Over the dam and into the depression

Some of the largest and oldest of the world's irrigation systems have caused waterlogging and leaching out of salts from the soil. Studies covering a period of 4,000 years (from 2600 BC to AD 1400) of written records in Mesopotamia indicate that such "side effects" are recurrent. Salinity surveys were started there in about 2400 BC but nevertheless, the history of the region is punctuated by the rising of saline waters to plant root level. Many historians believe that agricultural catastrophes, rather than wars, invasions, or climatic changes, have precipitated the fall of some of the first great civilizations in the "fertile crescent." In India likewise, **4,000** year-old surface salt traces, signifying similar agricultural decline and fall, have been found.

It may seem surprising that the problem has not been solved by modern science. In the 1950s and 60s, thousands of hectares of irrigated land in India were lost to salination. And today, Egypt faces the same situation, whose solution is essential not only to meet the agricultural needs of the country, but to the successful carrying out of vast irrigation schemes, now underway or projected, in the semi-arid regions of the Middle East and Africa.

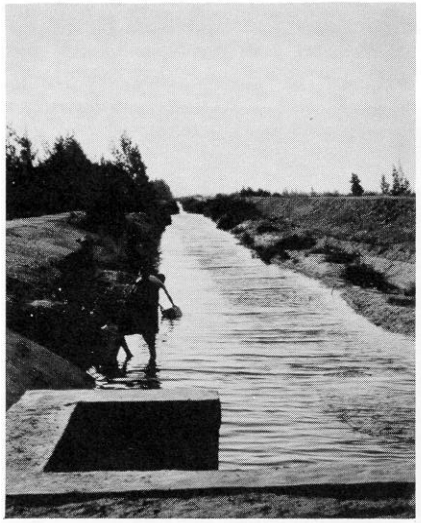
Salination of land is the latest and perhaps the most severe side effect of one of the world's largest water management undertakings, the High dam at Aswan and related developments. This year the dam is a major subject of public debate, and the target of a parliamentary investigation ordered by Sayed Marei, president of the National Assembly (who headed the World Food Conference in Rome last November).

The Aswan dam has been the subject of violent criticism, some of it ignoring a major achievement: the Nile valley farmer is no longer subjected to the sometimes deadly vagaries of the river. Year-round irrigation permits the growing of three or four crops a year on land where only one had been possible in the wake of the annual flooding of the past. The dam stands in the way of disastrous floods, and provides water in periods of drought. This was illustrated two years ago, when the natural flow of the Nile was the lowest in about 100 years.

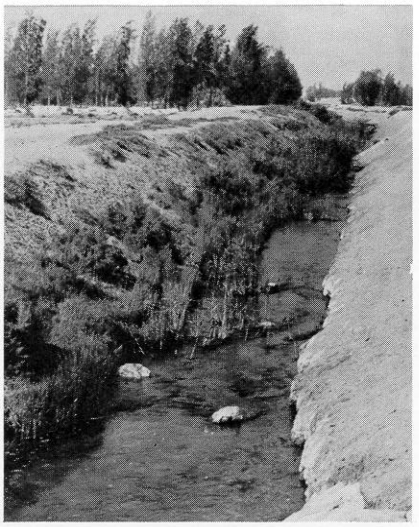
Nevertheless, it is true that this pharaonic project (masonry at Aswan has a volume 17 times greater than that of the Cheops pyramid) has cumulated almost every conceivable side-effect in addition to the waterlogging and salination of irrigated areas, which started manifesting itself in the Nubaraya region, some 50 kilometers south-west of Alexandria.

When the Nubaraya irrigation project was initiated, a study of underground water tables was envisaged, but it was not considered as urgent, since most aquifers were at depths of between 20 and 60 metres. A network of canals was dug and the water was pumped step by step to a few metres (and occasionally as high as a few tens of metres) above sea-level, to be distributed through secondary canals. The desert started growing green over an area of some 200,000 hectares, about 40 percent of all new land whose reclamation had been made possible by the High dam. Cultures included one-third fodder (chiefly alfalfa), one-third fruit, and one-third field crops and vegetables.

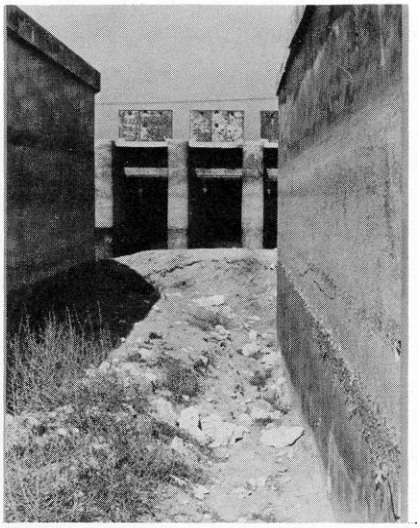
When, a few years ago, some trees and grape vines in limited areas started dying, inadequate use of fertilizer was first suspected. But it soon became evident that abundant irriga-



Healthy canal: ten years ago this was desert.



Sick canal: intensive research is underway.



Abandoned canal: the short-term solution.

tion had made water tables rise at a fantastic rate, sometimes exceeding one centimetre a day, or four metres a year. Saline groundwater percolated to the surface, overflowing into main irrigation canals, some of which had to be abandoned, and even threatening nearby low-lying fertile land in the Nile delta that had been cultivated for thousands of years.

Now hundreds of hectares have to be put out of cultivation every year and many farmers, complaining that "the harvest burns," leave the land that had been allocated them.

No long-term solution has yet been found. Drainage canals would have to be so deep that their cost is prohibitive, and digging wells to pump underground water out to sea is, likewise, too costly. Short term solutions include less abundant irrigation, constant monitoring of salinity, and closing some of the canals.

Intensive research is underway to find an answer, and also methods to foresee and prevent such potentially catastrophic situations. But in many respects, the Aswan dam's side effects point to the fact that water science, or hydrology, has remained largely empirical, and has not benefited from sufficient research.

(The year 1975 brings to a disappointing close the UNESCO-sponsored "Hydrological decade"; as is pointed out in a recent FAO report (Man's Influence on the Hydrological Cycle) "resources being devoted [to it] are sadly inadequate, and in spite of the efforts being made, progress is disappointingly small. The lack of fundamental information on the part of high-level decision-makers is often quite incredible.")

The decision of Egypt's political leaders to open the High dam debate appears as a significant step toward unprejudiced understanding of a project that, sooner or later, had to be carried out (unless one took the position that because of the magnitude of the task, nothing should be ventured, nothing risked, but nothing gained either). Now a holistic approach has been taken whereby agricultural, chemical, biological, geological, hydrological and other consequences of the dam, as well as its social and public health implications, will be studied and integrated on computer models.

As a technically and scientifically advanced developing country, and also one where good water management, in the face of rapid demographic growth, can make the difference between subsistance agriculture and sufficiency, Egypt may be a key contributor to hydrological science, particularly concerning its applications in semi-arid tropics and on sandy soils.

The High dam experience may have something to do with Egypt's cautious approach to another spectacular project, the flooding with sea water of the Qattara depression in the Western desert, a development that could produce five times as much electricity as the Aswan dam, and lead to the creation of agricultural and industrial centres and a large harbour near El Alamein, the site of a crucial World War II battle.

The project was, in fact, first suggested by Friedrich Bassler, a hydraulic engineer and professor at Darmstadt University, who was a young officer in Rommel's Africa Corps during World War II. In 1941 he had made a cursory inspection of the depression while studying various possible routes for the German army, and he has returned to the site several times since.

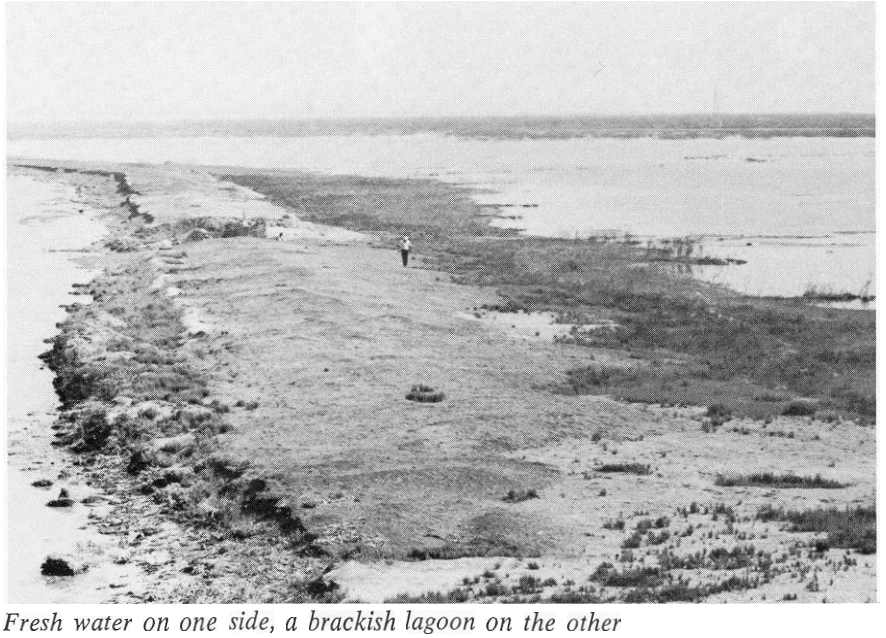
The depression starts about 70 kilometers south of El Alamein, curves west and then south for some 300 kilometers and, at its deepest point, reaches 133 meters below sea level.

The Qattara project involves the digging of a 40 kilometer-long canal from the Mediterranean to the northernmost tip of the depression. Water rushing from the sea would generate electricity, and eventually create a 14,000 square kilometer artificial lake. Water would then evaporate at a rate compensating for the inflow through the turbines.

The potential of the project, to be developed over 20 years, is enormous. Floating platforms could be used to drill for oil believed to exist under the depression (at present the oil is of difficult access because of salty swamps on the surface). Petrochemical industries would be created, and part of the electrical power generated would be used for water desalination to cultivate the desert. Oil would be exported to Europe through the canal and the new harbour. The canal could also be used for fishery and aquaculture, and a network of roads would be built for the area.

The Federal Republic of Germany has contributed funds for a preliminary study, and work on the Qattara project could theoretically start in two years. But the Ministry of Power has decided to form a council of experts, both Egyptian and foreign, to study not only the technical, economic and social aspects of the project, but its possible side effects. These could also be spectacular. Evaporation combined with the constant inflow of sea water would increase salt concentration to turn the lake into a "dead sea"; salt water under pressure might leak, through geological faults or fissures, to nearby agricultural areas; or else make existing water tables rise, either to feed fresh water artesian wells, or provoke a salination effect similar to that occurring in the irrigated areas west of the Nile delta.

There are many faces to a water management project, and Egypt is in a good position to realize the interest of knowing all of them.



Fresh water on one side, a brackish lagoon on the other