

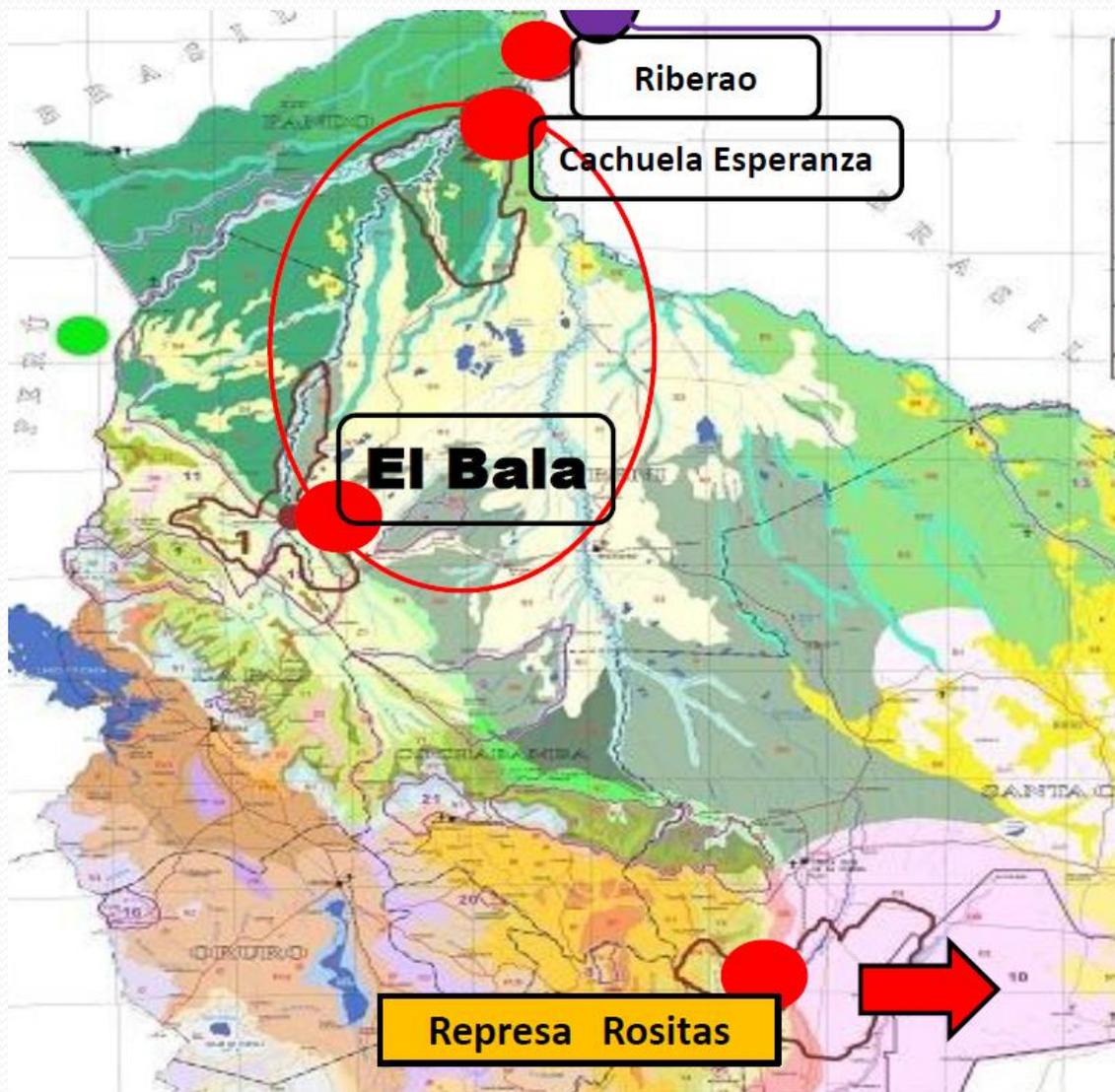


# Hydropower projects in the Bolivian Amazon: an update

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# Main hydropower projects of the Bolivian Amazon



- Riberao (3000 MW, Madeira river)
- Cachuela Esperanza (1000 MW, Beni river)
- Chepete-Bala (3700 MW, upper Beni river)
- Rositas (600 MW, Grande River)

Energy of these projects to be exported to Brazil. Current Bolivian installed capacity: 2500 MW (75% gas turbines)

Source: Ribera, 2015



Source: Furnas-Odebrecht

**Ribeirao Binacional (RB)** and **Cachuela Esperanza (CE)** are the upstream components of the **Madeira hydropower complex (Brazil)**

Jirau (3750 MW) and Santo Antonio (3550 MW) are operating.

A prefeasibility study of RB and CE is underway, sponsored by the CAF and BID banks, and ENDE and ELETROBRAS public companies. It is about to end this year.



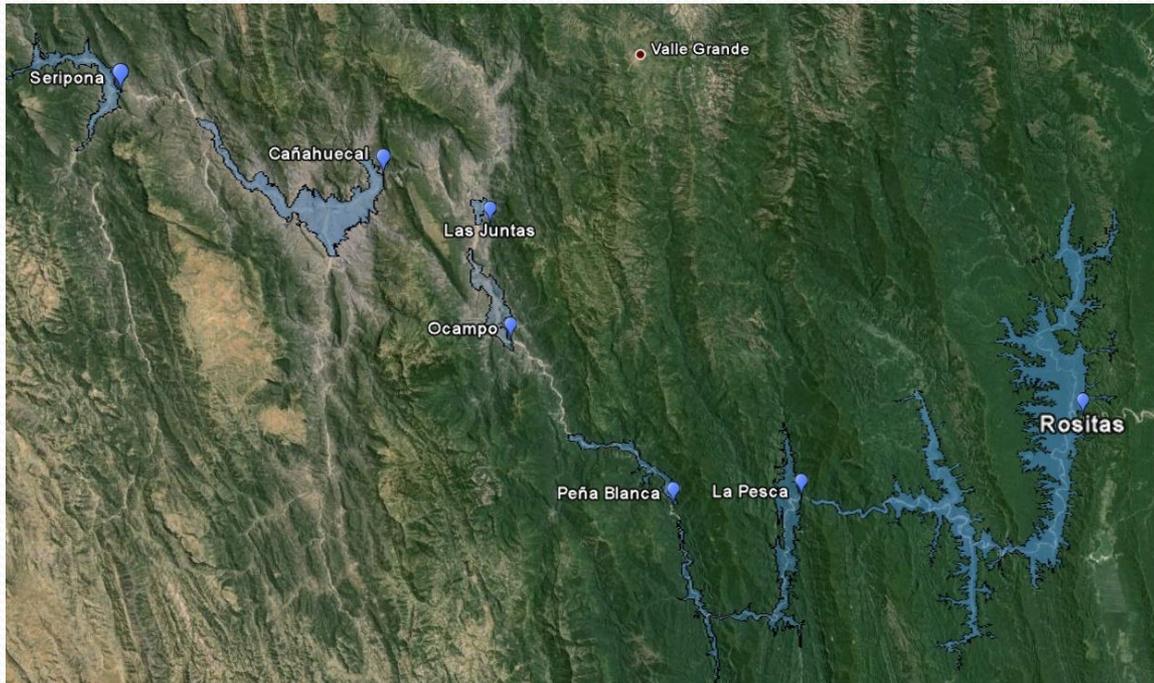
Aim of the recent study (Worley Parsons, Australia): “To support development and energy integration of Bolivia and Brazil by evaluating hydropower potential of the shared Madeira River basin”.

It is very likely that the study will discard the CE project as unfeasible and will recommend the Riberao one. **No data** has been made public about this study, in spite of the binding commitments to transparency of the CAF and BID banks and the continuous requests for information of local organizations in both countries.

Bolivian local communities have asked the Universidad Mayor de San Andres (UMSA) for help to provide them with information and analysis of the studies.

*The Jirau and Santo Antonio dams have already impacted negatively hydrosystems and people. Nobody in Bolivia has received compensation nor any mitigation measure is underway.*

# Rositas



It is the biggest dam of the Grande River complex (8 projected dams). It is a multipurpose project: Hydropower and irrigation.

Suspended **sediment** concentrations (SSC) in the Grande River are the highest recorded in the Bolivian Amazon (mean SSC=13 g/l,  $Q_s=187$  mill.ton/y, Vauchel et al. 2017). The Rositas studies suggest that the project is feasible only if upstream dams are built in order to retain sediments and extend the life of the Rositas reservoir.

# Rositas

In 2016 the Bolivian Government signed a contract with a Chinese company to build Rositas dam without having a final design nor an environmental impact assessment study (EIA)

HASTA QUE HAYA MAYOR "CONCIENCIA SOCIAL"

**Gobierno decide postergar la hidroeléctrica Rositas**

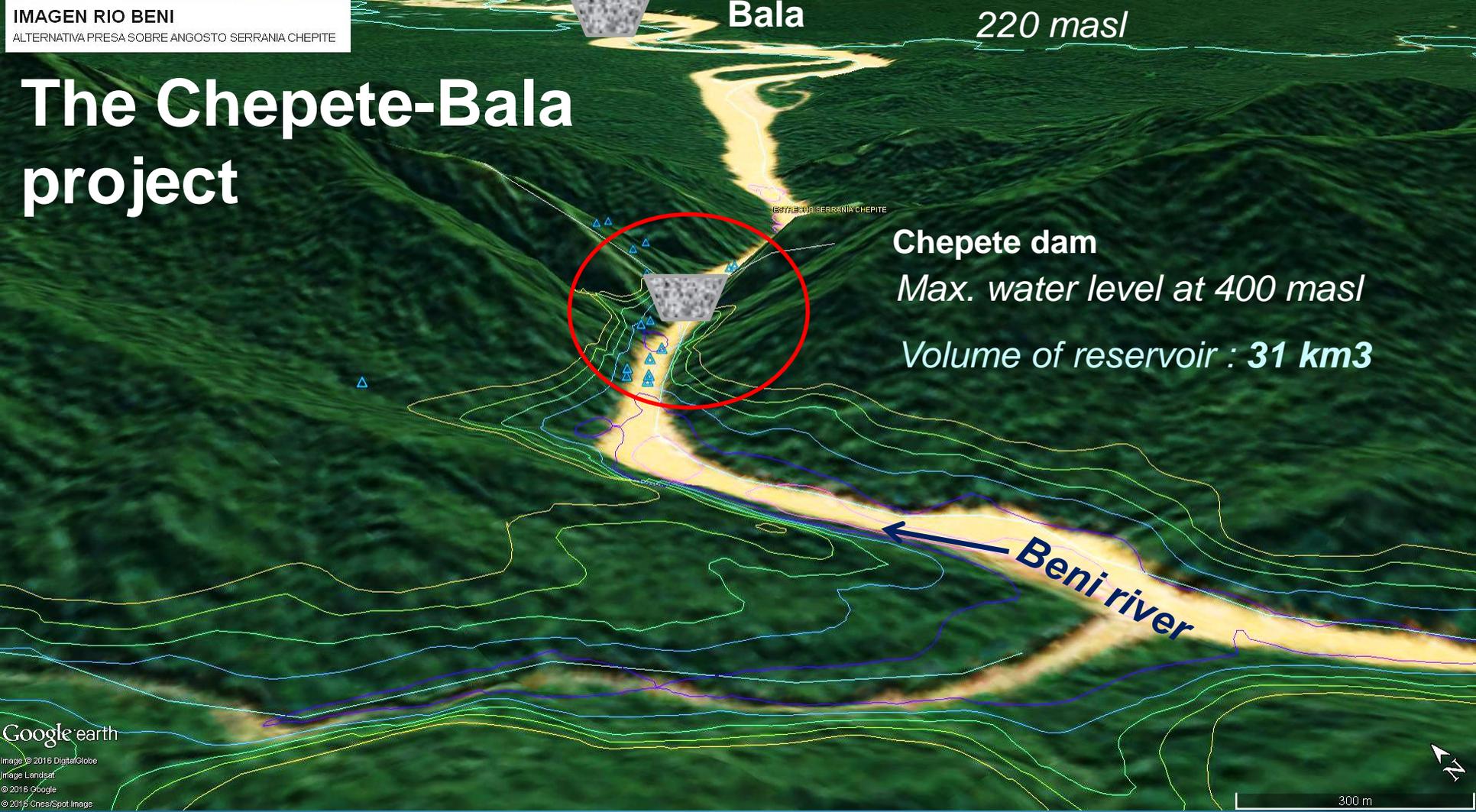
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In 2019 the Bolivian government halted the process, blaming local communities (as opposed to the project) for that. The EIA was also suspended.

The likely reason behind the halt/delay is the unfeasibility of Rositas, given his short reservoir life and high generation costs.

# The Chepete-Bala project



Fuente: Geodata Engineering, 2016

# **Analysis of the Identification Studies (IS)**

The Chepete-Bala project is at the final design stage, following a previous “Identification Study (IS, prefeasibility)” carried out by Geodata Engineering (Italy).

UMSA authorities signed an agreement with representatives of indigenous communities to be affected by the Chepete-Bala project, in order to produce a comprehensive and multidisciplinary analysis of the project and its impacts. The analysis is based on the IS, which was made available in 2017.

UMSA is committed to provide information, make it public and start a national discussion on the project.

Only some results of the analysis of the Chepete project will be shown here as the Bala dam is not feasible “by now”, according to the consultants.

# Chepete 400 project

Power house		CHEPETE 1	CHEPETE 2
Installed capacity	(MW)	1625	1625
Design discharge	(m <sup>3</sup> /s)	1325 regulated	1325 floods
Energy generation (GWh/y)		13352	2118
Plant capacity factor	(Eu/Ed)	92%	<b>15%</b>
Estimated construction time (years)		6	6
Energy users		Brazil	Bolivia
<b>Total installed capacity</b>		<b>3251 MW</b>	
<b>Total energy generation</b>		<b>15470 GWh/y</b>	

Source: Geodata Engineering, 2016

With such a low plant factor, the feasibility of Chepete 2 is dubious. It should have been evaluated separately.

# Sediments... again

The Beni River at Rurrenabaque provides nearly 20% of the Amazon sediment load, from a basin area 1% of the Amazon

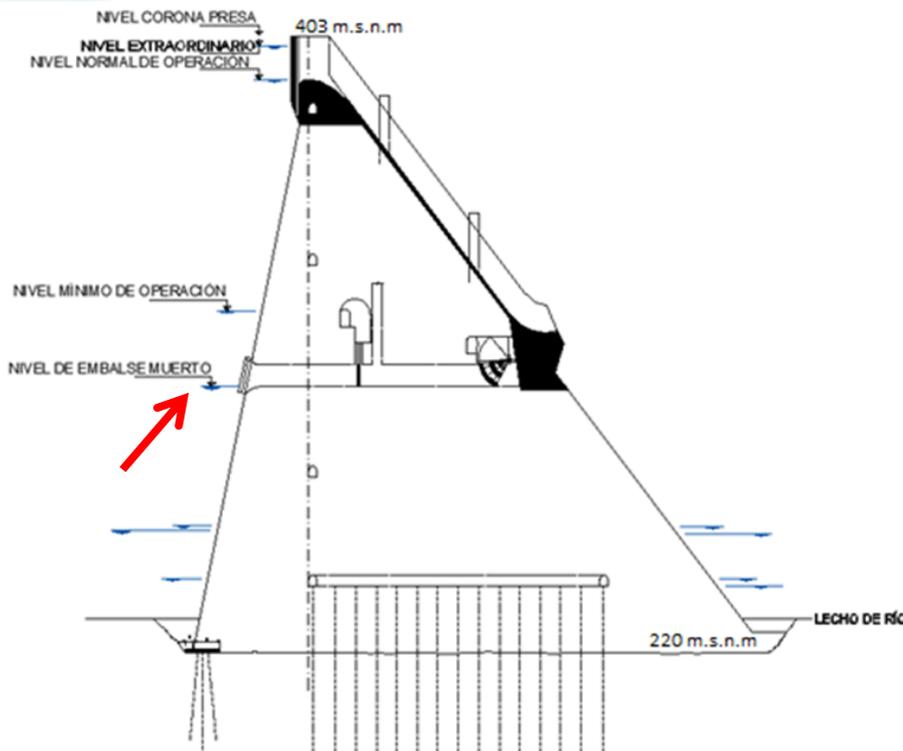


Figura 19. Esquema corte transversal de la presa Chepete

Chepete sediment deposition and water intakes (Geodata 2016)

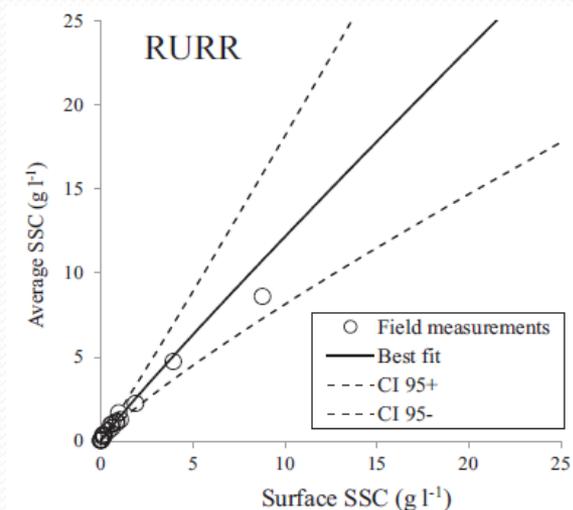
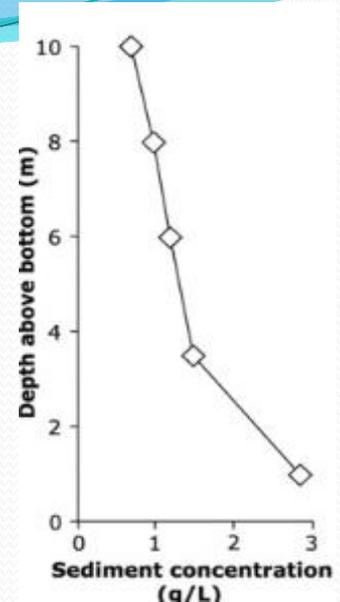
Cota (msnm)	Area (km2)	Volumen almacenado (Km3)	Observaciones
250.00	0	0.00	
298.85	100	2.16	Nivel muerto
321.00	195	5.53	Nivel mínimo operación
350.00	338	13.00	Nivel operación estiaje
390.00	595	31.43	Nivel normal de operación
400.00	680	37.78	Nivel máximo extraordinario

Sediment would occupy 2,16 km<sup>3</sup> (dead storage) in 50 years (project economic life), according to the Hydrology studies included in the IS. This corresponds to the 298,85 m elevation. Water intakes were located at that level.

## But...

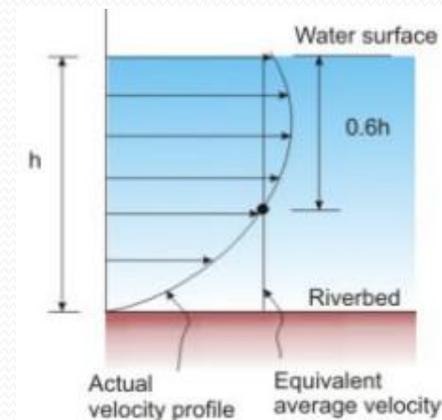
- Later in the IS study (Executive Summary, vol. 6.1), it is established that sediments would occupy 3 to 4 km<sup>3</sup> in 50 years. This should have forced to redesign the dam and the water intakes in order to avoid the sediment blocking the intakes quite before the 50 years life span. It did not occur.
- The 3-4 km<sup>3</sup> dead storage is based on a 90-110 mill. ton/y total load (SS and bed load), estimated at Chepete. HYBAM estimates of SS load at the Rurrenabaque/Bala site is in the range of 192 (Vauchel et al. 2017) to 212 mill. ton/y (Guyot 1993). The smaller basin area (-20%) at Chepete could explain part of the difference, but some consultants' assumptions make the bulk of those differences...

- a) The consultants assimilated the vertical sediment concentration profiles to the vertical velocity profiles in order to calculate average cross section suspended sediment concentrations.
- b) According to that assumption, consultants multiplied surface sediment concentrations samples by an averaged factor of 0.85 to get average cross section ones.



Armijos et al. (2013)  
 factor for fine  
 suspended sediments  
 in the Amazon=1.17

Vauchel et al. 2017



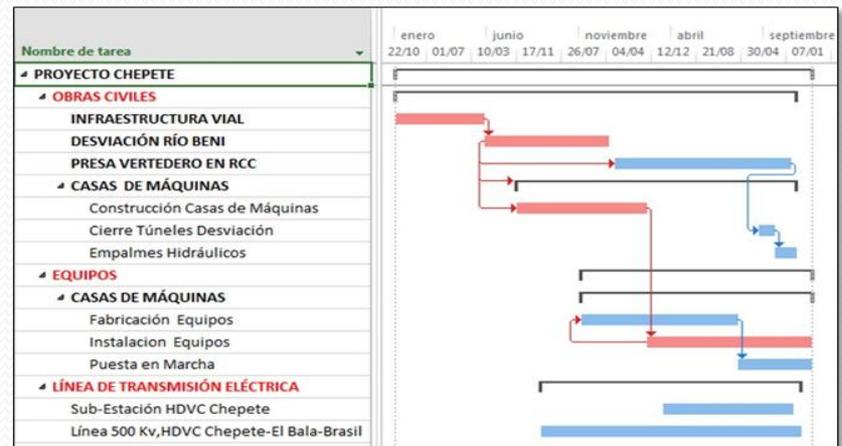
*The final Chepete-Bala studies, expected to be finished at the beginning of 2018, are currently the object of a lawsuit between the consultants (Geodata Engineering) and the Bolivian government (ENDE)*

# Construction schedule and costs

An optimistic construction schedule of 6 years was estimated for Chepete, based on comparisons with hydropower projects like Jirau, Santo Antonio and Hidroituango.

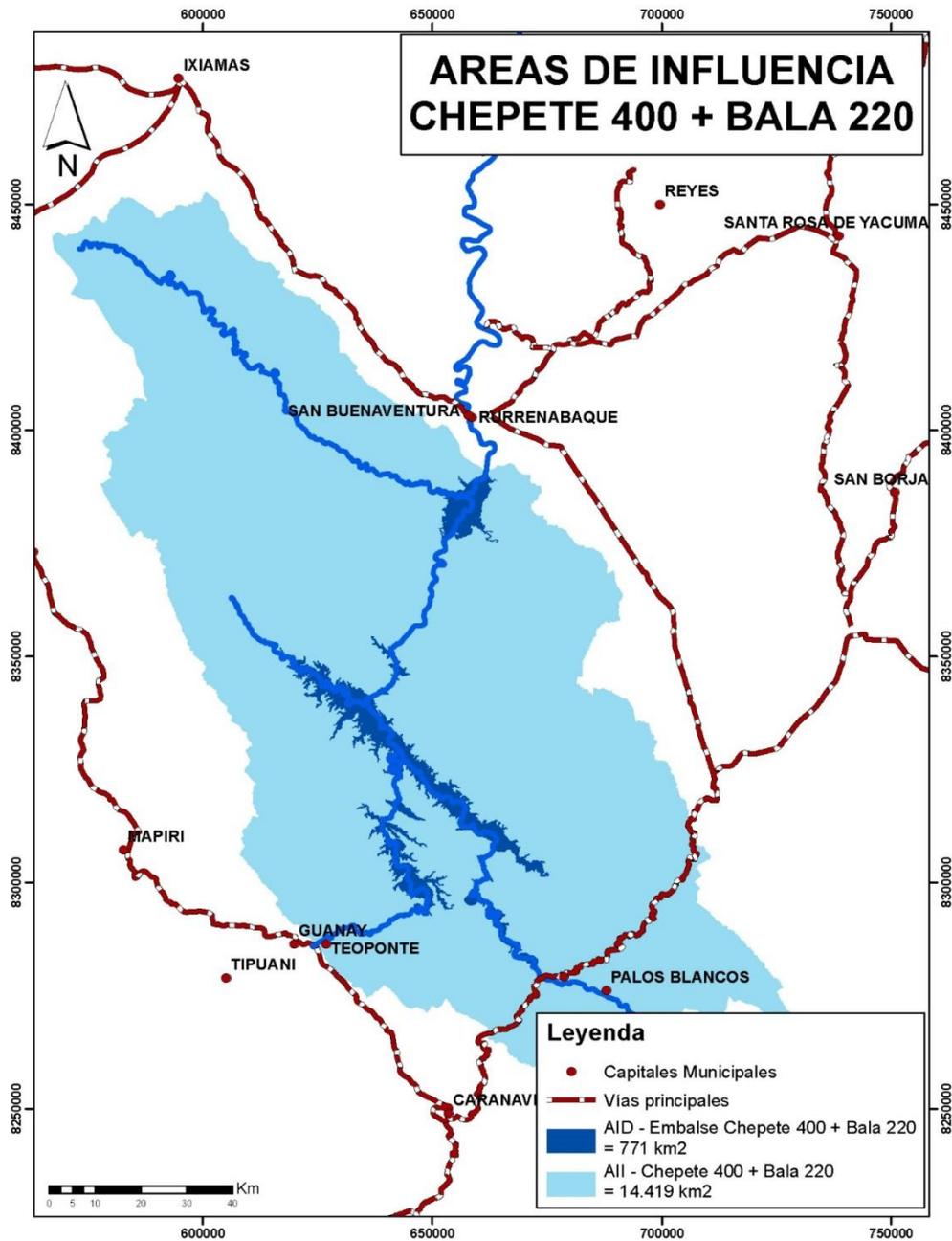
The tight schedule assumes that the access road (new, 150 km long, crossing a very rough terrain) is to be concluded in 20 months. The road is the schedule *critical path*. It departs of a 180 km road (Santa Barbara-Quiquibey, built on an existent one) that is under construction for 10 years and still it is not concluded.

As the investment (> 6000 mill. USD for Chepete) is so large, the risks for Bolivia are very high



Construction delays and increasing project costs will affect the project's energy generation costs, which are already estimated at 55 USD/MWh for Chepete, higher than almost all auctioned electricity projects in Brazil.

## AREAS DE INFLUENCIA CHEPETE 400 + BALA 220



## Environmental impact assessment

Definition of area of influence (AI) of the project just ignores the river downstream of the dams (Geodata, 2016).

- Direct AI is limited to the area flooded by the reservoirs, ignoring even the new road to the dams
- Indirect AI does not include the river downstream, nor even the towns of San Buenaventura and Rurrenabaque!
- Social, environmental and decommissioning costs were not evaluated

# Summary

- Chepete 2 should be assessed separately. It is likely unfeasible, but it was useful to show an impressive installed capacity (3250 MW)
- The (sediment calculation) problems detected in the IS study makes Chepete current design technically unfeasible.
- Both the Chepete project costs and time schedule are grossly underestimated.
- Most of the environmental impacts and costs are utterly ignored.
- The errors and loopholes identified in the IS studies strongly favour the econometrics of the project.
- Even if those mistakes are corrected during the Final Design stage, it is unlikely the project to be technically and economically feasible. And the environmental impacts and risks should be very high.

# Some questions

- Dams as sediment trapping facilities?

## *Strategic dam planning*

*“New dams should be located in such a way, that the final dam portfolio minimizes disruption of sediment transport” (Kondolf & Schmitt 2018)*

- Planning?

*How projects are prioritized? How decisions are made? Are alternative options studied?*

- Transparency?

*How to make international banks accountable? To fulfil their own norms? The role of science and academy*

## **Damming the rivers of the Amazon basin**

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The potential impact of new Andean dams on Amazon fluvial ecosystems

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Merci

Thank you

Obrigado    Gracias