

THEME 2 How can managing water in agriculture contribute to food security and public health?

Hydrological assessment approach for the elaboration of the hydro-agricultural infrastructure project aimed to the development of mangrove rice cultivation in Guinea Bissau

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One Water, One Health:

Water, Food and Public Health
in a Changing World

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supporting the improvement of the mangrove rice cultivation in Guinea Bissau



*Management, administration
and coordination for the operative actions*



Associated Partner

**Ministry of Agriculture Agency
DGEDR
Direção Geral da Engenharia e
Desenvolvimento Rural**

Technical consultant



Guinea Bissau is one of the 10 countries in the world with the highest per capita rice consumption

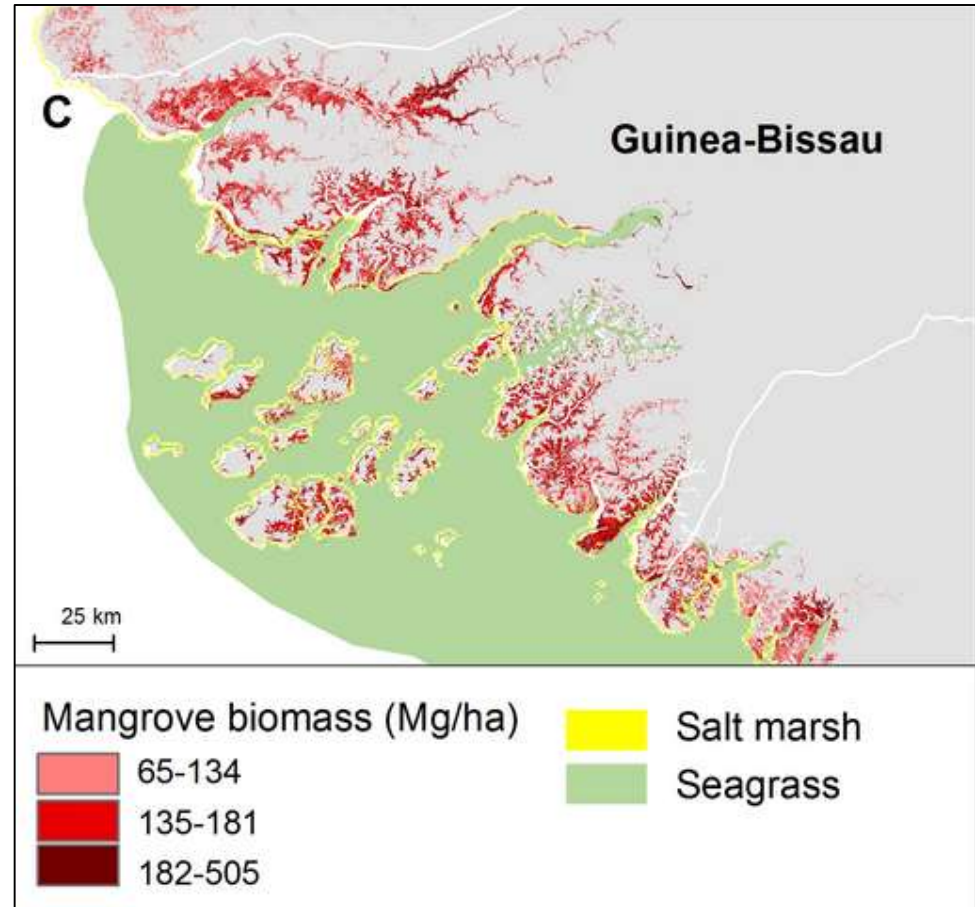
Rice cultivation is practiced by 90,000 small producers for about 600.000 people concerned (more than a third of the population), among whom over 22,000 produce mangrove rice.



Wet season

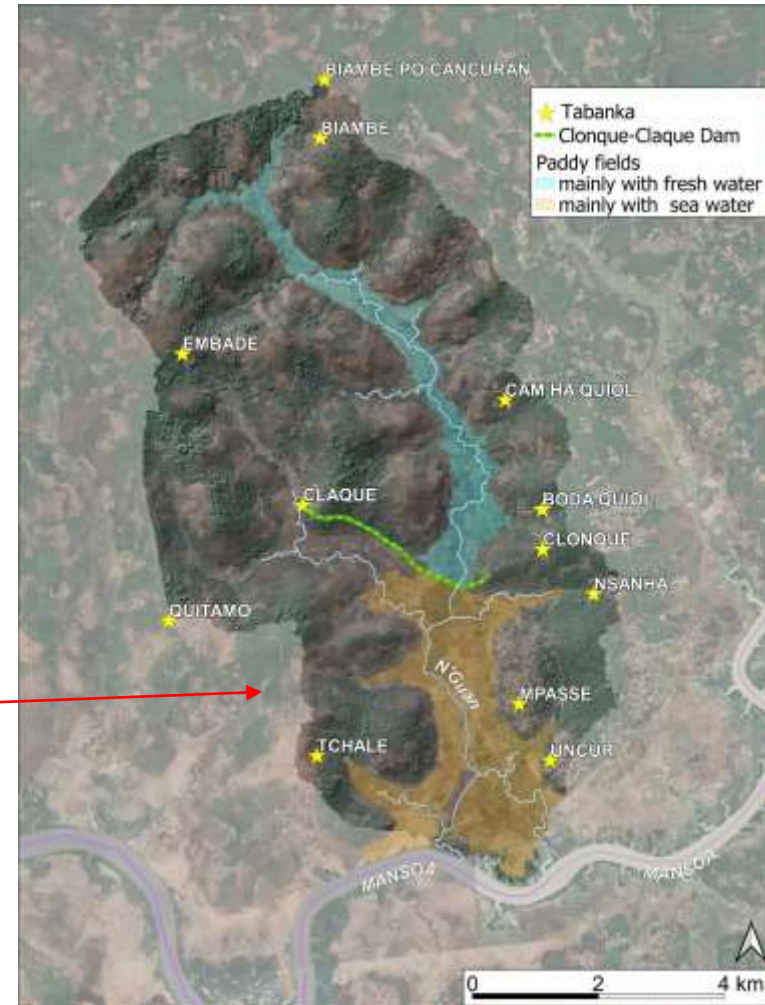


Dry season



The mangrove paddy field ("salt water paddy" or "bolanha") is essentially a land "stolen" to the sea, through the construction of a belt of earth-dams, to prevent saltwater inflow and allowing the leaching process of the soil by freshwater.

Site location - Geographical and Hydrological context

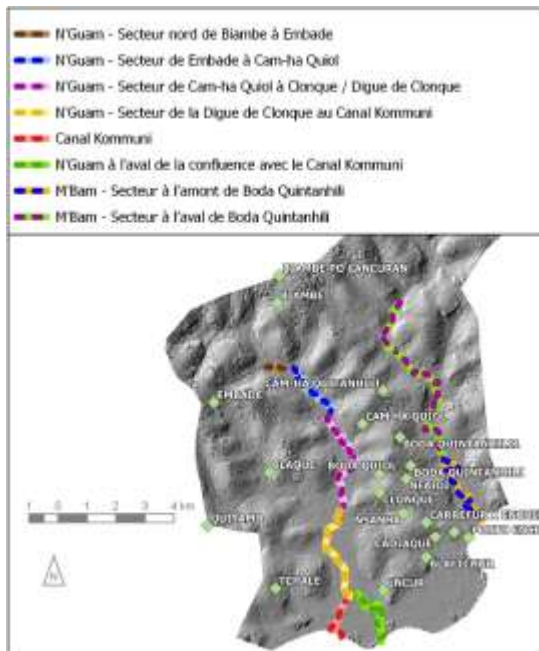


Encheia district along the Mansoa sea-branch
 ~ 25 km north west of Bissau
 ~ 100 kilometers far from the main coast

Work Process and followed approach

- The working team has been built to achieve the aims of the project taking in account three main items:
 - The socio economic context of the rural areas of the country
 - The complex hydrological framework of the concerned area
 - The actual availability of technological means for the construction of infrastructures by local companies

- The workflow has been developed planning three phases:
 1. General context of the catchment
 2. Preliminary Design
 3. Executive Design



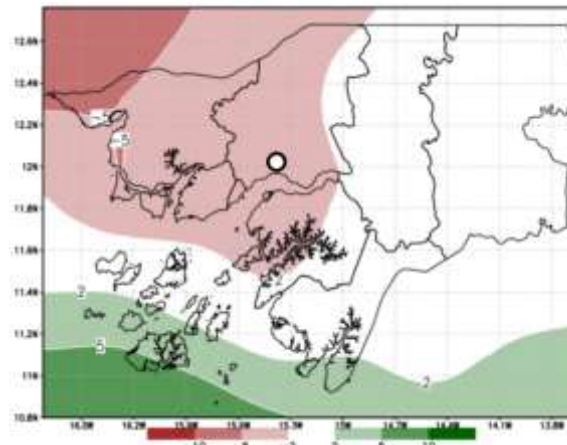
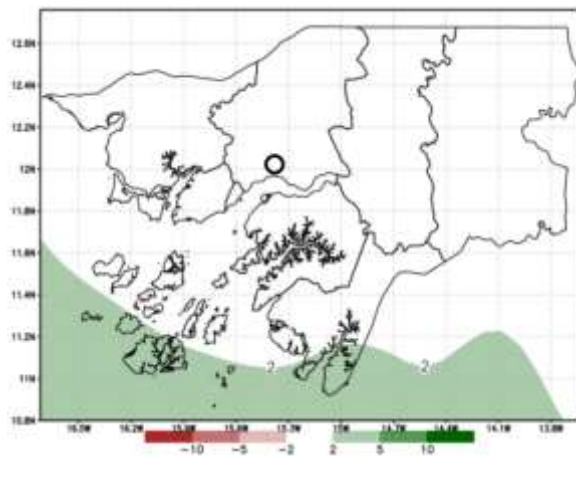
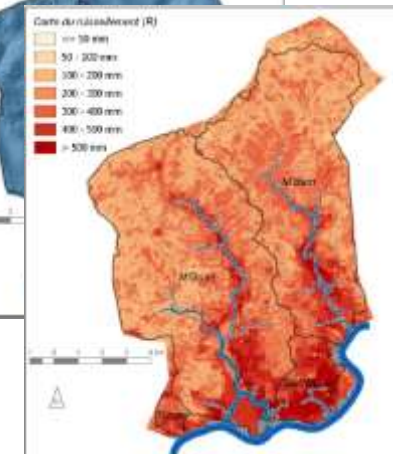
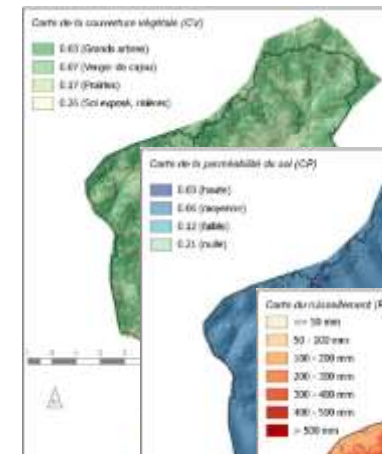
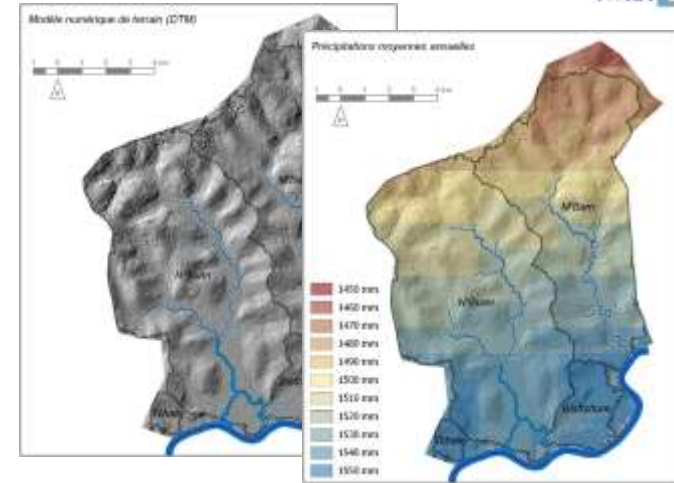
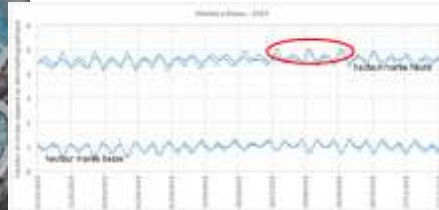
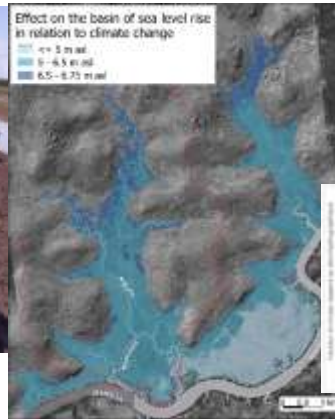
- Finally, the developed workflow model will be kept by the governmental agency of Guinea Bissau to the next projects of paddy fields rehabilitation and remediation.

The following technical activities has been carried out:

- Data research
- DTM acquisition
- Field survey
- Hydrological study
- Climate change impact evaluation

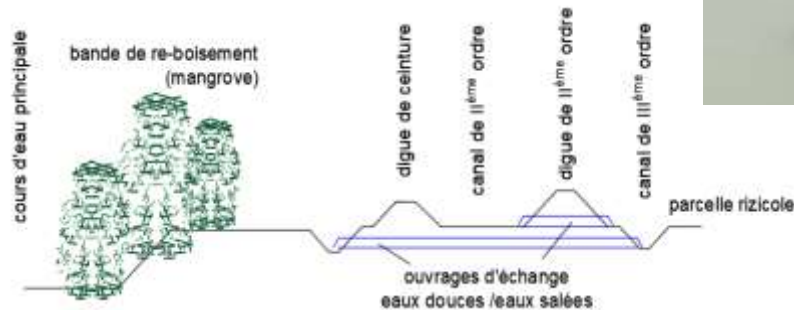
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		[mm/an]	éc. type	[°C]	éc. type
Bissau	GB 1981-2018	3556,5	63,3	27,2	0,1
	WC 1971-2000	1083,0		27,0	
Mansa	GB 1981-2018	1504,2	32,4	-	-
	WC 1971-2000	1560,0		26,8	
Bissau	GB 1981-2018	1347,4	41,8	-	-
	WC 1971-2000	1431,0		26,5	
Catio	GB 1981-2018	1805,6	252,2	-	-
	WC 1971-2000	2310,0		27,4	
Bolama	GB 1981-2018	1037,6	13,8	26,9	0,15
	WC 1971-2000	1010,0		26,5	

Approach for Preliminary Design



The Preliminary Design allowed to define the actions useful to move to the Final Design and to the construction of the main infrastructures. A work program made of two successive phases was settled:

- Phase 1: the works will be realized directly by the producers who are able to conduct the earth works mobilizing several teams of specialized workers:
 - Rehabilitation of the belt dam
 - Rehabilitation of the existing hydraulic works
 - Maintenance of the secondary channels
 - Mangrove reforestation



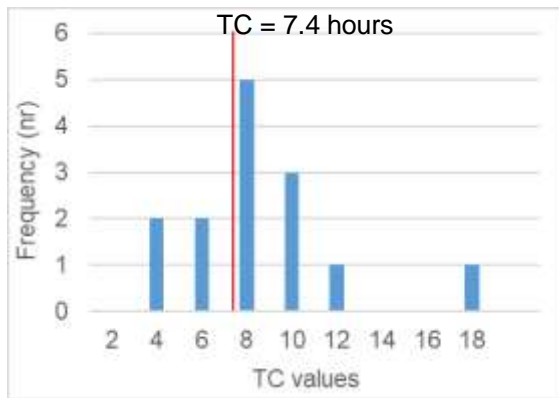
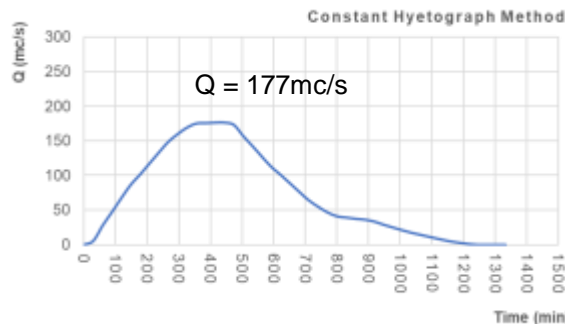
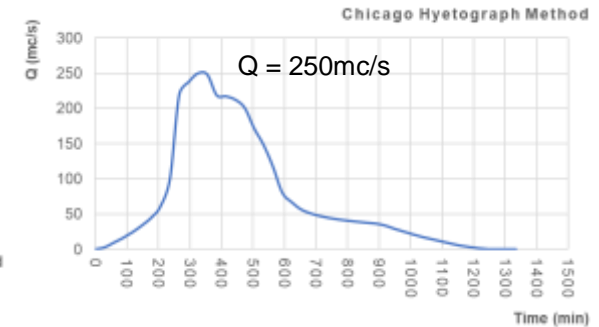
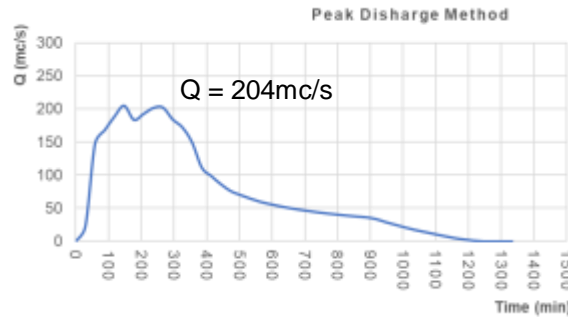
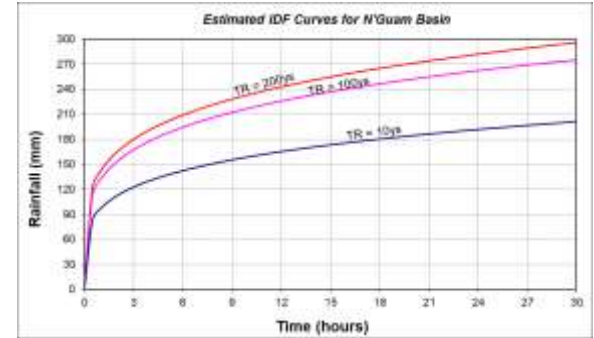
- Phase 2 concerning the final design of the main infrastructures and namely:
 - The Clonque dam
 - The Final Design has been accomplished in September 2020 and the works are in progress.
 - The hydraulic knot of Kommuni
 - The Final Design is underway and the work will begin in 2022.



The hydrological settlement of the basin has been made evaluating the following key factors:

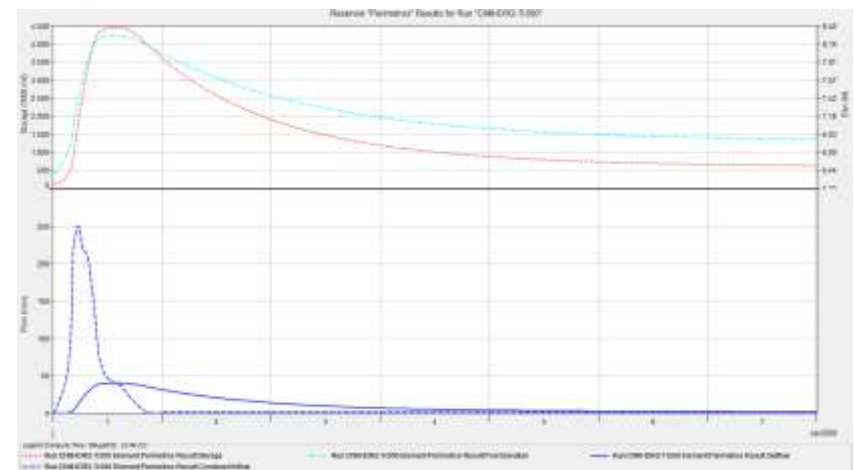
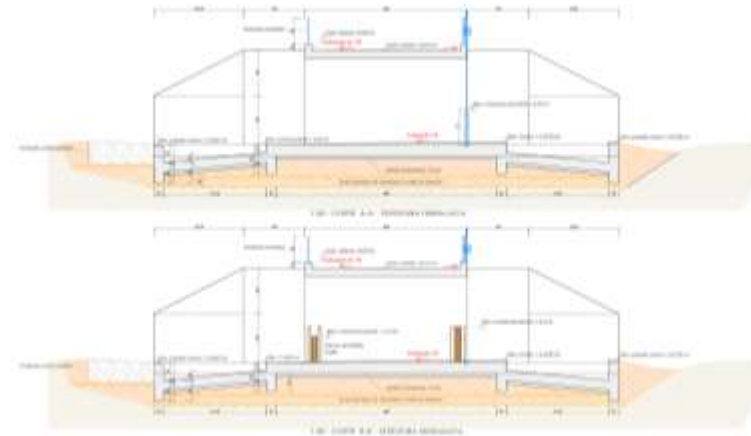
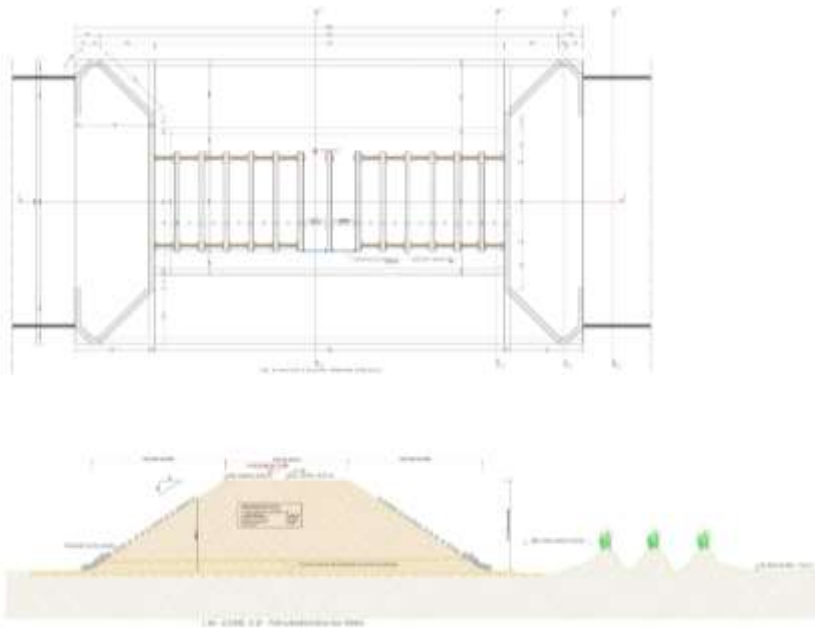
- IDF curve (Intensity-Duration-Frequency)
- Basic parameters of the drainage basin
- Time of concentration
- Flood Hydrograph of the basin and excess rainfall

Clonque-Claque Section	River bed	Basin Axis	Basin
Length (m)	8'909.0	13'183.5	3.9
Slope (%)	0.7	1.2	4.3
Max Elevation (m asl)	8.6	43.1	52.1
Min Elevation (m asl)	5.5	5.5	5.5
Avg. Elevation (m asl)	6.6	9.4	21.6
Surface (km ²)	-	-	32.6



The main infrastructure designed in this phase is the earth dam of Clonque-Claque which works also as a road link between the villages.

- It is equipped with a concrete hydraulic gate which allows to manage both the upstream and downstream flows.



From a technical point of view:

- The designed infrastructure allows to manage all the conditions simulated
- Having known all the hydraulic parameters, the structural and geotechnical calculation of the works was then carried out with FEM software according to the current Eurocode.

- *This is a real case of design and execution of hydraulic works designed with the aim of providing technologically modern tools that allow their sustainability in both the short and the long terms:*
 - *in the short term, the typology of the works allows their operative and their maintenance according to the technological constraints of a developing country as Guinea Bissau;*
 - *in the long term, the works sizing was verified considering the effects of current and future climate changes.*
- *One of the most purposes of the project was to transfer the workflow and the method to the local stakeholders:*
 - *After two years of work, the main difficulty stand still on the transfer of the technological knowhow for the design phases above all regarding the local fellows and engineers formation on the use of computer knowledge and tools for engineering, hydrological and hydraulic analysis.*
 - *In the other hands the construction solutions proposed by the final design seem to fit the technological level of the local building companies called to realize the hydraulic and civil infrastructures.*
 - *The costs of the infrastructure are also well equilibrated in relation to the socio-economic framework in which the works have to be realize.*



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Thank you for your attention.

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