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Preview on the demarcation process of the maritime border between Iraq and Kuwait by using GIS and satellite image (landsat8)

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Abstract

The demarcation in general and maritime borders in particular is an important process between any two states to define their respective regional Borders and their economic resources. This research is focused on the way in which demarcation took place between Iraq's maritime borders on the one hand and the Kuwaiti side on the other. Through satellite technology (Landsat8) and GIS can be identified the area and how the demarcation was done. The most important in addition, positive points of the demarcation have been explained. It was given a full description of the importance of the economic zone and Highlighting Iraq's most important marine facilities. More than one map of Iraq can be integrated and redesigned by GIS. This work has been talking about the most important vital installations in the region (Iraqi port of Faw AL- Kabeer and Mubarak port of Kuwait) and put them in Comparison with the negative and positive aspects affecting on two sides. In addition, the focus is on the most important economic and spatial Challenges for both ports. Finally, effective ideas and solutions have been offered to reduce economic adversities between the two sides.

Keywords: Demarcation, maritime Border, GIS Techniques, Landsat 8.

معاينة لعملية ترسيم الحدود البحرية بين العراق والكويت باستخدام نظام المعلومات الجغرافية وصورة القمر الصناعي (landsat8)

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الخلاصة

يعتبر ترسيم الحدود بشكل عام والحدود البحرية بشكل خاص، عملية مهمة بين أي دولتين لتحديد حدودها الإقليمية التي تتوفر فيها مكامن الموارد الاقتصادية. يركز هذا البحث على طريقة ترسيم الحدود البحرية التي حدثت بين الجانب العراقي والجانب الكويتي (من جهة خور عبد الله). من خلال تكنولوجيا الأقمار الصناعية (Landsat8) ونظم المعلومات الجغرافية تمكننا من تحديد المنطقة وكيف تم القيام بترسيم هذه الحدود. بالإضافة إلى ذلك، تم توضيح النقاط الإيجابية في عملية ترسيم الحدود البحرية بين الطرفين. وايضا تم تقديم وصف كامل لأهمية المنطقة الاقتصادية وتسلط الضوء على أهم المنشآت البحرية في العراق

بالإضافة الى ذلك، قمنا بدمج أكثر من خريطة للعراق وإعادة تصميمها بواسطة برنامج ال GIS. من جانب اخر توضيح التنافس الاقتصادي بي الطرفين من خلال بناء أهم المنشآت الحيوية الجديدة في المنطقة (ميناء الفاو العراقي وميناء مبارك في الكويت) ووضعها في مقارنة وابرار اهم الجوانب السلبية والإيجابية التي تؤثر على الجانبين. بالإضافة إلى ذلك، ينصب التركيز على أهم التحديات الاقتصادية والمكانية لكل من الموانئ. وأخيرا، تم تقديم أفكار وحلول فعالة للحد من التنازع الاقتصادية والاجتماعي والبيئي بين الطرفين.

1. Introduction

The sea is of great importance to all the countries of the world, whether coastal or landlocked, representing more than two thirds of the world's surface area, as well as its importance as a route for international maritime transport. International shipping is an important means of communication and trade across the seas, oceans and bays, the seas have vital economic importance for landlocked and landlocked States. It is also natural that international law is concerned with the creation of legal rules governing the navigational and economic uses of the seas and the legal regime of marine areas in terms of the natural jurisdiction of the coastal State, And the rights of other landlocked and geographically affected States in these different regions. The law of the sea has evolved in accordance with customary rules since ancient times, and with the beginning of the age of international regulation in the twentieth century, the law-making movement of these customary rules has begun because of international conferences and conventions in this area. The first step has begun towards the development of international legal Norms governing the rights of coastal and landlocked States at sea and the nature of the jurisdiction of the coastal States in the Geneva Convention 1958 [1].

These steps were completed at the third United Nations conference on the law of the sea, which established a new international law that most often fills the gaps in the Geneva Convention of the Sea of 1958. This law is reflected in a convention in Montego Bay (Jamaica) that it took place in 1982, at the end of the work of the conference, this took ten-year for conference [2].

The study of the coasts in all Gulf countries is reflected in the fact that it enjoys a strategic geo-economic position. The Gulf oil trade accounts for more than 65% of the annual international oil trade, most of which depends on the coast. Despite the short distance of the Iraqi coast (64 km) Compared to the coast of Kuwait, which extends for more than (500 km), Iraq shares with the State of Kuwait waterway to Khour Abed Allah. The north-west region of the Arabian Gulf is a region of unstable and variable nature due to the presence of many hydrological effects. It is considered an estuary of many rivers, such as, Karon, Basra channel and Khour al-Zubayr. These variables, which control the conditions of erosion and precipitation resulting from the different speed of tidal currents and impact skinning ships, all these factors change the course of the navigational channel between Iraq and Kuwait. These studies are increasingly important for shallow water areas [3].

2. Procedure for Paper Submission

2.1 study area:

The maritime border between Iraq and Kuwait stretches 120 miles (190 km) where Khour Abed Allah is established. Divided between six miles (10 km) on the Iraqi side, and three miles (5 km) on the Kuwaiti side. The border was demarcated in accordance United Nations resolution (833) in 1993. Khour Abdullah is located at the top of the Arabian Gulf and extends north-west as an important water port connecting the mouth of Shatt al-Arab and Boubyan Island at the head of the Gulf to Warbah Island. It has a "distinct geographical situation" in its repressive form and its baths represent the border between Mesopotamia and Boubyan Island. Moreover, it links Khour al- Zubayr and the Arabian Gulf. Due to the shape of Khour Abed Allah, it can be one of the most important water channels in the region, where it can connect three continents with each other (Asia, Africa, and Europe) if it is scientifically and carefully exploited. That the UN resolutions to resolve the dispute between Iraq and Kuwait on this waterway led to dividing this channel into two halves and laying the dividing line between the two sides. It did not rely on the theory of the Taluk line used to resolve disputes between the entire world's states, where the theory of the Taluk line states that the deepest point in the water channel is that the separation between any two parties and this is not happening between the Iraqi and Kuwaiti sides. See Figure-1.

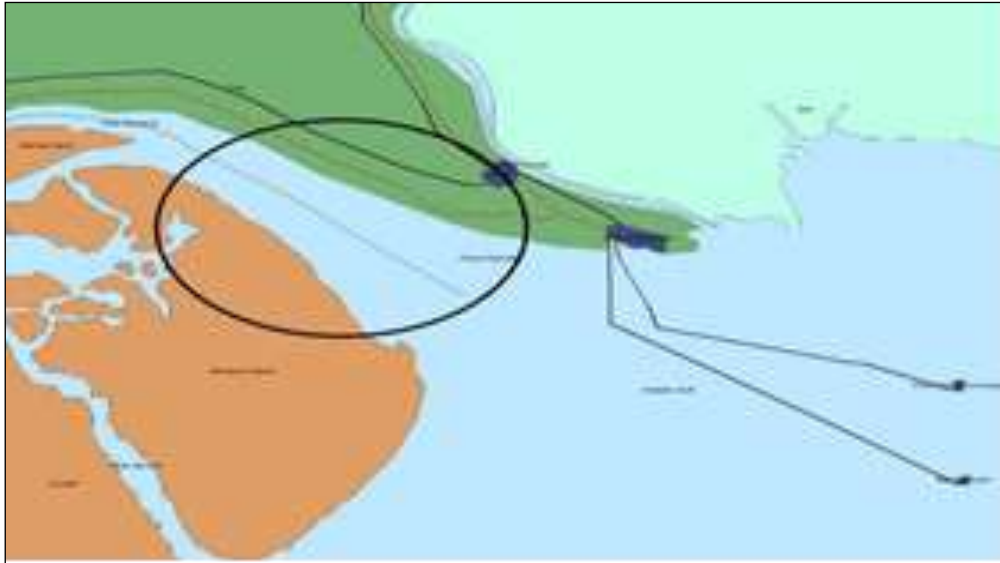


Figure 1- khour Abdullah area

2.2. Topographic changes of water (Shatt al-Arab):

There have been erosion and retreat of the zero line towards the Iraqi coast at the entrance of khour Abdullah by 284 m during the 46 years or 6.17 m / year, depending on the nature of the coastal soil and the high speed of the tide in particular. While erosion in the Iraqi side at khour shitaneh 370 m at a rate of 8.04 m / year, because the acceleration of tidal currents is also greater in this region.

While sedimentation occurs in the opposite direction, and there have been erosion and sedimentation in some areas of the Kuwaiti coast. The erosion amounted to 375 m or 8.15 m / year, sedimentation that reached 540 m during 46 years. An average of 11.73 m / year, which adds large areas to Kuwaiti side. And the possibility of the emergence of new islands, later effect on the international boundary between the two countries and the navigational channel, due to the adoption of the principle of the midline of the channel presentation from the beginning of the baseline for both countries in accordance with the united nations resolution (833) in 1993 [4].

2.3 Data Used:

- 1- Satellite image (landsat8) from USGS web site.
- 2- GIS techniques.

1.4 Problem Statement:

1. Preview area by Satellite Technology (Landsat 8), And how they can be controlled by remote sensing
2. Geometric correction of topographic maps based on latitude and longitude
3. Redesign of topographic maps, and digitally based
4. Note the drawbacks that have been made to Iraq because of poor planning in the demarcation of the maritime border in the area of Khour Abdullah with the Kuwaiti side.

2. Methodology of work

3.1 Techniques used'

The entirety of this study was conducted using ArcGIS software specifically, remapping and topology the toolsets used for this project analysis, chose Point in the area, selection by location, union and Path Distance. These techniques are chosen to provide the most optimal outcome for this site suitability analysis.

3.2 Geometric correction:

The image data acquired by remote sensing includes the considerable distortion portion made by the earth's curved surface. In order to overlap, this distorted image with the existing topography map. This process can be transformed the satellite's image in the same size and projection value as the topographical map that called the geometric correction.

Geometric correction is applied a number of given GCPs with the specific degree of the polynomial. The research objective is to determine the suitable number of GCPs with a degree of polynomial to get accurate results from available data [5, 6].

3.2.1 Two-Dimensional (2D) Transformation:

Two-Dimensional (2D) transformation can be used to project image f (U, v) coordinate on to the ground g (x, y) coordinates. The transformation involves scale factors in x and y directions, two translations from the origin and a rotation of x and y-axes about the origin.

3.2.2 Two-Dimensional Polynomials Transformation:

This search had been oriented to get the suitable requirements for geometric correction (rectification) for a two-dimensional image using GCPs and the first order transformation of the polynomials. The mathematical model of the first-order polynomial that is known as affine transformation equation has six unknowns, which need the minimum of 3 GCPs as shown in Equation (1).

$$\begin{aligned} x &= a_0 + a_1 X + a_2 Y \\ Y &= b_0 + b_1 X + b_2 Y \end{aligned} \tag{1}$$

Where: x, y = image coordinates X, Y = reference coordinate
 $a_0, b_0, a_1, b_1, a_2, b_2$ = translation, rotation and scaling parameters.

$$\begin{aligned} x &= a_0 + a_1 X + a_2 Y + a_3 XY + a_4 X^2 + a_5 Y^2 \\ Y &= b_0 + b_1 X + b_2 Y + b_3 XY + b_4 X^2 + b_5 Y^2 \end{aligned} \tag{2}$$

The minimum number of selected GCPs depends approximately the polynomial, as three points define a plane. Similarly, the equation used in a second order transformation is the equation of a PARABOLOID; at least six points are required [7, 8]. Equation (3) shows the mathematical relation between the minimum numbers of required ground control points and a transformation of order t.

$$\text{Min. Number of Required GCP} = [(T+1)(T+2)]/2 \tag{3}$$

Where: T Is the System of using Polynomial equation used.

3. The importance of the region for Iraq:

This region is important to Iraq because it is only waterfront and economic heart of Iraq (Al Ma'qal, Abu Flus, Umm Qasr, Khour Al Zubair), and the oil ports (Faw, Khour Al Amaya, Basra oil port), in addition, the new biggest ports (Faw AL_Kabeer), it is under construction.

A single new map is obtained that includes all the ports of Iraq by merging several topographical maps and redrawing them with GIS, see Figure- 2.



Figure 2- Iraqi ports.

4. Economic challenges in the region:

The Iraqi and Kuwaiti sides are competing to complete the most important facilities on their coasts. Iraq is trying to build the largest port in the Middle East (Faw AL-Kabeer port) at the end of Ras al-

Bisha, southern of khour Abdulla. Where Kuwait is building the port of Mubarak al-Kabeer on the Coast of Boubyan Island opposite Khour Abdullah and Kuwait is considering linking the port of Mubarak by rail with Iraq to transport goods to Europe.

5.1 Iraqi port (Faw AL-Kabeer):

The port project of Faw is one of the giant strategic projects in Iraq Plans, studies and research were prepared by the Iraqi government that the project extends over a distance of more than (22) kilometers in Ras al-Bisha from the Faw area, see Figure-2. The last land in the Iraqi territory which overlooking at the depths of more than (28) meters that provides deep comfort for the larger vessels and tankers of oil giant. It consists of 50 berths and will be joined by loading, unloading areas, warehouses, administrative facilities and residential compounds, show Figure-3. The length of the quays of Faw port will be about 40 km. It will be connected to railway lines and a fast road network between 10 selected free trade zones and the Establishment of an international airport in the future. The project gives Iraq a new view of the waters of the Gulf and from it to the international ports on the high seas, and contributes to the completion of the Iraqi ports of bottleneck of international shipping channels linking the Gulf and the port of Umm Qasr and Khour al-Zubair. Also to get rid of the node shallow water submersible, which impedes the entry of large vessels that exceed 11 meters, it the best submersible currently available. As well as the completion of the Problems of the Taluk line and related treaties, and to benefit from the ends of the land (in the area of Faw). The project is expected to generate high revenues for the Iraqi economy.

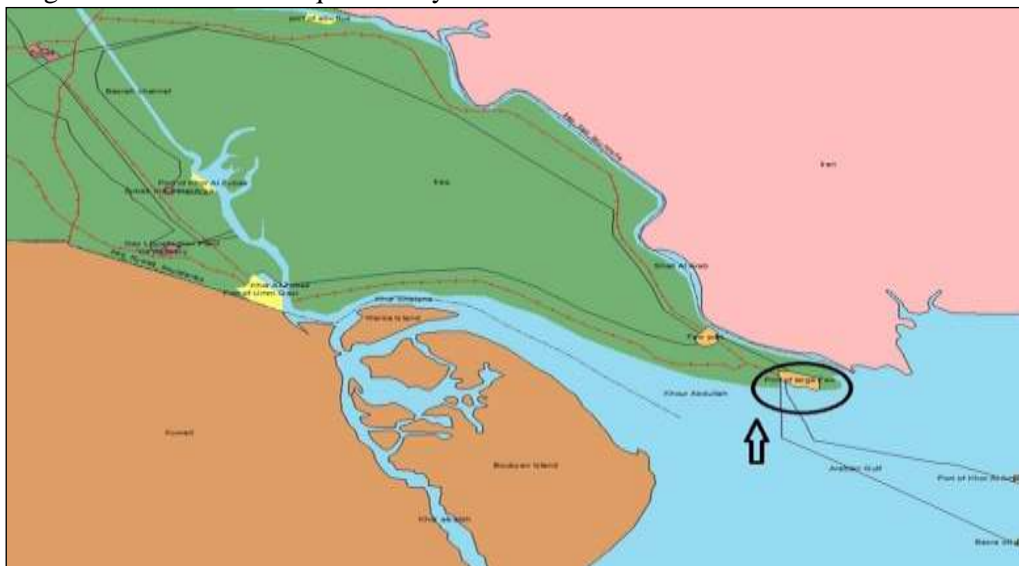


Figure 3-The location of Iraqi ports (Faw AL_Kabeer).

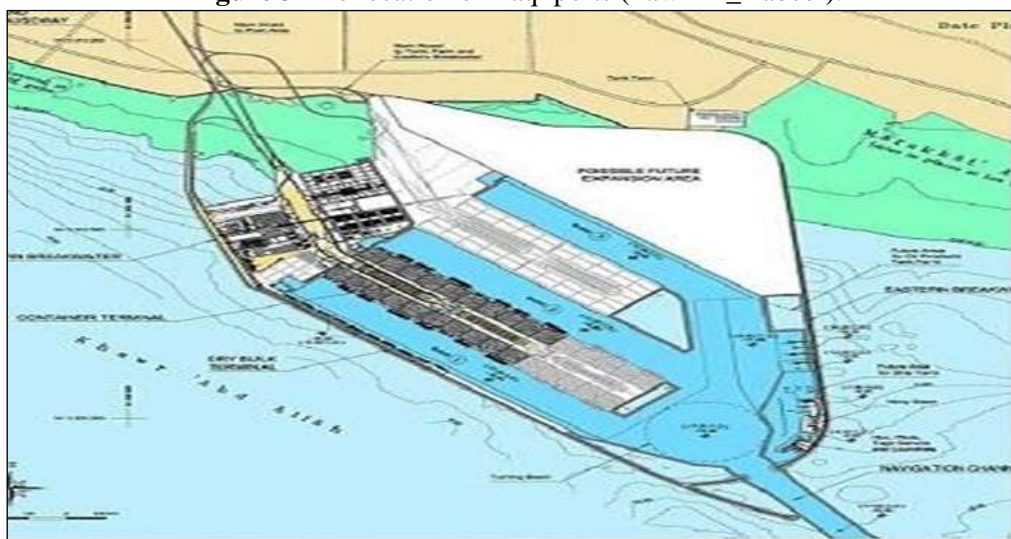


Figure 4-The design of Faw AL_Kabeer port

5.1.1 The project includes:

- Construction of an industrial city of 350 square kilometers, which extends within the sea by about 250 square kilometers, and the completion period of 3 years at a cost of about 12 billion dollars. It could be reduced to only 8 billion \$ because of the global financial crisis.

The Italian company will create something similar to the pavement of 35 square kilometers only and will be affected by the port of Mubarak, Kuwait certainly because it does not benefit from the depth of the sea, while the Scheme of the Faw AL_Kabeer, moving into the sea through landfills and the manufacture of long coasts.

- Construction of industrial and tourist facilities in an area of 350 km² In addition, housing complexes that will accommodate half a million people, experts and workers in the port and its remaining facilities.

- The plan will be 35 km long and 10 km wide and 15 km of the port facilities will be built with a large rocky stretch, but an industrial city by the sea and a submarine, according to international standards allowing the entry of giant vessels.

- "The plan includes the laying of one billion cubic meters in the sea with 25 million tons of stone," asserting "our plan is not affected by the port of Mubarak the scenario is the only practical solution. And neither Kuwait nor Iran can suffocate".

- The port of Faw will also include industrial and petrochemical facilities, offices for foreign investment agencies and a huge industrial zone for heavy and light industries, a tourist area on the sea including 5-star hotels and 4-star hotels on a tourist promenade. Also a residential city of 500,000 people. The plan includes the construction of a 2000 MW power plant and a desalination plant.

- It is planned to establish an oil island next to the port, an export card of 10 million barrels per day [9].

5.2 Kuwaiti ports (Mubarak):

The Mubarak Port of Kuwait is one of the largest Kuwaiti ports, located at the beginning of the Arabian Gulf, on the one hand and the north that its proposed location will suffocate Iraq by sea. There will be no role for the Iraqi ports in the future. It would block the arrival of international ships to Iraqi ports, thereby swallowing the waterway the only one leading to Iraq as a whole, and will form a wall isolates the road to any ships coming to Iraq.



Figure 5- The location of Mubarak port.

5.2.1 Building stages of the project:

Phase I: The port began to be paved with four container berths, which could receive one million and eight hundred per year.

Part I: Design and construction of a two-way double-lane highway (31 km) and a railway berth, passing through Kuwait and the mainland's of Kuwait.

Part 2: includes the design of 16 berths with deep deepening of the navigational channel 14 and the water basins at a depth of 16 meters with the construction of four anchors (16.00 meters long and 16 meters deep).

Part 3: Includes: - Deepening the navigational course in the sea and the port basin

- Creation of a port yard that includes the design and construction of the port yard buildings and processing equipment.
- Construction and maintenance of the main road including railways and bridges.
- Establishment of a power plant

Phase II: This phase includes the construction of 12 berths, with a total berth capacity of 16 berths. This phase will be ready since 2012 and will take one year to be able to accommodate one and a half million containers annually.

Phase III: This phase includes the construction of eight berths, with a total port capacity increasing to (24) to reach the capacity of containers to reach (2.5) million containers annually.

Phase VI: This phase includes the construction of 36 berths, bringing the total berths to 60 berths.

If Kuwait completes the fourth phase of construction of the port of Mubarak, it will effect on Iraq economically. The expansion of the port in the fourth stage will cover the entire navigable channel. In addition, the Iraqi ports will stop completely such as (Umm Qasr and Khour al- Zubair) because they are located deep in Iraqi territory. Although Kuwait has a coastline of more than 500 km, it insisted on building the port of Mubarak at this point facing Iraq [10].

4.4 Khour Abdallah Convention for the Regulation of Navigation:

After the navigational corridor in Khour Abdallah was entirely under the authority of Iraq, the UN resolution came to equalize between the two sides equally, and because Iraq was under the seventh item. One of the reasons for getting out of it was to conclude an agreement with Kuwait to demarcate the border and solve the problem around the sea corridor (Khour Abdullah), Thus Khour Abdullah agreement is between the two sides. In order to regulate maritime navigation in Khour Abdallah through the formation of a joint committee working to activate and implement the provisions of UN Resolution 833 in 1993. In order to develop joint maritime safety plans in Khour Abdallah for navigational and environmental issues, and to promote strengthening the relationship between the two countries and respect for the right of the traffic Navigation in international conventions, this Convention was concluded [11].

5. Results and Discussion:

5.1 Demarcation of the border between Iraq and Iran:

The border is demarcated in general and the sea in particular between Iraq and Kuwait in accordance with the United Nations resolution (833) in 1993. After the controversy and the conflict for long periods between them, and the decision was to divide the waterway between them (Khour Abdullah) into two halves, but the decision did not take into account the geographical nature and topography of the waterway (Khour Abdullah), in addition to the geological nature and the location of the ancient water channel. See Figure-6:

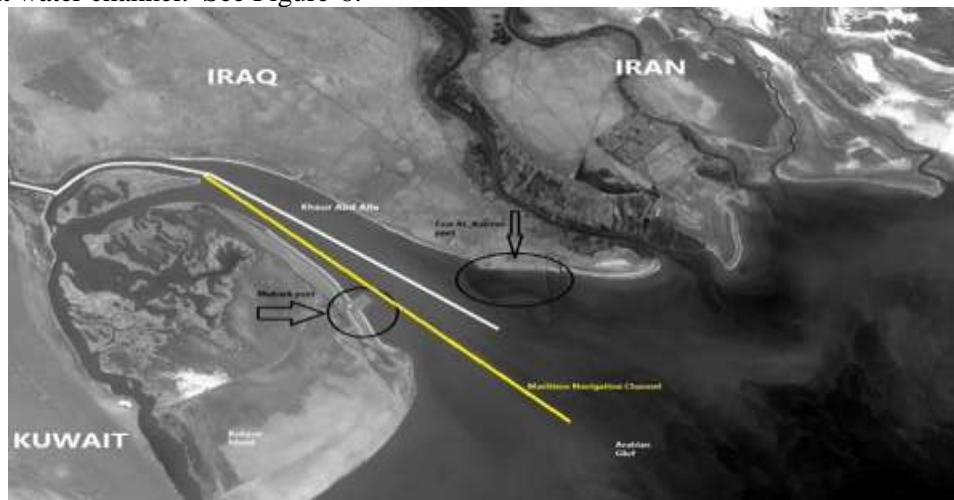


Figure 6- satellite image (Landsat 8) Focusing on the waterway (Khour Abdallah) and the demarcation process in accordance with United Nations resolution (833) in 1993.

In this study highlights the main drawbacks of this decision through design new maps by using the GIS program, First, geometric correction is done on the maps at geographical coordinates according to latitude and longitude by choosing topographic maps of khour Abdulla, show Figure-8 and Table-1:

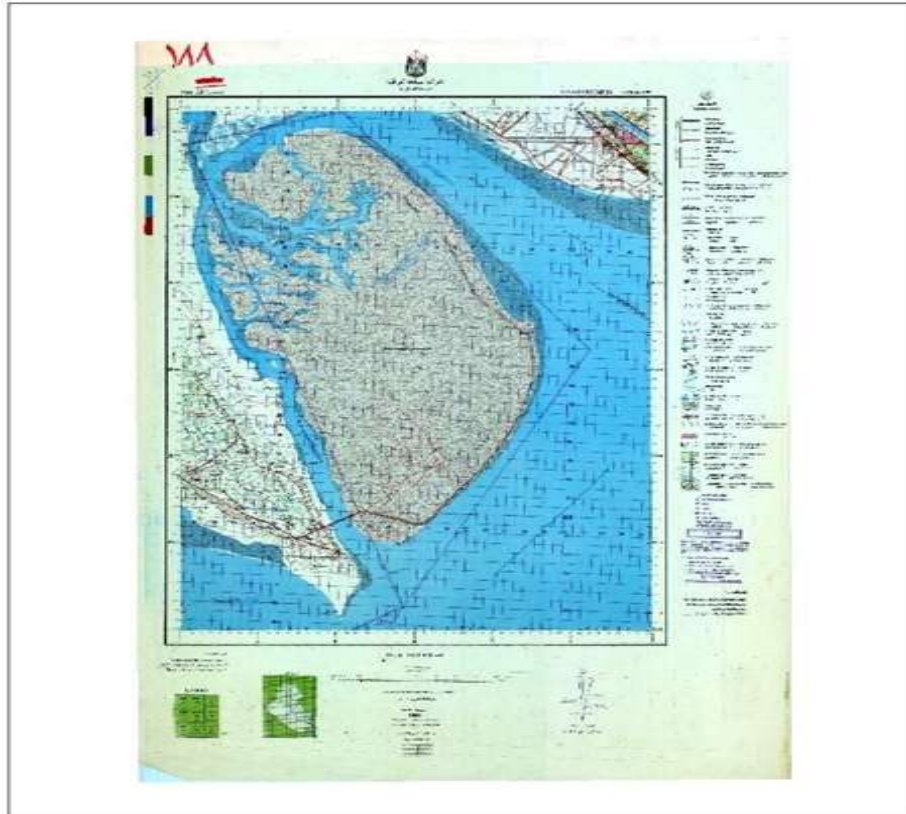


Figure 7- The original map of khour Abdallah area.

Table 1-the points are taken from the map of khour Abdallah for geometric correction according to latitude and longitude.

Number	A1	B1	C1	B1\60	C1\3600	Result (R)	Type	Direction
1	26	57	49.83828	0.95	0.013844	26.96384	long	W
1	45	30	15.04361	0.5	0.004179	45.50418	latit	N
2	0	41	40.54006	0.683333	0.011261	0.694594	long	W
2	39	36	11.21575	0.6	0.003115	39.60312	latit	N
3	28	14	22.74493	0.233333	0.006318	28.23965	long	E
3	24	56	44.28849	0.933333	0.012302	24.94564	latit	N
4	8	26	33.12889	0.433333	0.009202	8.442536	long	E
4	12	45	46.06323	0.75	0.012795	12.7628	latit	N
5	22	23	43.0038	0.383333	0.011946	22.39528	long	W
5	8	16	39.04084	0.266667	0.010845	8.277511	latit	N
6	21	44	37.40217	0.733333	0.010389	21.74372	long	E
6	14	35	20.79212	0.583333	0.005776	14.58911	latit	S
7	16	56	46.72727	0.933333	0.01298	16.94631	long	W
7	27	17	43.55049	0.283333	0.012097	27.29543	latit	S
8	19	16	8.70016	0.266667	0.002417	19.26908	long	E
8	35	11	42.86844	0.183333	0.011908	35.19524	latit	S
9	16	8	14.267	0.133333	0.003963	16.1373	long	W
9	45	39	53.53077	0.65	0.01487	45.66487	latit	S
10	13	56	20.72661	0.933333	0.005757	13.93909	long	E
10	56	8	4.1931	0.133333	0.001165	56.1345	latit	S



Figure 8- corrected map of khour Abdulla area

After finishing the geometric correction of the topographic map of the area, we redraw and designed the Digital map of the area and highlighted its most important features. As in Figure-9.

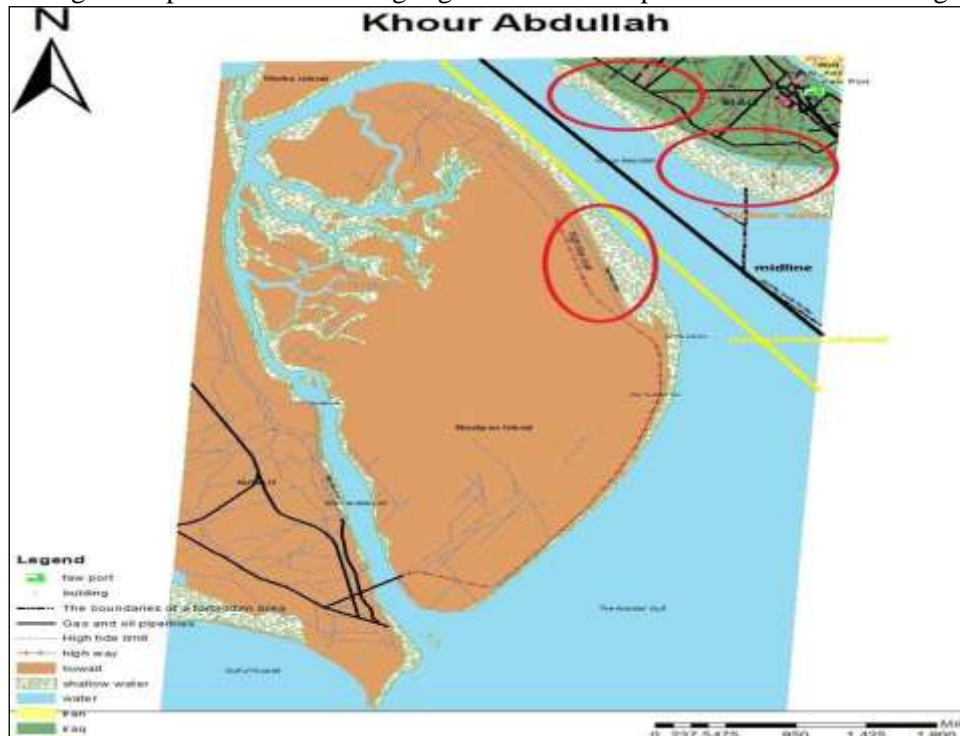


Figure 9- A redesigned map of the khour Abdulla area

Red circle: represented in shallow water areas.

Black line: represented to midline border according to United Nations resolution (833) in 1993.

Yellow line: represented to navigation channel in the waterway.

5.2 Result of Khour Abdulla agreement:

- That the process of demarcation wronged Iraq because the mid-line gave Iraq the side that not served previously. It fully with shallow water, marine plankton and submerged warships, and Iraq will cost a lot of time and money to sustain it.
- Therefore, Iraq has to object to the consequences of UN resolutions against it in the international forums, because these demarcation decisions did not take into account the geographical and geological nature of the region, and the erosion of the continental shelf due to natural phenomena (tides).

6 Conclusion:

1. GIS found a new design for the area.
2. Talking about the nature of the geological and geographical area and what are the natural phenomena affecting them.
3. Creating a single new map for all Iraqi ports.
4. Determining the location of the new port of Iraq (Faw AL-Kabeer) by satellite image.
5. Iraq has to object to the consequences of UN resolutions against it in the international forums.
6. Iraq should begin talks and new dialogues with Kuwait to put in place the mechanisms for implementation of the Khour Abdullah agreement, according to the principles of cooperation and mutual interest, and leave the imposition of wills by force.
7. Iraq must find strong allies to be able to defend its interests without harming others.
8. The government should not activate the railway agreement between Iraq and Kuwait unless the agreement is canceled Khour Abdullah.
9. In the event, that Iraq does not succeed in cancelling the United Nations resolution on the delimitation and its unjust consequences. The government must find new understandings with the neighbor Kuwait based on mutual interest. Through:
 - The cancellation of the former Khour Abdullah agreement, the formation of a joint committee between the two sides, working on a scientific and a thoughtful basis to find new understandings on the demarcation of the maritime border.
 - The basis of demarcation must be established in accordance with the common interest and benefit.
 - Joint action to establish a joint commercial area between the two parties. To develop the economy of the two parties without harming anyone.
10. Iraq should not wait for economic benefit for others. Therefore, Iraq must expedite the completion of all facilities of the port of Faw AL_Kabeer. Benefits of this port include:
 - This port contributes to the reorganization of other Iraqi ports.
 - Developing Iraq's economy by increasing imports.
 - Giving a competitive advantage for the Iraqi ports from the ports of neighboring countries.
 - Contributing to reducing unemployment through the employment of more than 5000 workers.

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