Journal of Engineering and Development, Vol. 16, No.1, March 2012 ISSN 1813- 7822

A Geographic Information System Application for Water Resources of Iraq

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Abstract

The geographical information system permits the study of local distribution of phenomena, activities and the aims that can be determined in the local surrounding like points, lines and areas, where the geographical information system treats the data related to these points, lines and areas to make the data ready to be returned for analysis or asking about certain information by using it. The research aims to employ the abilities given by GIS to use in the field of construction of water resources map in Iraq by transferring the paper maps into digital maps. Then extracting the layers from this map and preparing the geographic data base that are appropriate .After that analysis of these data is done which permits for less effort and cost and finally increasing in the production and speed and accuracy.

تطبيق نظام المعلومات الجغرافية للموارد المائية في العراق

الخلاصة

إن نظام المعلومات الجغرافية يتيح إمكانية دراسة التوزيع المكاني للظاهرات والنشاطات والأهداف التي يمكن تحديدها في المحيط المكاني كالنقط والخطوط والمساحات، حيث يقوم النظام بمعالجة المعلومات المرتبطة بتلك النقاط أو الخطوط أو المساحات لجعل البيانات جاهزة لاسترجاعها و تحليلها أو الاستفسار عن البيانات من خلالها. يهدف البحث إلى توظيف الإمكانات التي يتيحها نظام المعلومات الجغرافية لاستخدامها في مجال إنتاج خرائط رقمية للموارد المائية في العراق من خلال تحويل الخرائط الورقية إلى الصيغة الرقمية ومن ثم تكوين الطبقات المكونة للخارطة (طبقة السدود ،السدات ،الأنهار ، البحيرات) وإعداد قاعدة البيانات الجغرافية المناسبة لها .وإجراء تحليلات لهذه البيانات بأستخدام هذا النظام الذي يهدف الى تقليل الجهد والكلفة وزيادة الإنتاج والسرعة والدقة.

1. Introduction:

Geographical information system is a new technology is becoming an essential tool for analyzing and graphically transferring knowledge about the world. GIS is defined as an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information [1]

The later years witnessed a great care toward GIS employments . This includes fields of water studies and hydrologic analysis and this is very obvious from the assays that are published in scientific magazines ,written books and scientific conferences and especially (HydroGIS conference) which starts in 1991(which continued later on every three years). A GIS is also a computerized tool for solving geographic problems, a definition that speaks to the purposes of GIS, rather than to its functions or physical form an idea that is expressed in another definition, a spatial decision support system GIS is an analysis engine, to examine data, query, identify the spatial relationships between map features and etc [2] . Geographic information systems (GISs) are appropriate for managing and accessing digital database, and particularly collections of spatial data such as maps or images of the earth. But, they are also appropriate for any collection that can be geographically referenced. Furthermore, advanced GIS tools can link library collections; that is, GIS and coordinate information can be used as a general purpose indexing system to library collections. This would make it possible to access virtually all objects collected by a library that are geographically referenced [3]. Data GIS is a mathematical construct to represent geographic objects or surfaces. There are two types of data; spatial data and attribute data (tabular data). Spatial data represents Information about the locations and shapes of geographic features and the relationships between them. Spatial data format either vector data, which have shape and boundaries such as point, line and polygon, or raster data which have two- dimensional arrays of cells (pixels) [4] . In its simplest form, a raster consists of a matrix of cells (or pixels) organized into rows and columns (grid) where each cell contains a value representing information, such as temperature. Rasters are digital aerial photographs, satellites imagery, digital pictures, or even scanned maps [5] .

Water resources are essential to the functioning of any city. Besides residential supply, water is utilized for commercial and industrial uses, recreation,parks,cooling water for power plants,and other purposes. [6]In this research water resource map in Iraq which shown in figure (1) is transferred in to a digital map.Georeferencing is done to enable us to deal with this map in the Arc GIS, then layers were extracted from this map using digitizing process and finally descriptive analysis is done .

2. Digitization:

Digitization is one of the main sources of converting graphic images to digital form. In this process the maps are captured in layer concept and one layer after another is captured. The capturing method is that to simplify that process. The satellite image or a scanned map is displayed and traced with the mouse. As in standard digitization, the feature type is set (point, line, or polygon), and then the selected features are traced using the mouse as a puck [7] .in this research the layers have been constructed from water resources map in Iraq that are (Iraq bound layer, Government bound layer, Rivers layer, Dams layer, Barrages layer, and Lakes layer). As shown in these figures (2),(3),(4),(5),(6),(7) respectively. these layers were constructed by using Arc catalog program and digitizing where rivers is represented as lines, barrages layer is represented as points, dams layer is represented as polygon,and lakes layer is represented as polygon these layers were stored in Arc GIS as(shape file).these layers represented geo data base for water resources of Iraq.

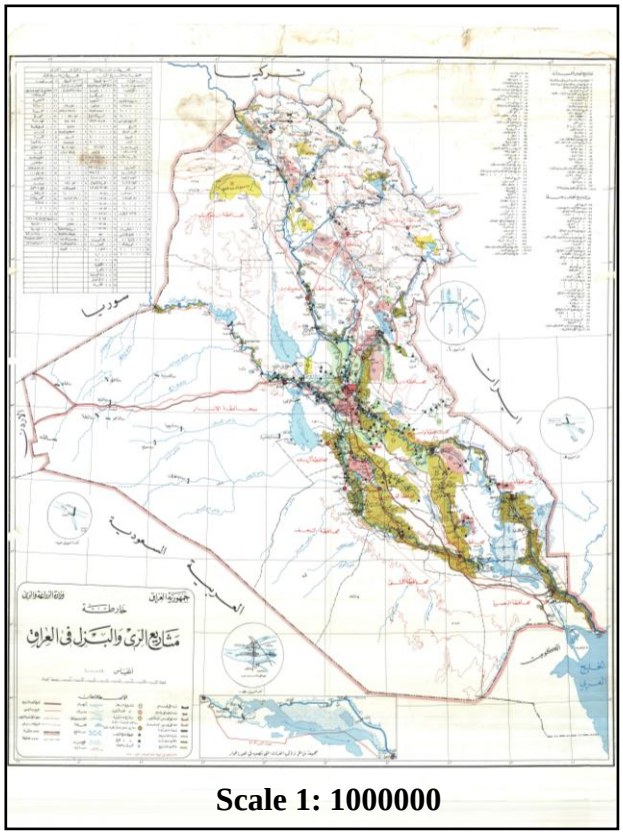

Figure (1): Water Resources Map in Iraq

Note: this map was given from ministry of water resources

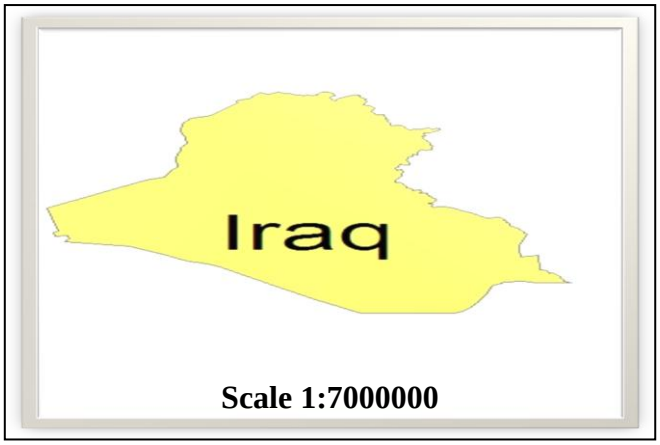

Figure (2) : Iraq boundaries layer

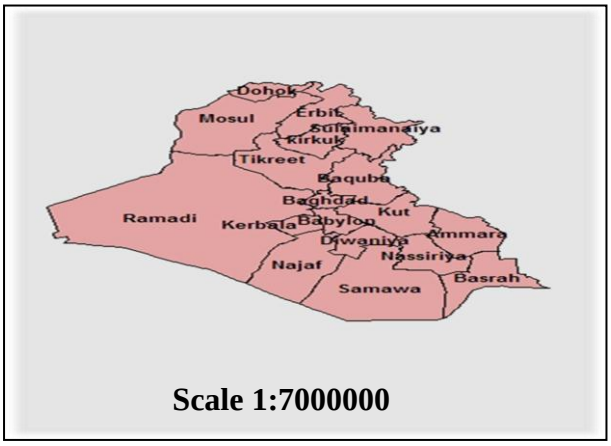

Figure (3): Iraqi Governorates boundaries layer

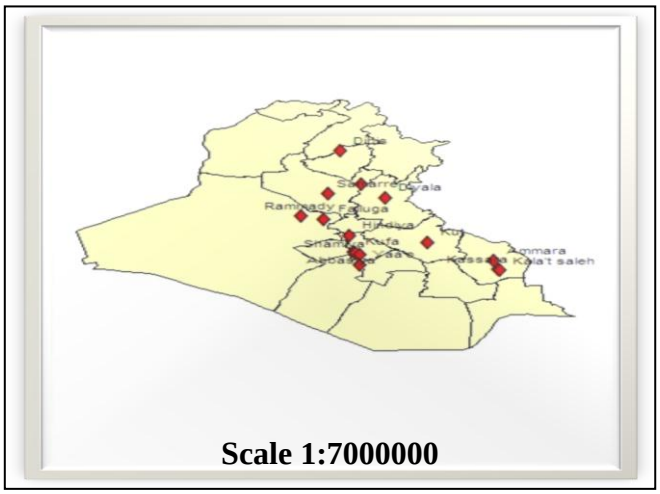

Figure (4): Iraq dams layer

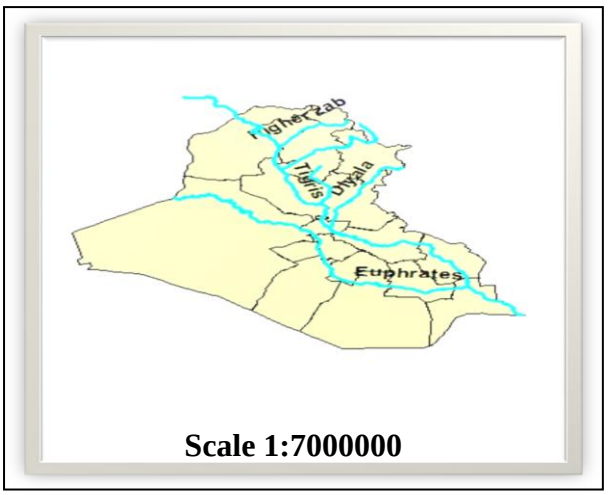

Figure (5): Iraq rivers layer

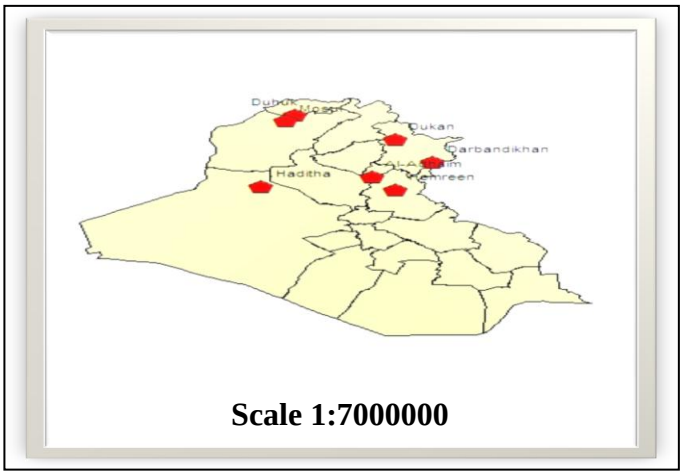

Figure (6): Iraq Barrages layer

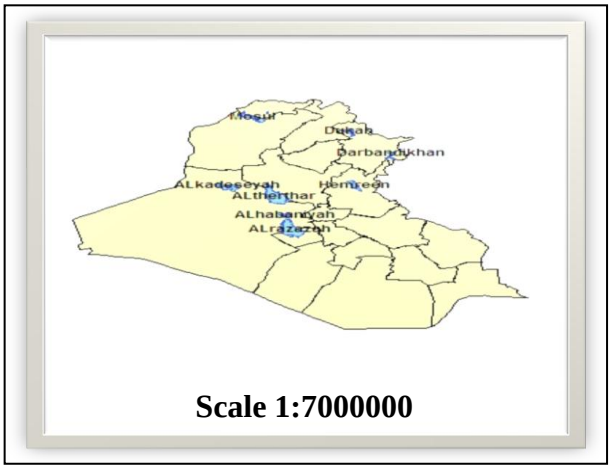

Figure (7): Iraq lakes layer

3. Data Treatment and Analysis:

After taking the main information related to dams and barrages. Descriptive analysis were taking out by using the (GIS) that are:-

1- Doing graphs for the chosen data from the dam layer based on the maximum storage for each dam as shown in table (1) and figure (8) and also the barrages layer according to the maximum discharge for each barrages as shown in table (2) and figure (9) .
2- Doing charts for the chosen data from the dam layer based on the dam height and storage capacity, amount of the electric energy and the total storage capacity for each dam as shown in figures (10),(11) ,(12)and(13) .
3- Doing graphs for the barrages according to No. of the gates and the highest water level , maximum discharge for each barrages as shown in figures (14),(15) , and(16) .

Table (1) The information related to the dams

Fid	Name of the Dams	Total Storage (m3)	Electricity (M watt)	Max. Storage (m3)	Dam Height (m)
0	Duhuk	52	0	619	60
1	Mosul	14530	750	339	113
2	Dukan	7250	400	515	117
3	Darbandikhan	4040	240	494	127
4	Al-Adhaim	3800	27	143	62
5	Haditha	10000	66	150	57
6	Hemreen	3560	50	108	40

Table (2) The information related to the barrages

Fid	Name of the Barrages	Electricity (M watt)	Max. Level (m)	Max. Discharge (m^3/sec)	No. of Gate
0	Dibis	Non	254	4000	8
1	AL_adhiam	Non	0	1100	0
2	Samarre	70	69	7000	17
3	Diyala	Non	68	1200	23
4	Rammady	Non	52	3000	24
5	Falluga	Non	45	3600	10
6	Hindiya	15	33	2500	6
7	Kufa	5	26	1400	7
8	Abbasiya	Non	26	1100	6
9	Shamiya	Non	23	1100	5
10	Yaa'o	Non	19	750	7
11	Kut	Non	20	1100	5
12	Ammara	Non	18	280	4
13	Kala't saleh	Non	17	200	7

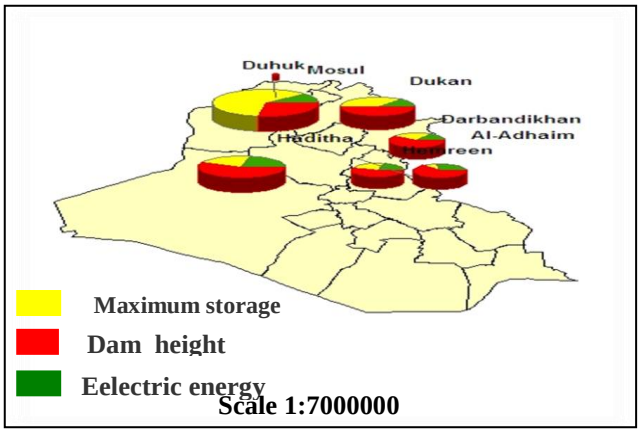

Figure (8): Dams data graph

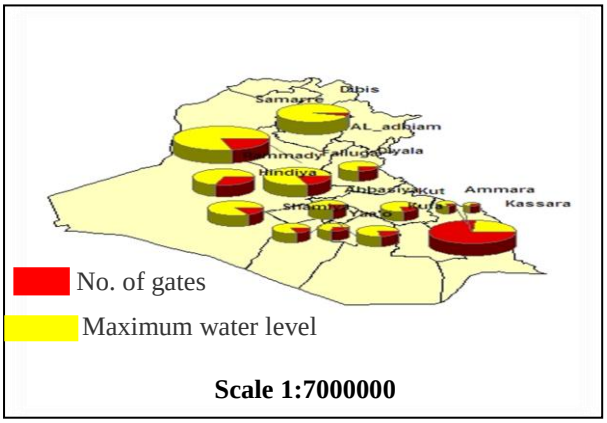

Figure (9): Barrages data graph

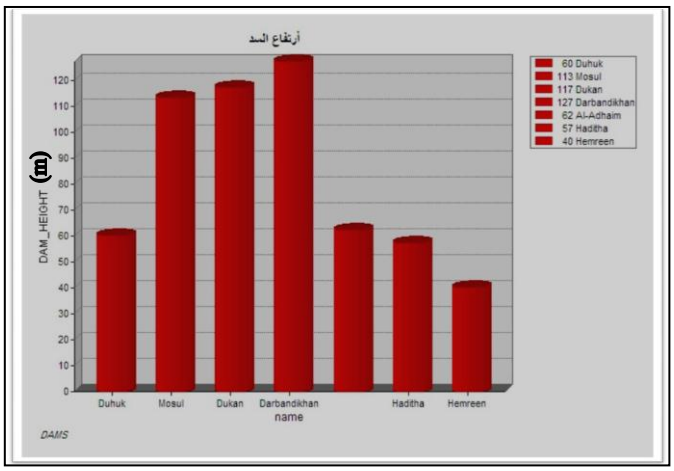

Figure (10): Dams height chart

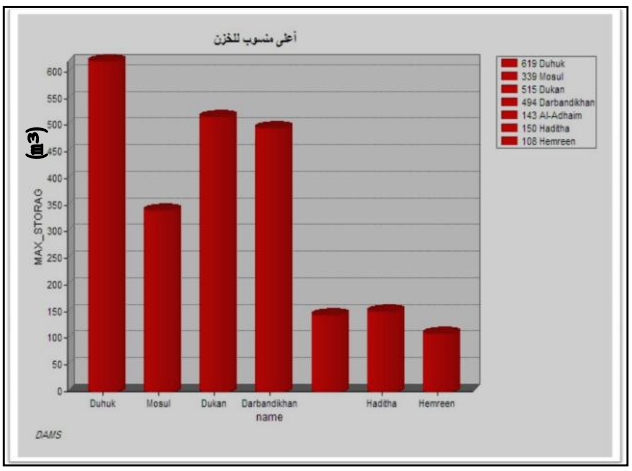

Figure (11): Maximum storage of the dames chart

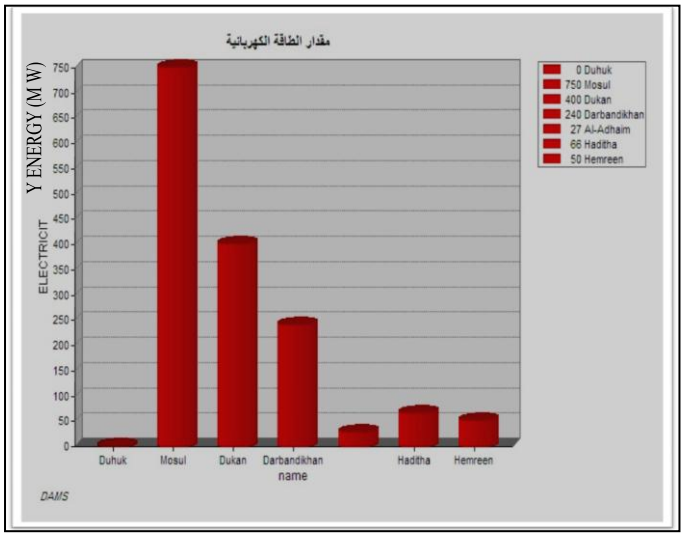

Figure (12): Electricity energy of the dams chart

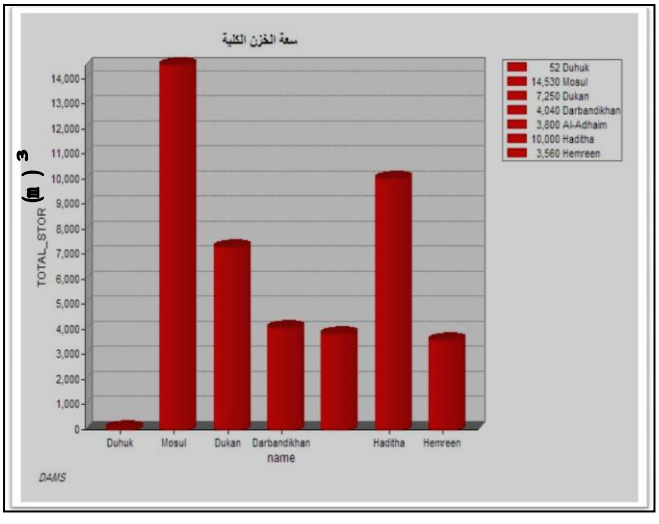

Figure (13): Total storage capacity of the dams chart

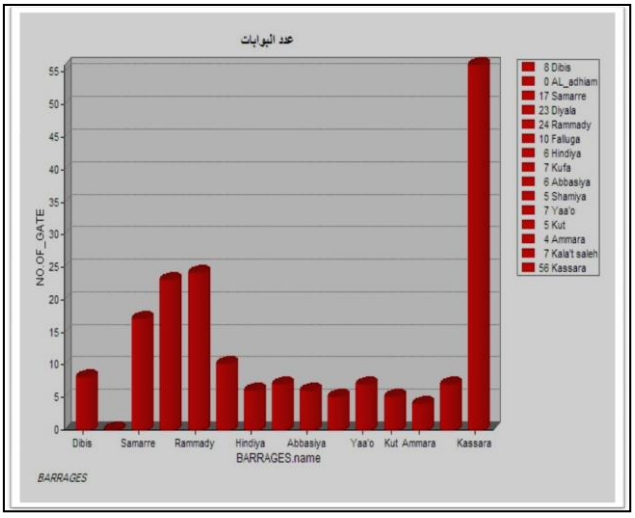

Figure (14): No. of gates of the barrages chart

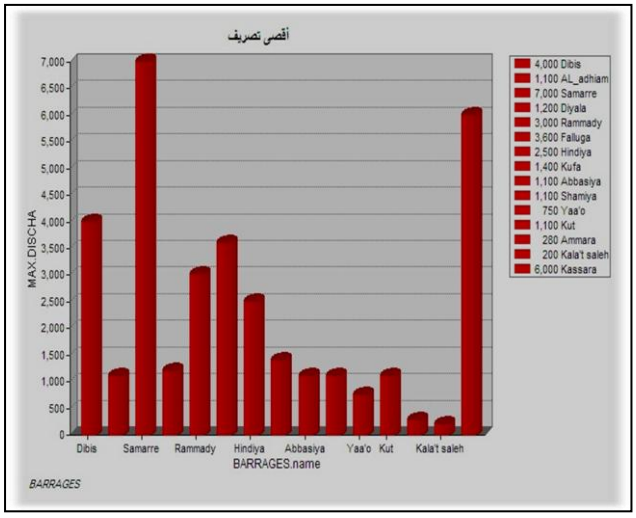

Figure (15): Maximum water level of the barrages chart

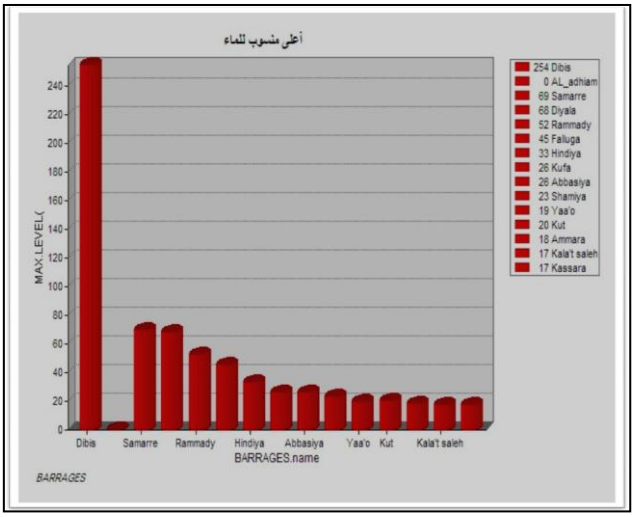

Figure (16): Maximum discharge of the barrages chart

4. Conclusions:

1. The use of GIS has been known to be efficient for preparing data base for decision making in water resources projects.
2. GIS have been apowerful supporting tool for spatial planning of water resources projects and locating of its features(dams,barrages,lakes,rivers)
3. Data bases for water resources are economical and have high accuracy because these layers represented vector data .
4. Data base for water resources can be update with short time and high speed
5. In the future work, other layers can be extracted from water resources map like as(regulators layer, irrigation canals layer)in order to integrate data with spatial component for water resources projects .
6. In the future work, attribute data of some features was need to join with spatial data in order to analyze them and to make decision in water resources projects .

5. References:-

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