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THE NILE TREATY

State Succession and International Treaty Commitments: A Case Study of The Nile Water Treaties

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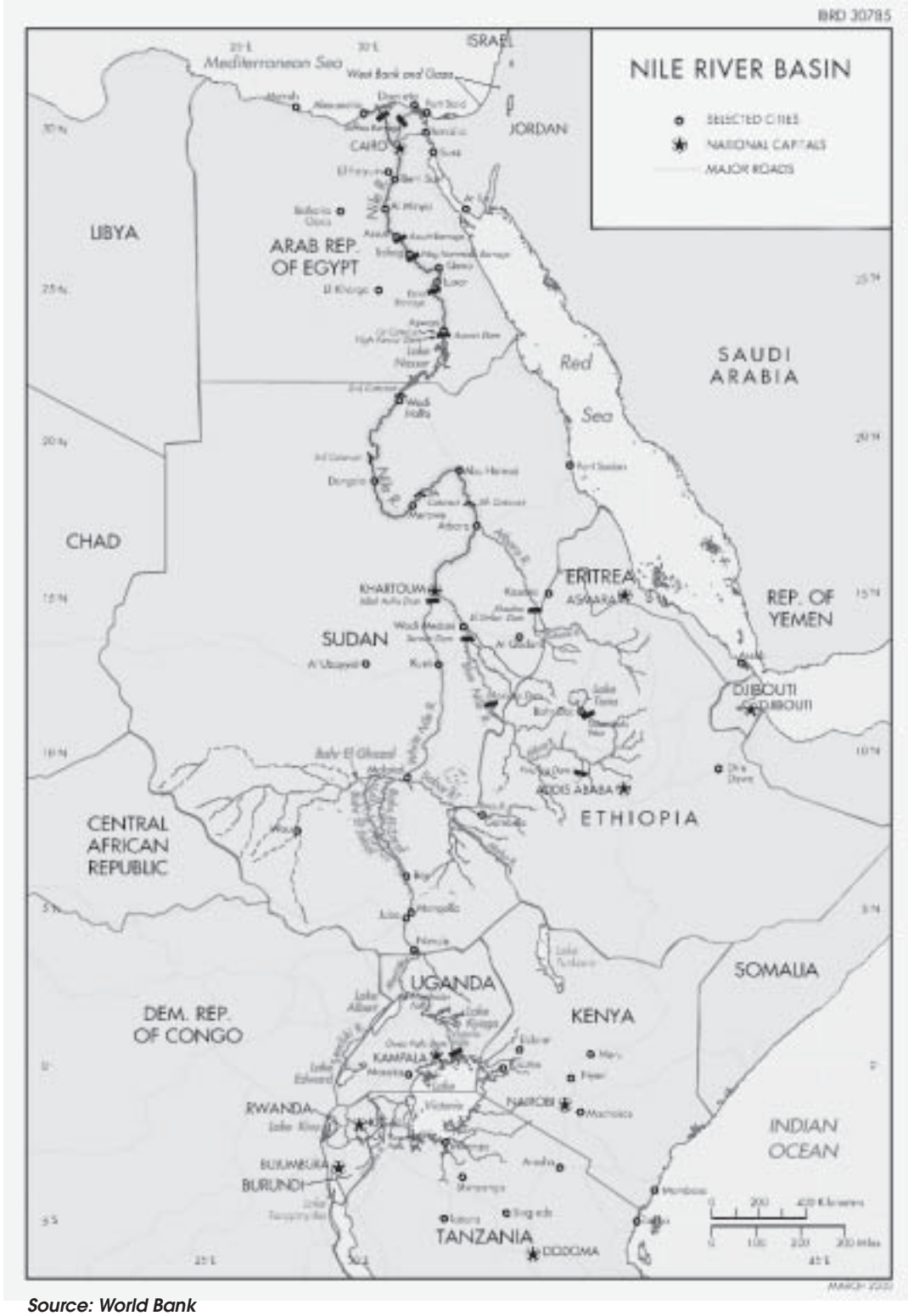

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BY ARTHUR OKOTH-OWIRO

Nairobi 2004

Contents

I. INTRODUCTION

Many bilateral treaties were concluded between Egypt, Britain and other powers between 1885 and the Second World War to regulate the utilisation of the waters of the River Nile. At that time, the entire Nile Basin was under the sovereignty of foreign, mainly European powers. They committed themselves to Egypt and Britain that they would respect prior rights to, and especially claims of "natural and historic" rights to Nile waters, which Egypt asserted. A legal regime based on these treaties was thus established over the Nile.

Since the Second World War, most of the territories on the Nile Basin have changed sovereignty with the majority acquiring full statehood as a result of de-colonization. Are these successor states bound by treaties, which were purportedly concluded on their behalf by their predecessors? It is obvious that the treaties can no longer reflect the priorities and the strategic interests of these "new" states as they see them. In particular, access to the Nile waters is now regarded by these states as a sovereign right and a prerequisite for development.

Indeed, many of the upper-riparian states invoke the Harmon doctrine, which holds that a state has the right to do whatever it chooses with the waters that flow through its boundaries, regardless of its effect on any other riparian state. It has also been suggested that the independence of the new states was a fundamental change in circumstances that made the continued validity of colonial-era treaties untenable. Some of the Nile basin countries have declared that they are not bound by any such treaties.

On the other hand, competing principles of international fluvial law has allowed lower riparian states, especially Egypt, to argue that the Nile water treaties are binding in perpetuity. Water scarcity and the national security of the Nile riparian states now threaten to escalate tension over access to Nile waters into an open conflict, with Egypt threatening war should upper riparians divert the waters of the Nile. A framework for the equitable distribution of Nile waters is urgently required.

The purpose of this paper is to explore the legal position of successor states with regard to international treaty commitments. A case study of the Nile Water Agreements is undertaken to clarify the rights and duties of states with regard to water treaties in general and Nile waters in particular.

This study is considered useful because the status of the Nile as a shared water resource, and the emergence of new states on its basin, dictate that a legal regime to regulate access to its waters has to be negotiated in the 21st Century. It is, therefore, necessary to clarify the historical and contemporary situation in order to prepare for the future. It may also be useful to remind riparian states of their fundamental interests in the Nile waters and treaty negotiations.

Ultimately, the views expressed in this paper are an East African view of the Nile question.

II. THE NILE: HYDROLOGICAL, ECONOMIC AND LEGAL ASPECTS

2.1 Hydrological Features

The Nile, which is the only drainage outlet from Lake Victoria, is one of the longest rivers in the world. Its total length together with those of its tributaries is about 3,030,300 kilometres. The catchment area of the Nile totals some 2,900,000 square kilometres, representing about one-tenth of the surface area of the entire African Continent.

The Nile measures some 5,611 kilometres from its White Nile source in Lake Victoria (East Africa) and some 4,588 kilometres form the Blue Nile source in Lake Tsana (Ethiopia). Thus, the river system originates from two distinct geographical zones.

One subsystem, with the White Nile as its main artery, originates in the equatorial lakes of East and Central Africa, the most important of which is Lake Victoria, and in the Bahr-el-Ghazal water system — a vast lagoon formed by the convergence of a number of streams rising to the East and North of the Nile-Congo divide.

The other subsystem consists of the Blue Nile and its tributaries, the Atbara and the Sobat. It originates from the Ethiopian Plateau (Hurst, 1952; Waterbury, 1979; Godana, 1985).

The Nile is made up of three main tributaries. These are the White Nile, the Blue Nile and the Atbara. The White Nile rises from its source in the highlands of Rwanda and Burundi and flows into Lake Victoria. It leaves Lake Victoria at its northern shore near the Ugandan town of Jinja, through a swampy stretch around Lake Kyoga in Central Uganda and then heads north towards Lake Albert.

Lake Albert receives a good amount of water from the Semliki River, which has its source in the Congo and empties first into Lake Edward, where it receives additional water from tributaries coming from the Rwenzori Mountains on its way to Lake Albert. From Lake Albert, the White Nile flows North into Southern Sudan (Kasimbaji, 1998).

Lake Victoria, Edward and Albert are the natural reservoirs, which collect and store great quantities of water from the high rainfall regions of eastern Equatorial Africa and maintain a permanent flow down the White Nile with relatively small seasonal fluctuations (Beadle, 1974: 124).

In Southern Sudan, near the capital city of Khartoum, the White Nile meets the Blue Nile, which drains Lake Tsana in the Ethiopian Highlands. The two flow together to just north of Khartoum where some 108 kilometres downstream, they are joined by the Atbara, the last important river in the Nile system, whose source is in Eritrea. The river then flows north through Lake Nasser and the Aswan Dam before splitting into major distributaries, the Rosetta and Damietta, just north of Cairo. These distributaries flow into the Mediterranean Sea (Okidi, 1982).

According to Godana (1985), the average annual flow of the Nile is 84 milliards of cubic metres as measured in Aswan. Of this total, Bard (1959) estimates that 84 per cent is contributed by Ethiopia and only 16 per cent comes from the Lake Plateau of Central Africa. A similar distribution pattern is given by Godana (1985: 82) who asserts that 85 per cent of the flow of the Nile originates from the Ethiopian plateau, whereas only 15 only comes from the East African source areas. It is, however, important to note that the statistics of the flow of the Nile are a complex matter, which the above estimates tend to over-simplify.

First, it must be remembered that the flow of the White Nile is relatively regular throughout the year as opposed to the Blue Nile - Atbara sub-system, which fluctuates seasonally. At its peak discharge is July-September, Godana (1985: 81) reports that the Blue Nile swells to an enormous torrential flow and accounts for some 90 per cent of the waters passing through Khartoum. By April, however, by April, the volume of water from these two sources dwindles to one-fortieth of the flood discharge, to account for no more than 20 per cent of the waters passing Khartoum. This calculation tallies with Garretson's (1967) estimates that at the peak of its flood (April-September), the Blue Nile alone supplies 90 per cent of the water passing through Khartoum, but in the low season (January-March) it provides only 20 per cent. From this statistical information Godana (1985) concludes:

> "the White Nile at Khartoum provides only 40 per cent of the river's peak discharge, but at the low flow it accounts for four-fifths of the total delta discharge" (page 81).

Secondly, there is something infinitely misleading about measuring the flow of the Nile at Khartoum. It is estimated that some 24 milliards of cubic metres of water flow down the White Nile from Lake Albert and the East African highlands, half of which is lost through the intense evaporation and soakage in the Sudd (Godana, 1985). In fact an official Sudanese Government publication puts the total swamp losses at 42 milliards of cubic metres (Sudan, 1975).

What should be measured is the amount of water leaving the lake plateau of East Africa, rather than what passes through Khartoum. This is a more realistic estimate of the White Nile's contribution. After all, Egypt and Sudan already have a treaty, the 1959 Agreement, on how to apportion any additional Nile waters, and the Jonglei Canal project is being undertaken to achieve the purpose of reducing the losses of water in the Sudd, in order to increase the amount reaching Khartoum.

Thirdly, estimating the flow of the Nile on the basis of how much water reaches Sudan or Egypt appears to assume that the purpose of the Nile is to feed these two countries with water. On such an assumption, only the water reaching its destination is worth accounting for! Surely, the waters of the Nile are important and useful for and in the entire basin – from Kagera to the Mediterranean.

2.2 Economic Aspects

In general, the waters of the Nile are utilised for irrigation, hydro-electric power production, water supply, fishing, tourism, flood control, water transportation and the protection of public health (Kazimbazi, 1998). In particular, it should be noted that the economy of the entire Nile Basin almost entirely consists in the agricultural activities of the co-riparians of the Nile - Rwanda, Burundi, Congo, Tanganyika, Kenya, Uganda, Sudan, Ethiopia, Eritrea and Egypt.

In the upper-basin states of Ethiopia, Eritrea, Kenya, Uganda, Tanzania, Democratic Republic of Congo, Rwanda and Burundi, settled agriculture is the general economic activity. The lower-basin states of Sudan and Egypt are also primarily agricultural economies but, in contrast with the upper-basin states, their agriculture is largely irrigation-based. The economic use of the Nile for purposes of agriculture (particularly irrigation-based agriculture) is, therefore, its most important use.

In Egypt, a desert agricultural country, the entire life of the nation is dependent on the river's waters. As President Anwar Sadat stated in 1978,

> "We depend upon the Nile 100 per cent in our life, so if anyone, at any moment, thinks of depriving us of our life we shall never hesitate to go to war" (Kukk and Deese, 1996:46).

The complete control of the river over the economy of Egypt has been characterised as the unique feature of the Nile, setting it apart from all other international rivers (Pompe, 1958).

Increasingly, all the basin states have come to view the Nile as a principal feature of their economies. They show an increasing interest in the abstraction and diversion of Nile water for various development purposes, irrigation included. Examples of such developments include the Jonglei Canal Project in Sudan (which has been dormant due to the raging conflict since 1983), and the planned construction, by Ethiopia, of a new facility on the Blue Nile to supply irrigation water for 1.5 million newly resettled peasants in the western province of Welega as well as to provide a steady source of hydroelectric power for the country (Kukk and Deese, 1996:44).

Godana (1985) also reports that Tanzania hopes to implement a plan to abstract the waters of Lake Victoria to irrigate the relatively low and dry steppes of Central Tanzania. And with the establishment of the Lake Basin Development Authority in Kenya, the country has began to treat the resources of the Lake Victoria basin more comprehensively.

The economic importance of the Nile is also reflected in the establishment of various sub-basin initiatives for the development and management of basin resources. These include the Kagera Basin Organisation, the Technical Cooperation for the Promotion of the Development and Environmental Protection of the Nile Basin (TECCONILE) and the Lake Victoria Environment Management Programme (LVEMP) (Kazimbazi, 1998).

2.3 The Legal Aspects

The Nile is an international river. As a shared water resource, the development, utilisation and management of the Nile basin waters is regulated by international water resources law. Following the nomenclature of Article 38 of the Statute of the International Court of Justice, international water resources law may be derived from:

a) International conventions, whether general or particular;
b) International customs;
c) The general principles of law recognised by civilized nations; and
d) As a subsidiary means, the judicial decisions and the teachings of the most highly qualified publicists of the various nations.

The conclusion of international treaties or conventions has been the most important method of international law-making, hence the primary means for the establishment of international rights and obligations over shared water resources. Most authorities would hold that an international treaty or convention is needed to ensure the most reasonable utilisation of international water courses (Bruhacs, 1993:59). There is no such international treaty applicable to the Nile, and even the *United Nations Convention on the Law of the Non-Navigational uses of International watercourses* of 1997 (36 I.L.M. 700), which is sure to change the regime of international water law, has not entered into force.

Besides, although "nearly all the commentators on the problems of the full development of the Nile basin have concluded their various analyses with a suggestion in one form or another of the need for a Nile River Basin Authority or Administration" (Garretson, 1960:144), such a basin-wide institution has never materialised.

The legal regime for the utilisation and management of the Nile, therefore, consists of bilateral treaties concluded amongst the riparian states, and the international customary law. It has been suggested that these bilateral treaties reflect customary law principles (Fahmi, 1986) — a position that has been vigorously contested (Batstone, 1959; Pompe, 1958).

III. THE NILE WATER TREATIES

The Nile water treaties have been the subject of many studies and comments, most notably by Batstone (1959), Garretson (1960), Teclaff (1967), Okidi (1982 and 1994), Godana (1985) and Carrol (1999).

As Godana (1985) observes, with the establishment of European colonial rule over most of the Nile basin in the closing decades of the 19th Century, it became necessary to regulate, through treaties and other instruments, the water rights and obligations attaching to the various colonial territories within the basin.

In this manner, the colonial period came to witness a steady development of formal treaties and regulations as well as of informal working arrangements and administrative measures which, taken together, constituted the legal regime of the Nile drainage system.

The treaties and legal instruments regulating the use of Nile waters may be divided into four categories. These are:-

(i) Treaties between the United Kingdom and the powers in control of the upper reaches of the Nile basin around the beginning of the 20th Century;
(ii) The 1929 Nile Waters Agreement;
(iii) Agreements and measures supplementing and consolidating the 1929 Agreement; and
(iv) Post-colonial treaties and other legal instruments.

The purpose of this section is to describe and analyse the treaties and legal instruments, which fall into the first three categories. These are the legal instruments whose devolution or inheritance is the subject matter of this paper.

3.1 Treaties between U.K and the powers controlling the Nile Basin

Between 1891 and 1925, the United Kingdom of Great Britain entered into five agreements on the utilisation of the waters of the Nile.

On April 15, 1891, the United Kingdom and Italy signed a protocol for the demarcation of their respective spheres of influence in Eastern Africa. Article III of this Protocol sought to protect the Egyptian interest in the Nile waters contributed by the Atbara River, the upper reaches of which fell within the newly acquired Italian possession of Eritrea. The Article provided as follows:

> "The Government of Italy undertakes not to construct on the Atbara any irrigation or other works which might sensibly modify its flow into the Nile".

On May 15, 1902, the United Kingdom of Great Britain and Ethiopia, the former acting for Egypt and the Anglo-Egyptian Sudan, signed at Addis Ababa, a Treaty regarding the Frontiers between the Anglo-

Egyptian Sudan, Ethiopia and British Eritrea. Article III of the Treaty was concerned, not with boundaries, but with the Nile waters originating in Ethiopia. It provided:

> "His Majesty the Emperor Menelik II, King of kings of Ethiopia, engages himself towards the Government of His Britannic Majesty not to construct or allow to be constructed, any works across the Blue Nile, Lake Tsana or the Sobat, which would arrest the flow of their waters into the Nile except in agreement with his Britannic Majesty's Government and the Government of the Sudan".

On May 9, 1906, the United Kingdom and the Independent State of the Congo concluded a Treaty to Re-define Their Respective Spheres of Influence in Eastern and Central Africa. Article III of the Treaty provided:

> "The Government of the Independent State of Congo undertakes not to construct or allow to be constructed any work over or near the Semliki or Isango Rivers, which would diminish the volume of water entering Lake Albert, except in agreement with the Sudanese Government".

On April 3, 1906, the United Kingdom, France and Italy signed a tripartite agreement and set of declarations in London. Article IV(a) provided that:

> "in order to preserve the integrity of Ethiopia and provide further that the parties would safeguard the interests of the United Kingdom and Egypt in the Nile basin, especially as regards the regulation of the water of that river and its tributaries …".

Finally, in December 1925, there was an exchange of Notes between Italy and the United Kingdom by which Italy recognised the prior hydraulic rights of Egypt and the Sudan in the headwaters of the Blue Nile and White Nile rivers and their tributaries and engaged not to construct on the head waters any work which might sensibly modify their flow into the main river.

Garretson (1960) and Godana (1985) observe that regardless of whether the above agreements were concluded by Britain with another European power seeking to establish a sphere of influence, or with an African state such as Ethiopia, they had the common objective of securing recognition of the principle that no upper-basin state had the right to interfere with the flow of the Nile, in particular to the detriment of Egypt.

3.2 The 1929 Nile Waters Agreement.

The Exchange of Notes between Great Britain (acting for Sudan and her East African dependencies) and Egypt in regard to the use of the waters of the Nile

for irrigation purposes ("The 1929 Nile Waters Agreement") is the most controversial of all the Nile Water agreements. It is also the most important. According to Batstone (1959), it is the dominating feature of legal relationships concerning the distribution and utilisation of the Nile waters today. Godana (1985) adds that the agreement""has become the basis of all subsequent water allocations (but) has been viewed differently by various writers" (page 176).

The purpose of the 1929 Nile Waters agreement was to guarantee and facilitate an increase in the volume of water reaching Egypt. The Agreement was based on the outcome of political negotiations between Egypt and Great Britain in 1920s, and in particular on the report of the 1925 Nile Waters Commission, which was attached to the agreement as an integral part thereof.

The Agreement provided as follows:

(i) Save with the previous agreement of the Egyptian Government, no irrigation or power works, or measures are to be constructed or taken on the River Nile or its branches, or on the lakes from which it flows in the Sudan or in countries under British administration, which would, in such a manner as to entail prejudice to the interests of Egypt, either reduce the quantities of water arriving in Egypt or modify the date of its arrival, or lower its level.

(ii) In case the Egyptian Government decides to construct in the Sudan any works on the river and its branches, or to take any measure with a view to increasing the water supply for the benefit of Egypt, they will agree beforehand with the local authorities on the measures to be taken to safeguard local interests. The construction, maintenance and administration of the above mentioned works shall be under the direct control of the Egyptian Government.

The Agreement also expressed recognition by Great Britain, of Egypt's "natural and historic rights in the waters of the Nile", even though the precise content of these rights was not elaborated.

The 1929 Nile Waters Agreement has been invoked by those who regard it as a praiseworthy recognition of the water rights of Egypt (Smith, 1931). To some Egyptian writers, it has merely recorded Egypt's established rights over the Nile since antiquity (Khadduri, 1972). But the overwhelming weight of expert opinion appears to favour the view that the "The 1929 settlement of the Nile waters was a political matter and that it cannot be used as a precedent in international law""(Berber, 1959:96)".

3.3 Agreements Consolidating and Supplementing the 1929 Agreement

The most important agreements falling into this category are the supplementary Agreement of 1932 (the Aswan Dam Project) and the Owen Falls Agreement. Given the effect of the 1959 Agreement for the full utilisation of the Nile Waters

between Egypt and Sudan, only the Owen Falls Agreement merits analysis here.

The last colonial-era treaty regulation of the Nile River System was the 1952 Agreement concluded by Exchange of Notes between Egypt and the United Kingdom (acting for Uganda) concerning the construction of the Owen Falls Dam in Uganda, then under British colonial administration. The purpose of the Agreement was two-fold:

(a) the control of the Nile Waters, and
(b) the production of hydroelectric power for Uganda.

The most important point of the substantive legal regime created by Owen Falls Dam Agreement was the regulation of the Nile River flow. The Agreement provided as follows:

> "The two governments have also agreed that though the construction of the dam will be the responsibility of the Uganda Electricity Board, the interests of Egypt will, during the period of construction, be represented at the site by the Egyptian resident engineer of suitable rank and his staff stationed there by the Royal Egyptian Government to whom all facilities will be given for the accomplishment of their duties. Furthermore, the two governments have agreed that although the dam when constructed will be administered and maintained by the Uganda Electricity Board, the latter will regulate the discharges to be passed through the dam on the instructions of the Egyptian Government for this purpose in accordance with arrangements to be agreed upon between the Egyptian Ministry of Public Works and the a pursuant to the provisions of agreement to be concluded between the two Governments."

The Agreement also provided that the Ugandan Government could take any action it considered desirable before or after the construction of the dam, provided that it did so after consultation and with the consent of the Egyptian Government, and provided further that:

> "— this action does not entail any prejudice to the interests of Egypt in accordance with the Nile Waters Agreement of 1929 and does not adversely affect the discharge of water to be passed through the dam in accordance with the arrangements to be agreed between the two Governments —."

In other words, the Egyptian interests in the flow of the Nile waters, as defined in the 1929 Nile Agreement, remained predominant, and Uganda's sovereign right to deal with its dam was made subject to the established and future Egyptian rights and interests. The Owen falls Dam was completed in 1954.

III. STATE SUCCESSION TO TREATIES

The purpose of this section is to outline the law on state succession and how this law affects treaties, with particular emphasis on water treaties.

3.1 State Succession

State succession arises when there is a definitive replacement of one state by another in respect of sovereignty over a given territory in conformity with international law (Brownlie, 1990:654). In other words, state succession consists of any change of sovereignty over a given territory whose effect is recognised in international law. It includes both "Succession in fact" and""Succession in law".

Succession in fact refers to the factual situation in which, through some political evolution, a territory that previously was placed under the sovereignty of one state comes to fall under that of another state i.e. to the transfer of territory from one state to another.

Such a transfer may occur when the territory of one state is annexed, in whole or in part; by another state, when one state cedes part of its territory to another; when two or more states merge to form a single state; when part of a national community secedes from a state, or combines with another existing state; or when a territorial community which was under colonial rule achieves independence by a process of revolution or constitutional evolution.

The common feature of all these forms of factual succession is that one state ceases to be real in a territory and another takes its place.

Succession in law refers to the succession of the new sovereign to legal rights and obligations of the old sovereign, or more generally, to pre-existing legal situations. Thus, succession in law is a legal consequence of succession in fact. We are here concerned with the obligations of the previous sovereign to its territorial successor.

State succession is an area of great uncertainty and controversy. This is due partly to the fact that much of the state practice is equivocal and could be explained on the basis of special agreement and various rules distinct from the category of state succession. Not many settled legal rules have emerged as yet (Brownlie, 1990).

In other words, it is not clear, from either writings on international law or the practice of states, how and to what extent a legal principle of state succession applies in the sense of the transmissibility of rights and obligations from one state to another. For state succession in fact does not entail an automatic juridical substitution of the factual successor state in the complex sum of rights and obligations of the predecessor state (Godana, 1985:134).

3.2 State Succession in the Nile Basin

The Nile Basin has witnessed several changes in territorial sovereignty over the years. Just as European occupation and colonisation was the most important

influence in state-formation in the region, decolonisation has been the most important cause of state succession. All the ten Nile Basin countries, except Egypt and Ethiopia, were dependencies of various European powers and became independent states in the second- half of the 20th Century. And aside from decolonisation, state succession in the Nile basin has been prompted by such diverse factors as conquest, annexation, merger and secession. A few examples will suffice.

Egypt has been part of the Ottoman Empire, under Turkish Suzerainty; a protectorate of Great Britain, an independent state and finally in 1958, part of the United Arab Republic after uniting with Syria. Ethiopia, a sovereign state, was conquered by Italy in 1936, a change of sovereignty that was recognised by European powers. Eritrea was a colony of Italy, became a part of Ethiopia and is now an independent state, after a war of secession. And Tanganyika, Rwanda and Burundi were colonised by Germany and then became mandated territories, respectively under Britain and Belgium, before gaining independence to become sovereign states. In 1964, Tanganyika merged with Zanzibar to form Tanzania. All the 10 riparian states on the Nile are successor states.

3.3 Succession to Treaties

The effect of change of sovereignty on treaties is not a manifestation of some general principles or rule of state succession, but rather a matter of treaty law and interpretation (O'Connell, 1956). When a new state emerges it is not bound by the treaties of the predecessor sovereign by virtue of a principle of state succession.

As a matter of general principle a new state, *ex-hypothesi* a non-party, cannot be bound by a treaty, and in addition other parties to a treaty are not bound to accept a new party, as it were, by operation of law (Brownlie, 1990:668). The rule of non-transmissibility applies both to secession of newly independent states (that is, to cases of decolonisation) and to other appearances of new states by the union or dissolution of states.

To the general rule of non-transmissibility (the "clean state" doctrine) there are some exceptions. The clear examples are:

i) law-making treaties or treaties evidencing rules of general international law,
ii) boundary treaties.

It is held by some writers that a third category of treaties, which they call "dispositive,""localized" or "real," are also an exception to the general rule of non-transmissibility (O'Connel, 1956; McNair, 1938). Proponents of the doctrine of dispositive treaties divide all treaties into two main categories, viz, personal treaties and impersonal or dispositive treaties. Personal treaties are those dealing with political, administrative or economic relations; they are, therefore, basically contractual in character in that they are personal to the parties. A personal treaty is said to be fundamentally a contract and, therefore, dependent on the continued existence of the parties. If any of the parties to such a treaty disappears in relation to a

part of its territory, it ceases to be able to fulfil the obligations undertaken as a sovereign power over that territory.

Dispositive treaties, on the other hand, are those which create "real" rights and obligations i.e. rights and obligations *in rem* in territory. As such, dispositive treaties are immune to the change of sovereignty and rem with the land like the easement of English Common law or the servitudes of Roman law. Examples of such treaties are said to include river treaties, boundary treaties and treaties of peace and neutrality.

The idea of dispositive treaties is unconvincing. Lester (1963) discusses it at length and finds first, that it is impossible to define the difference between localised and non-localised treaties, and second, that British state practice does not appear to recognise a special category of localised (dispositive) treaties for purposes of state succession.

In his opinion, both in theory and according to British and Commonwealth practice, localised treaties are no exception to the general rule that bilateral treaties do not devolve upon successor states, and this opinion accords with the position in international law. Where rights *in rem* are recognised by new states, recognition is explained otherwise than an account of the automatic descent of treaties.

A similar conclusion is reached by Brownlie (1990) when he says;

> "The present writer, in company with others, considers that there is insufficient evidence in either principle or practice for the existence of this exception to the general rule. First, much of the practice is equivocal and may rest on acquiescence. Secondly, the category is very difficult to define and it is not clear why treaties apparently included should be treated in a special way. Supporters of the alleged exception lean on materials, which are commonly cited as evidence of an independent concept of state servitude "(Brownlie 1990:669)"

3.4 The Practice

In practice problems of succession are dealt with by devolution (or inheritance) agreements, by original accession to conventions by new states and by unilateral declarations. (Brownlie, 1990:671).

On a considerable number of occasions the inheritance or devolution of treaty rights and obligations has been the subject of agreements between the predecessor and successor states. Such agreements promote certainty and stability of relations. In Africa, Great Britain concluded inheritance agreement with Ghana, Nigeria, Sierra Leone and the Gambia (Mutiti, 1976:33-39). It is, therefore, reasonable to conclude/ infer that Great Britain did not want treaty rights and obligations over the Nile to devolve. Otherwise, she would have concluded inheritance treaties with her former dependencies.

V. THE LEGAL STATUS OF THE NILE WATER TREATIES

What is the legal status of the Nile water treaties described above – or more specifically, is the international legal regime established over the Nile through treaties concluded between Great Britain and Egypt with other powers still operational and binding on Nile basin states? The answer to this question is fundamental to the issue of rights and obligations over Nile waters.

If the Nile Waters Treaties are valid and binding, they legitimise the legal order of the colonial period that gave Egypt pre-eminence in the control of the Nile and developments in the basin. This would be a severe constraint on the development efforts and opportunities of upper riparian states. But if the Nile Waters treaties are not binding, then the control and utilisation of Nile waters are regulated by the principles of customary international water law. It would also mean that the Nile is in search of a new legal regime in the form of a basin-wide agreement. This would provide plenty of room for negotiation and bargaining as amongst the riparian states. It could help develop a utilisation regime that is more sustainable and equitable.

5.1 The Problem in Perspective

The legal status of the Nile Water treaties has been a contentious issue since the 1950s. On May 18, 1956, in a statement attributed to the Joint Undersecretary for Foreign Affairs, it was stated that the British Government regarded the 1929 agreement and other treaties creating a regime over the Nile waters as subject to revision, and that it was intended to negotiate new terms on behalf of Kenya, Tanganyika and Uganda (Lester, 1963:501). And August 27, 1959, the United Kingdom made the following statement.

> "—the territories of British East Africa will need for their development more water than they at present use and will wish their claims for more water to be recognised by other states concerned. Moreover, they will find it difficult to press ahead with their own development until they know what new works downstream states will require on the headwaters within British East African Territory. For this reason the United Kingdom Government would welcome an early settlement of the whole Nile waters question". (Garrestson, 1960:143).

It is also a significant fact that as soon as the dependent territories became independent, they refused to accept the validity of the Nile Water Treaties. Thus, after attaining independence in 1956, Sudan denied the continued validity of the 1929 Nile Water Agreement. In fact, Egypt was compelled to negotiate a new treaty with its southern neighbour, the 1959 agreement on the full utilisation of the Nile Waters.

When it became independent in 1960, Tanganyika refused to be bound by treaties

concluded by Great Britain on her behalf, and in particular, objected to the 1929 Nile Waters Agreement. In 1961 the Government of Tanganyika made a declaration to the Secretary-General of the United Nations in the following terms:

> `As regards bilateral treaties validly concluded by the United Kingdom on behalf of the territory of Tanganyika, or validly applied or extended by the former to the territory of the latter, the Government of Tanganyika is willing to continue to apply within its territory on a basis of reciprocity, the terms of all such treaties for a period of two years from the date of independence— unless abrogated or modified earlier by mutual consent. At the expiry of that period, the Government of Tanganyika will regard such of these treaties which could not by the application of rules of customary international law be regarded as otherwise surviving, as having terminated.' (Seaton and Maliti, 1973; Brownlie, 1990).

Tanganyika's approach was adopted by other countries including Kenya, Uganda, Burundi and Rwanda, who all refused to be bound by treaties concluded by colonial powers (Okidi, 1982).

In the matter of the 1929 Nile Waters Agreement, the Government of Tanganyika, on July 4, 1962, addressed identical notes to the Governments of Britain, Egypt and Sudan outlining the policy of Tanganyika on the use of the waters of the Nile. The note read as follows:

> "The Government of Tanganyika, conscious of the vital importance of Lake Victoria and its catchment area to the future needs and interests of the people of Tanganyika, has given the most serious consideration to the situation that arises from the emergence of Tanganyika as an independent sovereign state in relation to the provisions of the Nile Waters Agreements on the use of the waters of the Nile entered into in 1929 by means of an exchange of Notes between the Governments of Egypt and the United Kingdom.
>
> As the result of such considerations, the Government of Tanganyika has come to the conclusion that the provisions of the 1929 Agreement purporting to apply to the countries under British Administration are not binding on Tanganyika. At the same time, however, and recognising the importance of the waters of the Nile that have their source in Lake Victoria to the governments and people of all riparian states, the Government of Tanganyika is willing to enter into discussions with other interested

> governments at the appropriate time, with a view to formulating and agreeing on measures for the regulation and division of the waters in a manner that is just and equitable to all riparian states and the greatest benefit to all their peoples" (Seaton and Maliti, '973).

Another source of pressure on the legal status of the Nile Water Treaties is water stress and water scarcity in the Nile Basin. Hydrologists define countries whose annual water supply averages between 1,000 and 2,000 cubic meters per person as water stressed (the category before water scarce). A country is determined to be water scarce when its annual supply of internal renewable water falls below 1,000 cubic waters per person (2,740 litres per day). In socio-economic terms, scarcity occurs when the lack of water endangers food production, constrains economic development and jeopardises a country's natural systems (Gleick, 1993).

Due to a combination of factors, including population growth, consumption practices and patterns, diversionary activities of water resources and climatic and environmental conditions, the Nile basin countries are beginning to experience water scarcity, with four of them (Egypt, Kenya, Rwanda and Burundi) already classified as water-scarce states. (Kukk and Deese, 1996). Access to the waters of the Nile is becoming a security matter, and the matter of rights and obligations is at the centre of things.

This pressure is compounded by the fact that most of the Nile Basin states have only recently started making systematic and appreciable (usually very unilateral) demands on the waters of the Nile and its effluents, as they embark on post-colonial programmes of development.

It is, therefore, not surprising that the status of the Nile treaties keep being raised as an issue in the fora in which resource rights and water are being discussed. In Kenya in recent times, there have been no less than four appeals to address the Nile waters question. Thus, speaking to journalists on February 12, 2002, Energy Minister Raila Odinga said that the 1929 Agreement should be renegotiated. Continued he;

> "The three countries (Kenya, Uganda and Tanzania) were not independent and were under colonial rule. That is what makes the treaty unfair. Why should we be denied the use of our water in the name of conserving it for others downstream?" (*Daily Nation,* 13th Feb, 2002, page 5).

And speaking at a water conference in Nairobi on 21st March 21, 2002, a prominent international lawyer, Prof. Charles Odidi Okidi declared that the 1929 Agreement was not binding and should not be honoured by Kenya and other East African countries (page 4, *Daily Nation* March 22, 2002) Mbaria (2002) and Kamau (2002) have made similar statements.

The status of the Nile Water treaties has also been raised in the East African legislative Assembly by Yona Kanyomozi of Uganda (Kamau, 2002).

5.2 The Claim that the Nile Water Treaties are valid and binding

The claim (and assertion) that the Nile Water treaties are valid and binding on successor states is based on, or encouraged by three sets of factors. These are the attitude of Egypt towards the treaties, the writings of certain publicists and the ambivalent position expressed by some riparian countries.

(i) Egypt's Position

Egypt holds the view that all the Nile River agreements are by their nature perpetually binding on successor states. In her estimation, these instruments are transmitted to the successor states and may be either amended or abrogated only by consent in accordance with the Vienna Convention on the Law of Treaties. Egypt further asserts that treaties concluded by European powers acting on behalf of colonised African states continue to be in force by virtue of the law of state succession and because of the territorial nature of the obligations resulting from these treaties (Godana 1985).

Egypt also holds the view that she has "natural and historic" rights over Nile waters acquired by long usage and recognised by other states like Great Britain and Sudan, and that the Nile Water treaties have been declaratory of international customary law relating to fluvial law.

And from statements attributed to her political leaders, Egypt clearly regards access to the waters of the Nile as a national security matter. Egypt has repeatedly stated that if Ethiopia or any other upstream country diverts the Nile, she would use force to rectify the situation (Myers, 1989; Starr, 1991).

(iii) The Writings of Publicists

Some writers have expressed the view, based on the controversial idea of dispositive treaties, that the Nile Waters treaties were either declaratory of prescriptive rights or territorial in character and, therefore, transmissible.

Thus Vali (1958) describes the 1929 Nile Waters Agreement as an agreement whose territorial character necessitates its respect by successor states (Lester, 1963:500). And Godana (1985) proceeds on the assumption that the 1929 agreement is binding. He declares:

> "— Of all the early instruments on the utilisation of the Nile Waters, only the 1929 agreement, as implemented by a number of subsequent agreements and measures, seems to survive. The survival of this particular treaty is unmistakably attested to by available evidence" (page 156).

But the "available evidence" is difficult to isolate, given that elsewhere, Godana (1985) opines as follows:

> "It seems doubtful that the 1929 agreement was seriously regarded or even intended as permanent in the sense that it would bind all successor states in perpetuity" (page 143).

Be that as it may, such opinions expressed by learned publicists create the impression, and encourage the interpretation that the Nile Water agreements are binding and valid, either because of their territorial character, or because it was the intention of the high contracting parties that the new sovereign states would be automatically bound by such treaties.

(iii) The Uncertain Position of Some Riparian States

Some Nile Riparian Countries have spoken strongly and consistently on the Nile Water Treaties, making it clear that they are not bound, and the treaties are not valid. These countries include Tanzania, Ethiopia, Sudan (on the 1929 Agreement) and Burundi. But there are states on the Nile basin whose positions have been rather ambiguous. A good example of such a state is Kenya.

Even before independence, it was reported that "the local legislative councils of the territories (of East Africa, Kenya included) have indicated their dissatisfaction at what they consider to be the United Kingdom's inadequate international expression of their interests as upper riparians" as regards the Nile Water treaties (Garretson, 1960:144).

Then at independence, Kenya adopted the Nyerere doctrine and declared her intention not to be bound, giving a grace period of two years within which to re-negotiate treaties entered into on her behalf by the United Kingdom. By a communication to the Secretary-General of the United Nations dated March 25, 1964, the Prime Minister of Kenya made the following declaration on the subject of succession of treaties extended or applied to Kenya by the Government of the United Kingdom prior to independence:

> "In so far as bilateral treaties concluded or extended by former Kingdom on behalf of the territory of Kenya or validly applied or extended by the former to the territory of the latter are concerned, the Government of Kenya is willing to be a successor to them subject to the following conditions:
>
> a) That such treaties shall continue in force for a period of two years from the date of Independence (i.e. until December 12, 1965)
>
> b) That such treaties shall be applied on a basis or reciprocity.
>
> c) That such treaties may be abrogated or modified by mutual consent of the other contracting party before December 12, 1965.
>
> At the expiry of the aforementioned period of two years, the Government of Kenya will consider these treaties, which cannot be regarded as surviving according to the rules of

> customary international law as having terminated. The period of two years is intended to facilitate diplomatic negotiations to enable the interested parties to reach satisfactory accord on the possibility of the continuance or modification or termination of the treaties" (Mutiti, 1976:114).

But recently, at a water conference in Nairobi, the Minister for Water Development, Mr. Kipngeno Arap Ngeny, inexplicably stated that the 1929 Nile Water Agreement was binding on Kenya"*(Daily Nation*, Saturday 23 March 2002, page 4). Some top government officials have even denied the existence of such treaties.

This kind of ambivalence encourages the assumption and belief that the Egyptian Government's position on the Nile is the true and legal position.

5.1 The Case Against

The thesis of this paper is that the Nile Water agreements concluded during the colonial era are not binding on the successor states of the Nile basin and that this is the position in international law as buttressed by the practice of the states. The following reasons support this thesis.

First, the majority of commentators, with the distinct exception of Egyptians have come to the conclusion, or taken the position that these treaties are not binding (see Godana, 1985:144-157). The only controversial cases appear to be the 1929 Nile Water Treaty and the Owen Falls Agreement. Godana (1985) takes the view that the 1929 Agreement has "survived". O'Connell (1967) and others would take the view that such treaties are binding on successor states because of their "territorial character". However, the reasons adduced below make these treaties as invalid as any other colonial era treaties.

Secondly, it is clear from the discussion in chapter IV that the strongest reason for claiming that the Nile Water treaties are binding is the doctrine of dispositive treaties. But it has already been shown that there is insufficient evidence for the existence of such a category of treaties as an exception to the general rule of non-transmissibility.

Moreover, in the absence of the doctrine of dispositive treaties, some other basis for the survival of the Nile water agreements must be demonstrated. These alternative theories could be servitudes, acquiescence or the idea of law-creating treaties (Lester, 1963). But none of these have been shown to be the reason for the survival of the Nile treaties and authorities are in agreement that these theories are inapplicable to the case of the Nile water agreements.

Thirdly, it has been implied by Egypt and some publicists that the validity of the Nile water agreements, their devolution on successor states, and their being binding in perpetuity is inferred from the intention of the parties. It is sometimes suggested that the description of a treaty as localised may refer to the intention of the high contracting parties with regard to the effect upon the treaty of alienation of territory to which it

has been specifically applied, and that such intention might be

> "that the new sovereign will automatically be bound by the treaty" (Lester, 1963:490). But the attitudes of Egypt and the United Kingdom and the provisions in the treaties do not evince such an"intention.

Fourthly, there is the doctrine of *rebus sic stantibus*. This doctrine asserts that if circumstances, which constituted an essential basis of the consent of the parties to be bound by a treaty, undergo such far-reaching changes as to transform radically the nature and scope of obligations still to be performed, the agreement may be terminated on the initiative of a party. It is submitted that the changes introduced by the decolonisation process and the emergence of independent states in areas which were formerly territories under British administration are of such fundamental importance as to permit the operation of the doctrine of *rebus sic stantibus*, and that the declarations of the new states to the effect that the treaties entered into by former colonial powers on their behalf does not bind them is their initiative to terminate these treaties. Nile water agreements could, therefore, not survive colonialism.

Fifth, state practice is inconsistent with any claim of validity of the Nile water treaties. To this end, Great Britain had adopted the attitude that these treaties should be re-negotiated, and all states on the Nile basin (except Egypt) have adopted the Nyerere doctrine on state succession to treaties and have thus refused to be bound. Available evidence also shows that states on the Nile are taking unilateral decisions (or sub-basin approaches towards) in the utilization and development of Nile water resources.

Lastly, and independently of the above, the conduct of Egypt with regard to the utilisation of the Nile Waters raises serious doubts about her capacity to bind co-riparians to their treaty and customary law obligations. Writing in 1958, Pompe submitted that the upper-basin states, already before their independence,

> "Could certainly not be held to the obligations which they undertook towards Great Britain by the aforementioned agreements of which Great Britain as administering power undertook towards Egypt by the 1929 agreement with regard to the construction of works affecting the Nile flow, if Egypt, or for that matter the Sudan were to construct dams which would change the natural conditions of the Nile Basin to the serious disadvantage of the upstream states." (Pompe, 1958:287, Godana, 1985:146-7).

In this connection, the building of the Owen Falls Dam (resulting in a rise of two and a half meters in the level of Lake Victoria), the Jonglei Canal project and particularly the diversion and piping of Nile

water to Sinai Desert. (Okidi, 1999, Mbaria, 2002), and its reported sale to Israel would appear to be conduct that should release the upper riparians from any obligation towards Egypt. If Egypt can do as she pleases with the water, why should the other riparians be restricted?

The position adopted by Egypt on the legal status is dictated more by self-interest than by international law and state practice. That may explain her frequent resort to threats of military action and other "sabre-rattling behaviour."

VI. THE NILE: IN SEARCH OF A LEGAL REGIME

The import of the conclusion that the Nile Water Treaties are no longer binding and operational is that only post-colonial agreements can be said to be valid. The only such treaty is the 1959 agreement for the full utilisation of the Nile waters. This agreement is a bilateral arrangement between Sudan and Egypt, which does not bind or affect the other riparian states of the Nile. Thus, the legal regime governing the utilisation of the waters of River Nile is customary international law. As the international law commission advised:-

> "In the absence of bilateral or multilateral agreements, member states should continue to apply generally accepted principles of international law in the use, development and management of shared water resources" (Biswas, 1993:175).

What then does international law say about shared water resources?

6.1 Customary International Law

International law concerning international fresh water resources has been vague and generally not accepted by states (Kukk and Deese, 1996:52). International water law as one of the new areas of the law of Nations has not yet fully coalesced into firm principles and rules. The problem here is not just one of lacunae in the law. Until very recently, there was doubt as to whether there were any principles and rules of general international law, which were applicable to international rivers or other shared water resources, in the absence of particular law in the form of treaties. These doubts have now been dispelled.

But such general law as has recently developed is not yet a fully-fledged system, as uncertainty remains on the scope of specific principles or rules. (Godana, 1985:135).

International law is particularly contentious on the issue of territorial sovereignty in international relations arising from the non-navigational uses of watercourses. A summary of the contending theories of water rights illustrates the problem. The essential point to note here is that due to the underdevelopment of international law, states are able to assert an almost infinite range of contradictory and mutually exclusive doctrines and principles whenever their interests demand that they do so.

There are two conflicting water rights theories known to international law. These are the doctrine of absolute territorial sovereignty ("the Harmon Doctrine.") and its antithesis, the absolute territorial integrity doctrine. Absolute territorial sovereignty doctrine holds that a state has the right to do whatever it chooses with the waters that flow through its boundaries, regardless of its effect on any other riparian state. Under this doctrine, a lower riparian has no recourse but to hope for cooperation from the upper riparian or threaten military action.

Absolute territorial integrity is the opposite view. Under this doctrine, an upper riparian may not harness a river if this would harm a lower riparian. Every state must allow rivers to follow their natural course; it may not divert the water, interrupt or artificially increase or diminish its flow. The doctrine reflects the claim that there is a principle of general international law that substantially restricts the water uses of the upstream state.

As would be expected, upper riparians have been quick to adopt the absolute territorial sovereignty doctrine. On the Nile Basin, Ethiopia has consistently subscribed to the Harmon Doctrine (Godana, 1985:33-4, Bruhacs, 1993:44). On the other hand, absolute territorial integrity is the common position of lower riparians. On the Nile Basin, Egypt has persisted in asserting this doctrine (Lipper, 1967:18).

Many scholars believe that both absolute territorial sovereignty and absolute territorial integrity are untenable as trans-boundary water-sharing regimes, and neither is generally accepted as a norm of customary international law.

Therefore, a third approach, essentially a compromise position between the two, has been developed. This is the limited territorial sovereignty doctrine, also known as the limited territorial integrity doctrine. Under this doctrine, every state is free to use the waters flowing on its territory, as long as such utilisation does not interfere with the "reasonable utilisation" of water by other states. In short, states have reciprocal rights and obligations in the utilisation of the waters of their international drainage basins.

Writers, state practice and jurisprudence have all consecrated this theory, which is generally accepted today (Godana, 1985:40). It is the overall position of international law then, that while each state enjoys sovereign control within its own boundaries where international drainage basins are concerned, it may not exercise such control over the portions of such basins located in its territory without taking into account the effects upon other basin states.

The customary international law concept of reasonable or equitable utilisation has now been granted the status of law by the United Nations …. on the Law of the non-navigational uses of International Watercourses adopted in 1997 (36 I.L.M. 700). Article V of the convention states that parties shall utilise an international watercourse in an equitable and reasonable manner. Article VI then gives the factors to be considered in determining reasonableness. These are "all relevant factors and circumstances, including":-

(a) Geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character;
(b) The social and economic needs of the watercourse states concerned;
(c) The population dependent on the watercourse in each watercourse state;
(d) The effects of the use or uses of the watercourses in one watercourse state on other watercourse states;
(e) Existing and potential uses of the watercourse;
(f) Conservation, protection, developments and economy of use of the use of the water resource of

the watercourse and the costs of measures taken to that effect;

(g) The availability of alternatives, of comparable value, to a particular planned or existing use.

However, the adoption of the limited territorial sovereignty doctrine in international law has not solved the problem of water rights in international watercourses. The main reason why this doctrine presents complications is that the definition of "reasonable" is unclear:-

> "The substantive law on the utilisation of shared water resources is defined in the vague language of the doctrine of equitable utilisation and offers little guidance to states on how they may proceed lawfully with the utilisation of "these waters in their territories" (Wouters, 1997).

The consensus of opinion appears to be that customary international law is not a comprehensive framework for the regulation of the utilisation of international watercourses. The law is underdeveloped and vague, with weak or non-existent mechanisms for enforcement.

Two other inherent limitations have been noted. The first is that each international watercourse constitutes a specific unit without an equal counterpart and with disparate types of hydrologic, economic and political conditions. In other words, international watercourses have a particular character from a geographic, economic, social, political and legal point of view (Bruhacs, 1993:53). They cannot, therefore, be managed effectively through the use of general rules universally applied to all watercourses. The particular character of international watercourses requires the conclusion of treaties, preferably bilateral or restricted multilateral treaties.

The second is the problem of reciprocity. International law has been based upon asymmetry of obligations, on mutual advantages granted by the states to each other on the basis or reciprocity. In the case of international watercourses, the respective states are in an unequal situation, as a consequence of the relative unidirectional character of the relevant trans-frontier effects.

This upstream/downstream relationship creates a permanent situation of conflict, and makes international law-making difficult. The particular character of international watercourses essentially requires bilateral law-making but the absence or limits of reciprocity here constitutes a serious obstacle. An assumption has usually been made that an upstream state does not need the establishment of international legal rules on account of its favourable situation (beati possidentes). But this has led to over concentration on the problem of lower riparian. This leads to the complaint that international law "has focused on the concerns of downstream states without providing real incentives for upstream states" (Lupu, 2000:366).

In 1997, the United Nations adopted the Convention on the Law of the Non-Navigational uses of International Watercourses. But the convention, which

attempts to modify and develop norms of customary international law, is only a partial response to the limitations of international water law.

The convention adopts the vague concept of "reasonable and equitable" use (Article 5). It then pins its faith on the negotiation of "watercourse agreements" as the institutional and normative framework for regulating the use of international waters (Articles 3 and 4). In other words, it does not add anything to the law as it existed before 1997, and most commentators do not think it provides a basis for regulating the use of international watercourses (Kahn, 1997, Hey 1998).

The weakness of the customary international legal regime has created or encouraged interest in the development of other approaches to the management of shared water resources. An interesting one is based on the theory of community of interests in the waters. Here, international borders would be ignored and the river basin would be administered as a collective water resource by an international institutional structure. A single state would need cooperation from its co-riparians to make any use of the shared water (Godana, 1985:48-9, Cohen, 1991).

At this stage it may be appropriate to consider the situation of the Nile.

6.2 The Case for a Nile Basin Commission

The management of the Nile waters requires either an international institution structure or a restricted multilateral treaty regime or both. Writing in 1960, Garretson observed as follows:

> "Nearly all the commentators on the problems of the full development of the Nile basin have concluded their various analyses with a suggestion in one form or another of the need for a Nile river Basin Authority or Administration" (1960:144)

This idea is supported by Godana (1985), who points to the realisation that the full development of the Nile can only be made possible through agreements which are concluded between all the basin states and in which all interests are taken into account. He then adds:

> "Basin states are bound to gain much from the creation of a comprehensive Nile Basin Commission serving as an institutional vehicle for cooperation. Above all, such a commission would ensure cooperation in the rational planning, conservation and development of resources of the basin as a whole" (page 264).

Okidi (1999) is also in favour of an institutional structure for cooperation in the management of the Nile. But a basin wide institution for the management of the Nile has never been established. In fact, the existence of sub-basin

institutional arrangements notwithstanding (Kasimbazi, 1998):-

> "The pursuit in the Nile basin of nationalist ends with national means within national frontiers in the hope that regional and international difficulties can be avoided".

remains the typical approach of the Nile basin states (Garretson, 1960:144).

The importance of river basin organisations has been emphasized by Kukk and Deese (1996). According to them, one reason why political tensions and conflict are common along some international rivers is the lack of river basin organisations. Where such organisations are established in water scarce areas, they provide a means for voicing and resolving water issues without resort to force.

A famous example is the Organisation for the Development of the Senegal River (OMUS). It is said to have been instrumental in averting international conflict among the riparians, and to have fostered such strong cooperation among them as joint owners of all major river works along the basin that it is used as a model by the United Nations and the World Bank when developing plans for managing other basins (Rangeley, 1994).

Establishing an international river basin organisation, authority, or commission is one of the best solutions for preventing and resolving water conflicts because it engages water scarce as well as water rich countries in negotiations.

The imperative of an international institutional structure for the management of international water resources is arrived at by Beavenisti (1996) through a different route: the logic of collective action. The basic argument is simple. International rivers are a unique type of good. Unlike internal resources, controlled by a single state, they are not a purely public good to which all states enjoy potentially unrestricted access, like the high seas, the mineral resources of the deep seabed, the electromagnetic spectrum and space. Freshwater resources that traverse political boundaries are a collective good to which only the riparian states enjoy access. Even though other states are excluded from using them, the riparian states still need to regulate their respective rights and obligations. To obtain the optimal utilisation of these resources, the riparian states must act collectively.

Benvenisti's approach is useful in another sense. It explains why cooperation through common action has been difficult to institutionalise, and demonstrates the importance of international law in encouraging it. Again the proposition is straightforward. The classical distinction among types of goods in economic literature is between "pure public" and""pure private".

Pure public goods are goods whose benefits are non-excludable and non-rival. They are non-excludable because it is impossible or prohibitively costly to prevent outsiders from gaining access to them. They are non-rival because a user's consumption of a unit of that good does not detract from its benefits to others. In contrast, the benefits

of a private good, such as a loaf of bread, are fully excludable and rival. The user may prevent others from using it and the consumption of any part detracts from the whole. Positioned between pure private and pure public goods are two other types of goods;

(a) Impure public goods that are non-excludable, yet rival, which may be consumed by all who gain access to them but whose consumption detracts from the consumption of others (for example, fisheries in the oceans, open-access pastures), and
(b) Common pool resources, which are partially excludable and rival.

International freshwater resources, to which only the riparian states enjoy access for purposes other than navigation, are an example of common-pool resources. Their benefits are partly excludable. In contrast to open-access commons, such as high seas fisheries and the electromagnetic spectrum, non-riparians have no access to the water resources and cannot benefit form them directly. Their benefits are also rival, since any unit of water diverted or polluted by one riparian reduces the amount available to the other riparians or its quality.

Both impure public goods and common-pool resources are susceptible to the tragedy of the common "syndrome" in which each of the appropriators receives direct benefits from its unilateral act, while the costs of the act are shared by all (Harding, 1968).

There is, however, a crucial distinction between common-pool resources and impure public goods: the possibility of excluding outsiders from using common-pool resources gives the limited number of insiders the opportunity to coordinate their activities in the interest of the optimal and sustainable use of the water, and thereby avert a tragedy of their commons.
Why then, would they not cooperate to avert a tragedy of their commons?

Since different states enjoy access to shared freshwater, they face a "collective action problem". Each has an interest in getting more out of the resource, and these interests conflict with each other. The key to cooperation lies in the solution of the collective action problem.

In this regard, it is possible to identify areas where international law may prove instrumental in enhancing states' willingness to cooperate, and there are at least three such areas: direct interaction, substantive requirements and effective institutions.

First, by insisting on negotiations as the basis for any arrangement, the law can prod the riparians to establish direct interaction.

Secondly, the law can prescribe minimal standards for water allocation, water quality and the sustainable development of the resource.

Finally, the law may offer riparians contemplating cooperative institutional means of enforcing commitments and ensuring long-term interdependence (Benvenisti, 1996:400).

However, cooperation can only truly emerge from a genuine realisation of shared

interest in the water resource. The practicality and inevitability of negotiation between upper and lower riparians cannot be over-emphasised. In the case of the Nile therefore, the states must address their "collective action problem" instead of basing their claims on conflicting and outmoded theories of water rights, or historical relics.

6.3 The Case for a Restricted Multilateral Treaty

As demonstrated above, international law is too general and inchoate to address the problems of particular international basins. At the same time, collective action is inevitable in the promotion of peaceful and sustainable international cooperation in the utilisation of shared water resources. Not only because customary international law is underdeveloped, but also specifically because the state of the law requires and recommends it, restricted multilateral treaties must be negotiated for the major international river basins of the world. This has been accomplished in the case of most basins. The Nile is a curious exception.

In negotiating a multilateral treaty, the bargaining is going to be between upper riparians and lower riparians. The collective and joint interests of these upstream/downstream countries dictate this. East African countries should prepare for this bargaining.

VII. THE NILE QUESTIONS: IMPLICATIONS FOR EAST AFRICA

The need to negotiate a legal and institutional framework for the management and utilisation of the waters of the Nile has been canvassed in this paper. Such a "framework" should take the institutional form of a Basin Organization and the normative form of a restricted multilateral treaty. The states in the East African region need to take a common position on the Nile question, and more importantly to develop that position in preparation for negotiations with other riparian states.

7.1 The Case for a Common East African Position

The logic of a common East African position on the Nile question is dictated by a number of considerations. These include the pact signed by Egypt and Sudan in 1959, the fact that the East African countries are upper riparians, the idea of regional integration, their sharing of Lake Victoria, the history of sub-basin initiatives and the war in Sudan.

(a) The Egyptian-Sudanese Pact (the 1959 Treaty)

In 1959 Egypt and Sudan signed an agreement, ("The 1959 Agreement for the Full Utilisation of Nile Waters") which guaranteed that 55.5 billion cubic meters per year would flow into Egypt without any hindrance from Sudan. The agreement also allowed Egypt to construct the Aswan Dam for "long term" water needs. Most importantly, the agreement was a pact between the two countries to act together, and against the upper riparian states of the Nile. Article V, in purporting to recognise the rights and interests of these other co-riparians provided:

> "Since other riparian countries of the Nile besides the Republic of the Sudan and the United Arab Republic claim a share in the Nile waters, both republics agree to study together these claims and adopt a unified view thereon".

This commonality of interest expressed in the form of a binding commitment by the two states dictates that other states with common interests should also take a common position on Nile waters interests. As Okidi (1999) has observed":-

> "Since Egypt and Sudan have retained their commitment for a collective bargaining position, it may be appropriate for Kenya, Tanzania and Uganda, and possibly Rwanda and Burundi to have a common position" (pages 42-3).

(b) The Upper Riparian Scenario

The interest conflict in sharing international rivers is between upper riparians and lower riparians. As already indicated, the problem lies in the diametrically opposed theories of water rights, which these two groups of riparians tend to take.

As a general rule, upper riparians in successive rivers have asserted claims to individual property rights in the part of the river flowing in their territory (e.g. the Harmon Doctrine), while lower riparians have made the opposite claim, insisting on the principle of non-interference with the natural flow of the river in their territory.

The "inherent conflict" is exacerbated by the problem of absence reciprocity in the sharing of successive rivers, caused by the unidirectional flow of trans-boundary effects. Upper riparians are expected to sacrifice for the benefit of lower riparians who do not bear responsibility for the costs. For example, a rule forbidding causing harm to co-riparians in the use of a shared river benefits lower riparians, and particularly the lower most, at the expense of upper riparians. It is difficult to see what the lower riparian can do to cause harm to the upper riparian.

For the case of the Nile, an accident of history has complicated the relationship between upper and lower riparians even further. Historically, the lower most riparian started using the waters of the Nile earliest - "from antiquity". It was later followed by the next (Sudan) in asserting interest in the use of the shared waters. The upper riparians meanwhile became states as a result of colonisation at the end of the 19th Century, emerging into full statehood after 1959.

Although other civilizations and predecessor states living on the Nile Basin must have relied on the waters of the Nile from antiquity (some are actually culturally and linguistically identified as "Nilotics"!) these""new" post-colonial states could not assert an interest in the waters of the Nile before they were born into statehood.

The upstream/downstream relationship between the two groups of riparians, and their *unequal situation*, dictates that East African countries should develop a position that is common as amongst themselves, but may be different from that of the lower riparians.

(c) Regional Integration

The East African region, which shares a common colonial history, has been experimenting with various forms of regional cooperation since the end of the Second World War. These efforts have resulted in the establishment, by treaty, of the East African Community, whose partner states are Kenya, Uganda and Tanzania.

The objectives of the community are to develop policies and programmes aimed at widening and deepening cooperation among the East African states in political, economic, social and cultural fields, research and technology, defence, security and legal and judicial affairs, for their mutual benefit (Article 5). The Partner States of the community undertake to establish among themselves a customs union, a common market, subsequently a monetary union and ultimately a political federation. Clearly, the East African region will be transformed into a single political unit for purposes of the exercise of sovereignty.

In matters relating to natural resources, the community is to ensure "the promotion of sustainable utilisation of the natural

resources of the Partner States and the taking of measures that would effectively protect the natural environment of the Partner States" [Article 5(3)], and the Partner States "agree to take concerted measures to foster cooperation in the joint and efficient management and sustainable utilisation of natural resources within the community" [Article 111(1)].

Among other things, the Partner States commit themselves to "adopt common regulations for the protection of shared aquatic and terrestrial resources" (Article 114).

The East African States are thus, under a legal obligation to act in common with regard to natural resources like water. This obligation arises from their membership in the East African Community.

(d) Lake Victoria

The three East African countries share Lake Victoria, a common-pool resource. The lake is an acknowledged source of the White Nile, a reservoir of water that drains the entire East African region.

Under the terms of the East African Community Treaty, the Partner States are under a legal obligation to strengthen regional natural resources management bodies, and more specifically to establish a body for the management of Lake Victoria (Article 114). The three East African states have also established by a treaty concluded in 1994, the Lake Victoria Fisheries Organization Treaty.

This joint ownership of Lake Victoria and the common approach to the management of its resources is one other reason for East African states to take a common position on the utilisation and management of the Nile waters resources.

(e) Sub-basin Initiatives

The importance of sub-basin initiatives in the management of the Nile basin resources has been formally acknowledged by scholars and commentators on the subject (Kasimbazi, 1998). In the absence of a basin-wide agreement on the utilisation of the Nile waters, a number of sub-basin initiatives have been developed by like-minded co-riparians. These include the 1959 Agreement between Egypt and the Sudan and the development projects initiated under its auspices.

In the East African region, the sub-basin initiatives most relevant to the utilisation of the Nile waters are the Kagera Basin Organisation, the Lake Victoria Environment Management Programme (LVEMP) and the Lake Victoria Fisheries Organization (LVFO). The agreement establishing the Kagera Basin Organisation was concluded in 1977 between Tanzania, Rwanda and Burundi. Uganda acceded to the treaty in 1981 (Godana, 1985: 191-3; Kasimbazi, 1998: 29-30).

The agreement is concerned with the establishment of institutional framework for cooperation of the drainage basin's water and related resources, including water and hydro-power reserves development, furnishing of water and water-related services for mining and industrial operations; the supply of drinking water, agriculture and livestock development, forestry and land reclamation, mineral exploration and exploitation, disease and

pest control, transport and communications, trade, tourism, wildlife conservation, fisheries and aquatic development and protection of the environment (Article 2).

The Lake Victoria Environment Management Programme was established by an agreement that was singed by Kenya, Uganda and Tanzania on August 5, 1994. The agreement envisages the creation of a programme that would strengthen coordination among the three states in the management of the lake resources including water quality and land use.

The rationale of the programme was that resources used by one riparian state impacted on the activities of other riparian states. For that reason, resource development and management by a riparian state within national jurisdiction has to proceed and be coordinated within a regional cooperation framework backed by political commitment from other riparian states: strategies, policies and action plans need to be coordinated with reference to broad regional objectives and guidelines.

The Lake Victoria Fisheries Organisation was established in 1994 through a convention signed by Kenya, Uganda and Tanzania. The main objective was "to promote the proper management and optimum utilisation of the fisheries and other resources of the Lake" (Article 2).

The importance of sub-basin initiatives lies in what Okidi (1999) describes as their gradual reworking to constitute integrated activities for Lake Victoria and River Nile. Membership in a sub-basin initiative should constitute an identifiable interest, which can be collectively canvassed and advanced as against non-member co-riparians.

(f) The War in Sudan

The civil war in Sudan is a complex conflict. It is at once a war of liberation for the Southern black, Christian Africans against the perceived domination by Northern Muslim Arabs and a struggle for the control of sovereign resources of the Sudan, which include land, oil and water. It could lead to the creation of another state on the Nile, should the South succeed in getting an acceptable measure of self-determination. It has direct implications on the security of the larger region, the Great Lakes and the Horn of Africa from East Africa to Egypt in the sense that conflict in the Sudan is bound to "suck in" the neighbouring states and populations. The war in the Sudan also has grave implications for the environment and the utilisation of natural resources in the region.

One country, which cannot claim neutrality in the Sudanese conflict is Egypt, because the war has direct impact on the 1959 Agreement with Sudan. Some of the development projects envisaged by the agreement, like the Jonglei canal project, have had to be suspended because of "rebel activity". It must also be remembered that having signed a pact with Sudan on the utilisation and apportionment of the Nile waters, Egypt cannot possibly be willing to risk the dismemberment of Sudan on the Nile Basin, which could turn out (in fact will turn out) to be hostile to her interests.

Due to the complexity of the conflict in Sudan, and its possible implication for the security and strategic interests of the East African region, a common position on the conflict and on the Nile is logical and justified.

6.2 The East African Position on Nile Waters

Having established the importance and logic of a common position on the Nile for the East African countries, it is necessary to identify the salient issues, which their common position should address.

The first issue a joint East African position must address is the water rights doctrine. As international law and state practice remains conflicting and fractured on this issue, East African countries must adopt one of the competing doctrines for purposes of bargaining. The obvious options, given that they are upper riparians, would be either the Harmon Doctrine or the limited territorial sovereignty doctrine.

Another issue on which a position must be taken is the geographical and hydrological relationship between Lake Victoria and the Nile. The logic of a basin-wide approach to the development and management of international water courses has been amply demonstrated in the literature of this subject (e.g. Borne, 1972). But the decision to treat Lake Victoria and the Nile as a single basin has such important and far reaching implications that a conscious policy position must be adopted.

The essential consideration here is that if Lake Victoria constitutes a basin that is separate from, and independent of the Nile, then the conservation, management and utilisation of the lake's basin resources cannot be qualified or restricted with reference to the requirement of the Nile.

The third issue of relevance is compensation for harm and damage arising from previous use and developments. The treaty arrangements between Egypt, and Great Britain and the Sudan allowed construction of works by Egypt in foreign territories. Dam development, especially Aswan and Owen Falls, were some of the direct results. These developments have had adverse effects on the upper riparian states: flooding of Sudanese territories and raising of the levels of the waters of Lake Victoria. In the case of Owen Falls Agreement, these adverse effects were anticipated by the parties to the Owen Falls Dam Agreement for it was provided in the agreement that Egypt: –

> "— will bear the cost of compensation in respect of interests affected by the implementation of the scheme or, in the alternative, the cost of creating conditions which shall afford equivalent facilities and amenities to those at present enjoyed by the organizations and persons affected and the cost of works or reinstatement as are necessary to ensure the continuance of conditions obtaining before the scheme comes into operation —-" (Godana, 1985:178).

As a direct result of the Owen Falls Dam Project, the level of the Lake Victoria waters

rose, causing material damage all around the lake (Okidi, 1980; Godana, 1985:179). No compensation has been paid by Egypt. It is submitted that compensation for damages arising from previous development and utilization activities on the Nile are a legitimate prerequisite to negotiations for a future regime for the regulation of the Nile basin.

The fourth issue of concern is the problem of incentive. As upper riparian states, and considering the absence of reciprocity, what can East African countries demand from the lower riparian states, especially Egypt? Quite apart from the legal and moral obligation to share the cost of "maintaining" the quality of the Nile basin, it makes sense to demand a share in the resources of Egypt and Sudan in exchange for an "equitable utilisation" pact.

The need to offer some economic or political benefit in exchange for cooperation in the utilisation of an international river has been discussed by Lupn (2000). Downstream riparians should grant some incentive to their upper riparian neighbours for cooperation. As Lupn (2000) complains:

> "International law has faltered in settling this (Tigris-Euphrates) dispute because it has focused on the concerns of downstream states without providing real incentives for upstream states. Unless changes are made to the international law on trans-boundary waters, it will continue to provide little guidance in managing or solving the political and economic tensions among (the region's) riparian states" (page 366).

Finally, as international fluvial law is still in a state of evolution, all the Nile riparian states can expect to contribute to its development through the refinement and popularisation of various doctrines and theories.

East African States are uniquely placed in a vantage position to challenge the stock assumptions that have tended to accompany discussion of the legal regime of the Nile. These stock assumptions include the claim that Egypt has acquired "historic and natural rights" to Nile water due to long time usage; the mindset that measures Nile waters in Khartoum or Aswan Dam; the assumption that East African communities have not been relying on Nile waters""from antiquity"; the false notion that an ex-colony is a "successor" state to the metropolitan colonizer; and the contradictory theories of sovereignty over water resources.

6.2 Conclusion

The Nile question has fundamental implications for the upper riparian states of East Africa. It is not sufficient for them to demonstrate that the treaties concluded by colonizing powers during the colonial period are no longer binding on them. What is required is a holistic doctrine of trans-boundary water rights. The underdevelopment and vague nature of international law offers an excellent opportunity for these countries to develop a whole new position on international water law, which can be applied to the Nile.

VII. SUMMARY AND CONCLUSIONS

The major premise of this paper has been that the legal regime **of the** Nile has consisted of colonial era treaties concluded between Great Britain and Egypt, on the one hand, and other powers that were in control of the upper reaches of the Nile Basin, and that this legal regime is no longer binding as the direct consequence of state succession and fundamental changes in the circumstances of the state concerned. The Nile is, therefore, in urgent and serious need of a legal regime to regulate the utilisation of its waters. Customary law cannot provide such a regime because of the vagueness and under-development of international fluvial (water) law. A new institutional and normative framework is required. Such a framework should consist of a Basin Organisation and a restricted multilateral treaty.

In developing such a new framework, there will be need and occasion for negotiation between upper and lower riparians, who constitute the natural protagonists in a trans-boundary water system. Since the lower riparians on the Nile (Egypt and Sudan) have entered into a pact to bargain collectively with and against the upper riparians, and since the interests of the upper riparians are fated to be similar, the East African states have an interest in taking a common position on the Nile.

In identifying and articulating their interests, the East African states should be bold because international law on this subject is in a state of flux and transition. The East African states may just be able to canvass their interests while developing international fluvial law.

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Annex I. THE POSITION OF THE NILE BASIN COUNTRIES ON THE NILE WATER TREATIES

1. EGYPT

Egypt holds the view that the Nile water treaties are binding, and are merely declaratory of natural and historic rights, which she already has in respect to the waters of the Nile. The agreements are, therefore, binding pending renegotiation, if at all.

2. ETHIOPIA

Ethiopia subscribes to the Harmon Doctrine, and holds the position that she is free to do as she pleases with the waters within her territory irrespective of the effects on co-riparian states (Kukk and Deese, 1996). Ethiopia further holds the view that treaties entered into by Italy and other powers, reportedly on her behalf, do not bind her and are invalid (Godana, 1985).

3. TANZANIA

On the matter of the 1929 Nile Waters Agreement, the Government of Tanganyika, on 4th July 1962, wrote identical notes to the governments of Britain, Egypt and Sudan outlining the policy of Tanganyika on the use of the waters of the Nile. The note read as follows:

> "The *Government of Tanganyika, conscious of the vital importance of Lake Victoria and its catchment area to the future needs and interests of the people of Tanganyika, has given the most serious consideration to the question that arises from the emergence of Tanganyika as an independent, sovereign state in relation to the provisions of the Nile Waters Agreements on the use of the waters of the Nile entered into in* 1929 *by means of an exchange of notes between the Government of Egypt and the United Kingdom.*
>
> *As a result of such considerations, the Government of Tanganyika has* reached *the conclusion that the provisions of the* 1929 *Agreement purporting to apply to the countries under British Administration are not binding on Tanganyika. At the same time, however, and recognising the importance of the waters of the Nile that have their source in Lake Victoria to the governments and people of all riparian states, the Government of Tanganyika is willing to enter into discussions with other interested states and governments at the appropriate time, with a view to formulating and agreeing on measures for the regulation and division of the waters in a manner that is just and equitable to all riparian states and to the greatest benefit of all their peoples" (Seaton and Maliti, 973).*

And generally on bilateral treaties, Tanzania made the following declaration in 1961:

> "As regards bilateral treaties validly conceded by the United Kingdom on behalf of the territory of Tanganyika, or validly applied or extended by the former to the territory of the latter, the Government of Tanganyika is willing to continue to apply within its territory on a basis of reciprocity, the terms of all such treaties for a period of two years from the date of independence. … Unless abrogated or modified earlier by mutual consent. At the expiry of that period, the Government of Tanganyika will regard such of these treaties, which could not by the application of rules of customary international law be regarded as otherwise surviving as having terminated" ((Seaton and Maliti, 1973; Mutiti, 1976; Brownlie, 1990:671).

4. **KENYA.**

Kenya adopted the Tanzanian approach and position on bilateral treaties, including the Nile water treaties (Mutiti, 1976; Okidi, 1982; Brownlie, 1990).

In addition, in 2002, the Minister for Water Development made a comprehensive policy statement on the utilisation of the waters of Lake Victoria and the River Nile. The statement said:

"At present, two instruments govern the utilisation of the waters of Lake Victoria and River Nile. These are;

1. The 1929 Nile Waters Agreement negotiated between the Governments of United Kingdom (on behalf of its colonies of Kenya, Uganda and Tanzania) and the Government of Egypt and,
2. The 1959 bilateral agreement between Egypt and Sudan.

Under the 1929 agreement the key provision that requires Kenya, Uganda and Tanzania and even Sudan to use the waters of Lake Victoria and the Nile with the acquiesce of Egypt states that:

> "Save for previous agreement with the Egyptian Government, no irrigation or power works or measures are to be constructed or taken on the River Nile or its branches, or on the lakes from which it flows so far as these are in Sudan or in countries under British administration, which would in such a manner as to entail prejudice to the interest of Egypt, either reduce the quantities of water arriving in Egypt, or modify the date of its arrival, or lower its level."

The 1959 Nile Agreement for full utilisation of the Nile waters was explicitly bilateral to Egypt and Sudan. Consequently, in line with the general rule of international Law, such a treaty creates neither rights nor obligation for third States (i.e. States which are not parties to the treaty) as

Kenya. These agreements were concluded during the colonial period and upon attaining independence, the government of Kenya made a declaration to the members of the United Nations on the subject of succession to Treaties extended or applied to Kenya by the Government of United Kingdom and Northern Ireland prior to independence. This declaration provided that;

> *"In so far as bilateral treaties concluded by the United Kingdom on behalf of the territory of Kenya or validly applied or extended by the former to the territory of the latter are concerned, the Government of Kenya signifies its willingness to be a successor to them subject to the following conditions:*
>
> *a) that such treaties shall continue in force for period of two years from the date of independence (i'e until December 12, 1965);*
> *b) that such treaties shall be applied on a basis of reciprocity;*
> *c) that such treaties may be abrogated or modified by mutual consent of the other contracting party before December, 12, 1965 ".*

At the expiry of the aforementioned period of two years the Government of Kenya was at liberty to consider those treaties, which cannot be regarded as surviving according to the rules of customary international law as having terminated. Under Articles 17 & 18 of the Vienna Convention 1978, a new State formed as a result of decolonisation is under no obligation to succeed to a treaty if it does not want to do so; it can start life with a "clean slate".

The doctrine of "clean slate" is not a well-established customary international law under which the Convention has made the following rules:

- A new State can succeed to a multilateral treaty, to which the predecessor State was a party, by notifying the depository that it regards itself as succeeding to the treaty.
- A new state succeeds to a bilateral treaty, which the predecessor state made with another state, only if that other state and new state both agree.

Kenya acknowledges and recognises that the use of international shared water resources such as the water of Lake Victoria and the Nile River must be based on the following principles and practice of international law:

- The Charter of the United Nations and the sovereign rights of states to exploit the natural resources within their territories according to their own environmental and development policies that are balanced by general responsibility to ensure that activities within their own jurisdiction do not harm the environment or cause significant harm to other riparian states or areas beyond the limits of national jurisdiction.

- The principle of appropriate equitable redress in cases of works done on watercourse causing significant harm to the interest of any riparian State.
- The principle of equitable and reasonable utilisation of international waters based on the considerations of socio-economic development, non-harmful and non-wasteful use of water.
- The principles of natural rights of all the states dependent on the same watercourse.
- The concept of sustainable development that meets the needs of the present without compromising the ability of future generations to meet their own needs, as contained in the universally accepted and adopted Brundtland report of 1987 and article 2 of the 1982 Rio Declaration.
- The need of involving all stakeholders to participate at appropriate levels of decision making and management of water resources during the agreement by all riparian states for the sustainable utilisation of waters of Lake Victoria and the Nile watercourse in general.
- The need to undertake environmental audits for current and previous projects touching on the use of Lake Victoria waters including all bilateral projects in all the concerned states using waters of the lake, river Nile or their sources.

Kenya, like other Lake Victoria and Nile River riparian States would further want to adopt the following procedural rules that give states' obligations in the utilisation of the water resources of the basin:

1. Environmental impact Assessment, to avoid, mitigate and minimise adverse impacts as already contained in Section 58 of the Environment Management and Coordination Act number 8 of 1999, Laws of Kenya.
2. Education and public awareness, to promote awareness on the importance of preserving the ecosystem of the shared watercourse.
3. The duty to inform, consult and engage in good faith negotiation and to work out a solution that obviates any expected significant harm as a result of any work done in the Lake Victoria Basin.

Such procedures would require the establishment of institutional arrangements that encompasses the decision making organ as a summit of heads of States of East Africa Community for the Lake Victoria waters and possibly a Nile Watercourse Summit of Heads of State for Nile W0˙ers in total, that defines the co-operation development policy and consultative mechanism for the agreement being negotiated.

Kenya continues to explore whether having a common position with other East African countries will serve our best interest of enhancing Kenya's negotiating position of the draft Nile basin agreement.

(Kenya would, therefore, continue to participate in on-going negotiations for the Nile Basin Co-operative Framework that is being conducted under the Nile Basin initiative by the 10 riparian states. It is Kenya's hope that the negotiations would in due course result into an agreement giving all the concerned countries their equitable and reasonable shares of the waters of Lake Victoria and the River Nile

In the meantime, Kenya will continue to use the waters from Lake Victoria Basin in a sustainable manner, taking into account the national development needs, environmental imperatives and adherence to its obligations under international laws as outlined above.

5. UGANDA, BURUNDI AND RWANDA

These countries also adopted the Tanzanian position on bilateral treaties, including the Nile water treaties (Mutiti, 1976; Okidi, 1982; Brownlie,1990).

6. SUDAN

Upon attaining independence in 1956, Sudan refused to be bound by the 1929 Nile Waters Agreement, thereby compelling Egypt to negotiate a new treaty, the 1959 Agreement for the full utilisation of the Nile Waters.

7. THE DEMOCRATIC REPUBLIC OF CONGO

The position of the Democratic Republic of Congo on the Nile Water Treaties is unclear as it has never been expressly stated.

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PART II: THE NILE TREATIES

PREAMBLE

FACTFILE ABOUT THE NILE RIVER

1. Geographical Features

Tributaries:
The Nile is made up of three main tributaries. These are the White Nile, the Blue Nile and the Atbara.

Major Regions:
Researchers believe that the Nile originated 30 million years ago in the mid-Tertiary period. Its headstream was probably the Atbara River. The river basin continued to evolve and now has seven major regions:

1. Lake Plateau of East Africa
2. AI-Jabal (Mountain Nile)
3. White Nile
4. Blue Nile
5. Atbara
6. United Nile (North of Khartoum in the Sudan and Egypt)
7. Nile Delta.

Sources:
The White Nile originates from the Lake Plateau region of East Africa where several headstreams contribute to the Lake Victoria and Lake Albert. The Ruvyironza, regarded as the ultimate source of the Nile, is one of the upper branches of the Kagera River.

The Blue Nile gathers its volume mainly from the Ethiopian upstream of Lake Tana, some 2,150m (or 7,054 ft.) above sea level.

Length:
The River Nile is the longest river in the world. From Lake Victoria to the Mediterranean Sea the length of the Nile is 5584 km (3470 miles). From its remotest headstream, the Ruvyironza River in Burundi, the river is 6671 km (4145 miles) long. From Lake Tana in Ethiopia to the Mediterranean Sea, the Nile is 4,588 km long.

The total length of the Nile, together with its tributaries, is about 3,030,300 kilometres.

Basin Area:
There are ten basin countries on the Nile. These are Egypt, Sudan, Ethiopia, Eritrea, Uganda, Tanzania, Kenya, the Democratic Republic of Congo, Rwanda and Burundi. The area of the Nile Basin is 3,030,700 square kilometres, distributed as follows:

1. Sudan	-	1, 900,000 sq.km (62.7%)
2. Ethiopia & Eritrea	-	368,000 sq.km (12.1 %)
3. Egypt	-	300,000 sq.km (9.9%)
4. Uganda	-	232,700 sq.km (7.7)
5. Tanzania	-	116,000 sq.km (3.8%)
6. Kenya	-	55,000 sq.km (1.8%)
7. D.R. Congo	-	23,000 sq.km (0.8%)
8. Rwanda	-	21,500 sq.km (0.7%)
9. Burundi	-	14,500 sq.km (0.5%)

The population of the basin area is estimated to be about 160 million, while the total population of all the basin countries is about 300 million.

Dams:
The major dams on the Nile are Roseires Dam, Sennar Dam, Aswan High Dam and Owen Falls Dam.

II. Hydrological Features

a) Flow rates:

The average discharge of the Nile is about 300 million cubic metres per day. (see Graph, Figure 1). Godana (1985) reports that as measured at Aswan, the average annual flow of the Nile is 84 milliards of cubic metres. Of this total, Bard (1959) estimates that 84 per cent is contributed by Ethiopia and only 16 per cent comes from the Lake Plateau of East and Central Africa. Garretson (1967) and Godana (1985) provide similar estimates.

Flow rate Graph

But as the flow chart diagram shows, while the flow of the White Nile is relatively regular and stable throughout the year, the flow of both Blue Nile and the Atbara sub-systems fluctuates seasonally.

At its peak discharge in August to October, the Blue Nile swells to an enormous torrential flow and accounts for some 90 per cent of the waters passing Khartoum. But by April, it will have dwindled to one-fortieth of the flood discharge, to account for no more than 20 per cent of the waters passing Khartoum.

Garretson (1967) estimates that at the peak of its flood, the Blue Nile alone supplies 90 per cent of the water passing through Khartoum, but in the low season, it provides only 20 per cent. Thus, according to Godana (1985), the White Nile at Khatoum provides only 40 per cent of the river's peak discharge, but at the low flow accounts for four fifths of the total delta discharge.

It has also been estimated that on average, 59 per cent of the Nile flow is from the Blue Nile, 28 per cent from the White Nile, and 13 per cent from the Albara River (Shapland, 1997; Carroll, 1999).

Fourteen per cent of the White Nile flow is from the upper Nile states and the other fourteen per cent is from the Sobat River. The Blue Nile's contribution is the largest but it is seasonal. Most of the flow comes in August, September, and October just after the monsoon season in the Ethiopian highlands. At those times the Blue Nile may account for up to 90 per cent of the Nile flow, whereas in July, just prior to the wet season, it may account for as little as 20 per cent of the main flow of the Nile (Shapland, 1997). The White Nile's contribution on the other hand, is small but steady.

The contribution to Nile flow also varies considerably among Countries. Ethiopia contributes eighty - six percent of Nile flow, whereas Egypt contributes nothing. The annual discharge of the Nile in units of 12 milliards of cubic metres has been calculated by Garretson (1967) as follows:

White Nile Down stream at Lake Albert in Uganda	- 2
White Nile Downstream of the Sudd in Southern Sudan	- 1
Sobat from South West Ethiopia	- 1
White Nile at Khartoum	- 2
Blue Nile at Khartoum	- 4
Atbara from Northwest Ethiopia	- 1
Main Nile at Sudanese/ Egyptian Border	- 7

b) Loss of water

Significant amounts of water are lost in the Nile basin through evaporation and soakage.

Some 812 billion cubic feet of water is brought into Lake Victoria by those rivers that drain into it. This represents 15 per cent of the water entering the lake, the other 85 per cent doing so from precipitation directly onto the lake surface. Evaporation helps to balance the water that drains into the lake and continues to Lake Albert. Some 85 per cent of the water leaving Lake Victoria does so through direct evaporation from surface and only the remaining 15 per cent leaves by way of the Victoria Nile, which leaves the lake near Jinja in Uganda, and flows via the Owen Falls, Lake Kyoga and the Murchison Falls to join the outflow from Lake Albert.

Godana (1985) estimates that some 24 milliards cubic metres of water flow down the White Nile from Lake Albert and the East African highlands, half of which is lost through intense evaporation and soakage in the Sudd.

An official Sudanese Government study puts the total swamp losses at 42 milliards of cubic metres (Sudan, 1975). In fact, the Janglei Canal project was intended to divert the flow of the Nile in Southern Sudan to avoid the enormous evaporation losses, which occur there.

Lake Nasser, the second largest manmade lake in the world and the result of the Aswan Dam project, loses 10 per cent of its volume annually through evaporation. This is because of its location in the middle of the desert.

III. Economic Aspects

Practically all the Nile basin states view the Nile as a principal feature of their economies. The Nile and its resources are used for irrigation (principally by Egypt and the Sudan), hydroelectric power generation, water supply, fishing, tourism, water transportation and the protection of public health.

Egypt is the most dependent country on the Nile. The Nile provides Egypt with an average of 55.5 billion cubic meters of water, or 86 per cent of the country's usable water. The Aswan Dam alone produces 1/3 of Egypt's electricity. It is estimated that Egypt relies on the Nile for 95 per cent of its water needs.

Ethiopia is planning to construct, or is in the process of constructing, a new facility on the Blue Nile in order to supply irrigation water for 1.5 million settlers in the Western province of Welega and to provide a steady source of hydroelectric power for the country. The facility is expected to divert 39 per cent of the Blue Nile's waters.

Sudan has also been increasing the number of projects it is undertaking on the Nile with the use of the Nile waters. These include irrigation, dam construction, hydro-electric power generation and canalisation. It is the second most dependent country on the waters of the Nile. There is general evidence of increased utilisation of Nile waters among the riparian states. This is raising the prospects of conflict and water-scarcity in the region.

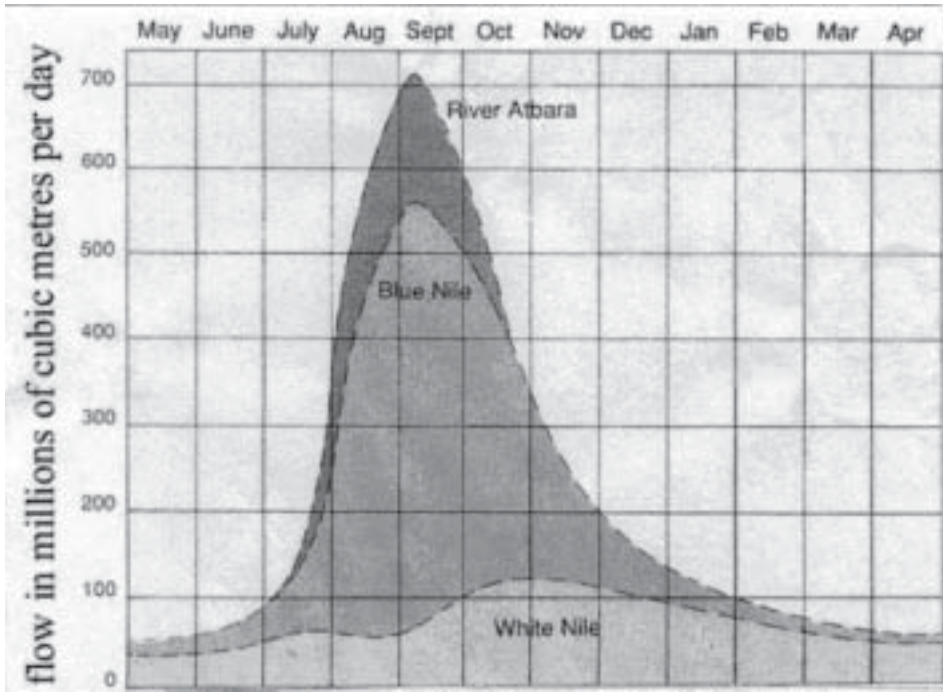
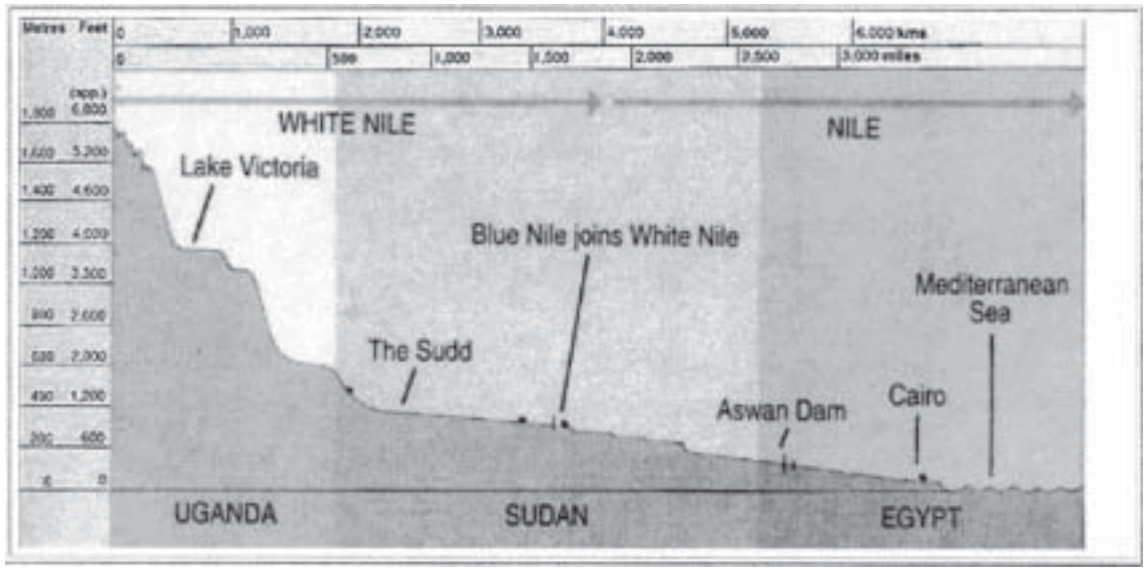


Figure 1
Annual Flow Rate of the three Tributaries of the Nile

Source: http://www.wordbank.org



GREAT BRITAIN AND NORTHERN IRELAND AND EGYPT

Exchange of Notes in regard to the Use of the Waters of the River Nile for Irrigation Purposes. Cairo, May 7, 1929.

Source: League of Nations Treaty Series, Volume 93-94 (1929)

No. 2103. — EXCHANGE OF NOTES BETWEEN HIS MAJESTY'S GOVERNMENT IN THE UNITED KINGDOM AND THE EGYPTIAN GOVERNMENT IN REGARD TO THE USE OF THE WATERS OF THE RIVER NILE FOR IRRIGATION PURPOSES. CAIRO, MAY 7, 1929.

No. 1.

MOHAMED MAHMOUD PASHA TO LORD LLOYD.

PRESIDENCE
DU CONSEIL DES MINISTRES.

CAIRO, *May* 7, I929.

EXCELLENCY,

In confirmation of our recent conversations, I have the honour to communicate to your, Excellency the views of the Egyptian Government in regard to those irrigation questions, which have been the subject of our discussions.

1. The Egyptian Government agrees that a settlement of these questions cannot be deferred until' such time as it may be possible for the two Governments to come to an agreement on the status of the Sudan, but, in concluding the present arrangements, expressly reserve their full liberty on the occasion of any negotiations which may precede such an agreement.

2. It is realised that the development of the Sudan requires a quantity of the Nile water greater than that, which has been so far utilised by the Sudan. As your Excellency is aware, the Egyptian Government has always been anxious to encourage such development, and will therefore continue that policy, and be willing to agree with His Majesty's Government upon such an increase of this quantity as does not infringe Egypt's natural and historical rights in the waters of the Nile and its requirements of agricultural extension, subject to satisfactory assurances as to the safeguarding of Egyptian interests as detailed in later paragraphs of this note.

3. The Egyptian Government therefore accepts the findings of the I925 Nile Commission, whose report is annexed hereto, and is considered an integral part of the present agreement. They propose, however, that, in view of the delay in the construction of the Gebel Aulia Dam, which, under paragraph 40 of the Nile Commission's Report, is regarded as a counterpart of the Gezira scheme, the dates and quantities of gradual withdrawals of water from the Nile by the Sudan in flood months as given in article 57 of the Commission's report be modified in such a manner that the Sudan should not withdraw more than 126 cubic metres per second before 1936, it being understood that the schedule contained in the above mentioned article will remain unaltered until the discharge report, and are therefore subject to revision as foreseen therein.

4. It is further understood that the following arrangements will be observed in respect irrigation works on the Nile :-

a) The Inspector-General of the Egyptian Irrigation Service in the Sudan, his staff, or any other officials whom the Minister of Public Works may nominate, shall have the

full liberty to co-operate with the Resident Engineer of the Sennar Dam in the measurement of discharges and records to satisfy the Egyptian Government that the distribution of water and the regulation of the dam are carried out in accordance with the agreement reached. Detailed working arrangements agreed upon between the Minister of Public Works and the Irrigation Adviser to the Sudan Government will take effect as from the date of the confirmation of this note.

(b) Save with the previous agreement of the Egyptian Government, no irrigation or power works or measures are to be constructed or taken on the River Nile and its branches, or on the lakes from which it flows, so far as all these are in the Sudan or in countries under British administration, which would, in such a manner as to entail any prejudice to the interests of Egypt, either reduce the quantity of water arriving in Egypt or modify the date of its arrival, or lower its level.

c) The Egyptian Government, in carrying out all the necessary measures required, for the complete study and record of the hydrology of the River Nile in the Sudan, will have all the necessary facilities for so doing.

d) In case the Egyptian Government decide to construct in the Sudan any works on the river and its branches, or to take any measures with a view to increasing the water supply for the benefit of Egypt, they will agree beforehand with the local authorities on the measures to be taken for safeguarding local interests. The construction, maintenance and administration of the above-mentioned works shall be under the direct control of the Egyptian Government.

e) His Britannic Majesty's Government in the United Kingdom of Great Britain and Northern Ireland shall use their good offices so that the carrying out of surveys, measurements, studies, and works of the nature mentioned in the two preceding paragraphs is facilitated by the Governments of those regions under British influence.

I) It is recognised that in the course of the operations here contemplated uncertainty may still arise from time to time either as to the correct interpretation of a question of principle or as to technical or administrative details. Every question of this kind will be approached in a spirit of mutual good faith.

In case of any difference of opinion arising as to the interpretation or execution of any of tile preceding provisions, or as to any contravention thereof, which the two Governments find themselves unable to settle, the matter shall be referred to an independent body with a view to the negotiations on the question of the Sudan.

5. The present agreement can in no way be considered as affecting the control of the river, which is reserved for free discussion between the two Governments in the negotiations on the question of the Sudan.

I avail, etc.,

M. MAHMOUD
President Council of Ministers.

Source: League of Nations
Treaty Series, Volume 93-94 (1929).

THE REPORT OF THE JOINT COMMISSION OF HIS MAJESTY'S GOVERNMENT OF THE UNITED KINGDOM AND NORTHERN IRELAND AND THE EGYPTIAN GOVERNMENT

ENCLOSURE IN No 1.

Nile Commission, 1925.

REPORT.

CONTENTS.

1 Not reproduced.

APPENDICES.

CHAPTER I

INTRODUCTORY.

1. The appointment of the Commission arose from an exchange of notes dated the 26th January 1925 between His Britannic Majesty's High Commissioner for Egypt and the President of the Egyptian Council of Ministers, in which it was agreed that a Commission should be appointed "for the purpose of examining and proposing the basis on which irrigation can be carried out with full consideration of the interests of Egypt and without detriment to her natural and historic rights."[1]

2. The following were appointed members of the Commission:

Mr. J. J. Canter CREMERS, *Chairman.*
Mr. R. M. MACGREGOR, British Delegate.
Abdel Hamid SOLIMAN Pasha, Egyptian Delegate.

The Commission was called upon to report by the 30th June, 1925.

The Chairman arrived in Egypt on the 16th February, and the first meeting was held on the following day.

Mr. W. Allard, of the Egyptian Irrigation Department, was appointed Secretary.

3. After preliminary discussions and visits to the Delta Barrage and the offices of the Physical Department, the Commission was able to lay its plans and to define the general lines of statistical examination. It next visited the sadd near Edfina, which is made annually to close the mouth of the Rosetta branch of the Nile; and then proceed on a tour of inspection up the Nile, including the Sennar Dam and the canalisation works of the Sudan Gezira, the site of the proposed Gebel Aulia Dam, the Aswan Dam, the Isna Barrage, the site of the proposed Nag-Hamadi Barrage, and the basin systems in the vicinity of Sohag.

4. During the course of its sittings in Cairo and its tours of inspection, the Commission examined many of the records of the Physical and Irrigation Departments, and obtained by interviews the opinions of various officials, both in Egypt and the Sudan, on subjects connected with its task. On its return to Cairo at the end of March, the Commission applied itself to an examination of the statistics as they became available, calling from time to time for such further data as the progress of the enquiry rendered necessary.

5. The Commission agreed at the outset of its deliberations that decisions arrived at during, the examination of the problem, point by point, should in the first instance be provisional and subject to review at a later stage when it became possible to envisage the problem as a whole. By the early part of May most of the ground had been covered, and a

1 See Notes reproduced at Appendix A.

large measure of agreement had been reached. On certain points, further statistical information was still awaited. It was decided at this stage that further progress would be facilitated by the preparation of a draft report embodying the conclusions so far reached, and it was arranged that the two delegates should prepare separate drafts, from which, with the assistance of the chairman, the final draft would be compiled.

6. At this juncture, the chairman's health began to cause anxiety, and he found it increasingly difficult to take part in the work of the Commission. On the 21st May his indisposition took a grave turn, and it was realised that he was seriously ill. For some weeks there was every hope of his recovery, but most unhappily and to the great grief of his colleagues, he died on the 21st June. The British and Egyptian delegates take this opportunity of placing on record their appreciation of the high professional and personal gifts of their late colleague and their sense of the loss sustained by the Commission over which he had so ably presided, and by the engineering profession in general, through his untimely death.

7. The chairman's illness necessitated the temporary adjournment of the Commission at a time when its task was within measurable distance of completion, and his subsequent death obliged the two Governments to consider the most appropriate course to follow in these unforeseen circumstances. The delegates meanwhile had returned to their normal duties in view of the progress that had already been made, and the desirability of completing the work. The two Governments eventually instructed their respective delegates to resume the studies, so unhappily interrupted and to present their Report.

8. The remaining statistical information having been obtained, the two delegates reviewed, the alternative drafts already prepared; and finding no reason to depart substantially from any proposals common to both of them, they proceeded to compile this agreed Report, which they believe would have met with the approval of their late chairman.

CHAPTER II

DESCRIPTIVE AND GENERAL

Previous History.

9. After the re-establishment of order in the Sudan, as a result of the campaign of *I896-98"* a demand arose in the Sudan for the erection of pumps for irrigation on a small scale; and; with the approval of the Egyptian Government, certain areas of land were given pumping rights. The area under permit was increased from time to time, as explained in detail in a later paragraph, some pumps being installed to test the possibilities of cotton growing, and others *for* the purpose of producing food grains at a time of scarcity during the war. The area now under irrigation in this way is inconsiderable, amounting to less than 40,000 feddans, of which rather more than half is licensed for perennial irrigation, the remainder being restricted to the flood season. An area of some 80,000 feddans in the Northern Sudan has been formed into basins, but, owing to the high Ievels of the land, they are only partly filled, even in years of high flood.

10. The greater part of the cultivable land of the Sudan either possesses an adequate rainfall or is inaccessible by canals. The only considerable area suitable *for* canal irrigation is the triangular tract between the Blue and White Niles with its apex at Khartoum and extending as far south as the Sennar-Kosti Railway. From 1905 onwards the possibility of irrigating some portion of this area had been under consideration and in 1913 a scheme was prepared for the irrigation of 100,000 feddans by means *of* a canal fed from the natural flow *of* the Blue Nile, the required levels being given by a barrage at Makwar. It was then believed that such a scheme would permit of the cotton crop being matured without detriment to Egyptian interests. Further experience of agricultural conditions, however, and the occurrence of the exceptionally low river of 1913-14, showed that this was impossible, and that the scheme should comprise a storage dam, and not merely a diversion barrage. With the addition of a reservoir for the storage of water abstracted from the natural flow during the flood season, it was calculated that the area could be increased to 300,000 feddans without the need for taking water from the river at low stage, and that such an increase of area was necessary to off-set the extra cost of the dam. The scheme was recast on these lines, but progress was interrupted by the war.

11. Simultaneously, the Egyptian Government had been considering the construction of a dam on the White Nile at Gebel Aulia, near Khartoum, *for* the dual purpose of controlling high flood, which threatened damage *to* Egypt, and of storing water for use during the summer season in Egypt. This scheme was also delayed by the war, though some *work* was actually executed during the years 1917-20.

12. The resumption of progress on both of these projects after the war was accompanied by vigorous public discussion and criticism in Egypt, directed chiefly against the accuracy of the data on which they were based. As a result of this the Egyptian Government in January

1920 appointed a commission of Enquiry, known as the Nile Projects commission, composed of three members nominated by the Government of India, the University of Cambridge and the Government of the United States. The terms of reference to the commission were as follows:

> The commission is requested to give to the Egyptian Government its opinion of the projects prepared by the Ministry of Public Works with a view to the further regulation of the Nile supply for the benefit of Egypt and the Sudan. In particular, the commission is requested:
>
> a) To examine and report upon the physical data on which the projects are based
>
> b) To report upon the propriety of the manner in which, as a result of these projects, the increased supply of available water provided by them will be allocated at each stage of development between Egypt and the Sudan.
>
> *c) To* advise as to the apportionment of the cost of the proposed works and of this enquiry as between Egypt and the Sudan.

The projects were those described in a publication of the Egyptian Government entitled " Nile Control ", and comprised the two dams already mentioned, a barrage in Upper Egypt, conservation works in the "Sadd" region and storage reservoirs in the Great Lakes.

13. The report of the Nile Projects commission, which was published in 1921, found that the projects were based on reliable data, and advocated their execution. In view, however, of the estimated heavy cost of the Gebel Aulia Dam and its complementary works, the Egyptian Government decided in May 1921 *to* suspend all operations in connexion with this *project.* The Sudan Government, on the other hand, in view of the favourable report, decided *to* continue *work* on the Gezira Irrigation Scheme.

14. The majority of the Nile Projects commission felt unable *to* advise on the problem of allocating those supplies of water, which still remained un-appropriated, and the only proposals made in this connexion, namely, those of *Mr. Cory,* the American member, were *not* adopted.

15. In view of the situation, which had led *to* the appointment of the above-mentioned commission, the British Government gave, in February 1920, an undertaking that the area of *300,000 feddans* comprised in the Gezira Irrigation Scheme would not be exceeded without reference to the Egyptian Government; and the *work* has been carried out within this limitation.

The Present Position

16. The immediate programme of works outlined in " Nile Control" consisted of the following items:

(a) The Gebel Aulia Dam to provide additional water for Egypt.

(b) The Makwar Dam, or, as it is now called, the Sennar Dam, with a canal system to irrigate 600,000 feddans in the Sudan Gizira.

(c) A barrage at Nag-Hamadi in Upper Egypt.

For various reasons, first the war, and then financial and other difficulties, no progress has been made with items *(a)* and *(c)*. On the other hand, item *(b)* has been carried to completion, and came into operation in July 1925. The cost of this work has greatly exceeded the original estimates, and the Sudan Government, who are responsible for its financial results, desire to extend the area so as to reduce the risk of financial failure, and generally to develop still further the resources of the country.

17. It was an important feature of the programme that these three works should be carried out so as to come into operation simultaneously. The actual position, however, with which the commission has to deal, is that the Sudan has completed the canalisation of 300,000 feddans in the Gezira, and desires to advance a further stage, while Egypt has not yet been able to carry out her part of the original programme. During the time which has elapsed since the commission was adjourned, the Egyptian Government have made considerable progress with their development programme, having now definitely sanctioned the construction of the Gebel Aulia Dam and the Nag-Hamadi Barrage, and the undertaking of an initial stage in the work of conserving the flow of the river in its course through the "Sadd" region.

18. The position as regards the limit of 300,000 feddans was modified by notes which passed between the British and Egyptian Governments in 1924 and 1925, of which the last two, giving rise to the appointment of this commission, are contained in Appendix A. The effect of these was to terminate the 300,000 feddans limitation of 1920, and to call for some new arrangement to regulate expansion of irrigation in the Gezira.

Scope of the Present Proposals.

19. The Nile Projects Commission of 1920 had been requested to examine and to give its opinion on certain projects then under construction or under consideration by the Ministry of Public Works. A less specific charge has been laid upon the present Commission, which has been asked only to propose a basis for irrigation in which full consideration should be given to the rights and interests of Egypt. The commission was thus let free to choose its own ground, to decide how far and in what direction its investigations should be carried, and the form, which its proposals should take.

20. The information brought together and the programme of works outlined in the publication entitled "Nile Control", the general conclusions of which were endorsed by the Nile Projects Commission, cover the very wide field of possible development of irrigation by works extending from the Great Lakes in Central Africa to the Mediterranean, and deal with possibilities belonging to the remote future as well as with works more immediately feasible. The present commission has not attempted so wide a survey and, indeed, the time available precluded any such possibility. Nor has the commission felt called upon to attempt a general analysis and definition of the principles underlying the allocation of water supplies between two communities. It is content to set out the considerations, which have guided it towards its own conclusions.

21. Precedents in this matter of water allocation are rare and practice varied; and the commission is aware of no generally adopted code or standard practice upon which the settlement of a question of inter-communal water allocation might be based. Moreover, there are in the present case special factors, historical, political and technical, which might render inappropriate too strict an application of principles adopted elsewhere. The commission, having regard to the previous ... history of the question, the present position as regards development, and the circumstances attending its own appointment, decided to approach its task with the object of devising a practical working arrangement which would respect the needs of established irrigation, while permitting such programme of extension as might be feasible under present conditions and those of the near future, without at the same time compromising in any way the possibilities of the more distant future.

22. The arrangement contemplated aims at interpreting in definite and technical terms the, intentions of the note quoted in the opening paragraph of this Report, wherein it was explained that in authorising extensions of irrigation in the Sudan "the British Government, however solicitous, for the prosperity of the Sudan, have no intention of trespassing upon the natural and historic rights, of Egypt in the waters of the Nile, which they recognise today no less than in the past." The commission has every hope that its proposals, framed in this spirit, and after full study of the technical aspects of the problem, may form an acceptable basis upon which, by harmonious and co-operative effort, the irrigation development of the future may be founded, and by which all existing rights may be perpetually safeguarded.

The Gezira Irrigation Scheme

23. As already explained, the chief field for irrigation development in the Sudan is the Gezira and therefore the conditions under which the irrigation of this tract is carried out must have an important bearing on the problem for which the commission has been called upon to propose a solution. It will be convenient therefore, before proceeding further with the discussion, to give more detailed account of this scheme.

24. The present scheme provides for the irrigation of an area of 300,000 feddans of cultivable land, of which one-third will be under cotton from July-August to not later than the 15th April, one-third under food crops from August-September to November in the case of durra and January in the case of lubia, and the remaining third fallow. From the 16th April to the 15th July there will be no crop on the ground, water being required for domestic purposes only. The really important crop is the cotton, both from the point of view of water consumption, and of the economic returns from the undertaking.

25. From the 16th to the 31st July the canal will be gradually raised from domestic supply level to irrigation supply level, the reservoir level being of necessity raised at the same time. From the 31st July onwards the canal will be drawing its supply in accordance with the agricultural needs, with a maximum discharge of 84 cubic metres a second. During the month of November the reservoir will be raised to full storage level, the discharge taken from

the river for this purpose being about 150 cubic metres a second for thirty days. During the first half of January the watering of lubia will cease, only the cotton remaining under irrigation. The calculations in "Nile Control", upon which the scheme was based, indicated that the requirements of the cotton crop on the above area could be taken from the river without detriment to Egypt, even under the conditions of the abnormally low year 1913-14, up till 18th January, after which date the requirements will have to be met from the stored water in the reservoir. The scheme was accordingly so planned that the reservoir should contain the volume estimated to be necessary, with due allowance for losses, to meet the cotton requirements of the defined area from the 19th January to the 15th April, and domestic requirements from the latter date till the 15th July.

26. Besides the above restrictions as to the season during which the Gezira Scheme should draw upon the natural flow of the river, and the volume of water to be withdrawn during that season, there was the undertaking already mentioned in paragraph 15, limiting the area of cultivation in the Gezira to 300,000 feddans. Thus, even if it were found possible to use less water than the calculations provided for, the water so economised would not be considered as available for an additional area.

Present Commission. General Considerations.

27. From an irrigation point of view, the year in Egypt has always been treated as into two seasons of about six months each. During one of these seasons the whole natural flow of Nile, supplemented by the stored water of Aswan Reservoir, is used for irrigation, the mouths the river being closed by earth banks as soon as conditions permit; whilst during the other water flows to the sea in volumes which for several months are very great.

28. The Sudan Gezira Scheme, which came into operation in July I925, has been planned so as to draw water from the natural flow of the rIver only during the latter season, and to draw up the water stored in the Sennar Reservoir during the low-river season. The commission regards this as a sound principle; and it is one, which has always been accepted by the Sudan authorities, who only claim at this season of the year the volumes necessary for the small area of navigation supplied by pumps under a long-standing arrangement sanctioned by the Egyptian Government. The commission accordingly determined that its first step should be the accurate division of year into the two seasons by a detailed examination of the conditions at the two critical points at the beginning and the end of the season of surplus where the change of conditions occurs.

29. When this division of the year had been carried out it would be possible to reserve absolutely to Egypt the natural flow of the river during the low season, subject to the pumping rights already mentioned. The available supplies during the rest of the year would be examined with a view to seeing how much might reasonably be used in the Sudan, taking into account the requirement corresponding development in Egypt. It would then remain to examine the minor questions of pump and basin irrigation in the Sudan, and to define the conditions on which these should be carried out.

30. The above are the general lines upon which the commission decided to develop its proposals. It is now necessary to explain certain principles and methods followed in the actual examination of the problem. The fundamental operation is the division of the year, and in particular the determination of the date at which the Sudan should cease to draw on the natural river at Sennar. The method adopted in "Nile Control" was to make this date correspond with the first withdrawal of stored water at Aswan, and the Sennar Reservoir was designed to supply the requirements of the canal after the I8th January, this date corresponding to the first withdrawal at Aswan in I9I3-14, an abnormally low year. The majority of the Nile Projects Commission had approved this method of determining the date, but had advocated that the date should be movable, and ordinarily later than the I8th January, in accordance with the condition of the river in each year, instead of being fixed absolutely with reference to the abnormal conditions of I9I3-14.

31. The present commission does not regard the time of first withdrawal of stored water at Aswan as a suitable criterion of the cessation of surplus flow in the river; since it might well be that the stored water is reserved for some time after there ceases to be any surplus in the river, in anticipation of more acute needs in the later months. The commission accordingly decided to discard this criterion, and to base its proposals on the actual cessation of surplus as indicated by the working of the canals, the regulation at the Delta Barrage, and the closing of the sadds across the mouths of the river.

32. The commission considered whether its proposals should be based on the abnormal conditions of 1913-14, or upon the mean of a series of years, or should provide something in the nature of a sliding scale under which the date in question would be advanced or put back in accordance with, the conditions obtaining in each year. The records of Nile floods cover a period of over 960 years, and years as low as 1913-14 has occurred only four times. The commission felt that while the, occasional occurrence of such years cannot be ignored, it should not be employed as a basis of any' scheme. The sliding scale would present complications in working, and it was soon clear that the yearly fluctuations were not so important as to preclude the use of a mean date. It was accordingly decided to work on means, and to test the results so obtained by considering them with reference to specially low years. In particular, the commission recognised that some special provision might be required to deal with a year like 1913-14.

33. The commission also had to consider whether its proposals for regulating the expansion of irrigation in the Sudan should be expressed in terms of areas to be irrigated as well as of volumes to be utilised during certain specified seasons. In the past, as explained in paragraph 26, a definite area limitation of 300,000 feddans had been fixed for the Gezira Scheme, in addition to the restrictions imposed naturally by the storage capacity of the reservoir, and the precise definition of the season during which, and the extent to which, water may be abstracted from the natural flow of the river.

34. It is in terms of volumes and seasons that the actual statistical examinations of the whole problem must be conducted, and the record of the working of the reservoir, and of the volumes drawn off daily by the canal, must be maintained. And it is the volumes and seasons which best lend themselves to the imposition of checks necessary to ensure a proper control over the working of whatever arrangement may be arrived at as the result of the commission's proposals.

35. An area limitation could not, in itself, constitute complete control over the volumes abstracted from the river, unless supplemented by a reservation as to the crops to be grown, and the system of crop rotation to be followed. It would involve also assumptions as to the volumes of f water necessary for each different crop, and these assumptions would have to include a considerable margin to allow for error. Such a margin, comprising allowances for doubts as to reservoir capacity, losses, and water requirements of crops, would, by preventing full use being made of very valuable storage water, react unfavourably on the Sudan's interests, without corresponding advantage to Egypt. Consequently, an area limitation, unless pitched too high, would have the effect of removing the incentive to economy in the use of water, and it would clearly be to the advantage of neither party that water taken from the river should be used uneconomically.

36. In view of the above considerations, the commission decided that its proposals should be stated in terms of volumes and seasons only. It was satisfied that the authorities concerned would have no difficulty in devising arrangements for ensuring complete control over the abstraction of water from the river and from the reservoir. Provided that such satisfactory arrangements are made, the commission saw no necessity, from a technical point of view, of imposing an area limitation over and above the volumetric one. A definition of seasons and volumes to be extracted would, in accordance with irrigation practice, be satisfactory and adequate in itself; and if it were held necessary, as formerly, to impose an area limitation as well, it would be for reasons outside the purview of a technical commission.

37. There is another matter, which the commission had to consider in connexion with the method of handling the problem submitted to it. The greater part of Upper Egypt is under basin irrigation, largely dependent on natural flood levels in the river, and only partially protected by barrages. Any abstraction of water in flood time in the Sudan must affect these levels to the detriment of the basin irrigation, and therefore to admit that the lands in question have, absolute right to undiminished natural levels must preclude any abstraction of water by the Sudan.

38. The commission felt that in the circumstances it was impossible either, on the one hand to postpone indefinitely all progress in the Sudan, or, on the other, to damage seriously by precipitate action or by excessive abstraction, the basins of Upper Egypt. It was according decided to take the line that consideration, of levels could not be carried to the point of precluding development in the Sudan, but only to the point of setting a limit to the extent and rate of this development.

39. The commission was assisted in coming to this conclusion by the decision of the Egyptian Government, soon after the appointment of the former, to undertake the construction of another barrage in Upper Egypt. It has also now been decided to construct, for the benefit of Egypt, the Gebel Aulia Dam in the Sudan. With the undertaking of these two works the question of levels in Upper Egypt loses much of the importance, which might be attached to it if development by the Sudan only were in prospect.

40. A further question of a general nature, calling for decision as a preliminary to detailed examination of the problem, was whether the Gezira Canal and the Gebel Aulia Dam should be treated as being on the same footing, though the latter work had not yet made any effective progress. It was considered that, as both works had originally formed integral parts of the same programme, no special priority should be accorded to the completed Gezira Scheme in respect of the allocation for any further supplies found to be available but that both should be treated as having equal priority to any extensions. As a corollary to this view, it follows, and it was so assumed by the commission, that the Sudan should afford every facility for the construction of the Gebel Aulia Dam.

41. Finally, the commission considered whether it must regard the completed Gezira Scheme as having an irrevocable right to take water to the extent and under the conditions provided for in the "Nile Control". There was the possibility that the commission's examination of the statistics, including those of the years, which had elapsed since the scheme was initiated, might lead to conclusions other than those of "Nile Control". At the same time, the scheme had been undertaken and practically completed after full examination of the question, not only by the Egyptian authorities but also by the Nile Projects Commission; and the Sudan Government had entered into certain commitments on the basis of the original water allotment. The commission felt that in these circumstances, any reduction in the volumes available for this scheme would raise issues with which, as a technical body, it would not be concerned. The detailed investigation of the basis of the original scheme by methods adopted by the Commission has, however, shown, as will be seen later, that no serious divergence exists between the results of the present investigations and those previously arrived at.

CHAPTER III.

STATISTICAL

42. As a preliminary to the detailed examination of the statistics, it will be convenient to describe briefly the nature of the records available, and to explain certain factors affecting the calculation.

Hydrological Records

43. The annual maximum and minimum levels at Cairo are on record from 641 to 1451 AD and again from 1737, with one break, to the present day. These records cover a period exceeding 960 years, and are of value in determining the periodicity of abnormally low years. Daily gauge readings at Aswan and Cairo were begun in 1870, with occasional discharge observations. Since 1903 upstream and downstream levels and the position of the sluices at Aswan have been recorded daily, and by means of the calibration of these sluices, which has now been determined with a high degree of accuracy, the discharges in the earlier years have been calculated. Distribution at the Delta Barrage has been carried out since 1919 by the calibration method. In general the accuracy and system of record of the statistics are being continually improved, and they are now of a high order; and great reliance can, in particular, be placed on those of the last seven years.

Time Lag

44. The great distances and the small slope of the river make the time of travel an important factor in any calculations regarding the Nile. This time of travel has to be borne in mind continually, and where reference is made to the date of some event at Sennar, for example, it is necessary to reckon the corresponding date on which the effect will be felt at Aswan, or the Delta Barrage, before the significance of that effect can be properly appreciated. Reference, in short, must be both by time and place. The lag, moreover, is not constant, but varies with the river stage.

45. At the request of the commission the time lag between one point and another has been' calculated by the Physical Department. The calculations are contained in Appendix B, from which it will be seen that the total time of travel from Sennar to the Delta Barrage at the critical times is estimated to be :

In January-February	=	34 days
In July-August	=	27 days.

Where necessary for the purpose of investigating special conditions, *i.e.,* low years, the lag taken into account has been specially calculated from the appropriate data.

Losses

46. "Nile Control" (page 248) estimated that 124 volumes of water passing Khartoum are reduced by losses to 100 at Aswan. In gauging the effect on the river conditions in Egypt of

any abstraction at Sennar the commission does not feel that it is necessary or even possible to take, these losses into account for the purposes of the present proposals. It prefers to assume that the full effect of any abstraction at Sennar will be felt in Egypt without any reduction. At some future time this factor may become more precisely known, and also more important, and it can then be taken into account if necessary.

Division of the Year

47. As already explained, the basic idea underlying the commission's proposals is the division of the year into two seasons, during one of which the Gezira Canal would take water from the natural river, whilst during the other its supply would be drawn from storage, leaving the natural river reserved to Egypt. In this respect the commission is merely following the principles of " Nile Control", and of the Nile Projects Commission, but adopting other methods of studying the problem and of demonstrating the results. The examination of the conditions at the critical points where the supply of the rising river overtakes requirements and where, on the falling river, the reverse takes place, formed the most important part of the commission's studies. The present Chapter is chiefly devoted to this examination, the presentation of its results, and the conclusions arrived at.

Rising River, July-August

48. The conditions of the rising flood at the Delta Barrage are illustrated in Diagram No. I contained in Appendix C, which is based on the discharge passing down the river below the Delta Barrage. The river curves are those of the mean of 1912-25, the abnormally low year 1913, and of the year 1915, in which the conditions were, except for 1913, the worst of the series of fourteen years. The discharge used for irrigation below the barrage at this time of the year is taken into account and the effect of the Sennar Dam, operated as provided in the table [1] on page 87 of "Nile Control", is shown with due allowance for the time lag, which, as already explained, varies with the stage of the flood.

49. It is seen from the diagram that in average years by the time the effect of withdrawals of water at the Sennar Dam is felt at the Delta Barrage, the supply passing down the river branches amounts to nearly *150* million cubic metres daily, and that the effect is negligible under those conditions. In 1915 the effect would have been appreciable but not injurious. Under 1913 conditions, the effect would have been to take water from the river about ten days in advance of the establishment of the real rise of the flood. The conclusion to be drawn from this diagram is that, provided the rise of the river is not later than in 1915, the arrangement in " Nile Control" is quite suitable whereby the Gezira Canal would begin on the 16th Ju1y to draw on the river at Sennar to the extent of the prescribed volumes. In years worse than 1915 some postponement of this date would be needed to avoid taking water actually required *for* irrigation in Egypt.

1 Reproduced as Appendix D.

50. It was explained in paragraph 41 that the commission would feel that, on general grounds, any proposal for reducing volumes already allotted to this scheme, and in respect of which commitments had already been entered into, would be outside its province. The question of postponing the opening of the canal for a few days in occasional years of a late rise of the river appears, however, to the commission in a somewhat different light. At this time of the year the water is chief required in Egypt for the durra crop, which should be sown as early as possible if the results are to be obtained. Similarly, in the Sudan Gezira, early sowing of the cotton is desired. It seems reasonable that in a year when the rise of the river is delayed, the Sudan should share with Egypt whatever disadvantages may attach to the late sowing of the crops.

51. The conditions of 1915 may be regarded as the worst conditions under which the "Nile Control" arrangement would be suitable; and those of 1913 as the worst likely to occur. A sliding-seal whereby the opening date would be postponed in proportion as the conditions fell short of those of 1915 would meet the requirements, which the commission has in view. Such a sliding-scale might be derived from the figures contained in Appendix E. It is seen that both in 1915 and in 1913, on the date when the Sudan could have begun to draw on the river, the combined discharge of, the Blue and White Niles amounted to 142 million cubic metres a day; and that the mean discharge for the preceding five days was 135 millions a day. Adopting a figure of *160* millions to allocated margin, it could be arranged that the Gezira Canal should not draw on the natural river until a mean total discharge of *160* millions a day for five days is reached at Sennar and Malakal, allowing for ten days' lag in the case of the latter.

52. The commission, whilst putting forward this proposal from considerations of equity, does not believe that in fact any appreciable harm wou1d be done to Egyptian interests if the Sennar works were operated according to the" Nile Control" scheme, regardless of the character of the season. Moreover, as stated in an earlier paragraph, it is not in favour of introducing complications such as might be involved in the use of a sliding-scale. But in this case the criterion as to the character of the season is so direct, and the procedure so simple, that no difficulties should arise on the rare occasions when the sliding scale would be called into play. The commission accordingly recommends the adoption of this arrangement if the authorities concerned think it worth while departing from the simplicity of a fixed date.

Flood Season

53. The rise of the river having, as already seen, become well established in the latter half of July, it has now to be seen what volumes, if any, could, consistently with the interests of Egypt and the principles followed by the commission, be taken in the Sudan, in addition to the volume allowed for the present Gezira Scheme, as detailed in "Nile Control". Diagrams Nos. 2 to 4 show the volumes escaped into the sea under average conditions and in the two lowest years, 1915 and 1913, and the effect which will be produced by the Gezira Canal and the filling of the Sennar and Gabel Aulia Reservoirs. With regard to the latter reservoir, the commission understands that the details of a revised scheme have now been approved by the

Ministry of Public Works, but commission is not aware of the exact particulars. The filling as shown on the diagram is an assumption made by the commission with the object, chiefly, of showing the proportion, which the capacity of this reservoir bears to the volumes available at this season. The water of the White Nile being free of silt, the filling of this reservoir, unlike that of Aswan or Sennar, can be carried out at any time.

54. Although there is seen to be a large volume of unused water at this season, the commission felt that any additional water allotted to the Sudan should, for two reasons, be on a moderate scale. In the first place, the losses in the new reservoirs at Sennar and Gebel Aulia are at present a doubtful factor, and will only become known accurately when the works have been in opera1 for a year of two. In the second place, there is the question of levels as affecting the basins in VI Egypt, to which the Commission has given careful consideration. Appendix F has been prepared to show the effect at Aswan of the withdrawal of volumes of 100, 150 and 200 cubic metres a second during the low floods of 1911, 1913, 1915 and 1918. No calculations have been made as to effect of the filling of the Gebel Aulia Reservoir in its revised form, but it is clear that this reservoir must have a much greater influence on the levels in Egypt than the abstractions at Sennar contemplated.

55. An important consideration bearing on this question is that, judging by the results of the pumping schemes, the irrigation requirements of the Gezira Canal will not be at their maximum in August and September, the season when the flood is at its maximum. The cotton crop is sown in the Sudan in the latter part of July and the early part of August, and, owing to rainfall at this season, the second watering is not required till the latter part of September, the food crop meanwhile being sown after the cotton. Consequently, whatever maximum discharge may be fixed for the Gezira Canal in flood time, it will, in fact, be taking a reduced discharge at the time of the basin filling in Egypt.

56. It has always been recognised that a lowering of levels in Upper Egypt, with consequent increased difficulty of filling the basins, must result from the working of the Gebel Aulia and Gezira schemes. The basins in the Sudan will be similarly affected. The present commission is not disposed to enter into an argument on general principles as to how far the maintenance of levels can be regarded as an established right.

Approaching the matter as a body of engineers invited to advise on a practical question, the commission considers that development or conservation works in the upper part of the river should not be indefinitely restricted by considerations of the natural levels lower down, but that the Sudan should accept a limited rate of progress, so as to afford Egypt the opportunity to overtake the effect of development in the Sudan by construction of the works, which formed her part of the original.

57. Subject to the above proviso, the commission finds that from the first August, the additional volumes shown in the following table could be taken as Sennar in flood time. The first August at Sennar corresponds to about the 25th August at the Delta Barrage, a date by which the flood is well established in its rise, and the Delta Canals have attained their full

supply levels. It further recommends that the additional volume should be taken progressively on a scale not exceeding that in the following table:

Year	Maximum Discharges in Cubic Metres per second		
	Already sanctioned For initial scheme	Proposed Addition	Total
1925-26	84	-	84
1926-27	84	-	84
1927-28	84	-	84
1928-29	84	-	84
1929-30	84	12	96
1930-31	84	24	108
1931-32	84	36	120
1932-33	84	48	132
1933-34	84	60	144
1934-35	84	72	156
1935-36	84	84	168

NOTE: The maximum discharge is 84 cubic metres a second in August, September, October and November; and 80 cubic metres a second in December.

58. The commission finds that in a year like 1913 the final filling of the Sennar Reservoir might have to be modified from the" Nile Control" programme if the additional discharge now proposed is taken by the canal. In all such years the programme of filling Aswan is carefully considered and adopted to the conditions prevailing. The commission foresees no difficulty in application of the same methods to the relatively small volume required for the Sennar Reservoir, and does not think it necessary to make any specific proposals in a matter which is best left for the authorities concerned to deal with if and when the need arises.

Falling River. January-February

59. The commission devoted much time to considering whether the 18th January could be taken as correctly marking the cessation of surplus in the river. Appendix G, with its accompanying statement of dates, gives an attempt to arrive at the correct date, employing as criteria the demands of the canals, the gradual shrinkage of the volumes passing the Delta Barrage and the closing of the sadds, or earth banks, at the river mouths.

60. The earlier years may be discarded as unreliable or inapplicable to present conditions. The year 1917-18 was entirely abnormal, as the river remained in flood all through the summer. Taking the remaining years in two groups, there ceased to be any excess water on the following mean dates:

	Delta Barrage	**Corresponding Date at Sennar**
1910-17	February 21	January 18
1919-25	February 11	January 8

Thus the earlier group of years representing the conditions obtaining when the Gezira Scheme II was being planned gives, by the method now employed, the same date at Sennar as was actually adopted by the framers of the scheme, namely, the 18th January. On the other hand, according to the data of the more recent years, the date would be the 8th January.

61. By way of further study of this question, the commission invited Dr. Hurst, Director General of the Physical Department, and Mr. Butcher, Director of the Delta Barrage, to investigate separately, and by whatever method seemed to them most appropriate, the conditions at this season of the year. They were asked firstly to test the correctness of the" Nile Control" date of the 18th January, and, secondly, assuming that the Gebel Aulia Dam had come into operation, to ascertain up to what date the surplus still remaining would permit of the Gezira Scheme being allowed the additional volume found by the commission to be available during the flood season. The object in making the assumption that the Gebel Aulia Dam was actually in operation was to give effect to the view expressed in paragraph 40, i.*e.,* to ensure that there should be sufficient water for the Gebel Aulia Dam and the resulting development of irrigation in Egypt before any further allotment of water were made for the Gezira.

62. Dr. Hurst based his study on the figures of 1920, which, for the month of February, was the lowest of the six years 1919-20 to 1924-25. The method adopted and the results arrived at are set out in Appendix H and its accompanying Diagram No.5. The conclusion arrived at is that under existing conditions, i.*e.,* ignoring the Gebel Aulia Reservoir, the Gezira Canal could be given the "Nile Control" volumes up to the 23rd February, Delta Barrage date, corresponding to the 20th January at Sennar. Taking Gebel Aulia into account without the losses in the reservoir, the date would be the 12th January at Sennar, while, allowing for these losses, the date would be the 8th January. As regards the additional water for the Gezira, it was found that, ignoring the losses, the proposed additional supply could be taken up to the 1st January at Sennar, and, with losses taken into account, up to the 28th December.

63. Mr. Butcher employed a different method, explained in the note in Appendix J, based on the average of the six years 1918-19 to 1923-24, for which period the records, as already mentioned, are exceptionally detailed and reliable. It is important to know how these six years compare with the mean of a longer cycle; and Appendix J shows that the mean supply in December and January of these years represents 91 per cent of the corresponding mean of the last 20 years, and that all six years are below the average of the twenty years. The commission regards these years as affording a suitable basis of calculation.

64. Nothing was known to the commission of the manner in which the additional storage water of the Gebel Aulia Reservoir would eventually be employed. Mr. Butcher, finding that the storage amounted to an addition of about 22 per cent to Egypt's supplies during the summer season, assumed that a corresponding expansion would take place in the demands for water at other seasons of the year. It is doubtful if such a result would actually

occur, but the effect of this assumption on the calculations is certainly favourable to Egypt. Assuming the Sennar and Gebel Aulia Reservoirs to be both in operation, there would, according to the Diagram No.6 employed in this calculation, be sufficient water to meet all requirements in full up to the 10th February corresponding to the 7th January at Sennar, after which there would still remain available a volume of 140 millions now running into the sea."

65. The diagram shows the effect of the further abstraction of 80 cubic metres a second after providing for the Gezira Canal on the" Nile Control" basis, and the expansion of cultivation in Egypt following the construction of the Gebel Aulia Reservoir. It will be seen that the addition volume can be abstracted up to the 5th February at the Delta Barrage, corresponding to the 2nd January at Sennar, without taking water now in use of for existing cultivation, and leaving discharge of 75 million cubic metres a day for navigation requirements during the annual closure of the canals in Egypt.

66. As another means of exhibiting graphically the conditions at this season of the year, and their relation in time to conditions at Sennar, Diagram No.7 was prepared. This shows the daily discharges of the two branches in January and February in the four lowest years, 1913, 1916, 1920 and 1922. The volumes being stored at Aswan at the same time are also plotted on the diagram, which therefore gives a fairly complete representation of conditions at this season. The Sennar dates, the 31st December and the 18th January, are also shown on the diagram, the appropriate lag being employed.

67. It will be seen that the calculations referred to in paragraph 60, so far as the earlier years are concerned, and Dr. Hurst's first calculation, both tend to confirm the arrangement by which the Gezira Canal was planned to draw on the river up till the 8th January. These calculations ignore the effect of the Gebel Aulia Reservoir, whilst the view expressed in paragraph 40, that no special priority should be given to the Gezira Scheme, would require that account be taken of both schemes. Taking both into account, the date given by Dr. Hurst's calculations is the 8th January. Although the commission takes the view stated as to priority, it is not prepared to argue that such a view should be applied retrospectively, and that the basis of a completed scheme should necessarily be changed as the result of the adoption of a new principle, new data and new methods of calculation.

68. Turning now to Mr. Butcher's calculations, attention must be drawn to the importance of the factor introduced by the closing of the sadds on the river branches at this time of the year. This operation requires the use of considerable volumes of water in order to maintain a sufficient flow through the gap in the uncompleted sadd to prevent the entry of seawater into the river. The closing is carried out under present conditions in February in most years but with the coming into operation of the Gezira Scheme and Gebel Aulia Reservoir, the resulting increased draw on the river will be such that, unless the sadds are closed earlier than at present, the water necessary to exclude the salt must be taken from storage.

69. With an earlier closing of the mouths of the river the water used under present conditions for excluding sea water will become part of the irrigation supply at this season. It is, in fact, included in the volume of 140 millions referred to in paragraph 64 as available after the date when a shortage would first be felt, namely, the 7th January, at Sennar. Now, according to the scale provided in "Nile Control" the Gezira Scheme would draw from the river a volume of 69 millions, or almost exactly one-half of the available 140 millions. Thus, with the change in the time of closing the sadds, which, according to Mr. Butcher's forecast, must take place with expansion of irrigation, the first instalment of the Gezira Scheme, though drawing its supply from the river till the 18th January would not be taking water at present used for irrigation in Egypt. In this calculation the commission sees confirmation for the view that, as far as the present Gezira Scheme is concerned, no change need be proposed in the original date the 18th January.

70. As regards the date up to which the additional supply could be taken, the results of the two investigations agree fairly well, being in the one case the 28th December and in the other 2nd January (Sennar dates). The commission recommends that the additional water be taken till the 31st December. It is important to explain at this point that for purposes of silt clearance and other works, the canals in Egypt are closed every year towards the end of December and reopened in the early part of February, the actual dates of reopening of the different canal systems depending on the completion of the closure works. This closure is an annual necessity and it must always take place at this season, as climatic conditions render it impossible at any other. It, therefore, forms an important feature of the irrigation year in Egypt. It is the reopening of the canals after this closure, which accounts for the rapid disappearance of surplus water in Egypt in February and the fact the shortage occurs at a fairly constant date every year. The effect of the commission's recommendation in this paragraph is therefore that the Gezira Canal should not take any additional water from the river after the time corresponding to the reopening of the canals in Egypt.

71. The arrangement by which the Gezira Canal would draw the volumes provided in "Nile Control" from the natural river to the I8th January, but would take no extra water after the 31st December, may perhaps be made clearer if the extent to which the Sudan may draw upon the river in January is expressed in terms of total volumes without the use of the date the 18th January. The volume provided in "Nile Control" is 117 million cubic metres up to the 18th January, and the commission's proposal is that no more than this should be taken in January. As explained in paragraph 49, the Sudan will not again draw on the natural river till the 16th July. Thus from the 1st January to the 15th July the Sudan will only take from the natural river, exclusive of the comparatively small volumes for pumps, a volume of 117 million cubic metres. At this period of the year Egypt will have practically all the remainder of the natural flow amounting, from the figures in Appendix K, to about 13,000 million cubic metres, as well as the volumes stored at Aswan and Gebel Aulia. Viewed in this light, the question of the precise date in January up to which the Sudan should draw the" Nile Control" volumes of 4.5 million cubic metres a day from the river is seen to be a matter of relatively minor importance from the point of view of the water supply of Egypt. On the

other hand, it would be of real importance to the Sudan, whose resources during the low-river season would amount to no more than the contents of the Sennar Reservoir, i.*e.,* something of the order of 500 million cubic metres, with rights in the natural river limited to the above volume of 117 millions and the small volume for the pumps.

72. The commission carefully considered whether it should propose any special provisions for dealing with abnormally low years, such as 1913-14. It was aware that in such a year, with the Gezira Scheme drawing on the natural river up to the 18th January, Sudan would on the method of calculation employed in this Report, be drawing to some extent on water not actually surplus to Egyptian requirements. In order to deal specially with such years it would be necessary to adopt some criterion or index by which abnormal conditions would be defined, a sliding-scale to regulate the amount of water to be taken by the Sudan in these years, and a method of forecasting these conditions some time in advance of their actual occurrence.

73. Various arrangements were thought of and discussed with the Physical Department. Finally, the commission decided that, in view of the relative insignificance of the volumes involved, the rarity of abnormally low years, and the fact that the Egyptian Government has now definitely embarked on a policy of developing the latent resources of the river, it would be of doubtful utility to propose special arrangements which would involve elaborate forecasting, would open the door to misunderstanding and friction, and which might never be needed. On the facts themselves and on the general grounds set out in paragraph 41, the commission would not propose any change in the original plan by which the volumes originally provided for the Gezira Canal in "Nile Control" may be taken from the natural river up to the 18th January.

74. As regards the additional water, however, the considerations in paragraph 41 do not apply and the commission felt that its proposals must take into account the occurrence of low years, even if this involved the inconvenience of a sliding scale. Owing to the winter closure of canals In Egypt, there is an important difference between the use of water at Sennar in the first eighteen days of January and its use in December. For whereas water taken in January might affect irrigation supply in Egypt, that taken in December would only be felt in Egypt during the time of closure of the canals, during which period the river is in flow to the sea, and navigation is the only interest involved. Thus, in considering a sliding scale for regulating the date at which the additional water should cease to be drawn from the river, the test to be applied is the effect of the proposed abstraction of water upon navigation facilities in Egypt.

75. There is no absolute figure of discharge, which can be adopted as the minimum required for navigation at any time. In "Nile Control" a figure of 1,500 to 2,000 millions downstream Aswan is mentioned as being required in January for navigation; and, in the minority recommendation of the Nile Projects Commission, the figure of 1,500 millions was proposed. As mentioned in paragraph 65, the arrangement proposed in this Report

would provide a discharge of 75 millions a day, or 2,300 during the month, under conditions somewhat below average. It would not be possible to fix such a discharge as an absolute minimum even for the worst years, since in January 1914 the discharge is seen (Diagram No.7) to have fallen to 40 millions a day, and even less; at the Delta Barrage.

76. An arrangement arrived at by another line of argument was considered by the commission. The natural river is seen from Diagram No.6 to be falling at a mean daily rate of about 1 million cubic metres a day at the end of January at the Barrage, corresponding to the end of December at Sennar. The total volume now proposed to be abstracted at Sennar in December is approximately 14 millions a day. Thus, whatever conditions would have occurred in Egypt in previous years would, under the new conditions, occur about fourteen days earlier. A possible arrangement would be to have a sliding-scale by which, according to the character of the season, the date for ceasing to take the extra water would be advanced until, under 1913-14 conditions, it would be the 18th December instead of the 31st December as in ordinary years.

77. As an index of the character of the year, the total natural river as at Aswan in the month of December may be employed. To determine the conditions to which the 31st December would be applicable, there is the calculation referred to in paragraph 62, indicating that in 1919-20, the date should have been the 28th December, and the calculation referred to in paragraph 65, indicating the 2nd January. Now, in 1919-20, the total December flow is seen (Appendix J) to have amounted to 4,410 millions, whilst in the six years employed for the second calculation it averaged 4,860 millions. From this it appears that a total of about 4,700 millions would be a suitable zero basis for the sliding scale. At the other end of the scale is the 1913-14 figure of 2,800 millions. On this basis the sliding-scale would take the following simple form: The date up to which the Sudan will take the additional volume of 80 cubic metres a second will be the 31st December in all years in which the total natural river at Aswan in December is not less than 4,700 million cubic metres; and it will be earlier in low years at the rate of three days for every 400 millions by which the actual total December natural river in any year falls short of 4,700 millions.

78. This scale may have the appearance of being somewhat of an approximation, but it is devised from the data available upon the only basis, which is applicable at this season of the year, namely, navigation needs, which do not lend themselves to accurate definition. It is in according with recorded facts, and it serves the purpose, which the commission has in mind, adjusting Sudan's supply in accordance with the vicissitudes of the season, from which neither party can reasonably enjoy immunity. In practice the Sudan would be obliged to go on drawing from the river until the end of December, and to make good the overdraft later on when the criterion of the year had been determined.

79. There are two outstanding objections to a sliding scale on the lines proposed. In the first place, any such arrangement opens the door to possible differences of opinion as to the figures upon which it depends; and it may well be that a fixed date, with its immunity

from the possibility of dispute, is preferable to an arrangement theoretically desirable, but liable in practice to lead to friction between the authorities who will have to work it. In the second place, and accentuating the above objection, the suggested scale depends upon the natural river at Aswan, and, with more reservoirs in operation above this point, the computation of the natural river at Aswan II become a difficult matter, involving a number of doubtful factors. It is, however, the best that commission can devise which will serve the purpose in view, namely, to ensure that the working of the Gezira Canal is, so far as extensions are concerned, adjusted to suit the conditions of low years.

CHAPTER IV.

PUMP AND BASIN IRRIGATION IN THE SUDAN

80. As pointed out in an earlier paragraph, the areas in the Sudan under pump and basin irrigation are on a small scale, and therefore relatively unimportant as factors in the situation. Nevertheless, important considerations are involved, and the Commission has devoted considerable thought in particular to the question of pump irrigation.

Pump Irrigation

81. Prior to 1904 pumps had been licensed in the Sudan, with the approval of the Egyptian authorities, to the extent of about 2,000 feddans of perennial irrigation. On the completion of the, Aswan dam in that year an increase of 10,000 feddans was approved, to which was added, on raising of the dam in 1912, a further 10,000 feddans. The approved area of perennial pump irrigation is therefore about 22,000 feddans. There is some doubt as to the total area authorised to receive perennial pumping, some of the records tending to show that the 10,000 feddans approved on the completion of the Aswan Dam included the area previously licensed, whilst others tend to show that the 10,000 feddans was for new licences. The difference is not of great importance, but the commission is of the opinion that the matter should be cleared up by the authorities concerned so as to avoid future misunderstanding.

82. The British delegate suggested that the two Governments concerned might be prepared to agree that, following the above analogy, the area *of* perennial Pumping in the Sudan should be increased by 20,000 feddans on the completion of the Gebel Aulia dam. This is not, however, a technical point, and it goes somewhat beyond the scope of this Report, as defined in earlier paragraphs; for it raises the question, whether the Sudan should be held entitled, by virtue merely of its geographical position, to draw on the river at a time when there is no surplus.

83. It should be noted that perennial pumping must involve taking water during the low stage of the river, and although in practice the actual area under irrigation in the summer has so far always been much less than the sanctioned area, the above suggestion would permit the Sudan to draw on water, which is at present beneficially used by Egypt. However, in view of the relative unimportance of the volumes that would actually be drawn from the river during its low stage by a limited expansion of perennial pumping, the commission feels that the Governments should have no difficulty in settling this question without the intervention of a technical body, and it accordingly refrains from making a definite recommendation.

84. In addition to the above perennial irrigation, the Sudan was authorised in 1905, under an order of the Egyptian Ministry of Public Works, to pump without restriction of area from the 15th July to the end of February (Sudan dates). This authority has, so far, been utilised to the extent of about 16,000 feddans. The investigations of present conditions, as

set out in this Report, "indicate that the flood season, to which this permit was intended to apply, cannot be said to extend beyond the end of December (Sennar); and, therefore, in accordance with the principles adopted by the commission, flood pumping, should, in the case of any new areas, cease at this date. Agricultural conditions, however, are such that pumping under these conditions would have little value. Consequently, it becomes necessary to consider how non-perennial pumping in the Sudan can be regulated in the future consistently with the principles of this Report, and under present conditions of supply in the river.

85. A solution, which suggests itself is that, the water consumed after the end of December, on any new areas of non-perennial pumping should be compensated for by the release of storage water from the Sennar Reservoir. A change in the method of working the reservoir would make available an additional volume, not taken into account in the calculations for the Gezira Irrigation Scheme, which could be utilised for this purpose. The original plan for working the Gezira Canal, as explained in an earlier part of this report, was that from the 15th April till the 15th July the canal should remain in flow with a discharge drawn from the reservoir estimated as being necessary for domestic purposes throughout the irrigated tract. Under this arrangement the reservoir would naturally have to be kept up to the level required to give this supply. Owing to the relative levels of the canal and the natural river, a volume estimated at about 150 million cubic metres would, under these conditions, remain permanently impounded in the reservoir. If the domestic water, supply were raised by pumps, it would be possible to release this volume, and thus return to the river any volumes required to compensate for the water abstracted by pumps after the close of the flood season, i.*e.* end of December (Sennar).

86. This volume must be again taken from the river in July before the canal can be brought into operation for the following season; and Diagram No.1 shows that, in a year of average or high flood, no serious effect would be produced on conditions in Egypt at the corresponding dates. In a year of very late flood the programme of filling of Sennar Dam can be retarded, in accordance with the arrangement proposed in paragraph 51, so as to reduce to a negligible quantity the effect of the above extraction. This should not present any difficulty to the authorities concerned, and the commission feels that the occasional occurrence of, very exceptional conditions should not be regarded as precluding the adoption of measures suitable under ordinary conditions, and not impracticable even under bad conditions. The commission is of the opinion, therefore, that permits for flood pump working to the end of February can, therefore, continue to expand gradually as in the past, so long as any water pumped after the end of December can be compensated for in the manner explained above.

Basin Irrigation in the Sudan

87. There are areas of basin land in the Sudan totalling about 80,000 feddans, of which, however, only a small part is annually flooded. These basins are, it is understood, not capable of much improvement, and are of no great agricultural value. The land is high and the conditions seem to be such that they cannot be filled from canals taking off at a distance

upstream, as is the case in Egypt. They will suffer to some extent from the abstraction of water at Sennar and Gebel Aulia, but the arguments employed in connexion with the basins of Upper Egypt apply here also. The commission does *not* regard this question of basin irrigation in the Sudan as an important factor in the problem before it, and sees *no* need *to* make any special recommendations in this, connection.

CHAPTER V

SUMMARY AND CONCLUSION

Summary

88. The commission's main findings may be summarised as follows:

(a) The natural flow of the river should be reserved *for* the benefit *of* Egypt from the 9th January, to the 5th July (at Senn) subject to the pumping in the Sudan as defined below.

(*b)* The Gezira Canal may begin *to* draw on the natural flow of the river on the 16th July, the canal being gradually raised to full supply level by the 31st July, according to the scale fixed in "Nile Control", contained in Appendix D, provided that a mean total discharge of 160 million cubic metres a day must have been reached at Sennar and Malakal during the preceding five days, allowing for ten days lag in the case of the latter.

(c) From the 1st August *to* the 31st December the Gezira Canal may, subject to the progressive scale laid down in paragraph 57 of "this Report, draw the following volume, effective *from* the river:

The 1st August *to* 30th November, 168 cubic metres a second.

The 1st *to* 31st December, 160 cubic metres a second, provided that, in any year in which the total flow of the natural river in December as at Aswan is less than 4,700 million cubic metres, *80* cubic metres a second shall be taken from the nature river during the whole of December, and the balance shall be taken from the natural river up *to* a date preceding the end of the month *by* three days for every *400* million cubic metres by which the actual total December natural river in that year falls short of 4,700 million cubic metres.

(d) The Gezira Canal

may not draw during the month of January more than the volumes provided in "Nile Control", i.*e., 80* cubic metres a second *from* the 1st to 15th, and 52 cubic metres a second from the 16th *to* 18th, a total of 117 million cubic metres.

(*e)* The final filling of the Sennar Reservoir from the level required *to* give full supply in the canal *to* the full storage level of the reservoir should be carried out in November, as provided in " Nile Control".

(f) Any further flood pumping carried out in the 'Sudan up to the end of February should be considered as drawing its supply from the Sennar Reservoir after the 31St December. In other words, a volume equal to that consumed on these areas after the 31st December, according to ascertained data, should be discharged from the reserve as compensation to Egypt, and the Sennar Reservoir should be worked so as to provide additional storage required *to* cover the compensation volumes as above.

(g) After the end *of* February only perennial pumping, as referred *to* in paragraph 8 should be carried out in the Sudan.

Conclusion

89. The commission foresees that it will be necessary from time to time to review the questions discussed in this Report. It regards it as essential that all established irrigation should be respected in any future review of the question. In particular, the Sudan should only take from the natural river in January, exclusive of pumping rights as now existing, the" Nile Control" volume of 117 million cubic metres. All other requirements till July should be provided by the Sudan from storage or other conservation works.

90. The commission has been impressed by the fact that future development in Egypt may require the construction of works in the Sudan and neighbouring territories, such as Uganda, Kenya and Tanganyika, and it feels that Egypt should be able to count on receiving all assistance from, the administrative authorities in the Sudan in respect of schemes undertaken in the Sudan, as well as from the British Government in any questions concerning the neighbouring territories.

91. The commission has endeavoured to find a practical and workable basis for irrigation and to foresee, and, as far as possible, to provide for any difficulty that may arise in the future. But it is aware that doubtful points may well arise in the interpretation of any document, and that differences of opinion as to fact cannot fail to occur from time to time in such matters as the volumes of water flowing in a river or canal, discharged through sluices, or lost by evaporation or seepage. It does not feel called upon to make proposals with regard to special arrangements for dealing with such doubts and differences, which seem to be outside the sphere of a technical commission. It does, however, desire to record emphatically the view that neither the elaborate drafting of an agreement nor the provision of special machinery for adjudication should be allowed to obscure the importance of mutual confidence and co-operation in all matters concerning the river and its waters.

92. Finally, the commission desires to draw attention to the very great importance of continued study of the river and systematic record of the statistics. A very good hydrological organisation has 'been built up, and its continued efficiency is absolutely essential, not only to fresh development work, but also to the correct working of the arrangements proposed in this Report, or, indeed, of any other arrangements that could be devised.

Abdul Hamid SOLIMAN,
Egyptian Delegate.

R. M. MACGREGOR,
British Delegate.

CAIRO, *March* 21, 1926.

APPENDIX A.

NOTES EXCHANGED.

[1] TRADUCTION. - TRANSLATION.

ZIWER PASHA TO LORD ALLENBY.

CAIRO, *January* 26, 1925.

YOUR EXCELLENCY,

In the note that your Excellency, on behalf of His Britannic Majesty's Government, addressed to my predecessor on the 22nd November, 1924, you asked that the area of land to be irrigated in the Sudan Gezira should be increased from 300,000 feddans to an unlimited extent.

To this note my predecessor replied in a note of the 23rd November, in which he declared that the question of immediately modifying the limit fixed for the area to be irrigated in the Gezira was, to say the least, premature and should, in accordance with the repeated declarations of His Britannic Majesty's Government, be settled by mutual agreement, taking into consideration the vital interests of Egyptian agriculture.

In view of this reply your Excellency then informed the Egyptian Government, in a note of the same date, that instructions had been given to the Sudan Government to the effect that it was free in future to irrigate an unlimited extent of lanel in the Gezira.

Now that friendly relations have happily been re-established between our two countries, it is my duty to draw your Excellency's attention to the fact that the measure announced in your note of the 23rd November has raised the most serious apprehensions in this country. Further, your Excellency is aware that in all the discussions which have taken place in the past between the two Governments with a view to reaching an agreement as to the control of the waters of the Nile, and in particular on the subject of the development of irrigation in the Sudan, the Egyptian Government has always firmly asserted its rights in the waters of the Nile.

The Egyptian Government has always maintained that this development should in no case be of such a nature as to be harmful to the irrigation of Egypt or to prejudice future projects, so necessary to meet the needs of the rapidly increasing agricultural population of this country. I do not think I am wrong in asserting that this principle, vital to Egypt, has been fully admitted by His Britannic Majesty's Government.

I have, therefore, to request your Excellency to be so good as to reconsider the question of the irrigation of the Gezira and to withdraw the instructions referred to in the above-mentioned note of the' 23rd November, 1924, since such a measure could only serve to strengthen the good relations between our two countries.

I avail, etc....

A. ZIWER,
President at the Council at Ministers,
Minister tor Foreign Affairs.

1 Communicated by His Britannic Majesty's Foreign Office.

LORD ALLENBY TO ZIWER PASHA.

CAIRO, *January* 26, 1925.

SIR,

1. I have the honour to acknowledge the receipt of the note, which your Excellency was good enough to address to me today asking me to reconsider the question of the irrigation of the Gezira and to revoke the instructions mentioned in the note, which I addressed to your Excellency's predecessor on the 23rd November 1924.

2. His Majesty's Government appreciate the sincerity of the friendly feelings expressed by your Excellency and fully share your desire to restore and strengthen the good relations between our two countries which have been so unhappily disturbed.

3. I am therefore glad to be able to inform your Excellency that I am now in a position to impart to you the views of my Government on this subject.

4. I need not remind your Excellency that for forty years the British Government watched over the development of the agricultural well-being of Egypt, and I would assure your Excellency at once that the British Government, however solicitous for the prosperity of the Sudan, have no intention of trespassing upon the natural and historic rights of Egypt in the waters of the Nile, which they recognise to-day no less than in the past, and in giving the instructions in question to the Sudan Government His Majesty's Government intended that they should be interpreted in this sense.

5. Moved by these considerations and in proof of their intentions, His Majesty's Government are disposed to direct the Government of the Sudan not to give effect to the previous instructions in regard to the unlimited development of the Sudan Gezira mentioned in the note of the 23rd November, on the understanding that an expert committee composed of Mr. J. J. Canter Cremers, chairman, who has been chosen by agreement between the two Governments, Mr. R. M. MacGregor, British Delegate, and Abdul Hamid Soliman Pasha, Egyptian Delegate, who has been selected by the Egyptian Government, shall meet not later than the 15th February, 1925, for the purpose of examining and proposing the basis on which irrigation can be carried out with full consideration of the interests of Egypt and without detriment to her natural and historic rights.

6. It is understood that the Committee will present its report by the 30th June, 1925.
I avail, etc.

ALLENBY, F. M.,
High Commissioner.

APPENDIX B.

TIME TAKEN FOR CHANGES OF RIVER LEVEL AT SENNAR TO REACH DELTA BARRAGE.

Method of Determination

Characteristic points on the gauge diagram at Makwar were traced to the gauge diagram of Khartoum gauge. The number of days for the points to reach Khartoum depends upon the level of the river. The number of days was therefore plotted against the gauge reading at Makwar and a mean curve drawn through the points.

The lag for a given date is obtained by reading from this curve the lag corresponding to the gauge on that date. This is the only practicable method, which can be employed.

APPENDIX C

TOTAL DISCHARGE ROSETTA AND DAMIETTA BRANCHES, JULY-AUGUST
(Millions of cubic metres per day)

Date at Barrage	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	Mean
July 20	10	0	0	1	0	20	62	2	23	1	0	23	24	16	13
25	12	0	0	6	0	50	57	9	35	1	1	24	40	24	18
August 1	21	0	0	9	92	93	75	34	125	13	30	44	93	28	47
5	23	0	0	12	265	110	125	87	140	16	47	74	120	43	76
10	125	0	38	27	410	170	150	190	220	40	135	250	200	84	146
15	330	17	270	61	490	370	195	340	340	190	280	350	340	149	266
20	390	22	460	165	550	460	240	390	360	360	450	440	370	284	346
25	450	40	480	195	550	400	300	365	500	375	440	525	420	335	384
31	430	115	515	200	595	395	345	355	510	385	435	515	530	327	404

The same method has been adopted for the reaches Tamaniat to Wadi HaIfa, Wadi HaIfa to Aswan and Aswan to EI-Leisi, and the lag in the different reaches added together to make the total lag.

One day was added for the Jag from El-Leisi to Delta Barrage and 0.7 day for the lag from Khartoum, to Tamaniat.

This method, using the curves obtained by Dr. Phillips, was checked by Dr. Hurst for the early part of January at Makwar. Dr. Hurst used similar methods, but traced the characteristic points over different stretches of the river.

The following are the results obtained:

Dr. Hurst, First Method.

Makwar, date (approximate) January 6-15, mean gauge (1919-24) 6.00, lag to soba 4.9
Soba date (approximate) January 11-20, mean gauge Khartoum 10.94, lag to Tamaniat 8
Tamaniat, date January 12-21, mean gauge 10.64, lag to Athbara 3.1
Atbara, date January 16-25, mean gauge 10.94, lag to Halfa 10.6
19.4

Dr Hurst, Second Method

Makwar, date January 6-15, mean gauge 6.00 lag to Khartoum 5.3
Khartoum, date January 11-20, mean gauge 10.94 lag to Halfa 14.9
20.2

Dr Phillips.

Makwar, date January 6-15, mean gauge 6.00, lag to Khartoum 5.7
Assumed, Soba to Tamaniat 1.0
Tamaniat, date January 13-22, gauge 10.61, lag to Halfa 14.7
21.4

HaIfa, date January 28-February 6, gauge 2.12, lag to Aswan 3.5

Collecting Results

Makwar to Khartoum
Dr. Hurst (1) 5.3
Dr. Hurst (2) 5.3
Dr. Phillips 5.7
Mean 5.4

Khartoum to Halfa

Dr. Hurst (1)	14.1
Dr. Hurst (2)	14.9
Dr. Phillips	15.7
Mr. Watt	15.5
Mean	15.0

Halfa to Aswan

Dr Phillips	3.5
Mr. Watt	3.5
Mean	3.5

Makwar to Aswan is therefore 23.9, say 24 days

Using the ordinary curves obtained by the Hydrological Service of the Physical Department, the lag from Aswan to Delta Barrage corresponding to the mean gauge (1919-24) at Aswan for February 1-10 is 10 days.

Mean lag from Makwar to Delta Barrage is therefore 34 days.

In the same way the mean lag from Makwar to Delta Barrage for the years 1912-25 was determined for the 15th July at Makwar and was found to be 27 days.

For specially low years the lag was worked out for each individual case.

(Signed) H.E HURST
Director General, Physical Service

TIME LAGS EMPLOYED IN DIAGRAM NO. 1

Year	Makwar Date	Lag in Days to Delta Barrage	Corresponding Delta Barrage Date
	July 15	33 days	August 17
1913	July 31	28 days	August 28
	August 31	22 days	September 22
	July 15	30 days	August 14
1915	July 31	22 days	August 22
	August 31	22 days	September 22
	July 15	27 days	August 11
Mean year 1912 to 1925	July 31	21 days	August 21
	August 31	19 days	September 19

(Signed) H.E HURST
Director-General, Physical Service

APPENDIX D.

TABLE SHOWING APPROXIMATE VOLUME EXTRACTED FROM THE RIVER TO RAISE LEVEL TO FULL CANAL SUPPLY LEVEL ON JULY 31, THE LEVEL IN THE CANAL BEING RAISED FROM SUMMER LEVEL TO FULL SUPPLY LEVEL IN THE SAME PERIOD.

(Figures reproduced from "Nile Control", p.87)

Day of July from River	Reservoir Level	Corresponding contents of reservoir	Volumes taken from River to raise US level		Level in Canal	Volume taken by canal	Total Volume taken
	R.I	Millions of cubic metres	Millions of Cubic Metres	Cubic Metres per second	R.I	Cubic Metres per second	Cubic Metres per second
15	414.50	68.5	–	–	414.50	10	10.0
16	414.60	73.8	5.3	61.4	414.60	11	72.0
17	414.70	79.1	5.3	61.4	414.70	14	75.0
18	414.80	84.4	5.3	61.4	414.79	16	77.0
19	414.90	89.7	5.3	61.4	414.89	18	79.0
20	415.00	95.0	5.3	61.4	414.99	20	81.0
21	415.20	107.0	12.0	139.0	415.18	25	164.0
22	415.40	119.0	12.0	139.0	415.38	31	170.0
23	415.60	131.4	12.4	144.0	415.58	37	181.0
24	415.80	144.2	12.8	148.0	416.77	43	191.0
25	416.00	157.0	12. 8	148.0	415.97	49	197.0
26	416.20	172.0	15.0	174.0	416.17	55	229.0
27	416.40	187.0	15.0	174.0	416.36	62	236.0
28	416.60	202.0	15.0	174.0	416.55	69	243.0
29	416.80	217.0	15.0	174.0	416.74	75	249.0
30	417.00	232.0	15.0	174.0	416.94	84	258.0
31	417.00	250.0	18.0	208.0	416.94	84	292.0

Canal Head Discharge, from table on p.108.

August 1st to November 30th ..... 84 Cubic metres per second
December 1st to January 15th ..... 80 Cubic metres per second
January 15th to 18th ..... 52 Cubic metres per second

APPENDIX E.

CRITERION FOR DETERMINING THE DATE AT WHICH WATER MAY FIRST BE ABSTRACTED FROM THE RIVER AT MAKWAR AT THE BEGINNING OF THE FLOOD

Makwar Date	Makwar Discharge Mills./Day	Malakal Date	Malakal Discharge mills./Day	Sum of Makwar and Malakal Discharges
1913				
June 21-30	5.9	June 11-20	57.0	62.9
July 1-10	32.1	21-30	56.5	88.6
11-20	60.9	July 1-10	67.6	128.5
21-31	92.1	11-20	72.7	164.8
August 1-10	153.0	21-31	77.1	230.1
1915				
June 21-30	64.4	June 11-20	61.3	125.7
July 1-10	56.0	21-30	69.6	125.6
11-20	101.0	July 1-10	74.2	175.2
21-31	179.0	11-20	78.5	257.5
August 1-10	325.0	21-31	83.3	408.3

Diagram No. 1 Shows that in 1915 there was just sufficient water for Sudan to begin taking water at Makwar on the 11th July. Sum of Makwar and Malakal at this date equals 142 mills/day.

Same diagram shows that in 1913 suffient supply for Sudan to begin to take water was not reached until the 20th July. Sum of Makwar and Malakal reached 142 mills/day on the 21st July as at Makwar.

In each case the discharge in the previous five days was approximately 135 mills/day.

(Signed) H. E. HURST
Director General, Physical Service.

APPENDIX G.

EXPLANATORY NOTE.

Date on which Shortage Occurred in Lower Egypt.

The dates on which the Rosetta and Damietta Branches were closed established a definite limit to the period of excess supply.

The dates are, however, not sufficient in themselves to fix the actual date on which shortage of supply was first felt, as water may be passing down the Nile branches for utility purposes and the canal discharges definitely limited to supply the Nile branches.

Damietta Branch. – Water in this branch is required for irrigation purposes throug? the Zifta main canals. A further supply is required during the construction of the Faraskour sadd In order to keep back the salt water.
Shortage is therefore considered to have been established if the discharge over Zifta Weir is less than 5 millions and no other water is available to increase this discharge.

Rosetta Branch. – Little or no water is required for irrigation, but a certain minimum discharge must be maintained during the last weeks of the construction of the Mehallet-el-Amir sadd in order to keep back the salt water.

This minimum discharge is considered to be :

5 millions for one week before the ideal date for closing the sadd.
10 millions for last week but one before the ideal date for closing the sadd.
15 millions for last week but two before the ideal date for closing the sadd.

Shortage is, therefore, considered to have been established if and when the available excess discharge falls below these figures.

The ideal date -for closing the sadd is considered to be the date on which the total supply is equal to the total demand for irrigation purposes only, plus 5 millions over Zifta Weir. This date corresponds with the date of closure of the Rosetta Branch unless excess water is still available in the Damietta' Branch.

The accompanying table shows the date necessary t.o establish the actual date of shortage on the above assumptions.

The records from 1919 onwards are complete and the date arrived at may be taken as correct.

The records before 1919 are less complete and the dates arrived at are therefore less reliable.

Furthermore, the system of feeding Zifta Circle down the Damietta Branch was not a routine procedure before 1919, and it is therefore less easy to determine whether water supplied to the Damietta Branch was for irrigation purposes or was actually in excess of the demand.

The question as to when shortage occurred has been considered for the years before 1919, in exactly the same way as for the period after 1919, that is to say, as if the present

system of feeding Zifta down the Damietta Branch had been established.

Except in certain individual years the dates finally arrived at are fairly definite and may be accepted, as such.

In any year such as 1923 there is a comparatively long period throughout which the excess, if any, was very small, and the exact date of shortage is difficult to establish.

(Signed) A. D. BUTCHER,
Director Delta Barrage.

DATE AT DELTA BARRAGE ON WHICH ALL WATER WAS REQUIRED FOR IRRIGATION OR CONSTRUCTION OF SADDS.

Year		Rosetta Branch				Damietta Branch				Zifta Weir	A	Remarks
		Closed	Last day of Discharge			Closed	Last day of Discharge					
			5 Mil.	10 Mil.	15 Mil.		5 Mil.	10 Mil.	15 Mil.	5 Mil.		
Records good	**1925…**	F.23	F.21	F.15	F.11	M. 17	M. 5	F. 20	F. 14	F. 15	F. 11[1]	[1] There was a flush on the Damietta Branch, February 25, to March 2.
	1924…	F.23	F.18	F.12	F.9	M.19	M.9	M.3	F.29	M.4	Feb.09	[2] The date is rather indefinite, but between February 6 and February 13.
	1923…	M.4	F.27	F.23	F.20	M.23	M.17	F.6	J.31	F. 7	Feb.13[7]	
	1922…	F25	F.10	F.8	F.6	M.23	M.16	F.18	F.11	F. 15	Feb.11[2]	
	1921…	F.23	F.13	F.13	F.13	F.22	F.22	F.15	F.15	F. 09	Feb.13	
	1920…	F.24	F.19	F.9	F.8	F.14	F.12	F.4	F.28	F.02	Feb.08	
	1919…	F.15	F.15	F.11	F.11	J.16[3]	M.5[8]	J.8	D.28	J.15	Feb.12	[3] Subsequently reopened for flush and finally closed March 6, about.
										Mean	Feb.11	
Records less Reliable	**1918…**	Not Closed		…	…	A.. 4	…	…	….	…	…	[4] Shortage occurred February 7 to 20, but final shortage not until March 9.
	1917…	A. 5	A.4	M.29	M.26	A. 27[6]	A. 23	A. 19	A.18[5]	…	M.30	[5] Flush to Faraskour pool to clear out salt.
	1916…	15	F.14	F.14	F.9	F. 11	F. 11	J. 11	J. 11	J. 12	Feb.10	[6] Damietta Branch was opened and closed agains several times.
	1915…	M. 10	M.9	M.8	M.6	F. 14[1]	F. 11	J. 13	J. 13	…	Feb.07[4]	
	1914…	F. 12	F.10	F.7	F.3	November 29, 1913				…	Feb.03	
	1913…	M. 3	M.1	F.16	F.11	M.10	M. 08	J. 30	J. 30	…	Feb.11	
	1912…	F.16	F.15	F.13	F.12	F. 27	F. 25	F. 25	F. 25	…	Feb.12	
	1911…	M.30	M.28	M.18	F.22	M.25	M.14	M. 13	M.13	…	Feb.22	
	1910…	AP. 7	A.5	A.5	M.31	Not Closed	M. 01	…	…	…	Mar. 22	
										Mean	Feb.21	[7] There was no excess from February 4 to February 22, and a mean date has been taken as February 13.
Records become unreliable	**1909…**	M.19	M.25	M.25	M.21	M.6	M.5	M.5	M.5	No Records	Mar.16	
	1908…	M.16	M.12	M. 4	M. 2	F. 10	M. 9	F. 6	F.4	…	Feb.25	
	1907…	M.27	M.9	F.9	F. 9	M.16	M.14	M. 5	M.1	…	M.3	[8] Also on January 13.
	1906…	M.25	M.25	M. 22	M.13	F.28	F. 27	F. 20	F.20	…	M.20	
	1905…	M.23	M.19	M.16	M.9	M.12	M.11	F. 21	F.20	…	M.20	
	1904…	M.5	M.5	M.5	M.5	A.12	A. 11	A.6	M.28	…	Mar.18	
	1903…	M.22	M.16	M.10	M.5	December 17, 1902						… Feb-27
	1902…	M.23	M.21	M. 5	F. 26	Decmber 13, 1901						… Feb-13

Note A. The dates shown in the last column are the first dates on which there was no water in the Rosetta and Damietta Branches in excess of that required for irrigation and for the construction of the Nile Sadds.

(Signed) A. D BUTCHER
Director, Delta Barrage

(Signed) H. E HURST
Director-General, Physical Service.

APPENDIX H.

EXPLANATORY NOTE ON THE DIAGRAM NO. 5

The year 1919-20 has been chosen as a means of determining the critical date for various stages of expansion. All these dates fall in the first part of February (Barrage). The following list shows that from the point of view of the critical date 1919-20 was probably the lowest of recent times [1], excepting 1913-14. Hence the dates will fall earlier in this year than in most others.

MONTHLY TOTALS – FEBRUARY

Million Cubic Metres

Year	Aswan Natural River	Delta barrage branches
1913	2,020	1,000
1914	1,150	200
1915	3,060	700
1916	2,400	600
1917	3,920	1,300
1918	3,990	1,300
1919	2,180	936
1920	2,110	438
1921	2,340	999
1922	2,090	726
1923	2,350	728
1924	2,650	902

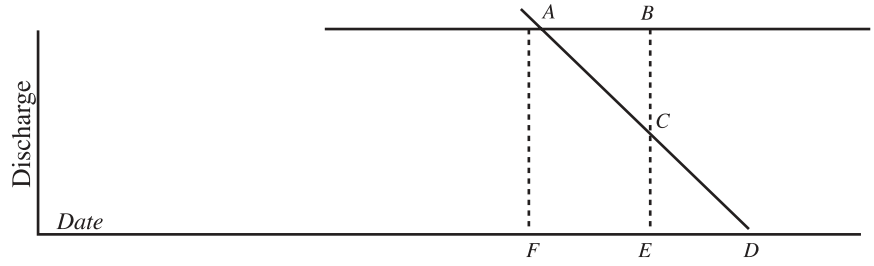
It has been assumed that all the discharge of December, January and February down the Damietta Branch was required, as it was plainly being regulated. The Rosetta discharge therefore has been taken as representing surplus. In the diagram a smooth curve has been drawn for this.

The discharge required for extra cultivation of developable from the Gebel Aulia Dam has been taken as 12 millions per day, except in January, when it would be practically zero. This has been obtained by supposing the storage of the Gebel Aulia reservoir to be the equivalent of 2 million milliards at Aswan, and this will be required to give water for 170 days to summer cultivation, or at the rate of 12 millions per day. Failing information as to how this water will be used, it is not worth while making more elaborate assumptions.

1 The surplus at the Delta Barrage in February was less in 1920 than in any other year excepting 1914.

The losses in Gebel Aulia have been taken as 11 millions per day while it is standing full, on information obtained from Mr. Tabor.

The date has been determined as follows:



A D is available discharge. *B E* required dicharge.
A B C= C D E and *E* is the critical date.

The closing of the sadds has not been considered, as when once extra water is available in Egypt the present arrangements for closing will need reconsideration and the sadds will probably be closed.

(Signed) H. E. HURST
Director-General, Physical Service.

APPENDIX I.

EXPLANATION NOTE ON DIAGRAM NO. 6

All discharges shown in the diagram are referred to dates at the Delta Barrage by introducing the appropriate lag, but without transmission losses.

Discharges are the actual means of the six years from November 1918 to February 1924, the period during which the records are most reliable and complete.

Delta Canals + Ibrahimia – The discharges shown include the Damietta branch of the Nile which, at this season of the year, may be considered as a channel serving the canals at Zifta Barrage and riverain cultivation.

Addition for Land Developed by Gebel Aulia

In default of a complete programme for the utilisation of the Gebel Aulia water, it has been assumed that the whole of the storage there was available will be used during the period of shortage and for the development of new areas, so that a corresponding increase of water for irrigation during the period of excess will also required.
No substantial error is made by considering that this increase will be necessary at the Delta Barrage, or to make good a deficit at the Barrage caused by the development of areas further south.

It is further assumed that the increase of water required from December to February will be proportional to the increase in the total summer supply available.

This is arrived at as follows:

Average date on which Aswan Reservoir is empty 1919-24, 20th July.
Beginning of summer conditions assumed 1st February.
Mean total discharge passing Aswan, February 1st-July 20th, 1919-24, 12,340 mills.
Mean total losses for some period, February 1st – July 20th, 1919-24, 340 mills.
Mean total discharge available for Delta Canals and Ibrahimia, 12,000 mills.
Estimated total increase due to Gebel Aulia, 2,700 mills.

Hence estimated increase in water requirements during December, January and February, 22 per cent.

Twenty two per cent has therefore been added to the curve for Delta Canals + Ibrahimia to represent water requirements after the completion of Gebel Aulia.

Gezira Canal and Sennar Reservoir – The water requirements for the Gezira Canal and Reservoir have been taken direct from "Nile Control" and have been deducted from the discharge available at Cairo without any adjustments for losses. The effect of allocating a

discharge of 7 millions to the Sudan in December in addition to the"“Nile Control” figures is also shown.

Aswan Reservoir – The area between the Aswan natural river and the Cairo discharge curve represents the water taken to fill the Aswan Reservoir but to the quantity shown (namely 2,042 millions) the gains, which occur between Aswan and Cairo must be added in order to arrive at the full contents of the reservoir.

Water for Closing Sadds – A considerable quantity of water is required, under existing circumstances in order to maintain a flow through the Nile Sadds at Faraskour and Mehallet-el-Amir during their construction in February, when surplus water has usually been available in the past.

The completion and full exploitation of the Gebel Aulia Reservoir will, however, put back the date when shortage begins and necessitate earlier closure of the sadds in the future, and the water necessary is therefore shown at a corresponding earlier date.

From the diagram it is clear that, on the mean of the years 1918-24 all demands can be satisfied in full up to the 10th February. From the 10th to the 22nd February (the date corresponding to “Nile Controls” 18th January at Sennar) future demands cannot be satisfied in full but a total cube of 140 million will still be available above present requirements.

(Signed) A. D. BUTCHER
Director, Delta Barrage.

APPENDIX J.

ASWAN NATURAL RIVER.

Total Discharge in Millions of Cubic Metres.

	December	January	**Total**
1905-06	5,100	4,060	**9,160**
1906-07	5,590	4,320	**9,910**
1907-08	4,480	3,550	**8,030**
1908-09	5,750	4,250	**10,000**
1909-10	6,420	5,030	**11,450**
1910-11	6,020	4,500	**10,520**
1911-12	5,370	3,800	**9,170**
1912-13	4,220	3,240	**7,460**
1913-14	2,810	1,720	**4,530**
1914-15	6,700	4,500	**11,200**
1915-16	5,260	3,840	**9,100**
1916-17	7,510	5,270	**12,780**
1917-18	7,250	5,270	**12,520**
1918-19	4,620	3,440	**8,060**
1919-20	4,410	3,340	**7,750**
1920-21	5,310	3,790	**9,100**
1921-22	4,690	3,540	**8,230**
1922-23	4,950	3,630	**8,580**
1923-24	5,200	3,990	**9,190**
1924-25	5,500	3,840	**9,340**
Mean 1905-06 to 1924-25	5,358	3,946	**9,304**
" 1918-19 to 1923-24	4,863	3,621	**8,485**

(Signed) H. E. HURST,
Director-General, Physical Service.

APPENDIX K.

ASWAN NATURAL RIVER DISCHARGES.
10 Day Totals in Millions of Cubic Metres

Date		1919	1920	1921	1922	1923	1924	Mean mills Day
Jan.	1-10……..	1,207	1,216	1,361	1,255	1,267	1,400	**128.4**
	11-20……. ...	1,144	1,093	1,205	1,135	1,160	1,300	**117.3**
	21-31……. ...	1,087	1,033	1,227	1,149	1,206	1,292	**106.0**
Feb.	1-10…….	858	822	933	889	990	1,021	**91.9**
	11-20……..	768	721	846	718	812	933	**80.0**
	21-28 -29……..	556	570	559	480	547	693	**68.1**
Mar.	1-10……..	669	582	636	538	568	648	**60.7**
	11-20……. ...	607	523	549	477	489	609	**54.2**
	21-31……. ...	633	561	554	446	488	592	**49.6**
Apr.	1-10	521	466	458	371	417	455	**44.8**
	11-20……. ...	503	466	433	333	383	434	**42.5**
	21-30……. ...	483	406	451	269	397	430	**41.1**
May	1-10	457	411	399	284	407	480	**40.6**
	11-20……. ...	446	395	369	243	456	459	**39.5**
	21-31……. ...	443	416	402	282	516	534	**39.3**
June	1-10	423	375	343	271	405	511	**38.8**
	11-20	483	406	451	269	596	546	**45.8**
	21-30	625	925	514	365	1,045	574	**67.5**
July	1-10	673	1,009	639	556	1,127	699	**78.4**
	11-20	1,125	1,420	894	727	1,145	1,476	**113.1**
	21-31	2,117	2,690	1,401	1,877	2,027	2,708	**194.2**
Aug.	1-10	3,966	4,089	2,723	3,417	4,480	4,076	**379.2**
	11-20	6,060	6,007	5,379	6,830	7,211	6,024	**625.2**
	21-31	6,986	8,382	7,275	8,156	9,437	8,962	**745.4**
Sept.	1-10	6,921	6,721	6,967	8,856	8,078	7,722	**754.4**
	11-20	7,398	5,673	6,096	9,798	7,169	8,553	**744.8**
	21-30	7,190	5,089	6,414	7,659	7,167	7,224	**679.0**
Oct.	1-10	5,789	5,220	6,076	5,806	6,902	5,854	**594.1**
	11-20	3,970	4,918	4,861	5,543	5,837	4,958	**501.4**
	21-31	3,282	4,520	4,034	4,966	4,445	4,053	**383.3**
Nov.	1-10	2,420	3,558	2,964	3,418	2,808	2,827	**299.9**
	11-20	1,989	2,770	2,321	2,686	2,264	2,522	**242.5**
	21-20	1,728	2,170	1,949	2,201	2,009	2,516	**209.6**
Dec.	1-10	1,569	1,937	1,677	1,821	1,828	2,059	**181.5**
	11-20	1,419	1,715	1,524	1,571	1,668	1,750	**160.8**
	21-31	1,426	1,662	1,491	1,557	1,708	1,695	**144.5**

Total of mean natural river 21st January to 31st July corresponding approximately to 1st January to 15th at Sennar = 13,214 million cubic metres

(Signed) H. E. Hurst.
Director General, Physical Service.

LORD LLOYD TO MOHAMMED MAHMOUD PASHA

THE PRESIDENCY, CAIRO, MAY 7, 1929

SIR,

I have the honour to acknowledge receipt of the note, which your Excellency has been good enough to address to me today.

2. In confirming the arrangements mutually agreed upon as recited in your Excellency's note, I am to express the gratification of His Britannic Majesty's Government in the United Kingdom of Great Britain and Northern Ireland that these discussions have led to a settlement which cannot fail to facilitate development and to promote prosperity in Egypt and the Sudan.

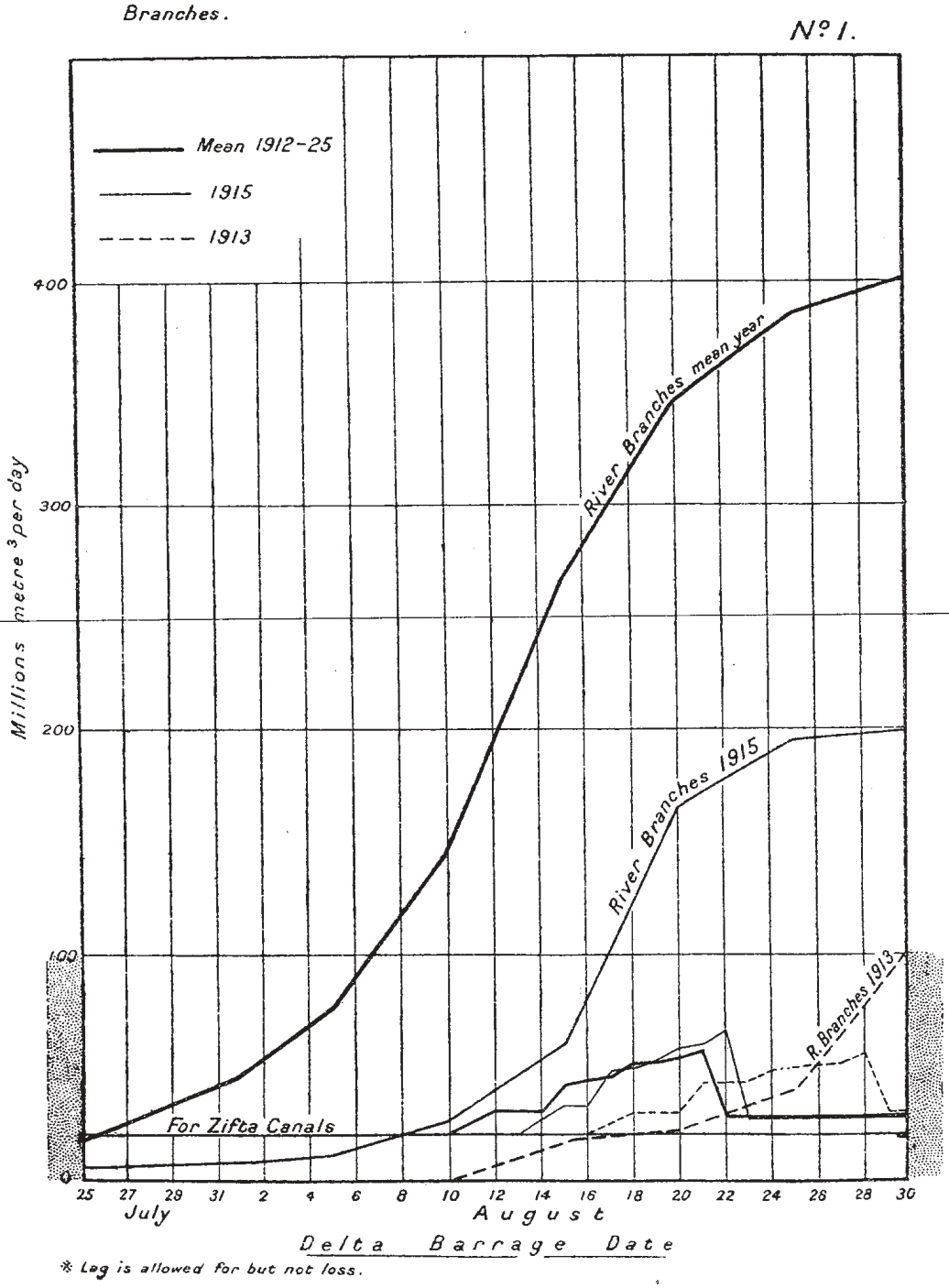
3. His Majesty's Government in the United Kingdom concur in your Excellency's view that this agreement is, and should be, essentially directed towards the regulation of irrigation arrangements on the basis of the Nile Commission Report, and has no bearing on the status quo in the Sudan.

4.In conclusion, I would remind your Excellency that His Majesty's Government in the United Kingdom have already acknowledged the natural and historical rights of Egypt in the waters of the Nile. I am to state that His Majesty's Government in the United Kingdom regard the safeguarding of those rights as a fundamental principle of British policy, and to convey to your Excellency the most positive assurances that this principle and the detailed provisions of this agreement will be observed at all times and under any conditions that may arise.

I avail, etc.

LLOYD
High Commissioner

※ Water taken for Sennar Reservoir & Gezira Canal transferred to Delta Barrage and sum of Discharges of Rosetta and Damietta Branches.



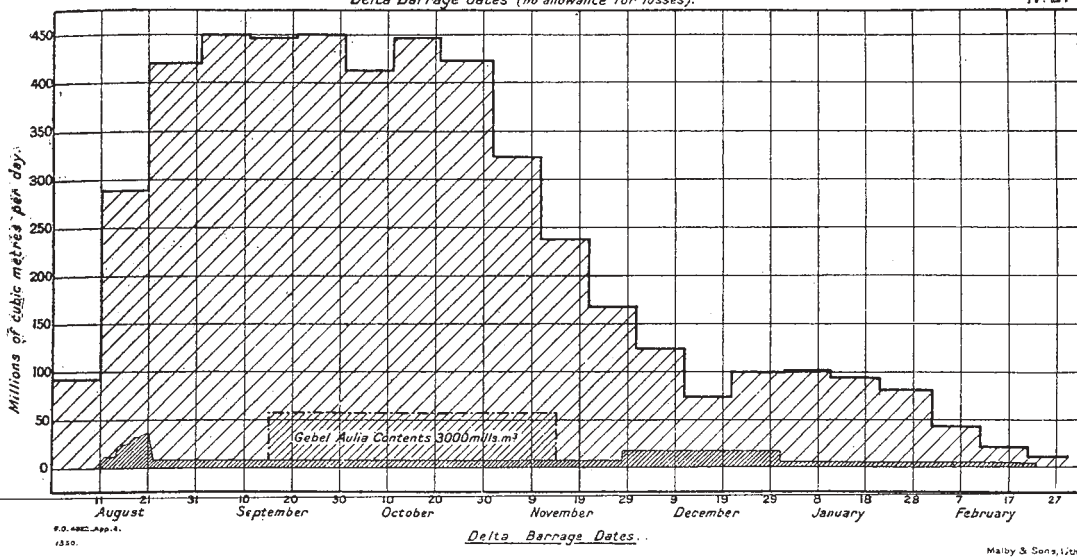
※ Leg is allowed for but not loss.

MEAN 1919-20 TO 1925-26.

Discharges of Rosetta and Damietta Branches (10 day means)

Quantities of water required for Sennar Reservoir transferred to Delta Barrage dates (no allowance for losses).

N°2.



F.O. 4822 App. 4. 1330.

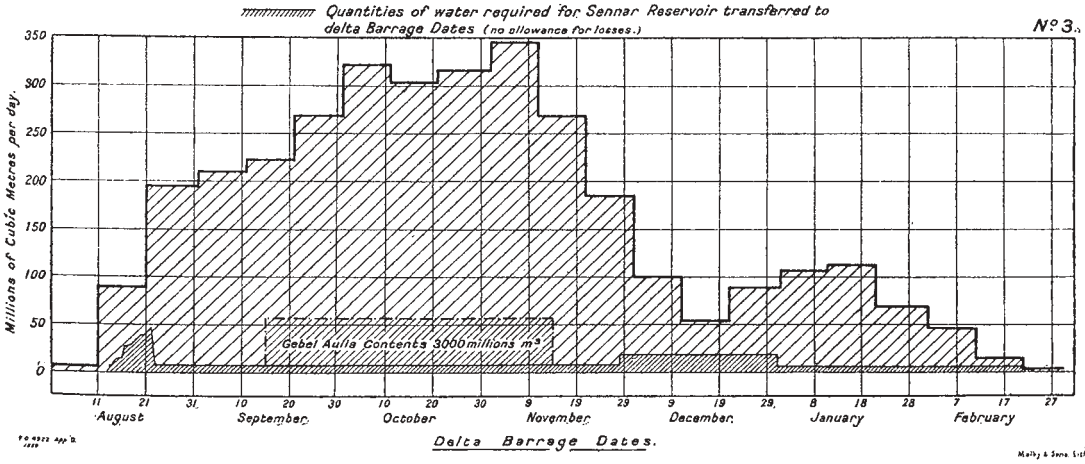
Malby & Sons, Lith.

1915-16.

Discharges of Rosetta & Damietta Branches (10 day means)

Quantities of water required for Sennar Reservoir transferred to delta Barrage Dates (no allowance for losses.)

N°3.



F.O. 4822 App. 12. 1330

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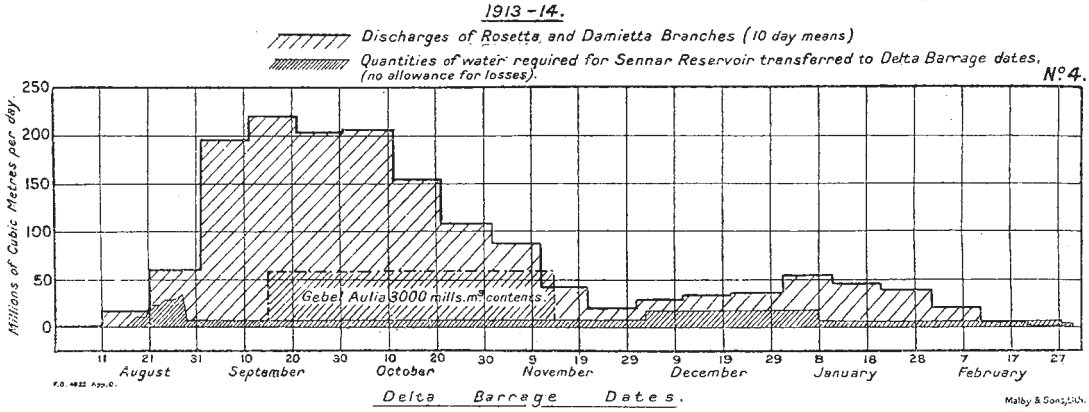
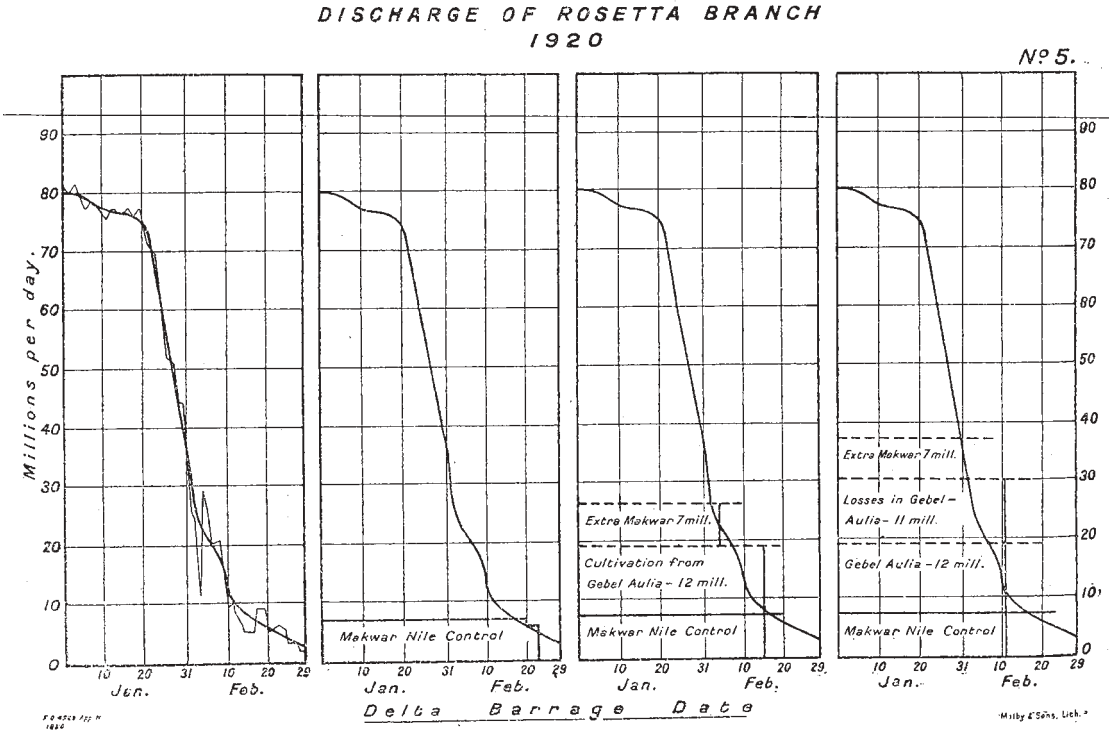
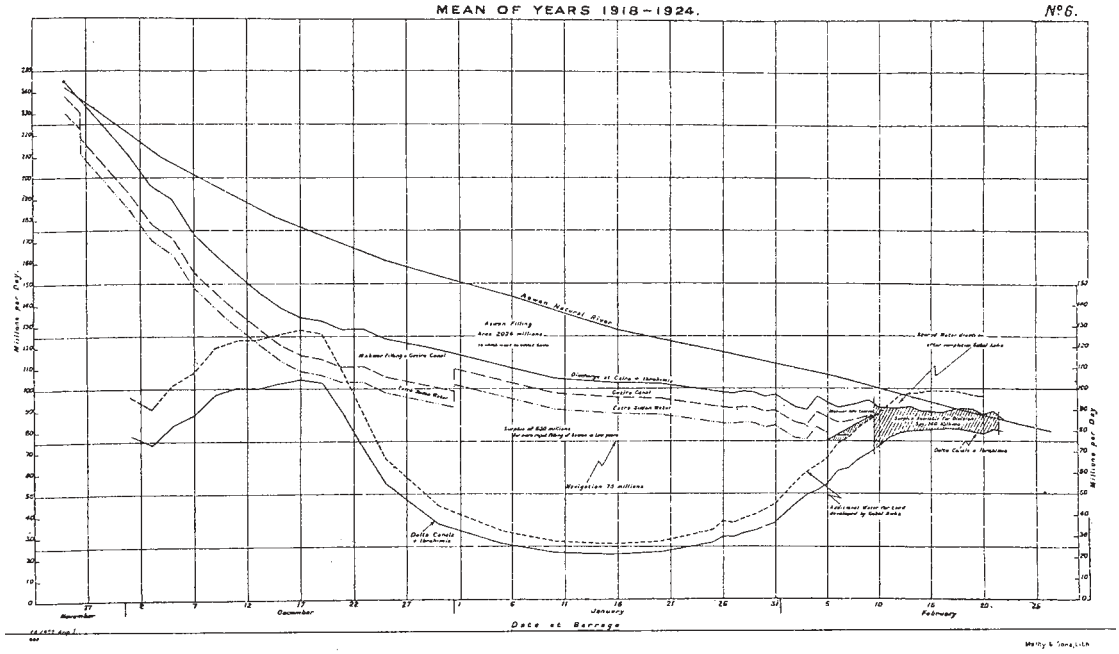
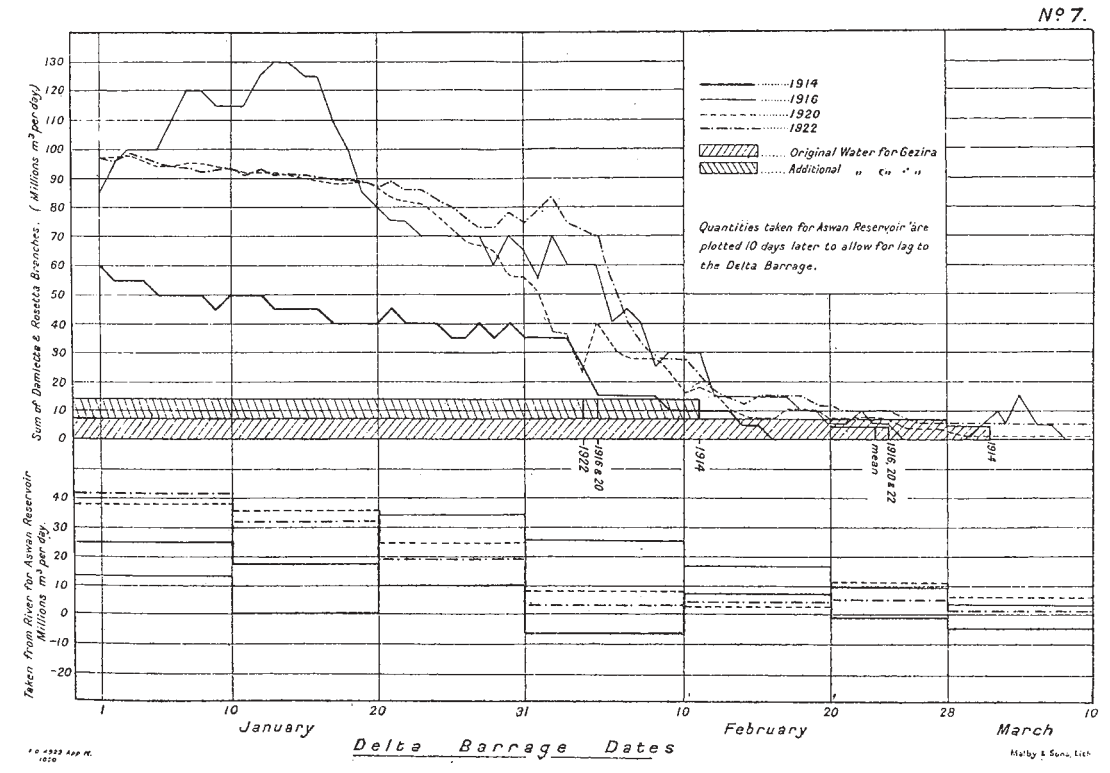

1913-14.
Discharges of Rosetta and Damietta Branches (10 day means)
Quantities of water required for Sennar Reservoir transferred to Delta Barrage dates, (no allowance for losses).
No. 4.
Millions of Cubic Metres per day.
250
200
150
100
50
0
Gebel Aulia 3000 mills. m³ contents.
11 21 31 10 20 30 10 20 30 9 19 29 9 19 29 8 18 28 7 17 27
August
September
October
November
December
January
February
Delta Barrage Dates.
Malby & Sons, Lith.


DISCHARGE OF ROSETTA BRANCH
1920
No. 5.
Millions per day.
90
80
70
60
50
40
30
20
10
0
Jan.
Feb.
Makwar Nile Control
Extra Makwar 7 mill.
Cultivation from Gebel Aulia - 12 mill.
Losses in Gebel-Aulia - 11 mill.
Gebel Aulia - 12 mill.
Delta Barrage Date
Malby & Sons, Lith.


MEAN OF YEARS 1918-1924.
Nº6.
Millions per Day.
Aswan Natural Flow.
Aswan Filling
Area 2024 millions
Mahsama Filling + Centre Canal
Delta Canals
Navigation 75 millions
Additional Water for Land Development by Sudd Area
Delta Canals + Perennials
November
December
January
February
Date at Barrage
Malby & Sons, Lith.


Nº 7.
1914
1916
1920
1922
Original Water for Gezira
Additional " " "
Quantities taken for Aswan Reservoir are plotted 10 days later to allow for lag to the Delta Barrage.
Sum of Damietta & Rosetta Branches. (Millions m³ per day)
Taken from River for Aswan Reservoir Millions m³ per day.
1916 & 20 1922
1914
1916, 20 & 22 mean
1914
January
February
March
Delta Barrage Dates
Malby & Sons, Lith

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