

International Bank for Reconstruction and Development  
International Development Association

PROGRESS REPORT  
TO THE BOARD OF EXECUTIVE DIRECTORS  
ON THE IMPLEMENTATION OF THE MANAGEMENT ACTIONS  
IN RESPONSE TO THE

REQUEST FOR INSPECTION OF THE  
  
CHILE  
EMISSIONS REDUCTION PURCHASE AGREEMENT

OFFERED TO COLBÚN FOR THE  
QUILLECO HYDROPOWER PROJECT  
(TRUST FUND NO. TF056272-CL)

April 12, 2011

## EXECUTIVE SUMMARY

i. ***This report is an update on actions undertaken by Management over the past seven months to address concerns from Requesters related to the Emissions Reduction Purchase Agreement (ERPA), signed with Colbún as the operator of the Quilleco Hydropower Project (TF056272-CL), as registered in the Request for Inspection on June 18, 2010 (RQ10/05).*** Requesters have expressed the view that the Quilleco Project is adversely affecting water availability which, in turn, is affecting their agricultural and livestock activities. As explained in the Management Response, dated July 20, 2010, and the Addendum to Management Response, dated August 20, 2010, Management made several commitments related to continuing supervision and undertaking studies to assess these concerns.

ii. ***The Bank agreed to undertake a study to re-examine whether the Quilleco Project has affected the hydrology and hydrogeology in areas surrounding the plant and, on that basis, to assess the impact on local communities*** (in part through a study on livelihoods). The studies, which were conducted by independent local experts and reviewed by Bank specialists, indicate two key conclusions.

A. ***There is no relationship between the construction or operation of the Quilleco plant and either the water flow in the springs or the supply of well water.*** The hydrology/hydrogeology study concludes that the hydrological regime of the springs and the water levels in wells depend on rainwater that recharges the aquifer located approximately 100m in elevation above the floodplain of the Laja River, and not on the Laja River itself. This finding is consistent with the September 1998 EIA and its amendment prepared for the Quilleco Project.

B. ***The studies indicate that the construction and operation of the Quilleco plant have not had any discernable impact on the Community's agricultural and livestock activities.*** The hydrology/hydrogeology study finds that the changes in river morphology of the Laja River, particularly a concentration of water flow in the southern branches of the Laja braided channel system and the reduction of flow in the northern branches, were occurring before the commencement of construction and the operation of the Quilleco plant. With regard to the change in flow levels over the distance of the Quilleco diversion, the livelihood study indicates that no discernable impact on pasture areas or agricultural activities can be attributed to Quilleco.

iii. ***The Bank has continued to supervise the Project and to maintain contact with the Valle del Laja Community,*** including the members that are considered Requesters (as reflected in the Inspection Panel report, paras. 70-73). In particular, a mission visited the site in November 2010 to explain the studies and introduce the consultants who conducted the above referenced studies. Another mission visited on March 29, 2011, to present the results of the studies to the Laja Community. Both studies were sent to the Community on April 11, 2011. The Community took note of the results, and Colbún proposed a joint working group to collaboratively analyze future options and next steps. The Bank also initiated a series of meetings with Colbún and shared good practices on community relations in order to enhance the company's ability to listen to, communicate and interact with the Valle del Laja Community.

iv. The Bank also undertook an analysis to determine the compliance of the Project with OP 4.37, Safety of Dams. A supervision mission by the Bank's dam safety advisor determined that the Bank has satisfied the requirements of OP 4.37: (i) neither Quilleco nor Rucúe have structures that would require actions under OP 4.37, and (ii) the only structure requiring specific dam safety measures is located at the Antuco hydropower plant, and the dam safety measures being implemented by the owner, ENDESA (a Chilean energy company), with respect to the facility have been reviewed and are satisfactory.

v. The Bank will continue to work with Colbún to enhance its communication and outreach to the communities and to assure compliance with the social and environmental considerations of the ERPA.

vi. *As a result of these studies and actions, Management believes that the Bank has made diligent efforts to apply its policies and standards in the context of this Project and that the Requesters' rights or interests have not been adversely affected, nor are they at risk of being adversely affected, by a failure of the Bank to implement its policies and procedures.*

## I. INTRODUCTION

1. ***This report is an update on actions undertaken by Management over the past seven months to address concerns from Requesters related to the Emissions Reduction Purchase Agreement (ERPA) offered to the operator of the Quilleco Hydropower Project (TF056272-CL), as registered in the Request for Inspection on June 18, 2010 (RQ10/05). As explained in the Management Response, dated July 20, 2010, and the Addendum to Management Response, dated August 20, 2010, Management made several commitments:***

A. *Supervision:* “The Bank team will continue to supervise the Project, including evaluating any potential concerns of affected populations.”<sup>1</sup>

B. *Hydrology, Hydrogeology and Livelihood:*

i. The Bank team will “analyze as a first step the impact of the Quilleco diversion on the local hydrology and hydrogeology, and, as a second step, the consequences, if any, on the availability of water to the agricultural and livestock activities of the local population living in the project area. It is anticipated that the primary focus of this review will be to examine existing information (data and baseline studies) that might clarify possible cause-effect relationships...”<sup>2</sup>

ii. The Bank team will, on the basis of the results of the analysis, “explore...follow-up actions.”<sup>3</sup>

C. *Colbún’s Outreach:* “The Bank team will continue to work with Colbún to enhance its outreach to the local population living in the project area to strengthen the ability of all stakeholders in properly identifying, understanding and addressing the impacts of the Quilleco plant.”<sup>4</sup>

D. *Dam Safety:* “Additional due diligence should be carried out with respect to the issue of dam safety regarding the dams located upstream of the Quilleco Project; Bank staff will consult with ENDESA and the responsible Chilean authorities to determine whether appropriate safety measures are in place and implemented at the existing dams in the upper Laja watershed and will follow up with a supervision mission.”<sup>5</sup>

E. *Supply Information:* “The Bank team...will continue to exchange information with the Requesters through the ongoing correspondence between them and Bank staff.”<sup>6</sup>

2. ***Management has been working to implement these actions,*** and updates on the status and results follow in Sections II and III respectively. Section IV concludes the report.

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<sup>1</sup> Management Response, July 20, 2010.

<sup>2</sup> Addendum to Management Response, August 20, 2010.

<sup>3</sup> Addendum to Management Response, August 20, 2010.

<sup>4</sup> Addendum to Management Response.

<sup>5</sup> Management Response.

<sup>6</sup> Management Response.

## II. ACTIONS SINCE MANAGEMENT RESPONSE

3. *Management has undertaken several actions to follow up on commitments made in the Management Response and Addendum.* Specifically, the Bank has continued to supervise the Project and follow up with the Community. Additionally, the Bank commissioned two studies to determine the impact of the Quilleco Project: one on hydrology/hydrogeology; and the other on resulting impacts of these changes, if any, on livelihoods in the Community. The Bank also undertook further evaluations to comply with OP 4.37, Safety of Dams.

### A. SUPERVISION

4. *The team has continued to supervise the Quilleco Project, including evaluating potential concerns of the Valle de Laja Community.* The supervision has included Bank missions to the field and Santiago in November 2010 and March 2011. The November 2010 mission included the task team leader, a communication specialist to assist with enhancing Colbún's local outreach, as well as a social specialist and a water specialist who joined via audio conference. In Santiago, the mission focused on introducing the hydrology/hydrogeology study to be undertaken and discussing Colbún's community outreach and communication. In the field, the mission met with almost 20 members of the Valle del Laja Community to gather more information on their concerns and to explain the hydrology/hydrogeology study the Bank planned to undertake (see Figure 1).

**Figure 1: WB meeting with Laja Community, November 2010**



Photo: World Bank

5. *During the meeting the Community presented its concerns, which were consistent with concerns that the Bank had heard on previous supervision missions* and are also recorded in the 2007 baseline study. The Community indicated that over the last 10 to 15 years it has been

facing water availability issues in wells and springs and changes in the river morphology that involved less water on the northern side of the river. The Community expressed its concern that the water issues have become more serious in the last few years.

6. As a result of the changes in river morphology, Community members indicated that pasture areas have been reduced and they have had to informally rely on a small diversion used for a fish farm to get water from the river. While this diversion is usually reliable because it is an authorized extraction of water from the river, the situation is uncertain, as it depends on the maintenance of the intake and the operation of the fish farm.

7. Another mission to the field was conducted on **March 29, 2011 to share the results of the hydrology/hydrogeology and livelihood studies with the Community (see Section B)**; the mission included representatives from Colbún (see Figure 2). Twenty-one members of the Valle del Laja Community attended the meeting and had the opportunity to discuss the results of the studies with the consultants, and to discuss with Colbún's representatives how to better interact with the company (see Section C for more details).

**Figure 2: WB meeting with Laja Community, March 2011**



Photo: World Bank

## **B. STUDIES**

8. ***The Bank commissioned two studies: a hydrology/hydrogeology study and a livelihood study.*** The purpose of these studies was to determine the impact, if any, of the Quilleco Project on water availability and, in turn, the effect of change in water availability on the livelihood of the Valle del Laja Community.

### **B.1. Hydrology/Hydrogeology**

9. ***In the fall of 2010, the Bank commissioned a study on the impact of Quilleco on hydrology and hydrogeology in the Valle del Laja study area.*** The study has two distinct activities:

- i. to evaluate the impact, if any, of the Quilleco facility (including the diversion) on wells and springs; and

- ii. to evaluate the impact of the Quilleco facility on the availability of other surface water (beyond the springs), notably on the flow in the Laja River.

10. Two technical experts were hired and a Bank water resources management specialist acted as the Bank technical counterpart for the study. The two independent experts are both well known professionals, each with more than fifteen years of experience in hydrology and hydrogeology issues and with a vast knowledge of the Chilean context. In addition to their consulting activities, they both work at a prestigious Chilean university. They have no ties to Colbún. The scope of the study was presented to Colbún and the Community during the November 2010 mission. The study began on November 15, 2010.

11. As part of the study, the consultants interviewed Community members who claimed to have been affected. In order to understand the cause of the complaints, the consultants reviewed existing information and studies and created a geo-referenced database of the Project area in order to develop a conceptual model of the hydrogeological processes in the study area. They also reviewed satellite images of the river basin over the past 25 years in order to determine what changes had occurred in the morphology.

12. A draft was delivered in February 2011, which was then reviewed by Bank staff. The results were shared with Colbún on March 17, 2011, and with the Community on March 29, 2011.

## **B.2. Livelihood Study**

13. *In early 2011, the Bank commissioned a study to examine the impact of the changes in water availability on the livelihood of the Community.* An independent agricultural expert with over ten years of experience in the field was hired to conduct the study and visited the Project area between March 1 and 4, 2011. The study provides an understanding of the sources of water and its uses in the Valle del Laja Community, as well as the productive changes that could be linked with changes in the availability of water, the alterations in river morphology over the last 10 to 15 years, and the reductions of water flow. The Bank team shared the findings of the livelihood study with Colbún and the Community on March 29, 2011.

## **C. STRENGTHENING COLBÚN'S COMMUNICATION AND OUTREACH WITH THE COMMUNITY**

14. *The Bank has worked with Colbún to strengthen its community outreach.* The main objective of the effort by Bank staff has been to enhance Colbún's ability to listen to, communicate and interact with the Valle del Laja Community. With the active engagement of a communication specialist, the Bank has also provided advice on good practices in community dialogue and productive initiatives for communities affected by energy projects. Following a request by Colbún, a guidance note on meaningful consultation procedures and good communication practices was provided to its staff. The Bank also shared relevant literature to illustrate best practices for communication in hydropower projects. Finally, the Bank provided information on best practices for productive livelihood initiatives. The communication specialist experienced in hydropower projects joined the Bank team during the November 2010 supervision mission and met with Colbún's Corporate Affairs Management Unit (responsible for

communication, outreach activities, and corporate social responsibility programs) to discuss different possibilities to strengthen Colbún's communication with the Community.

15. ***Colbún is taking steps to strengthen communication and outreach and is increasing communication and outreach with more focused actions.*** The company is beginning to mainstream its community relations approach, as it is conscious of a need to strengthen communication and outreach with communities. Until recently, all its communication and outreach efforts were oriented toward the communities located in the surroundings of new projects. Colbún's strategy is now to strengthen dialogue in the vicinity of all 23 of its active power plants nationwide. Meetings with local authorities and organizing visits to the plants are the initial tools to increase awareness. Colbún has also started to train its managers and field staff in community relations and communication.

16. Consistent with this new approach, the company recently created the Corporate Social Responsibility (CSR) Management Unit and a new staff member was appointed in January 2011. In addition, in April 2011 another staff member will join the company to handle the CSR for the 23 existing plants. The company is focusing its CSR support on three main pillars: support for productive activities, education and, to a lesser extent, sports. Once the dialogue is strengthened, specific support under these three areas can be channeled to the communities in coordination with local authorities and other stakeholders.

17. ***Following the November mission, Colbún informed Bank staff that, based on the Bank's suggestion, Quilleco had been identified by Colbún as the pilot site among its 23 existing projects for enhancing community relation abilities of Colbún project staff.*** The Bank team supported Colbún's idea to incorporate the community relations and communication function into the hydropower stations, in lieu of corporate headquarters, as the proximity to the communities provides the opportunity to strengthen dialogue and can increase the response speed to complaints or issues.

18. ***Colbún is also undertaking various activities to strengthen community relations.*** To date, the company's main activity in the region was the program for tertiary education at schools in communities neighboring Quilleco and Rucúe. These programs provide technical training in electrical and mechanical fields. Under the company's new strategy Colbún has taken several actions.

- i. The company has met with the mayors of the three municipalities surrounding the plants (Quilleco, Antuco and Tucapel) to initiate a dialogue with the communities concerned. Mayors were also asked to help Colbún identify all communities/stakeholders in the associated municipalities.
- ii. The company has conducted municipality and Community site visits to the Quilleco and Rucúe facilities as a starting point for such dialogue. Site visits for Quilleco county authorities and communities (around seven visits) took place during late February and early March 2011. Visits for Antuco and Tucapel authorities and communities will be coordinated in the coming months.



19. ***Colbún participated in the recent Bank mission of March 29, 2011 and its attendance at the meeting provided the grounds to establish more direct interaction with Laja Community members.*** Managers of Corporate Affairs, Corporate Social Responsibility, Environment, and Rucúe-Quilleco Operation joined the meeting and proposed the beginning of a new phase in community relations. During the meeting Colbún and the Community agreed that on April 14 and 15, 2011 Colbún will receive around 30 members of the Laja Community onto the premises of the Quilleco and Rucúe facilities with three purposes: (i) to conduct a site visit, (ii) to initiate a consultation process leading towards the assistance to productive initiatives, and (iii) to establish a better relationship and dialogue. After the Community's site visit, a small working group will be established, made up of four to five Community members and two to three Colbún staff, so as to collaboratively analyze options and next steps.

#### **D. SAFETY OF DAMS REVIEW**

20. ***Management also has taken necessary steps to ensure that the requirements of OP 4.37, Safety of Dams, have been met.*** The Bank's lead dam advisor visited Santiago between November 30 and December 2, 2010, and consulted with national experts on dam design and safety, as well as with staff of the companies owning the dams, namely, Colbún and ENDESA (a Chilean energy company), and conducted supplemental analyses thereafter. The objectives of these consultations were: (i) to prepare to conduct due diligence on dam safety for the three hydropower plants located upstream of Quilleco, i.e., El Toro (835MW), Antuco (320 MW) and Abanico (135MW), which operate on water from Lake Laja; and (ii) to confirm that Rucúe and Quilleco do not have structures that could require action under OP 4.37.

21. Based on these discussions, it has been determined that the upstream hydropower facilities that generate power from water stored in Lake Laja (namely, El Toro and Abanico) do not rely on man-made impoundments or water storage facilities. Laja is a natural lake which was formed by an ancient volcanic eruption. The lake is regulated in a way to avoid high water levels because the latter would cause large seepage losses (on the order of  $40\text{m}^3/\text{s}$ ) as the lake level approaches the natural rim; these seepages are most likely associated with the pervious upper layer of the deposits from the volcanic eruption. A small concrete weir, about 200m long and 5m high, has been built by ENDESA to control lake overflows in case of exceptionally high water levels, as per standard engineering practice. Apart from this small concrete weir, which does not add any storage capacity to the lake and does not retain water, there is no other artificial water storage structure, in other words there is no dam, associated with either El Toro or Abanico hydroelectric power plants (HPPs) that would produce a safety risk.

22. The Antuco HPP, which is in cascade below the El Toro and Abanico HPPs, does have a 26m high concrete structure which ensures a regulation capacity of 1 million  $\text{m}^3$  and makes Antuco independent from the hourly flow variations coming from El Toro. According to OP 4.37, the structure at Antuco is classified as a large dam. As determined from the discussions during the meeting in Santiago, ENDESA (the owner of Antuco) runs a satisfactory dam safety assurance system. Each ENDESA dam has an emergency preparedness plan which, in turn, requires each dam to have an effective communication system, as well as a warning and alarm system.

23. The Rucúe Project has a low weir to channel water to the intake for power generation. The weir is constructed part way across the highly braided channel of the Laja River. The low weir is not intended for storage; rather, it is a diversion structure that does not present a significant safety risk downstream. The Quilleco Project has no diversion structure; it captures water directly from the Rucúe Project tailrace and returns the water into the river.

24. As a consequence of these initial findings, the Bank's dam safety advisor has concluded that:

- i. neither Quilleco, nor Rucúe have structures that would require actions under OP 4.37; and
- ii. the only structure requiring specific dam safety measures is located at Antuco and the dam safety measures being implemented by ENDESA with respect to that facility are satisfactory.

#### **E. CONTINUE TO EXCHANGE INFORMATION WITH THE REQUESTERS**

25. As indicated in the Management Response, the Bank answered the letters received from a local stakeholder and sent information as requested, on May 14, 2010 and again on June 10, 2010. No response was received. As indicated in Section A, above, the Bank met with the Community to discuss again their concerns and to explain follow up actions, and has shared the findings of the hydrology/hydrogeology and livelihood studies with the Requesters, specifically with the Community on March 29, 2011. The Bank distributed these studies to the community on April 11, 2011. In addition, the studies were sent on April 11, 2011, to the representative of local stakeholders who had been corresponding in 2010 with the Bank (see paragraphs 7 and 8 of the Management Response, dated July 20, 2010).

### **III. EVALUATION OF FINDINGS**

26. This section provides the results and conclusions of the studies commissioned by the Bank. Each of the two studies commissioned (hydrology/hydrogeology and livelihood) presented findings, which were then evaluated by Bank staff. ***The results of these analyses indicate that: (i) there is no relationship between the construction or operation of the Quilleco plant and either the water flow in the springs or the supply of well water, and (ii) that the construction and operation of the Quilleco plant have not had any discernable impact on the Community's agricultural and livestock activities.***

#### **A. HYDROLOGY/HYDROGEOLOGY**

27. The hydrology/hydrogeology study has two parts. One section focuses on the availability of water in wells and to supply the flows to springs, and the other section focuses on the morphology, flow pattern and water availability of the Laja River.

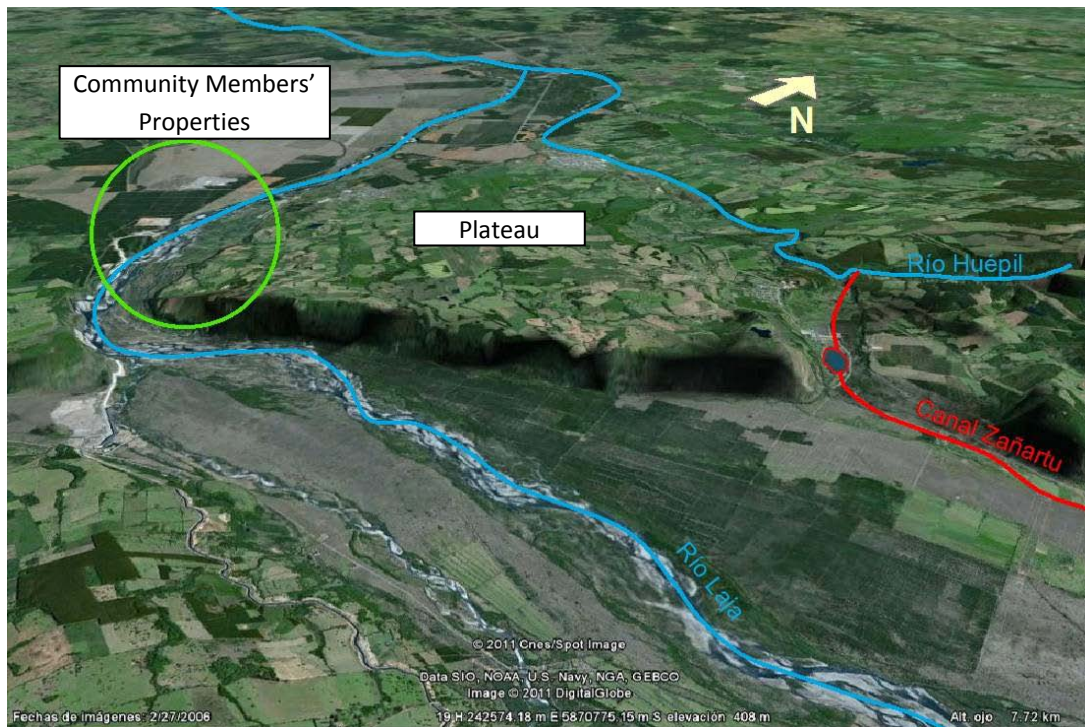
## A.1 Springs and Wells

28. *There is no relationship between the Laja River and the availability of surface and groundwater (i.e., water in springs and wells) in the Valle del Laja Community.* The study concludes that the water for the Community comes from an aquifer that is recharged by rainfall on the surface of a plateau about 100m above the Laja River floodplain; this is consistent with the Environmental Impact Assessment prepared for Quilleco in 1998 (the “EIA”) and its amendment in 1999 (Amendment).

29. *The Valle del Laja Community is located on a plateau that slopes steeply towards the Laja River, as shown in Figure 3.* Due to this topography, springs, which are the main source of water for the Community, drain off the plateau towards the river. Spring water is used for domestic consumption and for irrigation and only basic infrastructure is needed. There are four main permanent springs in the area: Bajada de Piedras, El Avellano, El Hoyon and Vaca Muerta. Other smaller and non permanent springs are also used by the Community during the wet season.<sup>7</sup>

30. As regards wells, there are 19 on the plateau and two on the slopes. It is important to note that only two families in the area under analysis use wells as a source of water.

**Figure 3: Image of Topography of Valle del Laja**

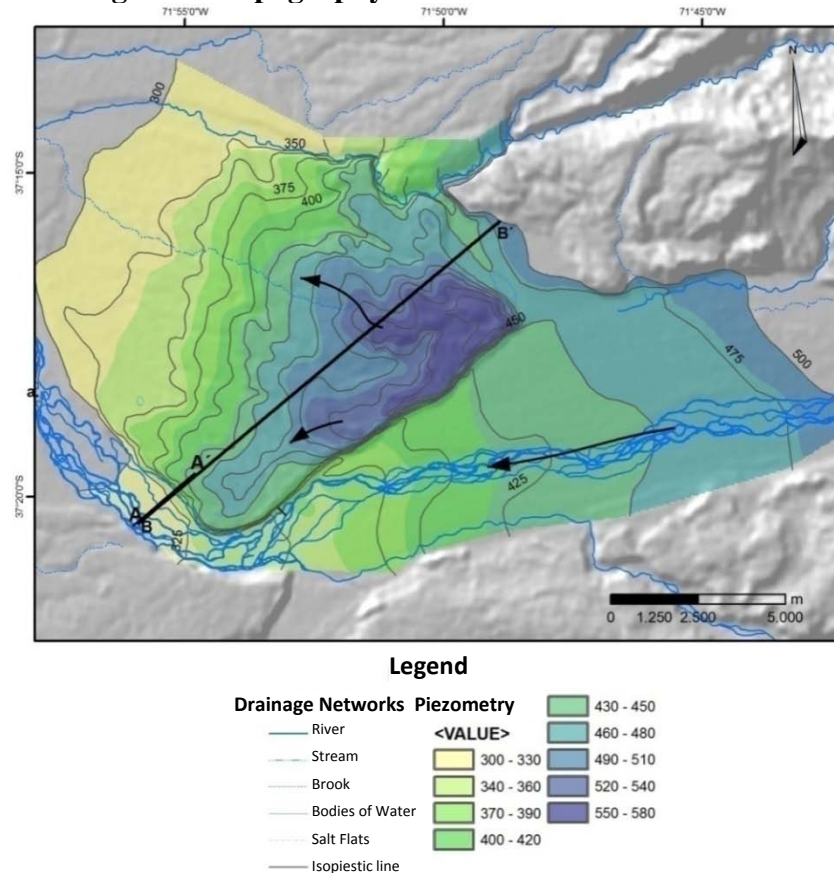


Source: Consultoria hidrogeológica Sector Río Laja en confluencia con Río Rucúe

<sup>7</sup> As noted in paragraph 5, the Community has complained that water from these springs has been decreasing over the past years. Since these four springs are not being measured on a regular basis, there is no objective data to corroborate the Community’s perception. We can only indicate that during the consultant’s field trips in December 2010 and March 2011, the four springs had water.

31. ***Rainwater drains from the plateau to the Laja River***, as shown in Figure 4. Taking a cross section of the topography map (from point B' to B), Figure 5a shows that the water flows from high elevation to low elevation through an aquifer towards a sloped area, the flood plains, and the river. In Figure 5, the dotted lines represent the water table level, as extrapolated from the depth of the wells. Therefore, even if the Community perception that there is less water in the springs could be confirmed, ***changes in Laja River discharge have no way of impacting these flows. Similarly, the 19 wells located on the plateau are recharged from the aquifer which is recharged from precipitation.***<sup>8</sup>

**Figure 4: Topography and water flow of the Plateau**

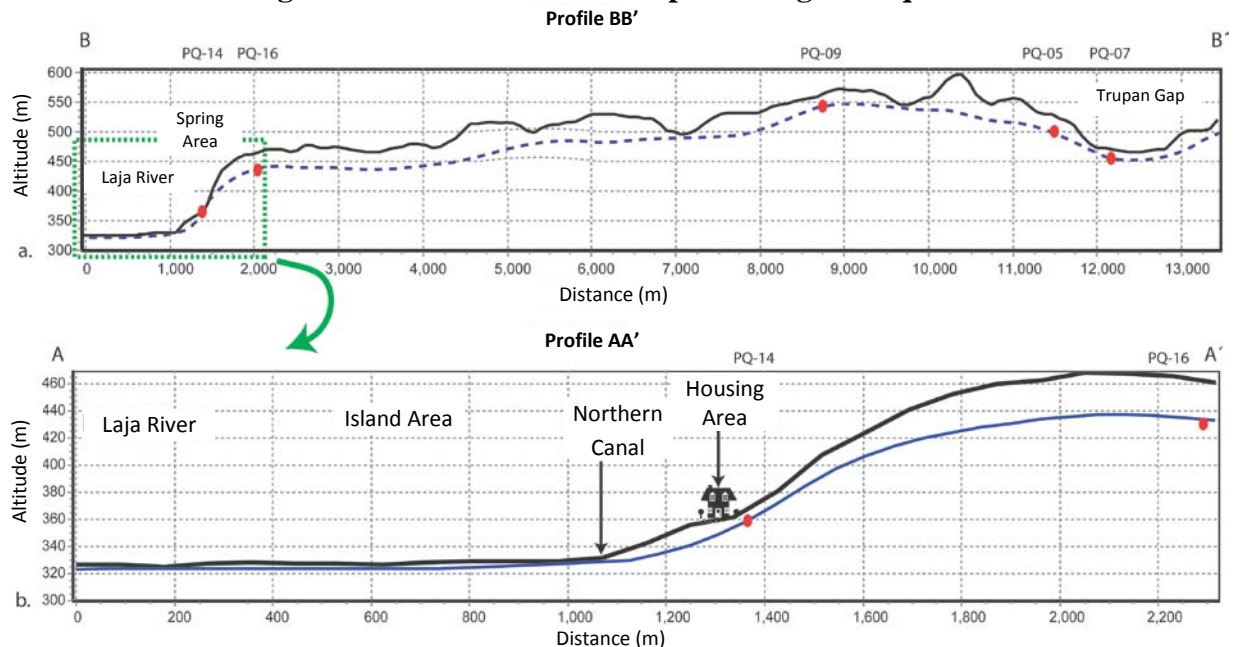


Source: Consultoria hidrogeológica Sector Río Laja en confluencia con Río Rucúe

<sup>8</sup> Two wells are in the sloped area closer to the flood plains, as shown in Figure 5b. Based on the information available, water levels in these two wells have also not changed significantly over the past four years. The wells are owned by two different community members. While baseline information for one well (which was never completed and is not in use) is not available, there are data for the other. In 2006, the river was at 339m above sea level and the well was at 350m above sea level. The baseline information shows measurements of a water level 2.6m below ground surface level on October 5, 2006, and 2.5m on January 29, 2007. In the recent follow up study, in November 2010 the well measured 3m below surface level; thus, based on the limited data, a small change was noted. It is unlikely, however, to have affected water availability, given that the well is 8.5 meters deep, and the variability remains within the range observed in wells located about 100m higher in elevation on the plateau.



**Figure 5 a and b: Schematic representing the Aquifers**

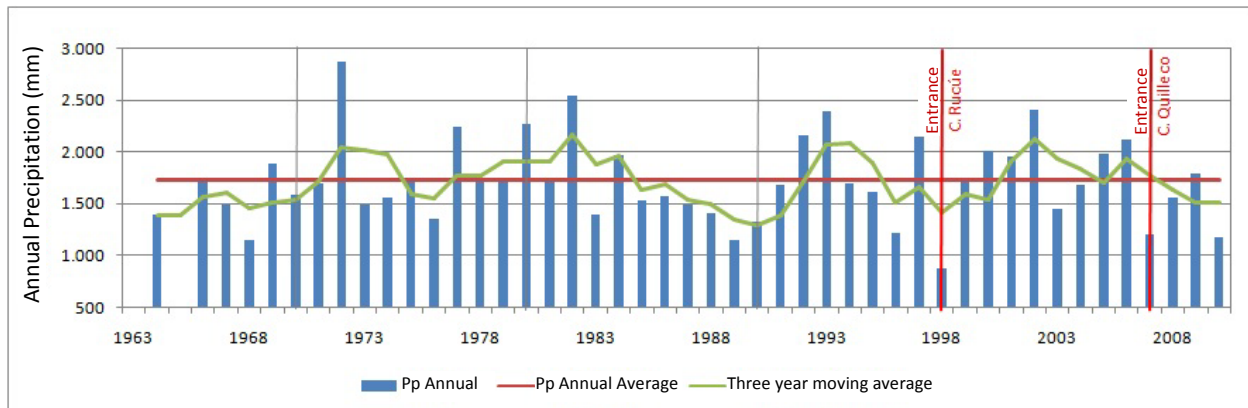


Source: Consultoría hidrogeológica Sector Río Laja en confluencia con Río Rucúe

32. *The reductions in the water level in the wells, if any, and the rate of flow in springs flowing off the face of the 100 m high escarpment, are most likely explained by decreased rates of recharge from precipitation in the past few years.* Over the last 10 years there has not been a significant change in the annual precipitation in comparison to the previous four decades (data are available as of 1964). However, 2007, when Quilleco began operation, and 2010 had the lowest annual precipitation in the last decade and were among the lowest eight percent for precipitation over the past 47 years. As shown in Figure 6, these two severe drought years have had a noticeable effect on the three-year moving average, which has been decreasing since 2006. There was also a severe drought in 1998, the year Rucúe began operation. This data would explain a decrease in the recharge rate of the aquifer. Moreover, local residents report that the pattern of precipitation has changed in recent years, with more intense rain falling in a smaller number of events. Such changes in the pattern of rainfall would not appear in data reporting either annual or monthly rainfall totals, but if local residents' perceptions are correct, this change in rainfall pattern also would have a significant effect on recharge of the aquifer.

33. There has also been an increase in recent years in the number of wells on the plateau, which suggests an increasing demand on the groundwater supply and may also contribute to the perceived change in water level in the wells. Finally, changes in land use in the plateau (shifts in the past few years to more silviculture and less grain production), as indicated in the livelihood study, could also contribute to explaining this reduction.

**Figure 6: Annual Precipitation at the Trupán Meteorology Station**



Source: Consultoría hidrogeológica Sector Río Laja en confluencia con Río Rucúe

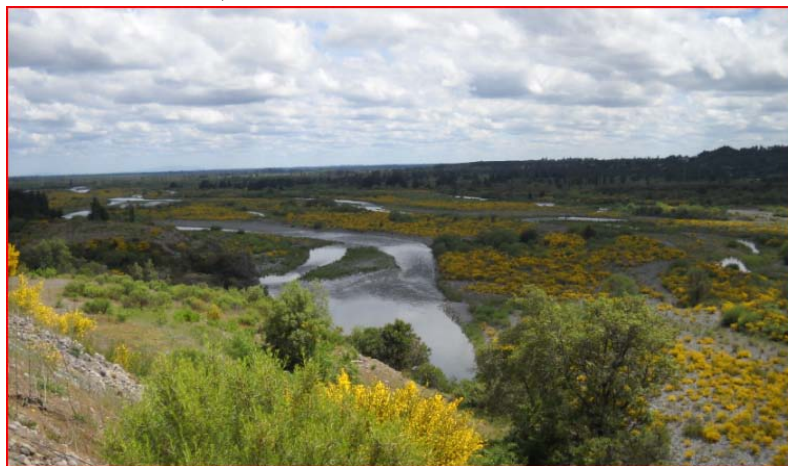
34. *In conclusion, the available information and studies provide strong evidence that the source of groundwater flow is not related to the Laja River* and additional analysis will most likely not lead to different conclusions. Management recommends no further studies on this subject.

## A.2 River Morphology and Flow Pattern

35. *In understanding the results of the study on river morphology, it is important to recognize that the river channel in the vicinity of the Quilleco and Rucúe Projects is a braided system, which is inherently dynamic.* This means that water does not always flow in the same single long-term channel; this is seen in Figure 7 below. Instead, the water may flow in multiple channels across a broad floodplain, often shifting location over time, and merging and splitting depending on recent deposition of sand, gravel, or debris forming temporary or, in some cases, persistent low islands. As indicated in paragraph 5, one of the concerns raised by local residents in the Valle del Laja Community is that islands on the northern “side” of the Laja floodplain, which they consider to be part of their farms, no longer support pasture or serve as locations to plant crops. Residents report that these islands in the northern part of the floodplain have been sterile in the past 10 to 15 years, characterized by sand and gravel rather than fertile soils.

**Figure 7: Braided river channels of the Laja River**

Source: World Bank, Nov 2010



36. *The results of the study indicate: (i) that Quilleco has not affected the river morphology; and (ii) that it has, over the distance of the Quilleco diversion, reduced the flow volumes to a limited extent (but, as indicated in the livelihood study described below, this has not had any discernible impact on the Community).* There are

several lines of evidence for this conclusion.

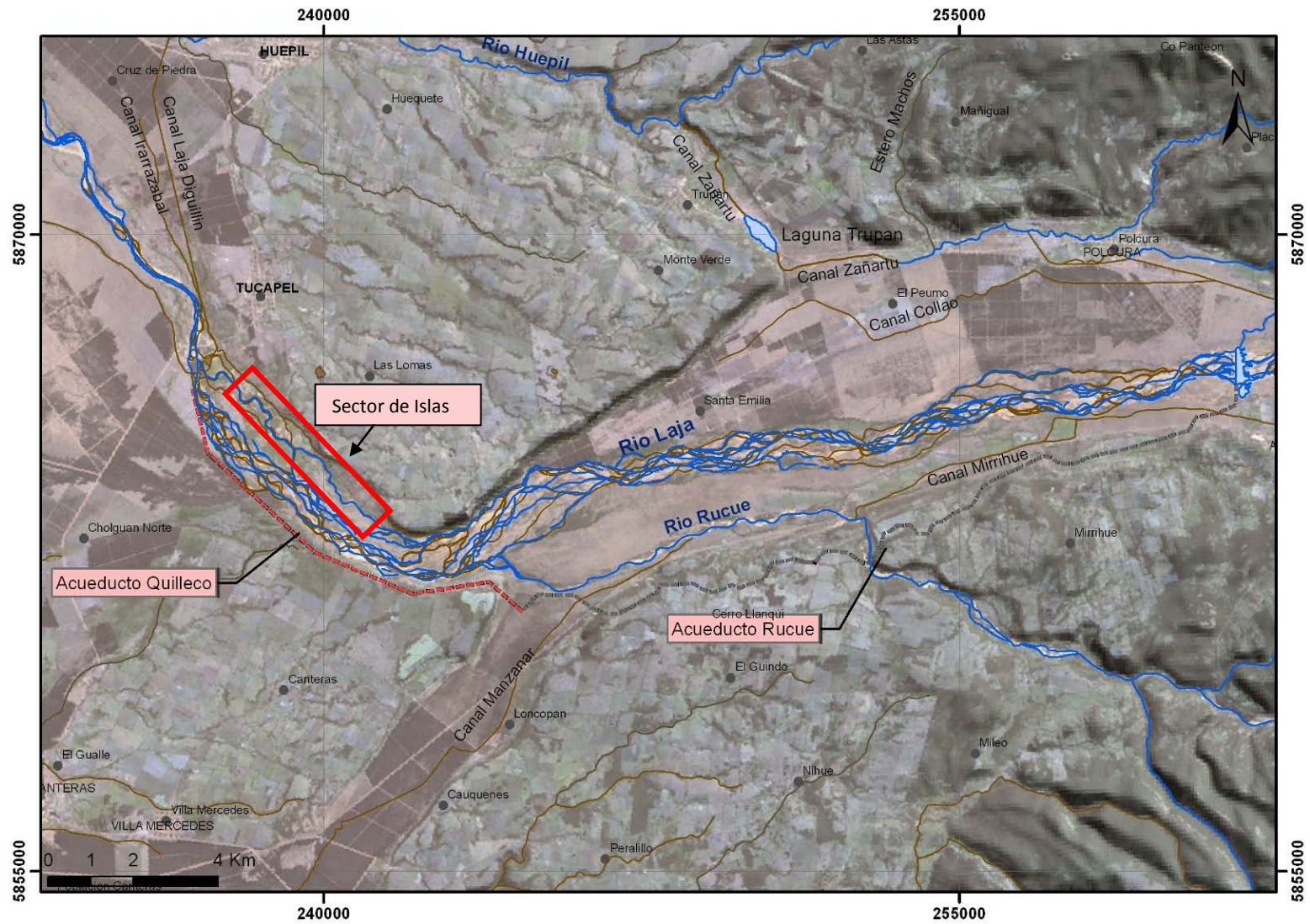
37. ***First, in interviews with the concerned residents, the consultants were told that the changes the residents have seen predate the Quilleco Project***, and they attribute the changes to the Rucúe Project which began operations in 1998, which also coincides with the most severe drought in almost five decades. When asked further about the perceived effects of the Quilleco Project, the local residents, in general, were firm that the biggest changes occurred with the commencement of operations of Rucúe in 1998. This position is consistent with correspondence between residents, Colbún, and, since 2005, the Bank.

38. ***Second, although a braided river channel system is inherently dynamic, no significant shifts in river morphology were observed after Quilleco was constructed and entered into operation; the majority of river flow remains in the southern side in the Valle del Laja area as was the case prior to September 1998, as stated in the Quilleco EIA (dated September 1998).*** The consultants conducted a morphometric study, examining satellite images as far back as 1986 and digital elevation models to determine if and when a significant change in the Laja River had been observed. When looking at images over the past 25 years, there was a change in the hydro-geomorphology of the Laja River, as the Requesters note. The images show that there were more channels of the river present in 1986 and 1998 than in January 2007 (before Quilleco began operation), and, in particular, that the northern branches of the river channel, where Community members live, have had less frequent flow activity over the past 25 years. In this context the study indicates that the reduction in active channels on the northern side of the Laja River is mainly due to the concentration of water discharges towards the southern side of the River. The study concludes that Quilleco plant did not modify the river morphology in a detectable way but could have affected the number of active channels because of the reduction in the flow (which as indicated in paragraph 45 has not had a discernible impact on the Community).

39. ***The reasons for the change in morphology seen in the Landsat imagery since 1986 are likely complicated and thus are difficult to pinpoint.*** Two significant events appear to have taken place in this time frame that likely altered water flows on the northern side of the river. First, water from the Polcura (Manco) stream, which used to feed into the northern side of the Laja River upstream of the area under analysis, was diverted into the Zañartu canal for irrigation purposes. Thus, a significant source of water was diverted away from the northern side of the braided river floodplain. Second, Rucúe began operations in October 1998. Rucúe's weir in the Laja River diverts water from the river upstream of the Community to the Rucúe canal and returns the water into the southern side of the river. Both diversions are shown in Figure 8. Reduced flows, such as those caused by the extraction of water from the Polcura (Manco) and the diversion of water by Rucúe, would be most noticeable on the northern side of the river just after the river bends to the northwest (because at river bends water moves to the outer, and in this case southern, bank due to centrifugal force).



Figure 8: Study Area



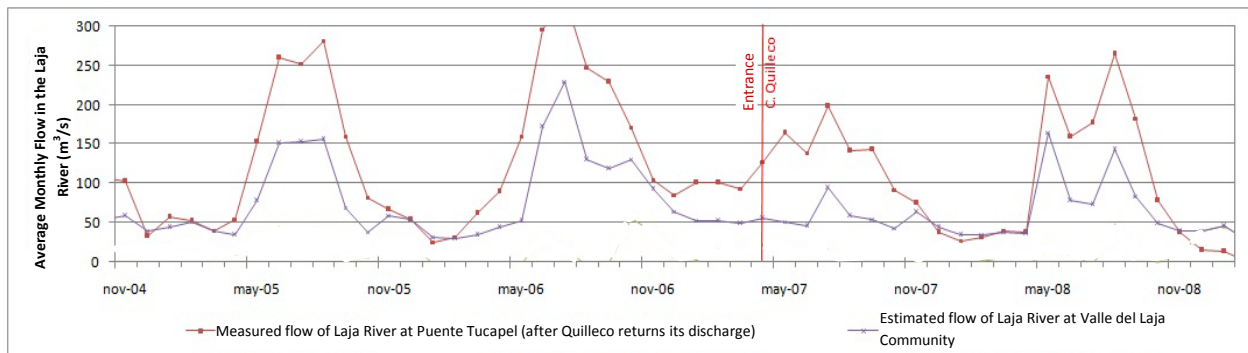
Source: Consultoría hidrogeológica Sector Río Laja en confluencia con Río Rucúe



40. ***Operation of the Quilleco Project has reduced the volume of discharge from the Rucúe tailrace, which formerly was returned to the Laja River just upstream of the Sector de Islas.*** The study established that the operation of the Project has reduced the mean annual flow in the study area from 78 to 50 m<sup>3</sup>/s (106 to 59m<sup>3</sup>/s in winter and 50 to 37m<sup>3</sup>/s in summer). These data demonstrate that the reduction in mean flows is not large, especially in the dry season (and, as explained in Section B, has not affected the livelihood of the Community). The mean of 50m<sup>3</sup>/s is over ten times the approved Minimum Ecological Flow (MEF) of 4.6 m<sup>3</sup>/s (see Figure 9).

41. The relatively small change in flow volumes in the Valle del Laja area before and after Quilleco operations began in April 2007 is illustrated in Figure 9. The upper trace in Figure 9 shows average monthly flow as measured at the Tucapel Bridge, a short distance downstream of the Valle del Laja area. The bottom trace shows the estimated average monthly flow in the Valle del Laja area based on the sum of contributions from upstream tributary sources, approved extractions for irrigation, power generation at Rucúe and Quilleco, and other purposes. The figure indicates that there is not a major difference in the flow pattern (i.e. the amount and timing of maximum and minimum flows) before and after Quilleco began operation (which, as indicated in paragraph 45, has not had a discernible impact on the Community).

**Figure 9: Flow Pattern in Laja River**



Source: Consultoría hidrogeológica Sector Río Laja en confluencia con Río Rucúe

42. As indicated previously, this new hydrology/hydrogeology study focused on possible impacts of the Quilleco plant, which started operating in April 2007, on water supply in the Valle del Laja area. This study confirms the baseline conditions and likely impacts that were presented in the September 1998 EIA for the Quilleco Project.

## **B. Impact of Quilleco on Livelihood of the Community**

43. ***The livelihood study also indicates that the Quilleco Project has not had an adverse impact on the local communities.*** The study looked broadly at changes in livelihood over approximately fifteen years, using baseline data compared with current observations. Two primary areas were the focus: (i) drinking water, and (ii) agricultural and livestock activities. On these two accounts, the report (in conjunction with findings from the hydrology/hydrogeology study) concludes that no changes in livelihood can be discerned as a result of the construction and operation of Quilleco.

44. The livelihood study indicates that water from springs is the main source of drinking water and irrigation for the Valle del Laja Community. However, the hydrology/hydrogeology study indicates that any changes in springs and wells are not related to Quilleco. ***Thus, any livelihood impacts from changes in water availability from springs and wells are not the result of construction or operation of Quilleco.***

45. ***With regard to the change in flow levels over the distance of the Quilleco diversion, the livelihood study indicates that no discernable impact on pasture areas or agricultural activities can be attributed to Quilleco.*** The livelihood study confirms that the Community has perceived a decline of pasture areas since 1999. The study points out that a reduction of pasture areas, as indicated by the Community, is consistent with the current characteristics of the soil in some specific locations and with the results of a Normalized Difference Vegetation Index applied to four LandSat images dated 1986, 1999, 2007 and 2011. The study indicates that the reduction of the pasture areas could already be identified in 1999. The study also indicates that existing information does not support attributing any substantive impact to the Quilleco Project.

#### IV. CONCLUSIONS

46. ***In conclusion, while changes have been perceived in the springs, wells and river morphology, the studies indicate that the construction and operation of the Quilleco Project are not the cause of these changes. The studies also indicate that the only change attributable to Quilleco is in the river flow, that this change has been minor and that it has not affected local agricultural or livestock activities.*** As part of the ongoing project supervision tasks, follow up actions will focus on continuing to strengthen Colbún's communication with the Community.

47. ***As a result of these studies and actions, Management believes that the Bank has made diligent efforts to apply its policies and standards in the context of this Project and that the Requesters' rights or interests have not been adversely affected, nor are they at risk of being adversely affected, by a failure of the Bank to implement its policies and procedures.*** It will continue to work with Colbún to enhance its communication and outreach to communities and to assure compliance with the ERPA commitments with respect to social and environmental aspects.