CONFIDENTIAL

RAMSAR CONVENTION MONITORING PROCEDURE

REPORT NO.16

AZRAQ OASIS, JORDAN

General Introduction

1. Each Contracting Party to the Ramsar Convention ("Convention on Wetlands of International Importance especially as Waterfowl Habitat" Ramsar, 1971) "shall designate suitable wetlands within its territory for inclusion in a List of Wetlands of International Importance" (Article 2.1 of the Convention). The Contracting Parties "shall designate at least one wetland to be included in the List" (Article 2.4) and "shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List"(Article 3.1). Furthermore, each Contracting Party "shall arrange to be informed at the earliest possible time if the ecological character of any wetland in its territory and included in the list has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference. Information on such changes shall be passed without delay to the organization or government responsible for continuing bureau duties" (Article 3.2).

2. These are the principal stipulations of the Convention concerning wetlands included in the Ramsar List. Successive meetings of the Conference of the Contracting Parties (held in 1980 at Cagliari, Italy, in 1984 at Groningen, Netherlands and in 1987 at Regina, Canada) have devoted special attention to the conservation of listed wetlands and to the best ways of avoiding 'change in ecological character'.

   Conference Document C.3.6 of the Regina meeting ("Review of national reports submitted by Contracting Parties and Review of implementation of the Convention since the second meeting in Groningen, Netherlands in May 1984") included a section (paragraphs 66 to 107) entitled "Changes in the ecological character of listed wetlands". This section recalls that it is "essential that, after a wetland has been designated for the List, its conservation status should be maintained", and that "the concept of preventing 'change in the ecological character' is fundamental to the Ramsar Convention". Paragraphs 74 to 107 then review the various wetlands on the List where such changes have occurred, are occurring, or are likely to occur.

4. During the discussion of these paragraphs, several delegates emphasized the importance of avoiding changes of this kind in listed wetlands and the Conference approved a Recommendation (C.3.9) on this matter. The Recommendation urges Contracting Parties to take swift and effective action to prevent any further

degradation of sites and to restore, as far as possible the value of degraded sites; the Recommendation requests Parties in whose territory are located the sites identified in Conference Document C.3.6 as having incurred or being threatened by damage, to report to the Convention Bureau the actions undertaken to safeguard these sites.

5. At the fourth Meeting of the Ramsar Convention Standing Committee, the members (Pakistan, Canada, Chile, Netherlands, Poland, Switzerland, Tunisia and USA) and observers (United Kingdom, IUCN, IWRB and WWF) considered the best way of promoting the implementation of Recommendation C.3.9. A 'Monitoring Procedure' (the text of which is attached to the present document) was adopted by the Standing Committee as a procedure to monitor Ramsar sites, and has been used since February 1988 by the Convention Bureau.

AZRAQ OASIS - general background

6. The Hashemite Kingdom of Jordan deposited its instrument of accession to the Ramsar Convention with the Director General of Unesco on 10 January 1977. On that occasion it designated a single wetland - Azraq Oasis - for the 'List of Wetlands of International Importance' The designation documents indicate that the site is composed of Azraq Waterfowl Reserve (1245ha) and Azraq Mudflat (6127ha).

7. A brief site description and map which accompanied the above-mentioned designation (Figure 1) were used in conjunction with published sources as the basis for the information contained in the 'Directory of Wetlands of International Importance' (IUCN, 1987) which states: "Among the few wetlands of this semi-arid to very arid country, the Azraq Oasis in the Eastern Desert is probably the only one which is of international importance. It is an outstanding example of the ecosystems characteristic of areas in semi-arid regions where surface water is available". The location and area of the designated site are given as 31°49'N 36°48'E and 7372ha respectively. The site description goes on to say, "The designated site comprises the marshy areas, mudflats and waterpools of Azraq Oasis, and lies in a depression at 500-600m altitude. The whole area is limestone bedrock overlain by grey desert soil.....Several major vegetation communities can be identified, whose composition is influenced by soil moisture content and salinity.....The unique fresh and saltwater communities support numerous hydrophytic plants, largely restricted within Jordan to Azraq.....Mean annual rainfall 50-75mm.....The wetland is of major importance to raptors and waterfowl on the Palearctic-Ethiopian migration routes, and is also a breeding site for some 70 bird species". The section on 'Changes in Ecological Character' refers to pumping of water from springs feeding the wetland to North Azraq and Amman, as well as difficulties connected with access and hunting. However, this section concludes, ".....since 1981/2 most of these activities have been stopped or controlled, and conditions are improving".

8. Several references testify to the outstanding importance of Azraq Oasis for wintering waterfowl during the 1960s and 1970s. Nelson (1973) refers to an aerial survey of waterfowl carried out in February 1967 by the Royal Society for the Conservation of Nature (RSCN), during which the following totals were estimated: Teal 180,000, Pintail 100,000, Coot 40,000, Wigeon 20,000, Tufted Duck 5,000, and Mallard 2000; total 347,000. 'A Directory of Western Palearctic Wetlands' (Carp, 1980) states that "The vast shallow lake formed in winter is frequented by great numbers of dabbling duck - Mallard Anas platyrhynchos (3,000), Wigeon A. penelope (8,000), Teal A. crecca (24,000), Garganey A. querquedula (8,000), Pintail A. acuta (17,000), Shoveler A. clypeata (10,000) and Coots Fulica atra (25,000), the figures quoted being for February 1974". Mid-winter counts co-ordinated by the International Waterfowl and Wetlands Research Bureau (IWRB) - see Appendix B - show that numbers were dramatically lower in the 1980s. For example, the highest count recorded for Teal in the five-year period 1984-1988 was only 1200. Fewer than 4000 waterfowl were counted in total during the 1989 mid-winter count.

9. The Jordanian National Report, submitted to the Third Conference of the Contracting Parties held in Regina, Canada, in June 1987 is published in full in the Proceedings of the Conference (Ramsar Bureau, 1988); see pages 491-492 in the English version. The report, prepared by the Jordanian Royal Society for the Conservation of Nature (RSCN), refers to the commencement of pumping from wells drilled in the oasis catchment, some 10-15km from the wetland reserve, in order to supply water to the Amman district. The wells replaced previous extraction which had involved pumping directly from the springs feeding the Wetland Reserve and quantities were increased gradually until sixteen million cubic metres per year (16 MCM/yr) were being taken. At this point, RSCN confronted the Water Authority and following the intervention of the Prime Minister and other ministers, the pumping was reduced on several occasions, but was increased again due to pressure for more water to be pumped to Amman. The report states, "The problem has taken a more dangerous form lately as the water balance between the salty water and fresh water in the area is disturbed and if pumping continues at this rate, the Azraq Water Basin could be destroyed".

10. Independent published sources (e.g. Nelson, 1985) had also suggested that the ecological character of Azraq Oasis was threatened by a variety of factors, most notably water extraction. A management plan for the Wetland Reserve had been prepared in 1979, with funding from IUCN and WWF (Conder, 1985), but was only partially implemented.

In the light of the National Report cited in point 9 above, the Regina Conference approved the following recommendation (Rec. C.3.8 - the only 'Regina Recommendation' dealing with a specific wetland), with strong support from the Jordanian delegation (H.E. The Minister for Municipal and Rural Affairs and the Environment, and the Director of RSCN):

"Conservation of Azraq Ramsar site

NOTING that Jordan has designated the Azraq wetland for the List of wetlands of international importance established under the Ramsar Convention;

AWARE that under Article 3 of the Convention, Contracting Parties "formulate and implement their planning so as to promote the conservation of the wetlands included in the List";

INFORMED that the Amman Water Authority is currently pumping 16 million cubic metres of water per annum from Azraq to supply drinking water for the Jordanian capital;

CONCERNED that extraction at this rate is likely to provoke serious changes in the natural properties of the Azraq wetland, and, in particular, may increase the salinity of the remaining water there;

THE CONFERENCE OF THE CONTRACTING PARTIES

CALLS for a proper assessment of the environmental impact of the pumping;

SUGGESTS that pumping be reduced by at least 50%, as demanded by conservation bodies in Jordan, at least until the environmental impact study is completed; and

URGES that there be established a long-term water resources plan guaranteeing the maintenance of the natural properties of this wetland of international importance."

12. The Jordanian Department of Environment (a section within the Ministry for Municipal and Rural Affairs and the Environment) made a national presentation to the 'Workshop on Integrated Management of Mediterranean Wetlands' (co-sponsored by the Ramsar Bureau) held in Doñana, Spain, from 12-19 November 1989. The report, entitled 'Review on Reserves and Al-Azraq Wetland Reserve' included an outline of the then current water situation at Azraq. It was noted that the basin is considered one of the main water sources providing the Amman area with drinking water as well as being a source of irrigation in the Azraq area. It is stated that, "This report is based on the water studies concerning Azraq basin, their uses and the effects of the uses. It stresses the necessity of limiting the quantities of water that can be used, since over-use may lead to the basin's salination. This is a fact proved by scientific studies and demonstrated by what happened in areas of the Jordan valley.....where salination of ground water happened as a result of over-use". Following a summary of technical data, the report concludes, ".....it is clear that not more than 20 million cubic metres per year should be discharged for all purposes....." and "Any increase in pumping drinking water from the springs for irrigation purposes will be at the expense of the drinking water quantities or the springs' flow. Continuation of the natural flow of Azraq springs is considered an indicator of water balance in the basin and the non-movement of saline water from the mud-flat area towards the drinking wells field".

13. In the light of Regina Recommendation C.3.8, and following extensive consultations with the Jordanian authorities, it was agreed that it would be appropriate for the Ramsar Bureau's Monitoring Procedure (see paragraph 5 above) to be applied at Azraq. As a consequence, the Bureau's Technical Officer (T.A.Jones) and a specialist Consultant with extensive previous experience of Azraq (Dr J.E. Clarke) visited Jordan from 23-31 March 1990 in order to gather as much information as possible on the current status of the Azraq wetland and to take part in discussions with Jordanian government officials and the Royal Society for the Conservation of Nature (RSCN). The arrangements and programme for the visit were handled most efficiently by the Department of Environment (Ministry of Municipal and Rural Affairs and the Environment).

14. Programme: on 24 March, our first full day in Amman, we were able to have discussions with officials representing the Ministry of Municipal & Rural Affairs & the Environment, the Ministry of Water & Irrigation, and the Royal Society for the Conservation of Nature. On 25 March, we travelled to Azraq (in the company of RSCN personnel) for a three-day stay, during which we were able to make a detailed field inspection of the oasis, with technicians from the two Ministries present for part of the time. We returned to Amman on the morning of 28 March for further consultations with the Jordanian government, including meetings with the Minister for Municipal & Rural Affairs & the Environment and the Minister for Water & Irrigation.

15. The report which follows is divided into four sections:

A. General features of the Azraq basin.
B. Review of the large-scale exploitation of Azraq as a source of water for domestic and agricultural use.
C. Current status of Azraq Oasis
D. Conclusions and recommendations.

16. Appendices to this report include the text of the Monitoring Procedure, a list of references and contacts, and a variety of technical data.

A. GENERAL FEATURES OF THE AZRAQ BASIN

This section has been compiled from sources referred to in the text, from information obtained during fieldwork and from discussions with the Jordanian authorities who provided a wealth of valuable data.

(a) Location: Azraq Oasis is located some 80km ESE of Amman at approximate geographical coordinates 31°49'N 36°48'E. It lies at the heart of a large drainage basin (covering around 12,710km²), 94% of which is Jordanian territory, with minor extensions into Syria (>5%) and Saudi Arabia (<1%) - see Figure 2. Major highways from Amman/Zarqa to Iraq and Saudi Arabia transect the basin, passing through the villages of South Azraq (formerly Shishan) and North Azraq (formerly Druze). Both villages lie on the north-western edge of the oasis itself (Figure 2).

(b) Topography: the Azraq drainage basin is irregular in shape having a pronounced SW-NE extension. It is a relatively shallow depression, with a central playa, the elevation of which is about 500m a.s.l. Away from the oasis playa, altitude increases gradually to reach 900m a.s.l. in the west, south and east, (occasionally exceeding 1000m), with the basin's maximum elevation of 1550m occurring in the Jebel Druze area of Syria some 80km to the north (see Figure 3).

(c) Geology: as can be seen from Figure 4, the surface geology of the basin is relatively simple. The north-eastern half is dominated by basaltic lava originating from Miocene/Oligocene volcanic activity in what is now Syrian territory. The basalt becomes progressively thinner towards the south and eventually gives way to a karst landscape dominated by Paleocene and Eocene limestones. The entire basin is dissected by an extensive network of wadis, especially on the limestone, which have carried large quantities of superficial deposits (alluvium and top soil) into the central depression during the Quaternary. These superficial deposits (which continue to accumulate, notably during the flash-floods which follow storm events) are most apparent at Qa Azraq, the large playa or "mud-flat" area which occupies the central depression of the basin (see Figures 4 and 5). In common with other arid regions of the world, the thin desert soils of Azraq are highly saline, reflecting the area's low rainfall and very high rates of evaporation.

(d) Climate: the average annual rainfall is about 87mm and the mean annual rainfall volume (in the catchment as a whole) has been calculated by the Ministry of Water and Irrigation (Directorate of Water Resources Studies, 1990) to be about 1101 million cubic metres (MCM). The average rainfall figure quoted above is somewhat misleading, since rainfall has a very skewed spatial distribution in the basin, showing a marked north-west to south-east negative gradient (350mm/yr in the extreme NW; <50mm in the SE). Some frontal (cyclonic) rain may occur in winter (Dec-Mar; especially in the west) but most precipitation is a result of thunderstorm activity.

The temperature regime of the basin is typical of arid to semi-arid regions, with considerable diurnal and seasonal variations. Overnight frosts are irregular but not uncommon in winter, whilst summer maxima regularly exceed 40C.

The Ministry of Water and Irrigation maintains an automatic weather station, located near South Azraq village, which is used mainly for calculating evaporation. Sensors take readings every few minutes and a technician changes the data-recording cassette once per month, taking each 'full' cassette back to Amman for analysis.

(e) Hydrology: the hydrology of the basin is complex and clearly can only be summarised in this report. The playa (Qa Azraq) is fed mainly by surface runoff from the many wadis (principally wadis Rajil, Hassan, Rattam, Aseikhim, Butum, Harth and Ghadaf; see Figure 5) which empty into it. As rainfall in the Azraq catchment is dominated by thunderstorm activity, flooding of the playa is very erratic and the mud-flat may be virtually dry for long periods of time. Peak storm runoff occurs mainly in January and March, although heavy thunderstorms occur frequently in April and May, sometimes resulting in major inundation of the playa. According to information provided by the Ministry of Water and Irrigation, the average annual surface runoff from the catchment is 26 million cubic metres (MCM) and although a small proportion of the water which collects on the playa infiltrates into the groundwater, the majority evaporates over a period of weeks or months.

Information provided by the Ministry of Water and Irrigation indicates that there are three aquifer systems in the Azraq basin (see Figure 6):

- Basalt/B4 aquifer: basalt/limestone; located a few metres below ground; salinity <400ppm.
- B2/A7 aquifer: about 600m below surface; B2 = chert limestone; A7 = silicified sandy limestone; salinity 800-1500ppm.
- Kurnub aquifer: >1000m below surface; sandstone; salinity unknown but assumed to be high.

The letter designations for the upper two aquifers are taken from the settlements of Ajlun (A) and Balqa (B).

The Ministry for Water & Irrigation estimates that the mean annual recharge (using data for a 23-year period) of the upper aquifer (basalt/B4) is about 34 MCM, with 88% of this recharge coming from the Jebel Druze plateau (i.e. between north-west and north-east), 11-12% from the west and south-west, and <1% from the south and south-east. The features and behaviour of the other two aquifer systems are relatively poorly understood, but it is understood that a major investigative study is being carried out in conjunction with the European Community.

Until recently, there were two groups of springs, located at the settlements of North Azraq (Druze) and South Azraq (Shishan). However, at the time of writing, owing to the exploitation of water for drinking and irrigation purposes (see below for full details and discussion), only the springs at South Azraq are flowing, the North Azraq group having dried up, reflecting the lowering of the water table. Water flowing from the Shishan springs has a relatively high salinity of around 1000ppm. This reflects the greater proportion of groundwater recharge in the Shishan area from the west of the basin,

where rainwater infiltrates substrates with higher salinities than are found to the north. There are two major springs at Shishan, which are known as Qaisiya and Souda.

Discharge from the Druze springs used to feed a small marshy wetland (now desiccated) close to the village, whilst the Shishan springs provided water to a much larger area - the Azraq Wetland Reserve (formerly referred to as Azraq Waterfowl Reserve). Although the Shishan springs continue to flow, information provided in section C of this report demonstrates that much less water reaches the Wetland Reserve now than ten years ago. Most of the discharge from the springs eventually evaporates, but some returns to groundwater via infiltration (Ministry of Water & Irrigation, 1990).

(f) Vegetation: the natural vegetation of the Azraq basin is largely controlled by water availability/substrate salinity, with geology and topography as secondary factors (although none of the factors mentioned operates in isolation from the others). However, human impact must be seen as the over-riding influence in many parts of the basin, where settlement, grazing, agriculture, water extraction, road construction and industrial developments (e.g. South Azraq salt refinery) have altered significantly the naturally occurring vegetation communities.

Overall, the basin is sparsely vegetated, reflecting the harsh desert environment and the effects of traditional Bedouin nomadic pastoralism. More extensive vegetation is limited to the major wadi networks and to Azraq Oasis itself - notably the area of the Wetland Reserve. A detailed account of the vegetation of Azraq Oasis is provided by Nelson (1973) and, therefore, only a brief summary is provided here.

Mixed scrub with date palms fringe the area around the Druze (no longer flowing) and Shishan spring groups and where water from the Shishan springs continues to provide wet, low-salinity habitats Typha, Scirpus, Juncus and Cyperus communities occur. Much of the Wetland Reserve, and other areas adjoining the playa, consists of saline silty dunes which support Nitraria and Tamarix communities. Whilst the most saline areas are devoid of vegetation, some of the mud-flat/playa is fringed with Halopeplis and Halocnemum. Further discussion of the Wetland Reserve vegetation is provided in section C of this report.

B. REVIEW OF THE LARGE-SCALE EXPLOITATION OF AZRAQ AS A SOURCE OF WATER FOR DOMESTIC AND AGRICULTURAL PURPOSES

Pumping from Azraq springs to supply water for the town of Irbid, initially limited to times of peak demand, began as long ago as September 1963 (Nelson, 1973). Pumping stations were built at the Druze and Shishan spring groups and a pipeline was constructed to take the water across the desert to Irbid, some 125km to the north-west. In comparison with the present-day level of exploitation, extraction during the 1960s and 70s was a relatively small-scale operation. As recently as 1980, the total annual discharge of the Azraq springs was about 13.2 MCM (Ministry of Water & Irrigation, 1990).

The (then) Amman Water Authority (now within the Ministry of Water and Irrigation) began pumping water to Amman on 15 November 1980 at an average rate of 900 cubic metres per hour, or around 75% of the spring discharge. In 1981, the Water Authority dug fifteen artesian wells some 10km north-west of the Druze springs and in 1982, pumping directly from the springs was replaced by extraction from the new well field.

The table below (reproduced from information provided by the Ministry of Water & Irrigation) summarizes the relationship between water extraction (withdrawals from government and private wells shown separately) and spring discharge at Azraq:

Year	withdrawal from government wells	Estimated withdrawal from private wells	spring discharge
1981	-	1.50	10.49
1982	9.50	1.50	8.35
1983	12.31	1.50	6.60
1984	14.36	2.00	6.04
1985	15.64	3.50	5.27
1986	13.72	4.50	3.57
1987	14.00	8.00	4.11
1988	19.64	12.00	2.15 *
1989	16.92	12.00	1.96 *

* refers to Shishan springs only; Druze springs dry after 1987.

NOTE all figures for water withdrawal and for spring discharge are in millions of cubic metres per year (MCM/yr).

As can be seen from the above table and from Figure 7, total withdrawal from the Azraq basin has risen dramatically from some 11 MCM in 1982 (when the well field first came on-line) to 31.64 MCM in 1988 and 28.92 MCM in 1989. At the same time, the discharge of the Druze and Shishan springs declined rapidly, eventually leading to the complete drying-out of the Druze springs in 1987. By 1989, the remaining discharge from the Shishan springs represented an 82% reduction from the total (Druze and Shishan) spring discharge in 1980.

It is also clear that the most significant increase in withdrawals since 1982 has occurred at the private wells. Hundreds of unlicensed wells have been drilled in the Azraq basin for agricultural irrigation purposes. However, the largest withdrawal takes place from the government wells in order to supply the Amman district with drinking water. It should be noted that only the government wells are equipped with meters to record the volumes of water extracted; total withdrawal from the private (unlicensed) wells can, therefore, only be estimated.

As mentioned earlier, the Ministry of Water & Irrigation has calculated the mean annual groundwater recharge of the Azraq basin to be some 34 MCM, of which around 14-16 MCM is estimated to be lost through evaporation. The Ministry engineers have therefore recommended a "safe yield" (i.e. maximum sustainable withdrawal) of about 20 MCM per year. Reference to Figure 7 and to the table above, shows that this level has been exceeded in every year since 1987. Modelling undertaken by the engineers has found that if the 1988 level of withdrawals were maintained, incursion of saline water could be expected within a few years. Further consideration of the "safe yield" concept is made in section D of this report ('Conclusions and Recommendations').

The Amman district (including Zarqa) is estimated to consume some 70 MCM per annum. In recent years, Azraq has therefore contributed a substantial proportion of this total; approximately one quarter in 1988 and 1989. Consumption is projected to increase substantially in line with the rapidly increasing population of the Amman district. Because water is such a scarce resource in Jordan, it is clear that loss of supplies from Azraq, which might result from salinization due to over-exploitation, would have extremely serious social and economic consequences. Further over-exploitation of Azraq's water would also contribute to continuing decline of the wetland's ecological status (see section C below).

The Amman district receives the remainder of its water from artesian well fields to the south of the city, from small dams on wadis in the Jordan valley, and from the Yarmuk river on the border with Syria. One of the wadi dams, the King Tallal dam, cannot be used for drinking water owing to pollution with agricultural pesticides, (treated) and sewage effluent from Amman and Zarqa. The bilharzia parasite Schistosoma also occurs in the dam. Jordan and Syria are currently planning to build a dam on the Yarmuk river, to provide water for both countries, but construction has not begun, as the necessary finance has yet to be secured.

In the second half of the 1980s, following fears about the consequences of over-exploitation of Azraq's water, a Cabinet Committee was formed by the Jordanian Government in order to review the situation. Representation on the Committee was as follows

Prime Ministry
Ministry of Agriculture
Ministry of Energy & Mineral Resources
Ministry of Finance
Ministry of Interior

continued.....

Ministry of Municipal & Rural Affairs & the Environment
Ministry of Planning
Ministry of Public Works and Housing
Ministry of Social Development
Ministry of Tourism & Antiquities
Water Authority

The Committee reported in October 1988 and made the following recommendations regarding the exploitation of Azraq's groundwater:

(a) The "safe yield" of 20 MCM per year, as estimated by the Water Authority engineers, should not be exceeded.

(b) A maximum of 14 MCM/yr should be taken for Amman and Zarqa.

(c) A maximum of 3.5 MCM/yr should be taken for irrigation.

(d) The spring discharge should be at least 2.5 MCM/yr in order to supply the Wetland Reserve and to "govern the water balance of the system" (Ministry of Water & Irrigation, 1990). "Continuation of the natural flow of Azraq springs is considered an indicator of water balance in the basin and the non-movement of saline water from the mud-flat area towards the drinking water wells field" (Department of Environment, 1989).

As a result of the Cabinet Committee's report, the following steps have been taken:

- The Ministry of Water and Irrigation plugged about 151 hand-dug wells and about 35 artesian wells (all private and unlicensed).

- Implementation of a water quality modelling study. This study has recommended at least two significant measures:

  * to drill at least two wells in the middle (B2/A7) aquifer in order to replace the decreased spring discharge into the Oasis. Salinity of this water would be in the range 1600-2000ppm (note: this figure disagrees with that given on page 7, reflecting a discrepancy between two sources of information)
  * construction of storage reservoirs (underground?) to aid recharge of the shallow aquifer. These storage tanks would be built on the main wadis which take surface runoff onto the playa. It is understood that the Canadian International Development Agency (CIDA) is supporting a feasibility study for this proposal).

- The Ministry of Agriculture issued instructions for the following measures to be taken (the degree of <u>implementation</u> is unclear):

  1. Prohibition of new wells.
  2. Prohibition of irrigation other than for flowering or newly-planted trees (i.e. ban on irrigation of crops/fodder).
  3. Use of drip-irrigation for maximum efficiency.
  4. Prohibition of any new planting.

5. Issuing of licences for tree planting when irrigation needed.
6. Annual per-dunum* allocation of irrigation water.

* a dunum is a commonly-used Arabic unit of area, equivalent to 1000m² in Jordan.

C. CURRENT STATUS OF AZRAQ OASIS

This section is based upon field observations made by the Ramsar Bureau's Technical Officer and Consultant, who visited Azraq from 25-28 March 1990.

The Azraq area had clearly undergone striking visible changes since 1975/79 (when JEC lived close to the oasis). The most noticeable differences being:

- a dramatic decrease in surface water in the Wetland Reserve and the cessation of flow from the Druze springs - see extensive report below.

- the routing of major highways through the oasis, making the Azraq area a major crossroad in the Middle East - see below.

- the development of Jordan's main military airbase close to South Azraq. The airbase occupies a large fenced tract of land to the south-west of the oasis, close to the village of South Azraq. It is understood that the airbase obtains its water supplies from wells independent of those used for supplying Amman. The base's annual water consumption is unknown but could clearly be a significant value when calculating the total volume of water extracted from the Azraq basin.

Status of Druze springs and marshes

In 1975, when JEC first visited the Druze marshes and the feeder springs Aura and Mustadhema, the wetland had already begun to deteriorate as a result of pumping to Irbid. During our visit to the area this year, however, flow from the Druze springs had completely ceased, and had been replaced by a cosmetic trickle of water being pumped from the nearby well field into a small concrete reservoir adjacent to the former pumping station. The Druze marshes which at one time abutted the edge of the village were completely desiccated.

Status of Shishan springs and Azraq Wetland Reserve

The Wetland Reserve is demarcated by a largely intact (though breached in some places) metal post and wire fence with a number of access gates (see Figure 8). Originally constructed in an attempt to control overgrazing and access of people, the present utility of the fence may be questionable. The fence undoubtedly detracts from the 'cosmetic' appearance of the reserve, as do the large quantities of (largely wind-blown) refuse originating from the villages and highways.

Although designated by the Jordanian government and wardened (one warden only) by RSCN, the Wetland Reserve receives relatively little attention in comparison with other reserves in Jordan (e.g. the nearby Shaumari Reserve, where captive breeding/reintroduction programmes are underway for several species - notably the Arabian Oryx). Whilst the ecological character of the reserve has

deteriorated for reasons largely outside the direct control of RSCN, the remaining wetland habitats, which are still of national and international importance, would undoubtedly benefit from the rigorous implementation of a management plan such as that drawn up by Conder in 1979.

Although some water was flowing from both the Souda and Qaisiya springs (the major springs of the Shishan group), JEC noted that the volume and rate of flow had decreased substantially since 1979. The former pumping station buildings were still in place (though vandalised), together with the additional fencing which had been erected to keep people away from the springs when they had been exploited directly for drinking water.

Rainfall in the 1989/90 winter had been very low; only 17mm had fallen between October and the middle of February. However, heavy rain at the end of the month had caused the Azraq playa to be extensively flooded, even though it had been dry throughout the preceding months. At the time of our visit, the playa resembled a vast inland lake. JEC could only recall having seen such extensive flooding of the playa on one previous occasion (spring 1976).

Despite the recent rains, the streams taking water from the springs through the Wetland Reserve and towards the playa (i.e. Burgess, Monfilit and Ingilesi streams; Figure 8) had extremely low flows. For example, the flow in the Burgess stream, close to Burgess pool, was estimated to be about 180 cubic metres per hour. The Ingilesi stream flow had become so reduced that local people had dug a narrow artificial channel in an attempt to supply water to the wildfowl hunting area around Ingilesi pool. The small quantities of surface water present in the Wetland Reserve were reflected by the apparently poor health of the area's vegetation.

Throughout the reserve, and especially around the perimeter, plant communities were clearly impoverished, with Tamarix and Nitraria scrub containing large areas of apparently dead or moribund plants. Close to the streams and pools, Cyperus and Juncus communities also appeared to be suffering from a severe lack of moisture with many areas of this vegetation type having been left well above water level. Date palms close to the villages also appeared to be in a poor condition and local people confirmed that the fruit quality and productivity of these trees had deteriorated considerably in recent years. Light herbaceous ground cover (e.g. graminoids) was generally absent, but it was difficult to conclude whether grazing pressure or drought was the more significant factor. Figure 8 has been annotated in order to highlight some of the vegetational changes which have taken place since Conder compiled his map in 1979.

Despite the clearly negative changes in ecological character which have taken place in the Wetland Reserve, the area remains a wetland of major international significance for migratory birds. Although tracts of open fresh water are now much more restricted than in the past, and numbers of Anatidae, and some other larger waterfowl, have decreased as a consequence, a considerable passage of passerines (mainly Hirundinidae, Motacillidae and Sylviidae), together with smaller numbers of waders and raptors, was observed during our visit.

The warden of the Wetland Reserve indicated that populations of feral horses and buffaloes were declining (it was said that current numbers were approximately 100-150 horses and 80-100 buffaloes, although these estimates appeared high in comparison with visual evidence; only 10 buffaloes were seen) owing to a lack of suitable grazing. Several carcases and skeletons were encountered on our visit, suggesting that starvation may be widespread.

Discussions with local people

The severe decline in the quantity and quality of grazing was one of the factors mentioned most frequently by villagers from both North and South Azraq. Whilst JEC recalled that many villagers had kept cattle in the 1970s, we were told that it had since become economically unviable, owing to the extent to which the poor natural grazing now needed to be supplemented with concentrates.

Many villagers, as well as representatives of RSCN, referred to the decline in waterfowl hunting which had accompanied the drying-out of the Wetland Reserve. The RSCN runs a hunting lodge close to South Azraq and there are a number of shooting blinds within the Wetland Reserve, close to Ingilesi pool. Discussions held with local people and with representatives of RSCN confirmed the impression obtained from count data gathered by the International Waterfowl and Wetlands Research Bureau (IWRB) - i.e. numbers of wintering Anatidae had been declining for some time and no longer reached the very high levels recorded in the 1960s. Some villagers said that duck numbers had been too low for hunting for at least five years. There had certainly been no hunting during the 1989/90 winter with the pools around the shooting blinds being more or less dry. In former years, this system of pools, east of the central Wetland Reserve marsh, began to form from groundwater seepage in early autumn. The limited water which the pools contained during our visit appeared to have resulted from the recent rain and it was understood that the autumn seepage from groundwater had not occurred for several years.

Given the decline in the pools and marshes (completely dry at Druze), and the consequent deterioration of grazing and date production, it might have been expected that the local people would be expressing concern over the situation. However, this was not the case; indeed most people indicated that their standard of living had improved as a result of income generated by the new highways and the introduction of electricity and television. Drinking water continued to be available, albeit from the well fields rather than from the springs, and the government had provided all houses at Azraq with a 2 cubic metres water tank.

The salt industry has also flourished, with the formerly small-scale operation having expanded with the establishment of a large commercial refinery, close to South Azraq. Extraction of brine takes place from wells sunk into the playa and salt production is carried out during the months June-October, with a village cooperative supplying raw salt to the refinery. 1989 had been an especially successful year with a total output of some 75,000 tonnes of refined salt. The Azraq refinery has contributed to Jordan's recently

achieved self-sufficiency in salt and small export market to Iraq. As prosperity has increased, the human population of Azraq has increased accordingly, with around 4000 people living at North Azraq and 1000 in South Azraq.

D. Conclusions and Recommendations

Although its ecological character has undoubtedly deteriorated since designation as a Ramsar site in 1977, largely as a result of groundwater extraction, Azraq Oasis remains a wetland of great ecological, economic and social value, meeting several of the criteria established under the Convention for identifying wetlands of international importance. Every effort should therefore be made to ensure that no further deterioration occurs.

It is abundantly clear that unlimited exploitation of the Azraq basin's water will lead to the ultimate destruction of that resource through salinization. Only the timing of such an occurrence is in any doubt. Hence, over-exploitation will lead not only to the disappearance of an ecologically outstanding area, but also to the loss of the considerable benefits which the wetland provides to the people of Jordan.

The concept of "safe yield" is clearly fundamental to the future of Azraq. Whilst 20 MCM has been identified as the maximum sustainable TOTAL yield (government and private/unlicensed extraction), it should be remembered that this level of exploitation would, at best, only maintain the wetland in its present severely impoverished condition. The former ecological character of the oasis could not be fully restored without a substantial reduction of total extraction below the maximum "safe yield".

The Jordanian government has recognised the points mentioned above and has established levels of groundwater extraction which should not be exceeded if Azraq's water is to be exploited sustainably, given the provisos mentioned in the last paragraph. If implemented effectively, such "wise use" (Article 3.1 of the Convention) could allow Jordan to benefit indefinitely from an irreplacable water resource, and at the same time, to fulfill her international obligations under the Ramsar Convention.

These general conclusions lead to the following specific recommendations:

(1) If the ecological character of the oasis at the time of Ramsar designation is ever to be restored, the present level of water exploitation must be reduced considerably. Recommendation C.3.8 of the Regina Ramsar Conference should be recalled in this connection.

(2) In any event, the total annual exploitation of Azraq's water must not exceed the "safe yield" identified by the Jordanian government.

(3) Further studies, perhaps in conjunction with experts having experience of similar situations in other semi-arid/arid countries, should be made to confirm the validity (in terms of wetland conservation) of the above-mentioned "safe yield" value of 20 MCM per year.

(4) Extraction from private wells should be strictly controlled; although some wells have been capped, withdrawals from private wells continue to exceed considerably the quota set by the Jordanian government.

(5) Urgent steps should be taken to evaluate the volume of water being consumed by the military base at Azraq.

(6) The instructionsm issued by the Ministry of Agriculture (see page 11) should be implemented and rigorously enforced.

(7) Flow from the Shishan springs (which provides an indication of groundwater stability as well as the basis of the Wetland Reserve's ecology) should not be allowed to decline any further and should, if possible, be increased.

(8) The possibility of using small quantities of water from the middle aquifer to supplement spring flow into the Wetland Reserve, as suggested by the Ministry of Water and Irrigation, should be pursued. Subject to the completion of satisfactory environmental impact studies, such a measure could make an extremely important contribution to the maintenance of surface water in the area of greatest ecological importance.

(9) Detailed hydrological and geological research should continue in order to achieve as complete an understanding as possible of the aquifer systems underlying Azraq. In particular, comprehensive feasibility and environmental impact studies should be undertaken prior to the construction of groundwater recharge tanks on the wadis feeding the oasis (as suggested by the Ministry of Water and Irrigation). In this connection, it should be noted that Recommendation C.3.5 of the Third Conference of Contracting Parties to the Ramsar Convention (Regina, 1987) related specifically to international development agencies and stated: "....the Bureau should carry out the following activities:.....4. requesting Development Agencies to provide the Convention Bureau with information on measures they have taken to integrate environmental aspects at all stages of projects affecting wetlands, including their planning and implementation, and monitoring the effectiveness of these measures;"

(10) Efforts should be made to ensure that water distribution in Jordan is as efficient as possible; i.e. that loss during distribution is minimized. Research and investment should continue in order to identify and exploit potential new sources of water which could help meet the country's ever-increasing consumption.

(11) A management plan for Azraq Wetland Reserve should be drawn up and implemented at the earliest possible opportunity, in order to

make the best possible use (in conservation terms) of the reduced spring flow. Conder's 1979 management plan could be used as the basis for such work, but would need considerable revision in the light of the ecological changes which have occurred in the past decade.

(12) Regular ecological monitoring should be undertaken within the Ramsar site in order to determine the effects of future exploitation of groundwater.

(13) It is hoped that Jordan will present a full report, detailing current and future measures to safeguard the future of Azraq Oasis, at the Fourth Conference of Contracting Parties, to be held in Montreux, Switzerland from 27 June - 4 July 1990.

Acknowledgements

We wish to thank, most warmly, officials of the Department of Environment, Ministry of Municipal and Rural Affairs and the Environment, for arranging the programme for our visit.

We are also indebted to the Minister for Municipal and Rural Affairs and the Environment, the Minister for Water and Irrigation and his officials; and to officials of the Royal Society for the Conservation of Nature, for making our time in Jordan so useful and interesting.

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(Ramsar Bureau Technical Officer)
22 April 1990

Dr J.E. Clarke
(Consultant)

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Figure 1.

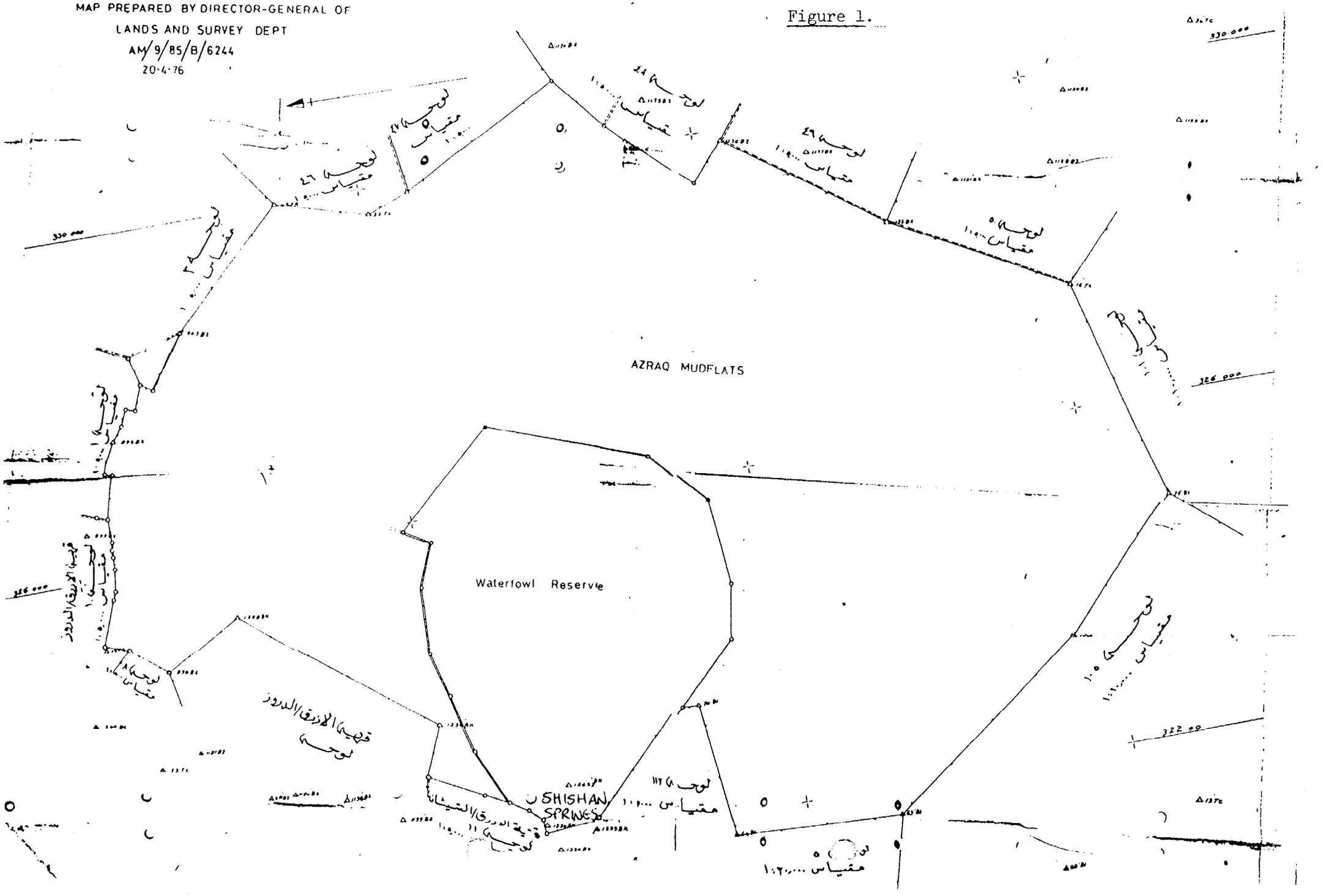

BLOCK 52 AZRAQ MUDFLATS
MAP PREPARED BY DIRECTOR-GENERAL OF
LANDS AND SURVEY DEPT
AM/9/85/B/6244
20·4·76
AZRAQ MUDFLATS
Waterfowl Reserve
SHISHAN SPRINGS
330 000
326 000
322 50

Figure 2.

Outline map of Azraq drainage basin, showing location of North and South Azraq

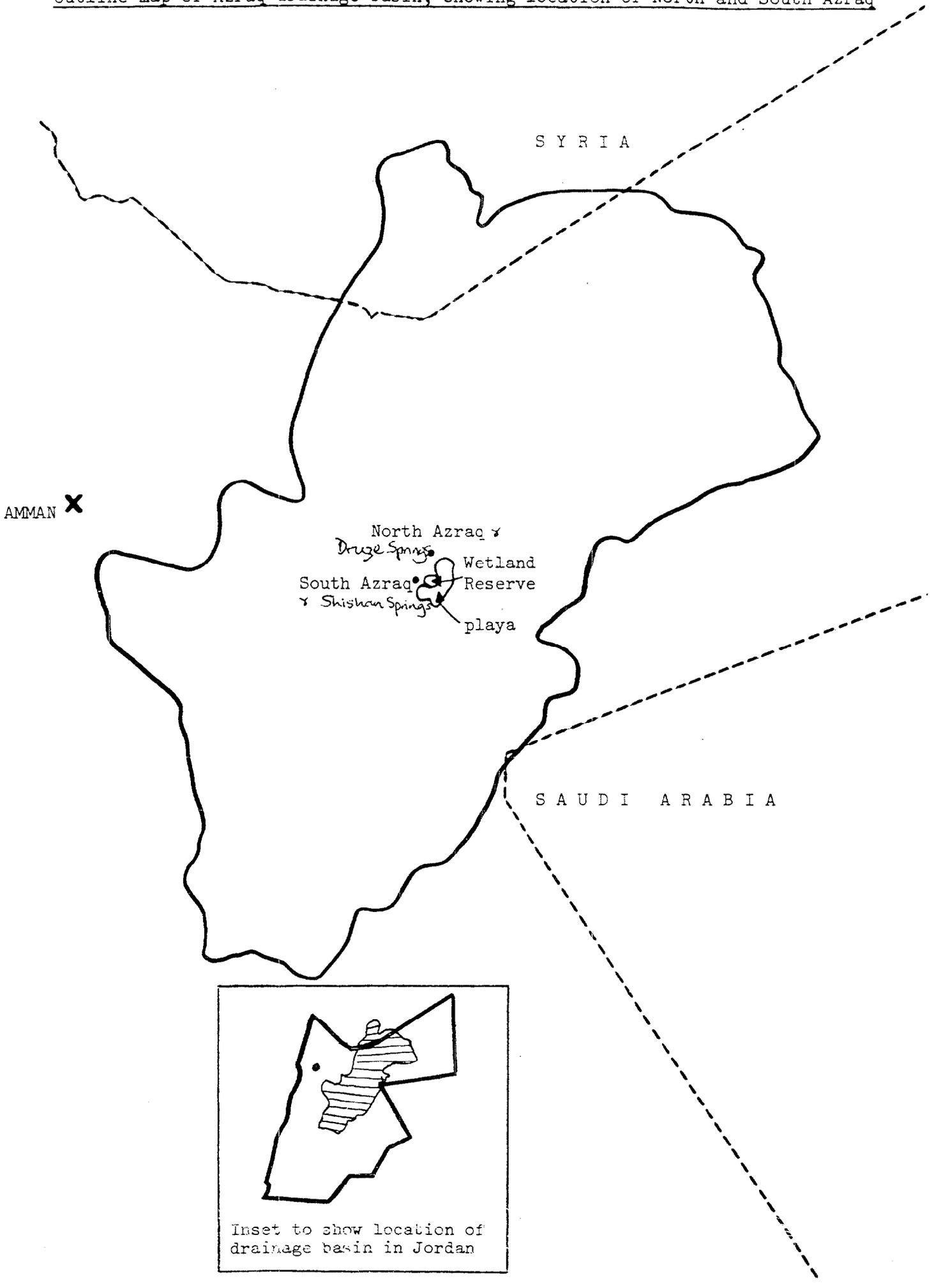
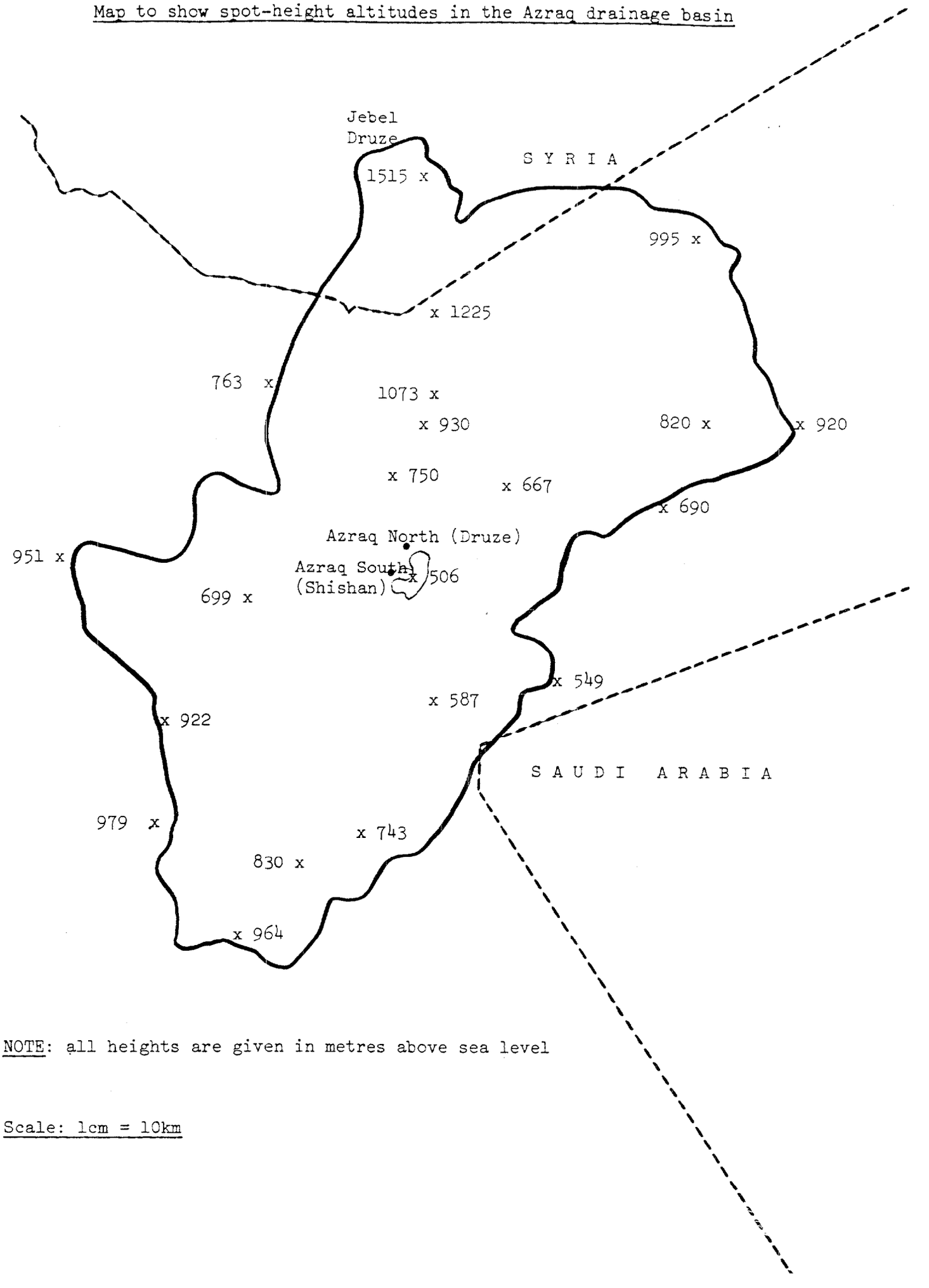


Figure 3.

Map to show spot-height altitudes in the Azraq drainage basin



NOTE: all heights are given in metres above sea level

Scale: 1cm = 10km

Figure 4.

Simplified surface geology of the Azraq drainage basin

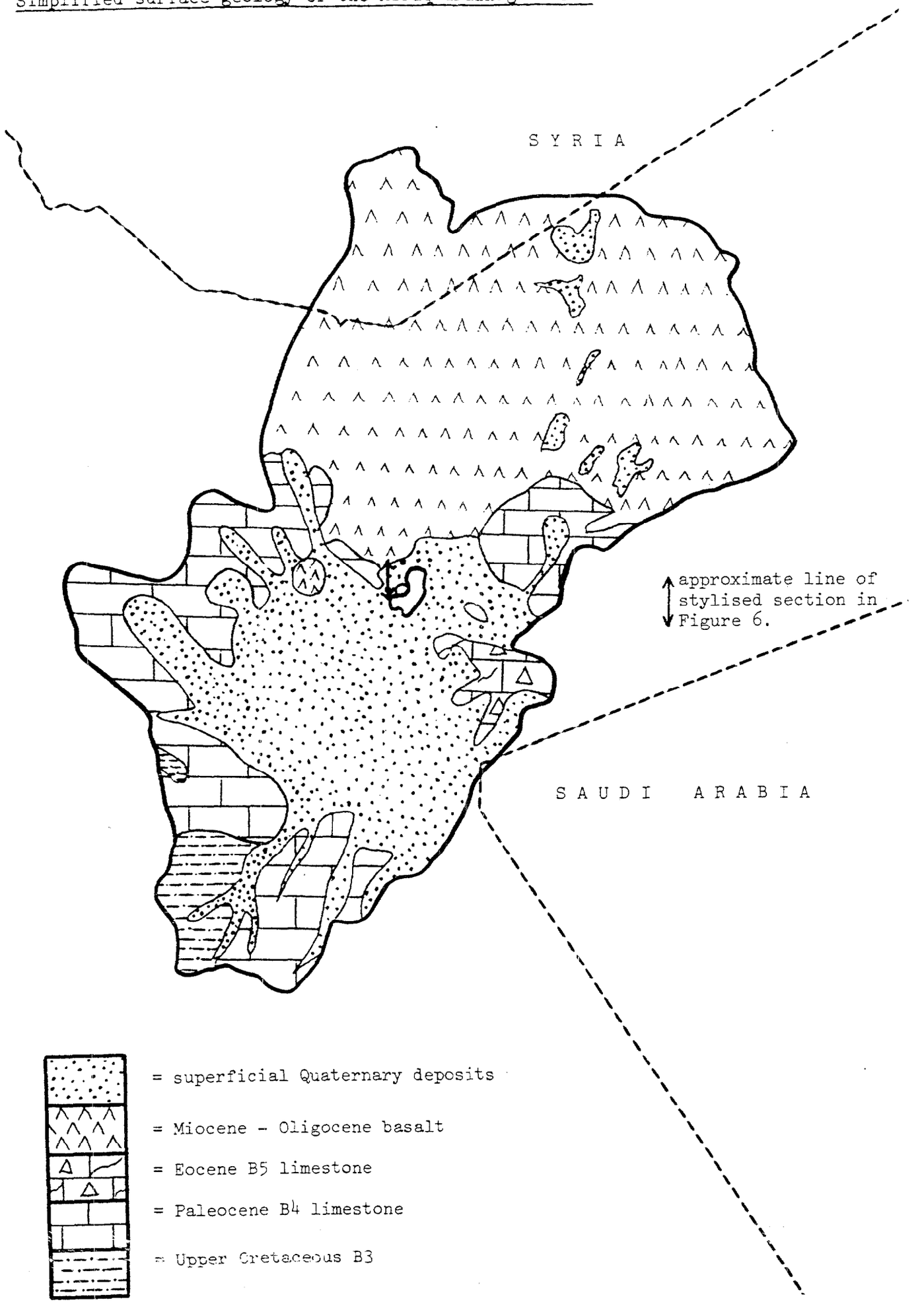


Figure 5.

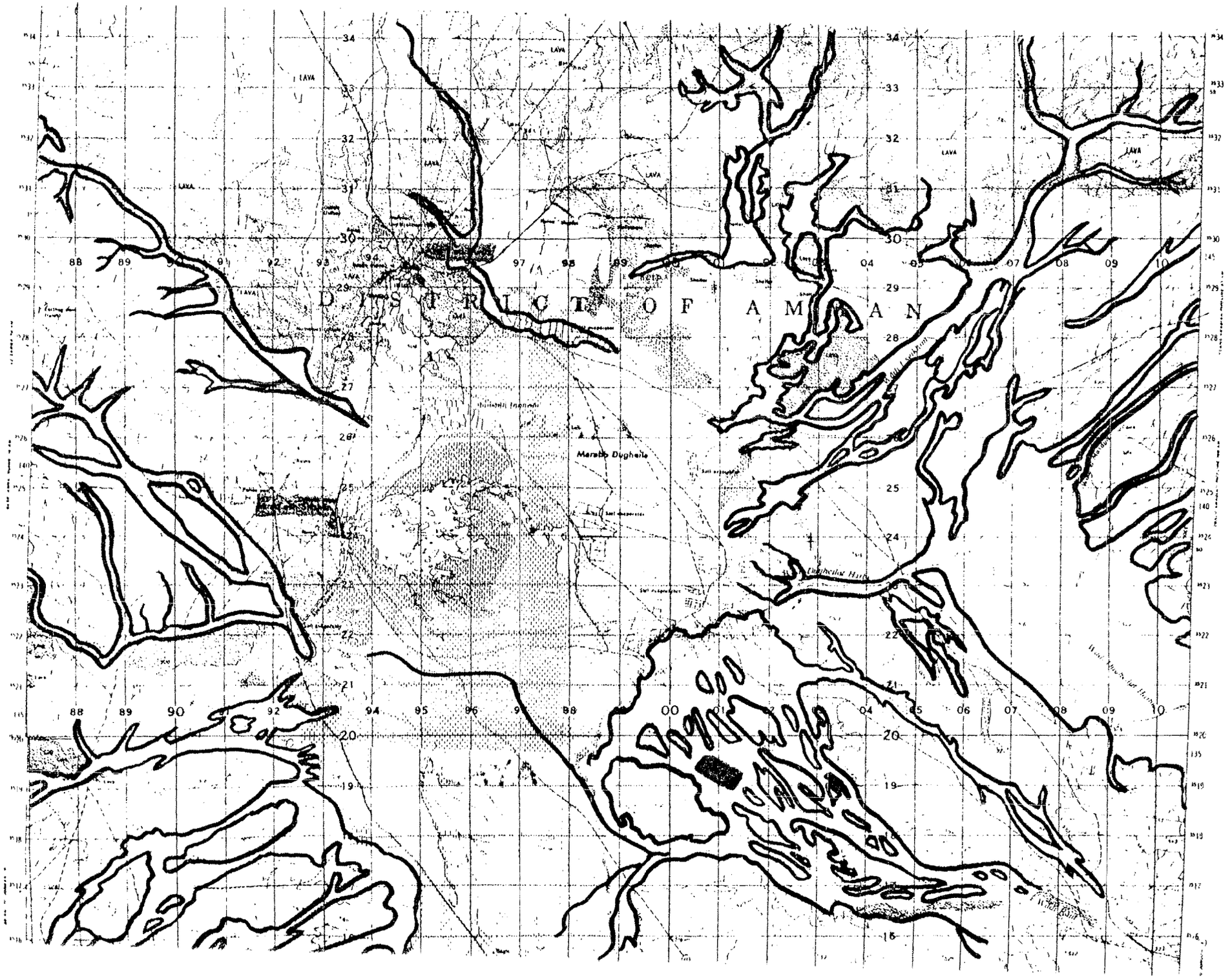
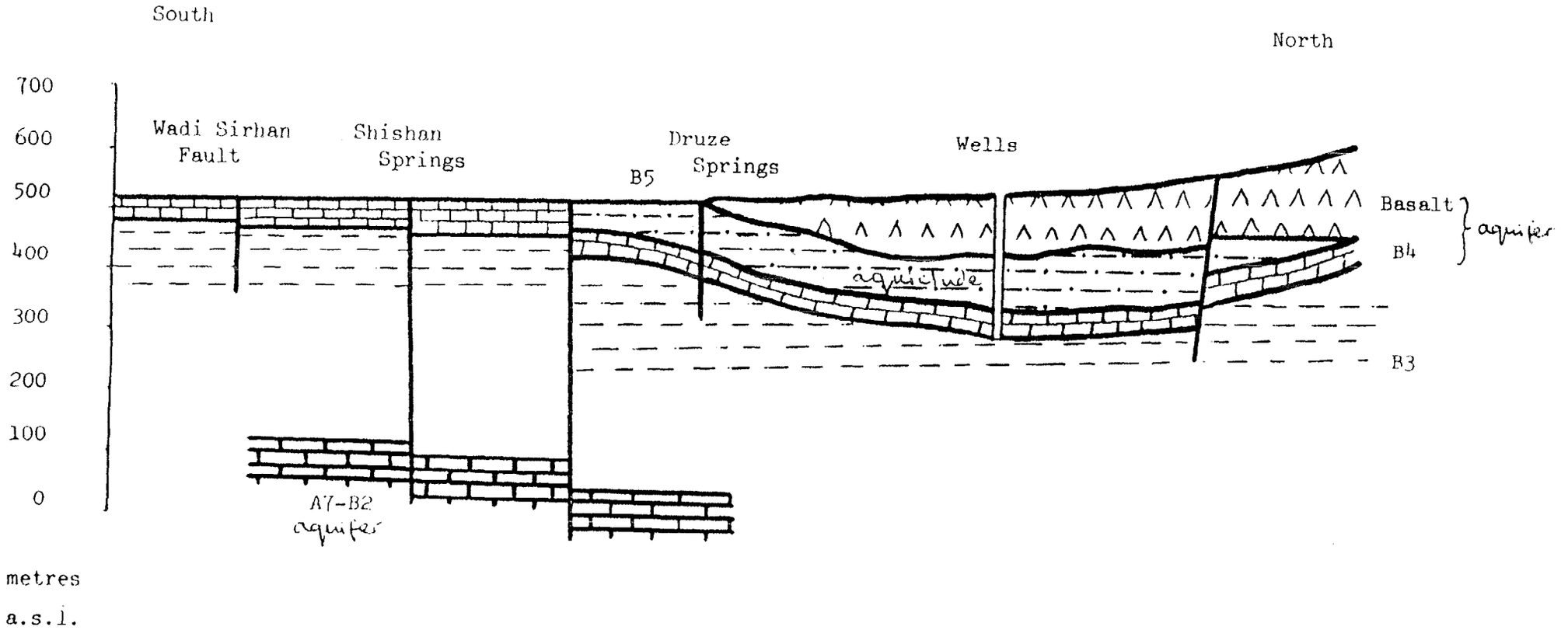


Figure 6.

Simplified geology of the Azraq basin to show position of aquifers



NB this is a stylised cross-section

Figure 7.

Graph to show exploitation of Azraq's water and corresponding spring flow, 1981-1989

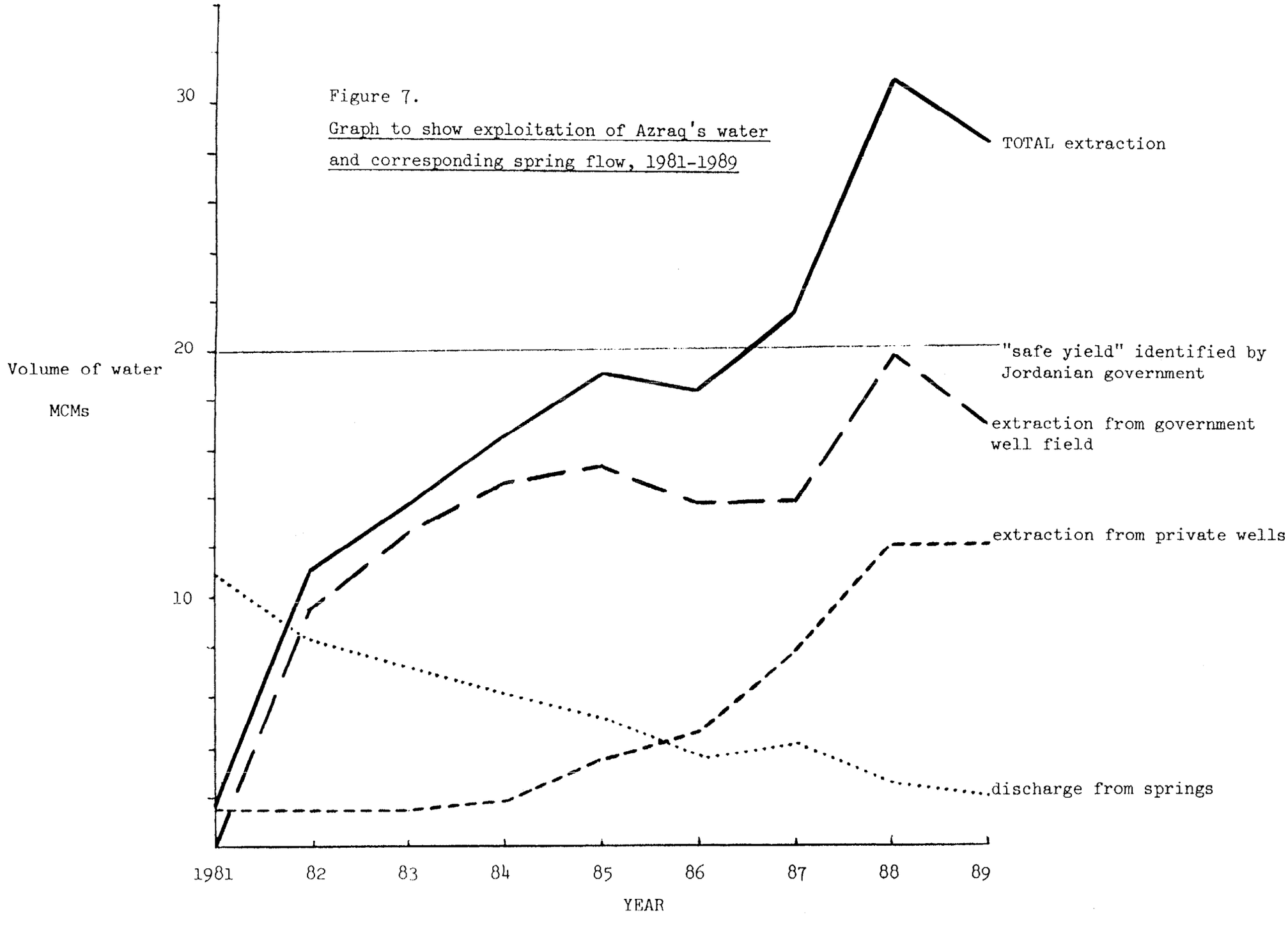
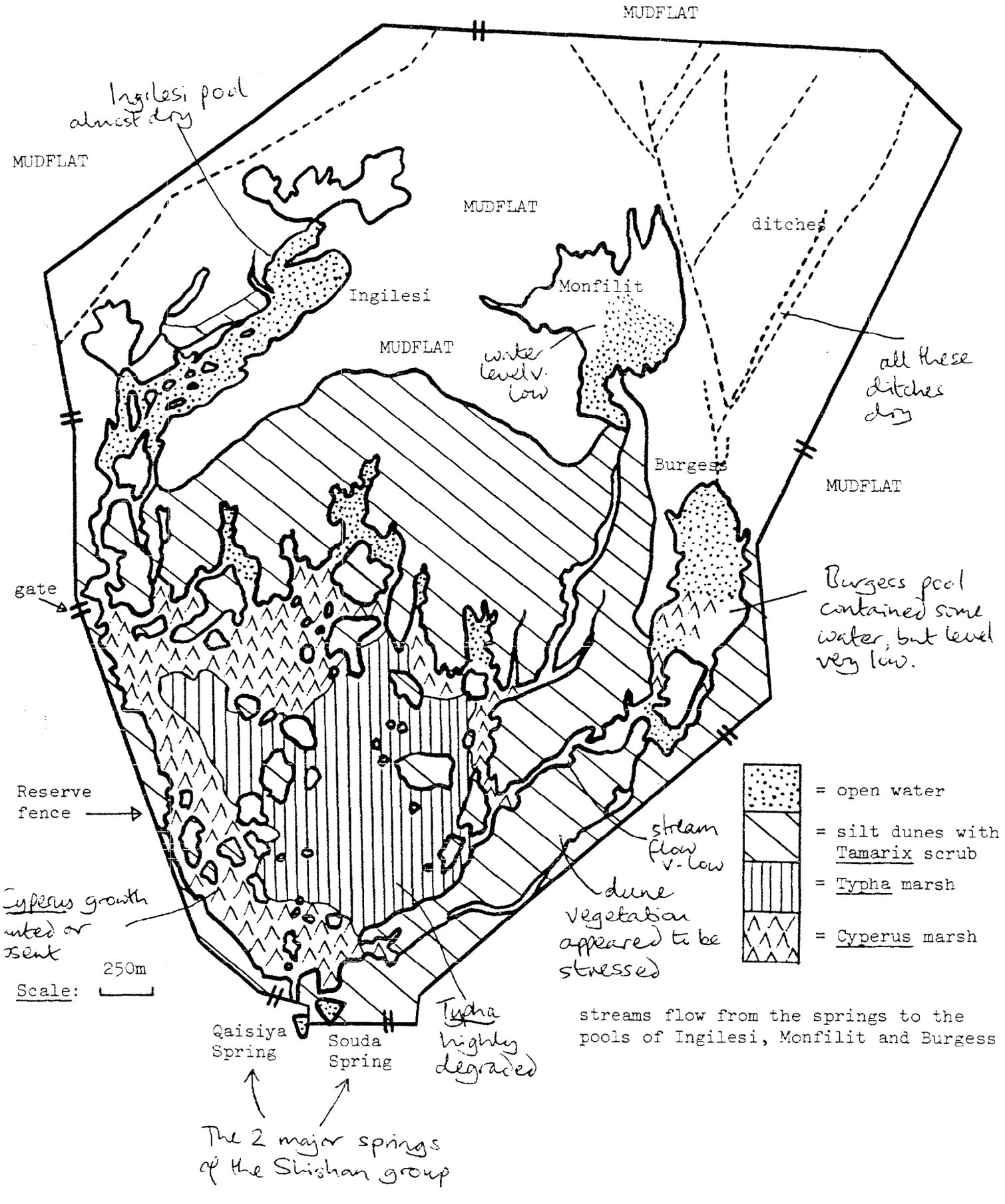


Figure 8.

Map to show former distribution of major habitats/vegetation communities in Azraq Wetland Reserve - redrawn from Conder (1979) Annotations refer to March 1990 observations.



streams flow from the springs to the pools of Ingilesi, Monfilit and Burgess