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The Archaeogeological Situation Of Babylon Site (IRAQ)

الوضع الجيواثاري لموقع بابل (العراق)

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Abstract :

Babylon archaeological site cited 90 kilometers south of Baghdad and 10 kilometers north of Hilla city. The studied site cited on the eastern bank of Shatt Al-Hilla (branch of the Euphrates River).

Office processing for the collected data started with preparing a combined topographic map for the studied site using a digital elevation model(DEM) with 90 m., and Global Maker 10,then topographic contour lines using Arc Map9.3 with spatial analyst tools. The Google Earth image used as a base to the topographic map. The borehole logs prepared by using Arc Map 9.3, three lithological cross sections are created using Rock Works 15program.

The Internal and external Walls played an important role in controlling the manner of sedimentation in the area inside them.

Two certain ancient residential levels (and some uncertain ones) are Discovered. The oldest Level cited about 10 meters above sea level and about 17-21 meters below ground surface. The youngest one level was cited on depth 21 meters above sea level and on 7- 10 meters below ground surface.

Key words : Babylon, Archaegeology, Ancient Mesopotamia, Ziqurate, Paleo residential Surfaces .

الملخص:

يقع موقع بابل الاثري حوالي ٩٠ كيلومتراً جنوب بغداد و١٠ كيلومتراً شمال مدينة الحلة ويقع الجزء المدروس من الموقع على الضفة الشرقية لشط الحلة.

تمت المعالجة المكتبية بإعداد خارطة طوبوغرافية مركبة لمنطقة الدراسة بإستخدام موديل المرتفعات (DEM) لتسعين متر، ثم تحويلها الى قاعدة بيانات باستخدام Global Mapper 10، ثم خطوط ارتفاعات كونتورية باستخدام Arc Map 9.3 مع وسائل التحليل المكاني، وصورة Google Earth كقاعدة للخارطة الطوبوغرافية تم اعداد سجلات الآبار باستخدام Arc Map 9.3 والمقاطع الليثولوجية باستخدام برنامج Rock Works 15 .

وقد تبين ان وجود السور الداخلي والخارجي لمدينة بابل قد لعب دوراً في تحديد الترسبات وتاثير الفيضانات الدورية او المستحثة . تم تاشير سطحين على الاقل (بالاضافة الى مؤشرات على سطوح اخرى غير اكيدة). السطح الاقدم يقع حوالي بين ١٧–٢١ متر تحت مستوى سطح الارض الحالي فيما يقع السطح الاستيطاني الاحدث بحدود بين ٧–١٠ متر تحت سطح الأرض الحالي.

الكلمات الدالة : بابل؛ جيولوجيا اثارية؛ الميزوبوتاميا القديمة؛ سطوح سكنية قديمة؛ الزقورة .

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Introduction:

Babylon archaeological site is located about 90 kilometers to the south of Baghdad and about 10 kilometers to the north of Hilla city. The studied part of the city cited between Longitudes 44 24 45"- 44 27 30" E and Latitudes 32 31 15"-32 33 30"N. The city lies on the eastern bank of Shatt Al-Hilla river (a branch of the Euphrates River) (FIG. №.1a & 1b)[1].

Geologically, the area consists of flood plain and aeolian sediments of Quaternary age. These sediments are formed of layers of silty clay, sand, and silt with gravels as secondary contents (gravelly sand and sometimes gravelly silty clay) located on depths more than 15-20 meters below ground surface[2].

This study was performed for the purpose of finding the possibility of lowering the underground water level to a depth lower than the oldest archaeological horizon, horizon of oldest human occupation which was expected to be at a depth 14-16 meters below present surface (b.p.s.). A preliminary study was made to collect information about the surface and subsurface geology and the hydrogeological condition of the site.

Core and auger drilling of 10 boreholes (of depths ranges 11-45 meters (b.p.s.) and 97 hand-dugged and auger holes with internal distances ranging between 50-200 meters and depths of 1.5-3.0 meters(b.p.s.) have been executed.

1. Geological Investigation and Data Processing:

Surface geological survey which was carried out using topographic base map scale(1:10000) with dense hand dugged and auger holes, the total of these holes is 97 holes with a distance of 50-200 meters between each two holes, the depths of these holes ranges between 1.50-3.00 meters (FIG. №. 1a & 1b).

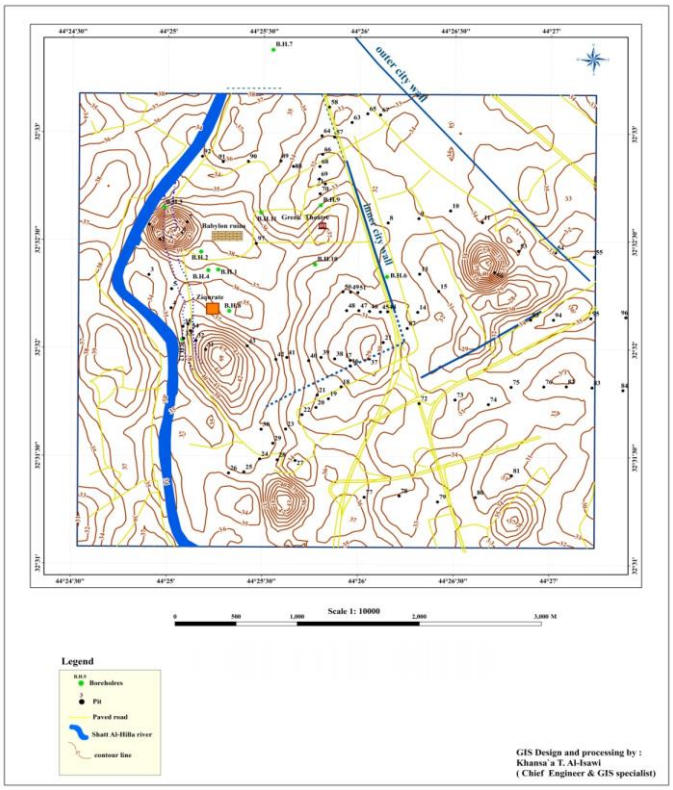
[1] AI-Sam s., Al-Niemi s.,et. al., «Preliminary Study about the Possibility of Lowering the Underground water level in Babylon», *Directorate General of Geological Survey and Mineral Investigation* ,Ministry of Industry, (DGGSMI) , unpublished report, 1979, 5-6.

[2] AL – SAM, AL – NIEMI, ET AL. , «Preliminary Study … in Babylon» , 5 – 6

I would like to express my great thanks for Ms. Khansaa T.Al – Isawi (Chief Engineers, GEOSURV – IRAQ) for great efforts in GIS processing and designing the collected data,
Great thanks for Prof. Olof Pedersen for his great efforts in maturizing most of contents of this research, especially with what related to updating and accuracy of the boreholes coordinates.

Core drilling was set to determine the vertical and horizontal changes in the recent sediments, their types and composition, and also to find out whether there are any archaeological materials and their depths. The depths of cored bore holes varied between 11.0-45.0 meters depending on the lithology and the depths of the archaeological remnants.

A laboratory study for selected soil samples to be studied petrographically for the purpose of delineating the Quaternary – Prequaternary contact.



(FIG. 1a) Topographic Map (With boreholes and pits Locations) For Babylon Archaeological Site.

Office processing for the collected data started with preparing a combined topographic map for the studied site using a digital elevation model(DEM) with 90 m, followed by converting it to a data base file using Global Mapper 10, then topographic contour lines using Arc Map 9.3 with spatial analyst tools. The Google Earth image used as a base to the topographic map. The borehole logs prepared by using Arc Map 9.3, three lithological cross sections are created using Rock Works15 program.

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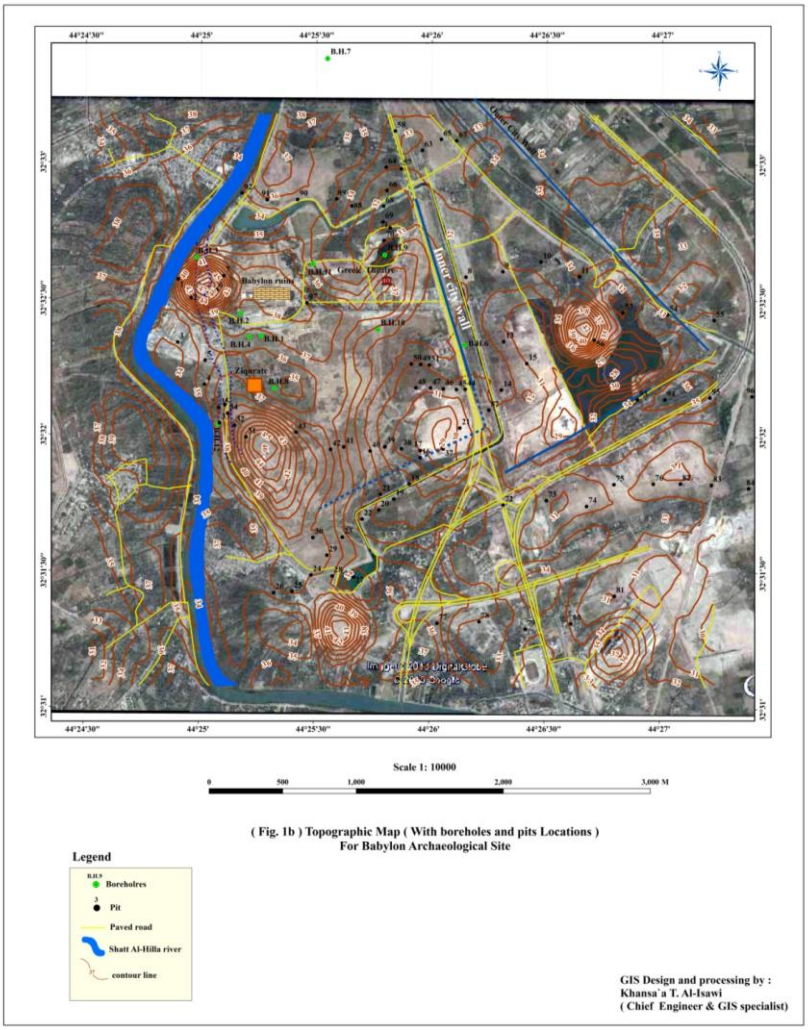

(FIG. 1b) Combined Satellite_Topographic Map (With boreholes and pits Locations) For Babylon Archaeological Site. ©by the other

2. Results and discus

- The area is covered by flood plain and aeolian sediments of Quaternary age.

- The presence of Babylon Outer Wall played a role in the manner of sedimentation on both of its sides and acts as an embankment so that the dishomogeniety of them in the inside area is highly effected by thick rain wash from the archaeological sites alternated or covered by aeolian sediments in addition to man action(FIG. 3a,4a,5a). The upper meter on the insides (except the archaeological areas) and outsides show homogenous sediments of mainly silty clay. This may be attributed to the continuous various human activities (FIG.2a, 2c). The western part of the area consists mainly of flood plain sediments of Shatt Al- Hilla. Some shallow depression fills at a depth ranging between 0.50-1.80 meters (b.g.s.) found in the area within the Outer Wall around the archaeological sites. The

second meter of sediments proved apparent action for the Outer Wall so that the area outside the wall composed of different deposits than that within the wall, which composed mainly of silty clay (FIG.2a, 2b).

- Downward, the western part of the area shows mainly river sediments of Shatt Al-Hilla River (Euphrates), while eastwards it becomes flood plain sediments reflecting, sometimes, typical cyclic flooding sediments (FIG.. 3a, 4a, 5a) (see also columnar sections of boreholes no. 1-12).

- Three boreholes (no. 1,6,8) shows marshy to semi marshy sediments on some depth intervals representing old shallow depressions or Oxbow lakes(abandoned river courses) with some bricks and pottery fragments referring to old human presence and or occupation surfaces.

- Certain and uncertain indications for Pre-Quaternary sediments reached by eight boreholes.(see columnar sections of boreholes no. 1,2,3,4,6,7,8,9) on different depths giving an evidence of old irregular erosional surface of the Mesopotamian plain in Babylon area.

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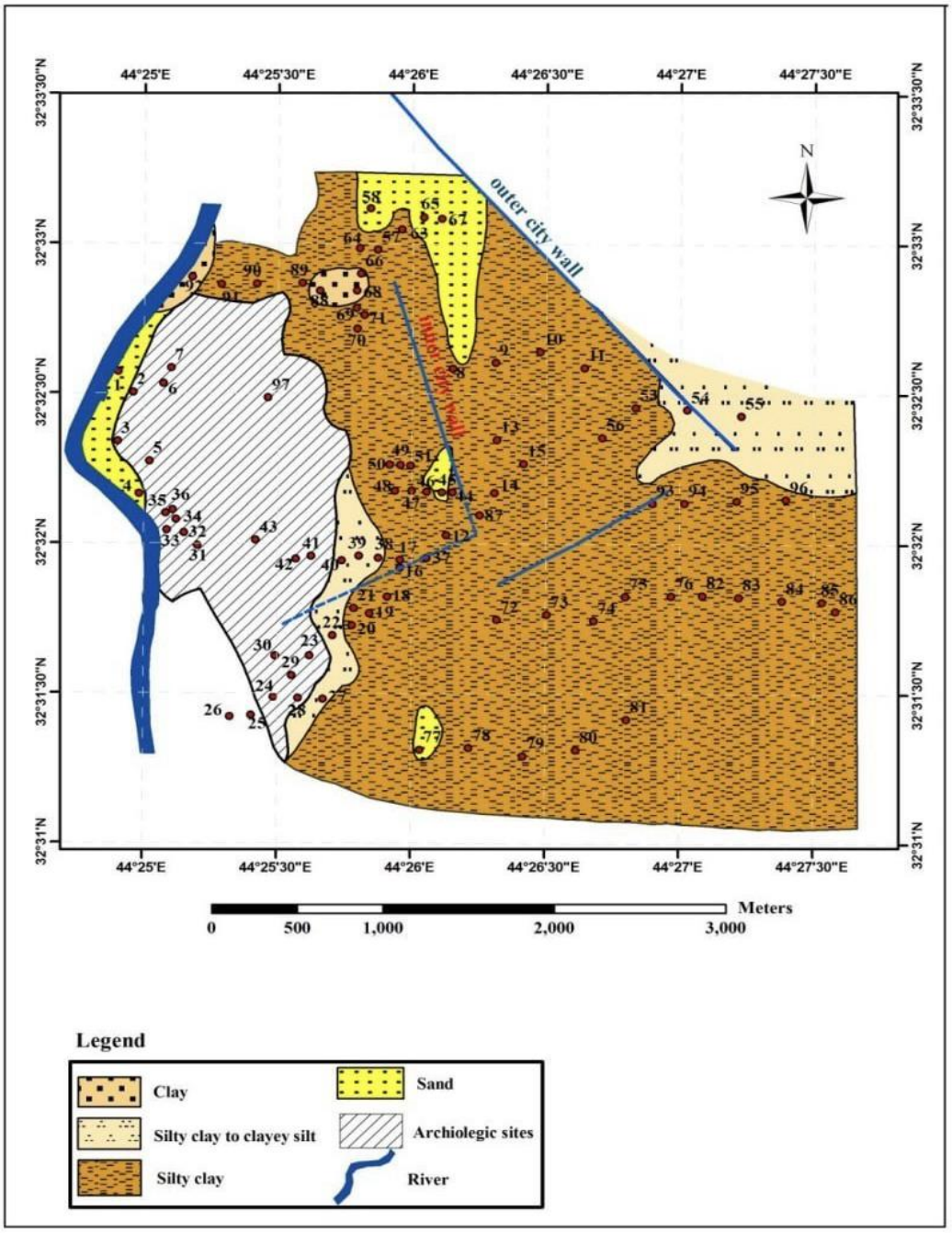
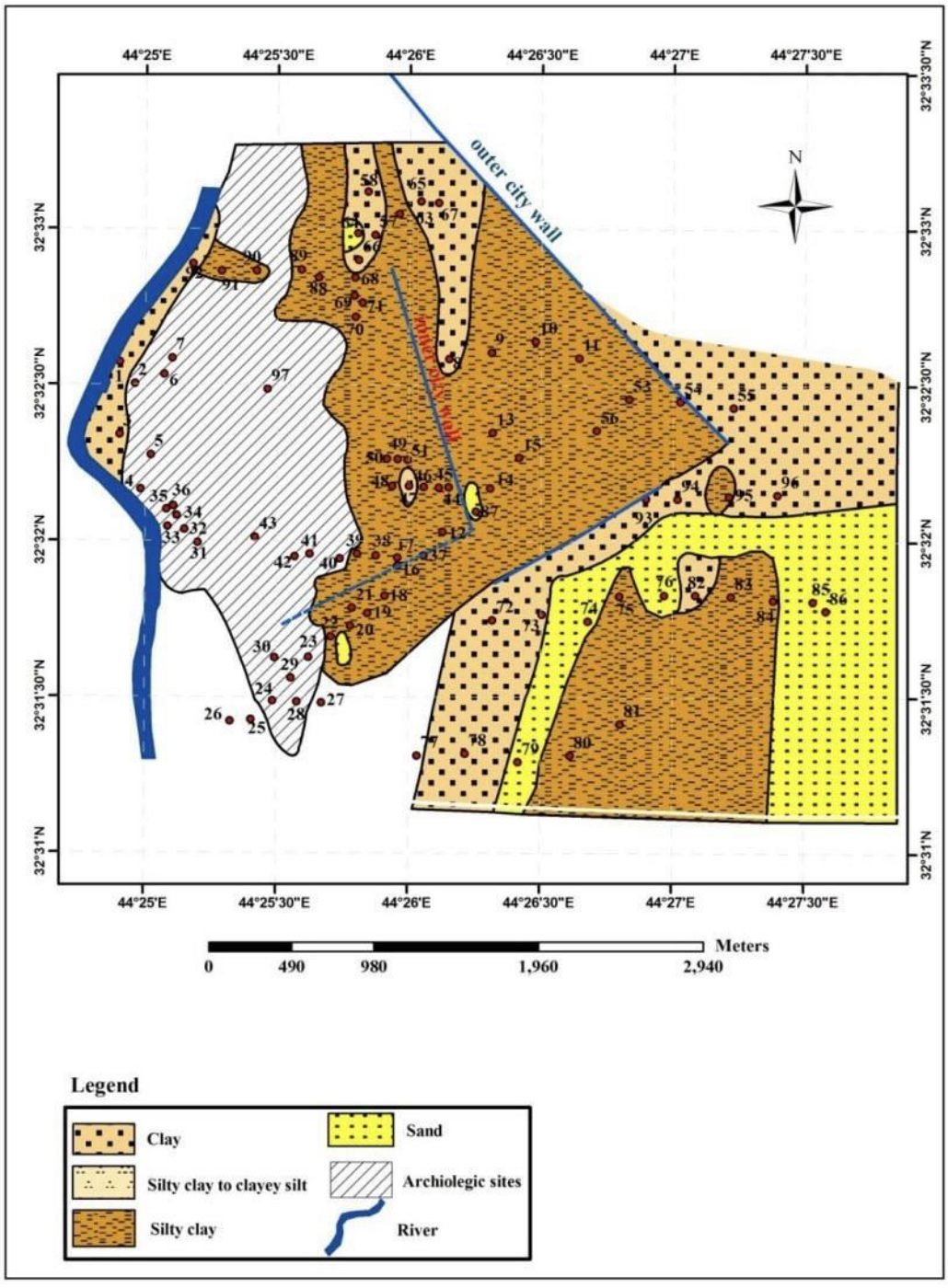


(FIG.2a) Lithological Map for the First Meter of Sediments, Babylon. ©by the other



(FIG.2b) Lithological Map for the Second Meter of Sediments, Babylon.

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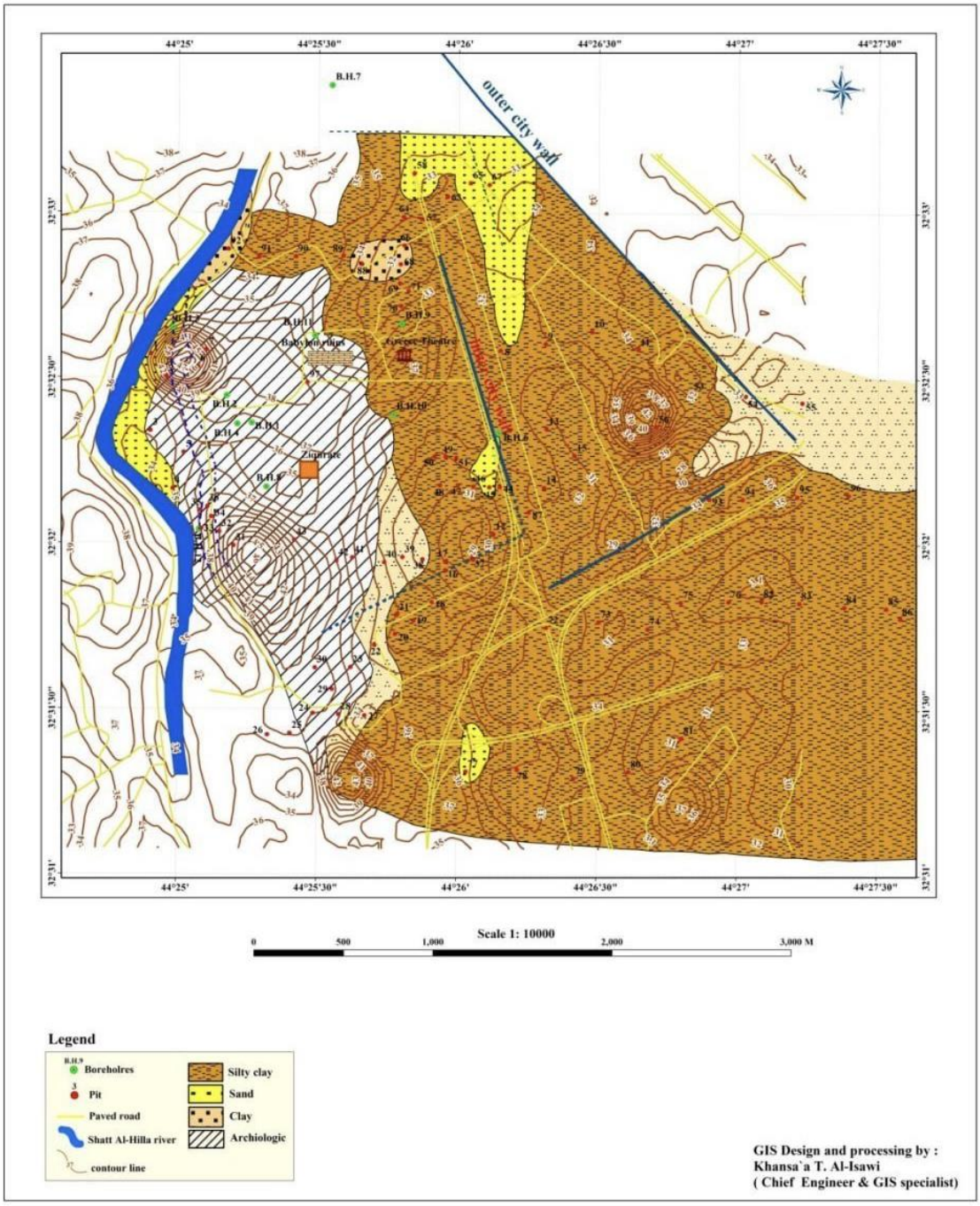
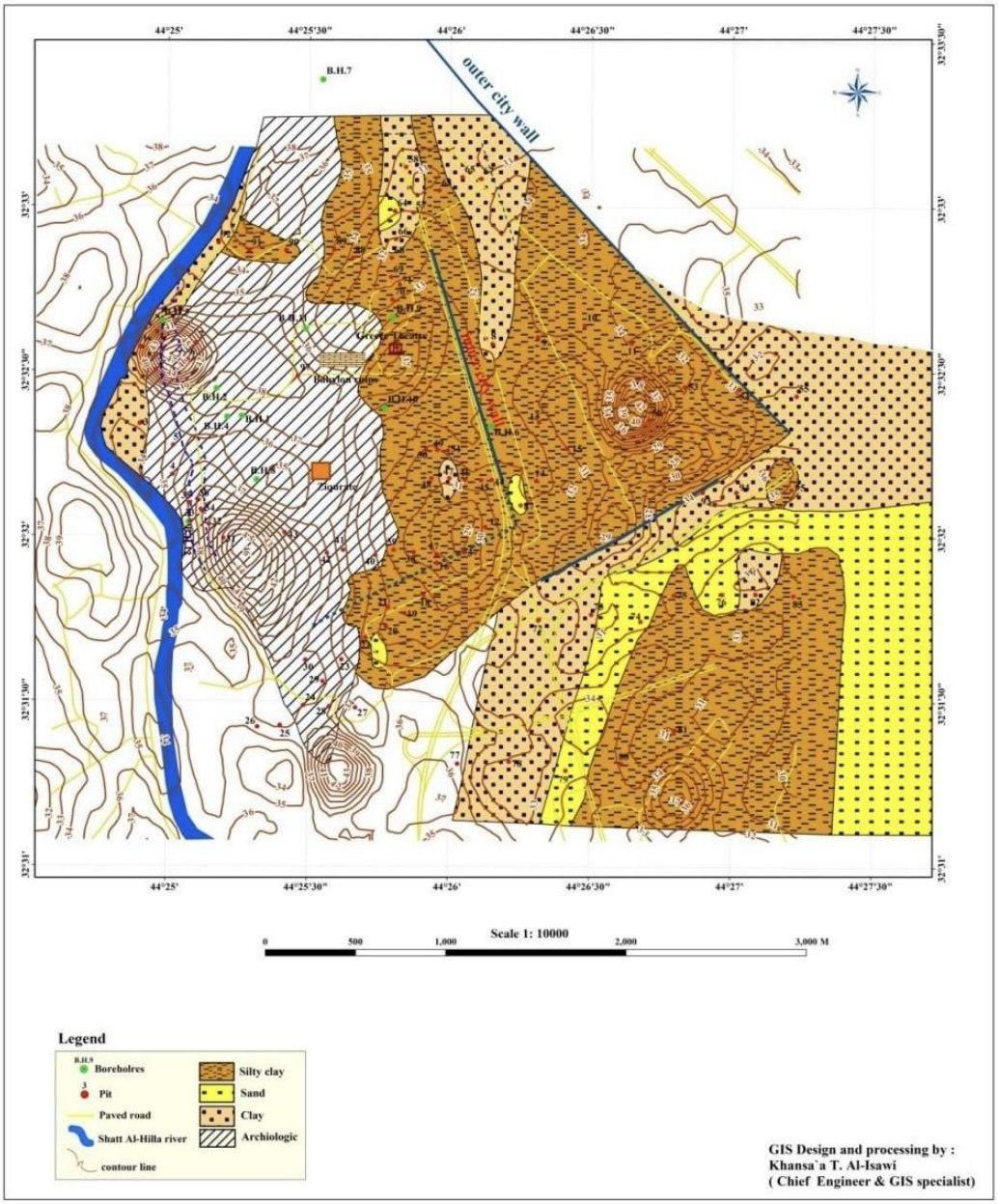


(FIG.2c) Combined Surface Topographic Map with Lithologic Map of the First Meter of Sediments for Babylon Archaeological Site. ©by the other



(FIG.2d) Combined Surface Topographic Map with Lithologic Map of the Second Meter of Sediments for Babylon Archaeological Site. ©by the other

3. Conclusions:

3.1. Geologically:

A. BH.s 7&6 (outside the inner wall) show ideal river cyclic flooding (i.e. depositional cycles) while inside it nearly no distinguishable or correlatable cycles.

B. The Quaternary-Prequaternary contact show questionable elevation if comparing the case outside and inside the inner wall. Generally, its elevation shown by BH.6 is 11.5 &BH.7is 12.4 or15.5 m below ground surface (b.g.s.) while in boreholes inside the wall the depth ranges between 14.0-16.0(BH3), 10.0-24.0m (BH.1), 14.5 or 21.0m (BH.8) b.g.s.. Boreholes

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No.11 and 12, (which drilled on 2012), shows more or less the same contact depth as that shown by the previously drilled boreholes. The predominance of sand-silt sized sediments in the lithological column of Boreholes No.2, 4, and 12 represent the meandering zone of the river course. The natural self-deepening of the river may result in eroding, and consequently deepening, the upper contact of the Prequaternary sediments (which reaches in B.H.No.1, 2, 4, and 11 depths ranges between 20-27 meters below ground surface.

The question is: Is there any relation between the elevations of relatively harder sediments (PreQ.) noticed around the ancient city (paleo topography) and the ancient river (Paleo river) on a side, and the decision for living and selection and distribution of main buildings of Babylon?. To have adequate answers, we need to make more boreholes drilling in and outside the wall.

3.2. Archaeologically:

Much archeological evidence (i.e. bricks and potteries fragment) have been collected from 5 locations which, more or less, indicate residential paleo levels as follows (attached cross sections):

_ **Borehole no.6:** (outside inner wall): The above mentioned evidence noticed at the depths 1.5, 4.2, 5.5, below 13 m and 22.7 m below ground surface

_ **Borehole no.9:** evidence found on depth 1, 8 & 7.5 m.b.s.

_ **Borehole no.1:** archeological evidence found on 7m in addition to potteries fragments along the sand interval 10.15 -24.0m below ground surface.

_ **Borehole no.8:** evidences found on depths 1.4m, 14.5m, and 20m and along the sand interval 26.5 -37.55 m.b.s.

- **Borehole no.3:** certain level on 16m in addition to evidences on depth 14.10m below ground surface.

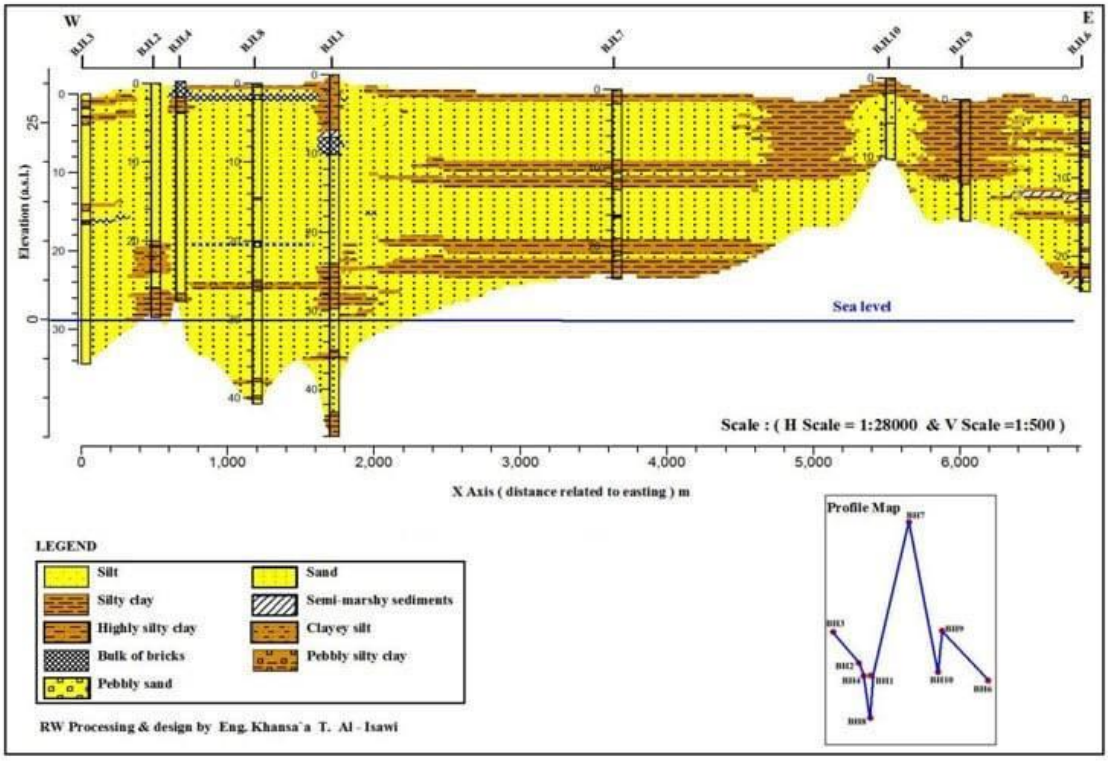
In accordance with the presence of geological paleo surfaces of non deposition lies in continuation on the same depths where corresponding presence of archaeological evidences, we can conclude two, at least, main residential paleo surfaces (fig 3b, 3c, 5b, 5c) lies at the levels:

- The older level lies around 10 meters above sea level (a.s.l.) or on depths 17-21 meters b.g.s.

- The newer level lies around 21meters (a.s.l.) or on depths 7-10 meters b.g.s.

The presence of archaeological remnants on depths other than that mentioned above are either due to old falling to the old river courses or due to drilling activity or other unknown reasons.

So, we need to execute some boreholes and field geophysical studies that (will be mentioned in the recommendations) for the purpose of delineating more accurately the other expected local or shortly extended residential surfaces.



(FIG.3a) Archaeo-Geological Cross Section. ©by the other

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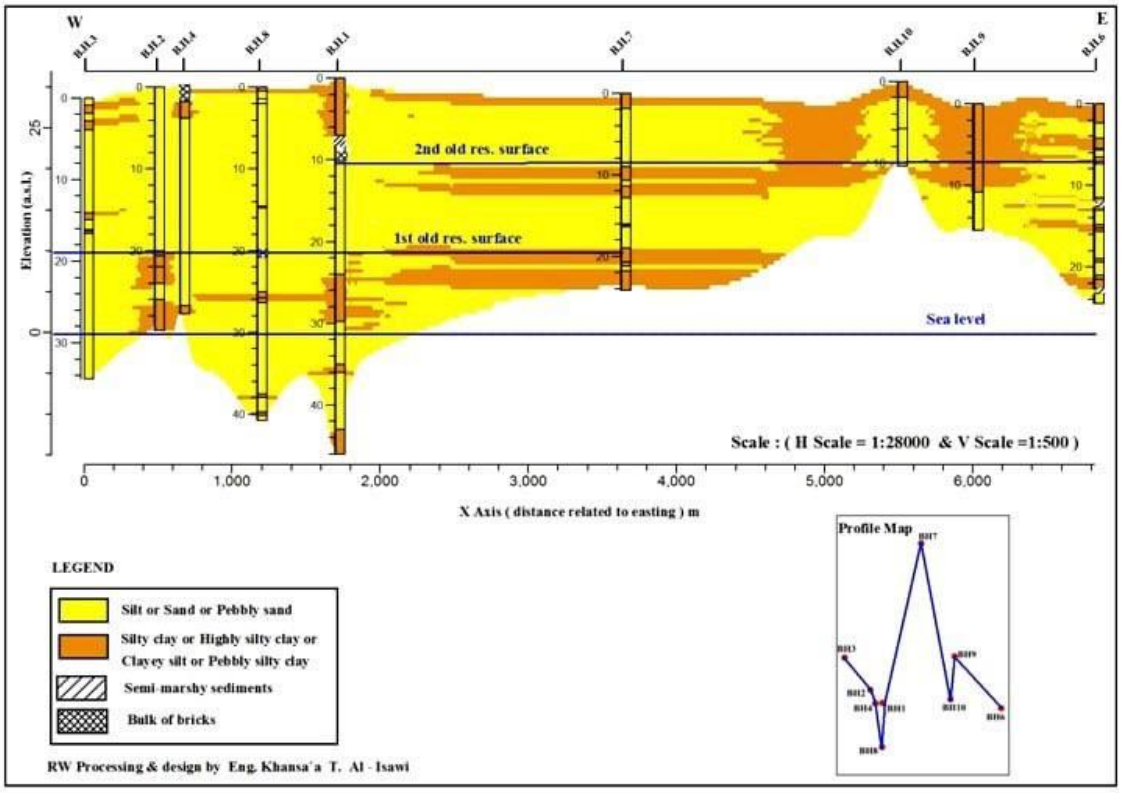
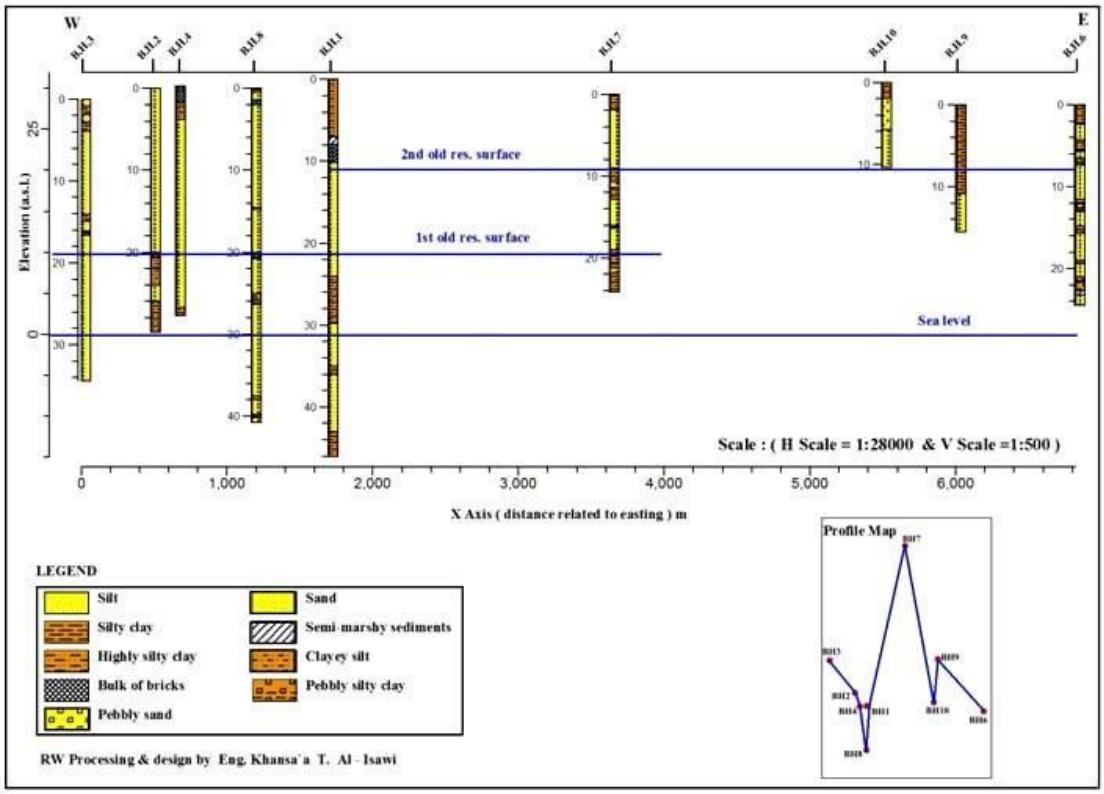
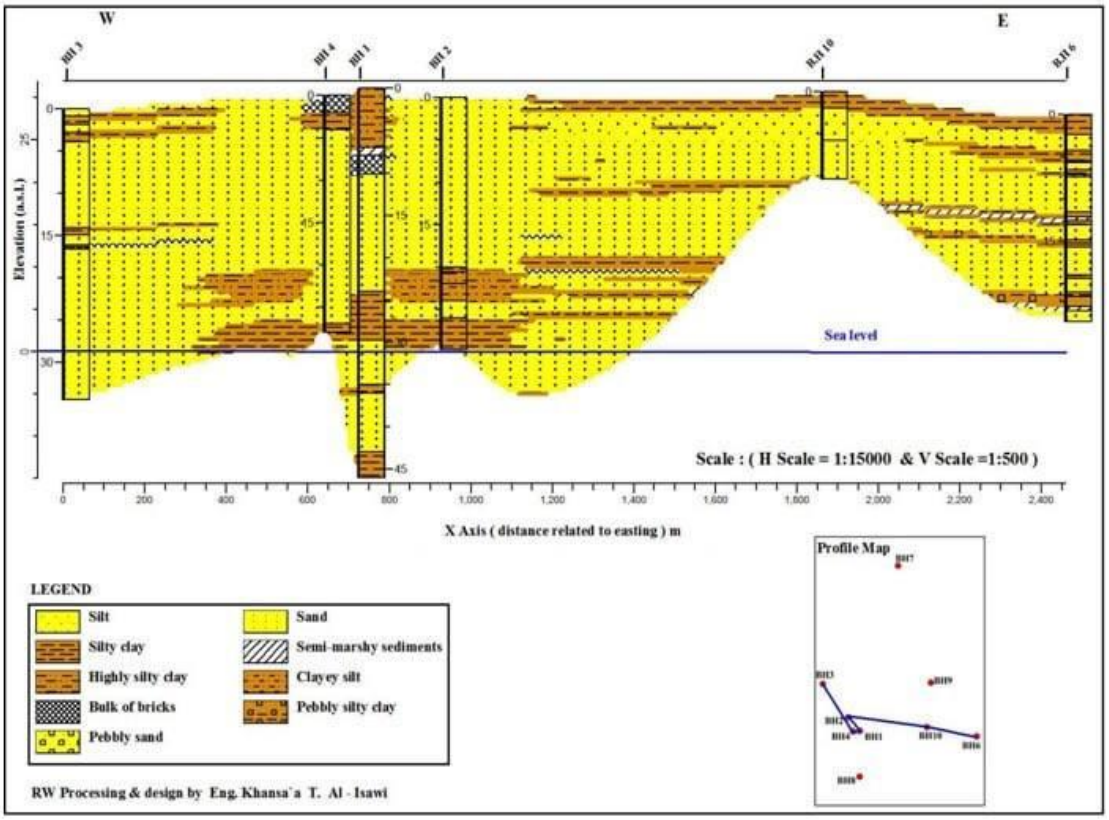


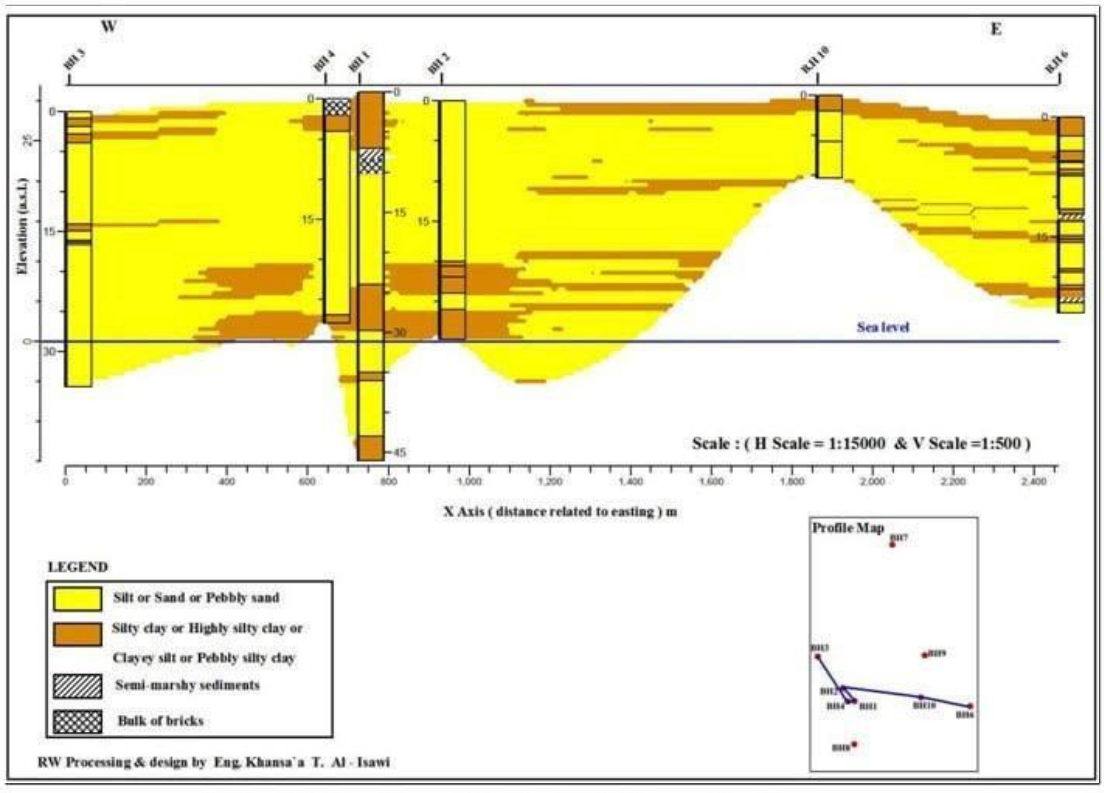
(FIG.3b) Archaeo-Geological Cross Section. ©by the other



(FIG.3c)Archaeo-Geological Cross Section. ©by the other



(FIG.4a) Archaeo-Geological Cross Section. ©by the other



(FIG.4b) Archaeo-Geological Cross Section ©by the other

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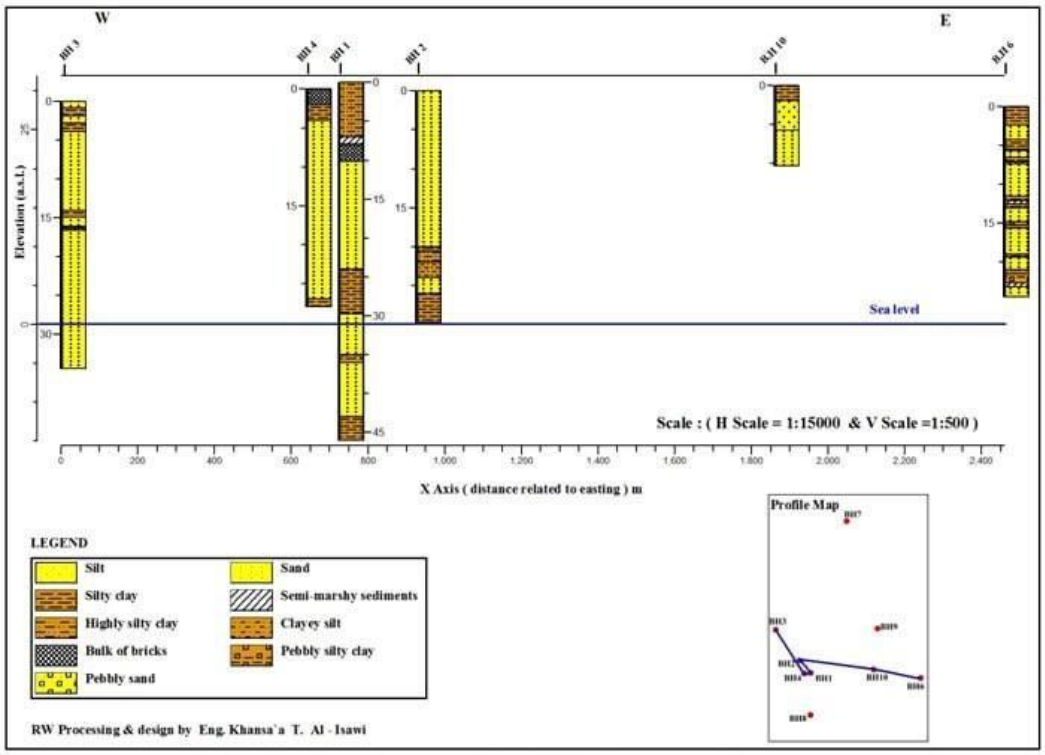
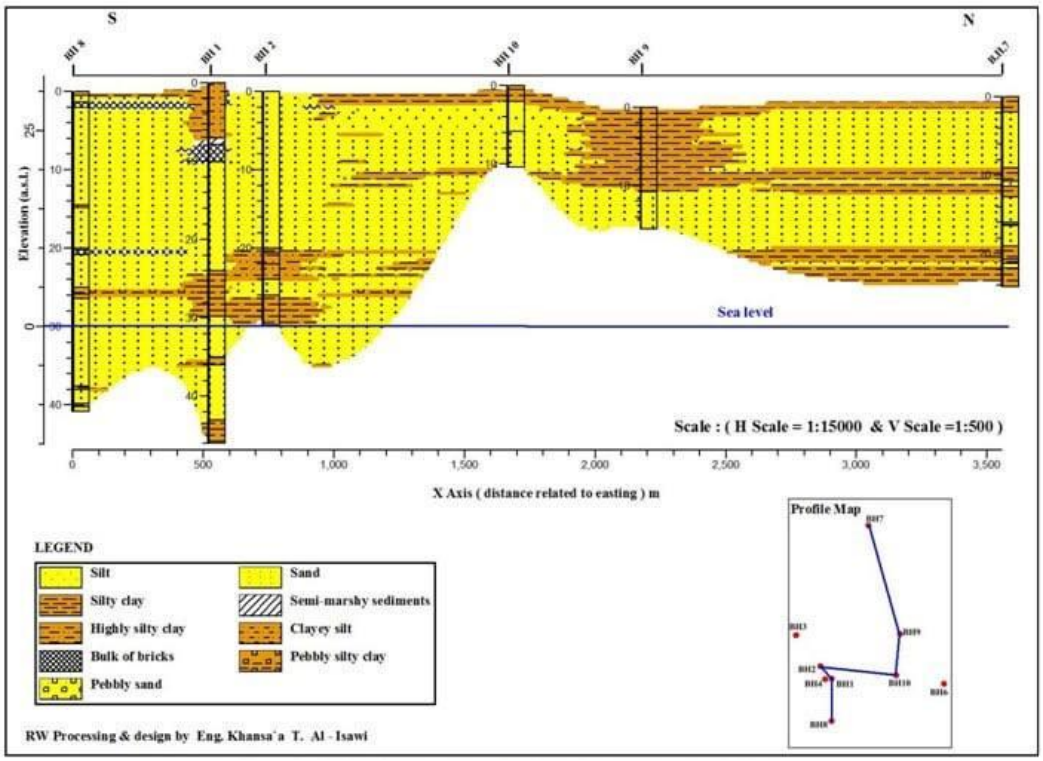
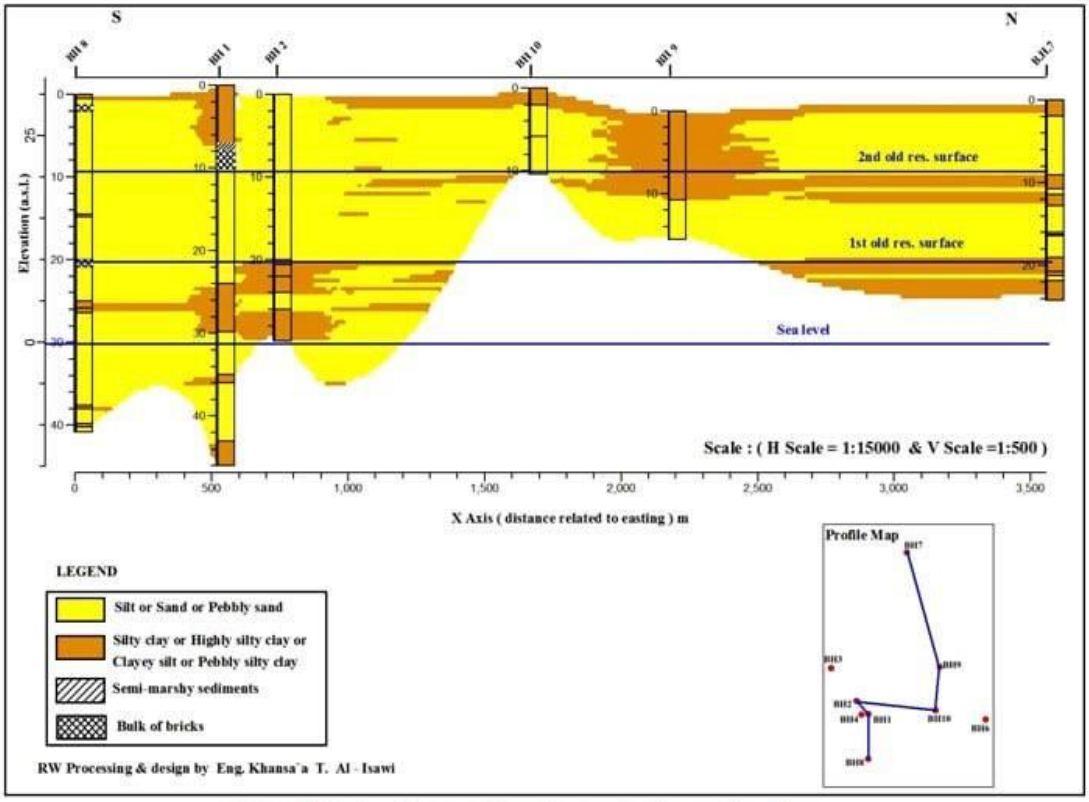


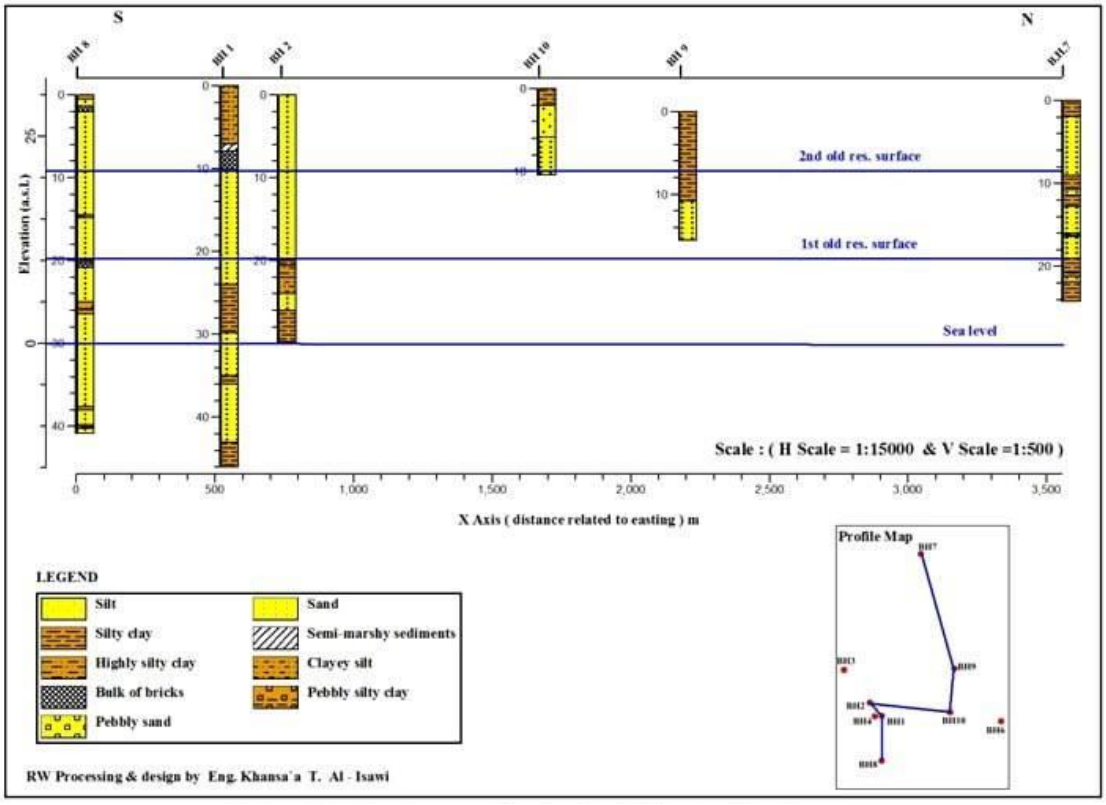
(FIG.4c) Archaeo-Geological Cross Section. ©by the other



(FIG.5a) Archaeo-Geological Cross Section. ©by the other



(FIG.5b) Archaeo-Geological Cross Section. ©by the other



(FIG.5c) Archaeo – Geological Cross Section. ©by the other

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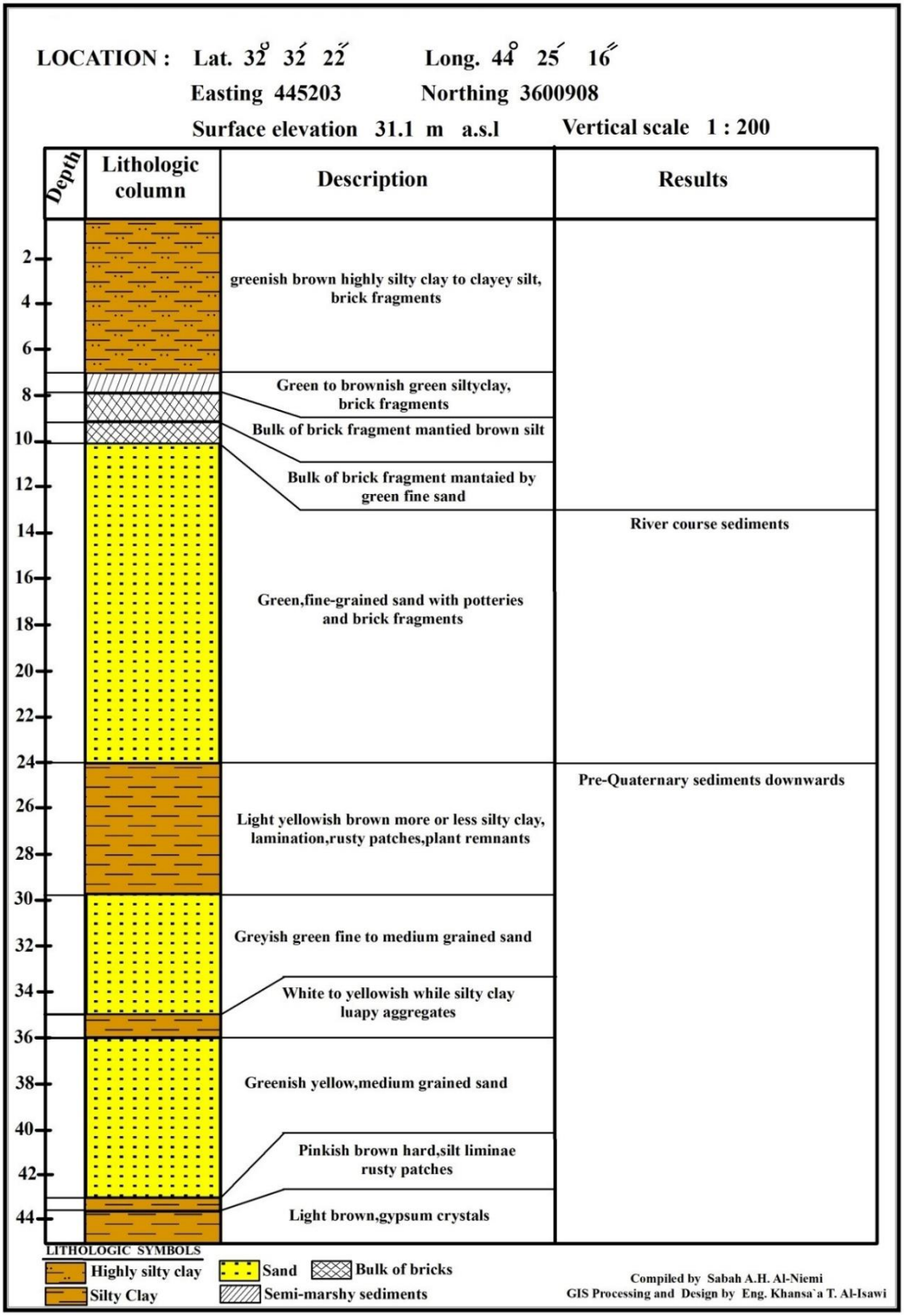
3.3. Ancient River Courses:

Dealing only with the sand bodies located above the supposed Quaternary- Pre Quaternary contact, sure evidences for ancient river courses and/or water canals found passing at the following localities:

- The biggest river course is that passing beneath the sites of boreholes 2 and 4. It is supposed to be the older Euphrates river route before shifting to its present one. The thickness of the river sand body reaches 20 meters and starting from the present ground surface. It may have synchronous flux with that water route reflected by Borehole no.3 on the depth 3-14 m. b.g.s. and Borehole no. 8 on depth 2-14m. b.g.s. , or, may be, the site of Borehole no.3 may be the diverging site into two routes southward in a manner that one route runs to the west of the Southern Palace southwards passing to the east of Ziqurate. The other route may be that one mentioned by the archaeologists.

- Borehole no.1, which cited to the south of Southern Palace, shows another thick sand body along the depth interval 10-24 meter b.g.s. . This sand body may be correlated to the previously mentioned sand bodies.

- Three not correlatabl river sand bodies mention the passage of a lesser size water canal(s); these are represented in Borehole no.7 (on depth 2-9 m.b.g.s.), Borehole no. 9(on depth 11-more than 16m.b.g.s.) and Borehole no.10 (on depth 6- more than 10m.b.g.s.).



Columnar Section of Borehole No .1 ©by the other

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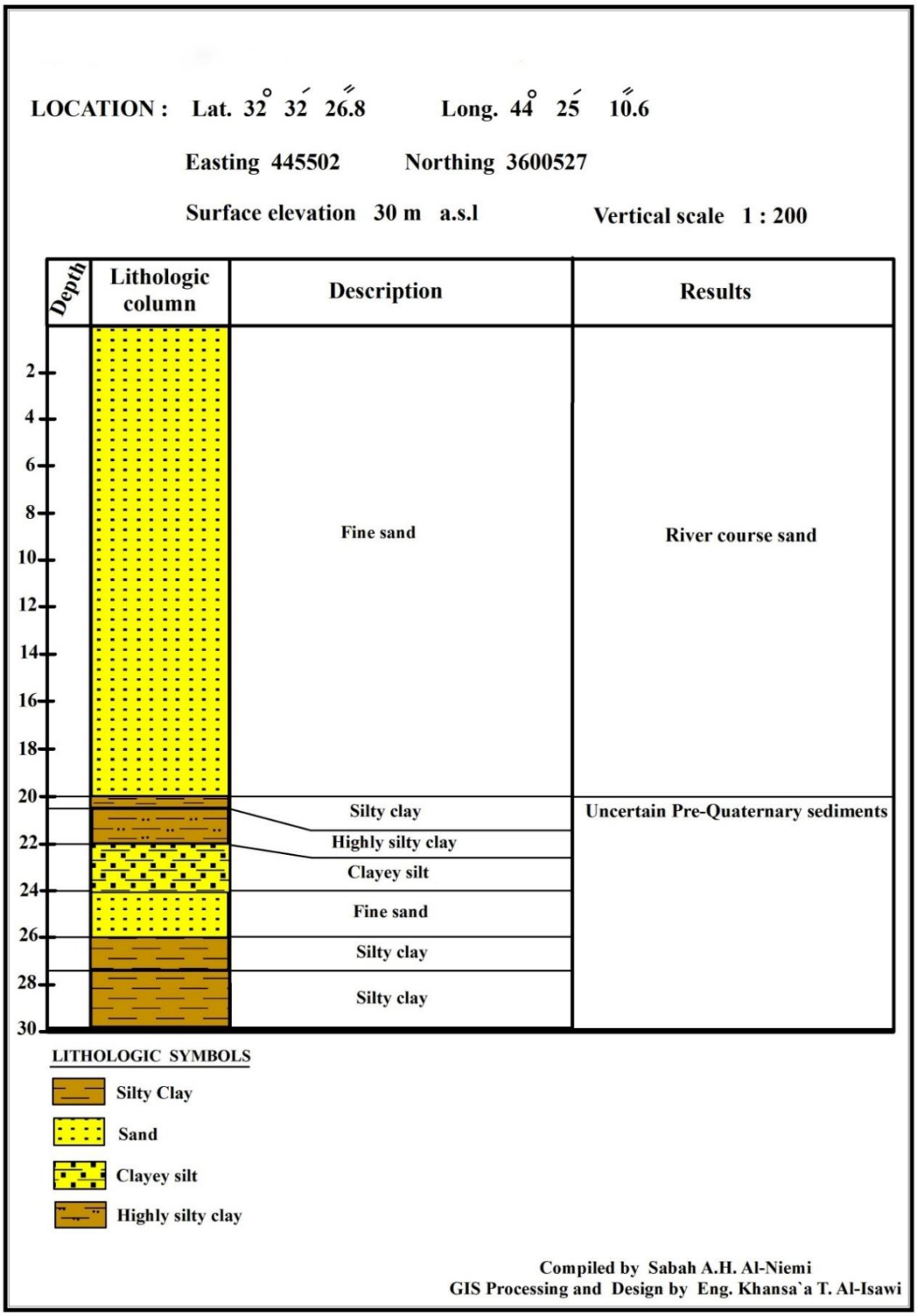
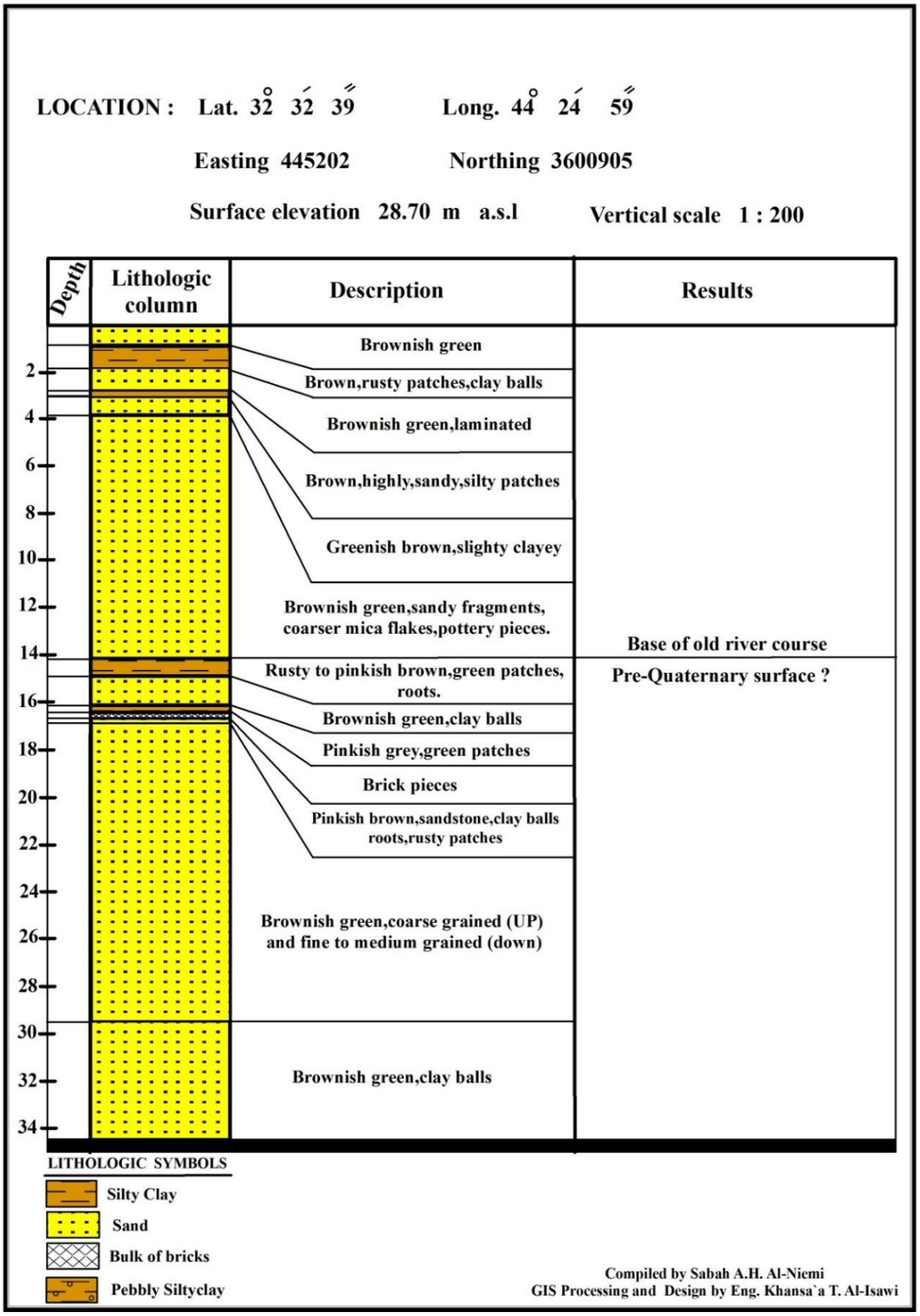


Columnar Section of Borehole No . 2 ©by the other



Columnar Section of Borehole No .3©by the other

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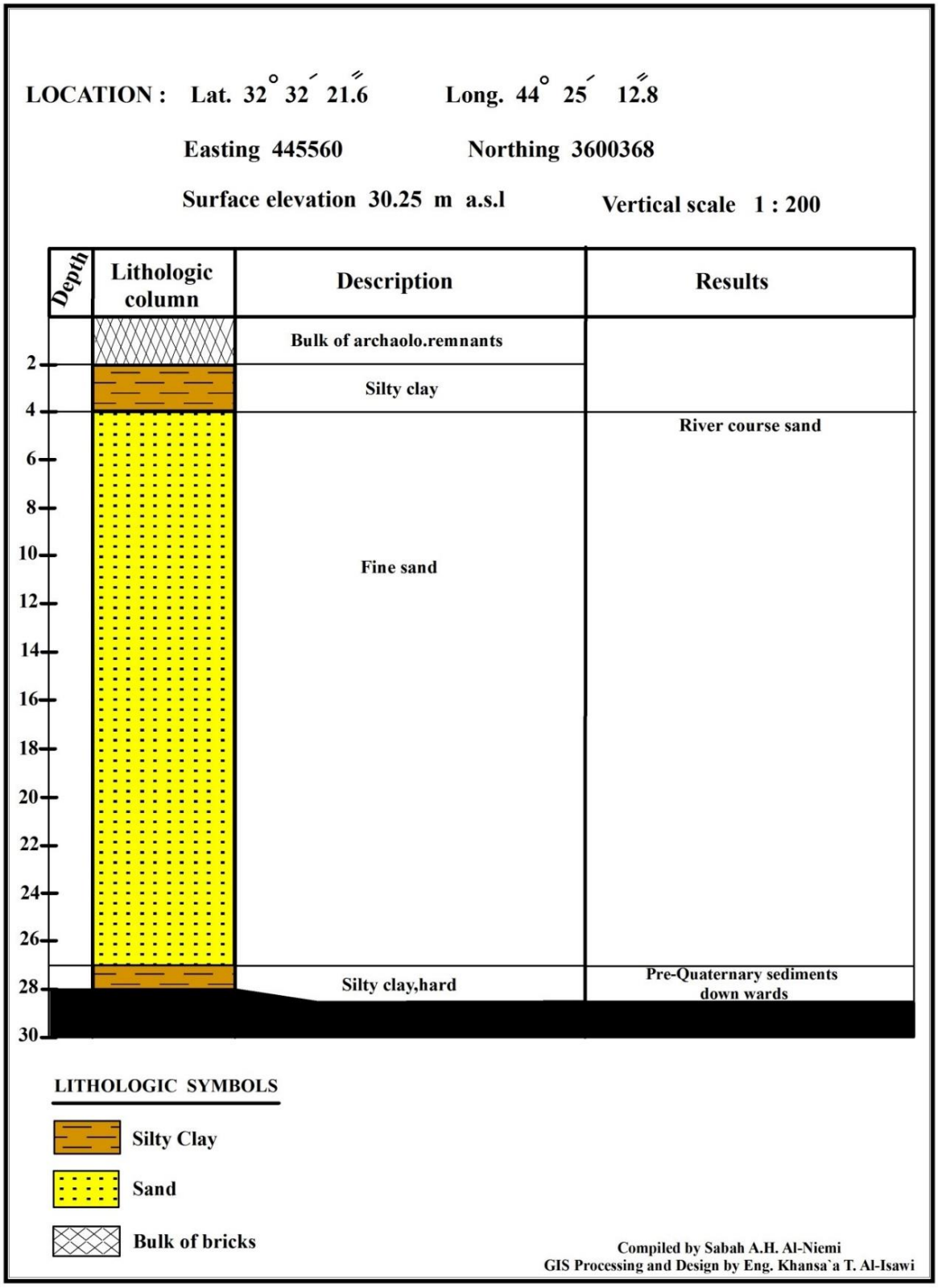
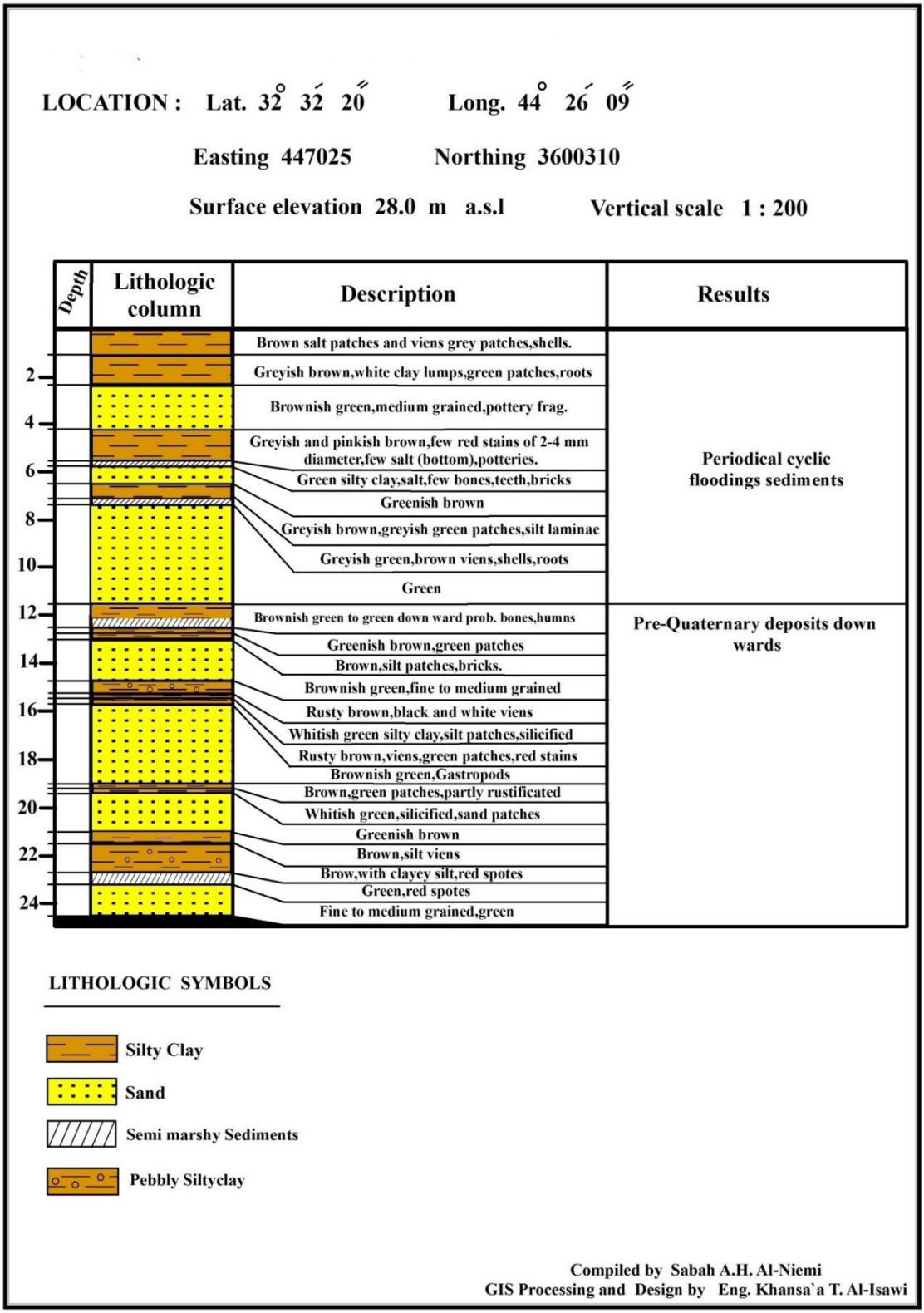


Columnar Section of Borehole No .4 ©by the other



Columnar Section of Borehole No .6 ©by the other

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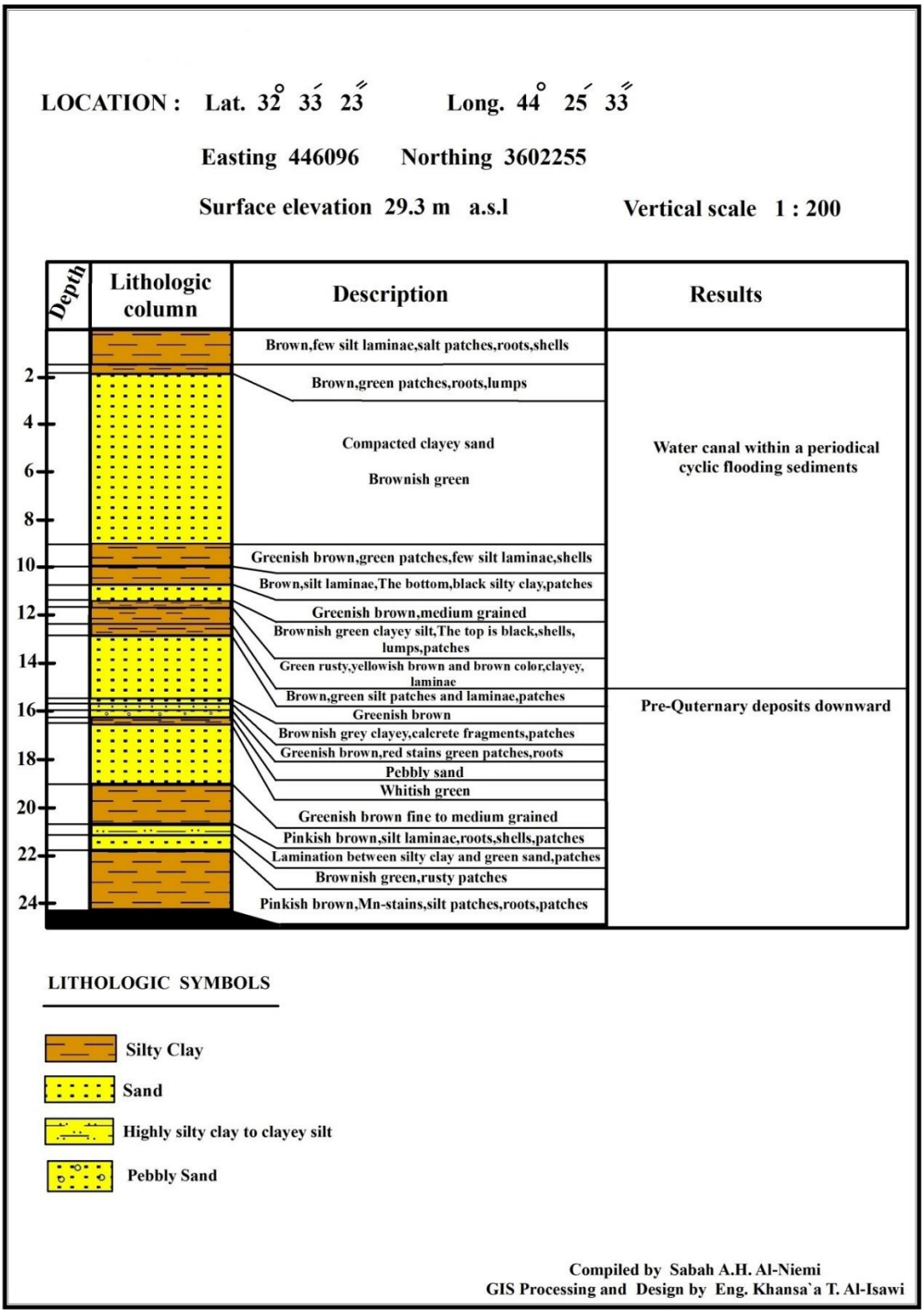
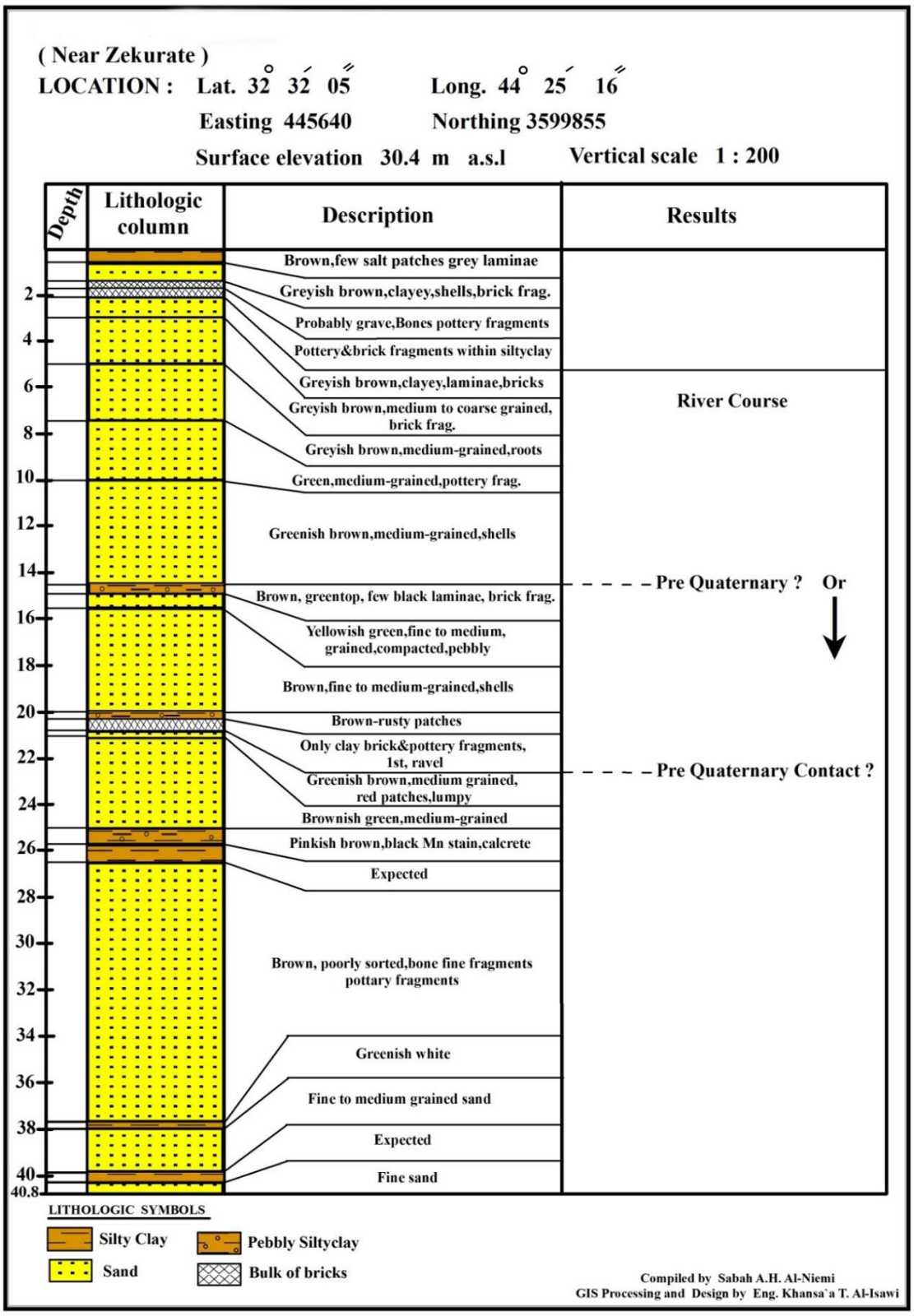


Columnar Section of Borehole No .7©by the other



Columnar Section of Borehole No .8©by the other

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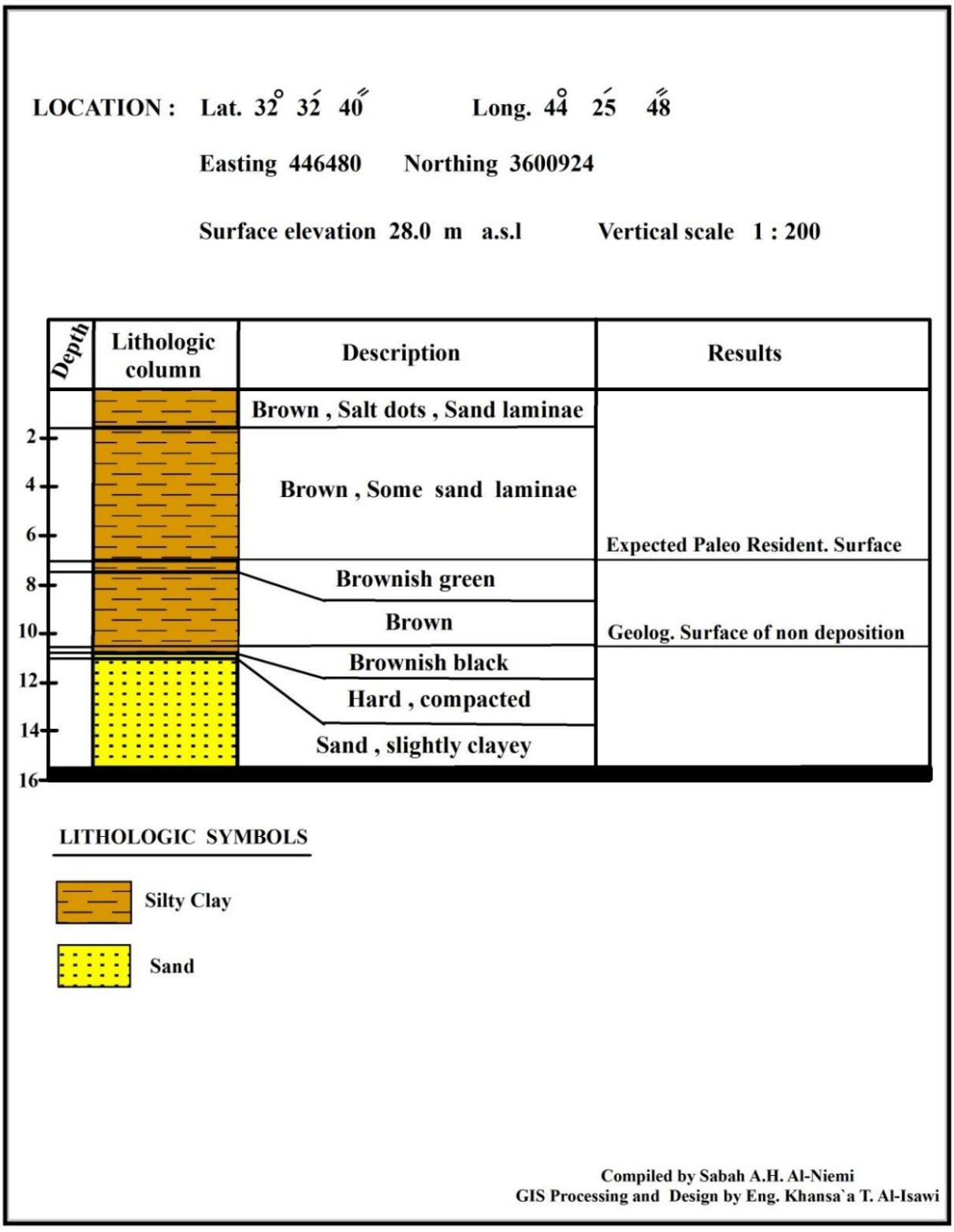
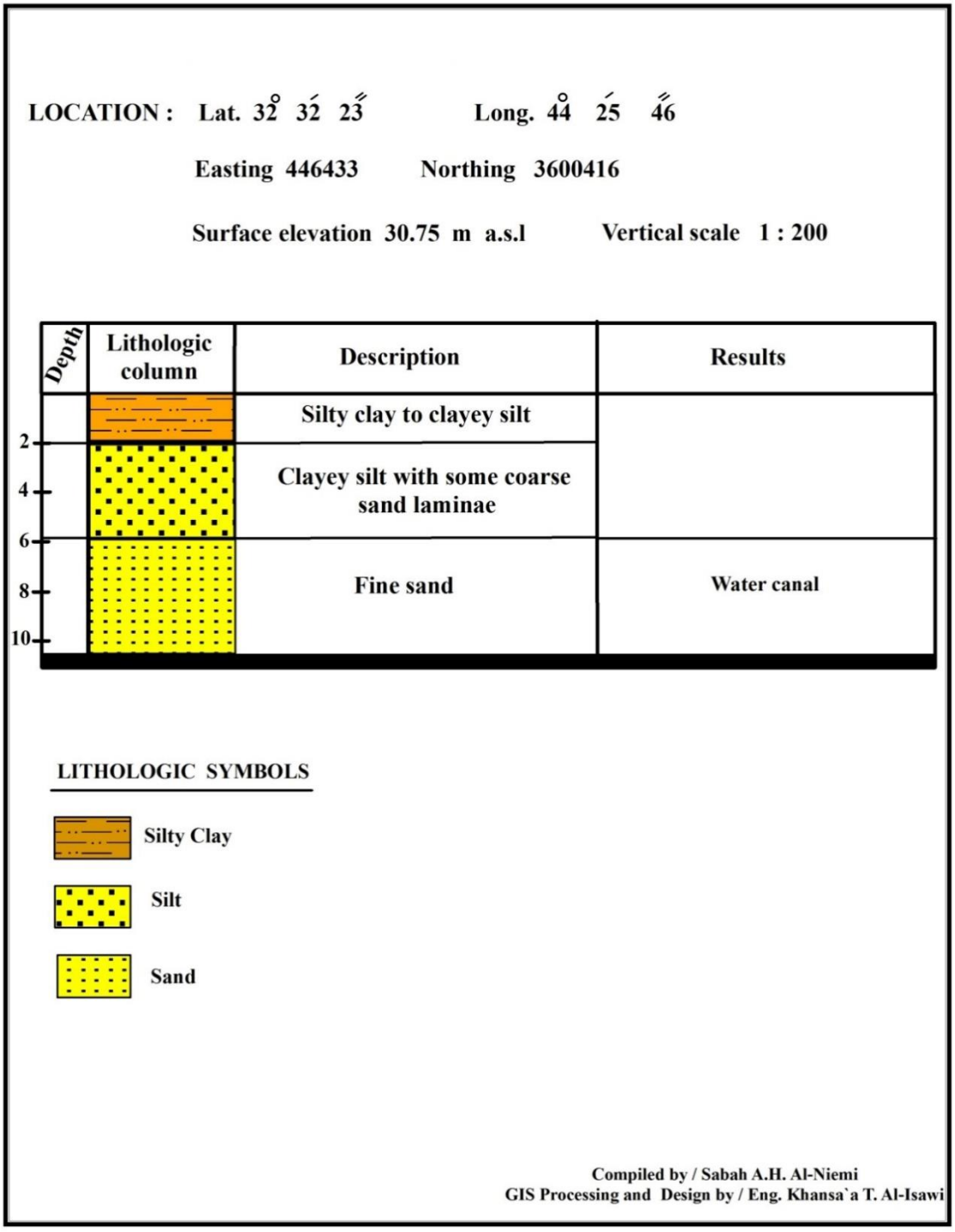


Columnar Section of Borehole No .9©by the other



Columnar Section of Borehole No .10©by the other

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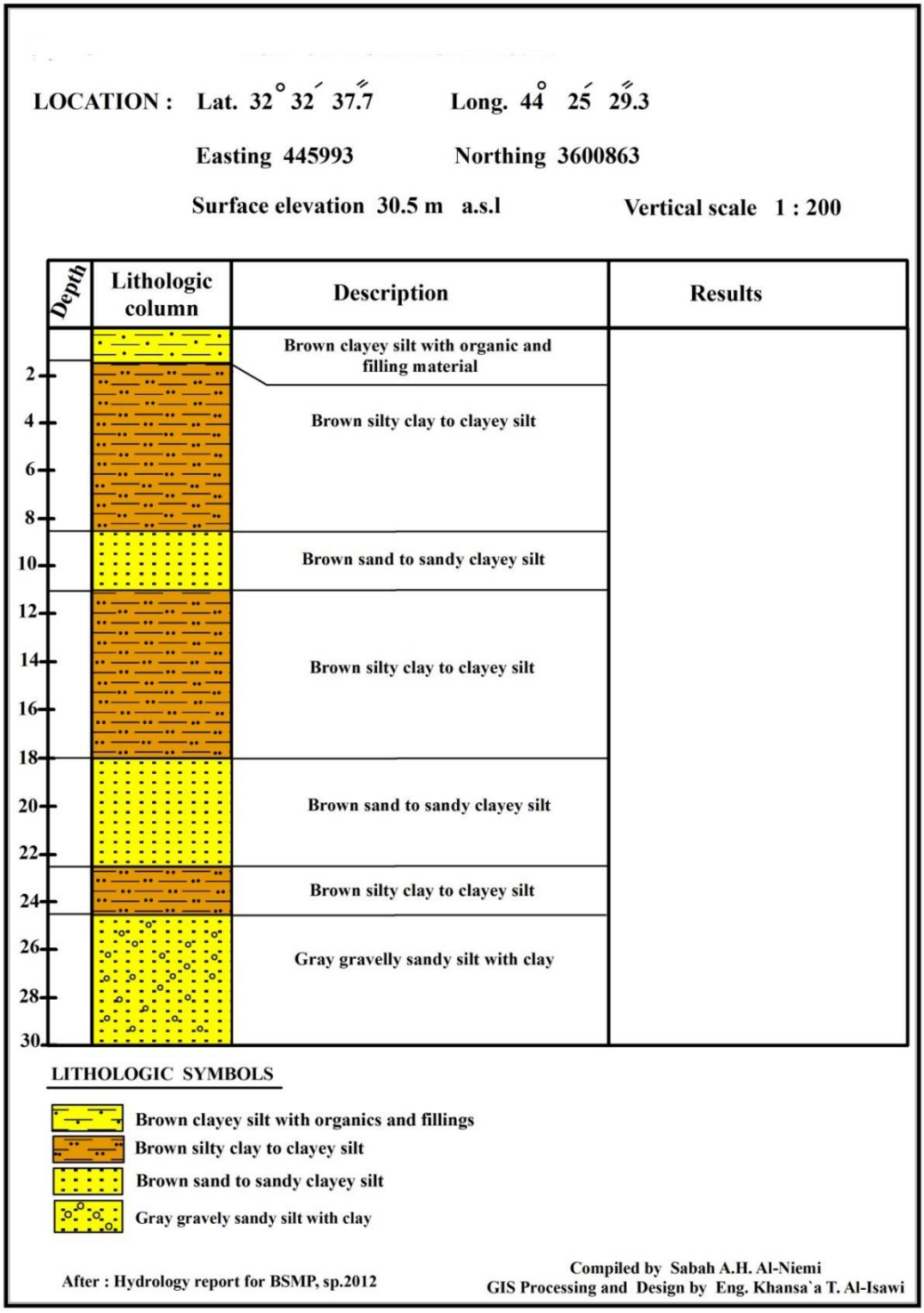
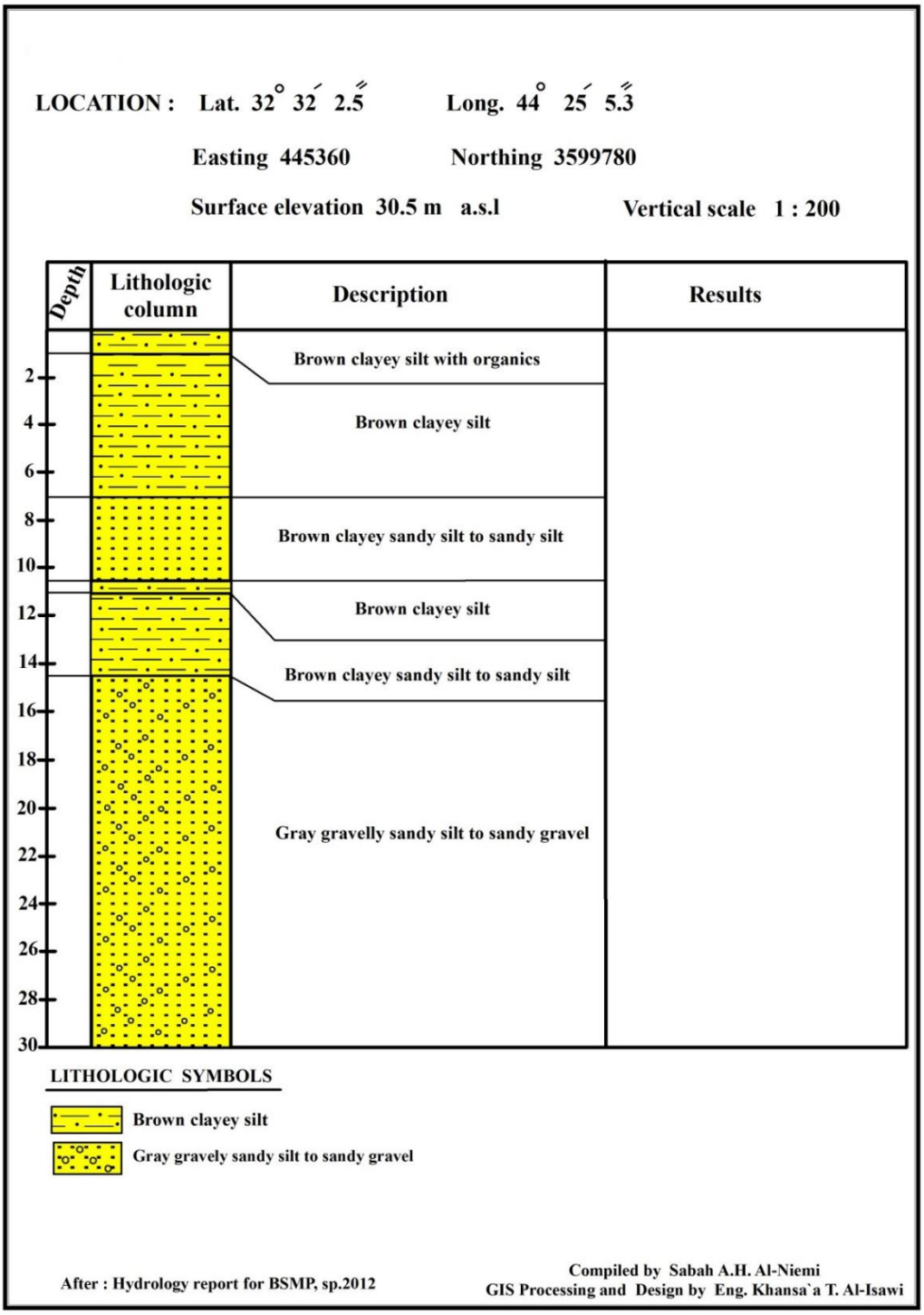


Columnar Section of Borehole No .11©by the other



Columnar Section of Borehole No .12©by the other

DOI: 10.21608/cguaa.2025.346657.1251

Recommendations:

For the purpose of having answers for the following questions,

- What was the shape and topography of the first historical earth surface when first settlement took place? Is it, partially or completely, the same Quaternary-Pre Quaternary surface or not?

- How was the 3D image of the historical rivers courses and its relation to the historical consequent settlements surfaces?

- How were the floods occurs, to what extents? and was it always natural or sometimes man-induced?

- What were the foundations conditions of the main historical buildings (i.e. Ziqurate, Southern Palace, Greek Theatre…)?

We need to execute a net of about 40 boreholes (core and auger drilling) reaching depths 30-40 meters below ground surface in addition to geophysical work for hydrological, geological and archaeological purposes.

For Babylon Archaeological Site, not all geophysical methods are applicable. It depends on the soil conditions at this site

2D Resistivity Imaging and 2D Seismic Refraction Imaging could be within the applicable geophysical methods for Babylon soil conditions. While 3D GPR (MIRA) can be helpful in recovering some of the buried parts of this old city.

Borehole radar survey (GPR cross hole survey) can be useful for direct identification of the archaeological layers and the natural soil layers. On the other hand the seismic cross hole tests can be another method for the same purpose. The MASW (Multichannel Analysis of Surface Wave) method is another new technology for detecting subsurface layers.

The site soil conditions and the survey target are the main factors for choosing the applicable geophysical method for Babylon archaeological city.

References:

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