	27		89.95	Extremely high	Several months
BN 300	120	50	214	184	0.0054	36	0.0278	123	0.0081	32.4	0.0309	372	0.0027							0.5	1.1	8.3	19	41.9				799.81	High	Several months to 3 yrs
BN 301	48.8	89.2	12.3	89	0.0112	96	0.0104	19.7	0.0508	13.4	0.0746	4.7	0.2128							1.1	2.2	1.5	1.3	24.9				5506.31	Extremely low	More than 25 yrs
BN 302	182	47	1260	79	0.0127	3060	0.0003	189	0.0053	900	0.0011	1180	0.0008	1680	0.0006					0.5	2	8.4	17	57.7	49.9			148.92	Extremely high	Several months
BN 303	206	46	1770	147	0.0068	768	0.0013	2580	0.0004	4460	0.0002	910	0.0011	1140	0.00088	3570	0.00028			0.5	1.4	9.1	17	39.5	38.4	52		120.63	Extremely high	Several months
BN 304	99.4	34.6	11	103	0.0097	205	0.0049	94	0.0106	44	0.0227	6.9	0.1449	2.3	0.43478	5.1	0.19608			0.9	1	2.5	2.9	19.2	27.5	15.8		17943.29	Extremely low	More than 25 yrs
BN 305	56.5	17.2	1140	124	0.0081	4120	0.0002	9400	0.0001	1680	0.0006	343	0.0029							0.4	0.7	3.9	15	24.4	12.1			83.88	Extremely high	Several months
BN 306	115	42	27.9	371	0.0027	4670	0.0002	420	0.0024	136	0.0074	22.3	0.0448	1.6	0.625					0.7	2	2.8	13	7.7	31.3	57.5		20012.36	Extremely low	More than 25 yrs
BN 307	52.7	30.7	470	131	0.0076	674	0.0015	4500	0.0002	9700	0.0001	1300	0.0008	302	0.00331					1.4	0.6	1.4	4.6	4.9	16.6	23.2		71.10	Extremely high	Several months
BN 308	61.5	34.6	1520	51.7	0.0193	445	0.0022	210	0.0048											3.4	4.9	18						162.49	Extremely high	Several months
BN 309	97.3	31.7	2600	211.8	0.0005	10300	0.0001	5480	0.0002	1000	0.0010	23500	4.00E-05	5170	0.00019					0.4	1.8	2.8	11	34.4	22.4			17.67	Extremely high	Several months
BN 310	52.5	20.3	2610	187	0.0053	6530	0.0002	2520	0.0004	664	0.0015	1960	0.0005							0.6	2.5	4.6	9.6	14.3				27.17	Extremely high	Several months
BN 311	72.5	8.6	1120	102	0.0098	2550	0.0004	1040	0.0010	5180	0.0002	5550	0.0002	1950	0.00051					0.6	2.8	15	12	9.9	17			34.22	Extremely high	Several months
BN 312	49.2	16.1	591	118	0.0085	1110	0.0009	99	0.0101	784	0.0013	3450	0.0003							0.5	1.5	3.6	3.4	17.4				51.33	Extremely high	Several months
BN 313	147	47	1140	210.0	0.0005	3740	0.0003	2550	0.0004	1180	0.0009	1630	0.0006	1520	0.00066					1	1.1	6.4	33	20.2	39.1			69.36	Extremely high	Several months
BN 314	76.4	43.6	1000	70.9	0.0141	283	0.0035	28	0.0357	33	0.0303	90	0.0111	278	0.0036	574	0.00174			1.2	1.2	10	9.6	7.6	9.8	11.1		846.41	High	Several months to 3 yrs
BN 315	117	39	5270	149	0.0067	2340	0.0004	658	0.0015	1650	0.0006	3790	0.0003	7490	0.00013	23800	4.20E-05			0.4	1.4	5.8	9.8	8.1	29.4	48		26.12	Extremely high	Several months
BN 316	58	18.4	2530	218	0.0046	615	0.0016	1160	0.0009	187	0.0054	715	0.0014							0.6	2.7	8.1	14	10.9	21.8			104.24	Extremely high	Several months
BN 317	166	50	1330	117	0.0085	33.8	0.0296	166	0.0060	226	0.0044	344	0.0029	278	0.0036	910	0.0011	534.0	0.00019	0.7	1.1	2.6	5.2	10.7	7.4	12.6		148.77	Extremely high	Several months
BN 318	93.2	26.1	1000	108	0.0093	52.7	0.0190	11.7	0.0855	608	0.0016	2330	0.0004	2310	0.00043	1650	0.00061			1.4	2.2	3.9	11	10.3	10.6			415.14	Extremely high	Several months
BN 319	102	29.2	2100	514.0	0.0002	1430	0.0007	6120	0.0002	42900	0.0000	5280	0.0002	2170	0.00046					0.6	6.7	3.2	18	17.8				9.12	Extremely high	Several months

BN 320	154	51	1540	395	0.0025	1080	0.0009	1830	0.0005	2860	0.0004	429	0.0023	166	0.00602	820	0.00122				0.8	2.8	5.3	18	16.2	38.1				281.09	Extremely high	Several months
BN 321	205	59	7510	217	0.0046	5230	0.0002	1590	0.0006	4730	0.0002	5690	0.0002								0.4	2	19	25	26.7					24.15	Extremely high	Several months
BN 322	63.2	14.3	860	771	0.0013	970	0.0010	6312	0.0002	4260	0.0002	7520	0.0001	3900	0.00026						1.4	1.3	16	8.6	10.4	11.4				12.02	Extremely high	Several months
BN 323	93.2	34.7	4160	1920	0.0005	330	0.0030	7020	0.0001	739	0.0014	187	0.0053	3310	0.0003						1.1	1.2	3.1	0.9	14.4	37.8				94.29	Extremely high	Several months
BN 324	77.4	32	1380	488	0.0020	111	0.0090	4100	0.0002	850	0.0012	367	0.0027	1270	0.00079						0.5	0.8	4.2	6	16.1	17.8				74.20	Extremely high	Several months
BN 325	59.4	21.1	1010	286	0.0035	166	0.0060	481	0.0021	233	0.0043	4710	0.0002								0.7	0.8	5.2	7.1	24.7					53.79	Extremely high	Several months
BN 326	589	19.5	240	870	0.0011	83	0.0120	3360	0.0003	880	0.0011	457	0.0022								0.5	1.1	4.3	5.6	27.9					82.52	Extremely high	Several months
BN 327	49.9	14.5	356	131	0.0076	368	0.0027	678	0.0015	1340	0.0008	1170	0.0009	3160	0.00032						1.1	8.6	3.8	4.6	3.4	13.9				48.11	Extremely high	Several months
BN 328	52.5	11.5	429	970	0.0010	4390	0.0002	4450	0.0002	2380	0.0004	1300	0.0008								0.5	1	12	8.3	19.6					22.00	Extremely high	Several months
BN 329	37.2	16.6	1280	520	0.0019	35.4	0.0282	1070	0.0009	105	0.0095	2240	0.0004								0.3	0.7	2	5.8	10.7					82.23	Extremely high	Several months
BN 330	86.6	54	1330	429	0.0023	117	0.0085	3360	0.0003	424	0.0024										0.5	0.8	6.6	25						68.93	Extremely high	Several months
BN 331	77.5	27.1	87	1380	0.0007	736	0.0014	1580	0.0006	200	0.0050	438	0.0023	41	0.02439						1.7	1.2	3.7	3.7	11.3	28.9				754.32	High	Several months to 3 yrs
BN 332	83.6	16.8	1850	453	0.0022	4580	0.0002	2510	0.0004	4270	0.0002	5730	0.0002								0.6	6.8	9.9	24	25.6					16.84	Extremely high	Several months
BN 333	234	21	2620	197	0.0051	68.4	0.0146	1430	0.0007	3890	0.0003	9300	0.0001	6520	0.00015	5410	0.00018	3520			4	5.8	14	21	49.4	43.3	45	31	140.56	Extremely high	Several months	
BN 334	223	39	990	237	0.0042	1060	0.0009	1170	0.0009	160	0.0063	297	0.0034	507	0.00197	609	0.00164				1.8	7.1	39	47	30	29	30		548.85	High	Several months to 3 yrs	
BN 335	136	48	5160	46.2	0.0216	80	0.0125	3160	0.0003	232	0.0043	77	0.013	840	0.00119	4780	0.00021	1170			1.1	0.5	4.8	12	14.2	6.3	15.3	33	278.42	Extremely high	Several months	
BN 336	40.1	11.4	1020	360	0.0028	150	0.0067	131	0.0076	1960	0.0005	3510	0.0003								0.7	4.6	3.5	6.4	13.5					66.44	Extremely high	Several months
BN 337	87.6	37.5	1260	95	0.0105	3840	0.0003	207	0.0048	273	0.0037	990	0.001								0.5	1.5	7	22	19.1					139.35	Extremely high	Several months
BN 338	131	34	572	192	0.0052	669	0.0015	312	0.0032	503	0.0020	2020	0.0005	4030	0.00025	515	0.00194				0.8	4.8	8	5.1	7.9	32	38.4		133.54	Extremely high	Several months	
BN 339	67.7	37.1	2240	5560	0.0002	1490	0.0007	42200	0.0000	354	0.0028										0.9	0.8	4	25						71.42	Extremely high	Several months
BN 340	95	71.4	3710	3500	0.0003	584	0.0017	10800	0.0001												3.3	3.2	17							8.00	Extremely high	Several months
BN 341	65.7	15.3	3830	4520	0.0002	4520	0.0002	12600	0.0001	354	0.0028	830	0.0012								1.2	3.4	14	19	13.3					71.83	Extremely high	Several months
BN 342	43	35	334	1324	0.0008	4576	0.0002														1	8	28							2.50	Extremely high	Several months
BN 343	118	24.9	2120	554	0.0018	285	0.0035	11600	0.0001	758	0.0013	4560	0.0002	19100	5.20E-05	5560	0.00018				0.9	1.1	5.8	14	13.9	34.4	22.9		33.42	Extremely high	Several months	

BN 344	88.1	18.7	1120	164	0.0061	517	0.0019	1810	0.0006	689	0.0015	2470	0.0004							0.5	3.4	9.4	18	38.6					56.57	Extremely high	Several months
BN 345	59.2	30.7	1170	86	0.0116	9200	0.0001	3360	0.0003	263	0.0038									0.6	2.7	3.4	22						91.93	Extremely high	Several months
BN 346	46.1	19	3010	3350	0.0003	431	0.0023	3690	0.0003	890	0.0011	11700	9.00E-05							0.4	0.7	2.1	3.6	20.3					8.09	Extremely high	Several months
BN 347	128	29.3	1650	123	0.0081	528	0.0019	1140	0.0009	312	0.0032	970	0.001	810	0.00123					0.7	7.2	29	28	20	14.3				172.78	Extremely high	Several months
BN 348	141	96	1020	100	0.0100	185	0.0054	65.6	0.0152	128	0.0078	28	0.0357	200	0.005	484	0.00207	628		0.7	1.5	4.6	7	17.5	16	22.9	2	5	892.23	High	Several months to 3 yrs
BN 349	172	30	1090	40.2	0.0249	68.5	0.0146	1340	0.0007	4650	0.0002	5220	0.0002	2560	0.00039					0.6	1.2	14	31	57.9	27				228.86	Extremely high	Several months
BN 350	150	40	2650	1410	0.0007	990	0.0010	525	0.0019	12600	0.0001	5680	0.0002							1.7	1.5	17	41	35.8					58.29	Extremely high	Several months
BN 351	126	98	4940	77.6	0.0129	1170	0.0009	2820	0.0004	20300	0.0000									0.4	5.4	3.8	18						12.00	Extremely high	Several months
BN 352	139	35	1670	704	0.0014	3040	0.0003	890	0.0011	529	0.0019	7500	0.0001	5960	0.00017	2310	0.00043			1.1	2.2	2.3	6.1	16.6	41.4	34.3			40.41	Extremely high	Several months
BN 353	63.9	22	960	132	0.0076	453	0.0022	17700	0.0001	3920	0.0003									0.4	7.5	17	18						25.14	Extremely high	Several months
BN 354	168	49	2850	215	0.0047	616	0.0016	790	0.0013	3710	0.0003	3860	0.0003							0.7	1.1	27	33	47.3					76.44	Extremely high	Several months
BN 355	221	50	3120	198	0.0051	381	0.0026	723	0.0014	6570	0.0002	4600	0.0002	4670	0.00021					0.4	3.4	20	48	47.8	50				67.01	Extremely high	Several months
BN3 56	53.5	26	2040	930	0.0011	26400	0.0000	1370	0.0007	8100	0.0001									0.4	1.5	7.6	18						8.26	Extremely high	Several months
BN 357	93.5	22	1390	739	0.0014	2090	0.0005	311	0.0032	1780	0.0006	1610	0.0006	6540	0.00015	4230	0.00024			0.5	0.7	1.9	5	17	24.5				29.48	Extremely high	Several months
BN 358	169	44	1450	1060	0.0009	5370	0.0002	1190	0.0008	4960	0.0002	2500	0.0004	860	0.00116					0.4	1.2	3.5	50	27.6	42.7				74.31	Extremely high	Several months
BN 359	34	50	2690	830	0.0012	1990	0.0005	744	0.0013	4770	0.0002	2000	0.0005							0.5	1.6	3.3	30	49.2					36.73	Extremely high	Several months
BN 360	150	27	1750	367	0.0027	1210	0.0008	3290	0.0003	6710	0.0002	1950	0.0005	3800	0.00026	2620	0.00038			0.4	3.6	3.6	8.7	19.4	47.4	39.9			44.11	Extremely high	Several months
BN 361	183	40	4180	286	0.0035	448	0.0022	2140	0.0005	4570	0.0002	7300	0.0001	5690	0.00018					0.7	2.7	13	33	38	46.9				35.22	Extremely high	Several months
BN 362	122	41	2210	306	0.0033	1910	0.0005	425	0.0024	2600	0.0004	452	0.0022	2480	0.0004					0.4	1.1	2.7	6.4	20.3	49.7				75.65	Extremely high	Several months
BN 363	122	35	1700	43.7	0.0229	1180	0.0008	136	0.0074	5676	0.0002	2220	0.0005	5240	0.00019	2360	0.00042			0.4	1.4	4.7	6.1	24.1	17.7	31			73.34	Extremely high	Several months
BN 364	113	109	198.01	170	0.0059															3.5									20.59	Extremely high	Several months
BN 365	123	118	188.02	170	0.0059															4.5									26.47	Extremely high	Several months
BN 366	20.5	2	3860	139	0.0072	600	0.0017	384	0.0026	1540	0.0007									0.4	2.9	6.6	3.3						27.04	Extremely high	Several months
BN 367	120	27	1530	354	0.0028	1730	0.0006	696	0.0014	4010	0.0003	6740	0.0001	11400	8.80E-05	3830	0.00026			0.5	1.9	4.1	19	15	29	23.2			23.97	Extremely high	Several months

BN 368	143	44	1430	105 0	0.00 10	3630	0.000 3	268	0.00 37	5540	0.00 02	14400	7.00E -05	1100	0.000 91					1	1. 8	16	-2	30 .8	52 .3			110.40	Extremely high	Several months
BN 369	61. 5	14	1180	434	0.00 23	572	0.001 7	1810	0.00 06	543	0.00 18	24900	4.00E -05	1550	0.000 65	751	0.001 33			0. 8	0. 6	2. 5	4. 9	17 .1	9. 9	11 .5		35.68	Extremely high	Several months
BN 370	226	102	2110	25.5	0.03 92	11.4	0.087 7	125	0.00 80	2260	0.00 04	11500	9.00E -05	2950	0.000 34	2380	0.000 42			0. 7	2. 2	1. 8	16	54 .2	48	51		284.33	Extremely high	Several months
BN 371	81. 4	13	1520	194	0.00 52	4660	0.000 2	970	0.00 10	5830	0.00 02	14800	7.00E -05	2880	0.000 35					0. 5	3. 6	9. 7	13	25 .8	15			22.53	Extremely high	Several months
BN 372	139	39	2900	165	0.00 61	543	0.001 8	236	0.00 42	5010	0.00 02	13900	7.00E -05	18800	5.30E -05					0. 5	1. 2	8. 8	7. 8	18 .4	62 .6			48.74	Extremely high	Several months
BN 373	131	43.9	1260	456	0.00 22	423	0.002 4	483	0.00 21	820	0.00 12	4310	0.000 2							1. 1	1. 1	10	23	51 .6				65.74	Extremely high	Several months
BN 374	138	130.5	2785	292	0.00 34	706	0.001 4	498	0.00 20	23568	0.00 00									1	5	0	11 6					15.43	Extremely high	Several months
BN 375	135	122	2356	235	0.00 43	1026	0.001 0	2162	0.00 05	27854	0.00 00									1	3	3. 5	13 1					13.50	Extremely high	Several months
BN 376	125	112	2259	255	0.00 39	3985	0.000 3	11254	0.00 01											0. 8	1 2	11 2						16.10	Extremely high	Several months
BN 377	110	94	8852	255	0.00 39	1125	0.000 9													0. 8	1 4							15.58	Extremely high	Several months
BN 378	121	27.2	1970	108 0	0.00 09	2310	0.000 4	1300	0.00 08	420	0.00 24	2090	0.000 5	5880	0.000 17					0. 6	2. 5	8. 5	27	17 .4	38			87.25	Extremely high	Several months
BN 379	128	69.8	1670	445	0.00 22	634	0.001 6	270	0.00 37	1320	0.00 08	5350	0.000 2							0. 9	2. 2	5. 2	9. 2	40 .6				39.47	Extremely high	Several months
BN 380	84. 5	22.8	69	111	0.00 90	1060	0.000 9	186	0.00 54	30.6	0.03 27	3.6	0.277 8	32	0.031 25					0. 4	1. 6	10	5. 2	24 .2	20 .3			7585.41	Extremely low	More than 25 yrs
BN 381	38. 1	20.5	1210	351	0.00 28	52.1	0.019 2	5450	0.00 02	23600	0.00 00									0. 9	1. 3	2. 1	13					28.45	Extremely high	Several months
BN 382	54	33.7	2700	758	0.00 13	150	0.006 7	6180	0.00 02											1. 3	3. 5	16						27.64	Extremely high	Several months
BN 383	174	35	1190	251	0.00 40	4010	0.000 2	970	0.00 10	12800	0.00 01	10300	1.00E -04	1700	0.000 59	7280	0.000 14			0. 8	3. 4	8. 7	26	40 .4	59 .4	35		58.71	Extremely high	Several months
BN 384	98. 3	21.6	169	237	0.00 42	704	0.001 4	1120	0.00 09	112	0.00 89	106	0.009 4	38.3	0.026 11	14.6	0.068 49	71	0.014 08	0. 6	1	3. 9	6. 4	13 .6	10 .7	22 .9	1 8	2040.75	Low	10 to 25 yrs
BN 385	96. 5	54	820	250	0.00 40	1310	0.000 8	440	0.00 23	28	0.03 57	16.3	0.061 3	113	0.008 85					1	1	7. 8	5. 8	10 .8	16 .1			1034.69	Moderate	3 to 10 yrs
BN 386	27. 2	11	2110	68.6	0.01 46	1010	0.001 0	10800	0.00 01											0. 5	2. 5	13						10.97	Extremely high	Several months
BN 387	137	22	1620	386	0.00 26	1800	0.000 6	1500	0.00 07	4650	0.00 02	5340	0.000 2	4960	0.000 2	3020	0.000 33			0. 8	4. 6	17	40	14 .9	15 .6	22 .3		37.88	Extremely high	Several months
BN 388	188	49	2160	416 0	0.00 02	1340	0.000 7	1380	0.00 07	7660	0.00 01	1730	0.000 6	2780	0.000 36					0. 6	4. 8	9. 3	28	50 .7	46			59.97	Extremely high	Several months
BN 389	118	48.5	1480	605	0.00 17	232	0.004 3	1340	0.00 07	358	0.00 28	950	0.001 1	21200	4.70E -05	2870	0.000 35			1. 1	1	1. 7	4. 4	2. 2	24 .3	34 .8		35.28	Extremely high	Several months
BN 390	45. 3	13.8	950	326 0	0.00 03	7100	0.000 1	1670	0.00 06	2920	0.00 03	13100	8.00E -05							0. 7	2. 1	6	6. 4	16 .3				7.54	Extremely high	Several months
BN 391	135	48.5	1820	164	0.00 61	85	0.011 8	5480	0.00 02	20100	0.00 01	2230	0.000 4							1. 1	3. 8	5. 3	33	43				73.30	Extremely high	Several months
BN 392	174	46	1420	164	0.00 61	219	0.004 6	1870	0.00 05	4170	0.00 02	1520	0.000 7							0. 9	0. 8	10	35	36 .2				46.70	Extremely high	Several months

BN 393	128	18	2270	178 0	0.00 06	72100	0.000 0	3620	0.00 03	509	0.00 20	8600	0.000 1	4450	0.000 22	2570	0.000 39				0. 6	3. 1	4. 7	16	43 .7	22 .6	19 .5		50.86	Extremely high	Several months
BN 394	70. 4	20.4	1300	234 0	0.00 04	88200	0.000 0	4080	0.00 02	27600	0.00 00	3000	0.000 3							2. 2	5. 9	7. 5	20	14 .3				8.34	Extremely high	Several months	
BN 395	74. 4	13	910	469	0.00 21	1660	0.000 6	641	0.00 16	12800	0.00 01	32600	3.00E -05	1060	0.000 94					0. 8	3. 2	6. 2	21	15 .1	15 .2			29.75	Extremely high	Several months	
BN 396	110	21.6	4280	192 0	0.00 05	5880	0.000 2	4750	0.00 02											1 4	2 5	49						21.86	Extremely high	Several months	
BN 397	54. 5	26.5	1790	654	0.00 15	11900	0.000 1	1180	0.00 08	3090	0.00 03	7270	0.000 1							1	2	4. 6	5. 4	15				9.41	Extremely high	Several months	
BN 398	129	46	554	47.6 10	0.02 10	2060	0.000 5	254	0.00 39	41.2	0.02 43	374	0.002 7	234	0.004 27	36.8	0.027 17			0. 6	2. 9	3. 5	14	33 .6	28 .7	45 .4		1813.78	Moderate	3 to 10 yrs	
BN 399	129	44.4	87	262 0	0.00 04	673	0.001 5	109	0.00 92	23.9	0.04 18	531	0.001 9	49.6	0.020 16	40.5	0.024 69			0. 5	3. 3	1. 3	5. 1	17 .2	20 .4	36 .8		1582.73	Moderate	3 to 10 yrs	
BN 400	54. 6	14.1	1490	156	0.00 64	638	0.001 6	1480	0.00 07	11600	0.00 01	4040	0.000 2							0. 9	6. 2	4. 7	17	12 .2				23.15	Extremely high	Several months	
BN 401	176	33	3460	850	0.00 12	7340	0.000 1	1380	0.00 07	4950	0.00 02	20200	5.00E -05	8800	0.000 11	5140	0.000 19			0. 4	1. 5	5. 5	34	44 .8	28 .1	29		22.58	Extremely high	Several months	
BN 402	118	33.7	2220	298	0.00 34	345	0.002 9	3000	0.00 03	22400	0.00 00	4990	0.000 2							0. 7	1 6	10	29	29 .1				59.19	Extremely high	Several months	
BN 403	177	31	2670	615	0.00 16	3210	0.000 3	1250	0.00 08	25400	0.00 00	31400	3.00E -05	9400	0.000 11	4130	0.000 24			0. 4	4	20	18	23 .7	23 .8	26 .6		28.33	Extremely high	Several months	
BN 404	117	21.8	1810	727	0.00 14	1000	0.001 0	1950	0.00 05	2880	0.00 04	5050	0.000 2	3330	0.000 3	2570	0.000 39			0. 5	3. 7	21	6. 3	32 .5	13 .9	17 .6		34.80	Extremely high	Several months	
BN 405	77. 9	29.1	1350	325	0.00 31	3390	0.000 3	381	0.00 26	5770	0.00 02	14300	7.00E -05							0. 9	2. 4	6	8. 6	30 .9				22.88	Extremely high	Several months	
BN 406	44. 6	21	6320	370	0.00 27	940	0.001 1	2600	0.00 04	7800	0.00 01									0. 6	4. 5	1. 8	17					9.28	Extremely high	Several months	
BN 407	68. 6	46.1	1020	105	0.00 95	34.4	0.029 1	490	0.00 20	28300	0.00 00	5130	0.000 2							0. 8	0. 9	0. 9	9. 1	10 .8				38.05	Extremely high	Several months	
BN 408	65. 4	42.6	1500	407 0	0.00 02	1030	0.001 0	5570	0.00 02	25600	0.00 00	82000	1.00E -05							5. 9	7	5. 3	12	35 .6				10.10	Extremely high	Several months	
BN 409	23. 5	12.8	1520	447 0	0.00 02	19500	0.000 1	31600	0.00 00	65800	0.00 00									3	1 6	24	28					2.68	Extremely high	Several months	
BN 410	32. 7	20	1620	400 0	0.00 03	1250	0.000 8	5470	0.00 02											0. 7	1. 6	8. 4						2.99	Extremely high	Several months	
BN 411	42. 7	25	1560	166 0	0.00 06	3270	0.000 3	49100	0.00 00											2. 5	1 1	20						5.28	Extremely high	Several months	
BN 412	58. 5	28.6	1400	198	0.00 51	910	0.001 1	184	0.00 54	6100	0.00 02									0. 7	2. 7	5. 6	21					40.38	Extremely high	Several months	
BN 413	124	27.2	2600	390 0	0.00 03	1660	0.000 6	9700	0.00 01	1150	0.00 09	12600	8.00E -05							2	3. 5	9. 3	23	28 .6				25.85	Extremely high	Several months	
BN4 14	37. 8	22.7	1140	890 0	0.00 01	1660	0.000 6	9500	0.00 01											2	3. 5	9. 6						3.34	Extremely high	Several months	
BN 415	33. 3	17.9	1080	209	0.00 48	2310	0.000 4	2180	0.00 05											0. 5	3. 4	12						9.37	Extremely high	Several months	
BN 416	51. 7	26.1	2060	340 0	0.00 03	930	0.001 1	22000	0.00 00											0. 7	1. 8	23						3.19	Extremely high	Several months	
BN 417	58. 4	43	1030	105 0	0.00 10	5060	0.000 2	44300	0.00 00											1. 1	1 4	43						4.79	Extremely high	Several months	

BN 418	55.3	50.4	3200	112	0.0089	850	0.0012													0.9	1.3									9.57	Extremely high	Several months
BN 419	49.5	20.3	2340	1188	0.0008	2890	0.0003	14100	0.0001											0.7	4.6	23								3.81	Extremely high	Several months
BN 420	65.8	33.8	1670	246	0.0041	1400	0.0007	266	0.0038	7451	0.0001									0.5	1.9	4.8	75							31.50	Extremely high	Several months
BN 421	37.5	16.7	2420	69.5	0.0144	680	0.0015													0.6	0.2									8.93	Extremely high	Several months
BN 422	180	103.6	2750	1020	0.0010	144	0.0009	30800	0.0000	6400	0.0002									1.5	2.2	26	47							24.94	Extremely high	Several months
BN 423	186	46	1900	492	0.0020	2300	0.0004	759	0.0013	298	0.0034	4350	0.0002	7900	0.00013	5980	0.00017			1.1	4.2	5.1	15	35.2	79.7	56				88.66	Extremely high	Several months
BN 424	118	35.7	3810	2870	0.0003	664	0.0015	6740	0.0001	44800	0.0000	10000	0.0001							1.9	3.3	18	37	22						11.33	Extremely high	Several months
BN 425	133	49.7	5690	568	0.0018	13500	0.0001	1310	0.0008	5670	0.0002	13200	8.00E-05	58400	1.70E-05					0.6	2.9	6.9	8.3	26	38.6					10.63	Extremely high	Several months
BN 426	143	55.8	1750	496	0.0020	860	0.0012	2470	0.0004	7860	0.0001	5180	0.0002							1.1	1.3	19	53	55.8						42.54	Extremely high	Several months
BN 427	171	70	1681	10200	0.0001	21200	0.0000	14500	0.0001	1.00E+05	0.0000									1.8	1.1	32	56							3.46	Extremely high	Several months
BN 428	115	65.1	1590	5010	0.0002	39200	0.0000	5260	0.0002											7.5	2.3	19								5.70	Extremely high	Several months
BN 429	62.9	35.6	3870	3560	0.0003	15000	0.0001	5400	0.0002											5.5	1.4	7.9								3.94	Extremely high	Several months
BN 430	180	39	4260	1430	0.0007	1090	0.0009	3200	0.0003	9300	0.0001	6740	0.0001							0.8	1.5	52	48	39						29.13	Extremely high	Several months
BN 431	73	31.7	1150	136	0.0074	317	0.0032	960	0.0010	9200	0.0001									1.4	3.8	8.5	28							34.18	Extremely high	Several months
BN 432	116	39.8	6820	97	0.0103	2050	0.0005	536	0.0019	83000	0.0000	22300	4.00E-05							0.4	1.2	4.4	30	40.4						15.09	Extremely high	Several months
BN 433	157	51	1410	162	0.0062	1150	0.0009	453	0.0022	1870	0.0005	4600	0.0002							0.9	3.4	6.5	21	74.6						50.31	Extremely high	Several months
BN 434	193	59	1750	1350	0.0007	263	0.0038	6640	0.0002	4410	0.0002	2300	0.0004							3.4	5	29	49	47.8						57.79	Extremely high	Several months
BN 435	27.3	22.2	1500	228	0.0044	7120	0.0001													0.5	4.6									2.84	Extremely high	Several months
BN 436	132	23	1790	3140	0.0003	1640	0.0006	1160	0.0009	742	0.0014									7.4	4.5	33	24							90.59	Extremely high	Several months
BN 437	194	65	2810	3350	0.0003	14000	0.0001	19100	0.0001	51900	0.0000									2.3	1.7	50	60							5.67	Extremely high	Several months
BN 438	34.9	28.9	3010	2500	0.0004	1790	0.0006													0.8	5.2									3.23	Extremely high	Several months
BN 439	61.1	51.8	2940	730	0.0014	4460	0.0002													3	6									5.45	Extremely high	Several months
BN 440	207	63	7060	4170	0.0002	7500	0.0001	14700	0.0001	16400	0.0001									3	3.5	54	52							12.23	Extremely high	Several months
BN 441	172	68	7390	1120	0.0009	1580	0.0006	2420	0.0004	6480	0.0002									0.6	1.5	19	70							28.68	Extremely high	Several months

BN 442	165	43	5110	548	0.00 18	900	0.001 1	3140	0.00 03	11300	0.00 01									1. 4	2. 7	28	90							22.44	Extremely high	Several months
BN 443	48. 9	36.9	1120	212 0	0.00 05	1100	0.000 9	407	0.00 25											0. 7	2. 1	9								24.35	Extremely high	Several months
BN 444	143	51.2	1950	153 0	0.00 07	3740	0.000 3	7250	0.00 01	26400	0.00 00	1.00E +05	1.00E -05							0. 8	6. 9	7. 1	77	51 .2						6.78	Extremely high	Several months
BN 445	139	80.1	3970	580 0	0.00 02	2040	0.000 5	850	0.00 12	3110	0.00 03									0. 6	2. 9	15	41							32.36	Extremely high	Several months
BN 446	201	50	2890	583	0.00 17	2150	0.000 5	3750	0.00 03	4890	0.00 02									1	3 3	59	58							44.66	Extremely high	Several months
BN 447	193	50	4460	175 0	0.00 06	323	0.003 1	800	0.00 13	7150	0.00 01	5760	0.000 2							0. 7	1. 4	14	71	55 .4						41.78	Extremely high	Several months
BN 448	183	48	2610	477	0.00 21	1780	0.000 6	3940	0.00 03	3580	0.00 03									1. 8	2 8	54	52							47.73	Extremely high	Several months
BN 449	148	61.1	1720	290 0	0.00 03	1180	0.000 8	4330	0.00 02	28800	0.00 00	2600	0.000 4							1	3. 2	30	53	61 .1						35.33	Extremely high	Several months
BN 450	139	49.6	1380	358 0	0.00 03	1970	0.000 5	4300	0.00 02	21400	0.00 00	1.00E +05	1.00E -05							2. 6	8. 8	35	43	49 .6						15.84	Extremely high	Several months
BN 451	167	51	5040	940	0.00 11	1930	0.000 5	4140	0.00 02	5900	0.00 02									0. 9	8. 7	45	62							26.84	Extremely high	Several months
BN 452	180	60	3800	271	0.00 37	8300	0.000 1	2750	0.00 04	7720	0.00 01									2. 2	2. 4	53	63							35.84	Extremely high	Several months
BN 453	175	62	2640	377	0.00 27	1910	0.000 5	1530	0.00 07	4140	0.00 02									2. 7	6. 1	54	71							62.80	Extremely high	Several months
BN 454	94. 7	63.9	3790	300	0.00 33	92	0.010 9	3220	0.00 03											0. 9	1. 3	29								26.14	Extremely high	Several months
BN 455	88. 9	26.4	1160	267	0.00 37	287	0.003 5	1060	0.00 09	278	0.00 36	1280	0.000 8	860	0.001 16					0. 9	0. 9	8. 8	23	16 .8	12 .1					124.74	Extremely high	Several months
BN 456	102	21.9	4210	152 0	0.00 07	561	0.001 8	6270	0.00 02	860	0.00 12									6. 1	6. 5	19	49							75.61	Extremely high	Several months
BN 457	91	31.6	3570	328	0.00 30	8600	0.000 1	1360	0.00 07	7420	0.00 01	2470	0.000 4	980	0.001 02					0. 5	2	4. 1	9. 8	14 .3	28 .7					41.17	Extremely high	Several months
BN 458	151	30	3810	366	0.00 27	15300	0.000 1	5490	0.00 02	980	0.00 10	1720	0.000 6	12500	0.000 08	48600	2.10E -05			0. 5	3. 5	4. 7	11	12 .3	22	66 .7				23.96	Extremely high	Several months
BN 459	71. 9	25.2	1730	92	0.01 09	22100	0.000 0	1380	0.00 07	611	0.00 16	5770	0.000 2							0. 3	1. 7	3. 1	12	29 .3						30.30	Extremely high	Several months
BN 460	120	19	1310	677	0.00 15	55300	0.000 0	3620	0.00 03	1880	0.00 05	5250	0.000 2	2100	0.000 48					0. 3	1. 8	3. 2	17	39 .4						17.91	Extremely high	Several months
BN 461	124	68.6	900	616	0.00 16	4830	0.000 2	1650	0.00 06	4660	0.00 02	410	0.002 4	358	0.002 79					0. 7	1. 9	4. 5	7. 9	9. 6	30 .8					115.40	Extremely high	Several months
BN 462	70. 1	23.8	5570	139	0.00 72	14500	0.000 1	2170	0.00 05	607	0.00 17	5120	0.000 2	3240	0.000 31					0. 3	2	2. 7	8. 2	16 .8	16 .3					25.36	Extremely high	Several months
BN 463	117	40.1	2210	253	0.00 40	5660	0.000 2	10000	0.00 01	12800	0.00 01	4770	0.000 2	4080	0.000 25	2920	0.000 34			0. 9	0. 9	4. 2	8. 6	15 .6	17 .3	29 .4				22.39	Extremely high	Several months
BN 464	123	53.4	4000	198 0	0.00 05	6990	0.000 1	2540	0.00 04	21100	0.00 00	25400	4.00E -05							0. 6	2 1	13	36	55 .4						12.31	Extremely high	Several months
BN 465	89. 8	28.1	5520	167 0	0.00 06	6960	0.000 1	614	0.00 16	980	0.00 10									1. 6	1 8	19	23							57.96	Extremely high	Several months

BN 466	82.9	18.9	1390	850	0.0012	8700	0.0001	860	0.0012	8200	0.0001									1.5	6.5	19	38							29.24	Extremely high	Several months
BN 467	69.3	19.2	8800	1840	0.0005	1370	0.0007	8500	0.0001	25600	0.0000									0.6	1.3	21	16							12.91	Extremely high	Several months
BN 468	109	23.1	1600	714	0.0014	1830	0.0005	980	0.0010	9100	0.0001	2680	0.0004							0.7	5.2	23	35	21.2						39.05	Extremely high	Several months
BN 469	40	20.2	150	251	0.0040	6610	0.0002	200	0.0050	487	0.0021	300	0.0033							0.4	1.7	3	7.6	7.1						56.12	Extremely high	Several months
BN 470	75	24.8	53	675	0.0015	2080	0.0005	6090	0.0002	1550	0.0007	231	0.0043	25.5	0.03922					0.8	2.1	4.6	3.1	5.8	33.8					1355.55	Moderate	3 to 10 yrs
BN 471	83.1	23	980	151	0.0066	211	0.0047	1790	0.0006	218										0.8	4.2	33	97							43.64	Extremely high	Several months
BN 472	65	33.6	9500	186	0.0054	1.00E+05	0.0000	1090	0.0009											0.5	1.7	4								6.37	Extremely high	Several months
BN 473	78.7	25.1	6520	5790	0.0002	12800	0.0001	24900	0.0000											0.6	2.4	33								3.30	Extremely high	Several months
BN 474	193	40	2030	321	0.0031	3200	0.0003	316	0.0032	27500	0.0000									0.9	1.6	37	25							125.80	Extremely high	Several months
BN 475	256	48	2890	182	0.0055	1210	0.0008	709	0.0014	12200	0.0001	9600	0.0001	4430	0.00023	4030	0.00025			0.4	1.6	7.8	24	23.8	29	33				33.70	Extremely high	Several months
BN 476	281	45	8200	1000	0.0010	2790	0.0004	1260	0.0008	17200	0.0001	25000	4.00E-05	18200	5.50E-05	12900	7.80E-05	9400	0.00011	1.8	6.5	15	43	48.4	46	47	4	8		26.64	Extremely high	Several months
BN 477	146	29	2850	154	0.0065	3160	0.0003	249	0.0040	7750	0.0001	58300	2.00E-05	10100	9.90E-05	2720	0.00037	3370	0.0003	0.5	6.6	8.3	23	34.7	4.7	43	7	9		58.50	Extremely high	Several months
BN 478	269	49	5650	495	0.0020	2150	0.0005	733	0.0014	19800	0.0001	24000	4.00E-05	12100	8.30E-05	7560	0.00013	6160	0.00016	0.4	1	4.5	5.5	26.5	25.2	26.9	2	7		14.44	Extremely high	Several months
BN 479	120	21.5	3500	218	0.0046	2970	0.0003	240	0.0042	3000	0.0003	19100	5.00E-05	10500	9.50E-05	5000	0.0002			3	5.1	14	25	35.5	42	47				97.40	Extremely high	Several months
BN 480	235	50	4450	2800	0.0004	7290	0.0001	1370	0.0007	4520	0.0002	7260	0.0001	7550	0.00013	5580	0.00018			0.4	1.4	4.2	6	26.5	23.5	36.5				18.03	Extremely high	Several months
BN 481	172	27	2600	583	0.0017	2930	0.0003	1260	0.0008	11600	0.0001	38100	3.00E-05	8200	0.00012	3800	0.00026	2910	0.00034	0.5	1.9	3.9	31	37.8	62.8	47	5	0		28.84	Extremely high	Several months
BN 482	286	40	3480	78.5	0.0127	255	0.0039	10900	0.0001	4150	0.0002	4170	0.0002	2410	0.00041	34600	2.90E-05	3620	0.00028	0.8	9.3	13	14	36.4	23.4	24	2	5		70.26	Extremely high	Several months
BN 483	202	41	3900	500	0.0020	820	0.0012	1590	0.0006	3310	0.0003	19700	5.00E-05	7210	0.00014	4110	0.00024			0.5	6.5	30	40	37.5	1	25				48.00	Extremely high	Several months
BN 484	150	40	6150	246	0.0041	7500	0.0001	713	0.0014	8700	0.0001	20600	5.00E-05	1.00E+05	0.00001	15100	6.60E-05	9200	0.00011	0.6	2	6.2	29	46.2	36.3	41	4	1		20.06	Extremely high	Several months
BN 485	247	26	6780	281	0.0036	1340	0.0007	411	0.0024	4370	0.0002	49300	2.00E-05	27900	3.60E-05	1.00E+05	0.00001	9100	0.00011	0.5	2	4.9	4.2	5.8	30.8	29.7	3	2		17.67	Extremely high	Several months
BN 486	245	45	3690	850	0.0012	3330	0.0003	1400	0.0007	2780	0.0004	8300	0.0001	5400	0.00019	5970	0.00017	5390	0.00019	1	2.6	5.6	7.4	55.1	50.5	48	4	7		32.59	Extremely high	Several months
BN 487	255	50	3170	157	0.0064	484	0.0021	1260	0.0008	8000	0.0001	20500	5.00E-05	3700	0.00027	3900	0.00026	3790	0.00026	0.5	1.1	7.6	26	42.6	35.4	41	4	6		36.90	Extremely high	Several months
BN 488	91.9	40	6930	1300	0.0008	5520	0.0002	2180	0.0005	14700	0.0001									1.1	1.7	2.3	6.7							2.66	Extremely high	Several months
BN 489	63.9	40.5	2550	199	0.0050	59.9	0.0167	3370	0.0003	17000	0.0001									0.9	2.9	8.7	39							57.81	Extremely high	Several months

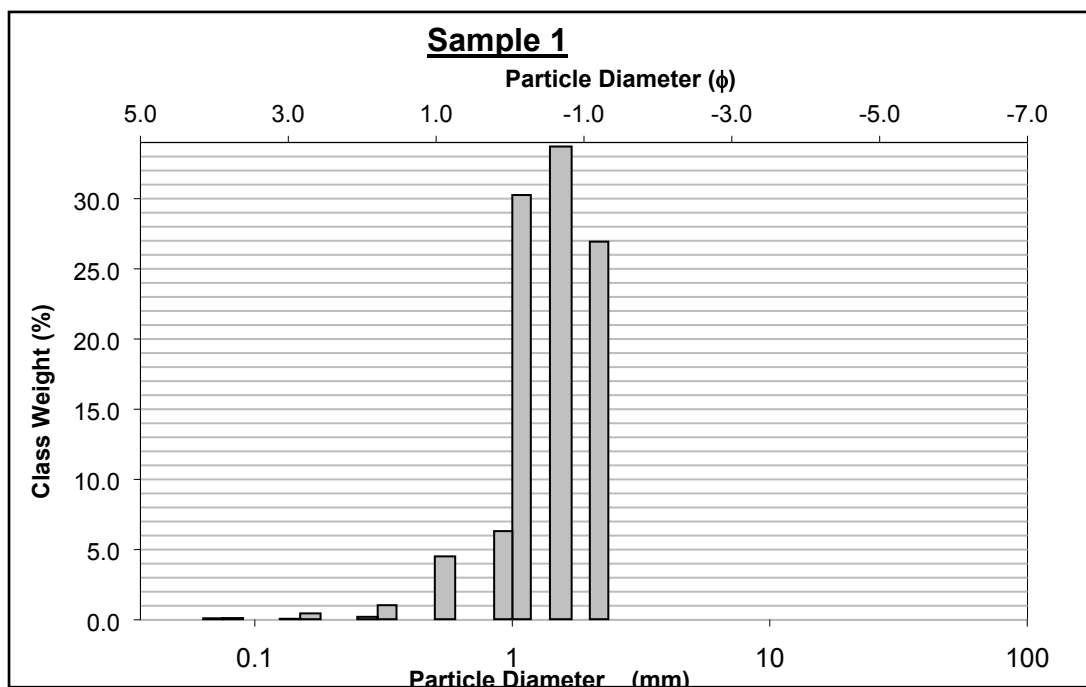
BN 490	250	46	6430	386 0	0.00 03	2330	0.000 4	406	0.00 25	3020	0.00 03	12100	8.00E -05	11800	8.50E -05	11000	9.10E -05	920 0	0.000 11	1. 4	1. 7	2. 4	18	40 .5	36 .1	53	7 2	24.19	Extremely high	Several months
BN 491	182	34	3070	405	0.00 25	1870	0.000 5	667	0.00 15	10700	0.00 01									1 3	2 7	39	23	32				107.16	Extremely high	Several months
BN 492	141	71.9	6820	593 1	0.00 02	522	0.001 9	1340	0.00 07	11400	0.00 01	6820	0.000 1	2840	0.000 35					0. 9	1. 8	3	16	27	34			23.17	Extremely high	Several months
BN 493	231	39	4160	414	0.00 24	1330	0.000 8	620	0.00 16	2150	0.00 05	4740	0.000 2	5390	0.000 19	4830	0.000 21			1. 4	7	12	23	31	38	41		60.78	Extremely high	Several months
BN 494	117	19.5	3410	90	0.01 11	13100	0.000 1	3150	0.00 03	800	0.00 13	2000	0.000 5							0. 7	1. 6	3	9	13	29			26.60	Extremely high	Several months
BN 495	70. 1	19.7	1160	840	0.00 12	2730	0.000 4	2330	0.00 04	920	0.00 11	3400	0.000 3	25000	0.000 04	3730	0.000 27			0. 3	1. 2	4	5. 7	13	23	29		21.23	Extremely high	Several months
BN 496	139	33	1630	185	0.00 54	664	0.001 5	236	0.00 42	2900	0.00 03	26400	4.00E -05	3190	0.000 31	1930	0.000 52			0. 5	1. 9	3	7	11	17	21 .6		37.63	Extremely high	Several months
BN 497	125	53.7	1420	185	0.00 54	664	0.001 5	236	0.00 42	2900	0.00 03	26400	4.00E -05							0. 7	1. 8	5	13	17				32.81	Extremely high	Several months
BN 498	104	33.7	2270	165 00	0.00 01	12600	0.000 1	47800	0.00 00	85000	0.00 00									1. 4	2. 5	8. 8	17					0.67	Extremely high	Several months
BN 499	126	48.8	1180	850 0	0.00 01	9500	0.000 1	72400	0.00 00	16200 0	0.00 00									3. 7	7	12	23					1.48	Extremely high	Several months
BN 500	130	50.2	1165	798 0	0.00 01	8700	0.000 1	83500	0.00 00	15378 9	0.00 00									3. 1	5	10	22					1.23	Extremely high	Several months
IS 501	91	37.5	1250	604	0.00 17	502	0.002 0	29.8	0.03 36	4.9	0.20 41	71	0.014 1	236	0.004 24	260	0.003 85			0. 9	1	3	4.	9. 1	13 .1	21 .5		1370.52	Moderate	3 to 10 yrs
IS 502	44. 5	14.2	2130	61	0.01 64	186	0.005 4	1570	0.00 06	8300	0.00 01									0. 4	6. 8	5. 3	18					48.66	Extremely high	Several months
IS 503	91. 2	20.6	111	146	0.00 68	3080	0.000 3	102	0.00 98	171	0.00 59	53.2	0.018 8	49.8	0.020 08					0. 4	1. 5	12	22	17 .9	16 .7			921.34	High	Several months to 3 yrs
IS 504	42. 7	14.1	291	101	0.00 99	2640	0.000 4	23.5	0.04 26	7.4	0.13 51									0. 4	0. 7	1. 5	8					1149.14	Moderate	3 to 10 yrs
IS 505	80. 6	25.1	511	445	0.00 22	423	0.002 4	5	0.20 00	124	0.00 81	364	0.002 7							0. 9	6. 2	14	14	20 .8				2986.73	Low	10 to 25 yrs
IS 506	105	18.8	200	289	0.00 35	69	0.014 5	7.5	0.13 33	42.2	0.02 37	12.6	0.079 4	27	0.037 04	100	0.01			1. 3	3. 4	7. 1	14	15 .6	19 .5	18 .8		3480.51	Low	10 to 25 yrs
IS 507	48	11.1	142	146	0.00 68	289	0.003 5	2010	0.00 05	3030	0.00 03	770	0.001 3	248	0.004 03					0. 8	3. 5	7	11	8. 1	6. 9			63.05	Extremely high	Several months
IS 508	51. 8	26.2	22.6	82	0.01 22	356	0.002 8	92	0.01 09	30.8	0.03 25	5.8	0.172 4							0. 5	1. 8	4. 6	4. 8	13 .9				2613.55	Low	10 to 25 yrs
IS 509	121	22.8	1290	247 0	0.00 04	3280	0.000 3	2620	0.00 04	2890	0.00 04									4. 5	4. 7	28	19					33.41	Extremely high	Several months
IS 510	104	42.3	2150	890	0.00 11	1550	0.000 6	149	0.00 67	422	0.00 24	8500	0.000 1							0. 9	2. 3	5. 3	7. 6	45 .5				61.49	Extremely high	Several months
IS 511	51. 7	24.2	401	990	0.00 10	32.6	0.030 7	564	0.00 18	2110	0.00 05									0. 9	2. 8	4. 2	20					103.72	Extremely high	Several months
IS 512	51. 8	26.2	22.6	82	0.01 22	356	0.002 8	92	0.01 09	30.8	0.03 25	5	0.2							0. 5	1. 8	4. 6	4. 8	13 .9				2997.00	Low	10 to 25 yrs
IS 513	41. 1	38.6	1140	117 0	0.00 09	735	0.001 4													1	1. 5							2.90	Extremely high	Several months
IS 514	102	40.4	130	45.7	0.02 19	10.1	0.099 0	3.5	0.28 57	25.5	0.03 92	85	0.011 8							0. 7	3. 3	6. 6	10	40 .7				3098.74	Low	10 to 25 yrs

IS 515	22.2	16.3	255	60.3	0.0166	28.3	0.0353	4.5	0.2222	17.1	0.0585								0.7	0.7	2	2.5						626.99	High	Several months to 3 yrs
IS 516	131	50.1	74.6	313	0.0032	6.7	0.1493	371	0.0027	42.5	0.0235								1	4.8	25	51						1987.00	Moderate	3 to 10 yrs
NS 517	93.4	15.9	686	582	0.0017	31400	0.0000	1860	0.0005	1380	0.0007	686	0.0015	207	0.00483				0.7	3.4	4.1	69	15.9	19.6				171.38	Extremely high	Several months
NS 518	77.1	23	40.1	165	0.0061	513	0.0019	1000	0.0010	1190	0.0008	49.1	0.0204	1.8	0.55556	13.4	0.07463		0.6	3.5	1.9	4.2	5.1	21.7	17.1		13451.43	Extremely low	More than 25 yrs	
NS 519	118	25.2	1390	223	0.0045	3460	0.0003	471	0.0021	7850	0.0001	1600	0.0006	3540	0.00028	2070	0.00048		0.5	2.4	7.1	13	28.4	20.6	21.1		53.43	Extremely high	Several months	
NS 520	164	39	1650	1550	0.0006	9500	0.0001	1010	0.0010	4010	0.0003	1820	0.0005	860	0.0016				0.5	1.4	5.1	45	27.9	45.5			84.98	Extremely high	Several months	
NS 521	291	105	6520	2320	0.0004	688	0.0015	4880	0.0002	267	0.0038	714	0.0014	8600	0.00012	34600	2.90E-05	13700	0.6	1.5	2.5	8.1	9.6	19.7	75.4	6.9	50.62	Extremely high	Several months	
NS 522	142	44.9	490	537	0.0019	362	0.0028	91	0.0110	9.3	0.1075	11.2	0.0893	43.4	0.02304	313	0.00319		1	0.6	13	9.3	7.3	19.4	46.2		2446.53	Low	10 to 25 yrs	
NS 523	201	25	250	334	0.0030	251		37.9	0.0264	11.7	0.0855	30.3	0.033	336	0.00298	4060	0.00025	4250	1	1.3	7.4	8.3	9.6	18.9	69.2	4.9	1297.77	Moderate	3 to 10 yrs	
NS 524	178	39	343	163	0.0061	5500	0.0002	392	0.0026	780	0.0013	129	0.0078	21.2	0.04717	110	0.00909	260	0.7	3.4	10	16	12.1	35.7	26.5	3.4	2069.61	Low	10 to 25 yrs	
NS 525	223	57	6230	386	0.0026	74.9	0.0134	1690	0.0006	3.9	0.2564	27	0.037	14100	7.10E-05	10100	9.90E-05	8800	1.3	1.2	1.1	17	14.2	26.5	33.2	7.2	4910.11	Extremely low	More than 25 yrs	
NS 526	128	28.2	31.6	157	0.0064	54.8	0.0182	11.9	0.0840	2400	0.0004	4890	0.0002	5.4	0.18519	14.7	0.06803		0.3	3.4	3.6	11	21.5	33.9	26.2		8435.55	Extremely low	More than 25 yrs	
NS 527	133	36.8	1070	1790	0.0006	2350	0.0004	17200	0.0001	2400	0.0004	4890	0.0002	749	0.00134	179	0.00559		1.1	1.7	5.4	13	16	16.1	43.1		272.62	Extremely high	Several months	
NS 528	89.2	29.7	177	416	0.0024	2140	0.0005	183	0.0055	46	0.0217	16.3	0.0613	4.5	0.22222	76.7	0.01304		0.4	0.8	2	1.7	15.8	18.7	20.2		5437.47	Extremely low	More than 25 yrs	
NS 529	61.6	23.8	33.5	5200	0.0002	460	0.0022	127	0.0079	52	0.0192	1430	0.0007	778	0.00129				0.8	1.2	2.7	4.6	11.6	18.1			143.86	Extremely high	Several months	
NS 530	62.5	49.1	267	157	0.0064	153	0.0065	31.7	0.0315	2.3	0.4348								1	2.5	1.7	8.2					3641.55	Low	10 to 25 yrs	
NS 531	148	29	2180	2240	0.0004	549	0.0018	8700	0.0001	4250	0.0002	21700	5.00E-05	5590	0.00018	2920	0.00034		0.4	0.6	4.1	19	43.8	24	23.7		20.64	Extremely high	Several months	
NS 532	59	10.9	323	106	0.0094	9100	0.0001	4220	0.0002	2940	0.0003	1080	0.0009	7060	0.00014	224	0.00446		0.5	2.1	4.9	5.6	8.9	19.9	6.2		46.75	Extremely high	Several months	
NS 533	96.2	52.7	1830	106	0.0094	74.4	0.0134	44.7	0.0224	7	0.1429	150	0.0067	990	0.00101				0.6	6.4	2.3	7.9	7.3	19			1339.57	Moderate	3 to 10 yrs	
NS 534	58.1	28.6	118	295	0.0034	840	0.0012	231	0.0043	767	0.0013	16.4	0.061						1.1	2	3.6	5.8	17				1065.84	Moderate	3 to 10 yrs	
NS 535	71.2	16.7	1360	270	0.0037	639	0.0016	9300	0.0001	920	0.0011	120	0.0083	601	0.00166				0.7	8.8	6.8	6.5	23.7	14			235.57	Extremely high	Several months	
NS 536	40.1	9.5	2020	1010	0.0010	14500	0.0001	4980	0.0002	1470	0.0007	8900	0.0001						0.9	2.3	3	7.5	16.9				8.65	Extremely high	Several months	
NS 537	44.2	12.8	1060	211	0.0047	378	0.0026	2230	0.0004	2930	0.0003	2930	0.0003	739	0.00135				1	5.1	9.4	10	5.5	12.8			45.06	Extremely high	Several months	
NS 538	88	30.2	2100	389	0.0026	1040	0.0010	1070	0.0009	3250	0.0003	4170	0.0002						0.6	4.7	6.5	14	31.8				24.07	Extremely high	Several months	
NS 539	56.5	42.3	132	447	0.0022	153	0.0065	960	0.0010	211	0.0047	18.1	0.0552						0.4	0.7	12	6.3	24.5				1401.42	Moderate	3 to 10 yrs	

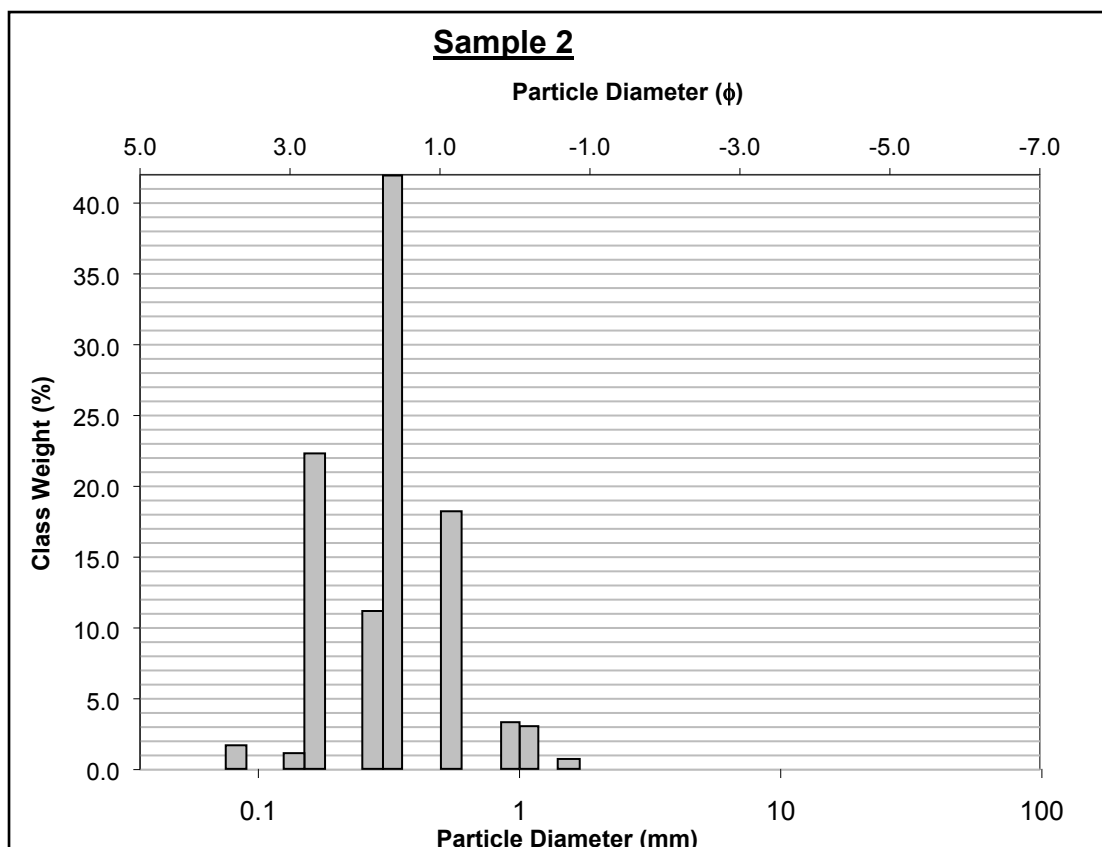
NS 540	71.8	34.1	745	1660	0.006	1880	0.0005	50	0.0200	298	0.0034	13300	8.00E-05							1.2	0.4	3	3.3	30.2				74.28	Extremely high	Several months
NS 541	124	90.9	228	73	0.0137	222	0.0045	478	0.0021	17.5	0.0571	63.7	0.0157							0.5	4	5.2	13	10				935.59	High	Several months to 3 yrs
NS 542	110	37.1	173	521	0.0019	20100	0.0000	2910	0.0003	425	0.0024	642	0.0016	89	0.01124					0.4	1.6	1.3	10	16.3	42.7			529.99	High	Several months to 3 yrs
NS 543	106.8	60.7	1320	114	0.0088	4000	0.0003	674	0.0015	93	0.0108	470	0.0021	1460	0.00068					1	2.7	3.1	11	10.2	17.7			166.15	Extremely high	Several months
OG 544	143	26	147	1650	0.0006	714	0.0014	5760	0.0002	340	0.0029	71.2	0.014	24.1	0.04149	71.8	0.01393			1	1.9	5.8	33	18.2	31.9	25		2028.79	Low	10 to 25 yrs
OG 545	44.8	15.5	1700	271	0.0037	52.1	0.0192	435	0.0023	1180	0.0009	5410	0.0002							0.8	3.7	2.3	3.5	19				85.73	Extremely high	Several months
OG 546	60.1	26.7	2640	295	0.0034	27100	0.0000	4840	0.0002	632	0.0016									0.4	2.7	4.9	25					42.02	Extremely high	Several months
OG 547	74.3	34.6	3040	741	0.0013	1660	0.0006	2620	0.0004	32200	0.0000	7200	0.0001							0.6	2.9	2.9	14	19.5				6.63	Extremely high	Several months
OG 548	152	89.9	1720	502	0.0020	4410	0.0002	1030	0.0010	40.8	0.0245	232	0.0043							0.5	1.5	17	24	19.8				691.42	High	Several months to 3 yrs
OG 549	145	45.6	2060	147	0.0068	3750	0.0003	268	0.0037	5390	0.0002	779	0.0013	184	0.00543	470	0.00213			0.3	1.1	4.2	15	12.8	31.9	34.3		283.57	Extremely high	Several months
OG 550	63.2	28.7	1470	195	0.0051	652	0.0015	5780	0.0002	11600	0.0001	2210	0.0005							0.6	6.7	5.8	13	8.3				19.23	Extremely high	Several months
OG 551	226	51	4190	391	0.0026	406	0.0025	101	0.0099	3000	0.0003	19800	5.00E-05	12000	8.30E-05	27300	3.70E-05	6320	0.00016	1	4.2	5.5	6	19.6	12.8	71.9	54	74.05	Extremely high	Several months
OG 552	189	31	292	126	0.0079	612	0.0016	342	0.0029	1080	0.0009	738	0.0014	391	0.00256	139	0.00719	131	0.00763	1.4	5.3	16	21	9.5	26.4	33.9	45	410.28	Extremely high	Several months
OG 553	82	28.8	1040	1450	0.0007	3000	0.0003	13100	0.0001	7820	0.0001	1280	0.0008							0.9	6.3	9.2	12	24.4				24.02	Extremely high	Several months
OG 554	30.9	13.4	6340	5106	0.0002	4540	0.0002	14900	0.0001	588	0.0017									0.3	0.6	2.8	14					24.19	Extremely high	Several months
OG 555	22.2	10	2630	313	0.0032	46300	0.0000	486	0.0021											0.3	1.7	10						21.57	Extremely high	Several months
OG 556	226	22	4350	742	0.0013	10900	0.0001	1620	0.0006	4060	0.0003	4510	0.0002	7240	0.00014	13100	7.60E-05	12100	8.30E-05	0.4	1.6	16	25	32.5	37.5	47	44	32.66	Extremely high	Several months
OG 557	101	37.5	1050	247	0.0040	454	0.0022	8100	0.0001	2530	0.0004									1.1	1.2	26	25					43.98	Extremely high	Several months
OG 558	43	24.1	1900	1860	0.0005	3130	0.0003	1060	0.0009	2706	0.0004									1.8	3.2	5.1	8.8					10.05	Extremely high	Several months
OG 559	107	44.7	8200	1960	0.0005	19500	0.0001	11700	0.0001											1.8	1.3	48						5.69	Extremely high	Several months
OG 560	188	50	2050	1150	0.0009	3610	0.0003	8000	0.0001	4070	0.0003	2020	0.0005	4070	0.00025	3350	0.0003			0.8	3.3	4.9	21	36.5	20.4	51		45.69	Extremely high	Several months
OG 561	68.4	13	1930	1910	0.0005	5340	0.0002	1810	0.0006	5350	0.0002	5310	0.0002	2760	0.00036					0.6	2	9.7	13	14.7	14.9			16.64	Extremely high	Several months
OG 562	129	65.8	1570	622	0.0016	3280	0.0003	6030	0.0002	430	0.0023	1360	0.0007							0.8	0.8	2.9	7.3	51.4	65.8			56.78	Extremely high	Several months
OG 563	226	44	1390	282	0.0035	3070	0.0003	366	0.0027	12000	0.0001	5620	0.0002	4020	0.00025	1460	0.00068	3240	0.00031	1.1	2.5	7.8	28	53.9	30.8	52.9	33	81.85	Extremely high	Several months
OG 564	106	79.3	180	193	0.0052	8100	0.0001	11200	0.0001											0.6	4	17						5.79	Extremely high	Several months

OG 565	69.7	31	2380	5730	0.0002	13400	0.0001	2.00E+05	0.0000											1	5.5	32							0.74	Extremely high	Several months
OG 566	111	36.8	27	1570	0.0006	546	0.0018	12.1	0.0826											6.7	5.7	61							5056.03	Extremely low	More than 25 yrs
OG 567	69.7	47	73.7	352	0.0028	13.4	0.0746	4.3	0.2326											4	6.5	12							3287.14	Low	10 to 25 yrs
OG 568	109	39.6	1380	2410	0.0004	127	0.0079	7120	0.0001	8300	0.0001	17500	6.00E-05	4170	0.00024					0.4	0.6	0.8	13	10.9	43.9				17.72	Extremely high	Several months
OG 569	64.8	36.2	146	503	0.0020	589	0.0017	88	0.0114	6.1	0.1639	66.9	0.0149							1.5	1.4	2.5	9.4	13.8					1781.03	Moderate	3 to 10 yrs

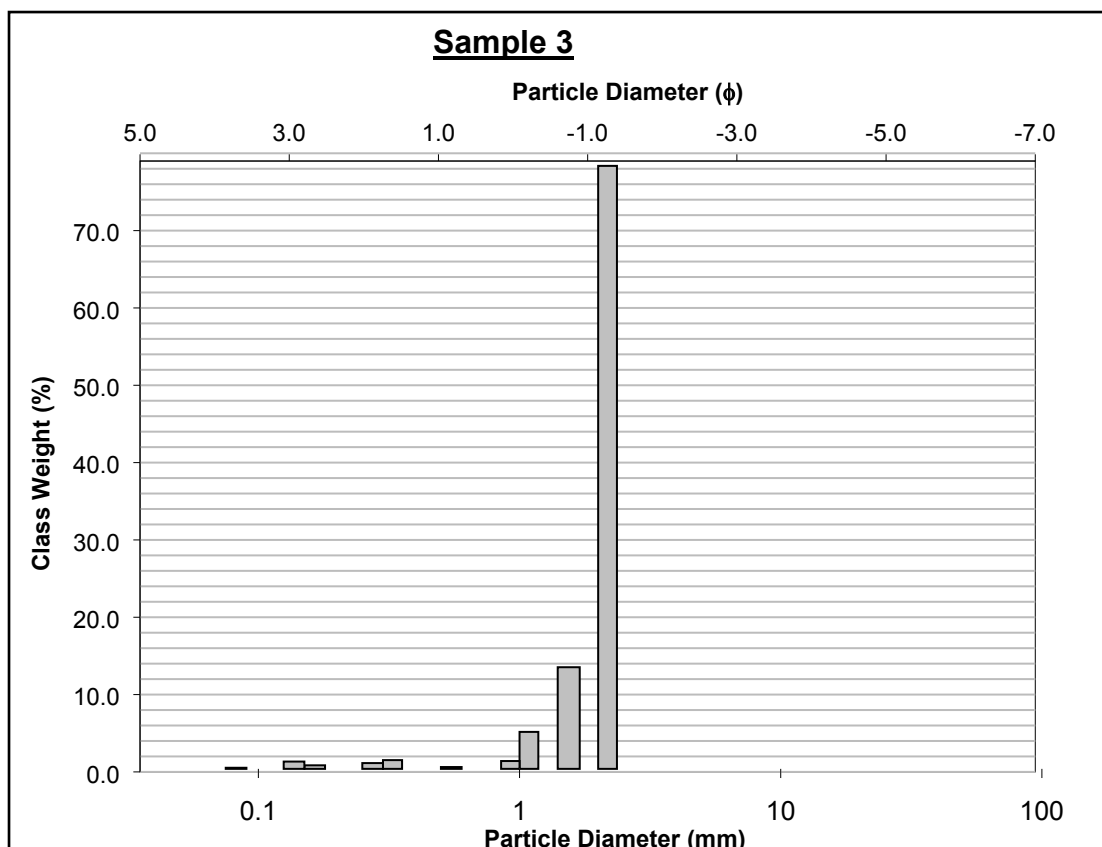
G: Samples description and statistics



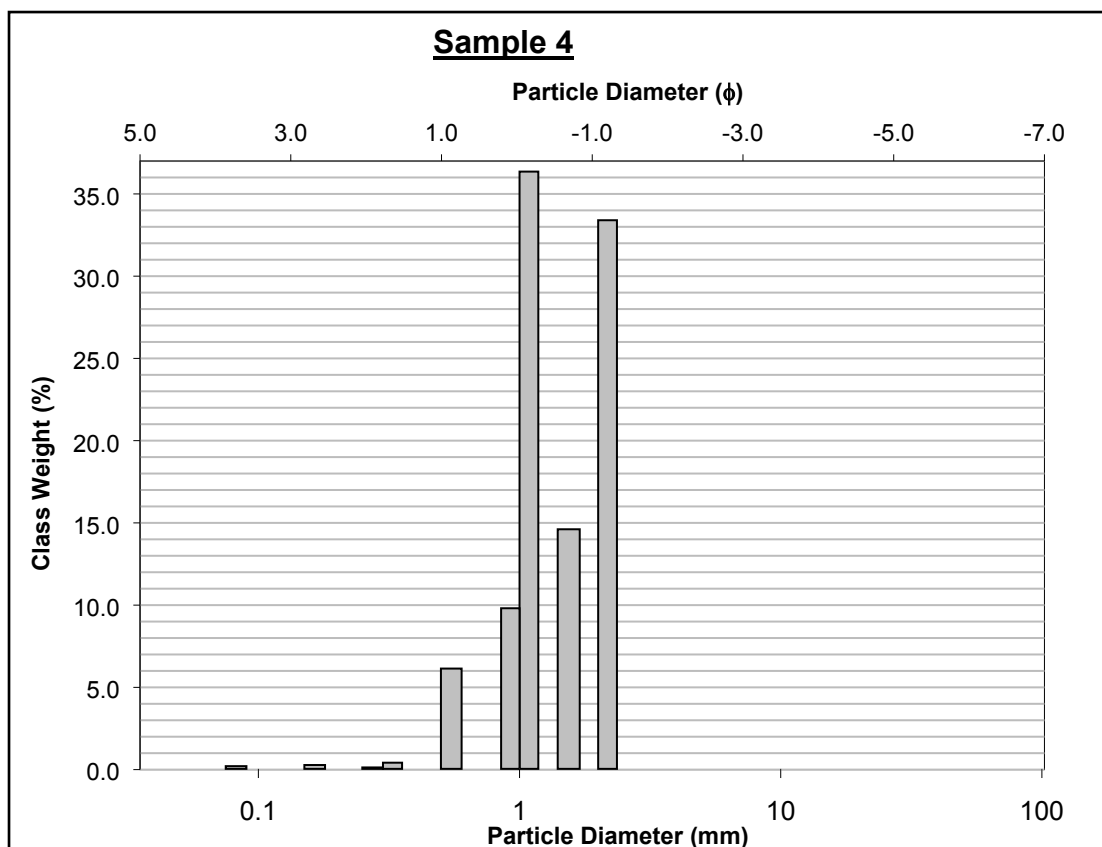
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 1			ANALYST & DATE: ,			
SAMPLE TYPE: Trimodal, Moderately Well Sorted			TEXTURAL GROUP: Gravelly Sand			
SEDIMENT NAME: Very Fine Gravelly Very Coarse Sand						
	μm	φ	GRAIN SIZE DISTRIBUTION			
MODE 1:	1550.0	-0.625	GRAVEL: 24.6%	COARSE SAND: 10.1%		
MODE 2:	1090.0	-0.119	SAND: 75.4%	MEDIUM SAND: 1.1%		
MODE 3:	2180.0	-1.119	MUD: 0.0%	FINE SAND: 0.4%		
D ₁₀ :	949.0	-1.142		V FINE SAND: 0.1%		
MEDIAN or D ₅₀ :	1482.3	-0.568	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	2206.1	0.075	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	2.325	-0.066	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	1257.1	1.217	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.567	0.150	V FINE GRAVEL: 24.6%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	613.5	0.648	V COARSE SAND: 63.6%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	φ	μm	φ	
MEAN ($\bar{x}$):	1475.8	1368.3	-0.452	1476.7	-0.562	Very Coarse Sand
SORTING (σ):	495.6	1.519	0.603	1.479	0.564	Moderately Well Sorted
SKEWNESS (Sk):	-0.050	-1.770	1.770	-0.196	0.196	Fine Skewed
KURTOSIS (K):	2.373	9.495	9.495	1.263	1.263	Leptokurtic



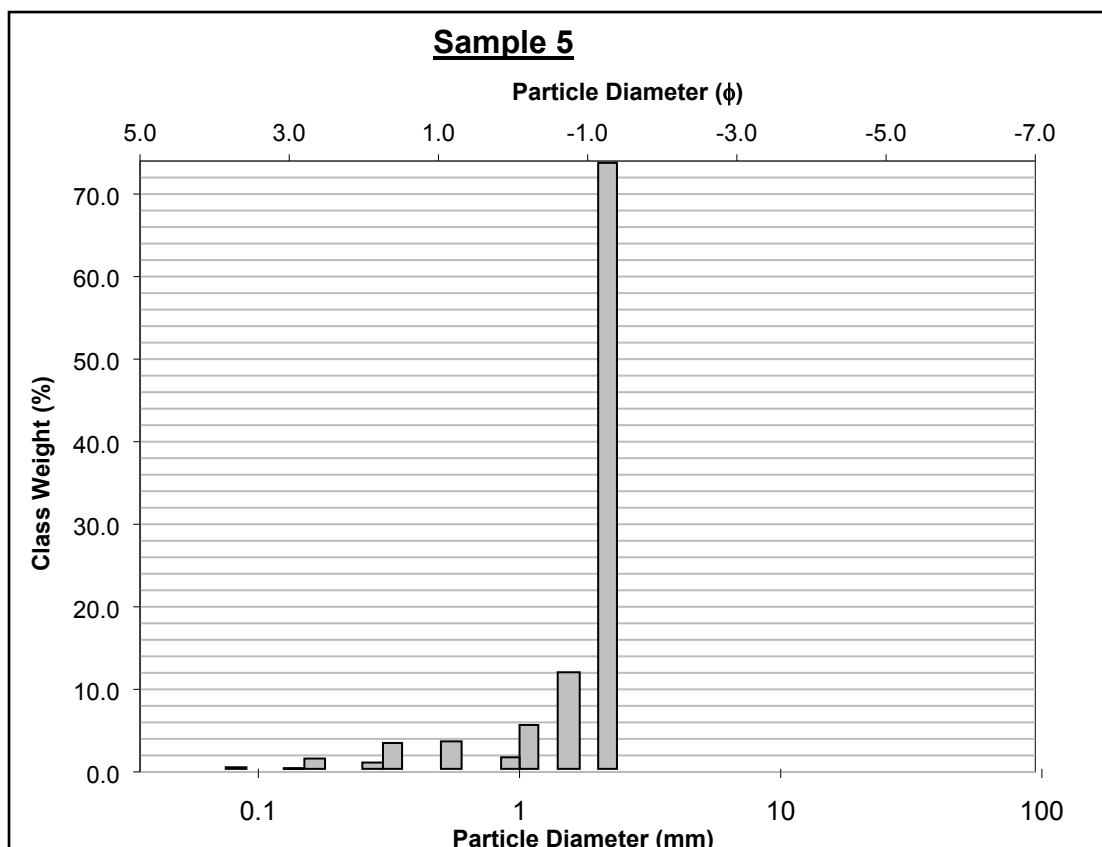
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 2			ANALYST & DATE: ,			
SAMPLE TYPE: Trimodal, Moderately Sorted			TEXTURAL GROUP: Sand			
SEDIMENT NAME: Moderately Sorted Medium Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	327.5	1.616	GRAVEL: 0.0%	COARSE SAND: 21.2%		
MODE 2:	165.0	2.605	SAND: 100.0%	MEDIUM SAND: 50.1%		
MODE 3:	550.0	0.868	MUD: 0.0%	FINE SAND: 23.5%		
D_{10} :	159.1	0.788		V FINE SAND: 1.7%		
MEDIAN or D_{50} :	318.2	1.652	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D_{90} :	579.1	2.652	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D_{90} / D_{10}) :	3.641	3.366	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
$(D_{90} - D_{10})$:	420.1	1.864	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D_{75} / D_{25}) :	1.973	1.655	V FINE GRAVEL: 0.0%	V FINE SILT: 0.0%		
$(D_{75} - D_{25})$:	174.9	0.980	V COARSE SAND: 3.5%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	367.5	314.8	1.667	307.2	1.703	Medium Sand
SORTING (σ):	229.8	1.708	0.772	1.765	0.820	Moderately Sorted
SKEWNESS (Sk):	2.184	0.269	-0.269	0.047	-0.047	Symmetrical
KURTOSIS (K):	9.227	3.277	3.277	1.084	1.084	Mesokurtic



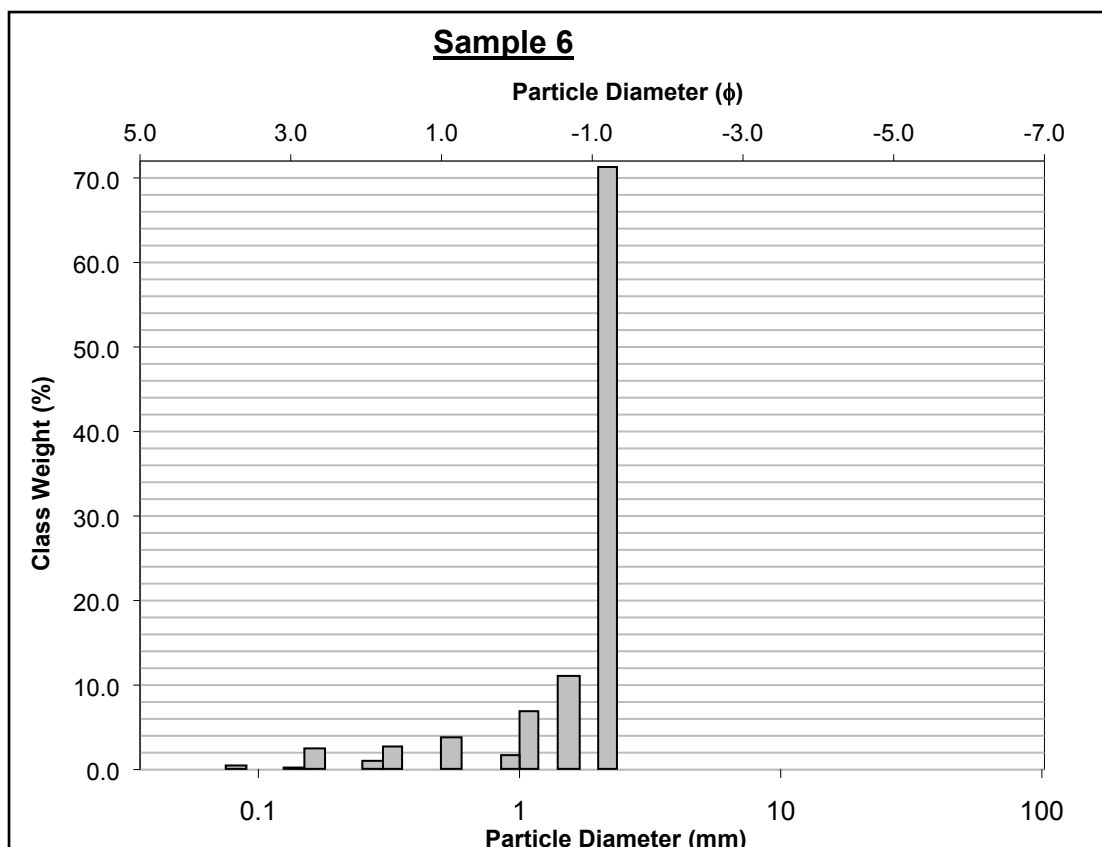
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 3			ANALYST & DATE: ,			
SAMPLE TYPE: Bimodal, Very Well Sorted			TEXTURAL GROUP: Sandy Gravel			
SEDIMENT NAME: Sandy Very Fine Gravel						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	2180.0	-1.119	GRAVEL: 75.6%	COARSE SAND: 1.2%		
MODE 2:	1550.0	-0.625	SAND: 24.4%	MEDIUM SAND: 1.9%		
MODE 3:			MUD: 0.0%	FINE SAND: 1.5%		
D ₁₀ :	1410.6	-1.207		V FINE SAND: 0.2%		
MEDIAN or D ₅₀ :	2115.4	-1.081	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	2308.9	-0.496	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	1.637	0.411	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	898.3	0.711	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.116	0.864	V FINE GRAVEL: 75.6%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	231.6	0.158	V COARSE SAND: 19.6%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1949.5	1817.9	-0.862	1944.4	-0.959	Very Coarse Sand
SORTING (σ):	468.1	1.599	0.677	1.256	0.328	Very Well Sorted
SKEWNESS (Sk):	-2.241	-3.950	3.950	-0.698	0.698	Very Fine Skewed
KURTOSIS (K):	7.673	19.89	19.89	3.146	3.146	Extremely Leptokurtic



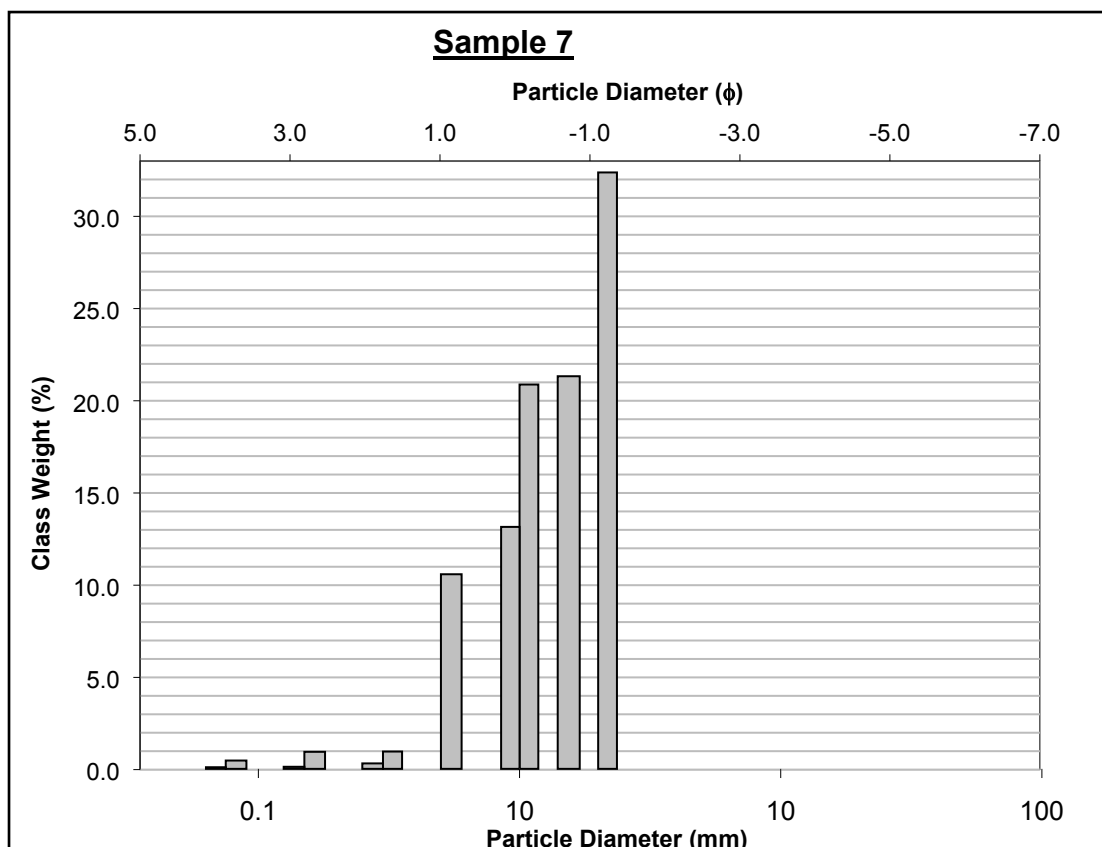
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 4			ANALYST & DATE: ,			
SAMPLE TYPE: Polymodal, Moderately Well Sorted			TEXTURAL GROUP: Sandy Gravel			
SEDIMENT NAME: Sandy Very Fine Gravel						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	1090.0	-0.119	GRAVEL: 32.1%	COARSE SAND: 15.7%		
MODE 2:	2180.0	-1.119	SAND: 67.9%	MEDIUM SAND: 0.5%		
MODE 3:	1550.0	-0.625	MUD: 0.0%	FINE SAND: 0.2%		
D ₁₀ :	890.8	-1.164		V FINE SAND: 0.2%		
MEDIAN or D ₅₀ :	1171.7	-0.229	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	2241.3	0.167	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	2.516	-0.143	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	1350.5	1.331	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.993	0.055	V FINE GRAVEL: 32.1%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	1033.6	0.995	V COARSE SAND: 51.4%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1457.6	1334.5	-0.416	1361.0	-0.445	Very Coarse Sand
SORTING (σ):	555.7	1.550	0.633	1.507	0.592	Moderately Well Sorted
SKEWNESS (Sk):	0.145	-1.069	1.069	0.264	-0.264	Coarse Skewed
KURTOSIS (K):	1.740	6.338	6.338	0.838	0.838	Platykurtic



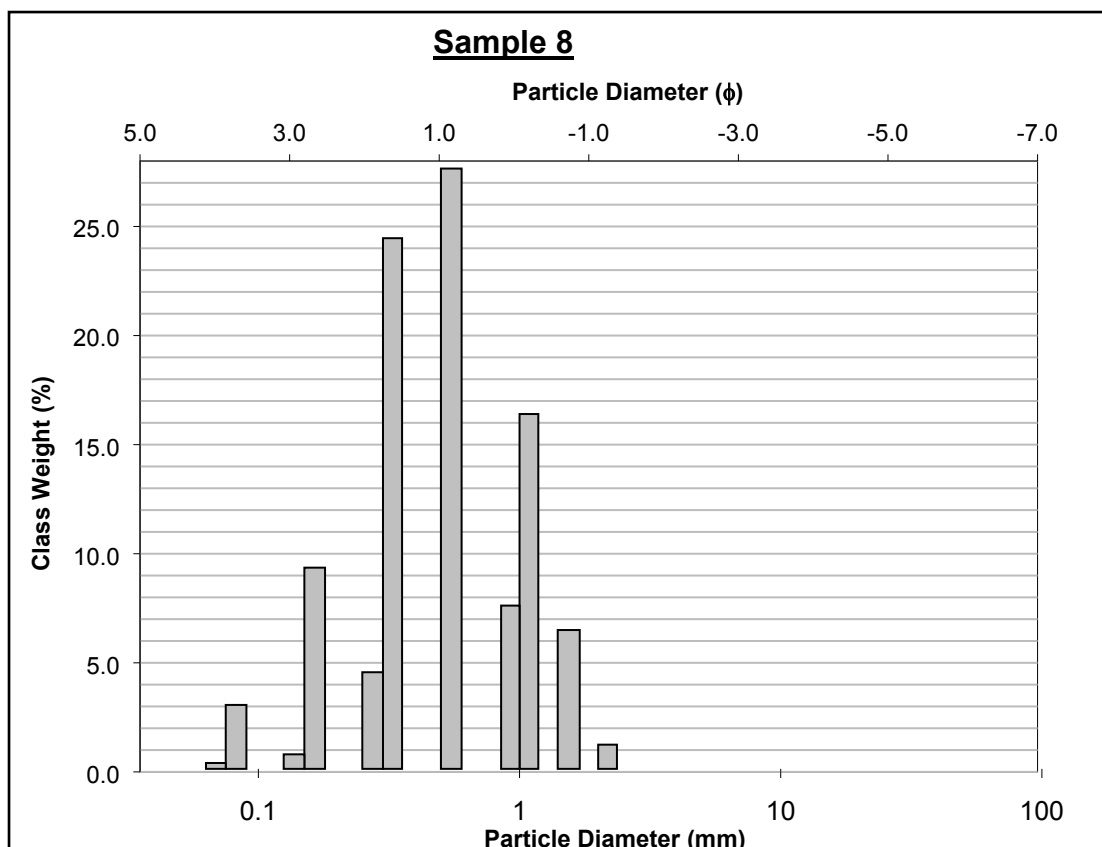
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 5			ANALYST & DATE: ,			
SAMPLE TYPE: Bimodal, Moderately Well Sorted			TEXTURAL GROUP: Sandy Gravel			
SEDIMENT NAME: Sandy Very Fine Gravel						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	2180.0	-1.119	GRAVEL: 71.1%	COARSE SAND: 4.9%		
MODE 2:	1550.0	-0.625	SAND: 28.9%	MEDIUM SAND: 3.9%		
MODE 3:			MUD: 0.0%	FINE SAND: 1.4%		
D ₁₀ :	950.8	-1.205		V FINE SAND: 0.2%		
MEDIAN or D ₅₀ :	2100.8	-1.071	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	2305.7	0.073	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	2.425	-0.060	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	1354.9	1.278	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.386	0.592	V FINE GRAVEL: 71.1%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	619.9	0.471	V COARSE SAND: 18.5%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1859.8	1674.3	-0.744	1888.0	-0.917	Very Coarse Sand
SORTING (σ):	573.6	1.749	0.807	1.506	0.590	Moderately Well Sorted
SKEWNESS (Sk):	-1.690	-2.647	2.647	-0.780	0.780	Very Fine Skewed
KURTOSIS (K):	4.625	9.794	9.794	2.400	2.400	Very Leptokurtic



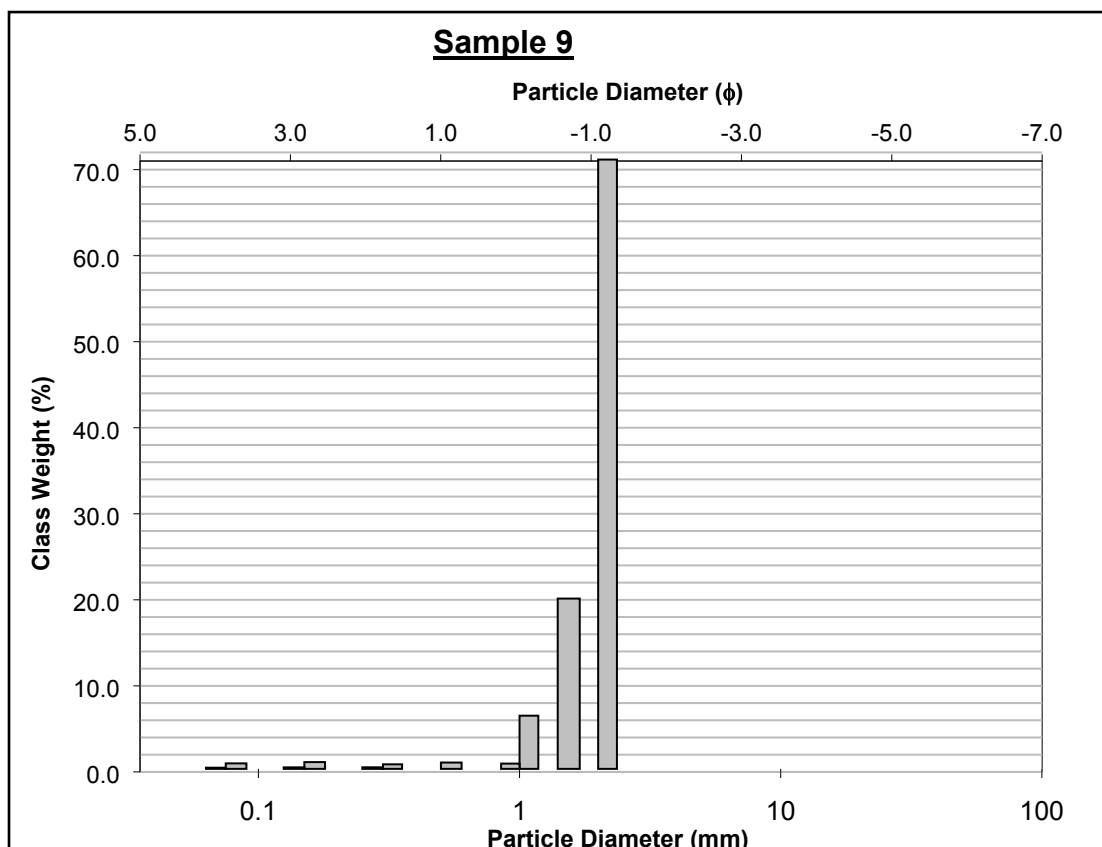
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 6			ANALYST & DATE: ,			
SAMPLE TYPE: Bimodal, Moderately Well Sorted			TEXTURAL GROUP: Sandy Gravel			
SEDIMENT NAME: Sandy Very Fine Gravel						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	2180.0	-1.119	GRAVEL: 68.7%		COARSE SAND: 5.5%	
MODE 2:	1550.0	-0.625	SAND: 31.3%		MEDIUM SAND: 3.6%	
MODE 3:			MUD: 0.0%		FINE SAND: 2.7%	
D ₁₀ :	580.0	-1.204			V FINE SAND: 0.4%	
MEDIAN or D ₅₀ :	2092.2	-1.065	V COARSE GRAVEL: 0.0%		V COARSE SILT: 0.0%	
D ₉₀ :	2303.8	0.786	COARSE GRAVEL: 0.0%		COARSE SILT: 0.0%	
(D ₉₀ / D ₁₀):	3.972	-0.653	MEDIUM GRAVEL: 0.0%		MEDIUM SILT: 0.0%	
(D ₉₀ - D ₁₀):	1723.8	1.990	FINE GRAVEL: 0.0%		FINE SILT: 0.0%	
(D ₇₅ / D ₂₅):	1.442	0.541	V FINE GRAVEL: 68.7%		V FINE SILT: 0.0%	
(D ₇₅ - D ₂₅):	681.2	0.528	V COARSE SAND: 19.0%		CLAY: 0.0%	
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1814.4	1591.6	-0.670	1734.4	-0.794	Very Coarse Sand
SORTING (σ):	616.0	1.886	0.915	1.623	0.699	Moderately Well Sorted
SKEWNESS (Sk):	-1.508	-2.462	2.462	-0.833	0.833	Very Fine Skewed
KURTOSIS (K):	3.942	8.604	8.604	2.236	2.236	Very Leptokurtic



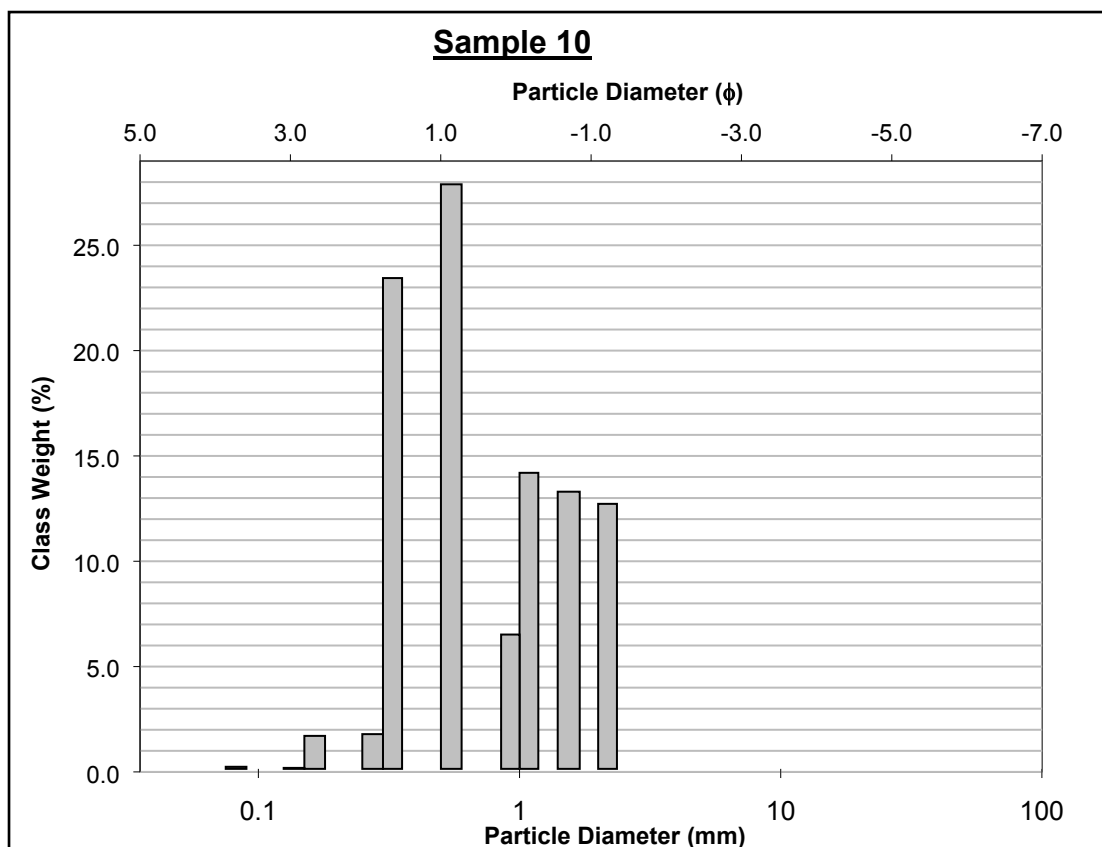
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 7			ANALYST & DATE: ,			
SAMPLE TYPE: Polymodal, Moderately Well Sorted			TEXTURAL GROUP: Sandy Gravel			
SEDIMENT NAME: Sandy Very Fine Gravel						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	2180.0	-1.119	GRAVEL: 30.6%	COARSE SAND: 23.2%		
MODE 2:	1550.0	-0.625	SAND: 69.4%	MEDIUM SAND: 1.2%		
MODE 3:	1090.0	-0.119	MUD: 0.0%	FINE SAND: 1.1%		
D ₁₀ :	562.9	-1.161		V FINE SAND: 0.6%		
MEDIAN or D ₅₀ :	1449.6	-0.536	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	2235.8	0.829	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	3.972	-0.714	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	1672.9	1.990	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	2.090	-0.019	V FINE GRAVEL: 30.6%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	1075.4	1.064	V COARSE SAND: 43.4%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1427.7	1261.3	-0.335	1400.0	-0.485	Very Coarse Sand
SORTING (σ):	597.7	1.737	0.797	1.572	0.652	Moderately Well Sorted
SKEWNESS (Sk):	-0.089	-1.558	1.558	-0.248	0.248	Fine Skewed
KURTOSIS (K):	1.869	6.967	6.967	0.828	0.828	Platykurtic



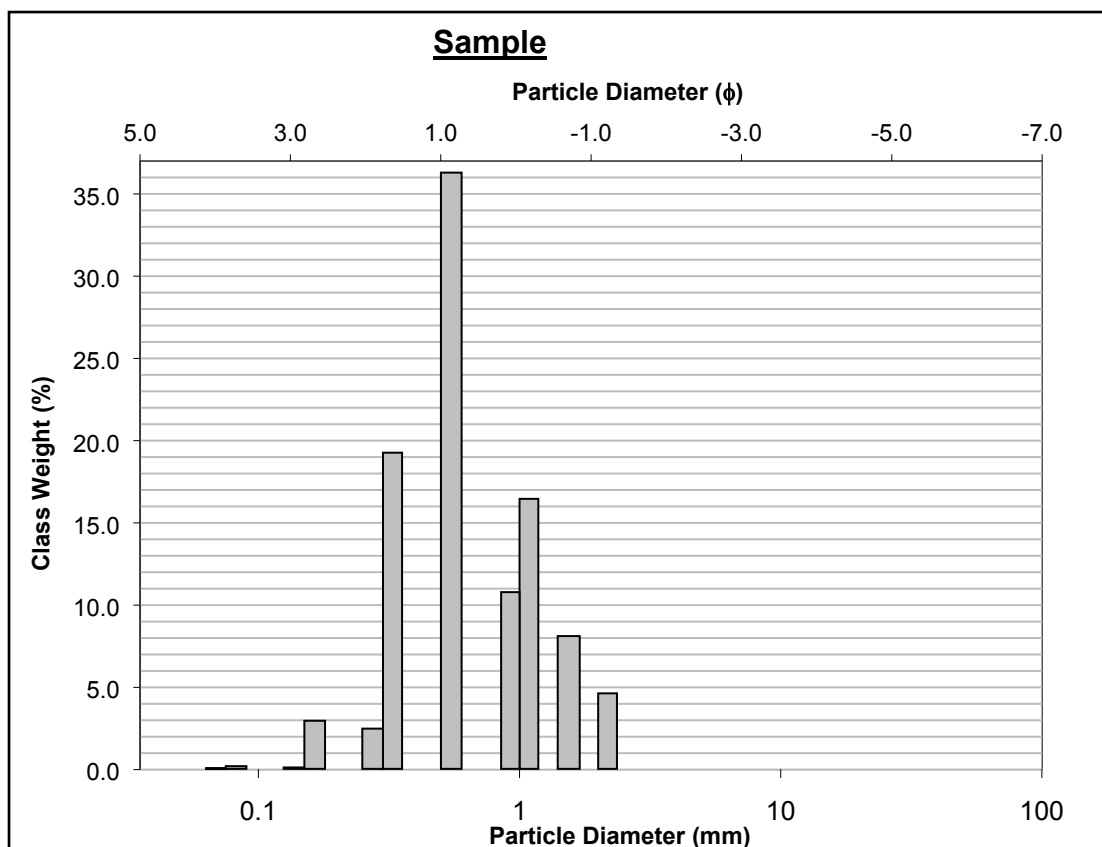
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 8			ANALYST & DATE: ,			
SAMPLE TYPE: Polymodal, Moderately Sorted			TEXTURAL GROUP: Slightly Gravelly Sand			
SEDIMENT NAME: Slightly Very Fine Gravelly Coarse Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	550.0	0.868	GRAVEL: 1.0%		COARSE SAND: 35.4%	
MODE 2:	327.5	1.616	SAND: 99.0%		MEDIUM SAND: 27.8%	
MODE 3:	1090.0	-0.119	MUD: 0.0%		FINE SAND: 10.2%	
D ₁₀ :	168.3	-0.208			V FINE SAND: 3.3%	
MEDIAN or D ₅₀ :	528.6	0.920	V COARSE GRAVEL: 0.0%		V COARSE SILT: 0.0%	
D ₉₀ :	1155.3	2.571	COARSE GRAVEL: 0.0%		COARSE SILT: 0.0%	
(D ₉₀ / D ₁₀):	6.866	-12.344	MEDIUM GRAVEL: 0.0%		MEDIUM SILT: 0.0%	
(D ₉₀ - D ₁₀):	987.0	2.779	FINE GRAVEL: 0.0%		FINE SILT: 0.0%	
(D ₇₅ / D ₂₅):	3.048	29.13	V FINE GRAVEL: 1.0%		V FINE SILT: 0.0%	
(D ₇₅ - D ₂₅):	645.8	1.608	V COARSE SAND: 22.3%		CLAY: 0.0%	
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	626.1	489.7	1.030	540.5	0.888	Coarse Sand
SORTING (σ):	428.6	2.070	1.049	1.994	0.996	Moderately Sorted
SKEWNESS (Sk):	1.113	-0.312	0.312	-0.015	0.015	Symmetrical
KURTOSIS (K):	3.840	2.709	2.709	0.845	0.845	Platykurtic



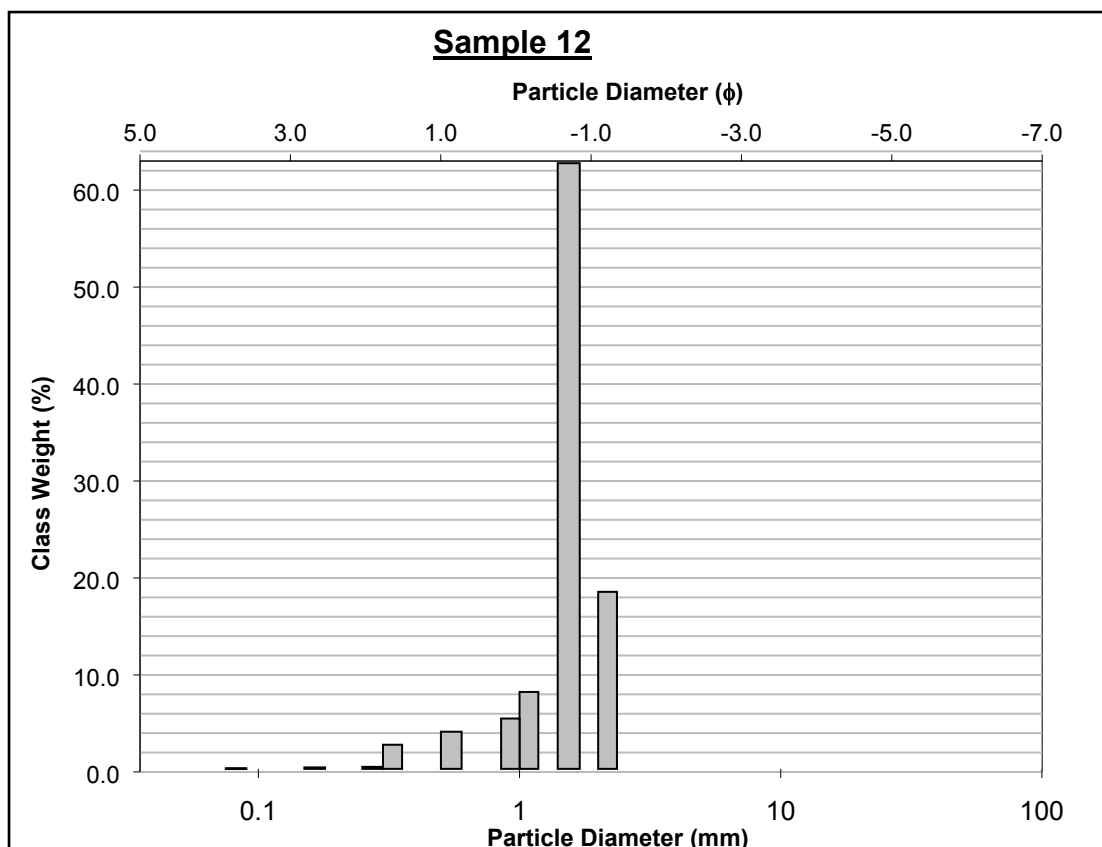
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 9			ANALYST & DATE: ,			
SAMPLE TYPE: Bimodal, Very Well Sorted			TEXTURAL GROUP: Sandy Gravel			
SEDIMENT NAME: Sandy Very Fine Gravel						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	2180.0	-1.119	GRAVEL: 67.9%	COARSE SAND: 1.4%		
MODE 2:	1550.0	-0.625	SAND: 32.1%	MEDIUM SAND: 0.7%		
MODE 3:			MUD: 0.0%	FINE SAND: 1.0%		
D ₁₀ :	1402.3	-1.204		V FINE SAND: 0.8%		
MEDIAN or D ₅₀ :	2089.3	-1.063	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	2303.2	-0.488	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	1.642	0.405	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	900.9	0.716	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.389	0.588	V FINE GRAVEL: 67.9%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	622.3	0.474	V COARSE SAND: 28.2%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1904.5	1778.7	-0.831	1913.6	-0.936	Very Coarse Sand
SORTING (σ):	463.0	1.596	0.674	1.260	0.333	Very Well Sorted
SKEWNESS (Sk):	-1.854	-4.320	4.320	-0.672	0.672	Very Fine Skewed
KURTOSIS (K):	6.399	24.96	24.96	1.016	1.016	Mesokurtic



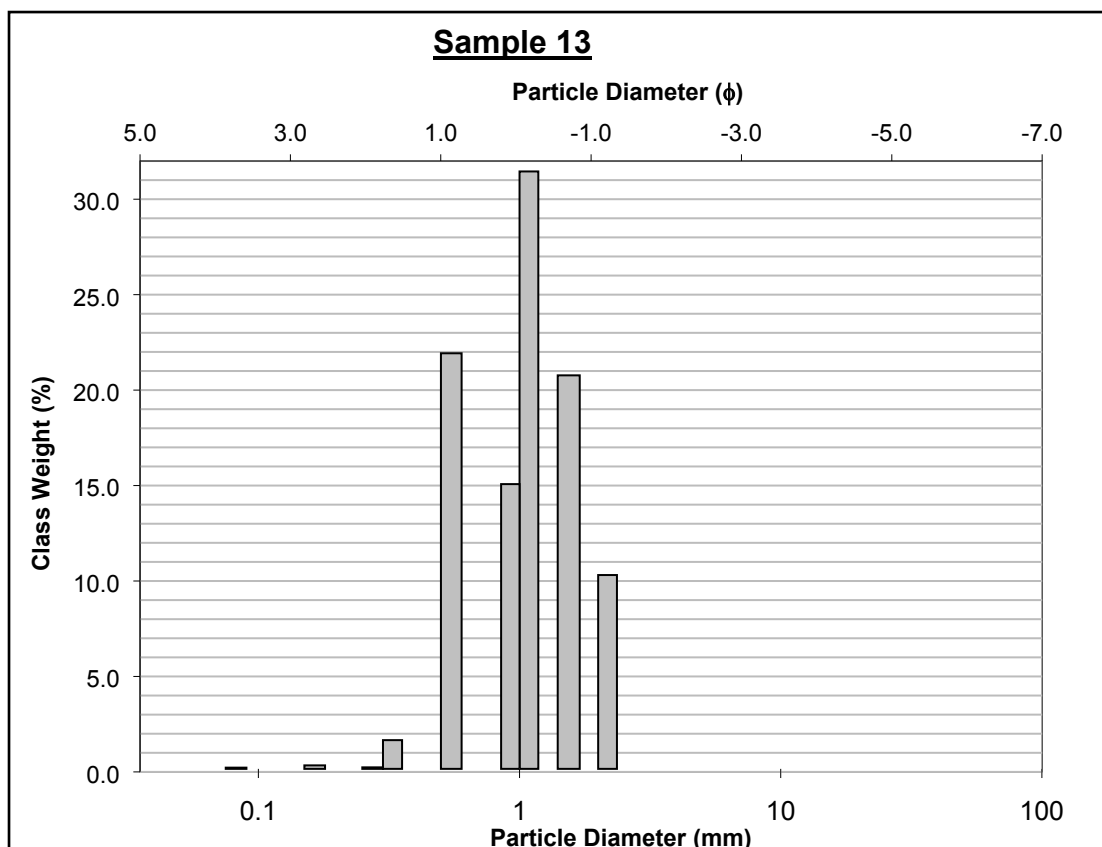
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 10			ANALYST & DATE: ,			
SAMPLE TYPE: Polymodal, Poorly Sorted			TEXTURAL GROUP: Gravelly Sand			
SEDIMENT NAME: Very Fine Gravelly Coarse Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	550.0	0.868	GRAVEL: 11.8%	COARSE SAND: 34.6%		
MODE 2:	327.5	1.616	SAND: 88.2%	MEDIUM SAND: 24.0%		
MODE 3:	1090.0	-0.119	MUD: 0.0%	FINE SAND: 1.7%		
D ₁₀ :	315.1	-1.037		V FINE SAND: 0.1%		
MEDIAN or D ₅₀ :	583.0	0.778	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	2052.0	1.666	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	6.511	-1.606	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	1736.9	2.703	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	4.039	-2.937	V FINE GRAVEL: 11.8%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	1072.7	2.014	V COARSE SAND: 27.7%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	920.4	728.5	0.457	676.1	0.565	Coarse Sand
SORTING (σ):	620.0	1.989	0.992	2.006	1.005	Poorly Sorted
SKEWNESS (Sk):	0.839	0.063	-0.063	0.311	-0.311	Very Coarse Skewed
KURTOSIS (K):	2.456	1.944	1.944	0.582	0.582	Very Platykurtic



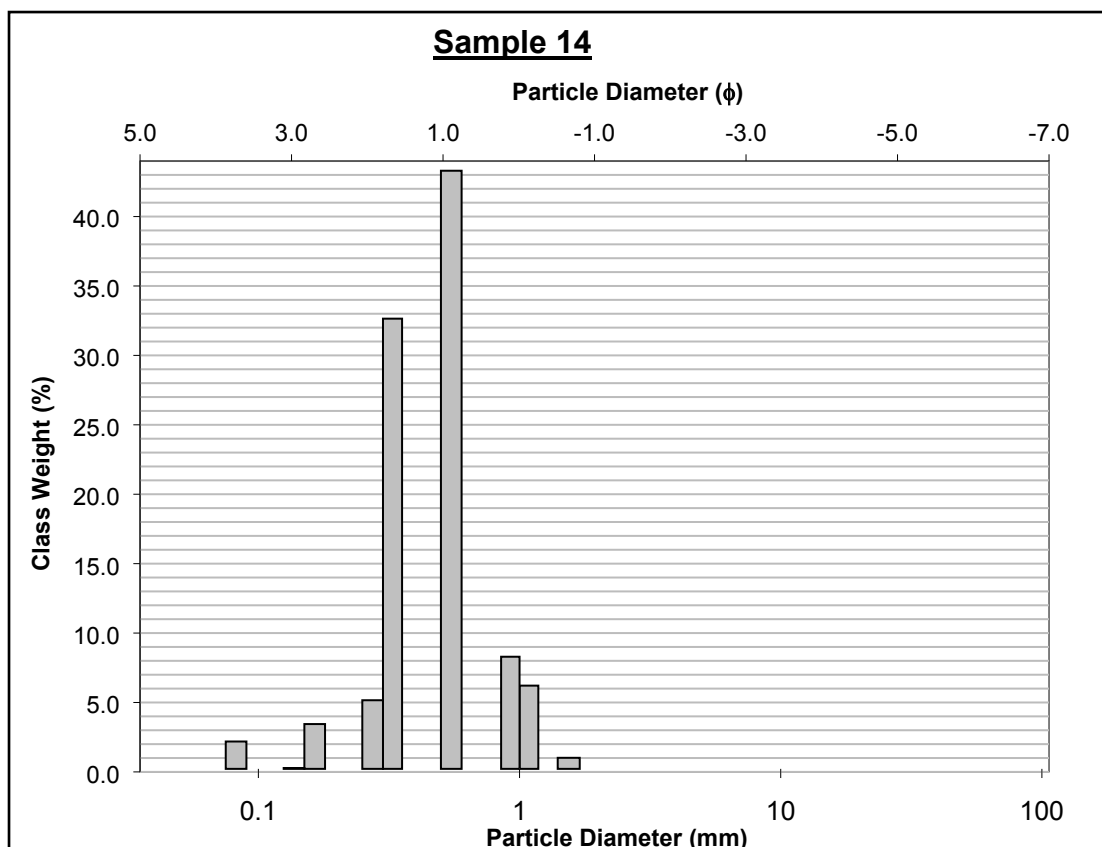
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 11			ANALYST & DATE: ,			
SAMPLE TYPE: Polymodal, Moderately Sorted			TEXTURAL GROUP: Slightly Gravelly Sand			
SEDIMENT NAME: Slightly Very Fine Gravelly Coarse Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	550.0	0.868	GRAVEL: 4.3%	COARSE SAND: 47.3%		
MODE 2:	327.5	1.616	SAND: 95.7%	MEDIUM SAND: 20.8%		
MODE 3:	1090.0	-0.119	MUD: 0.0%	FINE SAND: 3.1%		
D ₁₀ :	311.7	-0.586		V FINE SAND: 0.2%		
MEDIAN or D ₅₀ :	567.1	0.818	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	1500.6	1.682	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	4.814	-2.872	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	1188.9	2.267	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	2.069	-18.029	V FINE GRAVEL: 4.3%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	536.9	1.049	V COARSE SAND: 24.3%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	768.3	638.9	0.646	598.0	0.742	Coarse Sand
SORTING (σ):	479.7	1.832	0.873	1.788	0.838	Moderately Sorted
SKEWNESS (Sk):	1.257	-0.012	0.012	0.172	-0.172	Coarse Skewed
KURTOSIS (K):	4.145	2.696	2.696	1.003	1.003	Mesokurtic



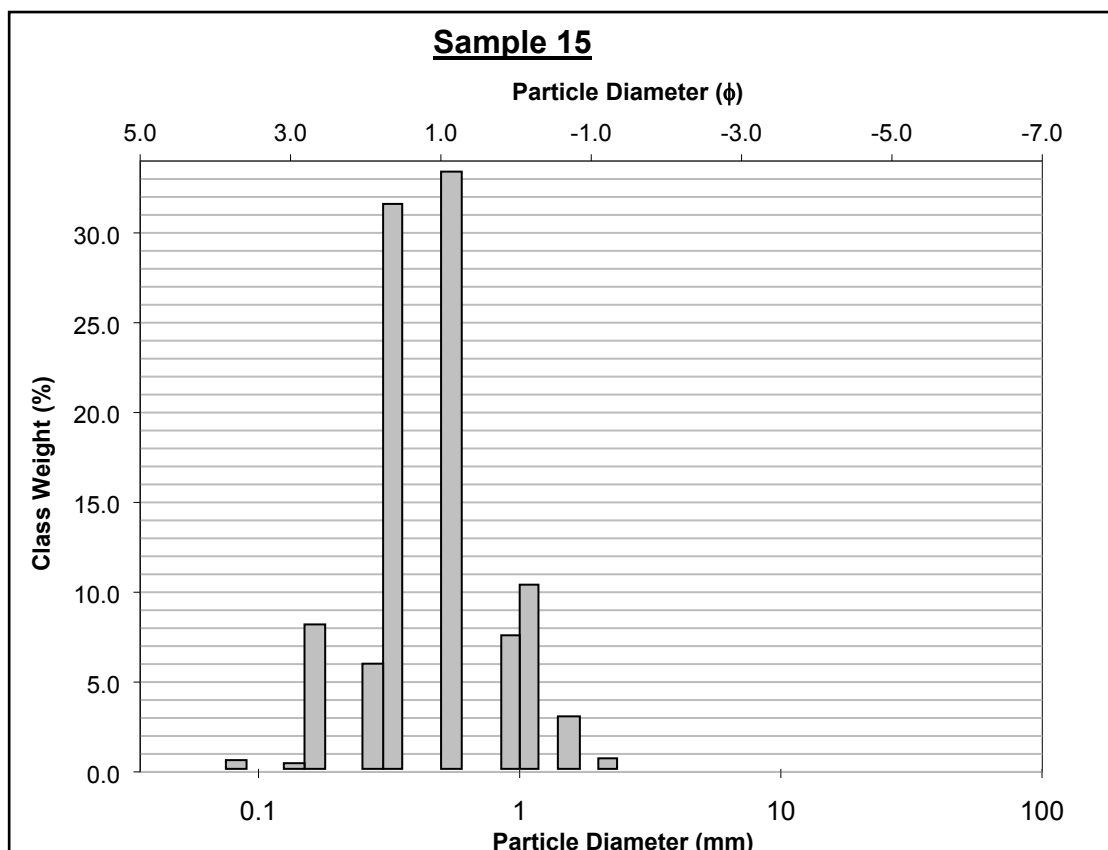
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 12			ANALYST & DATE: ,			
SAMPLE TYPE: Bimodal, Moderately Well Sorted			TEXTURAL GROUP: Gravelly Sand			
SEDIMENT NAME: Very Fine Gravelly Very Coarse Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	1550.0	-0.625	GRAVEL: 16.3%	COARSE SAND: 8.3%		
MODE 2:	2180.0	-1.119	SAND: 83.7%	MEDIUM SAND: 2.5%		
MODE 3:			MUD: 0.0%	FINE SAND: 0.1%		
D ₁₀ :	964.7	-1.093		V FINE SAND: 0.1%		
MEDIAN or D ₅₀ :	1538.7	-0.622	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	2132.6	0.052	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	2.211	-0.048	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	1167.9	1.145	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.160	0.707	V FINE GRAVEL: 16.3%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	228.0	0.214	V COARSE SAND: 72.7%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1520.8	1430.9	-0.517	1513.8	-0.598	Very Coarse Sand
SORTING (σ):	419.3	1.469	0.555	1.427	0.513	Moderately Well Sorted
SKEWNESS (Sk):	-0.690	-2.414	2.414	-0.271	0.271	Fine Skewed
KURTOSIS (K):	4.234	10.66	10.66	3.844	3.844	Extremely Leptokurtic



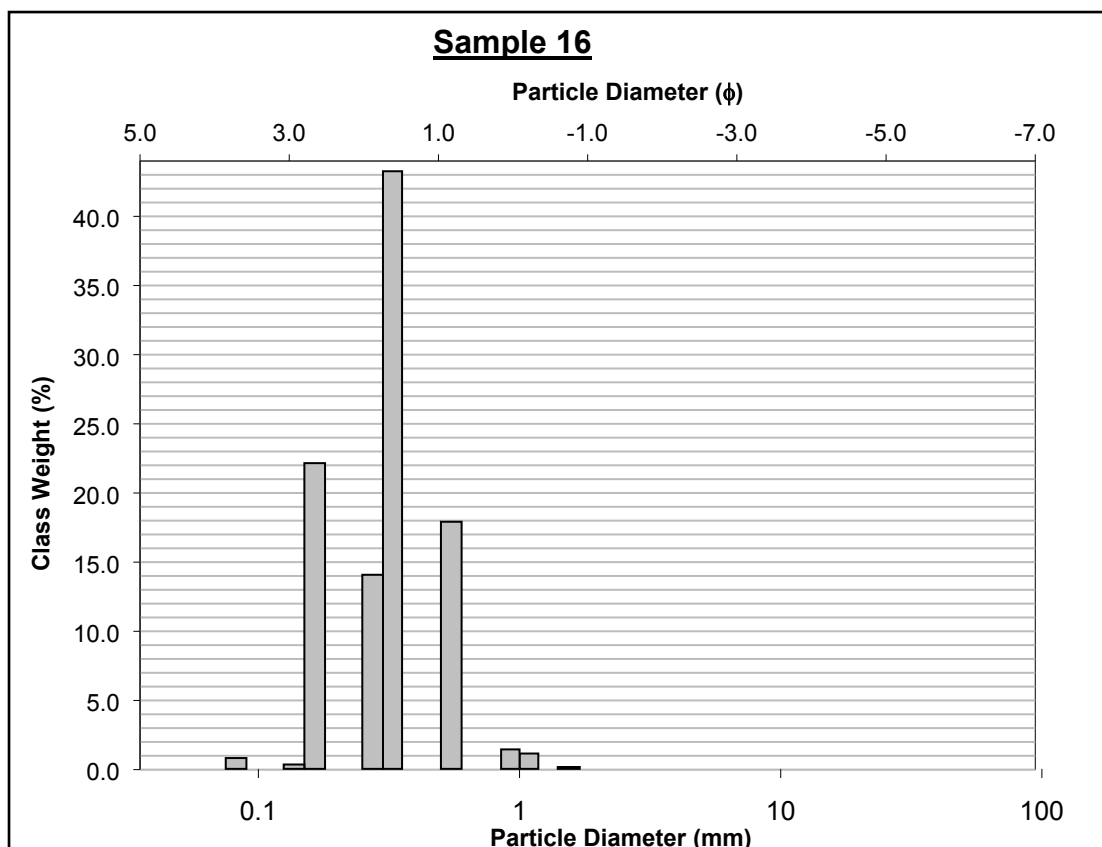
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 13			ANALYST & DATE: ,			
SAMPLE TYPE: Polymodal, Moderately Well Sorted			TEXTURAL GROUP: Gravelly Sand			
SEDIMENT NAME: Very Fine Gravelly Very Coarse Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	1090.0	-0.119	GRAVEL: 9.6%	COARSE SAND: 36.4%		
MODE 2:	550.0	0.868	SAND: 90.4%	MEDIUM SAND: 1.5%		
MODE 3:	1550.0	-0.625	MUD: 0.0%	FINE SAND: 0.2%		
D ₁₀ :	534.3	-0.760		V FINE SAND: 0.1%		
MEDIAN or D ₅₀ :	1068.7	-0.096	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	1693.7	0.904	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	3.170	-1.190	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	1159.4	1.664	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.741	-0.389	V FINE GRAVEL: 9.6%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	634.1	0.800	V COARSE SAND: 52.3%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1140.2	1028.3	-0.040	988.0	0.017	Coarse Sand
SORTING (σ):	490.1	1.589	0.668	1.619	0.695	Moderately Well Sorted
SKEWNESS (Sk):	0.548	-0.478	0.478	-0.121	0.121	Fine Skewed
KURTOSIS (K):	2.691	3.219	3.219	1.064	1.064	Mesokurtic



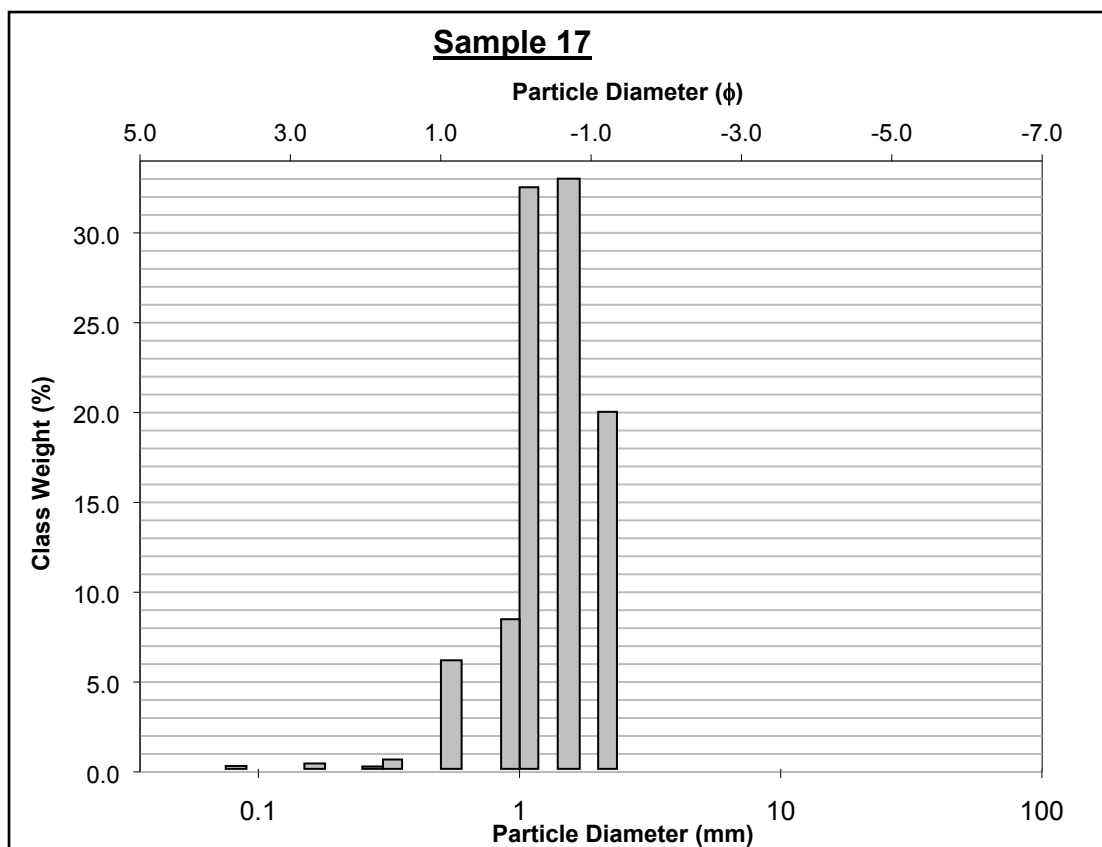
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 14			ANALYST & DATE: ,			
SAMPLE TYPE: Trimodal, Moderately Well Sorted			TEXTURAL GROUP: Sand			
SEDIMENT NAME: Moderately Well Sorted Coarse Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	550.0	0.868	GRAVEL: 0.0%	COARSE SAND: 52.0%		
MODE 2:	327.5	1.616	SAND: 100.0%	MEDIUM SAND: 36.1%		
MODE 3:	925.0	0.117	MUD: 0.0%	FINE SAND: 3.4%		
D ₁₀ :	294.2	0.110		V FINE SAND: 2.0%		
MEDIAN or D ₅₀ :	517.7	0.950	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	926.5	1.765	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	3.149	16.03	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	632.3	1.655	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.767	2.024	V FINE GRAVEL: 0.0%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	248.9	0.821	V COARSE SAND: 6.5%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	511.5	453.4	1.141	456.6	1.131	Medium Sand
SORTING (σ):	250.7	1.650	0.722	1.543	0.626	Moderately Well Sorted
SKEWNESS (Sk):	1.292	-0.572	0.572	-0.394	0.394	Very Fine Skewed
KURTOSIS (K):	5.156	4.599	4.599	1.283	1.283	Leptokurtic



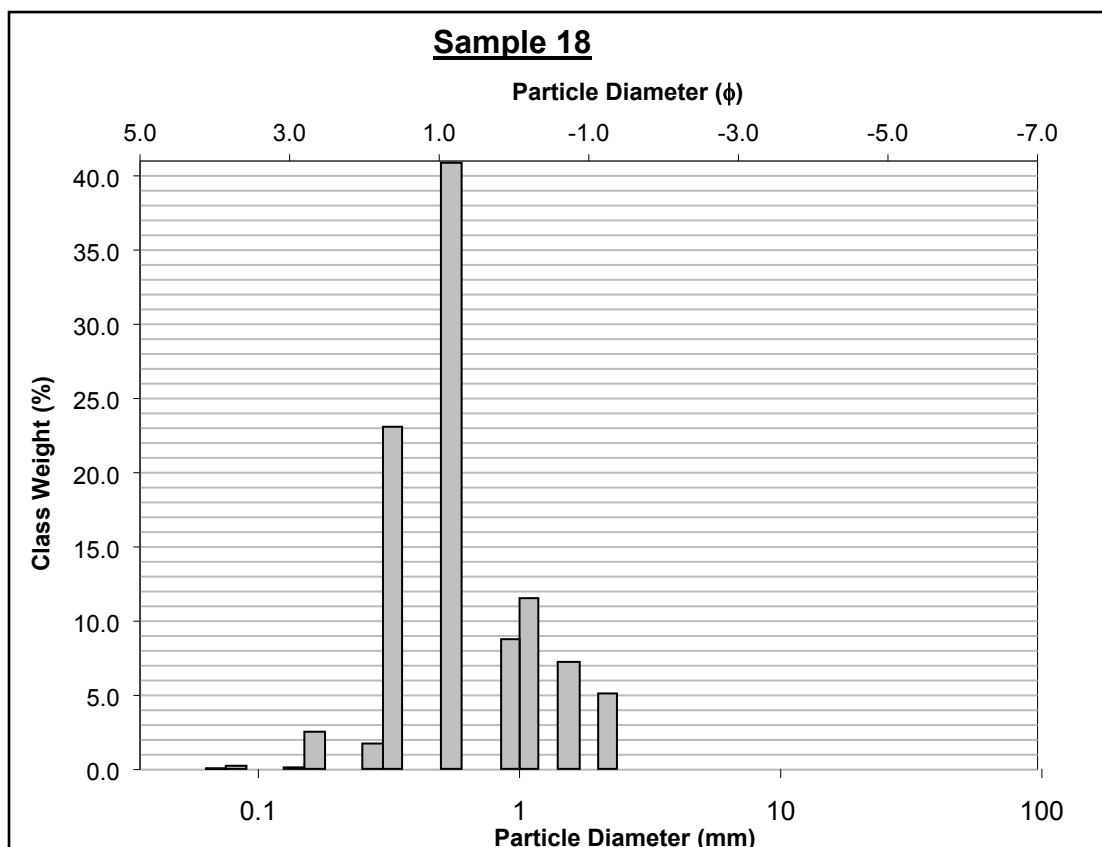
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 15			ANALYST & DATE: ,			
SAMPLE TYPE: Polymodal, Moderately Sorted			TEXTURAL GROUP: Slightly Gravelly Sand			
SEDIMENT NAME: Slightly Very Fine Gravelly Coarse Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	550.0	0.868	GRAVEL: 0.6%	COARSE SAND: 41.3%		
MODE 2:	327.5	1.616	SAND: 99.4%	MEDIUM SAND: 36.1%		
MODE 3:	1090.0	-0.119	MUD: 0.0%	FINE SAND: 8.7%		
D ₁₀ :	256.4	-0.085		V FINE SAND: 0.5%		
MEDIAN or D ₅₀ :	512.6	0.964	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	1060.4	1.964	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	4.136	-23.211	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	804.0	2.048	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.847	2.145	V FINE GRAVEL: 0.6%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	268.3	0.885	V COARSE SAND: 12.9%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	549.7	462.4	1.113	525.7	0.928	Coarse Sand
SORTING (σ):	343.7	1.784	0.835	1.786	0.837	Moderately Sorted
SKEWNESS (S_k):	1.600	0.080	-0.080	-0.050	0.050	Symmetrical
KURTOSIS (K):	6.025	2.879	2.879	1.303	1.303	Leptokurtic



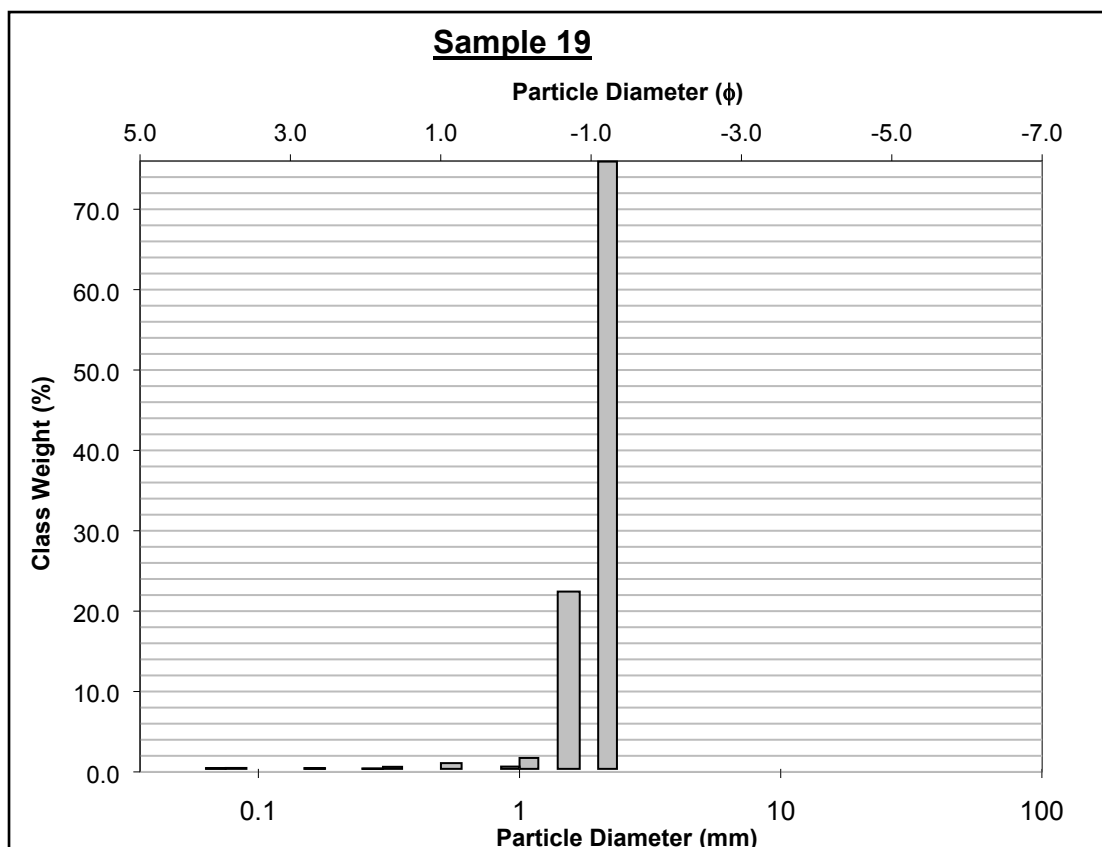
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 16			ANALYST & DATE: ,			
SAMPLE TYPE: Trimodal, Moderately Well Sorted			TEXTURAL GROUP: Sand			
SEDIMENT NAME: Moderately Well Sorted Medium Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	327.5	1.616	GRAVEL: 0.0%		COARSE SAND: 19.6%	
MODE 2:	165.0	2.605	SAND: 100.0%		MEDIUM SAND: 55.4%	
MODE 3:	550.0	0.868	MUD: 0.0%		FINE SAND: 23.0%	
D ₁₀ :	161.1	0.845			V FINE SAND: 0.8%	
MEDIAN or D ₅₀ :	314.9	1.667	V COARSE GRAVEL: 0.0%		V COARSE SILT: 0.0%	
D ₉₀ :	556.7	2.634	COARSE GRAVEL: 0.0%		COARSE SILT: 0.0%	
(D ₉₀ / D ₁₀):	3.456	3.117	MEDIUM GRAVEL: 0.0%		MEDIUM SILT: 0.0%	
(D ₉₀ - D ₁₀):	395.6	1.789	FINE GRAVEL: 0.0%		FINE SILT: 0.0%	
(D ₇₅ / D ₂₅):	1.375	1.303	V FINE GRAVEL: 0.0%		V FINE SILT: 0.0%	
(D ₇₅ - D ₂₅):	95.18	0.460	V COARSE SAND: 1.2%		CLAY: 0.0%	
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	338.7	303.7	1.719	303.4	1.721	Medium Sand
SORTING (σ):	169.6	1.573	0.654	1.624	0.699	Moderately Well Sorted
SKEWNESS (Sk):	2.038	0.115	-0.115	-0.083	0.083	Symmetrical
KURTOSIS (K):	10.39	3.232	3.232	1.711	1.711	Very Leptokurtic



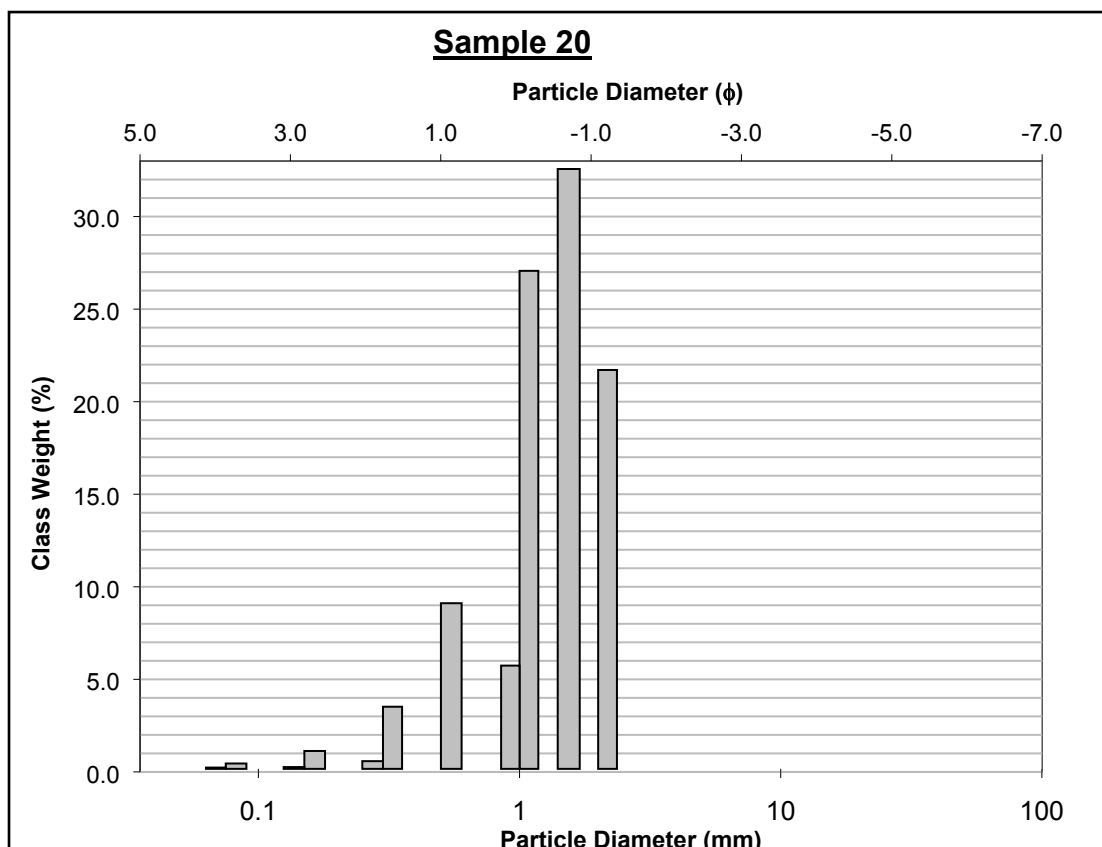
SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 17			ANALYST & DATE: ,			
SAMPLE TYPE: Polymodal, Moderately Well Sorted			TEXTURAL GROUP: Gravelly Sand			
SEDIMENT NAME: Very Fine Gravelly Very Coarse Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	1550.0	-0.625	GRAVEL: 18.6%	COARSE SAND: 13.9%		
MODE 2:	1090.0	-0.119	SAND: 81.4%	MEDIUM SAND: 0.6%		
MODE 3:	2180.0	-1.119	MUD: 0.0%	FINE SAND: 0.3%		
D ₁₀ :	899.3	-1.110		V FINE SAND: 0.2%		
MEDIAN or D ₅₀ :	1435.8	-0.522	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	2159.1	0.153	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	2.401	-0.138	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	1259.8	1.264	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.555	0.110	V FINE GRAVEL: 18.6%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	586.4	0.637	V COARSE SAND: 66.4%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1403.0	1303.5	-0.382	1435.0	-0.521	Very Coarse Sand
SORTING (σ):	477.3	1.499	0.584	1.475	0.561	Moderately Well Sorted
SKEWNESS (Sk):	0.131	-1.513	1.513	-0.176	0.176	Fine Skewed
KURTOSIS (K):	2.487	8.593	8.593	1.293	1.293	Leptokurtic



SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 18			ANALYST & DATE: ,			
SAMPLE TYPE: Polymodal, Moderately Sorted			TEXTURAL GROUP: Slightly Gravelly Sand			
SEDIMENT NAME: Slightly Very Fine Gravelly Coarse Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	550.0	0.868	GRAVEL: 4.7%		COARSE SAND: 50.0%	
MODE 2:	327.5	1.616	SAND: 95.3%		MEDIUM SAND: 23.7%	
MODE 3:	1090.0	-0.119	MUD: 0.0%		FINE SAND: 2.7%	
D ₁₀ :	312.5	-0.579			V FINE SAND: 0.2%	
MEDIAN or D ₅₀ :	553.5	0.853	V COARSE GRAVEL: 0.0%		V COARSE SILT: 0.0%	
D ₉₀ :	1494.0	1.678	COARSE GRAVEL: 0.0%		COARSE SILT: 0.0%	
(D ₉₀ / D ₁₀):	4.781	-2.897	MEDIUM GRAVEL: 0.0%		MEDIUM SILT: 0.0%	
(D ₉₀ - D ₁₀):	1181.5	2.257	FINE GRAVEL: 0.0%		FINE SILT: 0.0%	
(D ₇₅ / D ₂₅):	2.760	32.07	V FINE GRAVEL: 4.7%		V FINE SILT: 0.0%	
(D ₇₅ - D ₂₅):	617.1	1.464	V COARSE SAND: 18.6%		CLAY: 0.0%	
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	729.4	605.2	0.725	587.7	0.767	Coarse Sand
SORTING (σ):	481.9	1.811	0.857	1.767	0.821	Moderately Sorted
SKEWNESS (Sk):	1.523	0.238	-0.238	0.220	-0.220	Coarse Skewed
KURTOSIS (K):	4.784	2.912	2.912	0.697	0.697	Platykurtic

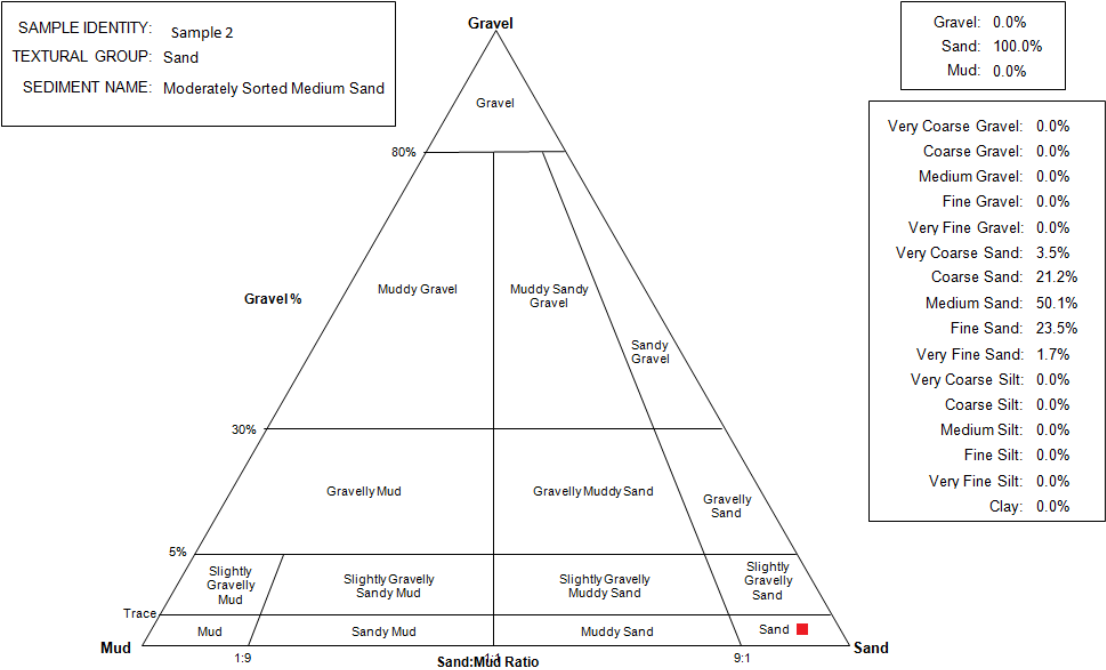
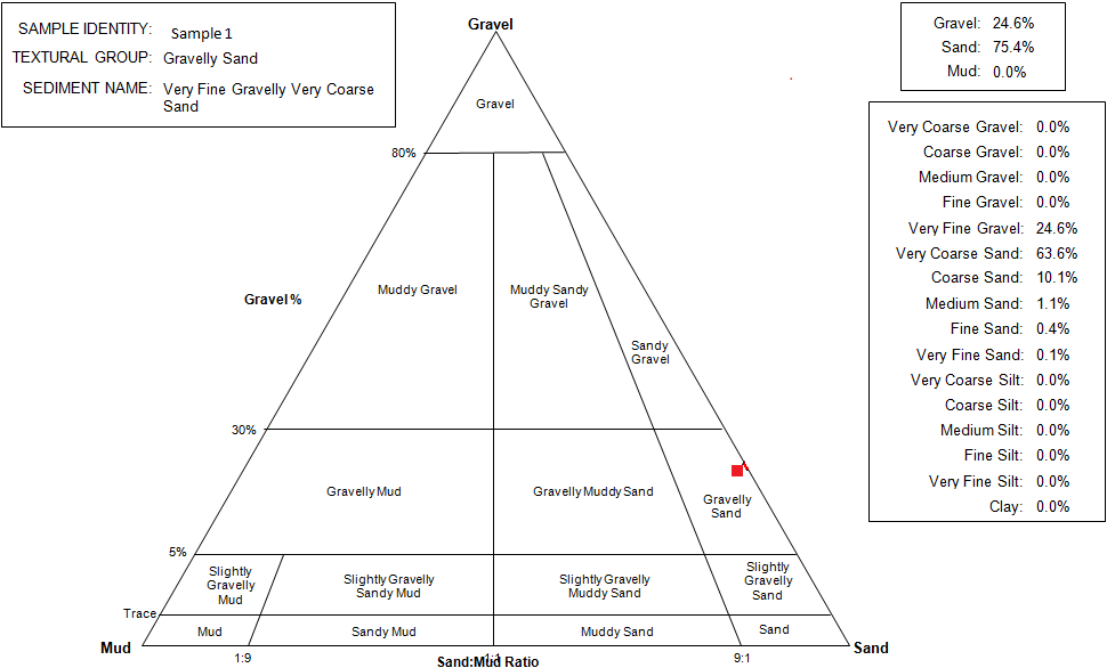


SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 19			ANALYST & DATE: ,			
SAMPLE TYPE: Bimodal, Very Well Sorted			TEXTURAL GROUP: Sandy Gravel			
SEDIMENT NAME: Sandy Very Fine Gravel						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	2180.0	-1.119	GRAVEL: 72.3%	COARSE SAND: 1.0%		
MODE 2:	1550.0	-0.625	SAND: 27.7%	MEDIUM SAND: 0.3%		
MODE 3:			MUD: 0.0%	FINE SAND: 0.1%		
D ₁₀ :	1479.7	-1.206		V FINE SAND: 0.2%		
MEDIAN or D ₅₀ :	2104.8	-1.074	V COARSE GRAVEL: 0.0%	V COARSE SILT: 0.0%		
D ₉₀ :	2306.6	-0.565	COARSE GRAVEL: 0.0%	COARSE SILT: 0.0%		
(D ₉₀ / D ₁₀):	1.559	0.469	MEDIUM GRAVEL: 0.0%	MEDIUM SILT: 0.0%		
(D ₉₀ - D ₁₀):	826.9	0.640	FINE GRAVEL: 0.0%	FINE SILT: 0.0%		
(D ₇₅ / D ₂₅):	1.339	0.636	V FINE GRAVEL: 72.3%	V FINE SILT: 0.0%		
(D ₇₅ - D ₂₅):	564.3	0.421	V COARSE SAND: 26.1%	CLAY: 0.0%		
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1982.1	1922.9	-0.943	1951.1	-0.964	Very Coarse Sand
SORTING (σ):	350.4	1.324	0.405	1.186	0.246	Very Well Sorted
SKEWNESS (Sk):	-1.944	-5.686	5.686	-0.589	0.589	Very Fine Skewed
KURTOSIS (K):	7.657	52.93	52.93	0.694	0.694	Platykurtic

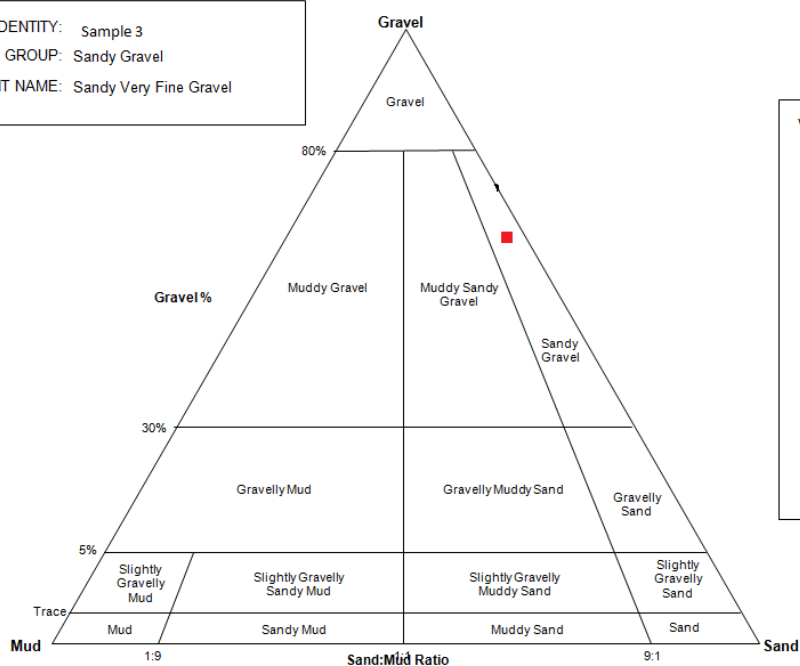


SAMPLE STATISTICS						
SAMPLE IDENTITY: Sample 20			ANALYST & DATE: ,			
SAMPLE TYPE: Polymodal, Moderately Sorted			TEXTURAL GROUP: Gravelly Sand			
SEDIMENT NAME: Very Fine Gravelly Very Coarse Sand						
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	1550.0	-0.625	GRAVEL: 20.1%		COARSE SAND: 14.3%	
MODE 2:	1090.0	-0.119	SAND: 79.9%		MEDIUM SAND: 3.6%	
MODE 3:	2180.0	-1.119	MUD: 0.0%		FINE SAND: 1.1%	
D ₁₀ :	551.4	-1.120			V FINE SAND: 0.4%	
MEDIAN or D ₅₀ :	1443.2	-0.529	V COARSE GRAVEL: 0.0%		V COARSE SILT: 0.0%	
D ₉₀ :	2173.4	0.859	COARSE GRAVEL: 0.0%		COARSE SILT: 0.0%	
(D ₉₀ / D ₁₀):	3.942	-0.767	MEDIUM GRAVEL: 0.0%		MEDIUM SILT: 0.0%	
(D ₉₀ - D ₁₀):	1622.0	1.979	FINE GRAVEL: 0.0%		FINE SILT: 0.0%	
(D ₇₅ / D ₂₅):	1.595	0.074	V FINE GRAVEL: 20.1%		V FINE SILT: 0.0%	
(D ₇₅ - D ₂₅):	617.1	0.673	V COARSE SAND: 60.5%		CLAY: 0.0%	
	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
MEAN ($\bar{x}$):	1372.4	1222.0	-0.289	1389.3	-0.474	Very Coarse Sand
SORTING (σ):	544.7	1.713	0.776	1.632	0.707	Moderately Sorted
SKEWNESS (Sk):	-0.141	-1.664	1.664	-0.326	0.326	Very Fine Skewed
KURTOSIS (K):	2.378	6.776	6.776	1.631	1.631	Very Leptokurtic

H: Classification Ternary diagram



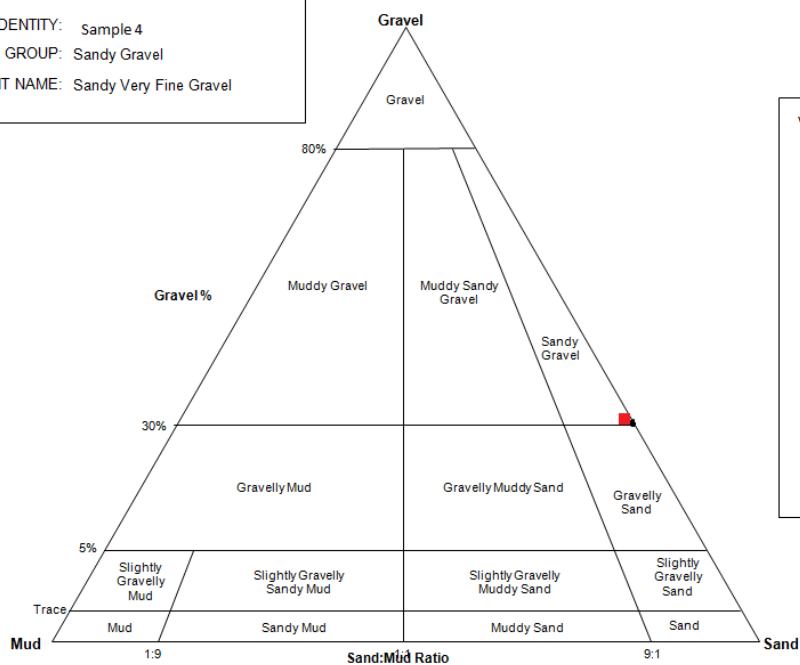
SAMPLE IDENTITY: Sample 3
 TEXTURAL GROUP: Sandy Gravel
 SEDIMENT NAME: Sandy Very Fine Gravel



Gravel: 75.6%
 Sand: 24.4%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 75.6%
 Very Coarse Sand: 19.6%
 Coarse Sand: 1.2%
 Medium Sand: 1.9%
 Fine Sand: 1.5%
 Very Fine Sand: 0.2%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

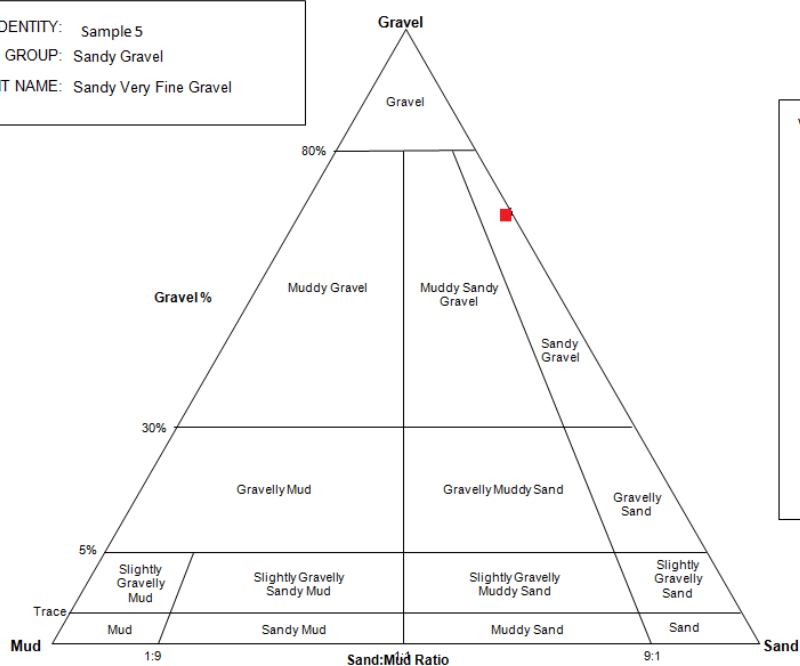
SAMPLE IDENTITY: Sample 4
 TEXTURAL GROUP: Sandy Gravel
 SEDIMENT NAME: Sandy Very Fine Gravel



Gravel: 32.1%
 Sand: 67.9%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 32.1%
 Very Coarse Sand: 51.4%
 Coarse Sand: 15.7%
 Medium Sand: 0.5%
 Fine Sand: 0.2%
 Very Fine Sand: 0.2%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

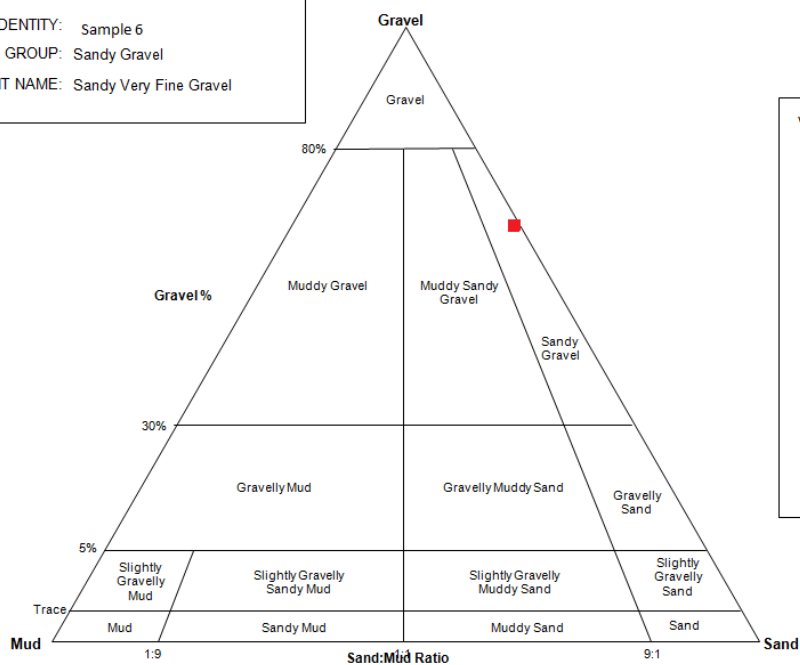
SAMPLE IDENTITY: Sample 5
 TEXTURAL GROUP: Sandy Gravel
 SEDIMENT NAME: Sandy Very Fine Gravel



Gravel: 71.1%
 Sand: 28.9%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 71.1%
 Very Coarse Sand: 18.5%
 Coarse Sand: 4.9%
 Medium Sand: 3.9%
 Fine Sand: 1.4%
 Very Fine Sand: 0.2%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

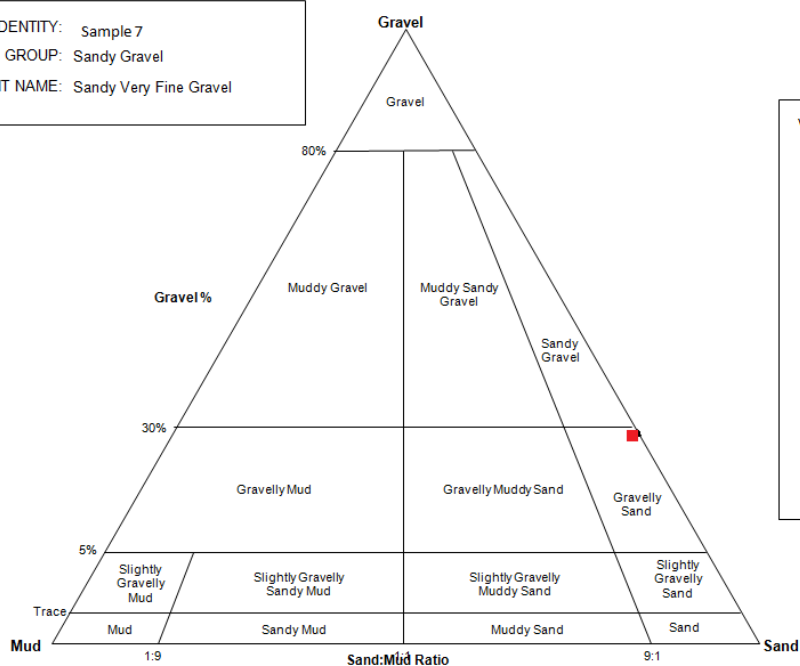
SAMPLE IDENTITY: Sample 6
 TEXTURAL GROUP: Sandy Gravel
 SEDIMENT NAME: Sandy Very Fine Gravel



Gravel: 68.7%
 Sand: 31.3%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 68.7%
 Very Coarse Sand: 19.0%
 Coarse Sand: 5.5%
 Medium Sand: 3.6%
 Fine Sand: 2.7%
 Very Fine Sand: 0.4%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

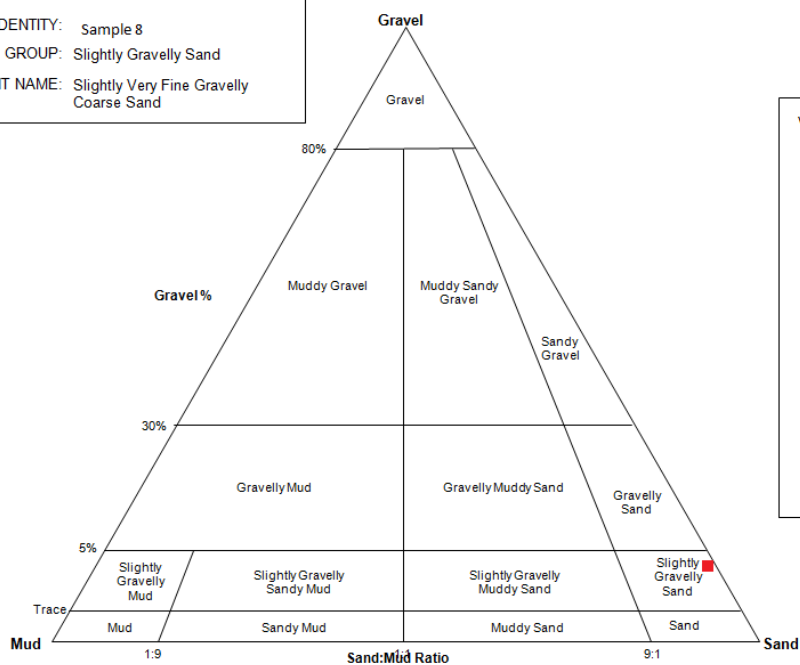
SAMPLE IDENTITY: Sample 7
 TEXTURAL GROUP: Sandy Gravel
 SEDIMENT NAME: Sandy Very Fine Gravel



Gravel: 30.6%
 Sand: 69.4%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 30.6%
 Very Coarse Sand: 43.4%
 Coarse Sand: 23.2%
 Medium Sand: 1.2%
 Fine Sand: 1.1%
 Very Fine Sand: 0.6%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

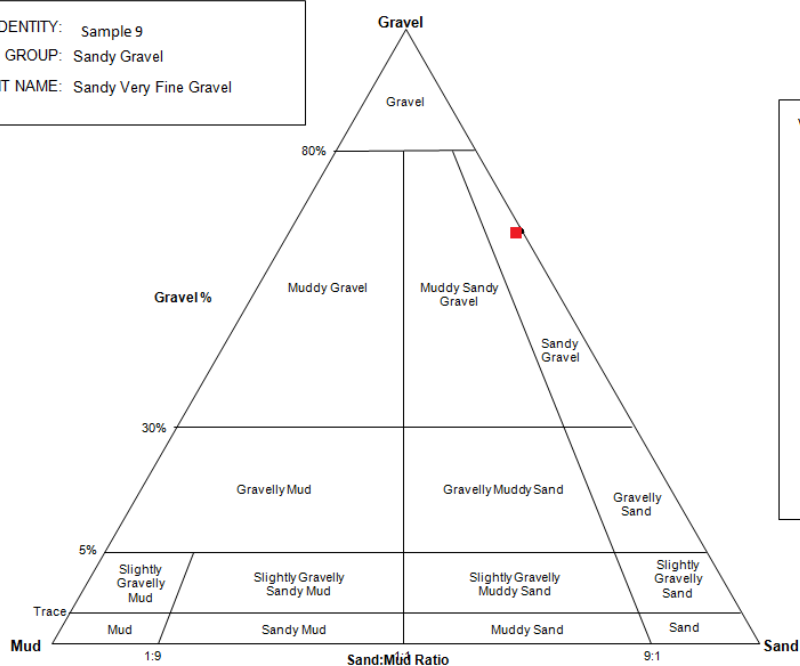
SAMPLE IDENTITY: Sample 8
 TEXTURAL GROUP: Slightly Gravelly Sand
 SEDIMENT NAME: Slightly Very Fine Gravelly Coarse Sand



Gravel: 1.0%
 Sand: 99.0%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 1.0%
 Very Coarse Sand: 22.3%
 Coarse Sand: 35.4%
 Medium Sand: 27.8%
 Fine Sand: 10.2%
 Very Fine Sand: 3.3%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

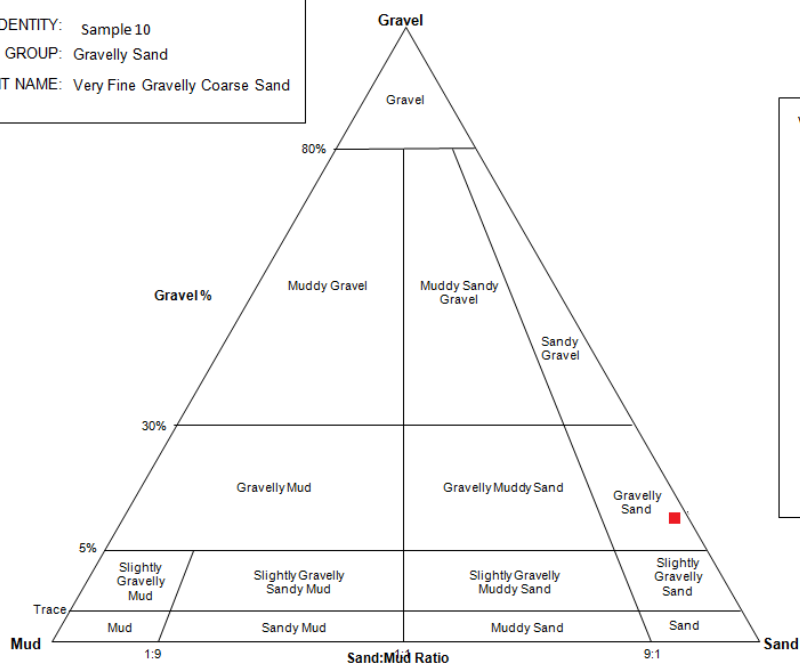
SAMPLE IDENTITY: Sample 9
 TEXTURAL GROUP: Sandy Gravel
 SEDIMENT NAME: Sandy Very Fine Gravel



Gravel: 67.9%
 Sand: 32.1%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 67.9%
 Very Coarse Sand: 28.2%
 Coarse Sand: 1.4%
 Medium Sand: 0.7%
 Fine Sand: 1.0%
 Very Fine Sand: 0.8%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

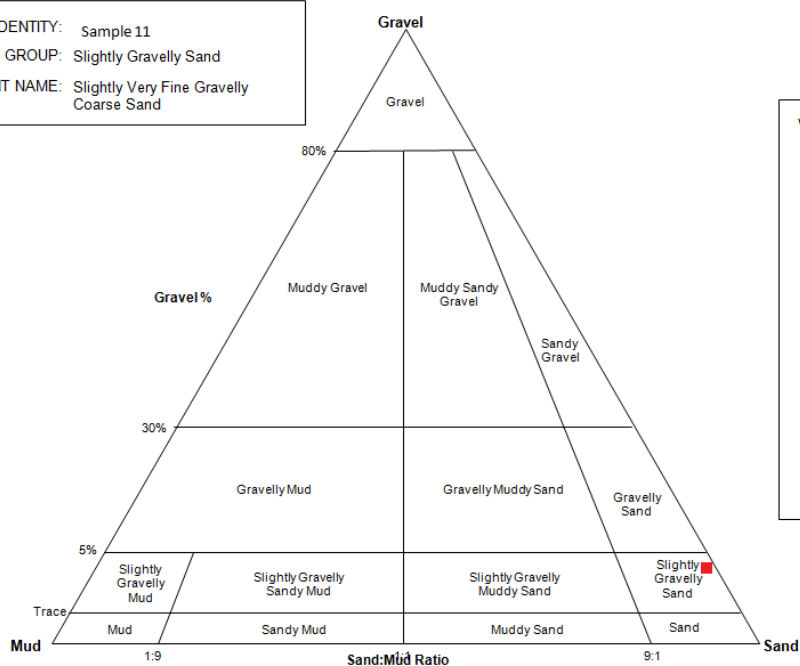
SAMPLE IDENTITY: Sample 10
 TEXTURAL GROUP: Gravelly Sand
 SEDIMENT NAME: Very Fine Gravelly Coarse Sand



Gravel: 11.8%
 Sand: 88.2%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 11.8%
 Very Coarse Sand: 27.7%
 Coarse Sand: 34.6%
 Medium Sand: 24.0%
 Fine Sand: 1.7%
 Very Fine Sand: 0.1%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

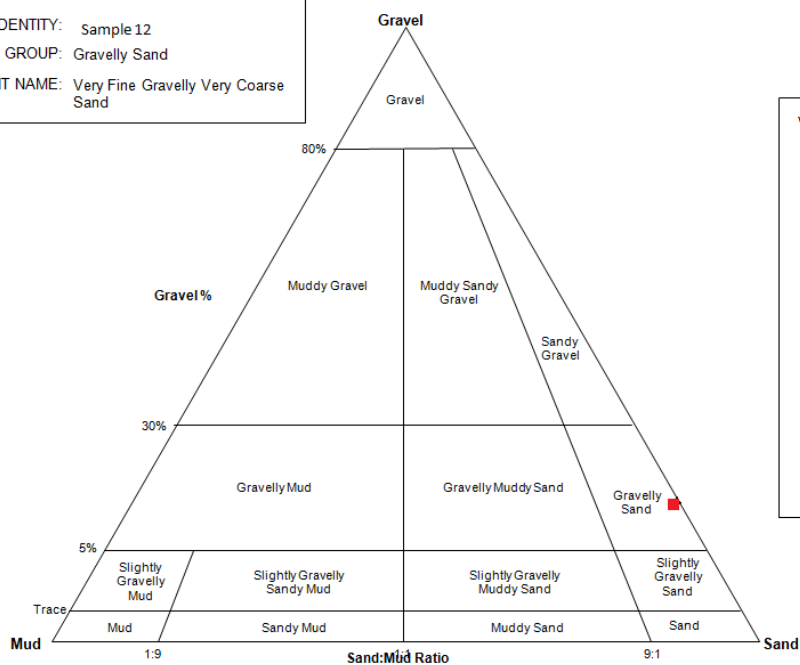
SAMPLE IDENTITY: Sample 11
 TEXTURAL GROUP: Slightly Gravelly Sand
 SEDIMENT NAME: Slightly Very Fine Gravelly Coarse Sand



Gravel: 4.3%
 Sand: 95.7%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 4.3%
 Very Coarse Sand: 24.3%
 Coarse Sand: 47.3%
 Medium Sand: 20.8%
 Fine Sand: 3.1%
 Very Fine Sand: 0.2%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

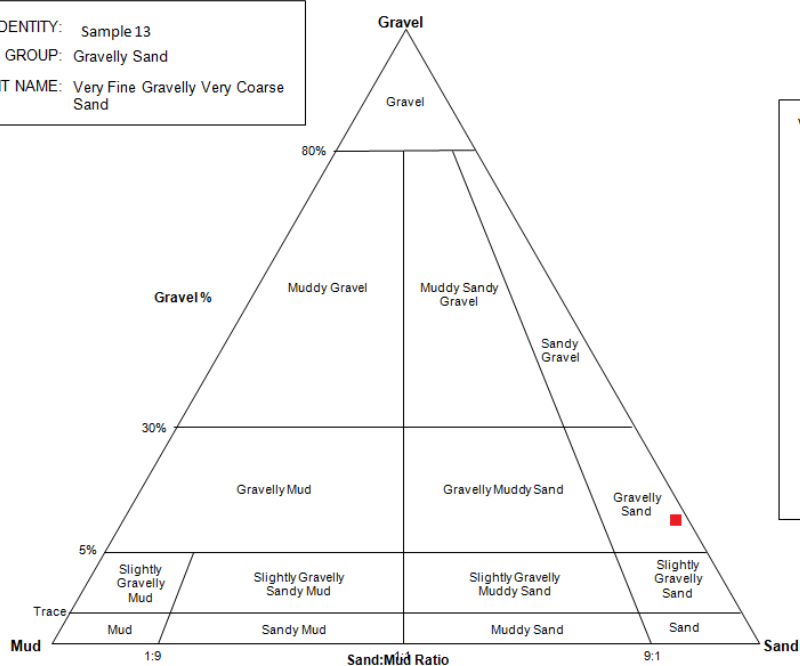
SAMPLE IDENTITY: Sample 12
 TEXTURAL GROUP: Gravelly Sand
 SEDIMENT NAME: Very Fine Gravelly Very Coarse Sand



Gravel: 16.3%
 Sand: 83.7%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 16.3%
 Very Coarse Sand: 72.7%
 Coarse Sand: 8.3%
 Medium Sand: 2.5%
 Fine Sand: 0.1%
 Very Fine Sand: 0.1%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

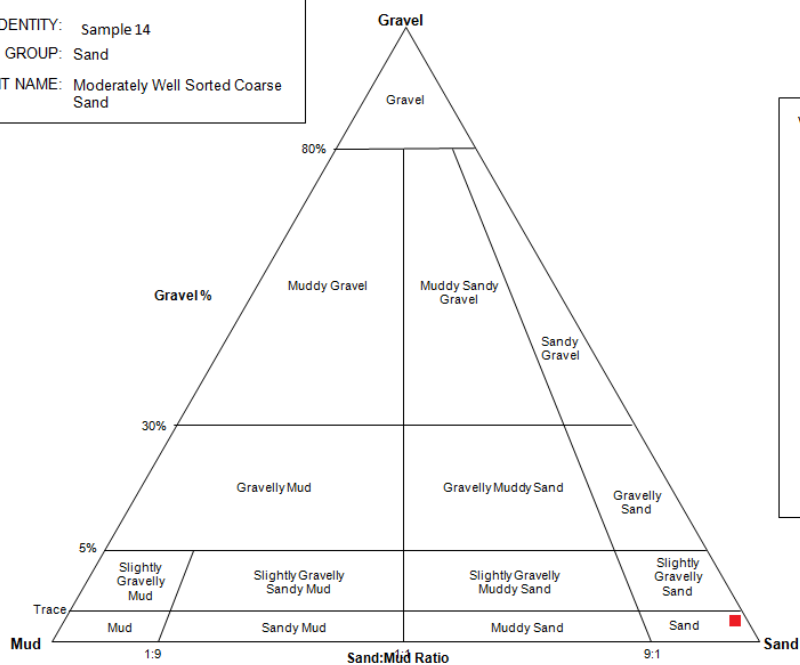
SAMPLE IDENTITY: Sample 13
 TEXTURAL GROUP: Gravelly Sand
 SEDIMENT NAME: Very Fine Gravelly Very Coarse Sand



Gravel: 9.6%
 Sand: 90.4%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 9.6%
 Very Coarse Sand: 52.3%
 Coarse Sand: 36.4%
 Medium Sand: 1.5%
 Fine Sand: 0.2%
 Very Fine Sand: 0.1%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

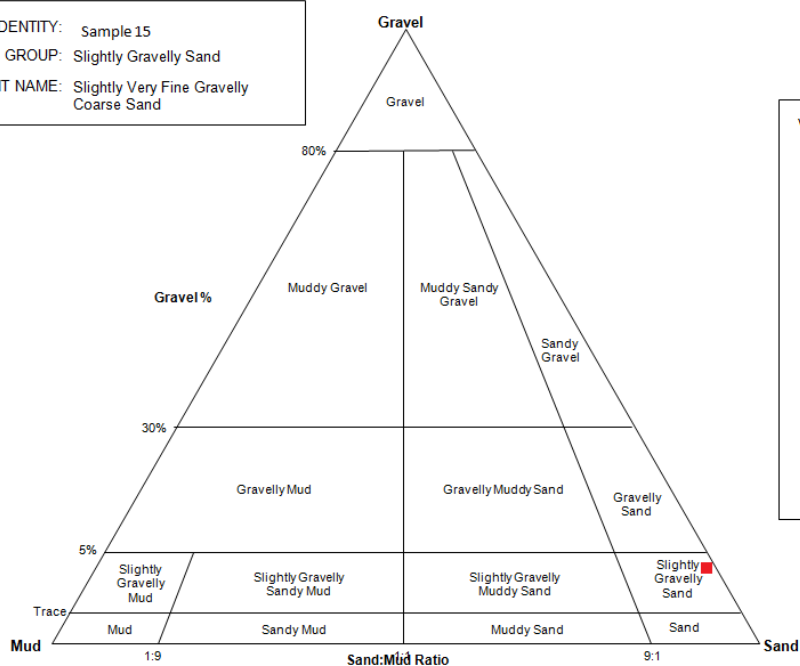
SAMPLE IDENTITY: Sample 14
 TEXTURAL GROUP: Sand
 SEDIMENT NAME: Moderately Well Sorted Coarse Sand



Gravel: 0.0%
 Sand: 100.0%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 0.0%
 Very Coarse Sand: 6.5%
 Coarse Sand: 52.0%
 Medium Sand: 36.1%
 Fine Sand: 3.4%
 Very Fine Sand: 2.0%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

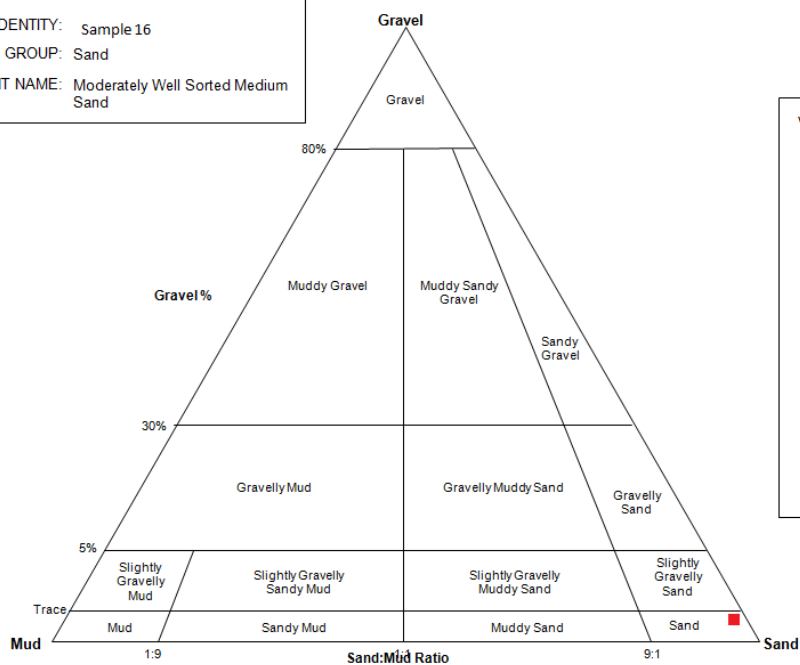
SAMPLE IDENTITY: Sample 15
 TEXTURAL GROUP: Slightly Gravelly Sand
 SEDIMENT NAME: Slightly Very Fine Gravelly Coarse Sand



Gravel: 0.6%
 Sand: 99.4%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 0.6%
 Very Coarse Sand: 12.9%
 Coarse Sand: 41.3%
 Medium Sand: 36.1%
 Fine Sand: 8.7%
 Very Fine Sand: 0.5%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

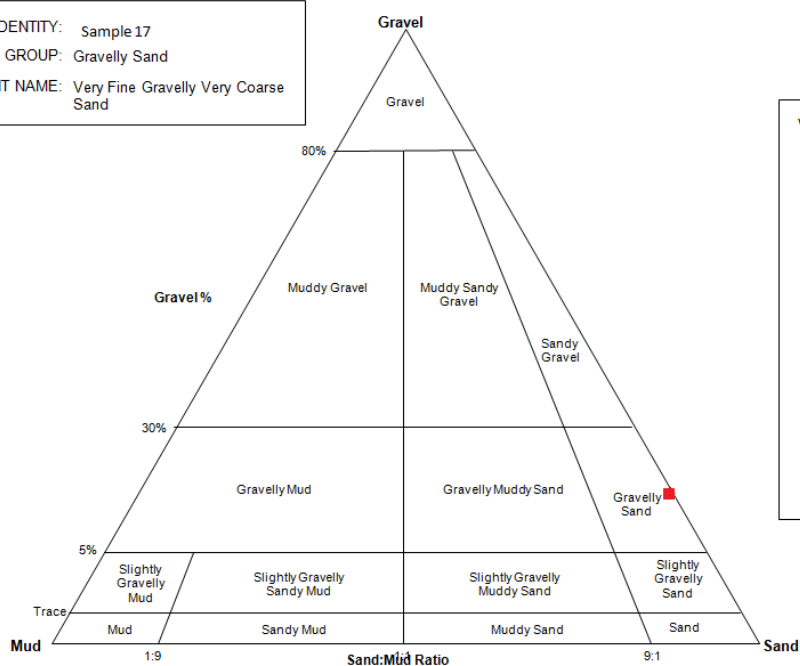
SAMPLE IDENTITY: Sample 16
 TEXTURAL GROUP: Sand
 SEDIMENT NAME: Moderately Well Sorted Medium Sand



Gravel: 0.0%
 Sand: 100.0%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 0.0%
 Very Coarse Sand: 1.2%
 Coarse Sand: 19.6%
 Medium Sand: 55.4%
 Fine Sand: 23.0%
 Very Fine Sand: 0.8%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

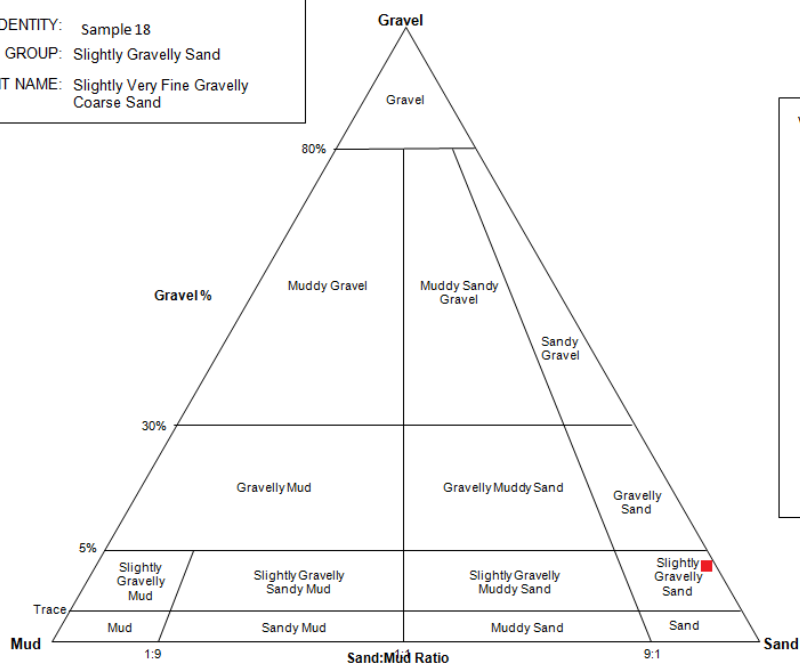
SAMPLE IDENTITY: Sample 17
 TEXTURAL GROUP: Gravelly Sand
 SEDIMENT NAME: Very Fine Gravelly Very Coarse Sand



Gravel: 18.6%
 Sand: 81.4%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 18.6%
 Very Coarse Sand: 66.4%
 Coarse Sand: 13.9%
 Medium Sand: 0.6%
 Fine Sand: 0.3%
 Very Fine Sand: 0.2%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

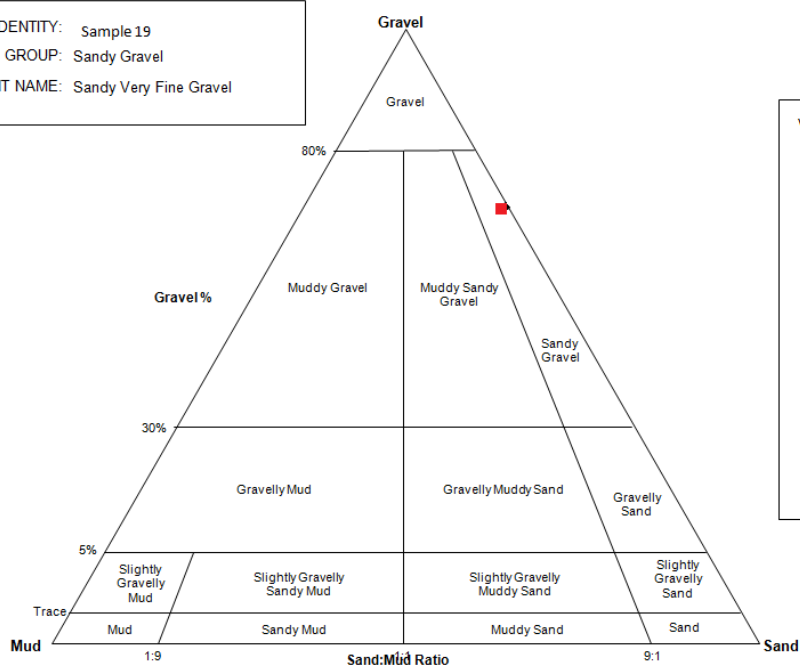
SAMPLE IDENTITY: Sample 18
 TEXTURAL GROUP: Slightly Gravelly Sand
 SEDIMENT NAME: Slightly Very Fine Gravelly Coarse Sand



Gravel: 4.7%
 Sand: 95.3%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 4.7%
 Very Coarse Sand: 18.6%
 Coarse Sand: 50.0%
 Medium Sand: 23.7%
 Fine Sand: 2.7%
 Very Fine Sand: 0.2%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

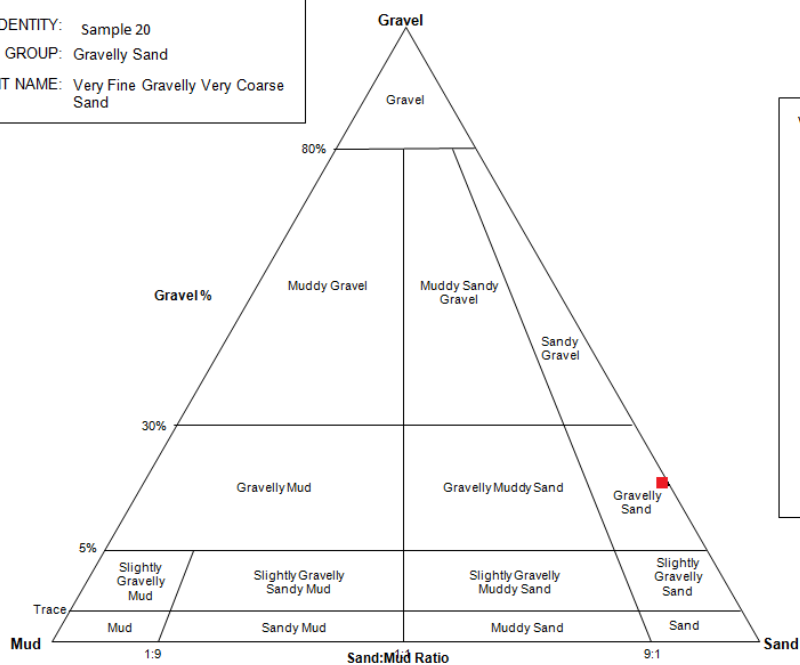
SAMPLE IDENTITY: Sample 19
 TEXTURAL GROUP: Sandy Gravel
 SEDIMENT NAME: Sandy Very Fine Gravel



Gravel: 72.3%
 Sand: 27.7%
 Mud: 0.0%

Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 72.3%
 Very Coarse Sand: 26.1%
 Coarse Sand: 1.0%
 Medium Sand: 0.3%
 Fine Sand: 0.1%
 Very Fine Sand: 0.2%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

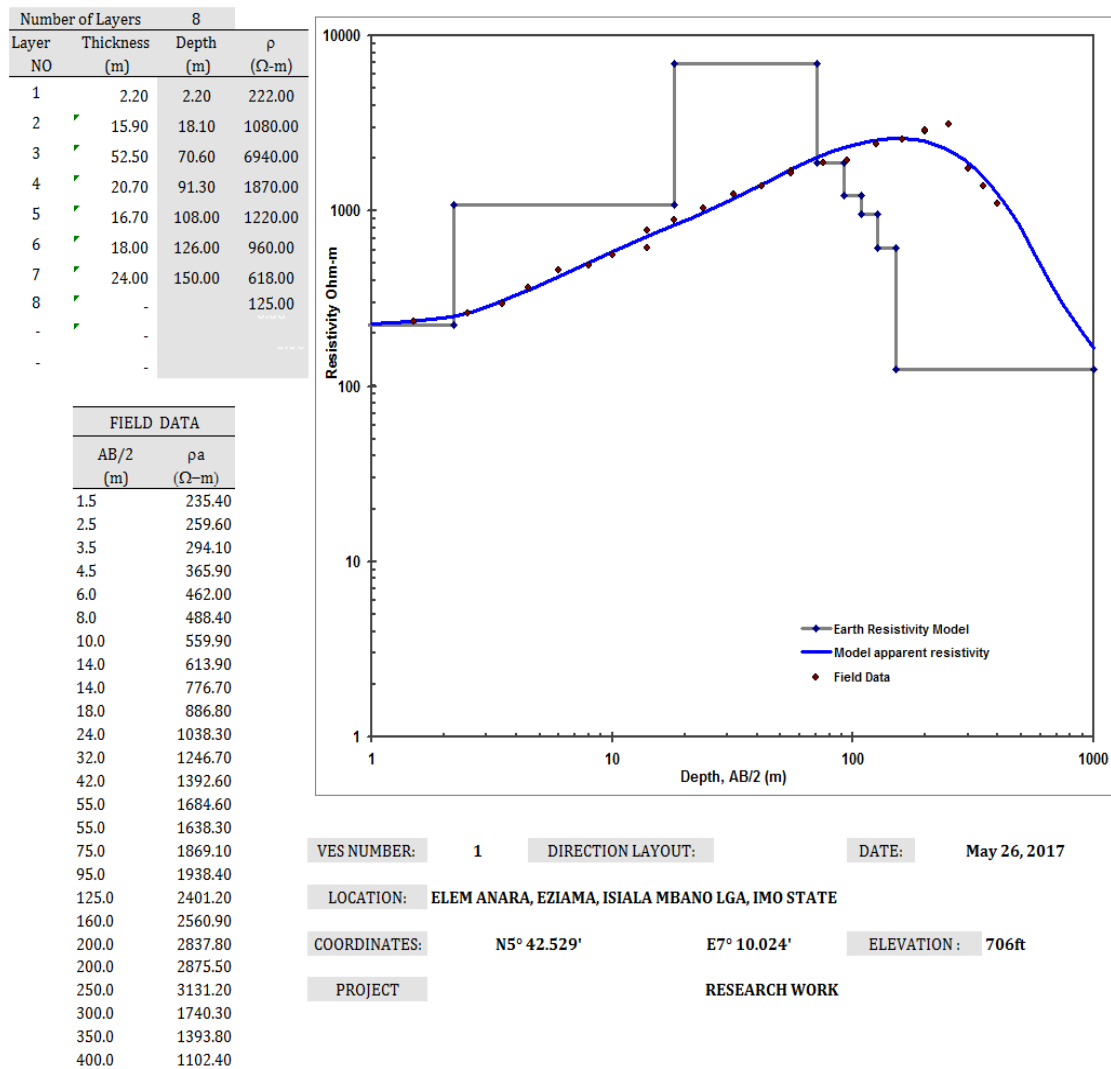
SAMPLE IDENTITY: Sample 20
 TEXTURAL GROUP: Gravelly Sand
 SEDIMENT NAME: Very Fine Gravelly Very Coarse Sand



Gravel: 20.1%
 Sand: 79.9%
 Mud: 0.0%

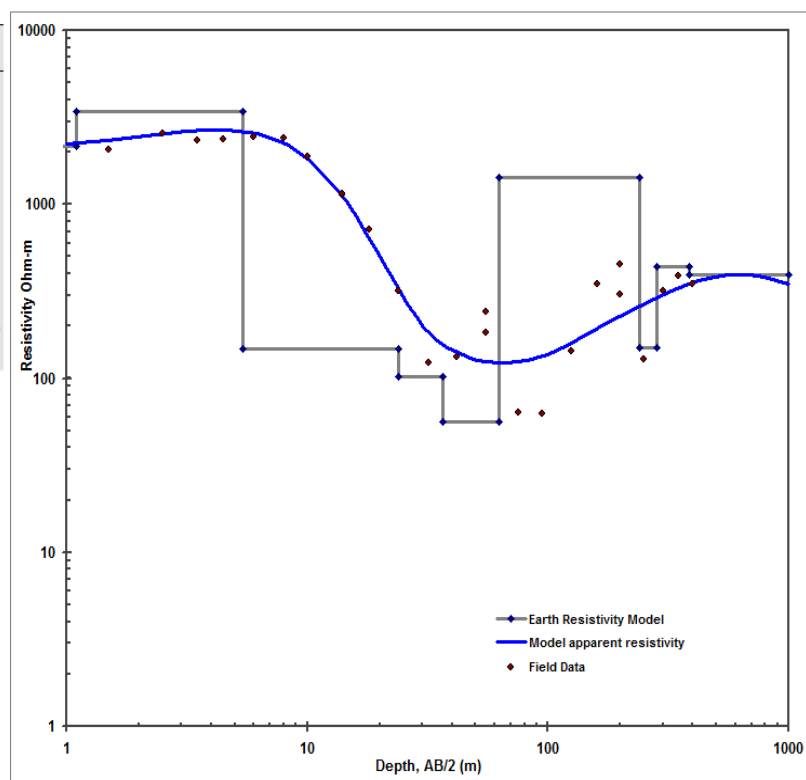
Very Coarse Gravel: 0.0%
 Coarse Gravel: 0.0%
 Medium Gravel: 0.0%
 Fine Gravel: 0.0%
 Very Fine Gravel: 20.1%
 Very Coarse Sand: 60.5%
 Coarse Sand: 14.3%
 Medium Sand: 3.6%
 Fine Sand: 1.1%
 Very Fine Sand: 0.4%
 Very Coarse Silt: 0.0%
 Coarse Silt: 0.0%
 Medium Silt: 0.0%
 Fine Silt: 0.0%
 Very Fine Silt: 0.0%
 Clay: 0.0%

I: Vertical Electrical Sounding (VES) in selected locations



Number of Layers 9			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	1.10	1.10	2160.00
2	4.30	5.40	3400.00
3	18.60	24.00	148.00
4	12.70	36.70	102.00
5	26.20	62.90	56.40
6	177.10	240.00	1430.00
7	44.00	284.00	151.00
8	101.00	385.00	439.00
9	-	-	394.00
-	-	-	-

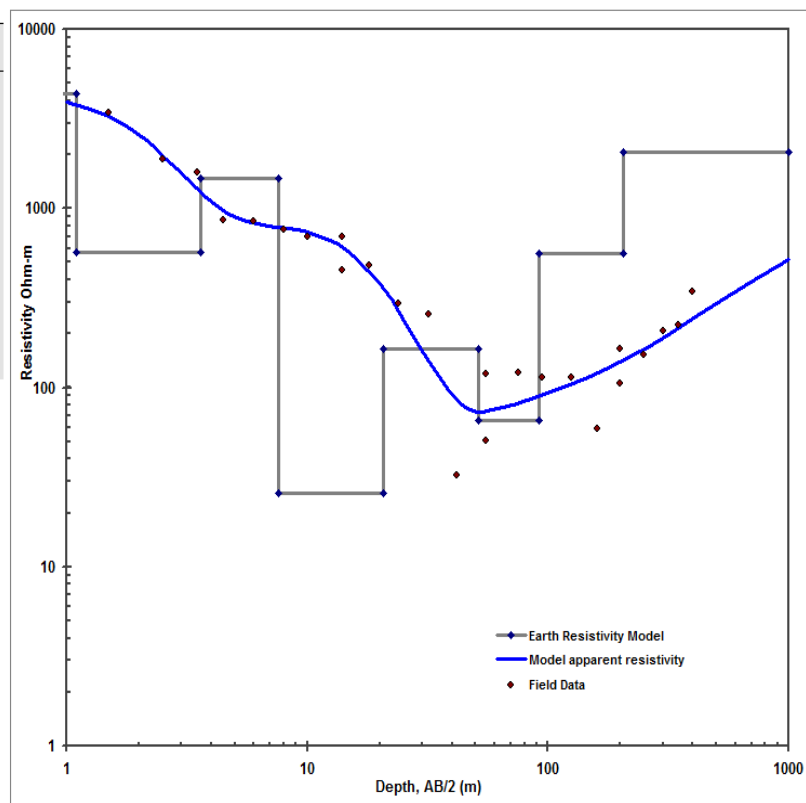
FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	2051.30
2.5	2539.60
3.5	2348.60
4.5	2380.10
6.0	2434.70
8.0	2390.00
10.0	1893.80
14.0	1127.90
14.0	1145.10
18.0	715.10
24.0	320.30
32.0	123.80
42.0	132.20
55.0	239.70
55.0	182.50
75.0	63.50
95.0	62.40
125.0	143.40
160.0	346.40
200.0	452.20
200.0	304.30
250.0	128.30
300.0	317.30
350.0	390.00
400.0	351.30



VES NUMBER: 2 DIRECTION LAYOUT: DATE: June 1, 2017
 LOCATION: OVIM, ISUIKWUATO LGA, ABIA STATE
 COORDINATES: N5° 43.123' E7° 31.459' ELEVATION: 458ft
 PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	1.10	1.10	4340.00
2	2.50	3.60	566.00
3	4.00	7.60	1470.00
4	13.20	20.80	25.70
5	30.60	51.40	165.00
6	40.00	91.40	65.80
7	114.60	206.00	565.00
8	-	-	2060.00
-	-	-	-
-	-	-	-

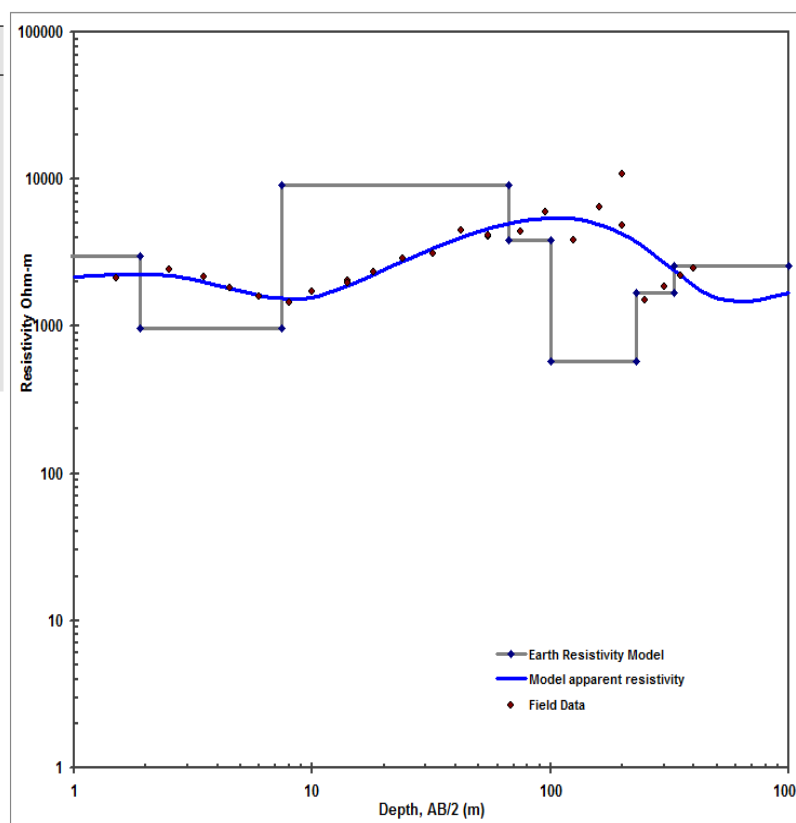
FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	3399.40
2.5	1867.40
3.5	1596.10
4.5	865.40
6.0	853.60
8.0	762.00
10.0	696.30
14.0	449.40
14.0	694.00
18.0	480.90
24.0	294.70
32.0	258.10
42.0	32.30
55.0	50.80
55.0	119.80
75.0	120.90
95.0	114.50
125.0	114.50
160.0	58.90
200.0	106.30
200.0	164.60
250.0	153.50
300.0	206.60
350.0	224.20
400.0	340.80



VES NUMBER: 3 DIRECTION LAYOUT: DATE: June 1, 2017
 LOCATION: UBAHA EZIAMA, NNEATO, UMUNNEOCHI LGA, ABIA STATE
 COORDINATES: N5° 56.802' E7° 18.225' ELEVATION: 593ft
 PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	0.80	0.80	2110.00
2	1.10	1.90	3000.00
3	5.50	7.40	970.00
4	59.20	66.60	9200.00
5	33.40	100.00	3840.00
6	130.00	230.00	580.00
7	102.00	332.00	1690.00
8	-	-	2580.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	2145.20
2.5	2424.70
3.5	2168.90
4.5	1814.30
6.0	1581.20
8.0	1461.40
10.0	1722.20
14.0	2062.70
14.0	1964.30
18.0	2354.80
24.0	2896.90
32.0	3105.80
42.0	4516.20
55.0	4069.50
55.0	4143.20
75.0	4423.70
95.0	6036.20
125.0	3838.90
160.0	6467.00
200.0	10811.20
200.0	4880.70
250.0	1516.10
300.0	1868.30
350.0	2222.40
400.0	2475.70



VES NUMBER: 4 DIRECTION LAYOUT: DATE: June 1, 2017

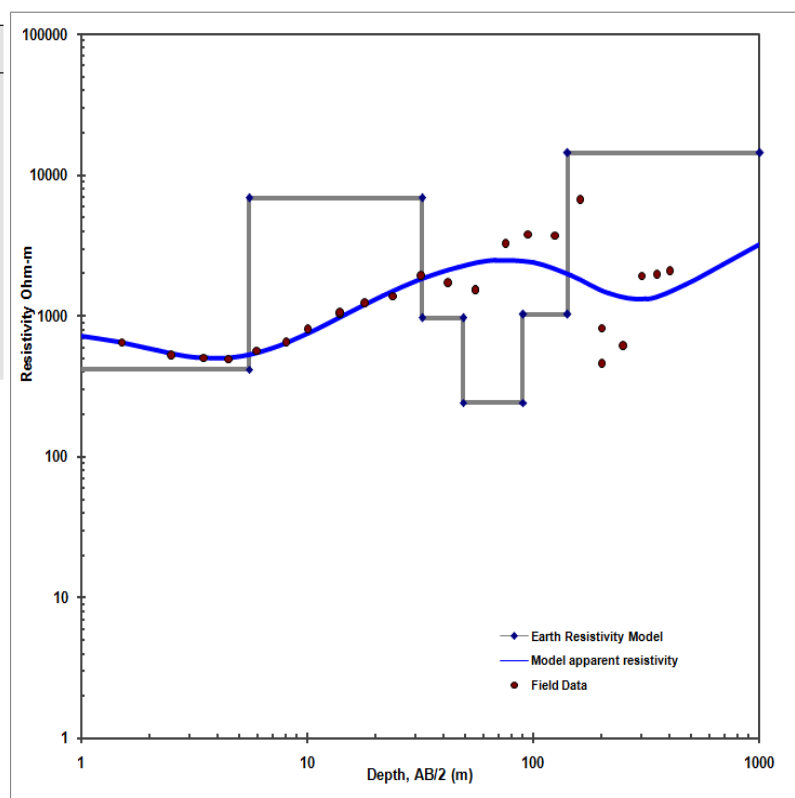
LOCATION: UMUOWA, UMULOLO OKIGWE LGA, IMOSTATE

COORDINATES: N5° 51.984' E7° 19.611' ELEVATION: 550ft

PROJECT RESEARCH WORK

Number of Layers 7			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	0.80	0.80	790.00
2	4.70	5.50	416.00
3	26.60	32.10	6840.00
4	16.60	48.70	970.00
5	40.90	89.60	241.00
6	51.40	141.00	1020.00
7	-	-	14400.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	648.70
2.5	521.10
3.5	503.80
4.5	495.20
6.0	567.90
8.0	642.40
10.0	801.30
14.0	1028.30
14.0	1044.50
18.0	1224.40
24.0	1384.40
32.0	1900.00
42.0	1688.30
55.0	1519.60
55.0	1519.40
75.0	3226.70
95.0	3796.50
125.0	3733.30
160.0	6583.80
200.0	452.20
200.0	818.70
250.0	603.40
300.0	1921.60
350.0	1953.50
400.0	2065.20



VES NUMBER: 5 DIRECTION LAYOUT: DATE: June 2, 2017

LOCATION: OWERRI NKWORJI, NWANGELE LGA, IMOSTATE

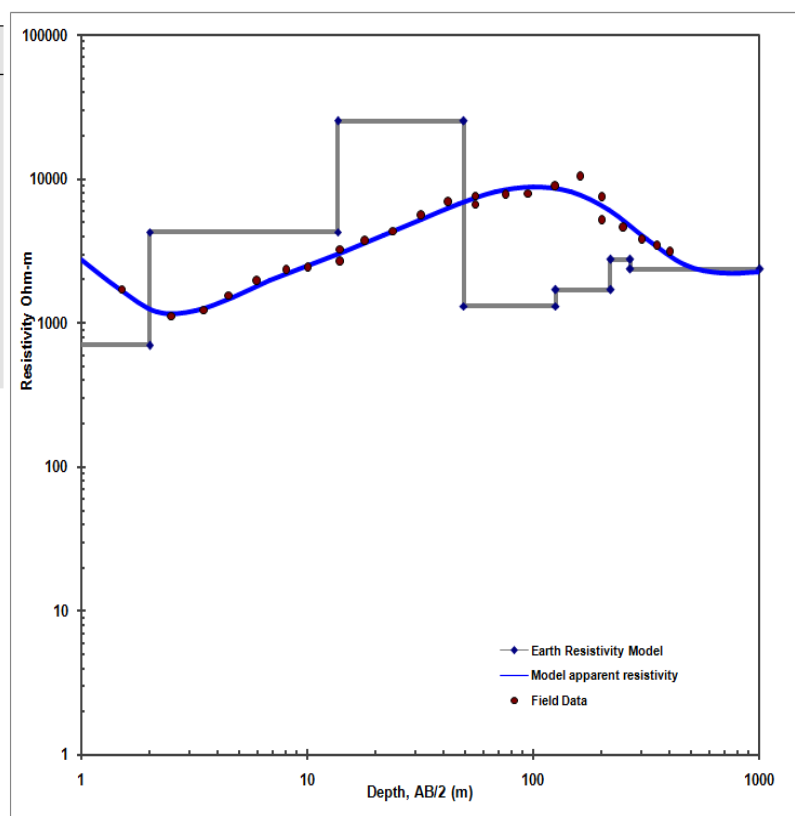
COORDINATES: N5° 44.113' E7° 05.679' ELEVATION: 579ft

PROJECT: RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	0.50	0.50	4890.00
2	1.50	2.00	698.00
3	11.60	13.60	4270.00
4	35.60	49.20	25200.00
5	75.80	125.00	1310.00
6	94.00	219.00	1690.00
7	49.00	268.00	2760.00
8	-	-	2360.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)

1.5	1718.20
2.5	1118.90
3.5	1232.70
4.5	1559.30
6.0	1933.80
8.0	2310.00
10.0	2415.40
14.0	2655.00
14.0	3253.00
18.0	3675.00
24.0	4359.20
32.0	5566.00
42.0	6874.40
55.0	7645.60
55.0	6682.40
75.0	7774.60
95.0	7943.90
125.0	8800.50
160.0	10392.80
200.0	7463.40
200.0	5166.90
250.0	4563.00
300.0	3786.10
350.0	3440.60
400.0	3097.40



VES NUMBER: 6 DIRECTION LAYOUT: DATE: June 2, 2017

LOCATION: UMUOPARA AKOKWA, IDEATO NORTH LGA, IMOSTATE

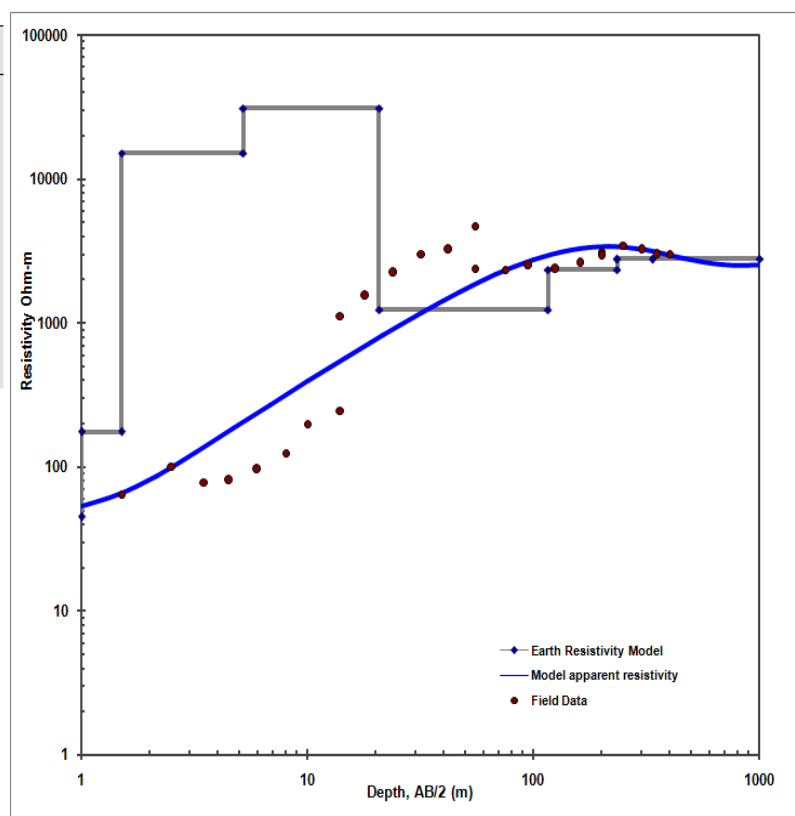
COORDINATES: N5° 54.141' E7° 07.905' ELEVATION: 954ft

PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	1.00	1.00	45.00
2	0.50	1.50	174.00
3	3.70	5.20	15100.00
4	15.50	20.70	31000.00
5	95.30	116.00	1235.00
6	119.00	235.00	2340.00
7	100.00	335.00	2770.00
8	-	-	2780.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)

1.5	64.20
2.5	100.80
3.5	77.90
4.5	80.20
6.0	95.70
8.0	124.90
10.0	198.50
14.0	245.60
14.0	1120.40
18.0	1545.60
24.0	2240.80
32.0	3018.20
42.0	3225.70
55.0	4713.10
55.0	2384.20
75.0	2344.60
95.0	2510.10
125.0	2349.30
160.0	2604.00
200.0	3054.10
200.0	2910.80
250.0	3455.30
300.0	3228.30
350.0	2986.10
400.0	3022.20



VES NUMBER: 7 DIRECTION LAYOUT: DATE: June 2, 2017

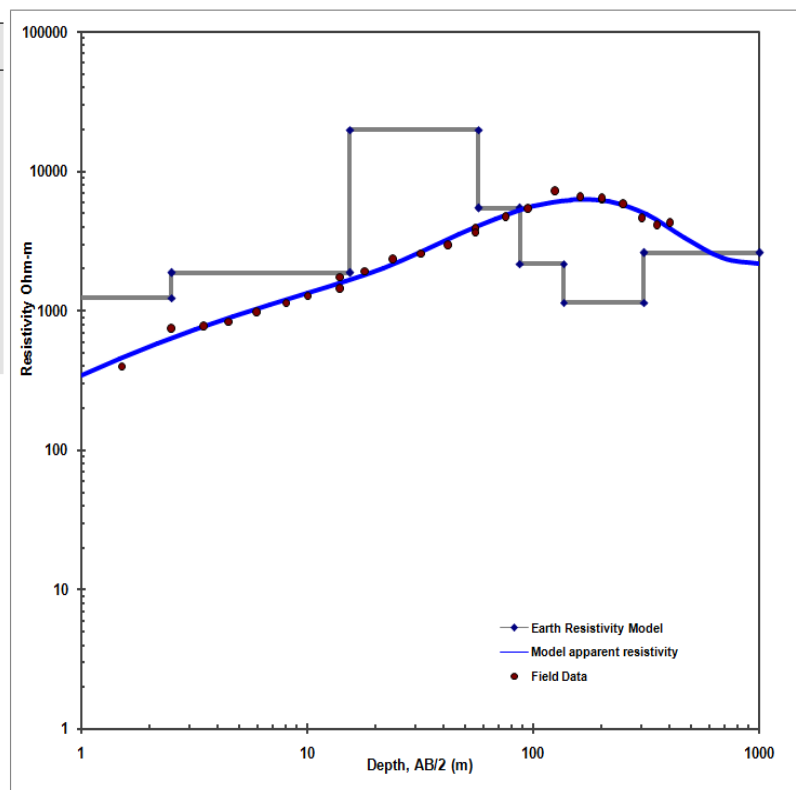
LOCATION: EZIOHA IHIOMA, ORLU LGA, IMOSTATE

COORDINATES: N5° 48.305' E6° 59.758' ELEVATION: 513ft

PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	0.50	0.50	212.00
2	2.00	2.50	1230.00
3	12.90	15.40	1870.00
4	41.70	57.10	19800.00
5	29.90	87.00	5430.00
6	49.00	136.00	2170.00
7	172.00	308.00	1140.00
8	-	-	2610.00

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	399.60
2.5	738.90
3.5	767.50
4.5	833.40
6.0	962.90
8.0	1139.00
10.0	1281.10
14.0	1433.60
14.0	1747.40
18.0	1929.20
24.0	2305.60
32.0	2581.40
42.0	2908.20
55.0	3837.00
55.0	3661.40
75.0	4658.10
95.0	5322.70
125.0	7153.60
160.0	6524.00
200.0	6284.90
200.0	6359.70
250.0	5746.20
300.0	4566.30
350.0	4046.80
400.0	4245.20

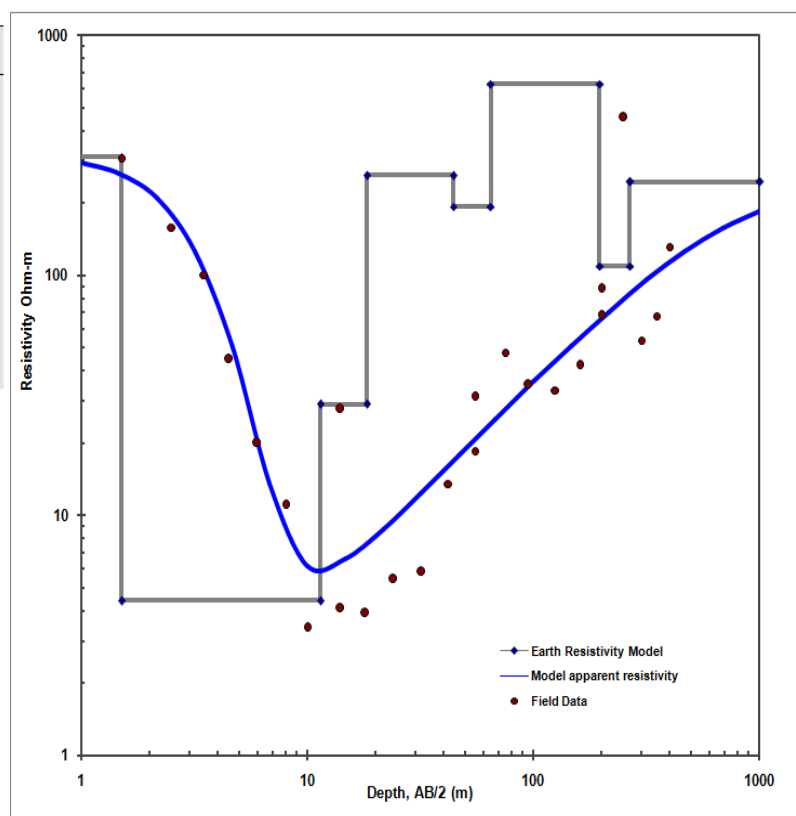


VES NUMBER: 8 DIRECTION LAYOUT: DATE: June 2, 2017
 LOCATION: OBIGBO AMAIGBO, NWANGELE LGA, IMOSTATE
 COORDINATES: N5° 43.545' E7° 06.297' ELEVATION: 592ft
 PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	1.50	1.50	311.00
2	9.90	11.40	4.40
3	6.90	18.30	28.90
4	25.80	44.10	260.00
5	20.60	64.70	193.00
6	131.30	196.00	626.00
7	71.00	267.00	109.00
8	-	-	245.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)

1.5	307.40
2.5	158.30
3.5	100.40
4.5	44.70
6.0	20.00
8.0	11.00
10.0	3.40
14.0	4.10
14.0	27.70
18.0	3.90
24.0	5.40
32.0	5.80
42.0	13.50
55.0	18.50
55.0	31.00
75.0	47.60
95.0	34.90
125.0	33.10
160.0	42.10
200.0	67.80
200.0	87.90
250.0	454.40
300.0	53.50
350.0	67.60
400.0	131.30



VES NUMBER: 9 DIRECTION LAYOUT: DATE: June 1, 2017

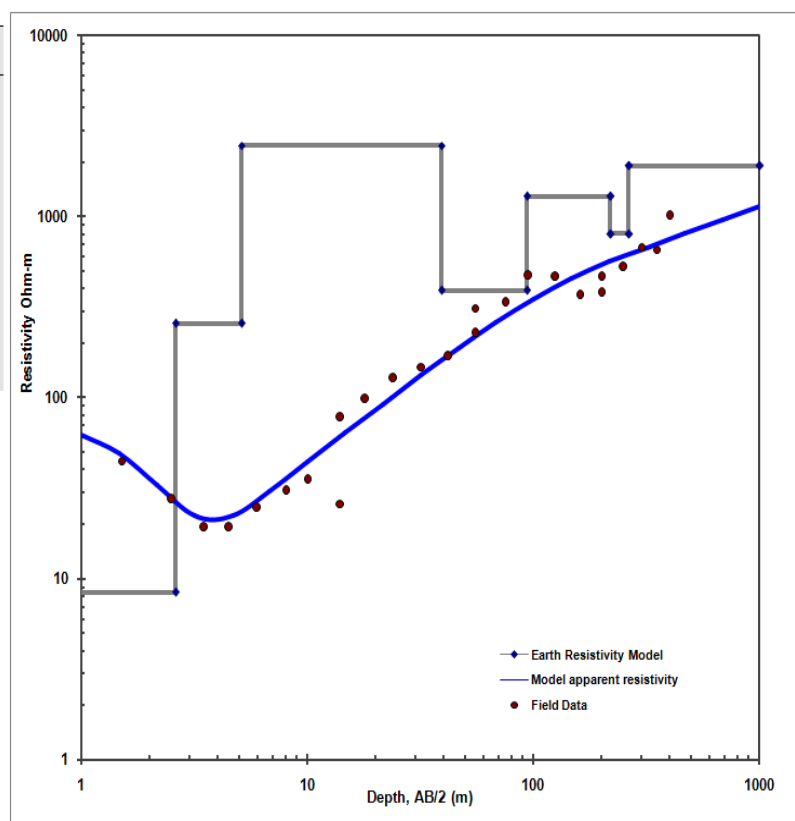
LOCATION: AMURO, OKIGWE LGA, IMOSTATE

COORDINATES: N5° 47.550' E7° 17.158' ELEVATION: 301ft

PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	0.90	0.90	74.00
2	1.70	2.60	8.40
3	2.50	5.10	255.00
4	34.10	39.20	2460.00
5	54.40	93.60	390.00
6	125.40	219.00	1290.00
7	45.00	264.00	800.00
8	-	-	1900.00
-	-	-	-
-	-	-	-

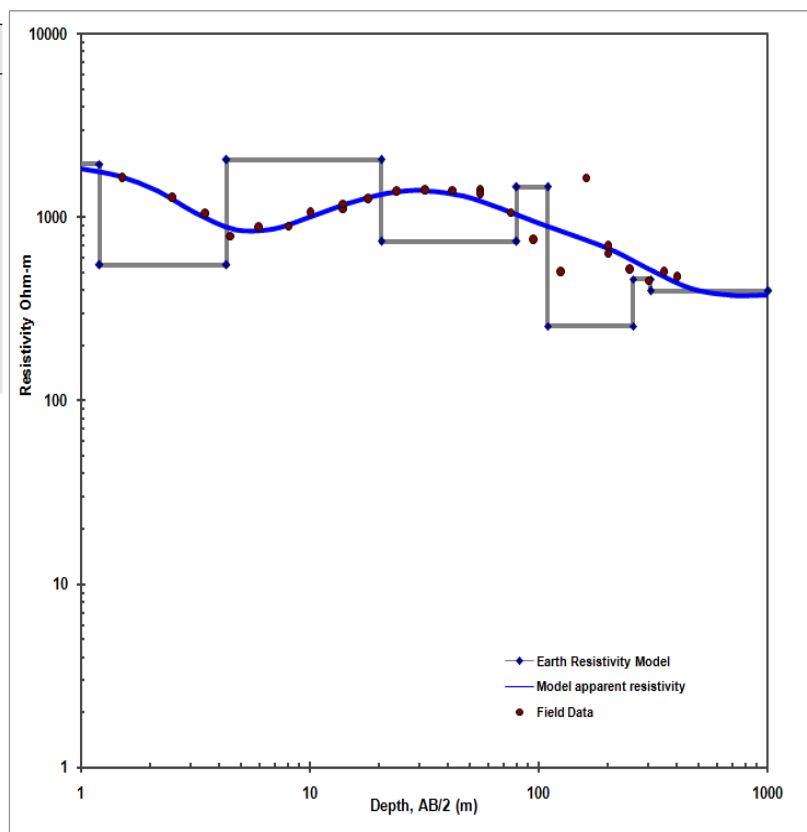
FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	44.70
2.5	27.30
3.5	19.10
4.5	19.10
6.0	24.60
8.0	30.40
10.0	35.00
14.0	25.90
14.0	77.20
18.0	97.50
24.0	127.40
32.0	147.20
42.0	168.40
55.0	226.10
55.0	310.70
75.0	332.50
95.0	468.00
125.0	461.20
160.0	366.70
200.0	376.40
200.0	464.30
250.0	523.20
300.0	676.70
350.0	656.80
400.0	1002.50



VES NUMBER: 10 DIRECTION LAYOUT: DATE: May 29, 2017
 LOCATION: UMUODE ROAD, ABA NORTH LGA, ABIA STATE
 COORDINATES: N5° 6.782' E7° 19.910' ELEVATION: 237ft
 PROJECT: RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	1.20	1.20	1950.00
2	3.10	4.30	547.00
3	16.10	20.40	2060.00
4	59.10	79.50	736.00
5	29.50	109.00	1460.00
6	148.00	257.00	254.00
7	50.00	307.00	458.00
8	-	-	394.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	1622.80
2.5	1271.50
3.5	1042.20
4.5	788.80
6.0	871.80
8.0	895.80
10.0	1050.00
14.0	1115.60
14.0	1187.20
18.0	1244.30
24.0	1369.20
32.0	1389.20
42.0	1401.40
55.0	1396.60
55.0	1333.30
75.0	1061.20
95.0	747.20
125.0	497.90
160.0	1642.80
200.0	691.90
200.0	634.80
250.0	515.50
300.0	450.90
350.0	500.00
400.0	468.10



VES NUMBER: 11 DIRECTION LAYOUT: DATE: May 29, 2017

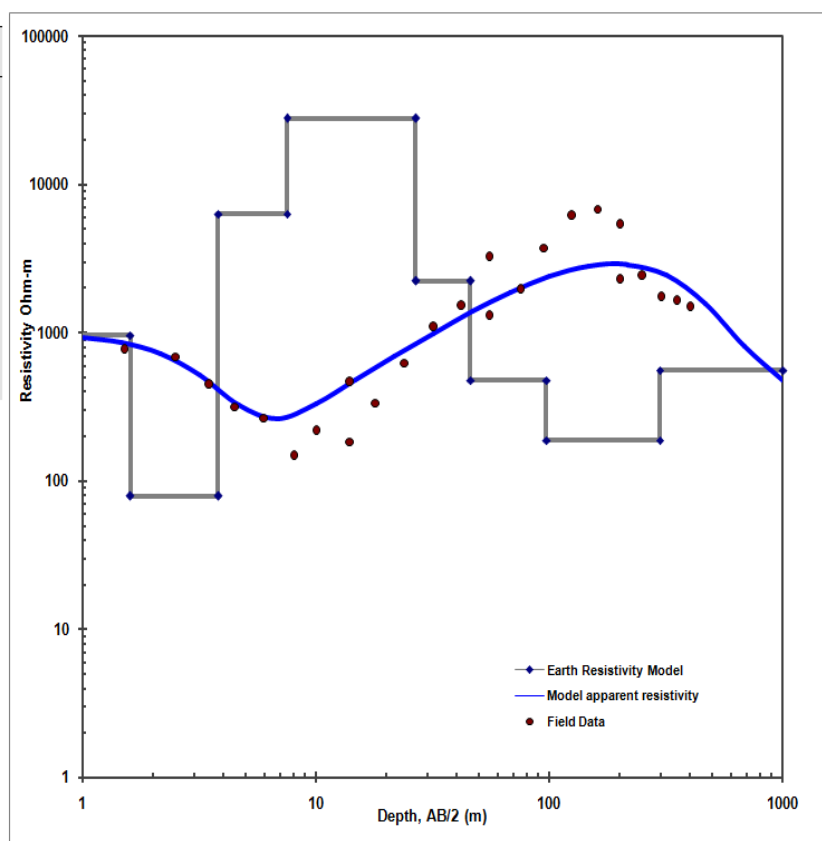
LOCATION: OBOHIA NDOKI, UKWA EAST LGA, ABIA STATE

COORDINATES: N4° 54.120' E7° 22.823' ELEVATION: 83ft

PROJECT: RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	1.60	1.60	960.00
2	2.20	3.80	79.00
3	3.70	7.50	6290.00
4	19.20	26.70	27900.00
5	19.10	45.80	2230.00
6	51.00	96.80	475.00
7	200.20	297.00	187.00
8	-	-	555.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	763.60
2.5	689.40
3.5	446.90
4.5	317.00
6.0	266.30
8.0	147.40
10.0	216.70
14.0	183.80
14.0	463.20
18.0	336.10
24.0	622.90
32.0	1089.60
42.0	1513.10
55.0	3232.60
55.0	1291.50
75.0	1955.50
95.0	3736.10
125.0	6100.00
160.0	6811.70
200.0	5334.20
200.0	2266.70
250.0	2424.70
300.0	1737.50
350.0	1626.60
400.0	1483.20



VES NUMBER: 12 DIRECTION LAYOUT: DATE: May 29, 2017

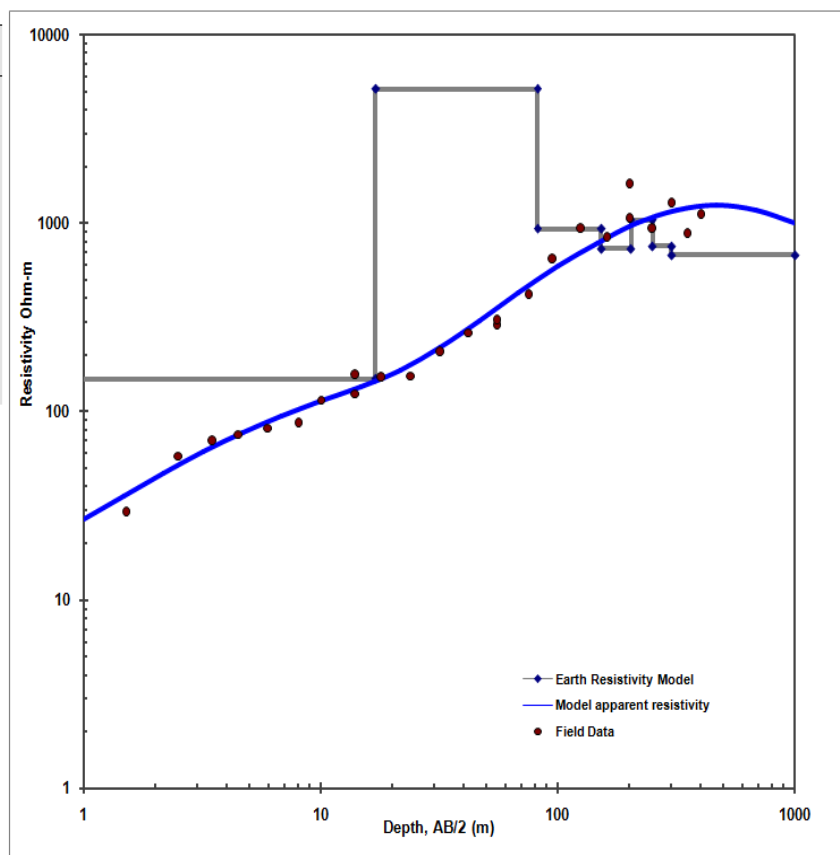
LOCATION: OVOM ABA, OBINGWA LGA, ABIA STATE

COORDINATES: N5° 06.421' E7° 23.296' ELEVATION: 227ft

PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	0.60	0.60	17.70
2	16.40	17.00	148.00
3	65.00	82.00	5140.00
4	70.00	152.00	930.00
5	51.00	203.00	728.00
6	48.00	251.00	1040.00
7	50.00	301.00	751.00
8	-	-	675.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	29.00
2.5	58.20
3.5	69.50
4.5	75.70
6.0	81.90
8.0	86.60
10.0	115.20
14.0	155.20
14.0	124.60
18.0	150.40
24.0	154.40
32.0	206.10
42.0	262.80
55.0	285.10
55.0	305.50
75.0	414.00
95.0	637.70
125.0	932.10
160.0	835.30
200.0	1605.60
200.0	1049.20
250.0	927.90
300.0	1275.10
350.0	874.20
400.0	1102.40



VES NUMBER: 13 DIRECTION LAYOUT: DATE: May 29, 2017

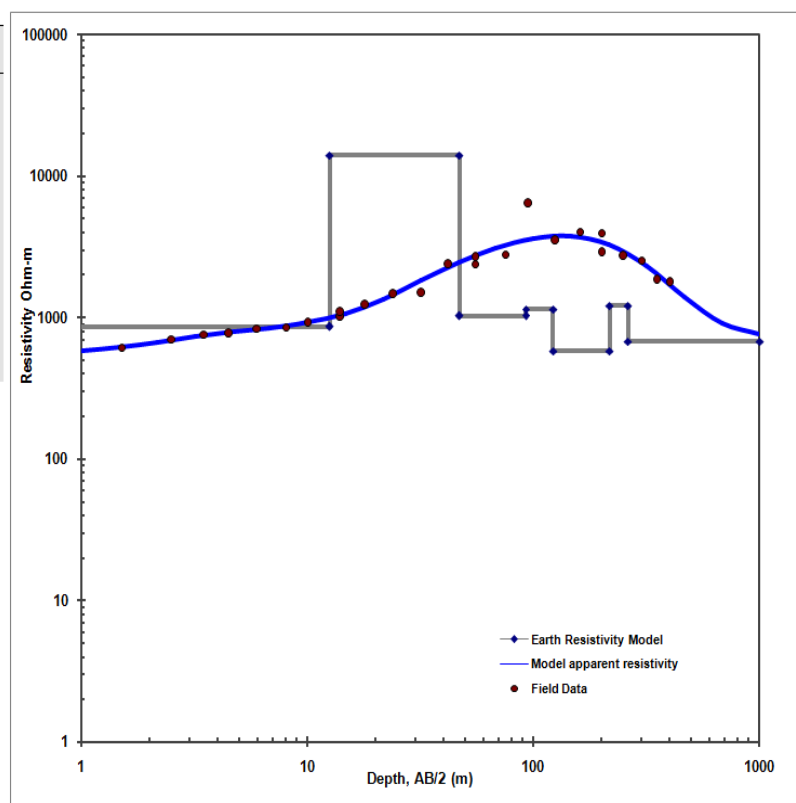
LOCATION: OBOHIA ABA SOUTH LGA, ABIA STATE

COORDINATES: N5° 05.873' E7° 21.993' ELEVATION: 215ft

PROJECT: RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	0.90	0.90	552.00
2	11.60	12.50	860.00
3	34.50	47.00	14000.00
4	45.30	92.30	1020.00
5	29.70	122.00	1140.00
6	95.00	217.00	577.00
7	45.00	262.00	1210.00
8	-	-	675.00

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	611.60
2.5	700.70
3.5	759.60
4.5	769.90
6.0	836.50
8.0	851.20
10.0	917.00
14.0	1003.10
14.0	1086.50
18.0	1227.20
24.0	1458.80
32.0	1476.90
42.0	2349.40
55.0	2658.00
55.0	2387.00
75.0	2795.10
95.0	6377.10
125.0	3487.00
160.0	4039.70
200.0	3958.40
200.0	2875.50
250.0	2692.30
300.0	2531.00
350.0	1840.00
400.0	1764.10



VES NUMBER: 14 DIRECTION LAYOUT: DATE: May 26, 2017

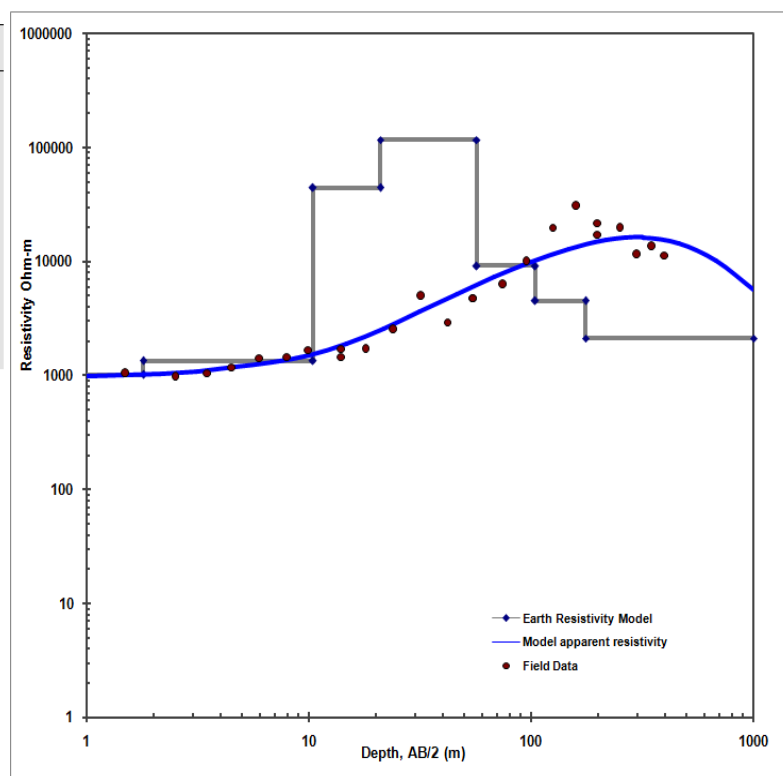
LOCATION: LORJI, ABOH MBAISE LGA, IMO STATE

COORDINATES: N5° 24.186' E7° 17.495' ELEVATION: 359ft

PROJECT: RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	0.80	0.80	970.00
2	1.00	1.80	1010.00
3	8.60	10.40	1340.00
4	10.60	21.00	44100.00
5	36.00	57.00	116000.00
6	47.00	104.00	9100.00
7	72.00	176.00	4500.00
8	-	-	2110.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	1037.50
2.5	968.00
3.5	1050.10
4.5	1176.90
6.0	1421.70
8.0	1457.40
10.0	1666.20
14.0	1714.00
14.0	1454.50
18.0	1688.40
24.0	2528.70
32.0	4921.40
42.0	2916.10
55.0	4768.50
55.0	4786.70
75.0	6228.20
95.0	9882.30
125.0	19808.50
160.0	30336.00
200.0	21756.20
200.0	17179.70
250.0	19650.10
300.0	11470.80
350.0	13440.50
400.0	11275.70



VES NUMBER: 15 DIRECTION LAYOUT: DATE: May 25, 2017

LOCATION: OBIZI EZINIHITE MBAISE LGA, IMO STATE

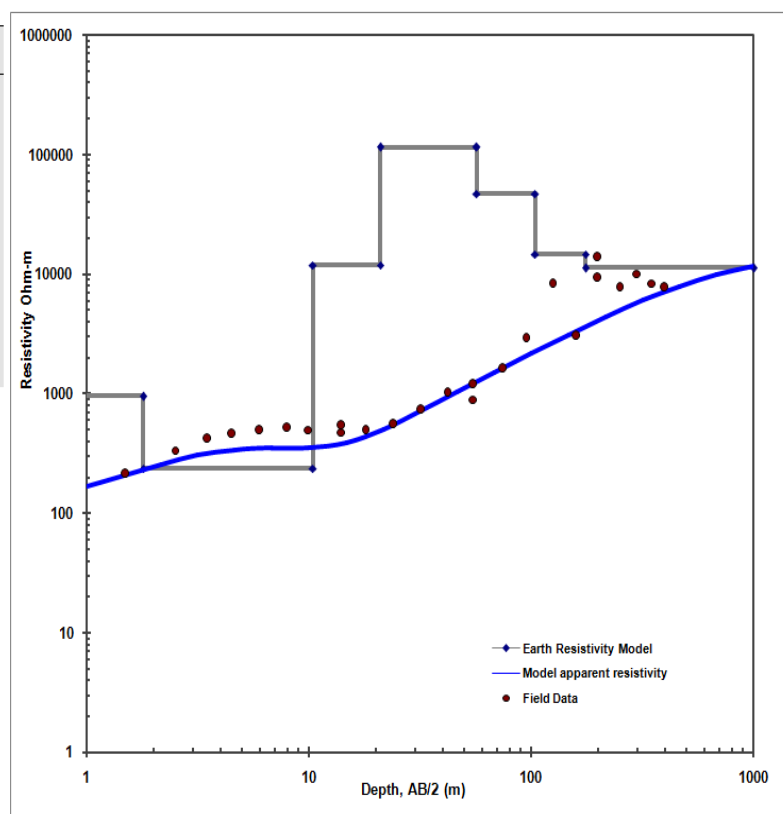
COORDINATES: N5° 30.034' E7° 20.648' ELEVATION: 557ft

PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	0.80	0.80	135.00
2	1.00	1.80	950.00
3	8.60	10.40	236.00
4	10.60	21.00	11800.00
5	36.00	57.00	115000.00
6	47.00	104.00	46700.00
7	72.00	176.00	14600.00
8	-	-	11250.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)

1.5	213.80
2.5	334.00
3.5	416.00
4.5	455.70
6.0	495.00
8.0	512.80
10.0	497.00
14.0	475.60
14.0	542.60
18.0	488.00
24.0	556.30
32.0	731.40
42.0	1019.40
55.0	893.40
55.0	1188.40
75.0	1610.30
95.0	2882.00
125.0	8310.90
160.0	3027.40
200.0	13842.00
200.0	9331.70
250.0	7731.90
300.0	10050.40
350.0	8361.20
400.0	7665.50



VES NUMBER: 16 DIRECTION LAYOUT: DATE: May 25, 2017

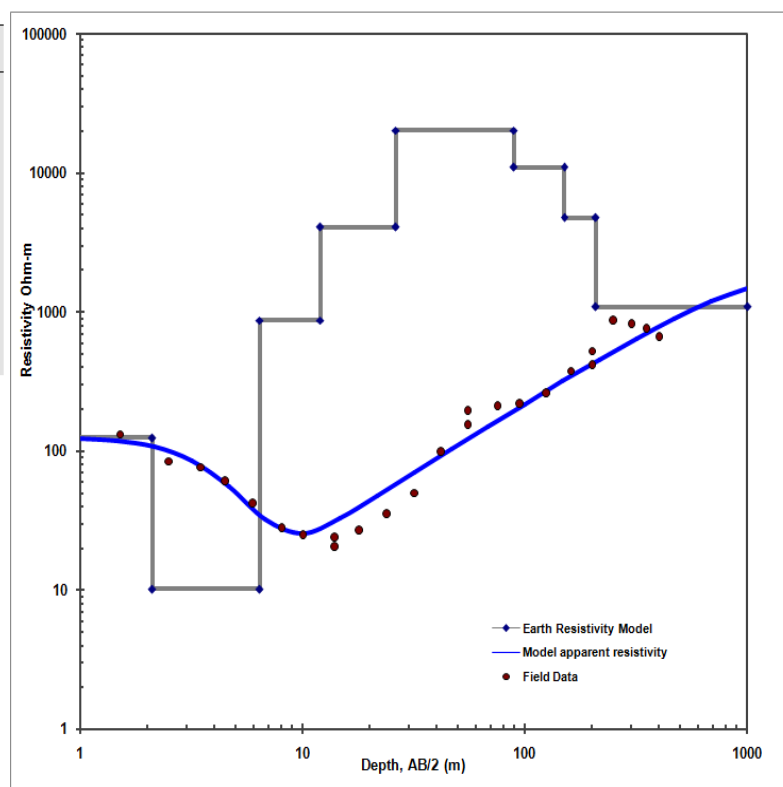
LOCATION: EZIUDO EZINIHITE MBAISE LGA, IMO STATE

COORDINATES: N5° 29.053' E7° 19.443' ELEVATION: 490ft

PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	2.10	2.10	124.00
2	4.30	6.40	10.10
3	5.60	12.00	870.00
4	14.20	26.20	4050.00
5	62.90	89.10	20200.00
6	60.90	150.00	10900.00
7	58.00	208.00	4740.00
8	-	-	1090.00
-	-	-	-
-	-	-	-

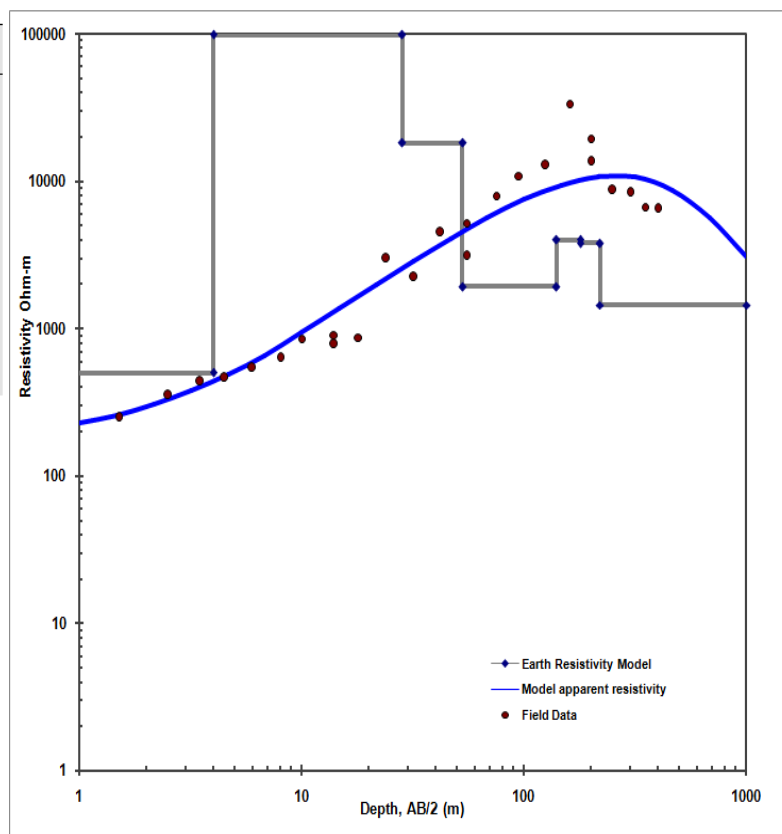
FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	132.40
2.5	84.60
3.5	76.60
4.5	59.90
6.0	41.60
8.0	27.60
10.0	24.50
14.0	20.30
14.0	23.80
18.0	26.50
24.0	35.10
32.0	50.10
42.0	97.40
55.0	153.40
55.0	193.80
75.0	208.50
95.0	215.90
125.0	257.60
160.0	376.20
200.0	410.30
200.0	525.60
250.0	856.50
300.0	810.70
350.0	747.50
400.0	655.20



VES NUMBER: 17 DIRECTION LAYOUT: DATE: May 25, 2017
 LOCATION: EZIALA ENYIOGUGU ABOH MBAISE LGA, IMO STATE
 COORDINATES: N5° 28.153' E7° 12.408' ELEVATION: 393ft
 PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	0.90	0.90	206.00
2	3.10	4.00	497.00
3	24.30	28.30	98000.00
4	24.50	52.80	18100.00
5	87.20	140.00	1920.00
6	39.00	179.00	3980.00
7	41.00	220.00	3790.00
8	-	-	1440.00
-	-	-	-
-	-	-	-

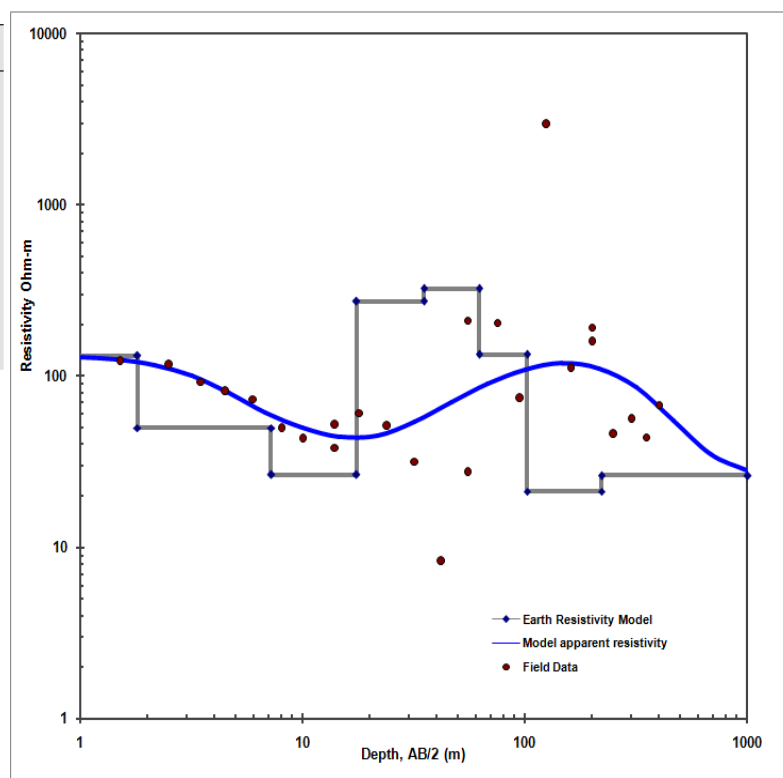
FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	248.80
2.5	353.10
3.5	435.20
4.5	464.00
6.0	537.10
8.0	630.20
10.0	850.40
14.0	903.40
14.0	777.60
18.0	869.70
24.0	2972.80
32.0	2231.40
42.0	4484.90
55.0	5179.50
55.0	3116.10
75.0	7957.30
95.0	10841.50
125.0	12869.50
160.0	33474.60
200.0	13659.00
200.0	19452.30
250.0	8649.40
300.0	8355.10
350.0	6680.70
400.0	6463.80



VES NUMBER: 18 DIRECTION LAYOUT: DATE: May 25, 2017
 LOCATION: AGUNEZE, AHIAZU MBAISE LGA, IMO STATE
 COORDINATES: N5° 32.677' E7° 18.453' ELEVATION: 526ft
 PROJECT: RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	1.80	1.80	131.00
2	5.40	7.20	49.60
3	10.20	17.40	26.40
4	17.60	35.00	272.00
5	27.20	62.20	323.00
6	39.80	102.00	133.00
7	119.00	221.00	21.20
8	-	-	26.20
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	121.50
2.5	116.50
3.5	92.80
4.5	81.50
6.0	73.50
8.0	49.20
10.0	42.70
14.0	38.10
14.0	51.60
18.0	60.70
24.0	50.80
32.0	31.60
42.0	8.30
55.0	27.40
55.0	210.70
75.0	204.30
95.0	73.90
125.0	2946.20
160.0	111.20
200.0	191.90
200.0	158.60
250.0	45.60
300.0	55.70
350.0	43.90
400.0	67.70



VES NUMBER: 19 DIRECTION LAYOUT: DATE: May 26, 2017

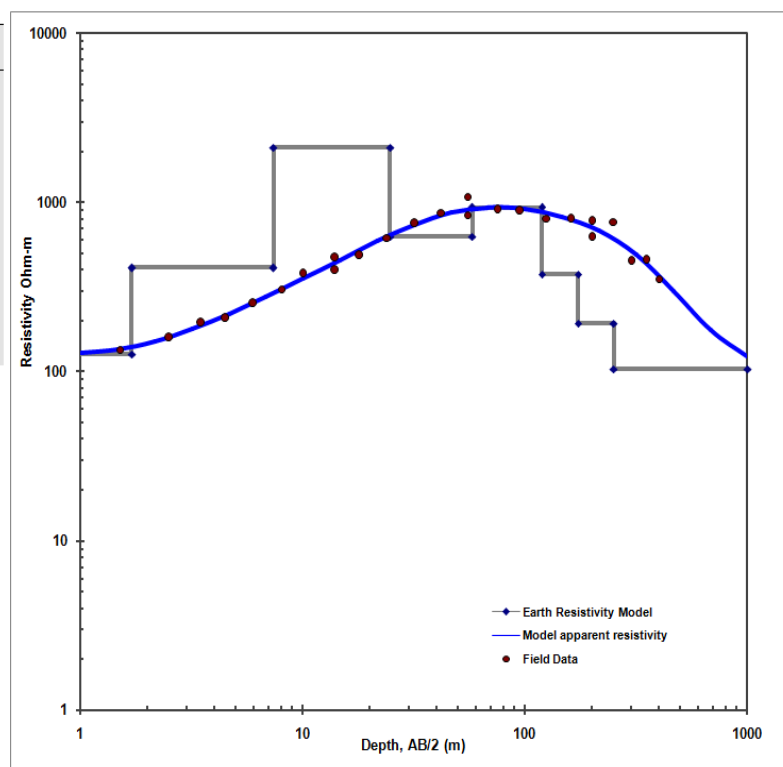
LOCATION: UMUELEMAL, ISIALA MBANO LGA, IMO STATE

COORDINATES: N5° 41.032' E7° 14.482' ELEVATION: 504ft

PROJECT RESEARCH WORK

Number of Layers 8			
Layer NO	Thickness (m)	Depth (m)	ρ (Ω -m)
1	1.70	1.70	126.00
2	5.70	7.40	410.00
3	17.30	24.70	2110.00
4	33.30	58.00	627.00
5	61.00	119.00	930.00
6	54.00	173.00	375.00
7	78.00	251.00	192.00
8	-	-	103.00
-	-	-	-
-	-	-	-

FIELD DATA	
AB/2 (m)	ρ_a (Ω -m)
1.5	134.30
2.5	157.90
3.5	193.20
4.5	205.50
6.0	252.60
8.0	306.00
10.0	377.90
14.0	468.10
14.0	394.60
18.0	483.80
24.0	615.30
32.0	745.00
42.0	867.70
55.0	842.70
55.0	1079.40
75.0	906.50
95.0	889.80
125.0	801.20
160.0	799.70
200.0	619.60
200.0	768.70
250.0	765.70
300.0	448.40
350.0	454.40
400.0	351.80



VES NUMBER: 20 DIRECTION LAYOUT: DATE: May 26, 2017

LOCATION: UMUEZEALA EHIME MBANO LGA, IMO STATE

COORDINATES: N5° 37.952' E7° 16.583' ELEVATION: 569ft

PROJECT RESEARCH WORK