ENVIRONNEMENTAL AND SOCIAL ASPECTS OF THE LOM PANGAR RESERVOIR FILLING PROGRAM

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ABSTRACT

The Lom Pangar dam, owned by EDC, is currently being built on the upper Sanaga River basin in Cameroon and should be completed in August 2016. Its reservoir capacity will be 6 billion cubic meters and the lake surface will be 540 km^2. It is located in a remote and sparsely populated area covered by rain forest and savanna with a rich and endangered wildlife. The project has been developed according to the World Bank policies.

The paper describes the different E&S management plans developed and reports some information on the first partial filling that happened in September 2015.

1. INTRODUCTION

In addition to the Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) of the Project, six specific management plans have been prepared: the Wildlife Management Plan, the Logging Management plan, the Local Communities Management Plan, the Fishery Management Plan, the Water Quality Management Plan and the Floating logs Management Plan. Each one describes the measures to implement during both the first reservoir filling and also before each annual reservoir filling to mitigate impacts on the environment, local communities and their activities. Each management plan includes the following information: the context and issues, the description of the measures to implement, the stakeholders identification, the needed material listing, the missions content details and the cost estimations. For all measures described in the different management plans, EDC responsibilities are both to mobilise human and financial resources, to implement them and also to control their effective implementation and monitoring.

2. WILDLIFE MANAGEMENT PLAN

2.1 Context and issues

The issues described target the potential impacts on the different species regarding their escape capabilities. Regarding the large primates (gorillas and chimpanzees), the water filling could trap them on islands or push them to populated areas. It could also increase the threat of poaching during their move away from the flooded areas. About the other species, the ones rapid enough to escape would colonise other ecological niches if the hosting capacity allows for it, or will compete with the present species until the biocenosis balance. The threat of poaching will increase during the individuals' escape. The slowest species will have a high drowning risk and some reclaiming measures cannot be feasible everywhere. Issues on fish species are covered in the water quality management plan.

2.2 Measures to implement

Five measures to implement are described in the Wildlife Management Plan.

- Eco-rangers patrols strengthening

The management plan identified that forty nine eco-rangers were mobilized in the park and in the forest. They were spread in six fixed points; two additional fixed points were not functional and two others were

not yet built. The eco-rangers were guarding from the fixed points and patrolling in the forest. Generally, the eco-rangers level of training was insufficient considering the issues. Poaching signs were regularly identified in the area and poachers were successful in avoiding the control points. Very few NGOs potentially active on forest protection strengthening were present in the area. The measure of strengthening the eco-rangers patrols aims to control poaching around the reservoir during the preparatory logging phase before the filling and also during the partial and full filling phases. This has been considered possible by improving the training level of the eco-rangers and also by mobilising, organizing and strategically localising the eco-rangers on high-risk sites during the fillings. The four planned training sessions were performed by the Deng Deng National Park (DDNP). During the first filling, the eco-rangers repartition was strengthened on some hotspots detailed on the map below. Eco-rangers' mobilisation was supervised by the DDNP.

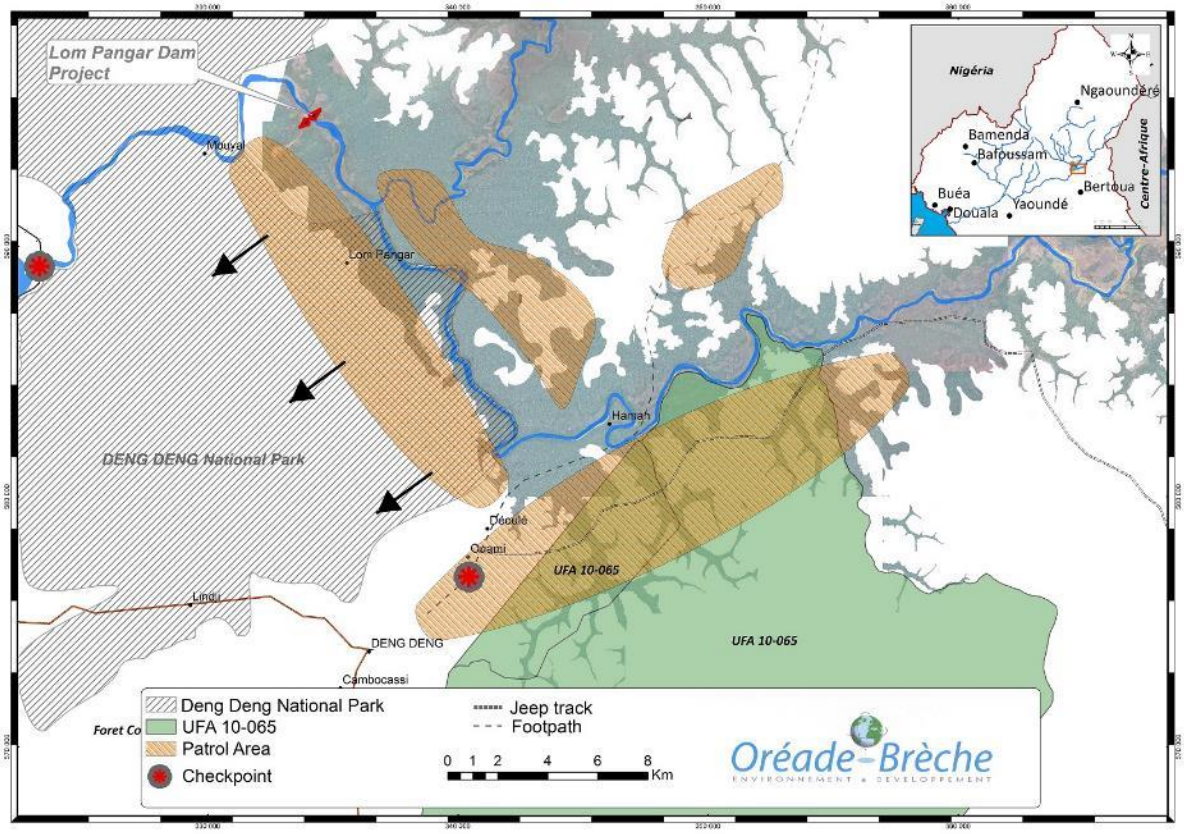

Figure 1. Control hotspots map for eco-rangers repartition during reservoir filling periods

- Futures island and flooded zones inspection

It was planned to log some forest zones located in the future reservoir. To assess high value woods trees, some forest paths were opened in the forest. This prospection has been an opportunity to also assess protected species' prints and especially large primates' ones. With the reservoir filling process, some islands will be formed and could disappear: these islands could be potential wildlife traps. This inspection measure aims to better evaluate issues related to species and especially protected species to better adjust the Wildlife Management Plan. Surfaces of the temporary and permanent future islands were determined and located. A prints' assessment and an analysis of the future island zones characterisation to evaluate their hosting potential for these protected species were done. Four hotspots island sites presented a very high gorilla presence probability.

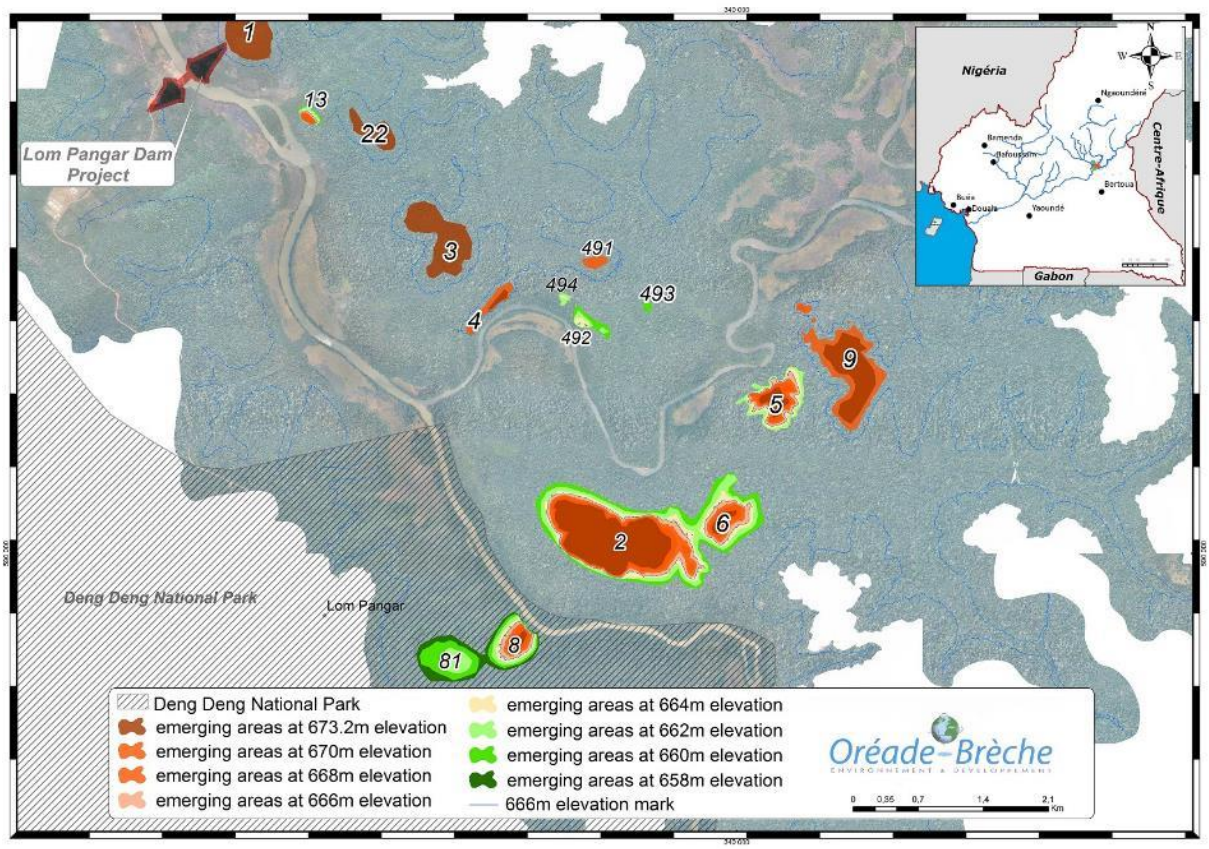

Figure 2. Creation of islands between the levels 650m and 673.2m

- Rescue missions

The wildlife management plan anticipated some rescue missions if the inspection measure described above concluded on their relevance. Some punctual missions have been implemented during the filling in order to rescue some animals trapped on the islands.

Figure 3. View of islands at the level 665 m

- Battues on all the area

The plan considered also the organisation of battues on all the area before the filling to push some slow species to start to escape before the water would come.

2.3 Means identifications, costing and planning

The human means identified includes 49 eco-rangers to mobilize and train, a 5-specialist team in charge of the eco-rangers training and management (identified) and 2 prospection teams of 8 persons managed by an ecologist.

The material listing of every stakeholders involved is detailed and described in the wildlife management plan. The costing of these human and material needs is set. Some management rules are also precisely described for these stakeholders for the periods before and during the fillings. And finally the operational schedules for the different phases are also detailed and set the timing of the different activities to implement.

3. LOGGING MANAGEMENT PLAN

3.1 Context and issues

The issues targeted the impacts on the wood resources: the area was resourced in high value wood trees that would have been a real added value loss for the Cameroonian forest wood value chain. Several risks were highlighted: a wood resource degradation risk, an illegal logging development risk and an informal value chains feeding risk. About the environment impacts, logging contributes to water quality degradation in the reservoir and also downstream and contributes to wildlife remoteness. Additionally, logging has impacts on economic value chains like fisheries activities disturbance in the reservoir, and also dysfunction risk on hydromechanic structures.

3.2 Measures to implement

Three measures to implement were described in the Logging Management Plan.

- Timber logging and clearcutting

It was estimated that around one million cubic meters of trading high value timber were present in the future reservoir. Six potential logging areas of 32 000 ha surface were identified. To prevent impacts on forest resources, the project included trading timber logging in the most interesting areas and forest biomasses removal. These measures aim to (i) keep the trading wood resource localised in the reservoir below the rating 674.5 NGC, (ii) secure dam hydroelectric equipment, (iii) contribute against water quality anti-degradation in the reservoir, and to (iv) facilitate fisheries development in the reservoir. The timber logging happened in the three richest zones of the reservoir: in two of them, it was done by a contractor selected by tender and implementing FSC standards, and in the third one which is a community forest, different companies were in charge of all technical, administrative and legal requirements of these logging activities. Logging wastes evacuation was identified as essential to prevent massive floating logs arriving at the dam level during the beginning of the filling stage.

To remove the biomasses upstream of the dam, three lots of 620 ha were attributed by tender to three companies who are in charge of technical, administrative and legal requirements linked to these biomasses removal activities.

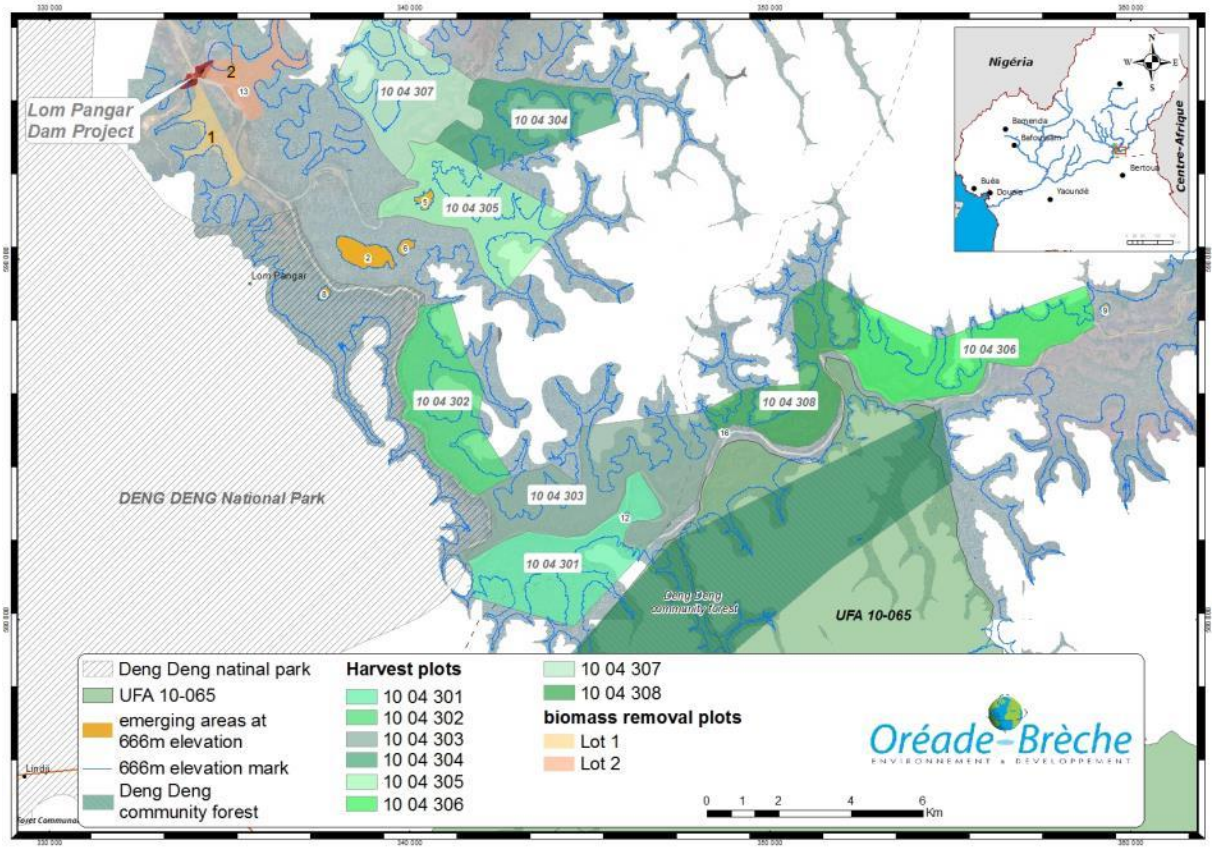

Figure 4. View on the main harvesting areas at the level 666 m

Figure 5. View of clearcutting operations

Figure 6. View of wood harvesting activities

- Prevent and control risks of poaching and illegal logging linked to forest paths opening

Two approaches were considered as measures: (i) implement FSC standards and (ii) operate the logging and biomasses removal monitoring management by a contractor in accordance with ESMP requirements.

- Protecting the logging companies working in the reservoir area

These measures were implemented by (i) informing in advance the loggers about the filling dates, and (ii) implementing the reservoir limits on field.

3.3 Means identifications, costing and planning

The human means were identified as five logging companies and one implementation contractor. They were all operational on the ground.

The material means listing needed for this logging management plan implementation is detailed and described for the different companies regarding their tasks and duties. The costing of these human and material needs is set in the companies' services contracts. Some management rules are also precisely described for these companies for the periods before and during the fillings. And finally the operational schedules for the different phases are also detailed and set the timing of the different activities to implement.

4. LOCAL COMMUNITIES MANAGEMENT PLAN

4.1 Context and issues

It was estimated that the rising water level in the reservoir would increase quite fast at the beginning and would decrease along the reservoir filling process.

The management plan issues targeted the main risks on the security of local communities. It was identified a risk of total or partial flood of areas valued by local communities (zones used for agricultural fields, flood retreat cultivation, harvest, hunting, mining, logging…) and risks of water encirclement and/or drowning of people located below the Maximum Water Level (MWL). Sudden water rising could also cause accidents for fishermen.

4.2 Measures to implement

Five measures to implement were described in the Local Communities Management Plan.

- Population assessment, information and awareness raising

It was described that the number of people living in or around the reservoir zone was currently increasing due to the development of activities to come (building, logging, clearcutting…). Local communities and migrants were looking for a job and were settling down to benefit from activities linked to the dam. These measures aimed then to (i) assess the population living in the reservoir below the MWL rating, and to (ii) inform and heighten awareness of the population of the risks on people and goods below the MWL rating during the filling and functioning phases of the reservoir.

The population has been informed by an information campaign through 3-hour daily local radios spots during the month preceding filling processes. During the three first years of dam functioning, 2 radio spots per months will be informing people on different progressing aspects, on risks and potential incidents targeting fishermen, breeders, farmers. Meetings in villages and in migrants' camps have been organized in every village and every camp; these meetings were well planned and well organized to maximize the presence rate and the good understanding of information and also to support the population assessment exercise. Additionally, EDC has set and supported a permanent contacts network with local populations through central and local representations. EDC has put information signs near villages, migrants' camp, and strategic locations to inform on dam construction, filling, dates, security measures…Boat patrols along Lom and Pangar riversides were done during the week before the different filling phases to check that living installation along the rivers were not in activity anymore. At filling periods, five alarms were set off before the filling and rang daily during the last 3 days.

- Physical signing of MWL rating

This measure to physically mark the MWL rating with coloured stakes aimed to materialise the MWL on the ground so as the population could easily spot the potential flooded zones where some accident risks exists.

- Gold-washers management

These measures aimed to check that gold miners effectively demobilized their material and left the zone before the first filling. The active gold-washers were assessed through available registration at the Ministry of mines and through boat patrols. Radio spots, information signs and boat patrols were addressed specifically to them.

4.3 Means identifications, costing and planning

The human and material means for the local populations' assessment, information and awareness heightening were identified and are detailed. Their costing is set in EDC's staff and in the companies' services contracts. Some management rules are also precisely described for the periods before and during the fillings. And finally the operational schedules for the different phases are also detailed and set the timing of the different activities to implement.

5. WATER QUALITY MANAGEMENT PLAN

5.1 Context and issues

The water quality of the reservoir is a critical issue. For reservoir located in tropical region where the biomass is basically let in place, a severe degradation on the water quality is expected. Due to the degradation of the biomass under anaerobic conditions, the water will become anoxic except in surface water.

5.2 Measures to implement

The main structural component of this plan is a reoxygenation sill to be built across the river 1 km downstream the dam. It is a stepped rockfill dam, 160 m long and 6 m high. It has been designed to guaranty 6 mg/l of oxygen in the range of discharge 0 to 100 m^3, corresponding to the Lom Pangar hydroelectric plant discharges.

The water quality and particularly the oxygen content, upstream and downstream the dam, is monitored on a weekly basis.

The reoxygenation sill will not be in operation during first emptying and drawdown of the partially filled reservoir when the power plant is not still implemented. During the first drawdown, the reoxygenation will be insured by the flow released through the restitution flip bucket, which proved very efficient.

Figure 7 shows the typical cross section of the steeped rockfill sill and figure 8 shows the hydraulic model tested in Liège University, in Belgium.

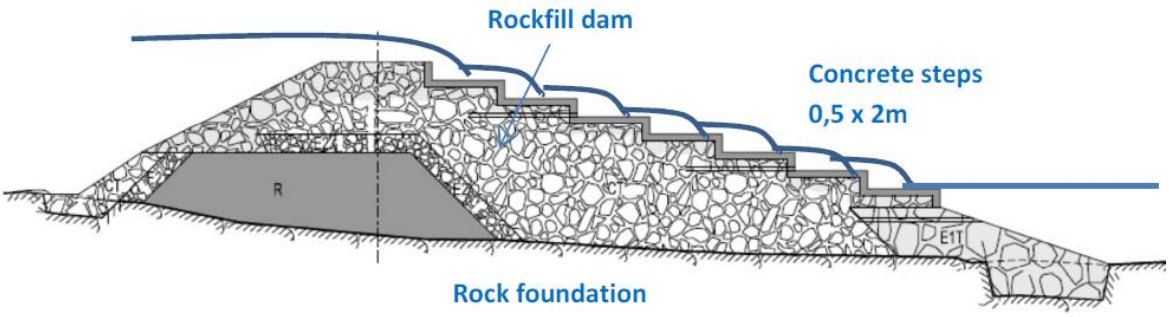

Figure 7. Reoxygenation sill profile

Figure 8. Hydraulic modelisation on the reoxygenation sill (Q = 50 m^3/s)

5.3 Means identifications, costing and planning

The reoxygenation sill has been design by Engineer in charge of the supervision of the dam construction. The cost of the reoxygenation sill is around 0,5% of the cost of the dam. The sill will be built from March to July 2016 during the first complete filling of the reservoir.

6. FLOATING LOGS MANAGEMENT PLAN

6.1 Context and issues

The wood harvesting activities and the removal of the biomass have been completed just in time before the closure on the dam and reservoir first filling. A huge quantity of logs and branches are still in the reservoir, as can be seen in Figure 9.

A risk of uncontrolled inflow of huge quantities of floating logs and debris during first filling and drawdown has been identified.

Figure 9. Floating logs on the reservoir at the level 665 m

6.2 Measures to implement

Two main measures were implemented:

- Removing of the floating debris and logs

EDC made an agreement with the National Navy to provide two 400 horsepower speedboats to remove logs and debris approaching the dam and remove a part of the logs floating on the reservoir.

- Installing a temporary boom to protect the restitution outlet during the first drawdown of the reservoir.

The first filling has been achieved in the beginning of December 2015. There were moderate quantities of logs and debris coming to the dam and the removal by boat proved its efficiency. The first drawdown is identified to be more critical because there will be a flow from the lake towards the dam during this period. The temporary boom is to be installed at the beginning of the first drawdown to mitigate this risk.

6.3 Means identifications, costing and planning

The cost of removing the debris by speedboats is high because of mobilisation of high-tech boats, highly qualified staff and high consumption of fuel. By the way, EDC decided to have a permanent surveillance of the 540 km^2 reservoir by the Navy. The cost of the temporary boom is marginal.

Figure 10. The speedboats removing the logs and debris

7. CONCLUSIONS

The lessons learnt from the first partial reservoir filling that happened in September 2015 could be summarized in the following main conclusions:

- The measures to implement described in the different management plans were successful. First, they prevented, solved and improved situations that were identified as risks and really happened. Also, they were detailed enough to prevent and reduce as efficiently as possible the social and environmental impacts of this filling process.
- The Environmental and Social Management Planning is crucial and its implementation is long. It is essential that these tasks have at least one year to be realised. This process needs time to mature the situation, measure the risks, coordinate with the construction, identify human and financial needs, respect legal aspects, hire often by tendering some contractors, timeframe all the measures and coordinate them, etc.
- The last two weeks before the reservoir filling start are a period when lots of actions happen in the same area. Lots of people are mobilized and concentred in the reservoir to perform technical work on the dam structure, to patrol to check that the population left the area, to beat to push wildlife to escape, to active the alarm system, etc. This period could be a success only if it has been very well prepared, planned and organized. The coordination of these different work planning is a crucial task to be efficient and successful.

8. RÉFÉRENCES

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9. THE AUTHORS

Jean-Paul Grandjean is Director of Oréade Brèche, a French consultancy specializing in environment and rural development. He acquired a wide experience of EIAs for large infrastructure projects in various regions of the world. He is currently in charge of the ESMP implementation supervision of Lom Pangar dam construction works for the joint-venture Coyne et Bellier/ ISL.

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