IRRIGATION POTENTIAL OF SURINAME RIVERS

"The thirsty rice plants will appease the hunger of nations"

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Introduction

The whole potentially fertile coastal area of Suriname could *in principle* be irrigated with the help of water of the Surinamese rivers.
In practice however, it seems that quite costly provisions have to be made to provide the potential agricultural land -more than 600,000 ha for the cultivation of dry and wet crops- with the necessary amount of good water from these rivers throughout the year, and year in year out as well.
It is therefore of the utmost importance that the responsible organizations and institutions carry out a thorough investigation to determine what areas should or can be irrigated, when, how and how often this ought to be done and what crops should be planted. Apart from ensuing civil engineering problems in this context, the agricultural, socio-economic and other problems should also be tackled and thoroughly examined.
In this paper only some civil engineering aspects with regard to the irrigation potential have been elucidated.

Pattern of the Surinamese Rivers

The main rivers, the Corantijn, Coppename, Suriname and Marowijne, have a south-north flow and discharge directly into the Atlantic.[1]) There are four other rivers as well, each deflecting towards one of the larger ones. Thus, the Nickerie river deflects and joins with the Corantijn, the Saramacca with the Coppename, the Commewijne with the Suriname, and the Mana (in French Guyana) with the Marowijne. In the coastal plain these deflecting rivers have an east-west flow.

Location and Size of Potential Agricultural Areas

The fertile claysoils in the coastal plains provide advantageous conditions for agriculture if sufficient water for irrigation becomes available. The importance of these rivers in this respect is evident if one considers that approximately 600,000 ha could be irrigated in the long run.
The fertile areas are located in the young "coastal belt" (marine and fluviatile sediments, including deltaic areas, estuaries, swamps; here and there sand- and shell-ridges, etc.) Measured from the coastline inland, the coastal belt is some 5 km wide in the east (Albina) and widens up to some 50 km in the west (Nieuw Nickerie).
The surface-area of the whole "coastal belt" is approximately 1,000,000 ha, of which some 60% can be developed for agricultural purposes in the (far) future.

Irrigation potential of Rivers

GENERAL

It is a well-known fact that the irrigation potential of a river is not a fixed and an exact figure, but that it varies during the year, and year after year and that it depends on a lot of factors. Some of these factors are mentioned here:
Atmospherical conditions (such as precipitation, wind, sunshine etc.)

Size, shape, geology, geomorphology, hydrology [2]), vegetation, etc.
River-regime (incl. geology, geomorphology, etc.)
Tidal effects (of the sea, i.e. the Atlantic)
Crops (what, when, how, how often)
Point of water-intake from the river
Engineering works: - Construction of a dam (with additional works) in the estuary of a main river, and the irrigation by gravity
- Water-intake from a far-lying point upstream of a main river, and irrigation -by gravity- via a long canal system
- Water-intake from a point of the river, at a safe distance from the salinity limit and irrigation by pumping into a canal system.
Other factors (kinds/modes of use of water: cattle, bathing, etc.)

SURINAMESE RIVERS

Taking into account the different factors which are responsible for the irrigation potential of a river, the following summary, with regard to the important rivers of Suriname, might be given: see table 1.

Need for Irrigation Water

The progressing development of agriculture in the country is constantly increasing the need for irrigation-water. This need evolves from the desire to increase the security against damage caused by drought. But also because higher yields are expected after the construction of irrigation facilities.
In terms of improvements of the security, it should be mentioned that the climate in Suriname is of a very precarious nature. In general the following seasons can be distinguished:

The long rainy season	: from the end of March till the beginning of August;
The long dry season	: from the beginning of August till the end of November;
The small rainy season	: from the end of November till the beginning of February;
The small dry season	: from the beginning of February till the end of March.

One can safely count on the occurence of the long rainy season, but the time of commencement of this season as well as its intensity deviate from year to year. Even more precarious is the occurence of the small rainy season, which is not reliable at all.
The absence of this season means a continuous period of dry weather, lasting for some eight months with disastrous consequences for inadequately irrigated lands. No appreciable higher yields of produce have been found after the construction of proper irrigation for crops such as citrus, cocoa, coffee and coconut, at least as far as the involved capital-investments are concerned. For rice and bananas this is the opposite: the yields are sufficient to justify -to a large extent- the investments.
Irrigation is known to be of vital importance to rice production, especially since the mechanized methods are at present operational on most projects, even on small farms. Expectations are that after varieties of rice with a short growing period (120 days) have been selected and a proper means of irrigation becomes available, the produce of the whole cultivated area can be harvested twice per year.
The quantative need for irrigation-water can be expressed in many ways, e.g. the *maximum* need over a short period, per unit of time, per unit of area (liters per second per hectare; l/s/ha) and the *total* need expressed in terms of the depth of the watercolumn that is needed in e.g. a 5% dry year in millimeters (mm).
A 5% dry year is one with such a low rate of precipitation that its frequency is *less than* or *equal to* once in twenty years.

Table 2 indicates, for different crops, the water need in terms of the above mentioned units. Column 2 indicates the maximum need over a short period in l/s/ha. Column 3 shows the total need in mm for a normal year, this is a 50% dry year, whereas column 4 indicates the same for a 5% dry year.

Conclusion

In *theory* the whole fertile coastal belt of some 600,000 ha could be irrigated by, for example, only the Corantijn river. But in *practice* this is not possible, for very expensive (and extensive) provisions (such as engineering works etc.) would be required, which could be harmful from a viewpoint of, for instance, the ecology.
Though *on the one hand* it is not desirable to consider building the above mentioned engineering constructions to avail oneself of huge amounts of irrigation-water, *on the other hand* it is not wise to let the rivers flow in their "natural" way either and supply irrigation-water by long canals, drawing water from a far-lying point of the river from where irrigation by gravity is possible.
This solution is also very costly and therefore not desirable for present consideration.
A practical solution for our irrigation problems would be sought somewhere between the two extremes. A review of three types of solutions is given below:
Wageningen project: pumping fresh water, at the salinity limit from the Nickerie river, directly to the polders;
Landbouw Ontwikkeling Commewijne (LOC) scheme: fresh water intake from the Surnau creek, a tributary of the regulated Suriname river, at a safe distance from the salinity-limit. This implies a rather long canal system and pumping.
Multipurpose Corantijn Project (MCP): pumping fresh water from the Corantijn (at a reasonable distance from the salinity limit) into a (rather) long canal, which brings the water to the polders.

Finally it may be stated that the irrigation capacity of the rivers depends mainly on the nature and sort of (engineering) structures which are already executed or are being constructed (or in preparation) and that this capacity is sufficient for the development of agricultural areas in the near future.
Table 3 gives an idea of the irrigation capacity of our main rivers, as well as the potential agricultural areas in the coastal belt.

Conclusive Remark

Though we are aware of our limitation in population, know-how and economy, I may draw your attention for only one fact in our agricultural development i.e. we are consuming some 35% of our paddi-yields; this means that we are contributing the world with approximately 65% of our paddi-production. Our intention is to double this export-ratio in the next decade(s).

The function of this congress is creative: to state the values and to set the goals, to indicate the course of action and to lead new paths. Let this congress inspire us with the spirit to sustain a new world (a new

Caribbean and Latin America) with men and women, who sub-ordinate personal and emotional, scientific and technological, economic and political divisions to the Ideal of Humanity: i.e. a peaceful world.

[1]) The Corantijn river is a Surinamese river, whereas the Marowijne is an international river (French Guyana and Suriname)
[2]) Hydrology is a covering name for i.a. *hydro-meteorology; hydrology of surface water,* distinguished in i.a. *limnology* (limnè=lake; lakehydrology) *and potamology* (potamos=river; river-hydrology);*pedo-hydrology* (i.e. soil-hydrology); *geo-hydrology* (i.e. hydrology of ground water).

TABLE 1

River	Catching area km²	Average annual discharge m³/s	Normal low discharge m³/s	Extreme low discharge m³/s	Normal high discharge m³/s	Extreme high discharge m³/s
Corantijn	67,600	1,580	200	100	10,000	15,000
Nickerie	10,100	200	20	10	1,200	1,800
Coppename	21,700	570	50	25	2,700	4,200
Saramacca	9,400	250	25	10	1,300	2,000
Suriname	16,500	450	45[3])	20[3])	2,600[3])	4,000[3])
Commewijne	6,600	140	10	5	800	1,200
Marowijne	68,700	1,800	200	100	10,000	15,000

[3]) Before the construction of the Brokopondo-project

TABLE 2 (indicative figures)

Crop	Maximum need l/s/ha	Total need in a normal year mm	Total need in a 5% dry year mm
Sugar cane	2/3	--	800
Bananas	2/3	600	1,050
Citrus	2/3	--	800
Cocoa	2/3	--	800
Coconut	2/3	--	800
Rice (mechanized farming)	2.2	1,500	2,000
Rice (small farms)	1.5	1,100	1,500

TABLE 3 (indicative figures)

River	Capacity of irrigation ha	Potential agricultural areas Location	Size in ha
Corantijn (with Nanni) [4]	> 60,000	left bank Nickerie river right bank Corantijn river	300,000
Nickerie	10-20,000	right bank Nickerie river	
Coppename	90,000	Coronie	
Saramacca	120,000	Saramacca and Commewijne district	200,000
Suriname	80,000	Suriname and Commewijne district	80,000
Commewijne	-,-	--	-,-
Marowijne	> 50,000	Upper Cottica	20,000

[4]) When regulated (by a waterpower structure), the irrigation capacity will increase to more than 300,000 ha.

Theses

1. Water, as a natural resource for use by man, animal and plant is in fact a *scarce* article, even for Suriname.

2. Optimal use of water requires a multi-disciplinary approach, whereby elements as:
   - expertise and responsibility,
   - teamspirit and sportsmanship,
   - self-activity and ingenuity,
   - initiative and creativity,
   - subject-integrity and sincerity,
   - awareness of limitedness and relativity of the own discipline,
   - acceptance of criticism which has a positive aim and
   - attitude of self-correction,
   - cooperation between government and private enterprises (such as trade and industry)
   - coordination and collaboration,

   have to take an important place and have to play a dominant role.

3. Coordination and collaboration at a national level with regard to activities, directed at hydraulic research and water-management, are necessary to come to e.g.
   - minimal spilling of related scarce material and immaterial goods;
   - optimum utilization of water

4. Together with all organizations and authorities concerned we have to draft a practical plan for an integral research and measuring program (regarding hydraulics and water-management) which should be adapted, adjusted, corrected and actualized periodically, for instance every year.

5. The management of irrigation-water, if necessary distinguished per region (for instance the northwestern region of Suriname and the northeastern region of Suriname), ought to be carried out by a separate, legal "Authority" with power to draft ordinances and with executive power.