INTERNATIONAL COURT OF JUSTICE

DISPUTE OVER THE STATUS AND USE OF THE WATERS OF THE SILALA

(CHILE v. BOLIVIA)

COUNTER-MEMORIAL OF THE PLURINATIONAL STATE OF BOLIVIA

ANNEXES 1 - 17

VOLUME 2

3 SEPTEMBER 2018

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Annex 1

United Nations, Sixth Committee, Summary Record of the 23rd meeting, 17 October 1996, A/C.6/51/SR.23, p. 11, para. 78

(Original in English)

UNITED NATIONS

General Assembly

FIFTY-FIRST SESSION

Official Records

SIXTH COMMITTEE
23rd meeting
held on
Thursday, 17 October 1996
at 3 p.m.
New York

SUMMARY RECORD OF THE 23rd MEETING

Chairman: Mr. YAMADA (Japan)

(Chairman of the Working Group of the Whole on the Elaboration of a Framework Convention on the Law of the Non-Navigational Uses of International Watercourses)

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Distr. GENERAL
A/C.6/51/SR.23
4 December 1996

ORIGINAL: ENGLISH

96-81469 (E)

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Mr. Yamada (Chairman of the Working Group of the Whole on the Elaboration of a Framework Convention on the Law of the Non-Navigational Uses of International Watercourses) took the Chair.

The meeting was called to order at 3.05 p.m.

AGENDA ITEM 144: CONVENTION ON THE LAW OF THE NON-NAVIGATIONAL USES OF INTERNATIONAL WATERCOURSES (continued)

Elaboration of a framework convention on the law of the non-navigational uses of international watercourses on the basis of the draft articles adopted by the International Law Commission in the light of the written comments and observations of States and views expressed in the debate at the forty-ninth session (continued) (A/49/10 and A/49/335; A/51/275 and Corr.1 and Add.1)

Cluster IV (articles 20-28) (continued)

Article 28

1. Mr. PAZARCI (Turkey) said that the definition of "emergency" in article 28 was so wide-ranging that it might pose a problem for developing countries, and he therefore suggested that the definition should be narrowed down.

2. Mr. CROOK (United States of America), Mr. KASSEM (Syrian Arab Republic), Mr. PRANDLER (Hungary) and Mr. AKBAR (Pakistan) wished to retain the article as drafted.

3. Ms. MATROOS (Botswana) said she understood that "when necessary" in paragraph 4 implied that the obligation to develop contingency plans jointly was optional, and yet as the sentence progressed it appeared to be dealing with a mandatory measure.

4. Mr. PRANDLER (Hungary) explained that the qualification "when necessary" meant that when an emergency occurred, it was obligatory to develop contingency plans, as it was imperative that States should cooperate.

5. Mr. ŠMEJKAL (Czech Republic) pointed out that there was no provision in the article for the equitable sharing of the cost of measures necessitated by an emergency.

6. Mrs. FERNÁNDEZ de GURMENDI (Argentina) asked the Expert Consultant to clarify the implications of the inclusion of "other States" as well as "watercourse States" in paragraph 1.

7. Mr. ROSENSTOCK (Expert Consultant) referred to paragraph (2) of the commentary to the article (A/49/10), where it was pointed out that "other States" would usually refer to coastal States suffering from the effects of, say, a chemical spill. Similarly, floods or diseases originating in a watercourse State could spread to other States, which was why the definition of an emergency was extended to cover non-watercourse States. It was true that there were no specific provisions in the article on the question of sharing the

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costs of dealing with an emergency, although the contingency plans mentioned in paragraph 4 could include prior agreements on burden-sharing. The point was that when a catastrophe struck, action had to be taken immediately, with no delay for wrangling over the sharing of costs.

8. Mr. LAVALLE VALDÉS (Guatemala) inquired whether the reference to non-watercourse States referred only to States parties to the convention or applied also to States that were not parties to the convention; if the latter, it would not be necessary to change the text to refer specifically to States parties to the convention.

9. Mr. ROSENSTOCK (Expert Consultant) replied that the hope was that not only watercourse States, but others too, would adopt the convention.

Cluster V (articles 29-32 and article 2)

Article 29

10. Mr. CROOK (United States of America) drew attention to the amendment proposed by the United States in document A/C.6/51/NUW/WG/CRP.1. The commentary to the article made it clear that the text was intended to be without prejudice to existing international law and was not to lay down any new rules. However, despite purporting not to extend the applicability of any instrument to States not party to that instrument, the article could be interpreted as making States parties to the watercourse convention subject to certain rules contained in Protocol I of 1977 Additional to the Geneva Conventions, which the United States did not accept as customary law. He therefore called on the Working Group to address that matter in the preamble or to revise article 29 in line with the amendment proposed by his delegation.

11. Speaking on behalf of the United Kingdom delegation, he said that it, too, had similar reservations about article 29, considering that the matter belonged to the area covered by the laws of armed conflict. It the matter was to be addressed in the watercourse convention, the United Kingdom delegation would like it to be done by means of a clause making explicit the intention that the article was without prejudice to the application to international watercourses of the principles and rules of international law on armed conflict.

12. Mr. SABEL (Israel) and Mr. LEE (Republic of Korea) said that they supported the United States amendment.

13. Mr. ENAYAT (Islamic Republic of Iran) said the draft proposed by the International Law Commission was well balanced. The essential point was that article 29 was not an enunciation of existing rules. The accompanying commentary made it quite clear that the article was without prejudice to existing law and that it did not "purport to extend the applicability of any instrument to States not parties to that instrument". To limit the scope of the article to watercourse States, as had been suggested, would be an a contrario interpretation, which would permit illegal acts. Besides, watercourse States were already bound by article 26, which dealt with terrorism and sabotage.

14. Ever since the International Law Commission had begun its consideration of the matter, it had sought to apply the provisions not only to watercourse States

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but also to other States, although, as was again made clear in the commentary, a State not party to the convention would not be bound by its provisions per se. He pointed out that that part of the commentary could also be found on page 77 of volume II of the 1991 Yearbook of the International Law Commission, that the original idea had been included in a resolution adopted at the 1976 conference of the International Law Association, and that it was also to be found in the sixth report of the Special Rapporteur, Mr. McCaffrey. Lastly, he cited the view of the Chairman of the Drafting Committee in 1991, Mr. Pawlak, that the inclusion of a reference to the principles and rules of international law was vital, and that the provisions should not be confined to watercourse States, since an attack could be carried out by a State that was not a watercourse State.

15. Mr. PRANDLER (Hungary) said that the article was formulated in general terms and did not prejudge the positions of respective States, and therefore his delegation could accept the current draft. However, he would be prepared to look at any new drafting suggestions if the concerns expressed about protocols to the Geneva Conventions were not sufficiently allayed by the remarks in the commentary that certain fundamental protections were afforded by the "Martens clause", which had achieved the status of general international law.

16. Mr. ROSENSTOCK (Expert Consultant), observing that the United States amendment sought to reflect the commentary more adequately, said that the only potentially substantive difference bore on the scope of the article, namely, whether it referred, as the amendment stated, only to watercourse States, or to all States or all States parties. The rest of the changes proposed were merely drafting changes.

17. Mr. CALERO RODRIGUES (Brazil) said he agreed that there was virtually no difference between the two texts. The United States amendment reflected the idea in paragraph (2) of the commentary that the principles and rules of international law that applied were those that were binding on the States concerned. Article 29 as it stood focused on what was to be protected, while the United States proposal focused on who must provide protection. The only substantive difference was that the amendment made the article applicable to watercourse States only, whereas the Commission's text could be interpreted as imposing an obligation of protection on non-watercourse States, a debatable point. Brazil could accept either proposal.

18. Mr. RAO (India) said that he had an open mind on that matter, but definitely thought the word "internal" should be replaced by "non-international", as proposed by the United States.

19. Ms. DASKALOPOULOU-LIVADA (Greece), Mr. CAFLISCH (Observer for Switzerland) and Mr. SANCHEZ (Spain) endorsed the existing text.

20. Ms. MEKHEMAR (Egypt) said that she supported the existing text because it was general and balanced.

21. Mr. KASSEM (Syrian Arab Republic) said that, since the United States amendment limited the scope of the article, he preferred to retain the Commission's text, which was in keeping with existing international and treaty law.

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22. Mr. CROOK (United States of America) said that the problem for his delegation had been that there was no general agreement as to the content of the principles and rules of international law that applied in armed conflicts; the amendment sought to make it clear that the only applicable rules were those that bound the particular State that was protecting a watercourse. The use of the term "watercourse States" had not been meant to exclude other countries, and he could agree to different language, such as "Parties shall ...". He did not regard that as a point of substance but as a drafting question.

23. Mr. AKBAR (Pakistan) said he preferred the existing text because it did not lay down any new rules but simply referred to existing rules.

24. Mr. HAMDAN (Lebanon) said that if there was no real difference between the two texts it was preferable to keep article 29 as drafted.

25. The CHAIRMAN said that since there was no difference in substance between the draft text and the United States amendment, article 29 could be referred to the Drafting Committee.

Article 30

26. The CHAIRMAN said that no written amendments to article 30 had thus far been received.

Article 31

27. Mr. CROOK (United States of America), speaking on behalf of the United Kingdom, said that the article as it stood was not acceptable in the view of the British delegation. The exception to the obligation to provide information was too narrowly drawn: it should also exempt data that should be confidential on industrial and commercial grounds, as had been done, for instance, in article 8 of the Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes and article 2 of the Espoo Convention on Environmental Impact Assessment in a Transboundary Context.

Article 32

28. Mr. CANELAS de CASTRO (Portugal), supported by Mr. CALERO RODRIGUES (Brazil) and Mr. CAFLISCH (Observer for Switzerland), said that since the first part of the article referred to two possibilities - the suffering of transboundary harm and the threat of suffering such harm - it would be more consistent to replace "occurred" by "occurs or may occur".

29. Mr. de VILLENEUVE (Netherlands) said that the scope of the article should perhaps be extended to make it incumbent upon a State party actually to introduce adequate administrative and legal procedures and not simply to provide equal treatment under the law. He would submit an amendment to that effect.

30. Mr. RAO (India) said that his delegation could not accept the article, because it interjected prematurely into the watercourse context a still-evolving principle drawn from the broad field of the environment. It should be either deleted or included in an optional protocol.

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31. The problems referred to in article 32 would generally affect private individuals within a State's own territory, in contrast to a liability convention where problems such as air pollution might have implications beyond a State's borders. The mechanisms whereby individuals could take legal action against a State were not universally uniform, but differed according to the law of the region concerned. The European region had a highly developed system allowing individuals to make claims against their own and other countries, through common institutions and common conventions and with freedom of movement and free access for all - an ideal situation which did not exist elsewhere. In any case, access to the courts by foreigners was never an easy matter, requiring much expense, a knowledge of languages and an understanding of alien laws and regulations. If the intent of the article was that individuals should be left to fend for themselves to press a claim against a State, it was meaningless. Even where class actions were involved, especially by poor people, the State had to intervene to assist them to obtain justice.

32. Moreover, conflict of laws was a very complicated matter in itself. There was also the further question of how justifiable it was for any individual or group of individuals, on either side of a border, to seek to frustrate, through long court delays, an international agreement struck between two watercourse States regarding protection against significant harm.

33. Mr. AKBAR (Pakistan) said that he, too, had many reservations regarding article 32 and through it should be deleted.

34. Mr. CALERO RODRIGUES (Brazil) said that the very divergent reactions to the text by the Netherlands and India showed that it probably struck the proper balance. Its aim was to set out what non-discrimination should mean and it expressed a widely accepted principle in very fair terms. His delegation believed it should be retained as drafted.

35. Mr. SVIRIDOV (Russian Federation) said that a very complicated issue was involved: the article went beyond establishing a State's obligation to provide individuals with access to legal procedures, for it obliged a State to provide foreign legal entities with equal legal and procedural protection. Article 32 was based on a very broad interpretation of a principle for which there were some precedents but which had not yet been developed in international customary law. His delegation could not support the text as it stood, and intended to propose a compromise text.

36. Mr. CAFLISCH (Observer for Switzerland) said that article 32 was probably based on the 1909 Treaty relating to boundary waters between the United States and Canada, a frequent source in treaty law. Switzerland supported the principle in article 32, which it felt must be included in the convention proper. The article would allow for the normal application of the rule regarding exhaustion of domestic remedies. It provided both for material non-discrimination and for non-discrimination in access to the courts, and his delegation did not see what needed to be added.

37. Mr. LAVALLE VALDÉS (Guatemala) said that article 32 tried to say too much in one paragraph. The expression "shall not discriminate" was a problem: the usual pejorative connotation of the word "discriminate" - which could in fact also mean the making of perfectly justifiable legal distinctions - made it

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somewhat disconcerting when coupled with the proviso that States might agree otherwise. Also, the use of the conjunction "or" between "access to judicial or other procedures" and "a right to claim compensation or other relief" implied that they were mutually exclusive concepts although that was not necessarily the case.

38. Mr. MAZILU (Romania), supported by Mr. LEE (Republic of Korea), suggested that, in view of the objections raised to article 32, informal consultations should be held between the delegations concerned, as it was important to ensure that the framework convention was acceptable to the great majority.

39. Mr. EPOTE (Cameroon) said that it might be helpful if the Expert Consultant were to give an exact explanation of the meaning of article 32 with a view to eliminating any problems of comprehension. As he understood it, watercourse States which caused harm to natural or juridical persons that were not nationals or residents of watercourse States should not discriminate against such persons.

40. Mr. REYES (Mexico) said that his delegation was willing to consider the Portuguese proposal and pointed out that, as stated in paragraph (3) of the commentary to article 32, the rule concerning non-discrimination was a residual one.

41. Mr. ROSENSTOCK (Expert Consultant) confirmed the residual nature of the rule and said that the article had been properly interpreted by the representative of Cameroon. In his view, its meaning was clear, but he clarified that meaning further by giving examples and added that consideration could be given to the drafting issue raised by the representative of Guatemala.

42. Mrs. DASKALOPOULOU-LIVADA (Greece) said that her delegation had no objection to the provisions contained in article 32, which were standard in legal assistance agreements.

43. Mr. NUSSBAUM (Canada) said that the principle of non-discrimination was important to his delegation, which viewed it as a significant factor in the growing trend to rely on civil liability as a remedy for transboundary harm. However, given the comments of the representative of India and others, he supported the Romanian proposal for informal consultations.

44. Mr. VARŠO (Slovakia) said that article 32 contained too many elements in a single sentence and was also contradictory, since it appeared to suggest that States could agree to discriminate. He therefore suggested that it should be divided into four sentences, covering in turn respect for the principle of non-discrimination, agreement otherwise reached between watercourse States, access to judicial or other procedures, and compensation.

Cluster V (article 2)

45. Mr. PAZARCI (Turkey) said that, as defined in paragraph (a), the term "international watercourses" did not cover the link between watercourses and the territory of watercourse States. With a view to drawing a distinction between international watercourses, he therefore proposed the following definition: "International watercourses are divided into the following two categories: watercourses which form a boundary; transboundary watercourses which flow

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successively through two or more States". Since a framework convention should deal only with surface waters, he also proposed that the words "and groundwaters" should be deleted from subparagraph (b).

46. Mrs. DASKALOPOULOU-LIVADA (Greece) supported the definition proposed by the representative of Turkey.

47. Mr. TAMRAT (Ethiopia), Mrs. VARGAS de LOSADA (Colombia) and Mr. AKBAR (Pakistan) supported the Turkish proposal concerning subparagraph (b).

48. Mrs. FERNÁNDEZ de GURMENDI (Argentina) said that in the Spanish text the term "aguas subterráneas" in subparagraph (b) was inappropriate, as such waters did not always flow into the common terminus of a watercourse. It would be preferable to use the term "aguas subálveas". Furthermore, the term "physical relationship" in subparagraph (b) was insufficiently clear, as it could refer to canals or basins. Her delegation would therefore prefer the term "physical or natural relationship" or "physical or geographical relationship".

49. Mr. SANCHEZ (Spain) supported the Argentine proposal concerning the use of the term "aguas subálveas".

50. Mrs. MEKHEMAR (Egypt) expressed disagreement with the proposal to delete the word "groundwaters", as it referred to a whole water system that could affect other parts of a watercourse. She also proposed that subparagraph (b) should be expanded to read: ... "groundwaters forming an integral part of the surface waters and constituting ...", as the definition would then include groundwaters which did not flow into a common terminus, but which were just as important.

51. Mrs. DASKALOPOULOU-LIVADA (Greece) and Mr. PULVENIS (Venezuela) said they, too, were opposed to the deletion of the word "groundwaters" from subparagraph (b).

52. Mr. de VILLENEUVE (Netherlands) said he was opposed to the deletion of the word "groundwaters" and supported the Egyptian proposal concerning the expansion of subparagraph (b).

53. Mr. ROSENSTOCK (Expert Consultant) said he wondered whether the problem raised by the representative of Argentina was caused by a poor translation into Spanish of the word "groundwaters".

54. Mrs. FERNÁNDEZ de GURMENDI (Argentina) said that the Spanish term "aguas subálveas" referred to waters that were linked to a river and flowed to the mouth of that river, whereas the term "aguas subterráneas" covered a much broader concept.

55. Mr. ROSENSTOCK (Expert Consultant) said that, in isolation, the term "groundwaters" in English could also encompass a much broader definition than that contained in subparagraph (b), which referred to a system and did not include confined groundwater. Deletion of the word "groundwaters" was a different matter.

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56. Mr. AKBAR (Pakistan) proposed that, throughout the framework convention, the word "watercourse" should be replaced by the word "river", as it was universally recognized and used in all engineering literature and relevant agreements on the subject.

57. Mr. de VILLENEUVE (Netherlands) said that his delegation was against use of the word "river"; in his country, it was difficult to differentiate between a river and a canal.

58. Mr. PULVENIS (Venezuela) said that his delegation was prepared to consider a shorter version of the Turkish proposal if it was felt that the issue which it addressed had a bearing on the standards and principles under discussion. He disagreed with the Pakistani proposal to use the word "river" and emphasized that the proposed use of the term "aguas subálveas" in the Spanish text should not be interpreted as minimizing or limiting the concept of groundwaters as reflected in the other languages.

59. Mr. CAFLISCH (Observer for Switzerland) said that his delegation could go along with article 2 as drafted and with the reference in subparagraph (b) of that article to "groundwaters constituting ... a unitary whole"; like the Commission, however, his delegation would be opposed to including confined groundwater in the definition.

60. The question arose whether definitions given in other parts of the convention should be included in article 2; if so, the definition of "regulation" in article 25, paragraph 3, should be transferred to article 2.

61. Lastly, his delegation wished to know why the Commission had chosen to define "international watercourse" before defining "watercourse".

62. Mr. ROSENSTOCK (Expert Consultant), replying to the previous question, said that the order in which the terms were defined was intended to make it clear that the convention dealt only with transboundary situations. As to the possible inclusion in article 2 of definitions found in other articles, the Commission had decided that terms used in more than one article would be defined in article 2, while definitions of terms occurring in only one article would be left in that article.

63. Mr. KASSEM (Syrian Arab Republic) said that article 2, subparagraph (a), was acceptable as drafted, especially since both contiguous and successive watercourses were governed by the same legal regime. Likewise, his delegation could accept the Commission's definition of "groundwater".

64. As to the possibility of including in article 2 definitions of terms used in other articles, his delegation had proposed a definition of the term "optimal utilization" found in article 5, and had agreed to defer consideration of that amendment to the discussion of article 2. In view of the criteria just outlined by the Expert Consultant, and the fact that "optimal utilization" occurred in at least two articles, he requested the Chairman to clarify whether the Syrian delegation's amendment should be incorporated into article 5 or article 2.

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65. The CHAIRMAN said that all proposed amendments would be referred to the Drafting Committee; the Syrian delegation would have an opportunity to discuss the placement of its proposal in the context of that Committee.

66. Mr. McCAFFREY (United States of America) said that his delegation associated itself with the comments made by the Syrian representative; the same principles applied to both contiguous and successive international watercourses. While the distinction between the two types of watercourse had long been recognized in State practice, many watercourses were both contiguous and successive at different points along their courses. The question was one of emphasis; references to contiguous and successive watercourses tended to omit other, related parts of the system, such as tributaries and groundwater. In that connection, knowledge of hydrology had increased in recent years, to the point where it was recognized that groundwater and surface water were usually interrelated. Attempts to regulate surface water alone could prove futile, because water that was extracted from the ground would reduce the amount of related surface water, and surface water that fed aquifers would, when extracted, reduce the amount of water available in the aquifer. Similarly, pollution of an aquifer would eventually seep into a surface stream. Accordingly, surface water and groundwater could not easily be separated, either physically or conceptually.

67. There were, of course, instances of confined groundwater; however, the Commission had concluded that it was essential to include groundwater in the definition of a watercourse, precisely because of its relationship to surface water. For those reasons, his delegation supported the Commission’s text as drafted.

68. Mr. EPOTE (Cameroon) said that his delegation endorsed the statement made by the United States representative. Since the actions taken by one watercourse State could affect the groundwater of another watercourse State, deleting the term "groundwaters" might make it impossible to impute legal liability in the case of harm caused to a third State.

69. Mr. TANZI (Italy) said that, while his delegation could accept article 2 as drafted, it had no objections to the Turkish proposal to distinguish between watercourses that formed and those that crossed an international boundary; such a distinction was appropriately made in article 1 of the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

70. The proposed deletion of the term "groundwaters" would be a step backwards from established international treaty practice, and would diminish the impact and relevance of the future convention.

71. Mr. MANONGI (United Republic of Tanzania) said that it was difficult to see how the term "groundwaters" could be deleted unless an appropriate alternative was found: a watercourse or river must be viewed as part of a systemic whole. His delegation supported the Egyptian proposal and the earlier proposal by Israel for the inclusion in article 2 of a definition of "watercourse agreements".

72. Mr. PAZARCI (Turkey) said that his delegation’s proposal concerned the distinction among contiguous watercourses, watercourses that formed a boundary

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and those that crossed a boundary; as recognized by the United States representative, such a distinction had long been accepted in State practice. The definition of the term "international watercourse" should clearly encompass all of those categories.

73. His delegation disagreed with the Syrian view that the legal regime applying to contiguous and successive watercourses was identical. While the convention itself did not make a clear distinction in that regard, its rules might be applied differently in one or the other case; for example, article 6 (Factors relevant to equitable and reasonable utilization), paragraph 1 (a), referred to "geographic ... and other factors of a natural character" which must be taken into account, while paragraph 1 (d) of the same article referred to "the effects of the use or uses of the watercourse in one watercourse State on other watercourse States". Those provisions made it clear that practice differed in respect of watercourse that formed and those that crossed a boundary.

74. Mr. KASSEM (Syrian Arab Republic) said that the definition of "watercourse" contained in the Commission's draft encompassed both watercourses that formed and those that crossed a boundary; in that connection, he drew attention to paragraph (2) of the Commission's commentary to article 2 (A/49/10). The lack of distinction between the two types of rivers or streams - not in respect of their definition, but of the legal regime applying to them - was well established in both treaty law and customary law, and had been confirmed by the International Court of Justice in a celebrated opinion.

75. Mr. LALLIOT (France) said that his delegation had no difficulties with the term "groundwaters" as used in article 2, subparagraph (b), provided that it did not apply to "confined" groundwaters, but only to groundwaters having a physical relationship to an international watercourse. He requested the Expert Consultant to confirm his understanding of the term.

76. Mr. ROSENSTOCK (Expert Consultant) said that the French representative's understanding of the term "groundwaters", as used in the Commission's draft, was correct: it referred to groundwaters that interacted with surface waters and were part of a system.

77. Mr. NGUYEN DUY CHIEN (Viet Nam) said that, while every watercourse undoubtedly had specific characteristics, that did not imply that the definition must include each and every distinguishing feature. His delegation agreed with the Syrian and United States delegations that the definitions of "watercourse" and "international watercourse" were sufficiently clear in the Commission's draft.

78. Mr. CRISÓSTOMO (Chile) said that the term "watercourse" was confusing, as shown by the fact that some delegations wished to replace it with "river", which was far too restrictive a term. His delegation proposed that "watercourse" should be replaced by "hydrographic system", "international watercourse" by "hydrographic system with shared water resources" and "watercourse State" by "State belonging to a hydrographic system with shared water resources".

79. Mr. HABIYAREMYE (Rwanda) said that his delegation welcomed the Turkish proposal, as it made for a more complete distinction between contiguous

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watercourses and those that formed a boundary. His delegation was also among those which felt that the term "groundwaters" was superfluous; it would not, however, insist on its deletion. Lastly, his delegation believed that it would have been more logical to define "watercourse" first and then "international watercourse".

80. Mr. MORSHED (Bangladesh) endorsed the views expressed by the United States representative.

81. Mr. MANNER (Finland), reiterating his delegation's comments, contained in document A/51/275, on the term "international watercourse", drew attention to the alternative expression "transboundary waters", which was used in the 1992 ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

82. Mr. REYES (Mexico) said that his delegation too was in favour of the Commission's text and had little to add to the comments by the United States representative. From the technical standpoint the term "international watercourse" was used correctly in article 2 because the source of the waters must always be distinguished from the waters themselves.

83. Mr. LAVALLE VALDÉS (Guatemala) asked the Expert Consultant to say whether a river, for simplicity's sake one without tributaries, which throughout its course ran between two States but with the State frontier established along only one of its banks, would constitute an international watercourse.

84. Mr. ROSENSTOCK (Expert Consultant) said that it was hard to give an answer on such a theoretical situation. It was inconceivable that a river could be so clearly demarcated, lacking any tributaries or distributaries or groundwater flows, that the State frontier could be established along a line at the river's edge. However, in such a situation he supposed that the river would not constitute an international watercourse.

Article 33

85. Mr. MAZILU (Romania) said that his delegation supported the French proposals concerning article 33 (A/C.6/51/NUW/WG/CRP.55).

86. Mr. KASSEM (Syrian Arab Republic) said that it would be possible for States to settle disputes under article 33, but unless the article was made compulsory they would not be obliged to do so. His delegation had therefore submitted an amendment to make all recourse under the article compulsory.

87. Mrs. MEKHEMAR (Egypt) said that the article was too detailed for a framework convention. It should be left to the parties to a dispute to find a peaceful solution under specific agreements.

88. Mr. ŠMEJKAL (Czech Republic) said that his delegation supported the French proposals, preferring the first option therein.

89. Mr. LAVALLE VALDÉS (Guatemala) said that his delegation would prefer provisions concerning a settlement dispute system drafted along the lines of

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such instruments as the Framework Convention on Climate Change. It would submit an amendment to that end.

90. Mr. RAO (India) said that his country had always taken the position that disputes should be settled by peaceful means but also by means acceptable to all the parties, a principle established in the Charter of the United Nations. No one party to a dispute must be allowed to impose any specific means of settlement on the other parties. That point was recognized in article 33, but recourse to a fact-finding commission was made compulsory and that might create more problems than it solved. The French proposals were helpful but did not resolve that particular issue. An article such as article 33 should have been avoided in a framework convention.

91. The CHAIRMAN said he took it that the Working Group wished all the proposals on clusters IV and V to be referred to the Drafting Committee.

92. It was so decided.

93. The CHAIRMAN said that there appeared to be two or three groups of delegations with differing positions on the policy issues. Some delegations had initiated coordination work within those groups and had begun to negotiate with the other groups. He hoped that that approach would be vigorously pursued. Such efforts could not of course replace the work of the Drafting Committee but would help to narrow the differences and pave the way to a generally acceptable text.

The meeting rose at 5.40 p.m.

Annex 2

United Nations, Sixth Committee, Summary Record of the 53rd meeting, 31 March 1997, A/C.6/51/SR.53, p. 8, para. 47 and p. 9, para. 53

(Original in English)

UNITED NATIONS

General Assembly

FIFTY-FIRST SESSION

Official Records

SIXTH COMMITTEE
53rd meeting
held on
Monday, 31 March 1997
at 10 a.m.
New York

SUMMARY RECORD OF THE 53rd MEETING

Chairman: Mr. YAMADA (Japan)

(Chairman of the Working Group of the Whole on the Elaboration of a Framework Convention on the Law of the Non-Navigational Uses of International Watercourses)

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Distr. GENERAL
A/C.6/51/SR.53
5 September 1997
ENGLISH
ORIGINAL: SPANISH

97-80954 (E)

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Mr. Yamada (Chairman of the Working Group of the Whole on the Elaboration of a Framework Convention on the Law of the Non-Navigational Uses of International Watercourses) took the Chair.

The meeting was called to order at 10.20 a.m.

AGENDA ITEM 144: CONVENTION ON THE LAW OF THE NON-NAVIGATIONAL USES OF INTERNATIONAL WATERCOURSES (continued)

Elaboration of a framework convention on the law of the non-navigational uses of international watercourses on the basis of the draft articles adopted by the International Law Commission in the light of the written comments and observations of States and views expressed in the debate of the forty-ninth session of the General Assembly (continued) (A/C.6/51/NUW/WG/L.1/Rev.1 and Add.1)

1. The CHAIRMAN invited the Chairman of the Drafting Committee to introduce that Committee's report contained in document A/C.6/51/NUW/WG/L.1/Rev.1/Add.1.

Report of the Drafting Committee

2. Mr. LAMMERS (Chairman of the Drafting Committee), introducing the second report of the Drafting Committee contained in document A/C.6/51/NUW/WG/L.1/Rev.1/Add.1, said that at the second session of the Working Group the Drafting Committee had held six meetings from 24 to 27 March 1997.

3. Before introducing the report, he expressed his sincere thanks to all the delegations for their cooperation and support. He also thanked the Expert Consultant, Mr. Rosenstock, for his contribution in advising the Committee whenever necessary. He also expressed his appreciation to the coordinators for their efforts to bridge gaps and bring together diverse views.

4. The pending issues before the Drafting Committee had been article 3, paragraph 3, articles 7 and 33, the preamble and the final clauses. The Drafting Committee, despite the best effort of everyone, had not been able to recommend a generally agreed text on all the pending issues. During the current week, work would continue on article 7 concerning the obligation not to cause significant harm and article 33 concerning dispute settlement.

5. The set of draft articles prepared by the International Law Commission (ILC) had not contained a preamble. General Assembly resolution 49/52 had therefore requested the Drafting Committee to prepare the text of a draft preamble and to submit it to the Working Group. That text was contained in document A/C.6/51/NUW/WG/L.1/Rev.1/Add.1 and consisted of 13 paragraphs.

6. The first sentence of the preamble made reference to the "Parties" to the Convention and not to "States Parties". The generic term "Parties" had been used because it had been envisaged that not only States but also regional economic integration organizations might become Parties to the Convention.

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7. The first preambular paragraph was meant to provide a very general introduction to the text of the Convention. It should be noted that there were two expressions between square brackets. The placing of the expression "the non-navigational uses of" between square brackets reflected the fact that, while some delegations had believed that a general introductory preambular paragraph should make reference to the importance of international watercourses in general, irrespective of the specific subject matter of the Convention, others had considered that the Convention's precise scope should be made clear already in the first preambular paragraph. The expression "and their ecosystems" had been placed between square brackets pending the outcome of the discussions on similar expressions found in articles 5 and 8, which were also between square brackets for the time being.

8. The second preambular paragraph was also of a general nature and simply restated the provision of Article 13, paragraph 1 (a), of the Charter of the United Nations relating to the progressive development of international law and its codification.

9. The third preambular paragraph linked the first two together in that it addressed the effects of successful codification and development of rules of international law not from a general standpoint, but in connection with the subject matter of the Convention, namely, the non-navigational uses of international watercourses. The paragraph highlighted the contribution of such exercise in the promotion and implementation of the purposes and principles set forth in Articles 1 and 2 of the Charter of the United Nations.

10. The fourth preambular paragraph drew attention to the problems affecting the viability of many international watercourses. It also listed two important sources of such problems: increasing demands and pollution. However, it was clear from the words "among other things", that the short list was only indicative.

11. The fifth preambular paragraph dealt with the intended concrete effects of the Convention: they were to "ensure the utilization, development, conservation, management and protection of international watercourses and the promotion of the optimal [and sustainable] utilization thereof for present and future generations". It should be noted, in that connection, that the words "and sustainable" were between square brackets, pending the conclusion of the discussions on article 5 where that expression also appeared between square brackets. It should also be noted that the term "framework" had been inserted before the word "Convention". It would be recalled that, in paragraphs 2 and 4 of the ILC commentary to article 3, as well as in paragraph 3 of General Assembly resolution 49/52, references had been made to "framework agreement" and "framework convention". The Drafting Committee had found it appropriate to simply recall those references without taking a position on their meaning.

12. The sixth preambular paragraph affirmed the importance of two general principles which were particularly relevant with regard to the non-navigational uses of international watercourses: international cooperation and good-neighbourliness. The seventh preambular paragraph was self-explanatory, since it called attention to the special situation and needs of developing countries.

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13. The eighth preambular paragraph was placed between square brackets. Indeed, delegations had expressed different views on that matter. Some had argued that it was important to recall that the sovereignty of States extended over the parts of international watercourses situated in their territory - to the extent that the exercise of such sovereignty was in conformity with international law - as well as to stress the ensuing direct responsibility of such States to take appropriate action in that area. Other delegations had felt that such emphasis on the sovereignty of States could be misleading, as the purpose of the Convention was precisely to impose certain limitations on the freedom of States regarding the non-navigational uses of international watercourses.

14. The ninth preambular paragraph recalled the provisions and principles of the Rio Declaration on Environment and Development and Agenda 21. It had been considered relevant to include such reference since the Convention addressed, among other things, the question of the protection and preservation of international watercourses.

15. The tenth preambular paragraph recognized the fact that a number of bilateral and multilateral agreements existed already regarding the non-navigational uses of international watercourses. The eleventh preambular paragraph recalled the work done in that field in other forums. The twelfth preambular paragraph recognized the fact that the draft convention under elaboration was based on the draft articles prepared by the International Law Commission. The Assembly would, by means of that paragraph, express its appreciation to the Commission for its contribution.

16. Finally, the thirteenth preambular paragraph made reference to General Assembly resolution 49/52, whereby the Working Group had been established. That paragraph was followed by the standard phrase which concluded a preamble, namely, "Have agreed as follows".

17. As for article 3, paragraph 3, the Drafting Committee recommended no changes in the text as proposed by the International Law Commission. That meant that the square brackets around the words "apply and adjust" in paragraph 3 of the text contained on page 3 of document A/C.6/51/NUW/WG/L.1/Rev.1 should be removed. As a consequence, the bracketed words "adjustment or application" in paragraph 5 should read "adjustment and application" without any square brackets.

18. The Drafting Committee, however, wished to place on record a very clear understanding regarding that paragraph. That understanding read:

> "It is understood that the present Convention will serve as a guideline for future watercourse agreements and that, once such agreements are concluded, it will not alter the rights and obligations provided therein, unless such agreements provide otherwise."

19. The Committee had been unable to agree on whether that understanding, which had been recorded verbatim in the summary records, would be sufficient, or whether it should be reflected elsewhere. Consultations were continuing on the subject.

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20. Article 7 was an important article. Both the Working Group of the Whole and the Drafting Committee had devoted days to discussing it and consulting on it. At the current session, Canada had been appointed as the coordinator on that article, and had continued its consultations with the delegations during the Drafting Committee's second session. Canada had reported, however, that the consultations were not completed and should continue.

21. As for article 33, the Drafting Committee was unfortunately unable to submit a text to the Working Group of the Whole. It would be recalled that the debate on that article in the Working Group of the Whole had shown that the delegations had very diverse views. The same views had been expressed in the Drafting Committee. Some delegations had favoured a simple provision providing only that disputes arising from the implementation of the Convention should be settled peacefully. In their view, States should be left entirely free to choose their own method of dispute settlement. Any obligatory compulsory binding procedure was not only devoid of any practical utility for the effectiveness of the Convention, but also was counter-productive by discouraging a number of States from joining the Convention. On the other hand, some other delegations had preferred a clearly spelled out compulsory and binding dispute settlement procedure. In the view of those delegations, the Convention would not be effective unless it was clear that, if parties did not comply with its terms, there would be a compulsory and binding dispute settlement procedure. Those delegations also felt that a number of issues in the Convention were stated in general terms and that, if parties could not agree on their exact meanings, there must be certainty that, at the last stage, the issue would be resolved through a compulsory and binding procedure. There had been yet another group of delegations which felt that many States would not agree to a compulsory <u>and</u> binding dispute settlement procedure. In their view, in order not to keep the Convention hostage to compulsory and binding dispute settlement procedures, it might be more appropriate to design a dispute settlement procedure with flexibility, allowing the parties to choose their own mode of settlement with an addition of compulsory <u>non-binding</u> procedure such as compulsory fact-finding or conciliation. Such a procedure could also provide for an opt-in procedure. Accordingly, at the time of ratification or later, States could choose a method of binding dispute settlement. That approach, indeed, was a middle ground between the two earlier approaches. It was his feeling that that approach would have the support of the majority of the delegations. Taking that approach as the basis, he had proposed a text for article 33 contained in document WG/CRP.83. He would continue his consultations on that and hoped to be able to report on the subject within a few days.

22. Articles 34 to 37 dealt with final clauses. It would be recalled that the draft proposed by the International Law Commission had not had any provisions on final clauses. During the discussion in the Working Group of the Whole on a number of proposals, Ireland, on behalf of the European Union and its member States, had submitted a draft allowing for the regional economic integration organizations to become parties to the Convention. The Drafting Committee had been amenable to that proposal. The text of articles 34 to 37 as agreed by the Drafting Committee had therefore left the possibility open for such organizations to become parties to the Convention.

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23. Article 34, on signature, allowed all States and regional economic integration organizations to sign the Convention. Because the term "regional economic integration organization" had not been defined in the Convention, the Drafting Committee had agreed that a definition for "regional economic integration organization" should be included in article 2 on "use of terms".

24. It would also be noted that the date for signature was left open. The Drafting Committee had agreed to follow the general practice of opening the Convention for signature for one year at United Nations Headquarters in New York. The dates would have to be completed during the adoption of the Convention in the General Assembly.

25. Article 35 was on "Ratification, acceptance, approval or accession". The Drafting Committee had decided that, instead of having two articles - one on ratification, acceptance and approval and one on accession - there should be a single article to deal with all those matters. That was the practice followed in recent treaties to simplify drafting and reduce the number of articles. Article 35 followed standard form.

26. Paragraph 1 provided that the Convention was subject to ratification, acceptance, approval or accession by States and by regional economic integration organizations. It would be open for accession from the day after the date upon which the Convention was closed for signature. The Secretary-General of the United Nations would act as the depositary for the instruments of ratification, acceptance, approval or accession.

27. Paragraph 2 addressed the relationship between a regional economic integration organization and its member States and third States. It provided that where such an organization became a party to the Convention without any of its member States being a party, the organization should be bound by all the obligations under the Convention. However, in the case of such an organization, one or more of whose member States was a party to the Convention, the organization and its member States would decide on their respective responsibilities for the performance of their obligations under the Convention. In such cases, the organization and the member States would not be entitled to exercise rights under the Convention concurrently.

28. Paragraph 3 also dealt with the particular situation of regional economic integration organizations becoming parties to the Convention. It provided that such organizations, in their instruments of ratification, acceptance, approval or accession, should declare the extent of their competence with respect to the matters governed by the Convention. Those organizations would also inform the Secretary-General of the United Nations of any substantial modification in the extent of their competence.

29. Article 36 dealt with the entry into force of the Convention. Paragraph 1 addressed two issues: the date of entry into force and the number of instruments of ratification, acceptance, approval or accession necessary for its entry into force. It was evident that the Drafting Committee had been unable to agree on the number of instruments of ratification necessary for the Convention to enter into force. Three views had been expressed. One was that the Convention should enter into force as soon as possible, which would require a

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low number of instruments to be deposited. That would allow the Convention to come into force for those States that wanted to be bound by the Convention. According to that view, those States that did not wish the Convention to have binding effect on them would simply not become parties to it. According to the second view, the requirement of a large number of instruments of ratification, acceptance, approval or accession would not only ensure that many watercourse States would become parties to the Convention but also increase the likelihood that watercourse States of the same watercourse would be bound by the Convention. According to the third view, it was more realistic to take a middle ground between the two opposing views, namely, that the Convention would enjoy greater support if the required number of instruments of ratification was neither too low nor too high. It had been impossible to reconcile those views in the Drafting Committee. The number 22 represented the views of those who supported a low number of ratifications; the number 60 represented the views of those who preferred a high number; and the numbers 30 and 35 represented the views of those who preferred the middle ground.

30. With respect to the date of entry into force, the Drafting Committee had agreed on the ninetieth day following the date of deposit of the required number of instruments of ratification, acceptance, etc., with the Secretary-General of the United Nations.

31. Paragraph 2 dealt with a State or regional economic integration organization that ratified, accepted or approved the Convention or acceded thereto after the deposit of the required number of instruments of ratification, acceptance, etc. For such a State or regional economic integration organization, the Convention would enter into force on the ninetieth day following the date of deposit by such State or regional economic integration organization of its instrument of ratification, acceptance, approval or accession.

32. Paragraph 3 avoided double counting by providing that any instrument deposited by a regional economic integration organization would not be counted as additional to those deposited by Member States.

33. Article 37 dealt with authentic texts. It was the standard text in such cases and was self-explanatory.

34. The CHAIRMAN said that the statement by the Chairman of the Drafting Committee was an integral part of the report of the Drafting Committee, and it should therefore be reproduced *in extenso* in the summary record.

35. *It was so decided*.

36. The CHAIRMAN invited the Working Group to consider the first report of the Drafting Committee (A/C.6/51/NUW/WG/L.1/Rev.1) which had been submitted at the Committee's 24th meeting.

37. Mr. GONZALEZ (France) said that some of the articles to be discussed - articles 3 and 7 in particular - were related to each other, a fact that should be taken into account in the final decision.

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38. The CHAIRMAN said he agreed that they were related and that a solution must be found that took into account the articles as a whole. He urged delegations to streamline the debate and avoid repetition. The discussion on article 10 would be deferred at the request of the representative of South Africa.

Part III. PLANNED MEASURES

Article 11. Information concerning planned measures

39. Mr. AMARE (Ethiopia) recalled that Ethiopia had reserved its position on all of part III (articles 11 to 19).

40. The CHAIRMAN said he took it that the Working Group wished to adopt article 11 *ad referendum*.

41. *It was so decided*.

Article 12. Notification concerning planned measures with possible adverse effects

42. The CHAIRMAN said that Turkey had reserved its position on articles 12 to 19 and had proposed that articles 12 to 15 should be changed. The positions of delegations had already been stated and could be found in summary records A/C.6/51/SR.20 and 21 for the meetings held on 14 October 1996.

43. Mr. AMARE (Ethiopia) proposed that the title of article 12 should be changed to read "Notification of planned measures which may have a significant adverse effect" in order to make it agree with the text of the article.

44. Mr. ISKIT (Turkey) said that his delegation maintained its reservation on part III as a whole. It had proposed that articles 12 to 19 should be replaced, and could not accept the adoption *ad referendum* of those articles.

45. Ms. FAHMI (Egypt) said that her delegation supported the title of article 12 as it appeared in the report of the Drafting Committee and would prefer to change the word "significant" in the text.

46. Mr. ROSENSTOCK (Expert Consultant) said that the best way to solve the problems posed by titles was to recognize that they were established for the sake of convenience and had no normative effect.

47. Mr. SALINAS (Chile) said that his delegation had no objections regarding the text of article 12, although the title did not match the content. Therefore, he suggested that "significant" should be inserted before "adverse effects".

48. Mr. HABIYAREMYE (Rwanda) said that the title of article 12 should agree with its text; therefore, he supported the inclusion of the adjective "significant".

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49. Mr. HAMID (Pakistan) said that he supported the suggestion of the representative of Egypt that "significant" should be deleted before "adverse effect" in the text of the article.

50. Mr. DEKKER (Netherlands) said that the text should not be changed, and proposed that the phrase "with possible adverse effects" should be deleted from the title. The proposed new title would be "Notification concerning planned measures", which would be in agreement with article 11, "Information concerning planned measures", and with the text of article 13, which referred to "planned measures".

51. Ms. LADGHAM (Tunisia) said that the word "significant" should not be included in the title, and that the Netherlands proposal was worth considering.

52. Mr. LOIBL (Austria) supported the proposal of the Netherlands and other delegations that the text should not be changed and that the title should be shortened.

53. Mr. SALINAS (Chile) said that the Netherlands proposal did not agree exactly with the content of the articles. Article 11 referred to planned measures without qualifying the possible adverse effects, while article 12 stipulated the obligation to give notification of planned measures that might have a significant adverse effect. Therefore, he maintained his proposal that "significant" should be added to the title.

54. Mr. LAMMERS (Chairman of the Drafting Committee) recalled that the word "significant" appeared in two ways in the text of the Convention: in article 4, paragraph 2, where it had been agreed to leave that word, and in other articles dealing with "significant damage". He referred to the footnote on page 31. The Drafting Committee had decided not to consider that question because it was related to article 7 and would have to be revised in the light of that article.

55. Mr. RAO (India), supported by Mr. BOCALANDRO (Argentina) and Mr. LOGIZA (Bolivia), said he preferred the text recommended by the Drafting Committee and the Netherlands proposal to shorten the title.

56. Mr. KASME (Syrian Arab Republic) supported Egypt's position. The title should match the text of the article. The word "significant" was not as important in the context of notification as in the context of "significant harm". He therefore suggested using the words "possible effects" or "possible adverse effects" in the text.

57. Mr. ZHOU Jian (China) said that it would be appropriate to shorten the title of article 12, as the Netherlands had proposed. The obligation to notify was clearly expressed in the original title; if that were changed, the content would also change, and China would then have reservations.

58. Mr. HARRIS (United States of America) agreed with the comment by India, and drew attention to two other issues: firstly, he favoured retaining the words chosen by the Drafting Committee and, secondly, he made a distinction between planned measures which might have a significant adverse effect and those which actually caused a significant effect. The International Law Commission had

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established a lower threshold for notification than that contained in article 7. As for the question raised by China, titles did not create normative obligations or rights; they were chosen as a matter of convenience. However, in response to the concern expressed by certain delegations, the title proposed by the Netherlands could be rephrased as "Notification concerning certain planned measures".

59. Mr. SVIRIDOV (Russian Federation) said he had no objection to retaining the title recommended by the Drafting Committee or to shortening it as proposed by the Netherlands, since the text of the article was quite self-explanatory. His delegation did not object to changing the title to "Notification concerning certain planned measures.

60. Mr. Sung-Kyu LEE (Republic of Korea) supported the position of the Netherlands.

61. The CHAIRMAN said that the word "significant" appeared throughout the text of the Convention, and the issue of the terminology of each article could not be settled until the end of the consultations currently under way, particularly on article 7. Consequently, he suggested leaving the word "significant" until work on the other articles had been finalized. As for the titles, the issue was not very important, and he asked the representative of China to clarify his statement in that regard.

62. Mr. ZHOU Jian (China) said he agreed with the proposal of the United States of America that the title should read "Notification concerning planned measures".

63. Mr. ISKIT (Turkey) drew attention to the alternative text proposed by Turkey in footnote 18 to document A/C.6/51/NUW/WG/L.1/Rev.1 and recalled that Turkey had reserved its position on articles 12 to 19.

64. The CHAIRMAN said he took it that the Working Group had noted the Turkish position, and asked the representative of Turkey to inform him of the results of his consultations with other delegations concerning his proposal.

65. Mr. KASME (Syrian Arab Republic) said that the proposal of the United States of America on the title of article 12 would cause confusion and make the text of the article inconsistent with its title.

66. Ms. LADGHAM (Tunisia) agreed with the statement by the Syrian Arab Republic.

67. Mr. CANELAS de CASTRO (Portugal) said that the United States proposal did not enjoy the consensus support which had been growing in favour of the Netherlands proposal. He wondered whether the delegation of the Netherlands itself would be prepared to accept the United States proposal; his own delegation supported the Netherlands proposal.

68. Mr. ROSENSTOCK (Expert Consultant) emphasized that the titles of articles had no normative effect.

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69. Mr. NGUYEN QUY BINH (Viet Nam) said he failed to understand the reason for insisting on using the word "certain", which would limit the number of measures referred to, if the title was not an operative part of the article. He supported the Netherlands proposal.

70. Mr. PASTOR RIDRUEJO (Spain) said that Spain would be flexible as to the title of the article, and supported the Netherlands proposal.

71. Mr. PRANDLER (Hungary) said that using the word "certain" would be meaningless, and supported the proposal of the Netherlands.

72. Mr. ADAM (Sudan) said that, in light of the fact that the title of the article had no normative effect, it would be better to concentrate on adopting its contents.

73. Mr. NGUYEN QUY BINH (Viet Nam) said that, although the Netherlands proposal had not been accepted unanimously, it was supported by a broader consensus than that of the United States of America. The issue should be considered again later.

74. Mr. ZHOU Jian (China) said that the phrase which the Netherlands proposed to delete restricted the measures to those that were being referred to; the deletion of the phrase would therefore require the use of the word "certain" before the word "measures" to maintain the restrictive nature of the sentence. His delegation opposed any change to the original text.

75. The CHAIRMAN took it that the Working Group wished to postpone the adoption of the title of article 12 in order to hold consultations on the subject, and that it wished to adopt the text of that article *ad referendum*.

76. *It was so decided*.

Article 13

77. The CHAIRMAN took it that the Working Group wished to adopt the text of article 13 *ad referendum*.

78. *It was so decided*.

Article 14

79. Mr. PREDA (Romania) introduced two proposals concerning article 14. The first was to insert in subparagraph (a), after the phrase "accurate evaluation", the words "of the planned measures". The second was to delete subparagraph (b) in its entirety because, on the one hand, its content was already summarized in article 17 (3), and on the other hand, it did not appear to take into account the provisions of article 8, which had already been adopted, concerning cooperation in good faith among watercourse States, but rather cast doubt upon the good faith of those States and, in particular, that of the notifying State.

80. Mr. LAMMERS (Chairman of the Drafting Committee) said that the Drafting Committee had not deemed it necessary to make article 14 (a) any more specific,

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since it had been considered that it was obviously a continuation of article 13, in which explicit reference was made to "planned measures".

81. Mr. KASME (Syrian Arab Republic) supported the statement by the Chairman of the Drafting Committee. Also, the missing conjunction should be added at the end of the Arabic text of article 14 (a) to bring it into line with the English version.

82. Mr. DEKKER (Netherlands), Mr. NGUYEN QUY BINH (Viet Nam) and Mr. HANAFY (Egypt) supported the statement by the Chairman of the Drafting Committee.

83. Mr. PREDA (Romania) said that he wished to withdraw his first proposal.

84. Mr. AMARE (Ethiopia) endorsed the second proposal of the Romanian delegation. In his view, the text of article 14, subparagraph (b), suggested that the implementation of the planned measures was left in the hands of the notified State instead of stressing cooperation and negotiation between the notifying and notified States.

85. Mr. MANONGI (United Republic of Tanzania) said that he also endorsed the second proposal of the Romanian delegation, since he felt that notified States could easily abuse the rights and privileges they were granted under article 14, subparagraph (b). Moreover, that subparagraph gave cause for concern in that there were bound to be situations in which States would have to implement measures arising from other already existing agreements covered by the draft Convention.

86. Mr. ROSENSTOCK (Expert Consultant) said that, in preparing the draft Convention, special care had been taken not to grant a veto to notified States. Article 14, subparagraph (b), was aimed at helping watercourse States to ensure that any planned measure was compatible with their obligations under draft articles 5 and 7. Furthermore, article 14, subparagraph (b), and article 17, paragraph 3, dealt with different situations and different periods of time. In that regard, the present title of article 14 had been carefully drafted to explain that its subparagraph (b) applied only to the period referred to in article 13, namely, the first six months of the period for reply.

87. Mr. NGUYEN QUY BINH (Viet Nam), Mr. KASME (Syrian Arab Republic), Mr. CANCHOLA (Mexico), Mr. HARRIS (United States of America), Mr. HANAFY (Egypt), Mr. AL-WITRI (Iraq), Mr. P. S. RAO (India), Mr. SABEL (Israel), Mr. BOCALANDRO (Argentina), Mr. SALINAS (Chile) and Mr. PULVENIS (Venezuela) expressed support for retaining the current version of article 14, subparagraph (b).

88. Ms. KALEMA (Uganda) said that, if subparagraph (b) applied only to the period of six months referred to in article 13, she was in favour of retaining it. However, should its application extend beyond that period, she would be in favour of its deletion.

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89. The CHAIRMAN said he took it that the Working Group wished to adopt, ad referendum, the present version of the text of article 14 as a whole.

90. It was so decided.

Article 15

91. The CHAIRMAN said he took it that the Working Group wished to adopt the text of draft article 15 of the Convention ad referendum.

92. It was so decided.

Article 16

93. Mr. HAMID (Pakistan) said that his delegation could not accept the text of article 16, in particular its paragraph 1; the text of that paragraph was dangerous because it permitted any State to proceed with the implementation of the planned measures by invoking reasons of emergency. Moreover, that provision to some extent ran counter to article 14, subparagraph (b), and article 17, paragraph 3, which prohibited the implementation of the planned measures without the consent of the notified State.

94. Mr. ROSENSTOCK (Expert Consultant) explained that article 16, paragraph 1, was intended solely to prevent the notified State from invoking the absence of a reply to exercise a veto, which was unacceptable. In his view, that paragraph was unrelated to emergency situations and did not run counter to article 17, paragraph 3.

95. Mr. KASME (Syrian Arab Republic) said that he agreed with the text of article 16. Referring to articles 5 and 7, he said that in order to be properly understood, the concepts of "equitable participation" and "significant harm", which had not been clearly defined, would have to be defined. That was equally crucial to understanding article 6.

96. The CHAIRMAN, supported by the Chairman of the Drafting Committee, said that, in his view, when a watercourse State implemented the planned measures, it had to comply with the principles governing the present Convention, including those provided for in articles 5, 6 and 7. Furthermore, he took it that, since Pakistan had accepted the text of article 16 following the explanation of the Expert Consultant, the Working Group wished to adopt article 16 ad referendum.

97. It was so decided.

Article 17

98. Mr. AMER (Egypt), noting that he had reserved his position on article 17, paragraph 3, said that a proposal was now being made in that paragraph linking the period of suspension of the implementation of planned measures to the peaceful resolution of the dispute in question. Since that link was based on objective reality, he was now prepared to enter into negotiations on that proposal.

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99. The CHAIRMAN said he took it that the Working Group wished to adopt *ad referendum* article 17, paragraphs 1 and 2.

100. *It was so decided*.

101. The CHAIRMAN, referring to article 17, paragraph 3, said that there was an alternative proposal by Portugal in square brackets. An informal survey of delegations had showed that there were more delegations against than in favour of that proposal. The paragraph was basically aimed at dealing with cases where a fact-finding commission was used; it was therefore related to article 33 concerning the settlement of disputes. Since the Chairman of the Drafting Committee was continuing his consultations on that article, he suggested deferring the adoption of any decision on that paragraph until the results of those consultations were known.

102. *It was so decided*.

Article 18

103. The CHAIRMAN said he took it that the Working Group wished to adopt *ad referendum* article 18, paragraphs 1 and 2.

104. *It was so decided*.

105. The CHAIRMAN, referring to article 18, paragraph 3, noted that there was a Portuguese proposal in square brackets, which had not enjoyed wide acceptance among members of the Drafting Committee. Since that paragraph also referred to the fact-finding issue, he suggested deferring the adoption of a decision until the Chairman of the Drafting Committee had concluded the consultations concerning the settlement of disputes.

106. *It was so decided*.

Article 19

107. The CHAIRMAN said he took it that the Working Group wished to adopt *ad referendum* article 19.

108. *It was so decided*.

Article 20

109. The CHAIRMAN, referring to article 20, said that there was a proposal by the representative of China to replace the words "preserve the ecosystems" by "maintain the ecological balance". That proposal was reflected in the summary record of the 21st meeting.

110. Mr. SVIRIDOV (Russian Federation), Mr. PASTOR RIDRUEJO (Spain), Mr. ISKIT (Turkey), Mr. CHIRANOND (Thailand), Mr. EL-MUFTI (Sudan) and Mr. AMARE (Ethiopia) said that they supported the Chinese proposal.

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111. Mr. DEKKER (Netherlands) said that the Chinese proposal restricted the concept of preservation of ecosystems. According to the definition in the Convention on Biological Diversity, "ecosystem" meant a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. The current text referred to a broader concept of protection than the mere maintenance of the ecological balance. He was therefore in favour of the original text.

112. Mr. TANZI (Italy) and Mr. PRANDLER (Hungary) said that they supported the proposal by the representative of the Netherlands.

113. Ms. LEHID (Finland) said that she supported the original text and wished to retain it for the reasons explained by the representatives of the Netherlands and Hungary.

114. Mr. RAMEOS (Malaysia), Ms. VARGAS de LOSADA (Colombia), Mr. JABER (Lebanon), Mr. PRIFTER (Switzerland) and Mr. HABIYAREMYE (Rwanda) said that they supported the Chinese proposal.

115. Mr. NGUYEN QUY BINH (Viet Nam), Mr. PATRONAS (Greece), Ms. LADGHAM (Tunisia), Mr. SALINAS (Chile) and Mr. LEE (Republic of Korea) said that they supported the current wording of article 20.

116. Ms. BARRETT (United Kingdom) said that she supported the current text for the reasons explained by the representative of the Netherlands.

117. Mr. PULVENIS (Venezuela) said that, like the representative of the United Kingdom, his delegation would prefer to retain the reference to ecosystems, as in the current text.

118. Mr. CANELAS de CASTRO (Portugal) said that he supported the original text and recalled that his delegation had referred several times to the systematic approach which had been endorsed at the United Nations Conference on Environment and Development.

119. Ms. GAO Yanping (China) said that, after an in-depth study, her delegation felt that the objective of the Convention was to make better use of international watercourses. It was not a convention on the protection of the environment, and it would therefore be better to use a more precise definition which would facilitate acceptance of the Convention by the largest possible number of States.

120. Mr. P. S. RAO (India) said that he supported the view expressed by the representative of China and suggested that the words "preserve the ecosystems" should be replaced by "maintain the ecological balance".

121. The CHAIRMAN said that the proposal to replace the words "preserve the ecosystems" by "maintain the ecological balance" had been put forward by the representative of China at the Working Group's meeting on 15 October 1996 and had been taken up by the Drafting Committee. Paragraph 2 of the commentary of the International Law Commission contained an explanation of the terminology used. He believed that there was general support for article 20 and suggested

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that action on article 20 should be deferred until consultations were held on terminology.

122. Ms. GAO Yanping (China) said that the decision to defer action on article 20 was well-founded, although she did not feel that there was general agreement on the article. Most delegations had supported her delegation's proposal.

123. Mr. ROSENSTOCK (Expert Consultant) said that he was concerned that there had been no explanation of the difference between "ecosystems" and "ecological balance"; if one term was to be replaced by another, there should be a reason. If the International Law Commission preferred to use the words "preserve the ecosystems" it was because those words were the most appropriate and had been selected for that reason.

124. The CHAIRMAN, referring to the comments made by the representative of China, said that there was general agreement on the current text because it came from the Drafting Committee.

Article 21

Paragraph 1

125. The CHAIRMAN said that there were no amendments to paragraph 1.

126. Paragraph 1 was adopted.

Paragraph 2

127. The CHAIRMAN said that paragraph 2 included a note on the term "significant harm" which would be reviewed in the light of the text of article 7; the Working Group would therefore return to that paragraph after holding the relevant consultations.

128. Mr. HARRIS (United States of America) said that, judging from the commentary by the International Law Commission on article 21, paragraph 2, article 22 and article 23, the obligation established was an obligation of due diligence. In the articles themselves, however, it was not clear whether an obligation of due diligence or another type of obligation was imposed. His delegation felt that, in order to avoid ambiguities which could cause problems later, it should be made clear that the articles under consideration imposed an obligation of due diligence.

129. Mr. LAMMERS (Chairman of the Drafting Committee) said that although the Drafting Committee had not agreed to make a specific reference to that effect, the Drafting Committee had agreed that it was not an absolute obligation or an obligation of guarantee which was being imposed, but an obligation of due diligence.

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130. The CHAIRMAN said that he took it that the Working Group wished to adopt article 21, paragraph 2 *ad referendum* on the understanding that it would revert later to the question of "significant harm".

131. *It was so decided*.

Paragraph 3

132. The CHAIRMAN drew attention to the two variants of article 21, paragraph 3; one referred to measures and methods in general, and the other included examples.

133. Mr. LAMMERS (Chairman of the Drafting Committee) said that the correct punctuation to reflect the two positions was as follows: the brackets should open at the beginning of the paragraph and also after the word "watercourse" in the third line; then both brackets should be closed at the end of the paragraph.

134. The CHAIRMAN, Mr. HARRIS (United States of America) and Mr. SVIRIDOV (Russian Federation) made statements about organizational matters.

The meeting rose at 1.03 p.m.

Annex 3

United Nations, Sixth Committee, Summary Record of the Second Part of the 62nd meeting, 4 April 1997, A/C.6/51/SR.62/Add.1, pp. 6-7, para. 24

(Original in English)

UNITED NATIONS

General Assembly

FIFTY-FIRST SESSION

Official Records

SIXTH COMMITTEE
62nd meeting
held on
Friday, 4 April 1997
at 3 p.m.
New York

SUMMARY RECORD OF THE SECOND PART* OF THE 62nd MEETING

Chairman: Mr. YAMADA (Japan)
(Chairman of the Working Group of the Whole on the Elaboration of a Framework Convention on the Law of the Non-Navigational Uses of International Watercourses)

CONTENTS

* The summary record of the first part of the meeting appears as document A/C.6/51/SR.62.

Distr. GENERAL
A/C.6/51/SR.62/Add.1
29 August 1997
ENGLISH
ORIGINAL: SPANISH

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The meeting was resumed at 6.15 p.m.

AGENDA ITEM 144: CONVENTION ON THE LAW OF THE NON-NAVIGATIONAL USES OF INTERNATIONAL WATERCOURSES (continued)

1. The CHAIRMAN said that, although the representative of France had cited rule 120 of the rules of procedure of the General Assembly, which provided that, as a general rule, no proposal should be put to the vote at any meeting of a committee unless copies of it had been circulated not later than the day preceding the meeting, that requirement was usually waived when negotiations were prolonged and there was a deadline for the conclusion of the discussion. After noting that each of the articles had been adopted separately, on the understanding that the document had been read in its entirety, he said that a vote would be taken on the draft convention as a whole and that a recorded vote had been requested.

2. A recorded vote was taken on the draft convention as a whole.

In favour: Algeria, Austria, Bangladesh, Belgium, Brazil, Cambodia, Canada, Chile, Czech Republic, Denmark, Ethiopia, Finland, Germany, Greece, Holy See, Hungary, Iran (Islamic Republic of), Italy, Jordan, Liechtenstein, Malawi, Malaysia, Mexico, Mozambique, Namibia, Netherlands, Nigeria, Norway, Portugal, Romania, South Africa, Sudan, Switzerland, Syrian Arab Republic, Thailand, the former Yugoslav Republic of Macedonia, Tunisia, United Kingdom of Great Britain and Northern Ireland, United States of America, Venezuela, Viet Nam, Zimbabwe

Against: China, France, Turkey

Abstaining: Argentina, Bolivia, Bulgaria, Colombia, Ecuador, Egypt, India, Israel, Japan, Lebanon, Lesotho, Mali, Pakistan, Russian Federation, Rwanda, Slovakia, Spain, United Republic of Tanzania, Uruguay

3. The draft convention as a whole was adopted by 42 votes to 3, with 19 abstentions.

4. Mr. RAO (India), speaking in explanation of vote, said that his delegation had done its best to promote the adoption of a convention by consensus and without a vote. As that had not been possible, India unfortunately had had to abstain.

5. From the outset, the Governments had been considering the draft convention within the framework and parameters which the International Law Commission had recommended for its adoption. The Commission had taken years to prepare the draft, and no delegation had had the opportunity to conduct the necessary in-depth study of the various issues raised. Articles 5, 6 and 7 should have been retained as proposed by the Commission, since it had been impossible to improve on the care with which they had been drafted and the balance achieved in their provisions. In particular, article 5, which was the only one that clearly

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established the principles of equitable and reasonable utilization, had been weakened and obscured by the introduction of undefinable concepts that were not even relevant to its implementation.

6. Article 7 had also lost the balance achieved in the Commission's proposal and was therefore unsatisfactory. India did not oppose the idea of paying due attention to environmental considerations in the management and use of river resources; however, like other environmental issues, they could not be separated from other development considerations, the need for transfers of technical resources and the need for capacity-building in all States, particularly developing ones. Sustainable development, protection, preservation and management were basically guiding principles and could not be considered specific and enforceable international standards.

7. India felt that article 32 on non-discrimination was inappropriate in a framework convention, since the application of that principle depended on the economic, political and legal integration of the States of each region. In any event, agreements concluded between States would always take precedence. Likewise, problems concerning private international law had no place in the Convention.

8. Lastly, the Indian delegation was fundamentally opposed to the inclusion of any provision on dispute settlement in the framework Convention, since the parties to a dispute should be free to choose the means of settling it. A convention of that type should set forth the basic standards and general principles for the negotiation of agreements between neighbouring States, without going into details which would only hamper such negotiations. The opportunity to adopt an instrument of high persuasive value had been lost.

9. Mr. AMER (Egypt) said that, although his delegation had taken part in the debates of the Sixth Committee with the greatest possible interest and effectiveness, it had abstained from voting. It believed, first of all, that the Convention codified only some of the customary rules of international law and that some of its provisions constituted new rules which departed from established customary law. In that regard, the new provisions which departed from international standards and with respect to which his delegation had reservations could not be used against the Arab Republic of Egypt in the future, even if other States adopted them. The framework Convention could not affect the legal validity of customs which had always existed and would always exist and which reflected established international standards. Likewise, it could not adversely affect bilateral, multilateral or international agreements on rivers or watercourses because such agreements reflected the general provisions of international contracts and because that would cause incalculable harm in many parts of the world. In Egypt's view, the expression "international watercourses" neither contravened nor formed part of the concept of an "international drainage basin"; consequently, the use of that new term could not in any way affect the rights or obligations deriving from other bilateral, regional or international agreements or from customs established in the relations between riparian States.

10. Given the importance it attached to the equitable sharing of international watercourses, Egypt had reservations about the establishment of a rigid formula

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in article 5 linking that principle to the obligation of riparian States not to cause harm to other States or making the two principles equivalent. The standards of equitable utilization that appeared in article 6 could not cancel or replace other standards established under international customary law. With respect to the wording of article 7, he felt that it added nothing to the customary principles already established and set forth by the Commission since the beginning of its work. The principle of the right to use international watercourses without harming other States was the cornerstone of any legal regime on international watercourses agreed upon between States.

11. Lastly, he stressed that the document was a framework convention, meaning that it contained a set of principles and general rules on the non-navigational uses of international watercourses, but that those principles and rules and their partial or full application to any given international river basin would depend on the mutual consent of all the States that shared that watercourse. Therefore, the Convention could not be applied directly to the resources of river basins unless the riparian States had concluded a special agreement governing their use. Special agreements would take into account the particular nature of the river in question and other bilateral or multilateral conventions, as well as the customs established with respect to the use of its waters, and their provisions would take precedence over the Convention.

12. Since the dawn of its civilization, Egypt had used the Nile and had cooperated with other basin States under international customary rules. It hoped that the Convention just adopted would promote constructive cooperation and help to guarantee the use of the Nile as a source of life for all the peoples of the region.

13. Mr. HARRIS (United States of America) said that the Convention was the outcome of a lengthy process, particularly in the International Law Commission, and that although it was not perfect, it had established a framework that could foster a common understanding among the majority of countries. Not all of its provisions were part of international customary law, but even the new ones served a vital function by forming a set of reasonable standards for the parties to the Convention which would help to settle disputes and to improve communication and cooperation between watercourse States.

14. Mr. SABEL (Israel), speaking in explanation of vote, said that although the Convention represented an effort to strike a balance among different interests, his country still had reservations about various aspects, and had therefore abstained from voting on the draft convention as a whole.

15. Mr. CHIMIMBA (Malawi) said that, while his delegation had voted in favour of the draft Convention as a whole, he wished to place on record its reservations concerning article 2 (c); article 3, paragraph 4; article 32; and article 33.

16. Mr. CAFLISCH (Observer for Switzerland), speaking in explanation of vote, said that his delegation had voted in favour of the Convention as a whole in the belief that it could be a useful instrument for the international community and that it represented the codification of a fundamental principle of the law on the uses of international watercourses, namely, equitable and reasonable

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utilization. Nonetheless, his delegation was concerned, first of all, at the lack of a preambular paragraph recalling the sovereignty of watercourse States over the part of the watercourse situated in their territory, even though the exercise of such sovereignty was subject to the norms of international law. Second, paragraphs 2 and 5 and the ambiguity of article 3, paragraph 4, gave cause for concern. Third, it was concerned at the wording of article 7, paragraph 2 for the reasons it had outlined previously. Lastly, it was not opposed to article 33, which was preferable to having no means of settling disputes, even though it believed that the Convention, in particular, should include the option of seeking binding court decisions as a last resort.

17. Ms. GAO Yanping (China), speaking in explanation of vote, said that her delegation had voted against the Convention for reasons that fell into two categories. First, it had voted against it for procedural reasons: her delegation had not had a 24-hour period to inform its Government of the outcome of the negotiations on the draft Convention and to request instructions; nor had it received the official translation of the instrument. While articles 3, 5, 6, 7 and 33 had been adopted by a vote, many other articles that had been adopted without a vote had given rise to reservations by numerous States. Clearly, the Convention had not been adopted by consensus of the international community, contrary to United Nations practice, which would hinder its implementation. Second, her delegation had opposed the Convention for reasons of content. In its view, there was no balance between the rights and obligations of watercourse States. Nor did the Convention reflect the principle of national sovereignty, recognized by both the Charter of the United Nations and international law. Moreover, its provisions on the settlement of disputes did not conform to the provisions of Chapter VI of the Charter. Lastly, her delegation continued to have reservations with regard to the first and fifth preambular paragraphs and articles 5, 7, 20, 22, 33 and 36.

18. Ms. VARGAS DE LOSADA (Colombia), speaking in explanation of vote, said that her delegation had abstained because the basic provisions of the Convention were not sufficiently balanced; such an agreement, particularly its basic provisions, should have enjoyed wider acceptance. Moreover, she wished to place on record that, owing to the circumstances surrounding the negotiations on the text of the Convention, there had been no time to compare the versions in the various official languages, which would all be equally authentic.

19. Mr. PASTOR RIDRUEJO (Spain), speaking in explanation of vote, said that his delegation had abstained because the content of article 7, paragraph 2, of the Convention was highly unsatisfactory. In his view, the provision, which was the backbone of the Convention, was not sufficiently balanced.

20. Mr. GONZALEZ (France), speaking in explanation of vote, said that his delegation had voted against the Convention because the point of order it had raised had been ignored; speakers had been denied the opportunity to explain their vote before the voting; and the Convention had been adopted without the two-thirds majority specified in the rules of procedure. His delegation had also voted against it because of the manner in which the work had been carried out, the procedure used to negotiate the adoption of the draft Convention and the ambiguities of some of its basic provisions, particularly those relating to the scope of the draft. There were also a number of articles which had given

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rise to numerous reservations, indicating that the Sixth Committee could not consider that it had completed its work; therefore, it could not submit a report on the question to the General Assembly. Lastly, he noted that the number of votes in favour of adopting the draft Convention was barely over the minimum of 35 States required for its entry into force; that would impede its general acceptance and its contribution to the development of international law and to the strengthening of international peace and security.

21. Mr. NUSSBAUM (Canada), speaking in explanation of vote, said that his delegation had voted in favour of adopting the draft Convention for a number of reasons. First, according to its interpretation, article 3, paragraph 1, of the Convention provided that agreements already in force could not be affected by the implementation of the Convention. Second, according to its interpretation, article 3, paragraph 2, implied no legal or other obligation whatsoever for the parties to harmonize agreements already concluded and in force with the principles of the Convention. Lastly, it supported the codification of international law in general and believed that it would help to strengthen peace and security at a time when many international watercourses and many sources of drinking water in general were being increasingly threatened by greater consumption and pollution.

22. Mr. SVIRIDOV (Russian Federation), speaking in explanation of vote, said that his delegation had abstained because it deemed article 32 of the Convention unacceptable.

23. Mr. ŠMEJKAL (Czech Republic), speaking in explanation of vote, said that his delegation had voted in favour of adopting the draft Convention because it was interested in promoting the process of codification and progressive development of international law. Nonetheless, it had reservations concerning a number of provisions of the Convention. First, it was difficult to accept the text of article 7, paragraph 2. Second, the fifth preambular paragraph and article 5 referred to "optimal [and sustainable] utilization"; in his delegation's view, the adjective "sustainable" was inappropriate. Equally unsatisfactory was the fact that the preamble lacked a paragraph recognizing the sovereignty of watercourse States over the watercourse in question. Lastly, it was regrettable that the approach taken in article 3 in order to resolve the problem of relations between the Convention and watercourse agreements concluded prior or subsequent to it was lacking in clarity and unnecessarily complicated.

24. Mr. SALINAS (Chile), speaking in explanation of vote, said that his delegation had voted in favour of the draft Convention, despite its reservations with regard to some of its provisions. For example, the deletion of the reference to the sovereignty of the watercourse States over the part of the watercourse situated in their national territory was a serious omission, since the principle of State sovereignty was the point of departure for the whole process. Nonetheless, the draft which had been adopted was a useful guideline for States insofar as it laid down, in a balanced fashion, the basic principles governing the question, namely, the principle of equitable and reasonable utilization and participation, the principle of not causing significant harm, the principle of cooperation and the principle of environmental protection. The Convention was also a useful instrument because it established a binding

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procedure for the settlement of disputes, particularly through the mechanism of fact-finding.

25. Mr. KASME (Syrian Arab Republic) said that his delegation had voted in favour of the draft convention because it considered it an important step forward. However, he had reservations on three of the articles. With regard to article 5, he endorsed the clarification which the International Law Commission had made in paragraph (3) of the commentary on article 5 in its report on the work of its forty-sixth session (A/49/10): "Attaining optimal utilization and benefits does not mean achieving the 'maximum' use, the most technologically efficient use, or the most monetarily valuable use much less short-term gain at the cost of long-term loss. Nor does it imply that the State capable of making the most efficient use of a watercourse - whether economically, in terms of avoiding waste, or in any other sense - should have a superior claim to the use thereof. Rather, it implies attaining maximum possible benefits for all watercourse States and achieving the greatest possible satisfaction of all their needs, while minimizing the detriment to, or unmet needs of, each." With regard to article 7, he endorsed the observations of the Commission in paragraph (14) of the relevant commentary: "A use which causes significant harm to human health and safety is understood to be inherently inequitable and unreasonable." Finally, with regard to article 33, his delegation was certain that the establishment of a compulsory procedure for the settlement of disputes regarding the application and interpretation of the Convention was the best way to make that instrument effective and prevent deadlocks.

26. Mr. BENÍTEZ SÁENZ (Uruguay) said that his delegation had abstained in the vote because, although it supported the principles contained in the Convention as adopted, it believed that the figure of 35 States established in article 36 for its entry into force was not sufficiently representative for such a framework convention.

27. Mr. LOAYZA (Bolivia) said that his delegation had abstained because of its previously stated reservations concerning the Convention as adopted, in particular concerning article 7, paragraph 2.

28. Mr. BOCALANDRO (Argentina) said he did not wish to restate the reservations which his delegation had already expressed concerning certain articles of the Convention, which could be found in the summary records. His delegation had abstained because the Convention as adopted presented some problems with regard to key elements which had not been resolved satisfactorily.

29. Mr. CANELAS DE CASTRO (Portugal) said that his delegation had voted in favour of the Convention because it represented a milestone in the process of the codification and progressive development of international law relating to the uses of international watercourses and to the uses of water in general, as well as to cooperation in that field, bearing in mind in particular the limitations, both quantitative and qualitative, to which waters and their ecosystems were subject. The instrument just adopted should be applied without prejudice to the principles, norms and general concepts of applicable international environmental law.

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30. Mr. DEKKER (Netherlands) said that his country maintained watercourse cooperation agreements with the riparian States of the rivers Scheldt, Moselle and Rhine - Germany, Belgium, France, Luxembourg and Switzerland. Those agreements dealt with flood prevention, pollution control and restoration of aquatic ecosystems. His delegation had voted in favour of the Convention because it hoped that, notwithstanding the reservations expressed by France and Switzerland, which, like the Netherlands, were parties to the aforementioned agreements, existing watercourse agreements would be respected under the provisions of article 3.

31. Mr. AL-WITRI (Iraq), said that his delegation had voted in favour of the Convention because it allowed the codification of international law on the uses of international watercourses. Riparian States of such watercourses should cooperate constructively to meet the needs of all in accordance with existing agreements, the Convention and international law, whether or not they were parties to the Convention. The modification made to the definition of the term "watercourse State" by the International Law Commission in article 2, subparagraph (c), was unnecessary. A provision should have been added to article 33 concerning arbitration and binding legal solutions to disputes between watercourse States which could not be resolved by other means. Finally, his delegation feared that the number of 35 States established for the entry into force of the Convention would be insufficient to guarantee its application.

32. Mr. AMARE (Ethiopia) said that although his delegation had made some reservations, it had voted in favour of the adoption of the draft convention as a whole, since it contained the basic norms for regulating the use of international watercourses on the basis of the principle of equitable use, which was fully recognized in articles 5, 6 and 7. It was to be hoped, however, that the ambiguous doctrines some States had cited regarding the use of watercourses would not be taken into account. The Convention would be highly useful in cases where no agreement had been made to regulate the joint use of an international watercourse. No State could claim an exclusive right on the basis of outmoded principles established unilaterally for its own benefit. The Convention would provide an appropriate framework within which watercourse States could negotiate in good faith an equitable allocation of water resources.

33. Mr. HABIYAREMYE (Rwanda) said that his delegation had abstained in the vote because the preamble to the Convention contained no reference to State sovereignty.

34. Mr. LAVALLE (Guatemala) said it was regrettable that it had not been possible to include in the preamble the proposed paragraph on State sovereignty and that the version of article 7 contained in the report of the International Law Commission, which established an adequate balance between upstream and downstream watercourse States, had not been adopted. It was also regrettable that it had not been possible to compare the different language versions, particularly as oral amendments had been made only to the English version of article 7.

35. Mr. NGUYEN QUY BINH (Viet Nam) said that his delegation had voted in favour of the adoption of the draft convention because it believed in the codification of international law. However, it had made a reservation because the principle

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of State sovereignty was not fully reflected in the Convention. In any event, the principle of State sovereignty did not absolve States of their liability for transboundary harm. In addition, the text adopted, although it constituted a framework convention, did provide for a minimum dispute-settlement mechanism. Therefore, his delegation had voted in favour of its adoption.

36. Ms. FLORES (Mexico) said that although it had, unfortunately, not been possible to adopt the Convention without a vote, the text represented a significant step forward in the codification and progressive development of international law and would help to improve cooperation and communication between States and promote the conservation and preservation of international watercourses to the benefit of current and future generations.

37. Mr. PRANDLER (Hungary) said that his delegation had voted in favour of the draft convention even though it had placed on record reservations concerning articles 5, 6, 7 and 33. The text as prepared truly represented a compromise, and thus it was regrettable that some countries had voted against its adoption or had abstained. The Convention would contribute to the progressive development and codification of international law, as the International Law Commission had anticipated.

38. Mr. VARSO (Slovakia) said that his delegation had abstained in the vote on the draft convention because it believed that there was a lack of balance between articles 5 and 7. Article 5 should allow the equitable and reasonable use of international watercourses, while article 7 should place limits on such utilization. Its abstention did not mean that Slovakia was against the codification and progressive development of international law. Cooperation among States was essential in order to strike a balance between the interests of upstream and downstream watercourse States.

39. Mr. PULVENIS (Venezuela) said that he would have preferred the Convention to have been adopted by consensus. His delegation had voted in favour of adoption because it believed that the best compromise solution within the limitations imposed by the negotiating process had been achieved. Despite those limitations, an important step had been taken in the direction of the codification and progressive development of international law.

40. Mr. MANONGI (United Republic of Tanzania) said that the Convention had been adopted not as a result of comprehensive negotiations, but because the Working Group had run out of time. The provisions of article 3, paragraph 2, and of articles 5, 7 and 32 did not represent a balance of interests between riparian States insofar as the equitable use of watercourse was concerned. Consequently, an instrument had been adopted which did not enjoy the confidence of a considerable number of States.

41. The CHAIRMAN introduced the draft report of the Working Group of the Whole to the General Assembly (A/C.6/51/NUW/WG/L.4 and Add.1).

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Part I. Introduction

42. The CHAIRMAN said he took it that the Working Group wished to adopt Part I of the draft report.

43. It was so decided.

44. Mr. GONZALEZ (France) said that the articles had been adopted with a number of reservations, which meant that the drafting process was not over. For that reason, the report of the Working Group could not be submitted to the General Assembly; instead, the work that had been done should be reported to the Sixth Committee.

Part II: Consideration of proposals

Paragraphs 6 and 7

45. The CHAIRMAN said he took it that the Working Group wished to adopt paragraphs 6 and 7 of the draft report.

46. It was so decided.

Paragraph 8

47. Mr. SVIRIDOV (Russian Federation) proposed that, in the statement of understanding pertaining to article 1, the words "conservation and management" should be replaced by the word "utilization".

48. The CHAIRMAN said he took it that the Working Group wished to adopt paragraphs (a) and (b) of the statement of understanding pertaining to article 1, as orally amended by the representative of the Russian Federation.

49. It was so decided.

50. The CHAIRMAN said he took it that the Working Group wished to adopt the paragraph of the statement of understanding pertaining to article 2, subparagraph c.

51. It was so decided.

52. The CHAIRMAN took it that the Working Group wished to adopt paragraph (a) of the statement of understanding pertaining to article 3.

53. It was so decided.

54. The CHAIRMAN said that one delegation had proposed that the phrase "in this article or elsewhere" should be added after the word "used" in the first line of paragraph (b) pertaining to article 3. He took it that the Working Group wished to adopt the paragraph with the proposed amendment.

55. It was so decided.

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56. The CHAIRMAN said he took it that the Working Group wished to adopt the paragraph pertaining to article 6, paragraph 1 (e).

57. It was so decided.

58. The CHAIRMAN read out a paragraph pertaining to article 7, paragraph 2, which was to be incorporated into the statement of understanding contained in document A/C.6/51/NUW/WG/L.4/Add.1 and which read: "In the event such steps as are required by article 7 (2) do not eliminate the harm, such steps as are required by article 7 (2) shall then be taken to mitigate the harm". He took it that the Working Group wished to adopt the paragraph.

59. It was so decided.

60. The CHAIRMAN said he took it that the Working Group wished to adopt the paragraphs pertaining to article 10, articles 21, 22 and 23, article 28 and article 29.

61. It was so decided.

62. The CHAIRMAN noted that throughout the consideration of the articles of the draft convention, reference had been made to the relevant comments which the International Law Commission had made to clarify its content.

Paragraphs 9 and 10

63. Mr. ISKIT (Turkey) said that, in order to place on record what had really happened during the meeting, it would be necessary to add a phrase in paragraph 9 after the word "adopted" to indicate that the Working Group had failed to reach consensus on the most important articles, nor had it adopted the draft as a whole by consensus.

64. The CHAIRMAN pointed out that the Working Group had adopted the draft convention as a whole after putting it to a vote. He suggested that, if delegations agreed, the results of that vote should be included in paragraph 9 of the draft report.

65. Mr. ISKIT (Turkey) said it would suffice to say that the draft convention had been put to a vote.

66. The CHAIRMAN said he took it that the Working Group wished to adopt paragraphs 9 and 10 of the report as amended by the representative of Turkey.

67. It was so decided.

68. The CHAIRMAN said he took it that the Working Group wished to adopt the draft report (A/C.6/51/NUW/WG/L.4 and Add.1) as a whole.

69. It was so decided.

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70. The CHAIRMAN said that the Working Group had concluded its work on adopting the draft convention, which represented the culmination of nearly 25 years of work. He thanked delegations, the Chairman of the Drafting Committee, the Expert Consultant, the Secretary and the Secretariat for their assistance.

The meeting rose at 8.05 p.m.

Documentation from the Bolivia-Chile Silala Working Group and Political Consultation Mechanism

(Annexes 4 - 10)

Annex 4

Joint Study Profile submitted by Chile in August 2004

(Original in Spanish, English translation)

Perfil de estudio conjunto

La naturaleza y características de los recursos hídricos del Silala

1. INTRODUCCIÓN

Conforme se desprende del Acta del 6 de mayo de 2004, correspondiente a la primera reunión de trabajo de la Comisión Técnica Mixta dispuesta por los Cancilleres de Chile y Bolivia para tratar materias atingentes a las aguas del Silala, y conforme al intercambio de Notas de fecha 7 de abril de 2004 de Chile y 4 de mayo de 2004 de Bolivia, *se determinó necesario realizar estudios técnico- científicos que permitiesen determinar la naturaleza, origen y flujos de las aguas del Si/ala* para, de esa manera, establecer una base científica que sea puesta a disposición de los respectivos Gobiernos.

Para dicho propósito, se acordó que organismos técnicos de ambos países realicen estudios conjuntos sobre las materias que indica el presente documento.

Se consideró en el Acta que los estudios que comprendieran investigaciones con técnicas isotópicas, hidroquímicas y otras, podrían ser encomendados a organismos y entidades calificados, solventes y de reconocida reputación, los que deberían ser definidos en su oportunidad.

Conforme a esos lineamientos, el presente documento comprende una proposición del perfil para llevar adelante esos cometidos.

Por lo tanto, desde el punto de vista científico y técnico, y en función de una adecuada organización del tiempo y los recursos a emplear, el perfil que propone Chile está orientado a dilucidar el asunto que se ha planteado entre ambos países, según diversos documentos intercambiados.

2. CARACTERIZACIÓN ESPACIAL y TERRITORIAL

En relación a este capítulo, se requiere que el estudio considere una introducción al área que será sometida a investigación, la cual incorporará una descripción del marco geográfico de la cuenca del río Silala, contemplando los siguientes aspectos:

2.1 Ubicación

Joint Study Profile

The nature and characteristics of Silala's water resources

1. INTRODUCTION

As is clear from the Act of 6 May 2004, corresponding to the first work meeting of the Joint Technical Commission arranged by the Foreign Ministers of Chile and Bolivia to deal with matters relevant to the Silala waters, and according to the Exchange of Notes dated 7 April 2004 of Chile and 4 May 2004 of Bolivia, *it was determined necessary to carry out technical-scientific studies that would allow to determine the nature, origin and flows of the Silala waters*, in order to establish a scientific base that is made available to the respective Governments.

For this purpose, it was agreed that technical organisms from both countries conduct joint studies on the matters indicated in this document.

It was considered in the Act that the studies that included investigations with isotopic, hydro-chemical and other techniques, could be entrusted to organizations and entities qualified, solvent and of recognized reputation, which should be defined in due course.

In accordance with these guidelines, this document includes a profile proposal to carry out these tasks.

Therefore, from the scientific and technical point of view, and in function of an adequate organization of the time and resources to be used, the profile proposed by Chile is aimed at elucidating the issue that has been raised between the two countries, according to various documents exchanged.

2. SPATIAL AND TERRITORIAL CHARACTERIZATION

In relation to this chapter, it is required that the study consider an introduction to the area that will be submitted to research, which will incorporate a description of the geographical framework of the Silala River basin, contemplating the following aspects:

2.1 Location

Dentro de esta parte se deberá efectuar una descripción que contenga lo siguiente:

- Ubicación política administrativa
- Superficie del área de estudio
- Accidentes relevantes identificables y toponimia inherente
- Entidades pobladas ubicadas en el área
- Actividades productivas en el área
- Accesibilidad y distancias

2.2 Descripción fisiográfica de la zona

En esta parte introductoria, el estudio deberá incorporar una descripción de los principales rasgos físicos del área, con los siguientes aspectos:

a) A nivel de relieve:

- *Rasgos volcánicos:* Considera la identificación de accidentes, disposición de estructuras, alturas y denominación toponímica.
- *Rasgos hidrográficos:* Considera una caracterización del sistema de drenaje que configuran la hoya hidrográfica, la clasificación de la cuenca y la identificación de su vía exutoria de acuerdo a la topografía del área.

- *Alturas relevantes:* Considera la identificación de las alturas máximas a nivel de cerros y volcanes, como también mínimas a nivel de base (m.s.n.m.). Considera la identificación de alturas en el umbral oriental de la cuenca, en las nacientes Orientales, en las nacientes de Cajón y en el cruce del límite internacional.

- *Pendientes general y locales:* El estudio deberá hacer referencia a los resultados de las pendientes del terreno en grados y porcentajes. Las pendientes locales, confonne se describe en la parte topográfica, responderán a perfiles representativos del área, incluyendo el eje longitudinal de la quebrada de Cajones, desde su umbral oriental hasta el límite internacional.
La referencia a la pendiente general se fundamentará en un perfil especial que comprenderá desde el umbral oriental de la cuenca, pasando por las nacientes Orientales, la quebrada Oriental y el límite internacional.

b) Rasgos vegetacionales

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Within this part, a description must be made that contains the following:

- Political-administrative location
- Surface of the study area
- Identifiable relevant accidents and inherent toponymy
- Populated entities located in the area
- Productive activities in the area
- Accessibility and distances

2.2 Physiographic description of the area

In this introductory part, the study should incorporate a description of the main physical features of the area, with the following aspects:

a) At the topography level:

- *Volcanic features*: Considers the identification of accidents, structure layout, heights and toponymic denomination.

- *Hydrographic features*: It considers a characterization of the drainage system that make up the hydrographic basin, the classification of the basin and the identification of its drainage path according to the topography of the area.

- *Relevant heights*: It considers the identification of the maximum heights at the level of hills and volcanoes, as well as minimum heights at the base level (meters above sea level). It considers the identification of heights in the Eastern threshold of the basin, in the Oriental springs, in the Cajon springs and in the crossing of the international boundary.

- *General and local slopes*: The study should refer to the results of the terrain slopes in degrees and percentages. The local slopes, as described in the topographic part, will respond to representative profiles of the area, including the longitudinal axis of the Cajones ravine, from its eastern threshold to the international boundary.
The reference to the general slope will be based on a special profile that will include from the Eastern threshold of the basin, passing through the Oriental springs, the Oriental ravine and the international boundary.

b) Vegetation features

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Comprende la identificación de especies y superficies de cobertura

c) Fauna

Comprende información sobre fauna silvestre e introducida.

d) Rasgos climáticos

El informe deberá contemplar en este factor una breve caracterización general del área de estudio en base a los siguientes fundamentos:

- Precipitaciones: Sobre la base de estadísticas disponibles del área.

-Temperaturas: máximas y mínimas sobre la base de la información disponible y aplicables con fundamento científico.

- Clasificación general climática aplicable conforme a los indicadores de localización regional, vertiente andina de pertenencia, alturas, temperaturas y precipitaciones[1].

e) Cartografía introductoria

Este capítulo deberá incorporar un mapa de ubicación del área de estudio a nivel de escala país, un mapa de ubicación a nivel local-regional y un mapa a nivel del área a estudiar con los detalles de ubicación de los principales accidentes, topónimos, caminos y senderos debidamente georreferenciados. Podrán utilizarse gráficos y perfiles de ser necesarios.

2.3 Caracterización topográfica y geodésica:

El capítulo deberá caracterizar topográficamente el área de estudio. Comprende tanto los **antecedentes disponibles,** como aquellos que deberán **obtenerse en terreno** para complementar la información del área. Esto se reflejará en la cartografía que

[1] La clasificación climática aplicable debe fundamentarse con indicadores científicos de incidencia en el área, como los señalados, y no en base a interpolaciones deducidas de una división político administrativa donde predominan factores no vinculantes con el área de estudio.

It includes the identification of species and coverage areas.

c) Fauna
It includes information about wildlife and introduced fauna.

d) Climatic features

The report should contemplate in this factor a brief general characterization of the study area based on the following fundaments:

- Precipitation: Based on available statistics of the area.

- Temperatures: Maximum and minimum on the basis of the information available and applicable with scientific basis.

- General climatic classification applicable according to the indicators of regional location, Andean spring of relevance, heights, temperatures and rainfall[1].

e) Introductory cartography

This Chapter should incorporate a location map of the study area at the country scale level, a map of local regional level and a map at the level of the area to be studied with the location details of the main accidents, place names, roads and trails, properly geo-referenced. Graphics and profiles may be used if necessary.

2.3 Topographic and geodesic characterization:

The Chapter should topographically characterize the study area. It includes both the **available background** information and the information that must be **obtained in the terrain** in order to complement the information of the area. This will be reflected in the cartography that will support the various works that will be carried out in the framework of this study.

[1] The applicable climatic classification must be based on scientific indicators of incidence in the area, such as those indicated, and not based on interpolations derived from a political-administrative division where non-binding factors predominate with the study area.

respaldará los diversos trabajos que se realizarán en el marco de este estudio.

En este capítulo, se deberá **interpretar** la documentación de gabinete y terreno señalada precedentemente (informes, levantamientos, mediciones, perfiles, cartas y planos).

Específicamente se requiere documentar y realizar los siguientes trabajos:

2.3.1 Recopilación de antecedentes topográficos, cartográficos y geodésicos del área

Se deberá efectuar una completa recopilación y revisión de los antecedentes existentes a nivel de:

- Comisión Mixta de Límites
- Organismos oficiales de cada país (Geográficos militares, mineros y similares)

2.3.2 Trabajos cartográficos y geodésicos.a realizar:

- Apoyo de terreno para la confección de la cartografia a escala 1: 10.000 de la cuenca, con curvas de nivel cada 5 m. Para este trabajo se cuenta con el levantamiento aerofotogramétrico binacional efectuado en noviembre de 2001.

- Levantamientos de detalle del terreno para la confección de planos a escala 1:1.000 de las nacientes Orientales y Cajones, con curvas de nivel cada 1 m. o 50 cm.

- Levantamientos de detalle a escala 1:500 de las secciones con mayor y menor pendiente hidráulica entre las nacientes Orientales, Cajones y el límite internacional.

- Medición de perfiles geodésicos de las quebradas Orientales y Cajones, con detalle de los accidentes del terreno, de las obras existentes y del escurrimiento de las aguas, desde los umbrales, pasando por las nacientes hasta el límite internacional.

- Medición de uno o más perfiles transversales al sentido de las quebradas Cajones y Orientales. Dichos perfiles deberán ser representativos para conocer el carácter colector de esta parte de la cuenca.

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various works that will be carried out in the framework of this study.

In this Chapter, the office and terrain documents indicated above must be **interpreted** (reports, surveys, measurements, profiles, letters and maps).

Specifically, it is necessary to document and perform the following tasks:

2.3.1 Collection of topographic, cartographic and geodetic information of the area

A complete compilation and review should be carried out of the existing background information at the level of:

- Joint Boundary Commission

- Official organizations of each country (military, mining and similar geographic organizations)

2.3.2 Cartographic and geodetic works to be carried out:

- Field support for the preparation of cartography at a 1:10.000 scale of the basin, with level curves every 5 m. For this work, we have the binational air-photogrammetric survey carried out in November 2001.

- Detailed terrain surveys for the preparation of 1:1.000 scale maps of the Orientales and Cajones springs, with level curves every meter or 50 cm.

- Detail surveys at 1:500 scale of the sections with the highest and lowest hydraulic gradients between the Orientales and Cajones springs and the international border.

- Measurement of geodetic profiles of the Orientales and Cajones ravines, with details of the accidents of the terrain, of the existing works and of the runoff of waters, from the thresholds, passing through the springs up to the international border.

- Measurement of one or more profiles transversal to the direction of the Cajones and Orientales ravines. These profiles must be representative in order to know the collector character of this part of the basin.

- Levantamiento detallado de las obras hidráulicas para la confección de planos constructivos por secciones.

- Confección de los planos de detalle de las obras hidráulicas, considerando extensión de los canales; características constructivas; materiales utilizados; secciones de pendiente; mediciones de talud, sello, anchos, altura y profundidades; indicación de estado de las obras y rebalses.

2.3.3 Plan de actividades

- Los trabajos topográficos y geodésicos de terreno serán efectuados por las Comisiones de Límites de ambos países (Comisión Mixta Chile - Bolivia de Límites) y se llevarán a cabo entre septiembre y diciembre de 2004, conforme al cronograma de trabajo que para este propósito la propia Comisión Mixta determinará.

- Las cartas, planos y perfiles que se originen en los trabajos que realizará la Comisión Mixta, estarán disponibles para su utilización en las demás actividades considerados en este estudio.

- El desarrollo de las demás labores de terreno requeridas en las otras actividades consideradas en este estudio, se programará estableciendo un cronograma o carta Gantt, el cual deberá generar un plan de trabajo que armonice el conjunto de las labores.

2.3.4 Caracterización del límite internacional

- La Comisión Mixta de límites precisará en terreno el límite internacional en el fondo de la garganta - cañadón del Silala. .

- Dicha ubicación y trazado general en la cuenca, deberá representarse en la cartografia, planos y perfiles señalados precedentemente.

- Se informará sobre las características del límite en el sector.

2.3.5 Interpretación de los antecedentes topográficos, cartográficos y geodésicos

El Presente punto deberá concluir los siguientes aspectos de acuerdo al resultado de los trabajos efectuados:

- Detailed survey of hydraulic works for the preparation of construction plans by sections.

- Preparation of detail plans for hydraulic works, considering the extension of the canals, construction characteristics, materials used, slope sections, slope measurements, seals, widths, heights and depths, and the indication of the condition of the works and overflow tanks.

2.3.3 Activity plan

- Topographic and geodetic terrain work will be carried out by the Boundary Commissions of both countries (Joint Boundary Commission Chile-Bolivia) and will be carried out between September and December 2004, according to the work schedule that for this purpose the Joint Commission itself will determine.

- Letters, maps and profiles that originate in the work that the Joint Commission will carry out, will be available for use in the other activities considered in this study.

- The development of the other field tasks required in the other activities considered in this study, will be scheduled establishing a chronogram or Gantt chart, which should generate a work plan that harmonizes the set of tasks.

2.3.4 Characterization of the international border

- The Joint Boundary Commission will specify the international border at the bottom of the ravine - Silala Ravine.

- Said location and general layout in the basin, shall be represented in the cartography, maps and profiles indicated above.

- There will be a report about the characteristics of the border in the sector.

2.3.5 Interpretation of topographic, cartographic and geodetic background information

This point must conclude the following aspects according to the result of the works carried out:

- Uniformidad de la cuenca en base a las pendientes y topografía local.

- Existencia de depresiones topográficas cerradas y de umbrales que afecten a la pendiente, y al
drenaje general de la cuenca, en sentido este - oeste (desde Bolivia a Chile).

- Sentido del escurrimiento de las aguas de acuerdo a la pendiente natural del terreno.

Los trabajos a cargo de la Comisión Mixta de Límites se programarán de manera que contribuyan con antecedentes para avanzar en el tema global.

3. CARACTERIZACIÓN HIDROLÓGICA

3.1 Labores de medición y obtención de datos

3.1.1 Recopilación de antecedentes

Una primera fase de este trabajo corresponde a la exhaustiva recopilación de la información hidrológica existente en la zona de estudio, e incluirá un área de influencia más amplia con el propósito de permitir *a posteriori* la definición de patrones de comportamiento de carácter hidrometeorológico. Por otra parte deberá recopilarse fotografías aéreas e imágenes satelitales (históricas y actuales) destinadas a conocer la cobertura nival y las formaciones vegetacionales relevantes para establecer su variabilidad en el tiempo.

Para tal efecto se deberá revisar los antecedentes consignados en estudios existentes en instituciones públicas, privadas y entes académicos.

La información a recabar dice relación con a lo menos lo siguiente:

Precipitaciones
Temperatura del aire
Evaporación
Caudales superficiales que cruzan la frontera.
Niveles de aguas subterráneas vinculados con las aguas superficiales que cruzan la frontera

- Uniformity of the basin based on the slopes and local topography.

- Existence of closed topographic depressions and thresholds that affect the slope, and the general drainage of the basin, in an east–west direction (from Bolivia to Chile).

- Water runoff direction according to the natural slope of the terrain.

The works in charge of the Joint Boundary Commission will be programmed in such a way that they contribute with background information in order to move forward in the global issue.

3. HIDROLOGICAL CHARACTERIZATION

3.1 Measurement and data collection

3.1.1 Gathering of background information

A first phase of this work corresponds to the exhaustive compilation of hydrological information existing in the study area, and will include a broader area of influence with the purpose of allowing *a posteriori* the definition of hydro-meteorological behavior patterns. On the other hand, aerial photographs and satellite images (historical and current) must be collected in order to know the snow cover and the relevant vegetation formations to establish their variability over time.

For this purpose, the background information recorded in existing studies in public and private institutions and academic entities should be reviewed.

The information to be collected relates to at least the following:

Precipitation
Air temperature
Evaporation
Surface flows that cross the border.
Levels of underground water linked to surface waters that cross the border.

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Calidad de las aguas superficiales que cruzan la frontera

El ámbito espacial para este caso debe considerar una zona mas amplia que el área del río Silala, de forma de poder contar con información vinculante que permita establecer relaciones hidrológicas orientadas a la ampliación de la estadísticas, o para realizar un análisis de carácter mas regional a través de índices hidrológicos. En este sentido es necesario que se obtenga información de precipitaciones, caudales, evaporación, temperaturas y calidad del agua.

La ampliación debe considerar zonas geográficamente vinculantes desde el punto de vista climático e hidrológico.

Se deberá diferenciar y distinguir la información de carácter sistemático y de carácter no sistemático o esporádico. En relación con las mediciones sistemáticas deberá distinguirse aquellas de registro continuo y aquellas de carácter directa. Respecto a la información de carácter esporádico deberá establecerse con claridad todos los antecedentes para su adecuada identificación y posterior empleo.

Toda la información recopilada deberá organizarse en tablas en formato adecuado para los posteriores procesos de homogenización, validación y utilización.

3.1.2 Plan de medición hidrológica

Se contempla el desarrollo de un plan de mediciones con el objeto de generar la información de carácter hidrológico e hidrométrico necesaria para cumplir los objetivos de evaluación planteados. Se considera que como mínimo debe contarse con mediciones que cubran un año completo de forma de disponer de antecedentes que representen la variación estacional.

El monitoreo estará destinado a complementar la información existente de forma de disponer de una base o plataforma de información suficientemente adecuada para realizar los análisis hidrológicos y evaluaciones que se contemplan en el presente perfil de estudio conjunto. Lo anterior sobre la base de análisis hidrológicos directos si la información disponible lo permite o bien, en forma alternativa o complementaria, sobre la base de métodos hidrológicos indirectos de carácter convencional.

Quality of surface waters that cross the border

The spatial scope for this case must consider a wider area than the Silala River area, in order to have binding information that allows establishing hydrological relations oriented to the expansion of statistics, or to carry out a more regional analysis through hydrological indexes. In this sense, it is necessary to obtain information on precipitation, flows, evaporation, temperatures and water quality.

The extension must consider geographically binding areas from the climatic and hydrological point of view.

The information of a systematic nature and of a non-systematic or sporadic nature should be differentiated and distinguished. In relation to systematic measurements, those of continuous recording and those of a direct nature must be distinguished. Regarding the information of sporadic nature, all the background information must be clearly established for its proper identification and subsequent use.

All the information collected must be organized in tables in an appropriate format for the subsequent processes of homogenization, validation and use.

3.1.2 Hydrological measurement plan

The development of a measurement plan is contemplated in order to generate the hydrological and hydrometric information necessary to meet the proposed assessment objectives. It is considered that, as a minimum, measurements that cover a full year should be available in order to have the background information that represents the seasonal variation.

The monitoring will be aimed at complementing the existing information in order to have a base or information platform sufficiently adequate to carry out the hydrological analyzes and evaluations contemplated in this joint study profile. The above must be performed on the basis of direct hydrological analyzes if the available information allows it or alternatively or complementary, on the basis of indirect hydrological methods of a conventional nature.

El plan de mediciones debe incluir - en la forma que se indica a continuación - la medición de precipitaciones, caudales, niveles de aguas subterráneas, calidad de aguas e isótopos, temperatura y evaporación. Este plan, que tiene el carácter de sistemático, debe contemplar como mínimo lo siguiente:

a) <u>Precipitaciones</u>

Al menos 4 puntos donde se localicen pluviógratos que permitan acumular o registrar información por lo menos durante tres meses debido a las condiciones de acceso.

Dos puntos ubicados en la zona de cabecera de la cuenca, uno en la vertiente oeste y otro en la vertiente este a cotas del orden de 4750 msnm.

En la zona del cruce de frontera a una cota no superior a 4500 msnm

En la zona mas al oriente de las nacientes Orientales para caracterizar la variabilidad este-oeste

Los pluviógrafos deben contar con un sistema para la medición de precipitación en forma de nieve y su acumulación

b) <u>Caudales</u>

Se contempla el control sistemático de caudales en los siguientes puntos[2]:

Quebrada Oriental en cruce camino

Quebrada Cajones antes de Quebrada Silala

Quebrada Oriental antes Quebrada Cajones

Quebrada Silala después de Quebrada Cajones
Río Silala en cruce de frontera

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[2] El término Quebrada Silala se refiere a la incisión que continúa aguas abajo de la confluencia de las quebradas Orientales y Cajones. Estas últimas se refieren a la bicación de las vertientes del mismo nombre.

The measurement plan should include –in the form indicated below– the measurement of rainfall, flow rates, underground water levels, water and isotope quality, temperature and evaporation. This plan, which has the character of systematic, must contemplate at least the following:

a) Precipitation

At least 4 points where pluviographs are located that allow gathering or registering information for at least three months due to access conditions.

Two points located in the headwaters of the basin, one on the western slope and another on the eastern slope at heights of the order of 4,750 masl.

In the area of the border crossing at an elevation no higher than 4,500 masl.

In the easternmost area of the Orientales springs in order to characterize the east-west variability

The pluviographs must have a system for the measurement of precipitation in the form of snow and its accumulation.

b) Flows

The systematic control of flows is contemplated in the following points[2]:

Oriental Ravine at the crossroad
Cajones Ravine before the Silala Ravine
Oriental Ravine before the Cajones Ravine
Silala Ravine after the Cajones Ravine
Silala River at the border crossing

[2] The term Silala Ravine refers to the incision that continues downstream from the confluence of the Orientales and Cajones ravines. These latter refer to the location of the springs of the same name.

Se considera la realización de aforos mensuales, por un periodo de un año, en dichos puntos. Se realizarán siguiendo las normas hidrométricas y se debe entregar toda la información detallada generada en dichos aforos así como la topografía de la sección de control en el caso de que se haga un levantamiento específico. Será necesario realizar trimestralmente una serie aforos a lo largo del día dichos puntos para conocer la variabilidad del caudal por efecto de la temperatura, se deberá desarrollar a lo menos 4 mediciones adecuadamente distribuidas trimestralmente.

b.1 Campañas detalladas

Adicionalmente deberá realizarse a lo menos tres campañas de mediciones detalladas, las cuales deberán espaciarse adecuadamente a lo largo del presente trabajo de forma de obtener información representativa.

En estas campañas se realizará el aforo del caudal de todos los flujos superficiales identificados, ya sean ríos, esteros, vertientes o manantiales y cualquier otro flujo o afloramiento que genere escorrentía superficial que no esté contemplada dentro del programa sistemático. En especial debe considerarse la realización de aforos en puntos intermedios de los cauces con el fin de determinar el balance de los aportes laterales y determinar los caudales de recuperación o pérdida por tramos de cauces. Del mismo modo deberá efectuarse el aforo del caudal de aguas en la zona de ubicación de obras de captación, considerando aforar el caudal aguas arriba, aguas abajo y el captado por dicha obra. La cantidad de puntos a aforar en total se estima en un número no inferior a 30.

c) Calidad de aguas

Se considera el monitoreo de la calidad del agua, con frecuencia mensual en los mismos puntos de control de caudales indicados anteriormente.

Además deberá considerarse el control de la calidad de las aguas en los puntos donde se realizarán aforos de caudal cuatrimestral, estas mediciones y muestreos se harán simultáneamente con dichos aforos. Las muestras deberán tener el tratamiento correspondiente, de acuerdo a los métodos estándares, para la debida preservación para su análisis en laboratorio. En forma adicional se obtendrán muestras de lluvias y nieve según lo

It is considered to carry out monthly stream-gauging, for a period of one year, at said points. They will be carried out following the hydrometric standards and all the detailed information generated in said gauging should be provided, as well as the topography of the control section in case a specific survey is made. It will be necessary to perform a series of exercises quarterly throughout the day at these points in order to know the variability of the flow due to the effect of temperature. At least 4 measurements must be carried out, properly distributed quarterly.

b.1. Detailed campaigns

Additionally, at least three detailed measurements campaigns should be carried out, which should be appropriately spaced throughout this work in order to obtain representative information.

In these campaigns the gauging of the flow of all identified surface flows will be carried out, whether rivers, estuaries, springs or streams and any other flow or outcrop that generates surface runoff that is not contemplated within the systematic program. Particularly, the carrying out of gauging at intermediate points of the channels should be considered in order to determine the balance of the lateral contributions and determine the recovery or loss flows by sections of channels. In the same way, the capacity of the water flow in the area where the catchments are located must be measured, considering the flow upstream, downstream and the volume abstracted by said works. The quantity of points to be gauged in total is estimated at a number not less than 30.

c) Water quality

It is considered to carry out the monitoring of water quality with monthly frequency in the same flow control points indicated above.

In addition, the control of the water quality at the points where quarterly flow gauging will be carried out should be considered. These measurements and sampling will be done simultaneously with said gauging. The samples must have the corresponding treatment, according to standard methods, for the proper preservation in order to analyze it in the laboratory. In addition, samples of rain and snow will be obtained as indicado en el punto 3.5.2. Las muestras deberán estar debidamente rotuladas indicando fecha, lugar para su debida correlación con caudales, precipitaciones, etc.

El monitoreo contempla que se mida in situ el pH, conductividad eléctrica, temperatura del agua y oxígeno disuelto. Valores que además deberán medirse en laboratorio al momento de efectuar el análisis del resto de los parámetros. El análisis deberá entregar la totalidad de los macroelementos, además microelementos tales como: Boro, Flúor, Arsénico, Litio, Cobre, Sílice y otras necesarias para lograr el adecuado estudio hidrogeoquímico.

Los análisis serán aceptables si el balance iónico de los macroelementos presenta un error de cierre menor a 5%, de lo contrario deberán repetirse; por lo tanto las muestras deberán ser de volumen suficiente para tal efecto.

3.2 Análisis de precipitaciones

A partir de los antecedentes obtenidos, tanto en terreno como de la recopilación, se procederá a efectuar lo siguiente:

3.2.1 Análisis de la calidad de la información

Se deberá efectuar un completo análisis de la información con el objeto de disponer de estadísticas adecuadas, compatibles y confiables. Para tal efecto se revisará los registros y veri ficará que los valores registrados no presenten distorsiones. .

Para dicho propósito, se deberán aplicar procedimientos convencionales que permitan verificar la homogeneidad y validez de la información.

Asimismo, se deberá considerar corno alternativa la completación o extensión de la serie estadística a partir de datos existentes en otras zonas que permitan fundadamente representar a escala regional un comportamiento similar. La escala de relleno para este proceso debe ser analizada y fundamentada adecuadamente.

El proceso deberá concluir con la confección de estadísticas de precipitaciones corregidas y validadas de extensión apropiada para los fines que se persiguen (mensual, anual, etc.)

indicated in point 3.5.2. The samples must be properly labeled, indicating the date, the place for its proper correlation with flows, precipitation, etc.

The monitoring contemplates that the pH, electrical conductivity, water temperature and dissolved oxygen are measured in situ. These values must also be measured in the laboratory when analyzing the rest of the parameters. The analysis must deliver all the macro-elements, in addition to the micro-elements such as: Boron, Fluorine, Arsenic, Lithium, Copper, Silica and others necessary to achieve the appropriate hydro-geochemical study.

The analysis will be acceptable if the ionic balance of the macro-elements presents a closing error of less than 5%, otherwise they must be repeated. Therefore, the samples must be of sufficient volume for this purpose.

3.2 Precipitation analysis

Based on the information obtained, both in the field and in the compilation, the following will be carried out:

3.2.1 Analysis of the quality of information

A complete analysis of the information should be carried out in order to have adequate, compatible and reliable statistics. For this purpose, the records will be reviewed and the registered values will be checked for distortions.

For this purpose, conventional procedures should be applied in order to verify the homogeneity and validity of the information.

Likewise, the completion or extension of the statistical series should be considered as an alternative, based on existing data in other areas that allow a similar behavior to be represented on a regional scale. The filling scale for this process must be analyzed and properly founded.

The process must conclude with the preparation of corrected and validated precipitation statistics of appropriate extension for the purposes pursued (monthly, annual, etc.).

Sobre la base de las series confeccionadas, se establecerán índices que permitan describir la variabilidad de la precipitación a través de indicadores característicos para tal efecto (varianza, coeficiente asimetría, etc.)

3.2.2 Caracterización de la precipitación

Sobre la base de lo anterior deberá efectuarse una caracterización del régimen de precipitaciones que permita conocer lo siguiente:

- Variabilidad temporal de la precipitación (estacionalidad, variación interanual)
- Variabilidad espacial (gradientes, área de precipitación nival, etc.)
- Precipitación media anual para diferentes zonas definidas según rangos de elevación
- Precipitación media anual para diferentes probabilidades de excedencia

Corno resultado de lo anterior deberá generarse mapas de isolíneas de precipitación media (isoyetas) para la cuenca en estudio.

3.3 Análisis de caudales

En primer lugar, se procederá a efectuar un análisis de los datos recopilados y generados. Como arte de este trabajo, el análisis deberá orientarse a la verificación y validación de la información.

A partir de lo anterior deberá efectuarse un proceso de extensión de las estadísticas generadas considerando la necesidad de generar series de caudales mensuales y anuales. Para tal efecto deberá considerarse la necesidad de recurrir a datos existentes en zonas o cuencas vinculantes desde el punto de vista de vecindad y de condiciones hidrometeorológicas. Dichas zonas deben presentar indicadores de régimen similar en el caso de abordar este trabajo a partir de métodos indirectos.

La serie de caudales mensuales generados deberá entregarse en una tabla indicando los valores rellenados y el método usado así como los valores extendidos y el método aplicado.

Based on the series prepared, indices will be established to describe the variability of precipitation through characteristic indicators for this purpose (variance, coefficient of asymmetry, etc.).

3.2.2 Characterization of precipitation

On the basis of the above, a characterization of the precipitation regime should be carried out, which allows knowing the following:

- Temporal variability of precipitation (seasonality, inter-annual variation).
- Spatial variability (gradients, snow precipitation area, etc.).
- Average annual precipitation for different areas defined according to elevation ranges.
- Average annual precipitation for different exceedance probabilities.

As a result of the above, it will be necessary to generate maps of isolines of average precipitation (isohyets) for the basin under study.

3.3 Flow analysis

First, an analysis of the data collected and generated will be carried out. As part of this work, the analysis should be oriented to the verification and validation of the information.

Based on the above, a process must be carried out in order to extend the statistics generated, considering the need to generate series of monthly and annual flows. To this end, consideration should be given to the need to resort to existing data in areas or basins that are binding from the point of view of neighborhood and hydro-meteorological conditions. These areas should present similar regime indicators in the case of approaching this work from indirect methods.

The series of monthly flows generated should be delivered in a table, indicating the values filled and the method used as well as the extended values and the applied method.

El tratamiento de los datos de aforos puntuales, dada la escasa información existente, es de la mayor importancia por lo que debe efectuarse un análisis en profundidad de esta información.

Sobre la base de dicha estadística se procederá a efectuar un análisis de los caudales cuyo primer propósito será la determinación de lo siguiente:

- Caudales medios mensuales
- Caudales medios anuales según probabilidad de excelencia.
- Caudales específicos anuales medios (m3/seg. y m3/s/km2/mm)

En segundo término es de interés efectuar una caracterización del régimen hidrológico distinguiendo régimen nival y pluvial, en la medida que sea pertinente.

Los resultados deben entregarse, siguiendo el orden de aguas arriba hacia agua abajo, en los siguientes puntos:

- Puntos donde se encuentran las estaciones de control de caudales indicadas en el punto 3.1.2 letra b.
- Junta de otras quebradas afluentes a la quebrada Silala
- Río Silala en el cruce de frontera

3.4 Caracterización de la calidad de las aguas

En este caso es necesario efectuar un análisis de la consistencia y coherencia de la información, verificando a través de criterios de validación rangos admisibles o físicos de los parámetros que se controlan (cuando ello proceda)

Del mismo modo, para el caso de los macroelementos se debe verificar el error de cierre del balance iónico según lo indicado en el punto 3.1.2 letra c.

Sobre la base de la información validada y corregida, se procederá a caracterizar el tipo de aguas en los puntos de control. Es de interés que se realice una caracterización respecto a la variabilidad temporal y espacial de la calidad. Adicionalmente se debe proceder a relacionar la calidad de las aguas con las características geológicas de la zona y las características de la recarga, teniendo en cuenta la información histórica disponible antes y después de la construcción de las obras.

The treatment of the data of detailed gauges –given the scarce existing information– is of the greatest importance for which an in-depth analysis of this information must be carried out.

On the basis of said statistics, an analysis of the flows will be carried out whose first purpose will be the determination of the following:

- Monthly average flows
- Annual average flows according to probability of excellence.
- Annual average specific flows (m3/sec and m3/s/ km2/mm)

Secondly, it is of interest to carry out a characterization of the hydrological regime, distinguishing the snow regime and the rainfall regime, insofar as is relevant.

The results must be delivered, following the order of upstream to downstream, in the following points:

- Points where the flow control stations are located indicated in point 3.1.2 letter b.
- Joint of other streams tributaries to the Silala ravine.
- Silala River at the border crossing.

3.4 Characterization of water quality

In this case it is necessary to carry out an analysis of the consistency and coherence of the information, verifying through validation criteria the admissible or physical ranges of the parameters that are controlled (when applicable).

In the same way, for the case of the macro-elements, the closing error of the ionic balance must be verified as indicated in point 3.1.2 letter c.

On the basis of the validated and corrected information, the type of water in the control points will be characterized. It is of interest that a characterization is made regarding the temporal and spatial variability of the quality. Additionally, the quality of the water must be related to the geological characteristics of the area and the characteristics of the recharge, taking into account the historical information available before and after the construction of the works.

3.5 Caracterización isotópica

Se procederá a efectuar una caracterización isotópica de los flujos que confluyen hacia la frontera, para lo cual se procederá a lo siguiente:

3.5.1 Recopilación de datos existentes

Se efectuará una completa recopilación de la información del contenido isotópico existentes en estudios, publicaciones científicas y en informes. La información deberá contener los antecedentes que permitan su adecuada identificación (fecha, ubicación, tipo de agua muestreada, etc.)

Se deberá recopilar información sobre isótopos ambientales (deuterio, oxigeno18, tritio, carbono 13 y 14) de la cuenca hidrográfica y de una zona suficientemente amplia de modo de disponer los antecedentes que permitan conocer su comportamiento regional. Para tal efecto se considerará información existente de aguas lluvias, nieve, lagunas o lagos, vertientes, aguas subterráneas, etc.

3.5.2 Muestreos y mediciones

Se deberá establecer un programa de muestreo y análisis de isótopos ambientales para la obtención de datos cuatrimestrales de aguas superficiales (ríos, lagunas y vertientes), aguas subterráneas aguas lluvias y nieve. El muestreo para aguas superficiales se realizará conjuntamente con las campañas de aforo mencionadas anteriormente; se incluirá también muestreo en lagunas en los mismos puntos donde se controle calidad del agua. El muestreo de aguas lluvias se realizará en los puntos definidos para medición de precipitaciones. El muestreo para aguas subterráneas se hará en los sondajes a perforar, según se indica mas adelante en el punto 4.2.1, siguiendo los estándares convencionales para este caso. Las muestras de nieve se obtendrán en puntos localizados en las vertientes norte y sur de la zona de cabecera de la cuenca considerando a 10 menos 4 puntos adecuadamente distribuidos para obtener buena representatividad. Para el caso de lluvias y nieve se tomarán muestras adicionales para el análisis de calidad de aguas según el protocolo establecido en el punto 3.2.1 letra c.

3.5.3 Resultados

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3.5 Isotopic characterization

An isotopic characterization of the flows that converge towards the border will be carried out, for which the following will be done:

3.5.1 Collection of existing data

A complete compilation of the information regarding the isotopic content existing in studies, scientific publications and reports will be carried out. The information must contain the background information that allows its proper identification (date, location, type of water sampled, etc.)

Information on environmental isotopes (deuterium, oxygen 18, tritium, carbon 13 and 14) must be collected from the hydrographic basin and a sufficiently large area in order to provide the background information to know their regional behavior. For this purpose, the existing information on precipitation, snow, lagoons or lakes, springs, underground water, etc., will be considered.

3.5.2 Sampling and measurements

A program of sampling and analysis of environmental isotopes should be established in order to obtain quarterly data on surface water (rivers, lakes and springs), underground water, rainwater and snow. Sampling for surface water will be carried out in conjunction with the capacity assessment campaigns mentioned above. Sampling in lakes will also be included in the same points where water quality is controlled. Rainwater sampling will be done at the points established for precipitation measurement. The sampling for underground water will be made in the holes to be drilled, as indicated below in point 4.2.1, following the conventional standards for this case. The snow samples will be obtained at points located on the north and south slopes of the headwaters of the basin, considering at least 4 points properly distributed in order to obtain good representativeness. In the case of precipitation and snow, additional samples will be taken for water quality analysis according to the protocol established in point 3.2.1 letter c.

3.5.3 Results

A partir de los antecedentes deberá realizarse un análisis orientado a determinar la dinámica del sistema. En particular se orientará a identificar la relación entre la precipitación, los caudales superficiales y los flujos subterráneos vinculados con las aguas del río Silala que cruzan la frontera.

Se consulta análisis de tritio y carbono con el objeto de conocer la dinámica de las aguas subterráneas que confluyen hacia la frontera y que se vinculan con los flujos superficiales pasantes.

Adicionalmente se deberá tener en cuenta el análisis que permita conocer la influencia de las zonas de humedales sobre los flujos superficiales, atendiendo su posible diferenciación evaporativa y/o sus características hidrogeoquímicas específicas.

4. CARACTERIZACIÓN HIDROGEOLÓGICA

4.1 Marco Geomorfológico, Geológico, Estructural y Tectónico Regional.

En lo referente a la geomorfología se deberá efectuar una definición y caracterización de las formas del relieve mas destacadas. En relación con la geología se deberá realizar una identificación, delimitación y caracterización de todas las unidades de suelos o depósitos no consolidados y rocas: En relación con los elementos estructurales se deberá identificar, delimitar y caracterizar los principales elementos estructurales, es decir, lineamientos y fallas de alcance regional, reconocidas en torno a la zona ocupada por la hoya hidrográfica del río Silala, como consecuencia de la evolución geodinámica neógena de este sector andino.

Se sustentará en la recopilación de todos los antecedentes relacionados con estudios e investigaciones geológicas realizadas en la zona, ya sea de carácter regional o local, debiéndose desarrollar trabajos en el propio terreno orientados a complementar las actividades conducentes a la elaboración de la cartografía geológica final.

4.1.1 Geología de Detalle.

a) Definición y caracterización de las formas del relieve:

From the background information, an analysis should be conducted in order to determine the dynamics of the system. In particular, it will focus on identifying the relationship between precipitation, surface flows and underground flows linked to the Silala River waters that cross the border.

Tritium and carbon analyzes are consulted in order to know the dynamics of the underground water that converge towards the border and that is linked to the superficial through-flows.

Additionally, the analysis that allows to know the influence of the wetland areas on the superficial flows, taking into account their possible evaporative differentiation and/or their specific hydro-geochemical characteristics, should be taken into account.

4. HYDROGEOLOGICAL CHARACTERIZATION

4.1 Regional Geomorphological, Geological, Structural and Tectonic Framework

With regard to geomorphology, a definition and characterization of the most important topographical forms should be carried out. In relation to geology, an identification, delimitation and characterization of all soil units or unconsolidated deposits and rocks must be carried out. In relation to the structural elements, the main structural elements must be identified, delimited and characterized, that is, guidelines and faults of regional scope, recognized around the area occupied by the hydrographic basin of the Silala River, as a consequence of the neo-dynamic geodynamic evolution of this Andean sector.

It will be based on the compilation of all the background information related to geological studies and investigations carried out in the area, whether of a regional or local nature, having to develop works in the field oriented to complement the activities leading to the elaboration of the final geological cartography.

4.1.1 Detail Geology

a) Definition and characterization of topographical forms:

- "tierras bajas": superficies peniplanicies altiplánicas-conos aluviales - zonas depresionarias (lagunas. salares)- sistemas fluviales (ríos, quebradas, esteros, vertientes, incisiones menores);

- "tierras altas": estructuras volcánicas, (edificios volcánicos, domos, flujos de lavas e ignimbritas).

- rasgos asociados a procesos glaciales (remanentes morrénicos y periglaciales) y remociones en masa: deslizamientos, desprendimientos, flujos de barro o detritos.

b) Identificación, delimitación y caracterización de todas las unidades de suelos o depósitos no consolidados y rocas, en todo el ámbito de la hoya hidrográfica comprometida por el flujo de las aguas del Silala que cruzan por la frontera.

- Definición y relaciones estratigráficas
- Distribución y litología.
- Espesores.
- Edades, (realización de dataciones radiométricas), correlaciones y mecanismos genéticos: intrusivos, extrusivos o actividad volcánica, sedimentaria (fluvial, coluvial, eólica, glacial, aluvional).

Para estos efectos se deberá recurrir al procesamiento de imágenes satelitales y la interpretación fotogeológica de fotografías aéreas de la zona.

4.1.2 Esctructura y tectónica

Identificación de los principales elementos estructurales presentes en la zona de interés: lineamientos, fotolineamientos mayores; fallas; patrones locales de fracturamiento; plegamientos y discordancias.

Para estos efectos, del mismo modo que en el caso anterior, se deberá recurrir al procesamiento de imágenes satelitales y el análisis de fotografías aéreas.

En este caso y el correspondiente al punto 4.1.1 se debe desarrollar trabajos en el propio terreno orientados a complementar las actividades conducentes a la elaboración de la cartografía geológica final.

- “Lowlands”: Altiplanic peneplain surfaces – alluvial cones – depressions (lakes, salt flats) – river systems (rivers, ravines, estuaries, springs, minor incisions);

- “Highlands”: Volcanic structures, (volcanic buildings, domes, lava flows and ignimbrites).

- Features associated with glacial processes (morainic and paraglacial remnants) and mass removals: landslides, mudslides, mud flows or debris.

b) Identification, delimitation and characterization of all units of unconsolidated soils or deposits and rocks, in the entire area of the hydrographic basin compromised by the flow of the Silala waters that cross the border.

- Definition and stratigraphic relationships
- Distribution and lithology.
- Thicknesses
- Ages (radiometric dating), correlations and genetic mechanisms: intrusive, extrusive or volcanic activity, sedimentary (fluvial, colluvial, wind, glacial, alluvial).

For these purposes, it will be necessary to resort to the processing of satellite images and the interpretation of aerial photographs of the area.

4.1.2 Structure and tectonics

Identification of the main structural elements present in the area of interest: guidelines, major photo guidelines, faults, local patterns of fracturing, refolding and unconformity.

For these purposes, in the same way as in the previous case, it will be necessary to resort to the processing of satellite images and the analysis of aerial photographs.

In this case and the one corresponding to point 4.1.1, work must be carried out in the field itself in order to complement the activities leading to the final geological cartography.

4.1.3 Escalas de trabajo.

Para el punto 4.1.1 se requiere generar y entregar la información a escala 1 :50.000 para el otro caso se requiere una escala 1: 25.000.

4.2 Labores prospectivas y de exploración

Se deberá mejorar y/o complementar el conocimiento geológico subsuperficial actual; en términos del carácter, continuidad lateral y profundidad, espesores, relaciones infra y suprayacente de las diversas unidades identificadas en superficie. Para estos efectos se deberá realizar una serie de actividades de exploración, empleando dos procedimientos:

4.2.1 Métodos de prospección hidrogeológica.

Dos alternativas pueden ser consideradas.

a) Geofísica.

Habida cuenta de los elevados costos de los sondajes de prospección, se recomienda considerar, en una primera etapa, este tipo de procedimiento prospectivo. Con sus resultados será posible acotar la posterior localización de sondajes y determinar sus respectivas profundidades.

Para este propósito es recomendable emplear el método de Transiente Electro Magnético, TEM, en atención a la experiencia en prospecciones en ambientes como el de la zona en estudio.

Para la zona objeto del estudio, la aplicación de este método permitiría:

- Estimar el espesor de los cuerpos acuíferos sedimentarios
- Estimar la situación de los niveles de agua
- Detectar la presencia y geometría del basamento rocoso del relleno sedimentario

Para los efectos del presente estudio se deberá efectuar perfiles geofísicos (TEM, etc) que permitan definir dos perfiles tranversales en los sectores siguientes:

- Sector de junta Quebrada Oriental con Quebrada Cajones

4.1.3 Work scales

For point 4.1.1, it is required to generate and deliver information at a scale of 1:50.000; for the other case, a scale of 1:25.000 is required.

4.2 Prospective and exploration work

The current sub-surface geological knowledge should be improved and/or complemented; in terms of the character, lateral continuity and depth, thicknesses, infra and superjacent relationships of the various units identified on the surface. For these purposes, a series of exploration activities must be carried out, using two procedures:

4.2.1 Methods of hydrogeological prospecting

Two alternatives can be considered.

a) Geophysics

Given the high costs of prospecting drilling, it is recommended to consider, in a first stage, this type of prospective procedure. With its results it will be possible to limit the subsequent drilling location and determine their respective depths.

For this purpose, it is advisable to use the Electromagnetic Transient (EMT) method, based on the experience in prospecting in environments such as the area under study.

For the area under study, the application of this method would allow:

- Estimate the thickness of the sedimentary aquifer water bodies.
- Estimate the situation of water levels.
- Detect the presence and geometry of the rocky basement of the sedimentary fill.

For the purposes of this study, geophysical profiles (EMT, etc.) should be carried out in order to define two transversal profiles in the following sectors:

- Joint sector of the Oriental ravine with the Cajones ravine

- Sector intermedio entre Quebrada Cajones y el cruce de frontera

- Sector del cruce de frontera

b) Sondajes

Los sondajes a realizar deben ser diseñados para satisfacer los siguientes propósitos:

- Generar información geológica e hidrogeológica
- Mejorar y complementar la información geofísica obtenida.
- Ajustar los resultados previos de la geofísica

Respecto de la geología, la información generada comprende tipo, relaciones de contacto, espesores. continuidad lateral y en profundidad de las secuencias ignimbríticas. Respecto de la hidrogeología se orienta a detectar la presencia de aguas subterráneas, tipos de acuíferos, situación de sus niveles, caudales, permitir la extracción de muestras para determinaciones físico - químicas e isotópicas. Lo anterior con el objeto de obtener una adecuada explicación de la interrelación de las aguas subterráneas que confluyen a la frontera e interactúan con los flujos superficiales pasantes en este sector.

Cada sondaje debe tener una descripción estratigráfica detallada que permita identificar los diferentes estratos encontrados durante la perforación. La localización de las cribas deberá quedar claramente definida. En el caso de encontrarse unidades acuíferas distintas, deberá señalarse la ubicación de las cribas en cada una de ellas.

Se deberá realizar pruebas de bombeos en cada sondaje, considerando gasto variable y de gasto constante, esta ultima con al menos una duración de 24 hr. o una duración mayor si la estabilización lo requiere. El trabajo incluye el análisis que permita el cálculo de los principales parámetros elásticos del sistema acuífero (coeficientes de transmisibilidad y almacenamiento). Además al inicio de la prueba, en la mitad y en la parte final se tomarán muestras para calidad de aguas y análisis isotópico.

En todos los sondajes se deberá realizar una determinación de la cota del nivel de la napa con una precisión que permita determinar el gradiente hidráulico. En caso de encontrarse más de una unidad

- Intermediate sector between the Cajones ravine and the border crossing
- Sector of the border crossing.

b) Drilling

The drillings to be performed must be designed to meet the following purposes:

- Generate geological and hydrogeological information
- Improve and complement the obtained geophysical information
- Adjust the previous results of geophysics

Regarding geology, the information generated includes type, contact relations, thicknesses, lateral and in-depth continuity of ignimbrite sequences. Regarding hydrogeology, it is aimed at detecting the presence of underground water, types of aquifers, situation of their levels, flow rates, allowing the extraction of samples for physical-chemical and isotopic determinations. The foregoing in order to obtain an adequate explanation of the interrelation of underground water that converge to the border and interact with superficial through-flows in this sector.

Each drilling must have a detailed stratigraphic description in order to identify the different strata found during drilling. The location of the screens must be clearly defined. In the case of finding different aquifer units, the location of the screens in each of them should be indicated.

Pumping tests must be carried out in each drill hole, considering the variable expense and the constant expense, the latter with at least a duration of 24 hours or a longer duration if the stabilization requires it. The work includes the analysis that allows the calculation of the main elastic parameters of the aquifer system (coefficients of transmissibility and storage). In addition to the start of the test, in the middle and in the final part samples will be taken in order to see the water quality and carry out an isotopic analysis.

In all drillings, a determination of the elevation level of the underground water must be made with a precision that allows determining the hydraulic gradient. If more than one aquifer unit acuífera en el relleno sedimentario los sondajes deberán habilitarse de forma de poder efectuar mediciones, muestreos, pruebas de bombeo en forma independiente para cada uno de ellos.

En una primera etapa, independiente de los resultados de la geofísica, se debería considerar la realización en cada costado de río Silala de por lo menos 3 sondajes someros cuya localización y profundidad permita reconocer el relleno sedimentario donde se desarrolla el río Silala. Asociado a cada sondaje debe construirse a lo menos un piezómetro que permita observar niveles y permitir conocer gradientes, estos también deben tener la nivelación de la cota del nivel de la napa.

La localización de estos sondajes será:

- La quebrada Oriental aguas abajo del cruce del camino;
- Aguas abajo de la confluencia de las quebradas Orientales y Cajones;
- Aguas arriba de las proximidades del cruce de frontera.

De estimarse necesario deberá considerarse dos sondajes adicionales, uno en las nacientes de la quebrada Orientales y otro en las nacientes de la quebrada Cajones.

4.3 Caracterización de unidades acuíferas y su geometría

En este punto, con ajuste al conocimiento geológico de superficie (mapeos y perfiles) y subsuperficie (sondajes y prospecciones geofísicas), se deberá efectuar una caracterización de las unidades acuíferas existentes aguas arriba del limite internacional, considerando lo siguiente:

- Caracterización litológica de las secuencias volcánicas y clásticas reconocidas
- Determinar su continuidad lateral y en profundidad
- Establecer relaciones infra y suprayacentes
- Definir espesores

Como resultado del trabajo se deberá entregar perfiles y mapas de planta donde se identifiquen las secciones reconocidas, tanto por sondajes como a través de geofísica, además de las secciones inferidas en base a la información de superficie.

is found in the sedimentary fill, the drilling must be enabled in order to be able to carry out measurements, sampling, and pumping tests independently for each of them.

In a first stage, independent of the results of geophysics, the realization on each side of the Silala River of at least 3 shallow holes should be considered, whose location and depth allow to recognize the sedimentary fill where the Silala River develops. Associated to each drilling must be built at least one piezometer that allows to observe levels and allow knowing gradients, these must also be leveled to the elevation of the groundwater layer.

The location of these drillings will be:

- The Orientales ravine downstream of the road junction;

- Downstream from the confluence of the Orientales and Cajones ravines;

- Upstream from the vicinity of the border crossing.

If necessary, two additional drillings should be considered, one in the headwaters of the Orientales ravine and another in the headwaters of the Cajones ravine.

4.3 Characterization of aquifer units and their geometry

At this point, with adjustment to geological knowledge of surface (maps and profiles) and sub-surface (drilling and geophysical surveys), a characterization of the existing aquifer units upstream of the international border should be carried out, considering the following:

- Lithological characterization of recognized volcanic and elastic sequences

- Determine its lateral and in-depth continuity

- Establish infra and supra-lying relationships

- Define thicknesses

As a result of the work, profiles and plant maps should be submitted where recognized sections are identified, both by drilling and through geophysics, as well as inferred sections based on surface information.

También se deberán indicar los sectores en los cuales la determinación de espesores, o de localización del basamento, se estima incierta para los efectos de establecer volúmenes de almacenamiento.

4.4 Caracterización de parámetros elásticos

Sobre la base de los antecedentes generados se definirán los coeficientes de transmisibilidad y almacenamiento. Este trabajo deberá establecer por zonas consideradas similares, la definición de parámetros que sean representativos. Para esto deberá considerarse lo siguiente:

- Revisión de la información estratigráfica existente

- Pruebas de bombeo en los sondajes que se realicen.

En base a lo anterior, se deberá definir los coeficientes de transmisibilidad y de almacenamiento para las distintas unidades (si se establecen) y además determinar áreas con coeficientes representativos efectuándose, para tal efecto deberá confeccionarse un mapa a escala 1:50.000 o de mayor detalle si es necesario para obtener una adecuada representación.

4.5 Interacción aguas superficiales y subterráneas

El análisis tiene como objetivo establecer la potencial interacción existente entre el escurrimiento superficial y la unidad acuífera que está directamente vinculado con este en la zona de cruce de la frontera.

Para tal efecto deberá considerarse la realización de aforos antes y durante la realización de las pruebas de bombeos, así como muestreos de calidad de agua natural antes de la prueba en el cauce y en el sondaje. Deberá considerarse la realización de pruebas con trazadores tales como sal, fluoresceína u otro no radiactivo y conservativo que permita establecer el grado de conexión entre el río y la unidad acuífera.

A partir de los parámetros elásticos podrán aplicarse relaciones indirectas para estudiar la interrelación río-acuífero las cuales requerirán su validación con los datos de terreno anteriormente mencionados.

It should also indicate the sectors in which the determination of the thickness, or location of the base, is considered uncertain for the purposes of establishing storage volumes.

4.4 Characterization of elastic parameters

On the basis of the generated background information the coefficients of transmissibility and storage will be defined. This work should establish, by zones considered similar, the definition of parameters that are representative. For this, the following should be considered:

- Review of existing stratigraphic information.

- Pumping tests in the drillings that are made.

Based on the above, the transferability and storage coefficients for the different units should be defined (if they are established) and also determine areas with representative coefficients. A map at a scale of 1:50.000 or more is made for that purpose if is necessary in order to obtain an adequate representation.

4.5 Interaction of surface and underground water

The objective of the analysis is to establish the potential interaction existing between surface runoff and the aquifer unit that is directly linked to it in the border crossing area.

For this purpose, carrying out drillings before and during the pumping tests should be considered, as well as natural water quality sampling before the test in the channel and in the drill hole. Tracers such as salt, fluorescein or other non-radioactive and conservative tracers should be considered to establish the degree of connection between the river and the aquifer unit.

From the elastic parameters, indirect relationships can be applied to study the aquifer-river interrelation, which will require their validation with the aforementioned terrain data.

5. IMPACTO DE LA INFRAESTRUCTURA HIDRÁULICA EXISTENTE

5.1 Descripción de las obras hidráulicas

Se consulta un trabajo de identificación y análisis de las obras hidráulicas existentes en el cauce aguas arriba del límite internacional. Este trabajo, considerando las labores indicadas en el punto 2.3.2 de este documento, considera lo siguiente:

- Descripción del tipo de obra (Tipo de estructura, estado de conservación, fecha de c construcción, dimensiones, materiales)

- Descripción histórica referida a su funcionamiento incluyendo antecedentes previos y posteriores a su construcción (fotografías, mapas, planos, cotas, dimensiones, etc)

- Ubicación precisa en coordenadas
- Capacidad de porteo y rebase
- Finalidad de la obra
- Vinculación con aportes laterales

Para tal efecto se elaborará una ficha para cada obra, en un formato definido, el cual contendrá la información indicada además de un croquis y una fotografía a color.

5.2 Interacción de las obras y los recursos hídricos

Tomando en consideración las aguas superficiales, se procederá a lo siguiente:

- Determinar el área de drenaje o aportante a cada obra hidráulica
- Determinar los caudales captados por cada obra
- Establecer los caudales superficiales en régimen natural aguas arriba de las obras hidráulicas en análisis
- Establecer los caudales sobrantes aguas abajo de dicha obra

En el caso de las aguas subterráneas deberá analizarse los efectos de cada obra sobre la inreacción del río con el acuífero directamente ligado con ella. Para tal efecto deberá analizarse los posibles cambios en la recarga o recuperaciones desde los cauces naturales hasta el cruce de frontera.

Sobre la base de los antecedentes topográficos, hidrológicos, hidrogeológicos y características de las obras hidráulicas, el análisis

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5. IMPACT OF THE EXISTING HYDRAULIC INFRASTRUCTURE

5.1 Description of hydraulic works

A work of identification and analysis of the hydraulic works existing in the channel upstream of the international border is consulted. This work, considering the tasks indicated in point 2.3.2 of this document, includes the following:

- Description of the type of work (type of structure, state of conservation, date of construction, dimensions, materials).

- Historical description referring to its operation including background information prior and after its construction (photographs, maps, plans, elevations, dimensions, etc.)

- Accurate location in coordinates
- Carrying capacity and overflow
- Purpose of the work
- Linkage with lateral contributions

For this purpose, a datasheet will be prepared for each work, in a defined format, which will contain the indicated information as well as a sketch and a color photograph.

5.2 Interaction of works and water resources

Taking into consideration the surface waters, the following will be done:

- Determine the drainage or contributor area for each hydraulic work
- Determine the flows abstracted by each work
- Establish the surface flows in natural regime upstream of the hydraulic works in analysis
- Establish the surplus flows downstream of said work

In the case of underground water, the effects of each work on the interaction of the river with the aquifer directly linked to it must be analyzed. For this purpose, the possible changes in recharge or recoveries from the natural channels up to the border crossing should be analyzed.

On the basis of the topographic, hydrological, hydrogeological background information and the characteristics of the hydraulic works, the analysis deberá pronunciarse sobre la existencia de modificaciones del sistema de drenaje, rupturas de pendientes. Del mismo modo deberá indicar la existencia de sistemas de elevación electromecánicas de aguas y trasvase de aguas de una cuenca a otra.

6. CARACTERIZACION DE FLUJOS Y SU BALANCE

6.1 Caracterización de flujos superficiales

Contempla la identificación de los flujos que genera la red de drenaje superficial a nivel de caudales medios y volúmenes, asociados, que cruzan la frontera. Del mismo modo deberán caracterizarse los flujos generados por afloramientos de vertientes.

Lo anterior debe considerar la variación estacional correspondiente, así como los valores asociados a diferentes probabilidades de excelencia.

Los flujos deberán definirse a nivel de caudal medio anual y caudales mensuales, para puntos relevantes del sistema hídrico, puntos que deben corresponder a lo menos a cuatro puntos del cierre oriental de la cuenca o sub- subcuenca, desde el punto de vista del balance hídrico, incluyendo el cruce de frontera.

6.2 Caracterización de flujos subterráneos y zonas de recarga

En base a la información de precipitaciones y de los flujos superficiales, se procederá a establecer las zonas de recarga, atendiendo las características hidrogeológicas de cada zona de estudio. El análisis de la recarga debe ser compatible con los flujos superficiales que se establecen, habida consideración de los aspectos relacionados con los flujos evaporativos y evapotranspirativos que se determinen.

Asimismo a partir de la información de aguas subterráneas, se procederá a estimar los flujos subterráneos pasantes de forma de asociar dichos flujos con sus zonas de recarga o alimentación. En este contexto se deberá estimar los flujos pasantes en los sectores ubicados aguas arriba de la quebrada Cajones; en la zona intermedia situada entre la quebrada Cajones y el límite internacional, y en la zona de cruce de frontera.

6.3 Interacción de las aguas superficiales y subterráneas

will have to pronounce itself on the existence of modifications of the drainage system, ruptures of slopes. In the same way, it should indicate the existence of electromechanical water elevation systems and water transfer from one basin to another.

6. CHARACTERIZATION OF FLOWS AND THEIR BALANCE

6.1 Characterization of surface flows

It includes the identification of the flows generated by the surface drainage network at the level of associated average flows and volumes that cross the border. In the same way, the flows generated by outcrops of springs should be characterized.

The above must consider the corresponding seasonal variation, as well as the values associated with different probabilities of excellence.

The flows should be defined at the level of average annual flow and monthly flows, for relevant points of the water system, points that must correspond to at least four points of the eastern end of the basin or sub-basin, from the point of view of the water balance, including the border crossing.

6.2 Characterization of underground flows and recharge zones

Based on the information on rainfall and surface flows, the recharge zones will be established, taking into account the hydrogeological characteristics of each study area. The analysis of the recharge must be compatible with the surface flows that are established, taking into account the aspects related to evaporative and evapotranspiration flows that are determined.

Likewise, based on the information of underground water, we will proceed to estimate the underground through-flows to be able to associate these flows with their recharge or feeding zones. In this context, the though-flows located in the sectors upstream of the Cajones ravine should be estimated, also in the intermediate zone located between the Cajones ravine and the international border, and in the border crossing area.

6.3 Interaction of surface and underground water

El análisis deberá orientarse a establecer los flujos entre ambos sistemas considerando que deberá realizarse lo siguiente:

- Identificar tramos de cauce superficiales donde pudiere producirse cambio en el caudal debido a la interacción entre el río y el acuífero directamente relacionado con este. Para ello, se podrá considerar el desarrollo especial de corridas de aforos para la cuantificación de los flujos involucrados.

- Identificar las zonas de aporte o drenaje hacia las vertientes, determinar la recarga pluvial asociada y los flujos subterráneos estimados. En este sentido es de importancia relacionar la variabilidad de los flujos con las precipitaciones e identificar la posible variabilidad dentro del día, lo que puede indicar el grado de relación con su área de drenaje o con zonas de vegas que pudieran estar asociadas.

- Establecer los consumos evapotranspirativos en zonas de vegas y bofedales (humedales), los flujos superficiales y subterráneos de alimentación que llegan a ellos. Debe considerarse la variación diaria y estacional que genera condiciones de temperatura muy diferentes en este análisis. Para tal efecto deberá efectuarse una detallada descripción de las unidades vegetacionales (superficie, tipo de vegetación, distribución de la vegetación, etc.) que permita cuantificar los consumos evapotranspirativos. Para tal efecto deberá considerarse la necesidad de disponer de datos de evaporación de tanque en torno a estas zonas, para lo cual será necesario que se contemple el control de esta variable durante el desarrollo de las actividades de terreno. En forma adicional deberá conocerse su funcionamiento a través de la medición de los niveles de agua subsuperficial (micropiezometros) de forma tal de caracterizar dirección y cuantía de los flujos superficiales y subsuperficiales someros.

Como resultado del análisis se establecerá los posibles flujos de interacción entre el cauce superficial y la unidad acuífera vinculada acumulados en la zona de interés hasta su confluencia en la zona de frontera.

6.4 Determinación de flujos que cruzan la frontera

En forma específica deberá efectuarse una evaluación de los flujos en frontera, considerando:

The analysis should be oriented to establish the flows between both systems, considering that the following should be done:

- Identify sections of the surface channel where change in flow could occur due to the interaction between the river and the aquifer directly related to it. For this, the special development of gauging runs for the quantification of the flows involved may be considered.

- Identify the zones of contribution or drainage towards the slopes, determine the associated pluvial recharge and the estimated underground flows. In this sense, it is important to relate the variability of the flows with the precipitations and identify the possible variability within the day, which may indicate the degree of relationship with their drainage area or with areas of fertile plains that could be associated.

- Establish the evapotranspiration consumption in areas of fertile plains and bofedales (wetlands), the superficial and underground recharge flows that reach them. The daily and seasonal variation that generates very different temperature conditions in this analysis should be considered. For this purpose, a detailed description of the vegetation units (surface, vegetation type, vegetation distribution, etc.) should be carried out in order to quantify the evapotranspiration consumption. For this purpose, the need to have tank evaporation data around these areas should be considered, for which it will be necessary to contemplate the control of this variable during the development of field activities. In addition, its operation should be known through the measurement of sub-surface water levels (micro-piezometers) in order to characterize the direction and amount of shallow surface and sub-surface flows.

As a result of the analysis, the possible interaction flows between the surface channel and the linked aquifer unit accumulated in the area of interest up to its confluence in the border area will be established.

6.4 Determination of flows that cross the border

Specifically, an assessment of border flows should be carried out, considering:

- Flujos superficiales

  Caudales medios anuales de largo plazo
  Caudales medios anuales de invierno y verano
  Caudales medios mensuales promedio
  Variabilidad interanual del caudal anual

- Flujos subterráneos en el cruce de frontera

  Caudal medio de largo plazo
  Caudales o volúmenes anuales

6.5 Determinación de las componentes del balance hídrico

Se consulta la integración de las componentes obtenidas en los puntos anteriores desde la perspectiva del balance hídrico de largo plazo. Las componentes del balance deberán establecerse a lo menos para los puntos donde se implementará el monitoreo de caudales.
Se incluye lo siguiente:

- Precipitación
- Evaporación y evapotranspiración
- Escorrentía superficial
- Escorrentía subterránea
- Estimación del error de cierre

6.5.1 Situación pre-existente

Se contempla en esta fase la integración de las componentes del balance hídrico de largo plazo en condiciones de régimen natural, es decir las condiciones previas a la materialización de las obras hidráulicas.

6.5.2 Situación actual

En este caso se contempla realizar el balance considerando la existencia de las obras y usos actuales dentro de la cuenca.

7. CONCLUSIONES

Como resultado del estudio se presentarán conclusiones orientadas a lo siguiente:

- Surface flows

  Annual long-term average flows
  Annual average flows of winter and summer
  Average monthly average flows
  Year-to-year variability of the annual flow

- Underground flows at the border crossing

  Average long-term flow
  Flows or annual volumes

6.5 Determination of water balance components

The integration of the components obtained in the previous points is consulted from the perspective of the long-term water balance. The components of the water balance should be established at least for the points where flow monitoring will be implemented.

The following is included:

- Precipitation
- Evaporation and evapotranspiration
- Surface runoff
- Underground runoff
- Estimation of closing error

6.5.1 Pre-existing situation

The integration of the components of the long-term water balance under natural regime conditions, that is, the conditions prior to the materialization of the hydraulic works, is contemplated in this phase.

6.5.2 Current situation

In this case, the water balance is carried out by considering the existence of works and current uses within the basin.

7. CONCLUSIONS

As a result of the study, conclusions will be presented oriented to the following:

- Características generales del régimen hidrológico existente en la zona
- Áreas de alimentación de vertientes
- Consumos evapotranspirativos
- Caudales superficiales generados en el sector de la cuenca boliviana
- Efectos de las obras hidráulicas en el drenaje y escurrimiento de las aguas
- Sentido del flujo y escurrimiento natural de las aguas
- Localización del cauce

8. BIBLIOGRAFÍA

Se indicará la bibliografía consultada tanto para la presentación de la proposición para realizar el estudio como en la fase de su ejecución. Todas las referencias indicadas deberán quedar consignadas debidamente para permitir su verificación.

- General characteristics of the existing hydrological regime in the area
- Spring feeding areas
- Evapotranspiration consumption
- Surface flows generated in the sector of the Bolivian basin
- Effects of hydraulic works on the drainage and runoff of waters
- Direction of flow and natural runoff of waters
- Channel location

8. BIBLIOGRAPHY

The bibliography consulted will be indicated both for the presentation of the proposal to carry out the study and in the implementation phase. All references indicated must be duly registered to allow verification.

Annex 5

Minutes of the II Meeting of the Bolivia-Chile Working Group on the Silala Issue, 20 January 2005

(Original in Spanish, English translation)

REPUBLICA DE BOLIVIA

MINISTERIO DE RELACIONES EXTERIORES Y CULTO

ACTA DE LA II REUNIÓN DEL GRUPO DE TRABAJO BOLIVIA – CHILE: SOBRE EL TEMA DEL SILALA

En la ciudad de La Paz, República de Bolivia, el día 20 de enero de 2005, se reunieron las Delegaciones de Bolivia y Chile, presididas por D. William Torres Armas, Director de la Unidad de Análisis de Política Exterior (UDAPEX), del Ministerio de Relaciones Exteriores y Culto de Bolivia, y la Embajadora María Teresa Infante, Directora Nacional de Fronteras y Límites del Estado, del Ministerio de Relaciones Exteriores de Chile, con el objeto de intercambiar opiniones y criterios acerca de las aguas del Silala y los recursos hídricos.

La nómina de las Delegaciones de ambos países se anexa a la presente Acta.

Ambas Delegaciones expresaron que se mantiene la voluntad política de alcanzar importantes acuerdos para cooperar en el tema de recursos hídricos compartidos y contar con un marco útil y práctico para este efecto. Un acuerdo satisfactorio para ambas partes sobre el tema del Silala servirá de valioso antecedente para avanzar en la cooperación mutua sobre dichos recursos.

Conforme al espíritu cooperativo que une a ambas Delegaciones y de acuerdo a lo establecido en la I Reunión del Grupo de Trabajo Bolivia – Chile sobre el tema del Silala, reiteraron su compromiso de avanzar en un programa de trabajo conjunto que abarcará estudios técnico–científicos en ambos lados de la frontera, necesarios para determinar la naturaleza, origen y flujos de las aguas del Silala, tanto a nivel superficial como subterráneo.

En su intervención, la parte chilena recordó la entrega con fecha 2 de agosto de 2004, de un perfil de estudio conjunto sobre "La naturaleza y características de los recursos hídricos del Silala", como fuese concordado en la reunión de 6 de mayo del mismo año. Al respecto, la Delegación boliviana se comprometió a presentar una contrapropuesta del perfil de estudio conjunto acerca de la naturaleza de los recursos hídricos compartidos.

En esta oportunidad, se concuerda actuar mediante una subcomisión de carácter técnico-científico, que dirigirá o supervisará los seis aspectos delineados en la reunión de 6 de mayo de 2004, priorizándose los siguientes:

1. Realizar los trabajos geodésicos y topográficos. Para ese efecto se recuerda el mandato a la Comisión Mixta de Límites.

MINUTES OF THE II MEETING OF THE BOLIVIA-CHILE WORKING GROUP ON THE SILALA ISSUE

In the city of La Paz, Republic of Bolivia, on 20 January 2005, the Delegations of Bolivia and Chile met, presided over by Mr. William Torres Armas, Director of the Foreign Policy Analysis Unit (UDAPEX), Ministry of Foreign Affairs and Worship of Bolivia, and Ambassador Maria Teresa Infante, National Director of State Borders and Limits, of the Ministry of Foreign Affairs of Chile, with the purpose of exchanging opinions and criteria about the Silala waters and the water resources.

The list of the Delegations of both countries is attached to this Minutes.

Both Delegations expressed that they maintain the political will to reach important agreements to cooperate in the issue of shared water resources and have a useful and practical framework for this purpose. A satisfactory agreement for both Parties on the Silala issue will serve as a valuable precedent to move forward in the mutual cooperation regarding these resources.

In accordance with the cooperative spirit that unites both Delegations and in accordance with the provisions of the I Meeting of the Bolivia–Chile Working Group on the Silala issue, they reiterated their commitment to move forward in a joint work program that will include technical-scientific studies on both sides of the border, necessary to determine the nature, origin and flows of the waters of Silala, both on the surfece and underground.

In his speech, the Chilean side recalled the delivery on 2 August 2004, of a joint study profile on "The nature and characteristics of the water resources of Silala", as agreed at the meeting of May 6th of the same year. In this regard, the Bolivian Delegation undertook to present a counterproposal of the joint study profile regarding the nature of shared water resources. In this regard, the Bolivian Delegation undertook to present a counterproposal of the joint study profile on the nature of shared water resources.

On this occasion, it is agreed to act through a technical-scientific sub-commission, which will direct or supervise the six aspects outlined in the meeting of 6 May 2004, prioritizing the following:

1. Carry out the geodesic and topographic works. For this purpose, the mandate of the Joint Boundary Commission is recalled.

REPUBLICA DE BOLIVIA

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2. Definir los parámetros del estudio conjunto y de complementar los estudios existentes en cada país, identificando las áreas en que se desarrollará cada actividad.
3. Construir una base de datos conjunta con la información disponible en ambos países.

La subcomisión mixta constituida procederá en el más breve plazo posible, a concordar el perfil definitivo del estudio conjunto, de acuerdo a los diez aspectos señalados en la reunión de 6 de mayo de 2004 y otros que pudieran concordarse. En tal sentido ambas Delegaciones acordaron la celebración de una reunión dentro del primer cuatrimestre de 2005, en una ciudad a convenir.

Ambas Delegaciones podrán solicitar conjuntamente, apoyo técnico de organismos internacionales especializados como el Organismo Internacional de Energía Atómica de las Naciones Unidas (OIEA) y el Programa de Recursos Hídricos de la UNESCO entre otros, para beneficiar, facilitar y complementar los trabajos de la subcomisión mixta. Los estudios conjuntos a que lleguen las partes, servirán de base para los acuerdos a los que arriben Bolivia y Chile.

La Delegación boliviana manifestó la importancia del manejo racional y sostenible de los recursos hídricos compartidos, en virtud de que dichos recursos tienen un carácter finito.

Al término de la Reunión la Presidenta de la Delegación de Chile, agradeció las atenciones y hospitalidad otorgadas por la Delegación de Bolivia.

Ambas Delegaciones determinaron que la III Reunión de este grupo de trabajo Bolivia – Chile sobre el tema del Silala se celebrará a fines del primer semestre del presente año.

La presente Acta es suscrita en la ciudad de La Paz, República de Bolivia, a los veinte días del mes de enero del año dos mil cinco.

POR LA DELEGACIÓN DE LA REPUBLICA DE BOLIVIA

POR LA DELEGACIÓN DE LA REPUBLICA DE CHILE

2. Define the parameters of the joint study and complement the existing studies in each country, identifying the areas in which each activity will be developed.
3. Build a joint database with the information available in both countries.

The constituted joint sub-commission will proceed as soon as possible, to agree the final profile of the joint study, according to the ten aspects indicated in the meeting of 6 May 2004 and others that could be agreed. In this sense, both Delegations agreed to hold a meeting within the first four months of 2005, in a city to be agreed upon.

Both Delegations may jointly request technical support from specialized international organizations such as the United Nations International Atomic Energy Agency (IAEA) and the Water Resources Program of UNESCO, among others, in order to benefit, facilitate and complement the work of the joint sub-commission. The joint studies to which the Parties arrive will serve as a basis for the agreements reached by Bolivia and Chile.

The Bolivian Delegation expressed the importance of rational and sustainable management of shared water resources, since these resources have a finite nature.

At the end of the meeting, the President of the Delegation of Chile thanked the courtesies and hospitality given by the Delegation of Bolivia.

Both Delegations determined that the III Meeting of this Bolivia–Chile Working Group on the Silala issue will be held at the end of the first semester of this year.

This Minutes is signed in the city of La Paz, Republic of Bolivia, on the twentieth day of the month of January of the year two thousand and five.

[Signature] FOR THE DELEGATION OF THE REPUBLIC OF BOLIVIA	[Signature] FOR THE DELEGATION OF THE REPUBLIC OF CHILE

REPUBLICA DE BOLIVIA

MINISTERIO DE RELACIONES
EXTERIORES Y CULTO

DELEGACIÓN BOLIVIANA

William G. Torres Armas
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Embajador Víctor Rico Frontaura
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REPUBLICA DE BOLIVIA

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Señor Anselmo Pommes
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Señor Arturo Heusser
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Annex 6

Minutes of the XVIII Meeting of the Bolivia-Chile Political Consultation Mechanism, 17 June 2008

(Original in Spanish, English translation)

ACTA DE LA XVIII REUNIÓN DEL MECANISMO DE CONSULTAS POLÍTICAS BOLIVIA – CHILE

En la ciudad de La Paz, República de Bolivia, el día 17 de junio de 2008, se celebró la XVIII Reunión del Mecanismo de Consultas Políticas Bolivia – Chile, con el propósito de realizar un análisis y seguimiento sobre los avances en los trece temas de la agenda común amplia y sin exclusiones, diseñada por ambos países.

La Delegación de Bolivia estuvo presidida por el Embajador Hugo Fernández Aráoz, Viceministro de Relaciones Exteriores y Cultos y la Delegación de Chile estuvo presidida por el Embajador Alberto van Klaveren Stork, Subsecretario de Relaciones Exteriores.

Esta reunión fue precedida, el día 16 de junio, por la VI Reunión del Grupo de Trabajo para Asuntos Bilaterales, cuyas conclusiones fueron sometidas a consideración y aprobación de los Jefes de Delegación. La nómina de las Delegaciones de ambos países se anexa a la presente Acta.

El Jefe de la Delegación de Bolivia dio la más cordial bienvenida a la Delegación de Chile, expresó que se ha dinamizado la relación a partir de la última reunión de este mecanismo, lo que muestra la vitalidad de las mismas, puntualizando que la Agenda de los 13 Puntos guía la relación bilateral y que el avance de cada uno de ellos permite el progreso del conjunto de la Agenda.

El Jefe de la Delegación de Chile agradeció la bienvenida y señaló que una de las principales prioridades de la política exterior de Chile consiste en fortalecer las relaciones bilaterales con los países vecinos, especialmente con Bolivia por medio de una agenda amplia y sin exclusiones. Agregó que las actuales relaciones bilaterales son fluidas y atraviesan por un muy buen momento, percepción que es compartida por los Gobiernos de Chile y Bolivia.

Con la finalidad de dar adecuado seguimiento al desarrollo de la Agenda de los 13 puntos, ambas Delegaciones acordaron mantener una efectiva coordinación con ese propósito.

Habiendo aprobado la metodología y agenda de la reunión, ambas Delegaciones procedieron al desarrollo de la misma:

I. Desarrollo de la Confianza Mutua.

Ambas delegaciones destacaron las numerosas actividades llevadas a cabo por los gobiernos desde la última Reunión de este Mecanismo, y coincidieron en continuar fomentando el desarrollo de encuentros de distintos sectores de la sociedad civil de Bolivia y Chile, de tal modo de ir profundizando el desarrollo de la confianza mutua que representa el pilar que sustenta el tratamiento de todos los temas de la relación bilateral.

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MINUTES OF THE XVIII MEETING OF THE BOLIVIA-CHILE POLITICAL CONSULTATION MECHANISM

The XVIII Meeting of the Bolivia-Chile Political Consultations Mechanism was held in La Paz, Bolivia, on 17 June 2008, in order to analyze and monitor the progress made on the thirteen points of the broad joint agenda without exclusions designed by both countries.

The Bolivian Delegation was chaired by Ambassador Hugo Fernandez Araoz, Vice-Minister of Foreign Affairs and Worship, and the Chilean Delegation was chaired by Ambassador Alberto van Klaveren Stork, Undersecretary of Foreign Affairs.

This meeting was preceded, on June 16th, by the VI Meeting of the Working Group on Bilateral Affairs, whose conclusions were submitted to the Heads of Delegation for their consideration and approval. A list of the Delegations of both countries is attached to these Minutes.

The Head of the Bolivian Delegation warmly welcomed the Chilean Delegation, stating that relations have grown closer since the last meeting of this mechanism, which shows its vitality, and pointing out that the 13-Point Agenda guides the bilateral relations and that the progress with each one of these items means that progress can be made with the entire Agenda.

The Head of the Chilean Delegation was grateful for the welcome and said that one of the main priorities of the Chilean foreign policy is to strengthen bilateral relations with its neighboring countries, especially with Bolivia, by means of a broad agenda without exclusions. He added that currently the bilateral relations are fluid, and are going well—perception shared by the Governments of Chile and Bolivia.

In order to properly monitor the progress of the 13-Point Agenda, both Delegations agreed to maintain effective coordination for that purpose.

Having approved the methodology and the agenda for the meeting, both Delegations proceeded to hold it:

I. Development of Mutual Trust

Both delegations emphasized the various activities that the two governments have carried out since the last Meeting of this Mechanism, and agreed to continue encouraging meetings of different sectors of the civil society from Bolivia and Chile, in order to progressively deepen the mutual trust that is the pillar that supports the treatment of all issues in the bilateral relationship.

Entre las principales actividades realizadas en este marco se destacan:

Tres encuentros Presidenciales, tres de Cancilleres y cinco de otros Ministros de Estado. Los Presidentes, Evo Morales y Michelle Bachelet, se reunieron en Santiago, en noviembre de 2007, en ocasión de la Cumbre Iberoamericana. En La Paz, en diciembre del mismo año, en ocasión de la suscripción de la "Declaración de La Paz", que impulsa el Corredor Interoceánico Chile-Bolivia-Brasil, que ratifica el compromiso con el proceso de integración regional en el ámbito de la infraestructura física. En Lima, en ocasión de la V Cumbre de Jefes de Estado de América Latina, el Caribe y la Unión Europea, realizada en mayo de 2008.

Los Cancilleres sostuvieron conversaciones, en Cartagena de Indias, en el marco de la Reunión del Comité de Delegados de UNASUR, en enero de 2008; en Santo Domingo, con ocasión de la Reunión del Grupo de Río, en marzo de 2008 y, en Medellín, durante la Asamblea General de la OEA, en junio de 2008.

Los Ministros de las Carteras de Defensa, Salud, Trabajo, Obras Públicas y la Ministra de Cultura de Chile y el Viceministro de Culturas de Bolivia, tuvieron ocasión de reunirse bilateralmente en diferentes oportunidades.

Con relación al trabajo junto a la sociedad civil se destacó la visita a Santa Cruz y La Paz, a invitación del Gobierno de Bolivia, de los directores de los medios de comunicación y formadores de opinión de Chile, en marzo de 2008, quienes tuvieron ocasión de reunirse con el Presidente y Vicepresidente de la República de Bolivia, otras autoridades y grupos sociales. Asimismo, se tiene programada en la segunda quincena de junio de 2008, la visita a Santiago de un selecto grupo de representantes de las organizaciones sociales de Bolivia. También están planificados un Encuentro de los Rectores de Universidades y el Encuentro de Mujeres Líderes de Chile y Bolivia, ambos en Santiago y en septiembre de 2008, como asimismo, el segundo Encuentro de Directores de Medios y Formadores de opinión, a realizarse en Santiago en octubre del año en curso, a iniciativa del Gobierno de Chile.

La intensidad de reuniones refleja el interés que existe en ambos gobiernos y en las respectivas sociedades civiles, por enriquecer las relaciones bilaterales en los distintos ámbitos y es una muestra efectiva de la confianza mutua que se ha alcanzado.

II. Integración Fronteriza.

- **Comité de Frontera.**

Ambas Delegaciones estimaron conveniente celebrar la IX Reunión de este Comité, el mes de septiembre del año en curso, en la ciudad de Iquique. La Delegación chilena propuso, en principio, los días 22 y 23 de ese mes.

Most notable among the main activities in this context are the following:

Three Presidential meetings, three meetings of Foreign Ministers, and five meetings of other State Ministers. Presidents Evo Morales and Michelle Bachelet met in Santiago, in November 2007, on the occasion of the Ibero-American Summit. In La Paz, in December that same year, on the occasion of the signing of the "La Paz Declaration," which promotes the Chile-Bolivia-Brazil Interoceanic Corridor, which confirms the commitment to the process of regional integration in the field of physical infrastructure. In Lima, on the occasion of the 5^{th} EU-CELAC Summit held in May 2008.

The Ministers of Foreign Affairs held talks in Cartagena de Indias, in the context of the Meeting of the Council of Delegates of UNASUR, in January 2008; in Santo Domingo, on the occasion of the Meeting of the Rio Group, in March 2008; and in Medellin, during the General Assembly of the OAS, in June 2008.

The Ministers of Defense, Health, Labor, Public Works, and Chile's Minister of Culture and Bolivia's Vice-Minister of Cultures were able to hold bilateral meetings on several opportunities.

As regards the work done alongside the civil society, most notable were the visits to Santa Cruz and La Paz of media directors and opinion makers from Chile, in March 2008, at the invitation of the Government of Bolivia; they had an opportunity to meet with the President and Vice President of the Republic of Bolivia, other authorities and social groups. Moreover, a visit to Santiago has been scheduled for the second half of June 2008, by a select group of representatives of social organizations from Bolivia. Plans have also been made for a Meeting of University Rectors and a Meeting of Women Leaders from Chile and Bolivia, both to be held in Santiago in September 2008, as well as the second Meeting of Media Directors and Opinion Makers, to be held in Santiago in October this year, at the initiative of the Government of Chile.

The very high number of meetings reflects the interest, on the part of both governments and their respective civil societies, in enriching the bilateral relationship in several fields, and is clear evidence of the mutual trust that has been reached.

II. Border Integration

- **Border Committee**

The Delegations agreed to hold the IX Meeting of this Committee in the city of Iquique this September. The Chilean Delegation proposed, in principle, 22 and 23 of that month.

- **Municipios y comunidades fronterizas.**

Ambas Delegaciones tomaron conocimiento de los positivos resultados del II Encuentro entre Municipios Fronterizos de Bolivia y Chile, que tuvo lugar en Arica, los días 13 y 14 de marzo de 2008. En dicha ocasión se consideraron distintos temas de interés, entre los que destacan aquellos relativos a capacitación en diferentes niveles; apoyo a las iniciativas en el ámbito de la salud; seguridad y vigilancia para fronteras armoniosas, en cuyo ámbito se propuso considerar la posibilidad de implementar la Tarjeta Vecinal Fronteriza. Mención especial merece el proyecto para la recuperación, fomento y puesta en valor del patrimonio cultural y natural aymara, que cuenta con financiamiento del BID, el que fue acordado el 26 de mayo de 2008.

También se tomó debida nota del Acta del Encuentro de Alcaldes sobre Turismo que se celebró en la ciudad de Potosí, el 27 de mayo pasado, habiéndose acordado ir encausando sus recomendaciones en las respectivas instancias del Comité de Frontera.

- **Reunión bilateral de autoridades aduaneras.**

Ambas Delegaciones acordaron promover la próxima realización de la III Reunión Bilateral entre las Aduanas de los dos países.

- **Taller sobre las peores formas de trabajo infantil.**

Ambas Delegaciones coincidieron en la importancia de realizar el II Seminario Taller, que se efectuará en la ciudad de Iquique, tentativamente en la segunda quincena de agosto de 2008.

- **Desarrollo Fronterizo.**

La Delegación chilena se comprometió a proponer lugar y fecha para el II Encuentro Salud sin Fronteras, dentro de las próximas dos semanas.

- **Controles Integrados de Frontera.**

Las Delegaciones destacaron la celebración de la V Reunión del Comité Técnico de Controles Integrados de Frontera, que tuvo lugar en la ciudad de Iquique, el 28 de mayo de 2008, y tomaron nota de los resultados de dicho encuentro.

Con la finalidad de preparar la implementación de un control integrado de doble cabecera en Pisiga - Colchane, acordaron en principio que a partir de la segunda semana del mes de septiembre, se inicie bajo marcha blanca dicha modalidad de control, cuyos resultados se conocerán en la IX Reunión del Comité de Frontera, con miras a su implementación definitiva. Hubo coincidencia entre los Jefes de las Delegaciones en la importancia de que la inauguración oficial de los Complejos sea realizada conjuntamente por los Presidentes de Bolivia y Chile.

- **Border Municipalities and Communities**

Both Delegations were informed of the positive results of the II Meeting of the Bolivia-Chile Border Municipalities, held in Arica on 13-14 March 2008. At said Meeting, various issues of interest were discussed, including, most notably, those concerning training at different levels; support for health-related initiatives; security and surveillance for peaceful borders, with a proposal, in this context, to consider the possibility of implementing the Border Residents Card. Special mention should be made of the project to recover, promote and revamp the Aymara cultural and natural heritage, supported by IBD funding, agreed on 26 May 2008.

The Delegations also acknowledged the Minutes of the Meeting of Mayors on Tourism that was held in Potosi this past May 27th; an agreement was reached to progressively implement their recommendations at the relevant levels of the Border Committee.

- **Bilateral Meeting of Customs Authorities**

Both Delegations agreed to promote the upcoming III Bilateral Meeting between the two countries' Customs agencies.

- **Workshop on the Worst Forms of Child Labor**

Both Delegations concurred on the importance of holding the II Seminar-Workshop, which will take place in the city of Iquique, tentatively in the second half of August 2008.

- **Border Development**

The Chilean Delegation undertook to propose a date and a place for the 2nd Health without Borders Meeting, within the coming two weeks.

- **Integrated Border Controls**

The Delegations noted the V Meeting of the Technical Commission on Integrated Border Controls that was held in Iquique on 28 May 2008, and duly noted the results of the meeting.

In order to prepare for the implementation of a joint Pisiga-Colchane dual-manager control, they agreed that, in principle, a trial run will start in the second week of September, the results of which will be revealed at the 9th Meeting of the Border Committee, with a view to final implementation. The Heads of the Delegations agreed on the importance of having the Complexes be officially jointly inaugurated by the Presidents of Bolivia and Chile.

Con relación a la propuesta de Bolivia de realizar un ejercicio de control integrado bajo la modalidad de cabecera única en Ollague, con una duración de cuatro semanas, la Delegación chilena confirmará el período de duración y la fecha de realización.

En cuanto a Hito Cajones, la Delegación boliviana reiteró que se ha terminado el diseño para la construcción de un centro integrado, teniendo previsto iniciar su construcción dentro de 6 meses. Por su parte, Chile reiteró que evalúa la posibilidad de trasladar sus instalaciones desde San Pedro de Atacama hasta un punto más cercano del paso.

III. Libre Tránsito

Ambas Delegaciones recogieron los acuerdos alcanzados en ocasión de la IX Reunión del Grupo de Trabajo sobre Libre Tránsito, que se realizó en la ciudad de La Paz, el 27 de mayo del 2008. Asimismo, coincidieron en la necesidad de concretar la realización de las reuniones de los Comités Técnicos Bilaterales de los puertos de Arica y Antofagasta.

También destacaron la importancia de las recomendaciones del Seminario sobre Manipulación, Almacenamiento y Transporte de Mercancías Peligrosas en el Contexto de las Relaciones Bilaterales Bolivia – Chile, que tuvo lugar el 26 de mayo de 2008, en la ciudad de La Paz. En este sentido, la Delegación de Chile informó que próximamente presentará un cronograma de actividades para el seguimiento de las recomendaciones arriba citadas, sin descartar la posibilidad de realizar un segundo seminario.

- **Sistema Integrado de Tránsito (SIT).**

Ambas Delegaciones coincidieron en la necesidad de continuar trabajando en la revisión del Manual Operativo del Sistema Integrado de Tránsito y recomendaron que la próxima reunión del grupo Ad-Hoc se lleve a cabo en agosto de 2008, en la ciudad de La Paz.

- **Habilitación del Puerto de Iquique.**

La Delegación de Bolivia informó que ha recibido oficialmente la nota verbal del Gobierno de Chile sobre la habilitación del Puerto de Iquique al Régimen de Libre Tránsito, e indicó que la misma está siendo analizada y estudiada por las instancias correspondientes de Bolivia y que se dará una respuesta oportunamente.

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As regards Bolivia's proposal for a joint single-manager control exercise in Ollagüe, intended to extend for a period of four weeks, the Chilean Delegation will confirm the duration period and the date of implementation.

As to the Cajones Marker, the Bolivian Delegation reiterated that the design has been completed to build an integrated center, with construction set to begin within 6 months. Moreover, Chile reiterated it is assessing the possibility of moving its facilities from San Pedro de Atacama to a location closer to the border crossing.

III. Free Transit

Both Delegations addressed the agreements reached on the occasion of the IX Meeting of the Working Group on Free Transit, which was held in the city of La Paz, on 27 May 2008. They also agreed on the need to hold meetings of the Bilateral Technical Committees for the ports of Arica and Antofagasta.

They also emphasized the importance of the recommendations of the Seminar on Handling, Storage and Transport of Dangerous Goods in the Context of Bilateral Relations between Bolivia and Chile, which was held on 26 May 2008, in the city of La Paz. Along these lines, the Chilean Delegation reported that it will soon present a schedule of activities for monitoring the recommendations cited above, although not discarding the possibility of holding a second seminar.

• Integrated Transit System (ITS).

Both Delegations agreed on the need to continue working on the revision of the Operations Manual for the Integrated Transit System and recommended that the next meeting of the Ad-Hoc Group be held in August 2008, in the city of La Paz.

• Enabling of the Port of Iquique

The Bolivian Delegation reported that it had officially received the verbal note from the Chilean Government regarding the enabling of the Port of Iquique under the Free Transit Regime, and indicated that this note is being analyzed and studied by the proper authorities in Bolivia and that an answer will be given in due course.

IV. Integración Física

- **Grupo Técnico sobre Infraestructura (GTM).**

Ambas Delegaciones acordaron realizar la III Reunión del GTM en julio del presente año, en la ciudad de Iquique, para intercambiar información, entre otras materias, sobre los avances en la construcción del Corredor Interoceánico definido en la "Declaración de La Paz", de diciembre de 2007. Asimismo, convinieron en incluir los temas ferroviarios en dicha reunión.

La Delegación boliviana informó que el cronograma acordado en la "Declaración de la Paz", para la construcción de los tramos Paraíso-El Tinto-San José de Chiquitos, se encuentra en proceso de reprogramación de obra, que prevé una ampliación hasta el mes de noviembre de 2009.

- **Reunión Bilateral de los Organismos Competentes de Aplicación del ATIT.**

Ambas delegaciones tomaron nota del Acta de la VIII Reunión de los Organismos de Aplicación del Convenio de Transporte Internacional Terrestre Bolivia – Chile, que se realizó en La Paz, el 28 y 29 de noviembre de 2007.

La Delegación de Chile confirmará el lugar y fecha para la realización de la IX Reunión del ATIT.

- **Ferrocarril Arica - La Paz.**

La Delegación boliviana realizó una recapitulación de la información que disponía desde la última Reunión de este Mecanismo, en el que se reflejaba el anuncio de la parte chilena de que la vía se rehabilitaría el 2008.

La Delegación chilena informó que se aprobó la Declaración de Impacto Ambiental y que se encuentra en proceso de elaboración el proyecto de rehabilitación que ha incorporado las medidas de remediación establecidas en dicha declaración. Agregó que en el proyecto se ha incluido además un mejoramiento sustancial del estándar de la vía, lo que ha generado un retraso en los plazos originales. El proyecto será adjudicado en el segundo semestre de 2008 y las obras se desarrollarán durante el año 2009.

La Delegación boliviana expresó su preocupación por la reprogramación y reiteró la importancia que tiene el avance y conclusión de este proyecto en los nuevos plazos señalados.

La Delegación chilena hizo presente que su Gobierno le está dando la máxima prioridad a este proyecto de rehabilitación.

IV. Physical Integration

- **Technical Group on Infrastructure (TGI)**

The Delegations agreed to hold the III Meeting of the TGI in July this year, in the city of Iquique, to exchange information on, among other issues, the progress made in the construction of the Interoceanic Corridor defined in the "La Paz Declaration" of December 2007. In addition, they agreed to include railway-related issues in the agenda for that meeting.

Both Bolivian Delegation reported that the schedule established in the "La Paz Declaration" to build the Paraiso-El Tinto-San Jose de Chiquitos sections is in the process of being reworked, and the works are now expected to extend to November
2009.

- **Bilateral Meeting of the Competent Enforcing Authorities of the ATIT**

The Delegations duly noted the Minutes of the VIII Meeting of the Enforcement Authorities of the Bolivia-Chile Agreement on International Ground Transport (ATIT), which was held in La Paz on 28-29 November 2007.

The Chilean Delegation is to confirm the time and place for the IX ATIT Meeting.

- **Arica-La Paz Railway**

The Bolivian Delegation summarized the information it has since the last Meeting of this Mechanism, at which the Chilean Delegation announced that the railway would be refurbished in 2008.

The Chilean Delegation reported that the Environmental Impact Declaration had been approved and that the refurbishment plan is currently being drawn up, as it has incorporated the remediation measures provided for by the declaration. They added that the project has also included a substantial improvement to the standard of the railway, which has led to a delay from the original deadlines. The project will be awarded in the second half of 2008 and the works will be implemented in 2009.

The Bolivian Delegation expressed its concern with the rescheduling and reiterated how important the progress and completion of this project within the new deadlines is.

The Chilean Delegation pointed out that their Government considers this refurbishment project to be a top priority.

V. Complementación Económica.

Ambas partes tomaron nota del Acta de la XIX Reunión de la Comisión Administradora del ACE 22, que se celebró en La Paz, el 5 de junio de 2008, en la cual sesionaron los comités técnicos en las áreas comercial, silvoagropecuaria, turismo, aduanas, promoción comercial y cooperación, así como los subcomités silvícola, de normalización y medidas sanitarias y fitosanitarias. Cada una de estas instancias definió su programa de trabajo para los próximos meses.

Ambas Delegaciones coincidieron en la importancia que ha tenido el desarrollo del Convenio CEPROBOL – PROCHILE, y se felicitaron en particular por el éxito de las Ferias de la Construcción de Bolivia que se han efectuado en Arica e Iquique y la que se inaugurará en Antofagasta el 26 de junio de 2008.

La Delegación de Chile recordó que en la reunión de la Comisión Administradora del ACE 22, Bolivia se comprometió a responder dentro de 15 días la solicitud chilena de restituir los anteriores niveles arancelarios a una lista de 34 productos. Asimismo, recordó su compromiso a dar respuesta, también en un plazo de 15 días, a la solicitud boliviana para que Chile apoye la participación de Bolivia en diversas instancias de promoción comercial que tendrán lugar en Santiago durante el año 2009.

Ambas Delegaciones destacaron la importancia que tienen, para el fortalecimiento de la agenda económica – comercial, las acciones y actividades de cooperación que se acuerden realizar. Además, resaltaron que el ámbito económico – comercial constituye un componente importante del Plan de Trabajo que se menciona en el punto VIII de la presente Acta.

La Delegación de Chile transmitió el interés de la Junta de Aeronáutica Civil de su país por celebrar en Santiago, una reunión con su contraparte boliviana. La delegación chilena anunció que en los próximos días se hará llegar una carta de invitación a dicha reunión.

La Delegación de Chile informó que, en el marco del compromiso de su Gobierno por dinamizar la agenda económica – comercial con Bolivia, este año participará por primera vez en la Feria de Santa Cruz con un pabellón propio.

VI. Tema Marítimo.

En la perspectiva de la profundización del diálogo sobre este tema, conforme a las directrices de los respectivos Gobiernos y considerando la existencia de importantes logros en la confianza mutua, se intercambiaron ideas y criterios sobre formas específicas para abordar este tema y aproximaciones concretas en la materia.

Analizadas las distintas opciones existentes, se profundizó en aquellas que ofrecen mayor viabilidad a corto plazo. Para avanzar en este análisis, se comprometieron a encomendar los debidos estudios técnicos.

V. Economic Complementation

Both parties took note of the Minutes of the XIX Meeting of the Administrative Commission for ACE 22, held in La Paz on 5 June 2008, comprising meetings of the technical commissions for trade, forestry and agriculture, tourism, customs, trade promotion and cooperation, as well as the sub-commissions on forestry, standardization and sanitary and phytosanitary measures. Each such body defined its work schedule for the coming months.

Both Delegations agreed on the importance of the implementation of the CEPROBOL – PROCHILE Agreement, and congratulated each other, in particular, on the success of the Bolivian Construction Fairs held in Arica and Iquique, and the one that will open in Antofagasta on 26 June 2008.

The Chilean Delegation mentioned the fact that, at the Administrative Commission for ACE 22, Bolivia agreed to provide an answer to Chile's request to restore the previous tariff levels to a list of 34 products within 15 days. It also mentioned its promise to have an answer, within 15 days as well, to Bolivia's request that Chile support Bolivia's involvement in the various trade promotion efforts to take place in Santiago in 2009.

Both Delegations highlighted the importance that the cooperation actions and activities they may agree upon have in terms of strengthening the economic-trade agenda. Moreover, they noted that the economic-trade context is an important component of the Work Plan mentioned in item VIII of these Minutes.

Chile's Delegation conveyed the interest of Chile's Civil Aviation Board in holding a meeting with its Bolivian counterpart agency in Santiago. The Chilean Delegation announced that a letter of invitation to the meeting will be sent in the next few days.

The Chilean Delegation reported that, in the context of the Chilean Government's commitment to make the economic-trade agenda with Bolivia more dynamic, this year it will be participating in the Santa Cruz Fair with its own sector for the first time.

VI. Maritime Issue

With a view to deepening the dialogue on this topic, in accordance with the guidelines from their respective Governments, and considering the existence of important achievements in mutual trust, they exchanged ideas and criteria on specific ways to address this topic and concrete approaches to the issue.

Having analyzed the various existing options, they then deepened those that are more viable in the short term. To move ahead with this analysis, they undertook to commission the appropriate technical studies.

Los Vicecancilleres reiteraron su convicción que mediante este proceso de diálogo, con un enfoque realista y de futuro, podrán alcanzarse los acuerdos necesarios.

Los Vicecancilleres coincidieron en dar continuidad a este diálogo, para lo cual consideraron necesario apoyarse en sus respectivos equipos internos.

VII. Silala y Recursos Hídricos.

En relación a esta materia, las Delegaciones destacaron los acuerdos alcanzados en la III Reunión del Grupo de Trabajo sobre el tema del Silala y que consignó el Acta suscrita el día 10 de junio de 2008.

Después de un amplio intercambio de ideas, en el cual se constató la coincidencia en darle a esta materia una dimensión real, las Delegaciones acordaron que en los próximos 60 días se intercambiarán esquemas con los contenidos para un acuerdo básico inmediato, que tenga en cuenta el recurso hídrico en sus usos existentes, los derechos de cada país, y las formas y mecanismos para su aprovechamiento de manera de generar beneficios económicos para Bolivia, considerando la sostenibilidad del recurso. En este período se constituirá una Comisión Bilateral que estudiará los elementos antes indicados para la conclusión de dicho acuerdo antes de fin de año.

En forma paralela se coordinarán las medidas para dar cumplimiento a lo abordado en el Acta de la III Reunión, en lo relativo a los aspectos técnicos.

VIII. Instrumentos de lucha contra la pobreza.

Las Delegaciones constituyeron el Grupo de Trabajo de Cooperación coordinado por las respectivas Cancillerías, integrado por el Viceministerio de Inversión Pública y Financiamiento Externo de Bolivia (VIPFE) y la Agencia de Cooperación Internacional de Chile (AGCI). Ambas Delegaciones se congratularon por la suscripción entre ambas instituciones del Plan de Trabajo "Programa de Cooperación para el Fortalecimiento de Capacidades e Intercambio de Experiencias 2008/2009", que se adjunta al presente Acta como Anexo II.

Ambas Delegaciones manifestaron su satisfacción por el significativo incremento del trabajo de cooperación experimentado durante los dos últimos años, esfuerzo que se espera persista y que sea funcional a los objetivos de la Agenda de los 13 Puntos.

La Delegación chilena anunció que para el año 2009 habrá un significativo aumento del número de becas de Magíster, incrementando el número de 21 a 40 becarios bolivianos, lo que fue agradecido por la Delegación boliviana.

Destacaron asimismo la ampliación de la cooperación hacia la sociedad civil con el apoyo del Programa de Voluntarios para Haití. Se espera conformar el primer

The Vice-Ministers reiterated their conviction that the necessary agreements could be reached through this process of dialogue, with a realistic and future-oriented approach.

The Vice-Ministers agreed to continue this dialogue, for which they deem it necessary to rely on their respective internal teams.

VII. Silala and Water Resources

In relation to this matter, the Delegations highlighted the agreements reached in the III Meeting of the Working Group on the Silala issue and that was recorded in the Minutes signed on 10 June 2008.

After a broad exchange of ideas, in which an agreement was reached of giving this subject a real dimension, the Delegations agreed that in the next 60 days, the contents will be exchanged for an immediate basic agreement, that takes into account the water resource in its existing uses, the rights of each country, and the means and mechanisms for its use in order to generate economic benefits for Bolivia, taking into account the sustainability of the resource. During this period, a Bilateral Commission will be constituted in order to study the aforementioned elements for the conclusion of said agreement before the end of the year.

At the same time, measures will be coordinated in order to comply with the provisions of the Minutes of the III Meeting, regarding the technical aspects.

VIII. Instruments to Fight Poverty

The Delegations set up the Cooperation Working Group coordinated by the respective Ministries of Foreign Affairs, consisting of the Vice-Minister of Public Investment and Foreign Financing of Bolivia (VIPFE) and Chile's International Cooperation Agency (AGCI). The Delegations exchanged congratulations on the execution of the "2008/2009 Cooperation Program for Strengthening Capacities and Sharing Experiences" Work Plan signed by both institutions, attached as Annex II hereto.

Both Delegations expressed their satisfaction with the significant increase in the amount of cooperation work during the past two years, which efforts they expect to continue and be functional to the goals set in the 13-Point Agenda.

The Chilean Delegation announced a significant increase in the number of scholarships for Master programs in 2009, with the number of Bolivian slots rising from 21 to 40, which the Bolivian Delegation expressed its appreciation for.

They also highlighted the expansion of cooperation to include civil society by supporting the Volunteers for Haiti Program. The first team grupo de voluntarios bolivianos y chilenos a ese país, para el segundo semestre del 2008.

Por otra parte, ambas Delegaciones coincidieron en la importancia de suscribir un Convenio de Cooperación, entre las instituciones correspondientes, con el objeto de fortalecer y facilitar la colaboración en áreas de interés mutuo.

Las Delegaciones propondrán una fecha para coordinar una reunión de seguimiento del mencionado Plan de Trabajo durante el segundo semestre del presente año.

IX. Seguridad y Defensa.

Ambas delegaciones constataron que ha continuado la dinámica de visitas institucionales de autoridades de los Ministerios de Defensa y de las Fuerzas Armadas de los dos países, lo cual constituye medidas concretas de transparencia y de fomento de la confianza y la seguridad.

En ese contexto, destacaron la importancia de las visitas oficiales a Chile del Ministro de Defensa de Bolivia, Sr. Walker San Miguel, los días 5 y 6 de diciembre de 2007 y el 14 de mayo de 2008, la última como un gesto de solidaridad ante la catástrofe ocurrida en Chaitén.

Asimismo, resaltaron la relevancia de la visita oficial a Bolivia del Ministro de Defensa Nacional de Chile, Sr. José Goñi, del 15 al 17 de junio de 2008, en la cual se suscribió el "Memorándum de Entendimiento entre el Ministerio de Defensa Nacional de la República de Chile y el Ministerio de Defensa Nacional de la República de Bolivia sobre Cooperación en Defensa".

- **Desminado de Frontera**

La Delegación de Bolivia señaló que ha manifestado permanentemente que, en el marco de la confianza mutua que construyen ambos países, la integración fronteriza requiere de mayor seguridad y cuidado de la vida humana así como de la vida silvestre que habita en la frontera común.

La Delegación de Chile entregó copia a la Delegación de Bolivia del último Informe de Transparencia, presentado a Naciones Unidas el 30 de abril de 2008, en cumplimiento del artículo 7 de la Convención de Ottawa sobre Prohibición de Minas Antipersónal y de la Memoria Anual de la Comisión Nacional de Desminado, correspondiente al año 2007. Asimismo, comunicó que a fines de mayo de 2008 concluyeron los trabajos de desminado en Cancosa, iniciados en octubre de 2007. Además, dio a conocer que con fecha 9 de junio de 2008 comenzaron las labores de desminado en Chapiquiña.

La Delegación de Chile transmitió el deseo de la Comisión Nacional de Desminado de hacer una reunión con su contraparte boliviana para abordar, especialmente, el desminado fronterizo.

group of Bolivian and Chilean volunteers would be created to that country, for the second half of 2008.

On the other hand, both Delegations concurred on the importance of having the relevant institutions sign a Cooperation Agreement with a view to strengthening and facilitating collaboration in areas of mutual interest.

The Delegations will be proposing a date to arrange a follow-up meeting for the aforementioned Work Plan in the second half of this year.

IX. Security and Defense

The Delegations verified that the institutional visits by authorities from both countries' Ministries of Defense and Armed Forces have continued, which represents concrete transparency and trust and security promotion measures.

In this context, they noted the importance of the Bolivian Minister of Defense, Mr. Walker San Miguel's official visits to Chile on 5-6 December 2007, and 14 May 2008, the latter one as a demonstration of solidarity in the face of the Chaiten disaster.

They further noted the importance of the Chilean Minister of National Defense, Mr. Jose Goñi's official visit to Bolivia on 15-17 June 2008, during which the "Memorandum of Understanding between the Ministry of National Defense of the Republic of Chile and the Ministry of National Defense of the Republic of Bolivia on Defense Cooperation" was signed.

- **Border Demining**

The Bolivian Delegation pointed out that it has consistently expressed that, in the context of the mutual trust both countries are in the process of building, border integration calls for increased security and care for human life, as well as the wild life along the common border.

The Chilean Delegation provided the Bolivian Delegation with a copy of the latest Transparency Report, submitted to the United Nations on 30 April 2008, pursuant to Article 7 of the Ottawa Convention on the Prohibition of Anti-Personnel Mines and the 2007 Annual Report of the National Demining Commission. Moreover, it reported that the demining works in Cancosa, which had begun in October 2007, were completed in late May 2008. It also informed that demining works in Chapiquiña started on 9 June 2008.

The Chilean Delegation expressed the National Demining Commission's wishes to hold a meeting with its Bolivian counterpart agency to discuss, in particular, the issue of border demining.

Ambas delegaciones valoraron la realización del "I Curso Básico de Desminado Humanitario", efectuado en el Centro de Desminado de la Escuela de Ingenieros Militares del Ejército de Chile, del 24 de marzo al 3 de abril de 2008 y en el que participaron 5 oficiales y 10 suboficiales del Ejército de Bolivia.

- **Proyecto de Convenio de Cooperación entre Carabineros de Chile y la Policía Nacional de Bolivia**

Respecto de este proyecto de Convenio, ambas delegaciones observaron que el texto está terminado, razón por la cual coincidieron en la pertinencia de suscribirlo próximamente, conforme a lo acordado en la VIII Reunión del Comité de Fronteras. Hubo acuerdo en incluir en dicho Convenio la figura del Oficial de Enlace.

- **Desastres Naturales**

La Delegación de Bolivia hizo entrega del proyecto de Convenio de Cooperación en Materia de Desastres Naturales y lo puso a consideración de la Delegación de Chile.

Ambas Delegaciones recordaron que es necesario consultar sobre los cursos de acción respecto del acuerdo de los Ministros de Defensa en cuanto a efectuar un ejercicio sobre control de desastres naturales durante el año 2008, conducido por el Estado Mayor Conjunto de Bolivia y el Estado Mayor de la Defensa Nacional de Chile.

La Delegación de Bolivia agradeció a nombre de su Gobierno por la cooperación proporcionada por la República de Chile durante las inundaciones en el Departamento del Beni que se produjeron durante los primeros meses del presente año.

Por su parte, la Delegación de Chile también agradeció la muestra de solidaridad del Ministro de Defensa de Bolivia al visitar la zona afectada por la erupción del Volcán Chaitén.

- **Tratamiento de otros temas en materia de seguridad y defensa**

Ambas Delegaciones coincidieron en la necesidad de ampliar el punto relativo a seguridad y defensa, abordando las coincidencias en estas materias en los foros multilaterales. Al respecto, la Delegación boliviana se comprometió a presentar una agenda actualizada.

Both Delegations recognized the value of the "1st Basic Course in Humanitarian Demining," which took place at the Demining Center of the School of Military Engineers of the Chilean Army from 24 March to 3 April 2008, with 5 officers and 10 non-commissions officers from the Bolivian Army in attendance.

- **Draft Agreement on Cooperation between the Chilean Uniformed Police [Carabineros] and the Bolivian National Police**

As regards this draft Agreement, both Delegations noted that the draft is ready, and therefore agreed it should be signed soon, as was agreed at the 8th Meeting of the Frontier Committee. They agreed to include the Liaison Officer rank in the Agreement.

- **Natural Disasters**

The Bolivian Delegation presented the draft Agreement for Cooperation on Natural Disasters and submitted it to the consideration of the Chilean Delegation.

Both Delegations recalled that consultations are necessary regarding the course of action to be taken in connection with the agreement by the Ministers of Defense for a natural disaster monitoring exercise to be carried out in 2008, run by the Joint Chiefs of Staff of Bolivia and Chile's National Defense Chief of Staff.

The Bolivian Delegation expressed the Bolivian Government's appreciation for the cooperation provided by the Republic of Chile during the floods in the Department of Beni, in the early months of this year.

Moreover, the Chilean Delegation also expressed its appreciation for Bolivia's Minister of Defense's show of solidarity by visiting the area affected by the eruption of the Chaiten volcano.

- **Discussion of Other Security and Defense Issues**

The Delegations agreed on the need to expand the security and defense discussion, addressing the shared viewpoints in these areas at multilateral fora. In this regard, the Bolivian Delegation agreed to submit an updated agenda.

X. Cooperación para el control del tráfico ilícito de drogas y de productos químicos esenciales y precursores

Ambas delegaciones constataron los avances logrados en la "VII Reunión de la Comisión Mixta sobre Drogas y Temas Conexos entre las Repúblicas de Bolivia y Chile", celebrada en La Paz en septiembre de 2007, en la que se estableció un mecanismo de seguimiento permanente en las Cancillerías de ambos países. La celebración de la VIII Reunión de esta Comisión Mixta se realizará en Chile el año 2009 y su convocatoria estará a cargo de las Cancillerías.

La Delegación boliviana mencionó que ambas Cancillerías vienen coordinando para el próximo año la celebración, preferentemente en una zona fronteriza, de un Seminario sobre Cooperación Judicial, Policial y Lavado de Activos.

Con relación al Proyecto de "Convenio sobre Intercambio de Información de Antecedentes Penales por Delitos de Tráfico Ilícito de Estupefacientes y Sustancias Sicotrópicas y Lavado de Dinero asociado a estos Delitos" que fue presentada por la Delegación de Chile en la VII Comixta antes mencionada, la Delegación boliviana informó que está preparando una contrapropuesta a ser oficializada próximamente.

XI. Educación, Ciencia y Tecnología.

Las Delegaciones resaltaron la reunión preparatoria para la Comixta de Educación, Ciencia y Tecnología entre representantes de los Ministerios de Educación de ambos países en la que se identificaron, entre otros, los siguientes temas:

- Apoyo para desarrollar la segunda etapa del Portal Educabolivia.bo
- Encuentro de Académicos y Universidades
- Educación intercultural
- Encuentro anual de historiadores
- Cooperación chilena en escuelas de las ciudades de El Alto, Oruro y Tarija
- Programa Escuelas sin Frontera
- Qhapaq Ñan
- Ofrecimientos de cooperación a nivel de experiencias en áreas educativas

La Delegación boliviana confirmará la fecha de realización de dicha Comixta, que se llevará a cabo en la ciudad de La Paz, en el curso del presente año.

XII. Culturas.

Ambas Delegaciones convinieron que la constitución de la Comisión Mixta de Culturas se realice durante el tercer trimestre del año en curso en Santiago y que posteriormente se firme en La Paz, el Memorando de Entendimiento

X. Cooperation for the Control of Illegal Trafficking of Drugs, Precursors and Essential Chemicals

Both Delegations verified the progress made during the "VII Meeting of the Mixed Bolivia-Chile Commission on Drugs and Related Issues" that took place in La Paz in September 2007, at which a mechanism for permanent monitoring at both countries' Ministries of Foreign Affairs was established. The VIII Meeting of said Mixed Commission will take place in Chile in 2009, to be convened by said Ministries.

The Bolivian Delegation mentioned that both Ministries of Foreign Affairs have been making arrangements for a Seminar on Judicial and Police Cooperation and Money Laundering to be held next year, preferably in a border location.

As regards the draft "Agreement on the Exchange of Information on Criminal Records for Trafficking of Narcotic Drugs and Psychotropic Substances and Related Money Laundering Crimes" that was submitted by the Chilean Delegation at the aforementioned VII Meeting of the Mixed Commission, the Bolivian Delegation reported that it is preparing a counterproposal to be made official in the near future.

XI. Education, Science and Technology

The Delegations highlighted the preparatory meeting for the Mixed Commission on Education, Science and Technology between representatives of both countries' Ministries of Education, at which, among others, the following issues were identified:

- Support for the second stage of the Educabolivia.bo website
- Meeting of Academia and Universities
- Intercultural education
- Annual meeting of historians
- Chilean cooperation in El Alto, Oruro and Tarija schools
- Schools without Borders Program
- Qhapaq Ñam
- Offering of cooperation concerning experiences in educational fields

The Bolivian Delegation will confirm the date for the meeting of the Mixed Commission, which will take place this year in the city of La Paz.

XII. Cultures

Both Delegations agreed that the Mixed Commission on Cultures is to meet in the third quarter of the current year in Santiago, then for the Inter-institutional Memorandum of Understanding

Interinstitucional para un Programa de Intercambio Cultural entre las instancias correspondientes de los Gobiernos de la República de Chile y de la República de Bolivia para los años 2008-2011, proyecto que está siendo considerado por el Viceministerio de Desarrollo de las Culturas de Bolivia.

La Delegación chilena expuso sobre las actividades culturales realizadas durante el primer semestre de 2008 y las que están programadas para el resto del año.

Ambas Delegaciones se congratularon por la intensa agenda que se ha desarrollado.

En relación al Proyecto de Convenio de Protección y Restitución de Bienes del Patrimonio Cultural, la Delegación boliviana ofreció remitir próximamente sus comentarios.

XIII. Otros Temas

- **Contactos Interparlamentarios**

Ambas Delegaciones tomaron conocimiento de la programación del II Encuentro Oficial de las Comisiones de RREE de los Senados de Bolivia y Chile, que tendrá lugar el 8 de julio del presente año en Valparaíso.

- **Convenio en materia de seguridad social**

La Delegación de Chile reiteró la importancia de suscribir próximamente este Convenio que favorecerá a un número importante de bolivianos en Chile y de chilenos en Bolivia y espera una respuesta respecto al texto propuesto.

La Delegación de Bolivia informó que se encuentra en trámite de aprobación congresal el Convenio Iberoamericano de Seguridad Social y en ese marco poder avanzar en un acuerdo bilateral con Chile sobre la materia.

- **AADAA.**

Ambas Delegaciones decidieron que los respectivos Directores Jurídicos de las Cancillerías se reúnan próximamente para dar continuidad a este tema y presenten fórmulas alternativas para determinar una solución definitiva a esta materia.

- **Visas a estudiantes chilenos en Bolivia**

La Delegación de Chile expresó su preocupación por el cobro de visas a estudiantes chilenos por oficinas regionales del Servicio Nacional de Migración de Bolivia en los Departamentos de Cochabamba y Santa Cruz, lo que no se ajustaría a la reciprocidad acordada en el Convenio Andrés Bello.

for a Cultural Exchange Program between the relevant authorities of the Governments of the Republic of Chile and the Republic of Bolivia for 2008-2011, which is under the consideration of Bolivia's Office of the Vice-Minister of Cultural Development, to be signed in La Paz.

The Chilean Delegation provided an account of the cultural activities carried out in the first half of 2008, and those scheduled for the rest of the year.

Both Delegations exchanged congratulations on the busy agenda that has been worked through.

As regards the Draft Agreement on the Protection and Restitution of Cultural Heritage Assets, the Bolivian Delegation offered to provide its feedback shortly.

XIII. Other issues

- **Inter-Parliamentary Contacts**

Both Delegations noted that the II Official Meeting of the Bolivian and Chilean Senate Commissions on Foreign Affairs has been scheduled to take place on July 8th, this year, in Valparaíso.

- **Social Security Agreement**

The Chilean Delegation brought up, once again, the importance of signing an Agreement in the near future that will favor a significant number of Bolivian citizens in Chile and Chilean citizens in Bolivia, and is awaiting an answer on the proposed draft.

The Bolivian Delegation informed that it is in the process of obtaining congressional approval for the Ibero-American Convention on Social Security, which will allow making progress towards a bilateral social security agreement with Chile.

- **AACW (Autonomous Administration of Customs Warehouses)**

Both Delegations decided that the Directors of Legal Affairs of their respective Ministries of Foreign Affairs will soon meet in order to continue to discuss this issue and present alternative formulas to define a definitive solution in this regard.

- **Visas for Chilean Students in Bolivia**

The Chilean Delegation expressed its concern over the fact that the regional offices of Bolivia's National Immigration Services in the Departments of Cochabamba and Santa Cruz have been charging Chilean citizens for student visas, which is not in line with the reciprocity agreed in the Andres Bello Convention.

La Delegación de Bolivia se comprometió a hacer las consultas al Servicio Nacional de Migración para solucionar esta situación.

- **Convenio Marco de Cooperación entre el Servicio Nacional de la Mujer de Chile y el Viceministerio de Género y Asuntos Generacionales de Bolivia**

La Delegación de Chile informó que el Servicio Nacional de la Mujer de Chile (SERNAM) hizo entrega de la propuesta de Convenio al Viceministerio de Género y Asuntos Generacionales de Bolivia en enero de 2008 y que estaba a la espera de una respuesta oficial. Asimismo, se comprometió a enviar el texto de dicho Convenio a la Cancillería boliviana.

Al término del encuentro, las Delegaciones acordaron que las próximas reuniones del Mecanismo de Consultas Políticas y del Grupo de Trabajo sobre Asuntos Bilaterales se realicen en Chile, en fecha a convenir por canales diplomáticos.

El Subsecretario de Relaciones Exteriores de Chile expresó en nombre de su Delegación, los más sinceros agradecimientos y aprecio por las atenciones recibidas con ocasión de estas reuniones, de parte de la Cancillería de Bolivia.

Suscrita en La Paz, a diecisiete días del mes de junio del año 2008.

POR BOLIVIA	POR CHILE
Embajador Hugo Fernández Aráoz Viceministro de Relaciones Exteriores y Cultos	Embajador Alberto van Klaveren Stork Subsecretario de Relaciones Exteriores

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La Paz, 23 JUN 2008

Dra. Patricia Alina Mendoza García
RESPONSABLE DE LA OFICINA DE LEGALIZACIONES
Min. de Relaciones Exteriores y Cultos

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The Bolivian Delegation agreed to contact the National Immigration Service to resolve the issue.

- **Framework Agreement for Cooperation between Chile's National Women's Service and Bolivia's Deputy Minister of Gender and Generational Issues**

The Chilean Delegation stated that Chile's National Women's Service (SERNAM) submitted the draft Agreement to Bolivia's Office of the Deputy Minister of Gender and Generational Issues in January 2008, and was awaiting an official reply. Moreover, it undertook to send the draft Agreement to the Bolivian Ministry of Foreign Affairs.

As the meeting ended, the Delegations agreed that the coming meetings of the Political Consultations Mechanism and the Working Group on Bilateral Affairs will be held in Chile, on dates to be agreed upon via diplomatic channels.

The Undersecretary of Foreign Affairs of Chile expressed on behalf of his Delegation the sincerest thanks and appreciation for the attentions received on the occasion of these meetings, on behalf of the Bolivian Foreign Ministry. Subscribed in La Paz, on the seventeenth day of the month of June of the year 2008.

Done in La Paz, on 17 June 2008.

FOR BOLIVIA	FOR CHILE
[Signature]	[Signature]
Ambassador Hugo Fernandez Araoz	Ambassador Alberto van Klaveren Stork
Vice-Minister of Foreign Affairs and Worship	Undersecretary of Foreign Affairs

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[Signature]

Stamp: Dr. Patricia Alina Mendoza Garcia
Head of the Legalization Office
Ministry of Foreign Affairs and Worship

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ANEXO I

DELEGACIÓN BOLIVIANA

Embajador Hugo Fernández
Viceministro de Relaciones Exteriores y Cultos

Embajador Freddy Bersatti
Cónsul General de Bolivia en Santiago de Chile

Embajador Jean Paul Guevara
Director General de Asuntos Bilaterales y Cultos

Embajador Edgar Pinto
Dirección General de Asuntos Multilaterales

M.C. María Estela Mendoza
Jefe de Unidad de América

P.S. Frolián Castillo
Jefe de Unidad de Asuntos Especiales

T.S. Gabriela Orosco
Jefe de Unidad de Gestión de Proyectos y Cooperación Internacional
Viceministerio de Relaciones Económicas y Comercio Exterior

S.S. Franz Orozco
Responsable UDAPEX

S.S. Arturo de la Riva
Funcionario UDAPEX

S.S. Yuri Arce
Funcionario, Unidad de América

T.S. Paola Soux
Responsable Escritorio Chile, Unidad de América

Claudia Benítez
Funcionaria
Viceministerio de Inversión Pública y Financiamiento Externo

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DELEGACIÓN CHILENA

Embajador Alberto van Klaveren
Subsecretario de Relaciones Exteriores

Embajador Jorge Montero
Director de América del Sur

Embajador Roberto Ibarra
Cónsul General de Chile en La Paz

Embajadora María Teresa Infante
Directora Nacional de Fronteras y Límites del Estado

Sra. María Cristina Lazo
Directora Ejecutiva de la Agencia de Cooperación Internacional (AGCI)

Sr. Anselmo Pommes
Director de Fronteras

M.C. Juan Pablo Crisóstomo
Cónsul General Adjunto de Chile en La Paz

M.C.E. Enrique Soler
Director Oficina Comercial de Chile en La Paz

C. Jaime Bascuñán
Encargado Unidad de Bolivia, Diramesur

Sr. Alejandro Manríquez
Agregado Cultural de Chile en Bolivia

Sr. Sebastián Herreros
Jefe del Departamento de América Latina de la Dirección de Asuntos Económicos Bilaterales

P.S. Rodrigo Hume
Jefe del Departamento de Desarme de DIPESP

Sr. Eugenio Pössel
Encargado Escritorio Bolivia, AGCI

P.S. Rodrigo Olsen
Jefe de Gabinete del Sr. Subsecretario

S.S. José Miguel Concha
Encargado Cooperación Consulado de Chile en La Paz

T.S. Fernando Morales
Unidad Bolivia, Diramesur

Javier Fernández
Asesor de Prensa Subsecretario

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Annex 7

Minutes of the IV Meeting of the Bolivia-Chile Working Group on the Silala Issue, 14 November 2008

(Original in Spanish, English translation)

Acta de la IV Reunión del Grupo de Trabajo Bolivia – Chile sobre el Tema del Silala

En la ciudad de Santa Cruz de Sierra, Bolivia, el día 14 de noviembre de 2008, se reunieron las delegaciones de Bolivia y Chile, presididas por el Embajador Hugo Fernández Araoz, Viceministro de Relaciones Exteriores y Cultos de Bolivia, y la Embajadora María Teresa Infante, Directora Nacional de Fronteras y Límites del Estado del Ministerio de Relaciones Exteriores de Chile, con el objeto de continuar el tratamiento del tema relativo a las aguas del Silala (Siloli).

La nómina de las delegaciones de ambos países figura como anexo de la presente Acta.

Después de aprobar la agenda y el programa de trabajo de la reunión, los jefes de las delegaciones se refirieron a la forma como podrían implementarse los acuerdos alcanzados en la III Reunión de este Grupo de Trabajo, coincidiendo en que se debe trabajar para que los enfoques técnicos sean los mismos y así llegar a resultados aceptables para ambas partes, que sirvan de base para un acuerdo preliminar a corto plazo y su posterior perfeccionamiento en otro definitivo.

I.- Respecto a los estudios técnicos a realizar hubo coincidencia en lo siguiente:

1. **Implementación de una red de estaciones hidrometeorológicas**

La implementación de una red de estaciones de medición de variables hidrometeorológicas para obtener registros de precipitación (líquida y nival), temperatura del aire y otras variables, según el siguiente detalle:

Estación meteorológica en el sector de cruce de frontera para registrar precipitación (líquida y nival), temperatura del aire y viento (velocidad y dirección).

Estación hidrométrica en el sector de cruce de frontera que registre caudales. En el lado chileno, inmediatamente próximo al cruce del límite internacional, existe una estación de la Dirección General de Aguas de Chile, DGA, que puede actuar como fuente corroborativa de la estación que se situará en el sector de cruce de frontera.

Estación hidrométrica en el cruce del camino próximo a los bofedales orientales (Bolivia).

Estación meteorológica en la divisoria de aguas en el extremo este.

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MINUTES OF THE IV MEETING OF THE BOLIVIA-CHILE WORKING GROUP ON THE SILALA ISSUE

In the city of Santa Cruz de la Sierra, Bolivia, on 14 November 2008, the Delegations of Bolivia and Chile met, presided by Ambassador Hugo Fernandez Araoz, Vice-Minister of Foreign Affairs of Bolivia, and Ambassador Maria Teresa Infante, National Director of State Borders and Limits of the Ministry of Foreign Affairs of Chile, with the aim of continuing addressing the issue related to the waters of the Silala (Siloli).

The list of the Delegations of both countries is annexed to this Minutes.

After approving the agenda and the work program of the meeting, the Heads of the Delegations referred to the way in which the agreements reached in the III Meeting of this Working Group could be implemented, agreeing that work must be done so that the technical approaches are the same and thus reach results acceptable to both Parties, which serve as the basis for a preliminary agreement in the short term and its subsequent improvement into a final one.

I. Regarding the technical studies to be carried out, there was an agreement in the following:

1. **Implementation of a network of hydro-meteorological stations**

The implementation of a network of hydro-meteorological variables measuring stations in order to obtain records of precipitation (liquid and snow), air temperature and other variables, according to the following detail:

Meteorological station in the border crossing area to record precipitation (liquid and snow), air temperature and wind (velocity and direction).

Hydrometric station in the border crossing sector that record flows. On the Chilean side, immediately next to the crossing of the international boundary, there is a station of the General Directorate of Water of Chile (DGA for its acronym in Spanish) that can act as a corroborative source of the station that will be located in the border crossing sector.

Hydrometric station at the crossing of the road near the Orientales bofedals (Bolivia). (Bofedals: High altitude wetlands)

Meteorological station in the watershed divide at the east end.

Estación meteorológica en una ladera del volcán Inacaliri.

Estación meteorológica en la zona de bofedales (vertiente oriental) que registre precipitación (líquida y nival), temperatura del aire, velocidad del viento, radiación solar y humedad.

De las seis estaciones propuestas, tres están en el cruce de frontera y son binacionales, dos están ubicadas en territorio boliviano y la última se situará en la ladera del volcán Inacaliri, en una localización a determinar. Adicionalmente, Chile tiene en su territorio una estación hidrométrica, próxima a la frontera. El emplazamiento de las seis estaciones propuestas se definirá luego de una visita conjunta a terreno.

Dada la ubicación remota de la red de estaciones y la necesidad de que ambos países cuenten con información continua, simultánea y en tiempo real, las estaciones tendrán transmisión satelital, de modo que ambos países puedan monitorear la información y el funcionamiento general de las estaciones y sus sensores.

2. Responsabilidad de la ejecución

Por la parte chilena, la ejecución del proyecto estará a cargo de la DGA; por la parte boliviana la ejecución será del Servicio Nacional de Meteorología e Hidrología, SENAMHI. Estas instituciones designarán a sus respectivos coordinadores.

La propiedad de las estaciones ubicadas sobre la línea de frontera será binacional; consecuentemente sus costos de adquisición e implementación serán compartidos.

La definición de los equipos, el número de visitas conjuntas anuales, la operación del sistema, etc., será realizada conjuntamente por las instituciones antes indicadas.

Cada institución asumirá sus propios costos operativos.

3. Periodo de Monitoreo

Se define un periodo de monitoreo conjunto de cuatro ciclos hidrológicos anuales que permita determinar el balance hídrico, el comportamiento hidrométrico, la datación de las aguas, los flujos superficiales, la influencia de las obras sobre el caudal entre otros, utilizando una metodología científicamente validada y concordada.

2

Meteorological station on a slope of the Inacaliri volcano.

Meteorological station in the area of bofedales (eastern spring) that records precipitation (liquid and snow), air temperature, wind speed, solar radiation and humidity.

Of the six stations proposed, three are at the border crossing and are binational, two are located in Bolivian territory and the last one will be located on the slope of the Inacaliri volcano, in a location to be determined. Additionally, Chile has a hygrometric station in its territory, close to the border. The location of the six proposed stations will be defined after a joint field visit.

Given the remote location of the network of stations and the need for both countries to have continuous, simultaneous and real-time information, the stations will have satellite transmission, so that both countries can monitor the information and the general operation of the stations and their sensors.

2. Implementation responsibility

For the Chilean part, the implementation of the project will be in charge of the DGA; for the Bolivian part, the implementation will be the responsibility of the National Service of Meteorology and Hydrology, SENAMHI. These institutions will appoint their respective coordinators.

The property of the stations located on the border line will be binational; consequently, their acquisition and implementation costs will be shared.

The definition of the teams, the number of annual joint visits, the operation of the system, etc., will be carried out jointly by the aforementioned institutions.

Each institution will assume its own operating expenses.

3. Monitoring Period

A period of joint monitoring of four annual hydrological cycles is defined to determine the water balance, hydrometric behavior, water dating, surface flows, the influence of the works on the flow, among others, using a scientifically validated and agreed upon methodology.

El procesamiento, archivo y acceso a los datos quedará a cargo de cada organismo y su análisis se efectuará utilizando modelos y metodologías acordadas conjuntamente.

4. **Actividades adicionales**

Programa de monitoreo de la calidad y datación del agua, con toma de muestras dos veces al año, en invierno (julio) y verano (enero), en los sectores de bofedales y en el cruce de frontera.

Recopilación y sistematización de los antecedentes meteorológicos e hidrológicos.

Complementación de los trabajos cartográficos del área del Silala, mediante el apoyo terrestre a las fotografías aéreas tomadas en conjunto en 2001, adquisición de imágenes satelitales, elaboración de modelos digitales de terreno y otras.

5. **Informes**

Conjuntamente se elaborarán informes semestrales y un informe final al cabo de los cuatro años con los resultados de los estudios. Este informe final constituirá la base de un acuerdo definitivo sobre los porcentajes de las aguas de libre disponibilidad de cada país.

II.- Respecto a los acuerdos preliminar y definitivo:

Las delegaciones propusieron la celebración por parte de ambos Estados de un acuerdo provisional, relativo al aprovechamiento de las aguas, que servirá de base para uno definitivo.

Para llegar al acuerdo preliminar, las partes realizarán en el corto plazo mediciones en el cruce de frontera, con el fin de establecer el caudal sobre el cual se determinarán los porcentajes de las aguas de libre disponibilidad correspondientes a cada parte.

Las aguas que resulten de libre disponibilidad de Bolivia y que no fueren utilizadas en ese país, podrán ser puestas a disposición para su uso en Chile, para lo cual se deberá acordar un mecanismo que permita la constitución de derechos de aprovechamiento en la frontera, así como el valor que correspondiere por su uso exclusivo. Bolivia no afectará la naturaleza y la continuidad de dichas aguas. En el acuerdo se deberá establecer un procedimiento de solución de controversias.

Con estos elementos del acuerdo preliminar y los datos técnicos emanados de los estudios conjuntos, se procederá a elaborar un acuerdo definitivo.

The processing, filing and access to the data will be the responsibility of each organism and its analysis will be carried out using jointly agreed models and methodologies.

4. Additional activities

Program for quality monitoring and water dating, with sample taking twice a year, in winter (July) and summer (January), in the bofedales sectors and at the border crossing.

Collection and systematization of meteorological and hydrological history.

Complementation of cartographic works in the Silala area, through ground support to the aerial photographs jointly taken in 2001, acquisition of satellite images, development of digital terrain models and others.

5. Reports

Jointly, semi-annual reports and a final report will be prepared after four years with the results of the studies. This final report will constitute the basis of a definitive agreement regarding the percentages of freely available waters in each country.

II. Regarding the preliminary and final agreements:

The Delegations proposed the conclusion of a provisional agreement by both States, regarding the use of waters, which will serve as the basis for a definitive agreement.

In order to reach the preliminary agreement, the Parties will carry out measurements in the short term at the border crossing, in order to establish the flow rate over which the percentages of the freely available waters corresponding to each Party will be determined.

The waters that are freely available in Bolivia and that were not used in that country, may be made available for use in Chile, for which a mechanism must be agreed upon that allows the constitution of exploitation rights in the border, as well as the value that corresponds for its exclusive use. Bolivia will not affect the nature and continuity of said waters. In the agreement, a dispute resolution procedure must be established.

With the elements of the preliminary agreement and the technical data emerging from the joint studies, a final agreement will be elaborated.

Finalmente, ambas delegaciones convinieron que la V Reunión de este Grupo de Trabajo se efectúe en Chile, en la última semana de enero de 2009. En dicha oportunidad, los equipos técnicos expondrán los resultados de sus trabajos preliminares sobre el caudal de las aguas del Silala en el cruce de frontera, a fin de avanzar en la elaboración del acuerdo preliminar, teniendo en cuenta las propuestas aportadas por ambas delegaciones sobre los otros aspectos arriba mencionados.

La delegación de Chile agradeció las especiales atenciones recibidas de parte de la delegación de Bolivia.

Embajador Hugo Férnández Aráoz Por la Delegación de Bolivia	Embajadora María Teresa Infante Caffi Por la Delegación de Chile

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La Paz, 04 DIC. 2008

Dra. Patricia Alina Mendoza García
RESPONSABLE DE LA OFICINA
DE LEGALIZACIONES
Min. de Relaciones Exteriores y Cultos

Finally, both Delegations agreed that the V Meeting of this Working Group be held in Chile, in the last week of January 2009. On said occasion, the technical teams will present the results of their preliminary work regarding the flow of Silala waters at the border crossing, in order to move forward in the preparation of the preliminary agreement, taking into account the proposals made by both Delegations regarding the other aforementioned aspects.

The Delegation of Chile thanked the special attention received from the Delegation of Bolivia.

[Signature]
Ambassador Hugo Fernandez Araoz
For the Delegation of Bolivia

[Signature]
Ambassador Maria Teresa Infante Caffi
For the Delegation of Chile

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La Paz, 4 December 2008

[Signature]
Stamp: Dr. Patricia Alina Mendoza Garcia
Head of the Legalization Office
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Mr. Juan Carlos Alurralde
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Ministry of Foreign Affairs

Annex 8

Initial Agreement [Silala or Siloli], Agreed Draft, 28 July 2009

(Original in Spanish, English translation)

Borrador de versión final (28 de julio 2009)

ACUERDO INICIAL [SILALA O SILOLI]

El Gobierno de la República de Chile y el Gobierno del Estado Plurinacional de Bolivia, en adelante "las Partes",

CONSIDERANDO

Que los Ministerios de Relaciones Exteriores de la República de Chile y del Estado Plurinacional de Bolivia constituyeron en 2004 un Grupo de Trabajo Bolivia - Chile sobre el tema del Silala, que plasmó sus resultados en las actas suscritas el 6 de mayo de 2004, el 20 de enero de 2005, el 10 de junio de 2008 y el 14 de noviembre de 2008;

Que el tema del Silala o Siloli fue incluido en el punto VII de la Agenda bilateral de 13 puntos adoptada por ambas Partes en julio de 2006 y que desde esa fecha, ellas se han esforzado en proponer fórmulas destinadas a superar las diferencias surgidas en torno al sistema hídrico del Silala o Siloli, y las características de sus aguas;

Que los estudios realizados hasta el presente en forma individual, por cada una de las Partes, han aportado suficiente información para establecer el presente Acuerdo inicial que servirá de base para un nuevo Acuerdo de largo plazo, que se concluirá teniendo en consideración los resultados de los estudios técnicos contemplados en el presente Acuerdo, la continuación de los trabajos conjuntos iniciados en el año 2000, los aprovechamientos existentes y el uso sustentable de las aguas del Silala;

Que el presente Acuerdo no se refiere a otros temas relativos al Silala o Siloli que a cada una de las Partes interese abordar al momento de negociar el nuevo Acuerdo de largo plazo;

Que el ambiente de mutua confianza que se ha desarrollado entre ambos países ha permitido acercar las voluntades para profundizar los entendimientos que los pueblos anhelan, formulando un Acuerdo de mutuo beneficio sobre este punto de la agenda bilateral.

Final version draft (28 July 2009)

THE INITIAL AGREEMENT [SILALA OR SILOLI]

The Government of the Republic of Chile and the Government of the Plurinational State of Bolivia, hereinafter "the Parties",

CONSIDERING

That the Ministries of Foreign Affairs of the Republic of Chile and the Plurinational State of Bolivia created a Bolivia-Chile Working Group on the Silala issue in 2004 and recorded the results attained in the minutes signed on 6 May 2004, 20 January 2005, 10 June 2008, and 14 November 2008;

That the Silala, or Siloli issue was included in Point VII of the Bilateral Agenda of 13 Points, adopted by both Parties in July 2006, and that since that date, they have made efforts to propose formulas intended to overcome their differences regarding the Silala, or Siloli hydrologic system and the characteristics of its waters;

That the studies carried out to date by each of the parties individually have provided sufficient information to reach this initial Agreement, which shall serve as a basis for a new long-term Agreement that will be concluded taking into consideration the results of the technical studies referred to herein, the continuation of the joint work started in 2000, and the present utilization and sustainable use of the waters of Silala.

That the present Agreement does not address other issues that each of the parties might have an interest in addressing when negotiating the new long-term Agreement regarding the Silala or Siloli.

That the atmosphere of mutual trust that has been developed between the two countries has helped bring together their will to deepen the understandings that both their peoples long for, formulating a mutually beneficial Agreement on this point of the bilateral agenda.

1

Borrador de versión final (28 de julio 2009)

ACUERDAN

ASPECTOS GENERALES

Artículo 1

Establecer un Acuerdo bilateral para la preservación, sostenibilidad, uso y aprovechamiento del sistema hídrico del Silala o Siloli para beneficio de ambos países.

Artículo 2

El presente Acuerdo inicial considera el volumen de agua del sistema hídrico del Silala o Siloli que fluye superficialmente a través de la frontera desde el Estado Plurinacional de Bolivia hacia la República de Chile. Considera, asimismo, que del volumen total de aguas superficiales que actualmente fluyen a través de la frontera, un porcentaje corresponde a Bolivia y es de su libre disponibilidad, y que los estudios científicos servirán de base a las decisiones que se adoptaren en el futuro a este respecto, de acuerdo a lo que establece el artículo 6.

Artículo 3

Por el presente Acuerdo se establece que las aguas de libre disponibilidad de Bolivia y captadas en su país podrán ser conducidas para ser aprovechadas en Chile. En tal caso, el titular público boliviano de la autorización para el otorgamiento del uso de dichas aguas será compensado por las personas jurídicas de derecho público o privado que se constituyan en aprovechatarias de dichas aguas.

Para el otorgamiento del uso de dichas aguas de libre disponibilidad, el titular público boliviano considerará el derecho preferente de las personas jurídicas de derecho público o privado que actualmente estuvieren haciendo uso de dichas aguas en Chile. Este derecho preferente se ejercerá por un espacio de sesenta días a partir de la comunicación por vía oficial de la implementación de esta parte del Acuerdo.

Las personas jurídicas antes individualizadas deberán desarrollar las acciones que correspondieren en Chile, en caso de que esas aguas fueren a ser utilizadas en este país, pudiendo Bolivia caducar la autorización otorgada si no se concretaren esos propósitos en el plazo que hubiese fijado.

2

Have agreed as follows:

GENERAL ASPECTS

Article 1

To conclude a bilateral Agreement for the preservation, sustainability, use, and exploitation of the Silala, or Siloli hydrologic system to the benefit of both countries.

Article 2

This initial Agreement takes into consideration the volume of water of the Silala, or Siloli hydrologic system that flows on the surface across the border, from the Plurinational State of Bolivia to the Republic of Chile. This Agreement also takes into consideration the fact that, of the total volume of surface water that currently flows across the border, a percentage corresponds and shall be freely available to Bolivia, and that scientific studies will inform the decisions that might be adopted in the future in this regard, as per the stipulations of article 6.

Article 3

The present Agreement hereby establishes that the waters that are freely available to Bolivia and abstracted in that country may be driven to be exploited in Chile. In such case, the Bolivian public holder of the authorization to award the use of these waters shall be compensated by the public or private legal entities established as users of these waters.

To award the use of these freely available waters, the Bolivian public holder shall take into consideration the right of first refusal of public or private legal entities that were currently making use of such water in Chile. This right of first refusal shall be exercised during a period of sixty days from the implementation of this part of the Agreement via official channels of communication.

In case these waters were to be used in Chile, the legal entities previously individualized shall take the actions that are applicable in that country; Bolivia, nevertheless, shall be able to declare that the authorization granted has expired if the said actions are not taken during the established period.

Artículo 4

Considerando la fragilidad del ecosistema del Silala o Siloli, por el presente Acuerdo las Partes se comprometen a mantener las condiciones actuales de caudal y calidad del agua que fluye a través de la frontera, y a cuidar que cualquier obra que emprendan a futuro individual o conjuntamente no afecte dicho caudal y calidad.

Artículo 5

Por este Acuerdo las Partes se comprometen a efectuar conjuntamente estudios complementarios sobre el sistema hídrico del Silala (Siloli), para lograr un mayor conocimiento sobre su funcionamiento y naturaleza.

Artículo 6

Las Partes establecen, de conformidad con el Artículo 2, que del volumen total del agua del Silala o Siloli, que fluye a través de la frontera (100%), el 50% corresponde, inicialmente, al Estado Plurinacional de Bolivia, es de su libre disponibilidad y lo podrá utilizar en su territorio o autorizar su captación para su uso por terceros, incluyendo su conducción a Chile. Este porcentaje podrá ser incrementado a favor de Bolivia, en función de los resultados de los estudios conjuntos que se lleven a cabo en el marco del presente Acuerdo.

Tan pronto sea suscrito el presente Acuerdo las Partes se comprometen a instalar la estación hidrométrica mencionada en el Artículo 8, letra b), la cual registrará los volúmenes de agua en el cruce de frontera, que servirán para su implementación.

ASPECTOS TÉCNICOS

Artículo 7

A partir del presente Acuerdo inicial, las Partes implementarán en la zona una red de estaciones hidrometeorológicas que permitan obtener datos y realizar estudios conjuntos con vistas a la suscripción de un nuevo Acuerdo de largo plazo.

Article 4

Considering the fragility of the Silala or Siloli ecosystem, by this Agreement, the Parties undertake to maintain the current flow and water quality conditions of the water flowing across the border, and to ensure that any future work undertaken individually or jointly will not affect said flow and quality.

Article 5

By this Agreement, the parties undertake to jointly perform complimentary studies on the Silala (Siloli) hydrologic system in order to achieve a better understanding of its functioning and nature.

Article 6

The Parties hereby agree, in accordance with Article 2, that the out total water volume of the Silala, or Siloli that flows across the border (100%), 50% corresponds, initially, to the Plurinational State of Bolivia, is freely available to it and shall be used within its territory, or authorized to be abstracted for the use of third parties, including its conveyance to Chile. This percentage may be increased in Bolivia's favor based on the results of joint studies to be carried out under this Agreement.

As soon as this Agreement is signed, the parties undertake to install the hydrometric station referred to in Article 8, b), which will record the volume of water crossing the border; volume which will be used for the Agreement's implementation.

TECHNICAL ASPECTS

Article 7

After this initial Agreement is signed, the parties shall implement a network of hydrometeorological stations in the area to collect data and perform joint studies with a view to signing a new long term Agreement.

Artículo 8

Con el propósito de establecer el porcentaje de aguas de libre disponibilidad de cada país y avanzar en la comprensión del sistema hídrico, se acuerda implementar una red de estaciones de medición de caudales y variables hidrometeorológicas para obtener registros de precipitación (líquida y nival), temperatura del aire y otras variables, según el siguiente detalle:

a. Estación meteorológica en el sector de cruce de frontera.
b. Estación hidrométrica en el sector de cruce de frontera.
c. Estación hidrométrica en el cruce del camino próximo a los bofedales orientales en territorio de Bolivia.
d. Estación meteorológica en la divisoria de aguas en el extremo Este del sistema.
e. Estación meteorológica en la ladera boliviana del volcán Inacaliri.
f. Estación meteorológica en la zona de bofedales de la vertiente oriental.

De las seis estaciones propuestas, dos (a y b) se encontrarán en el cruce de frontera, y serán binacionales, cuatro (c, d, e y f) estarán ubicadas en territorio boliviano.

Además, formará parte de la red la estación de la Dirección General de Aguas de Chile, DGA, ubicada en el lado chileno, próxima al cruce del límite internacional.

Adicionalmente, las Partes se comprometen a intercambiar datos provenientes de otras estaciones próximas al área de investigación.

Dada la ubicación remota de la red de estaciones y la necesidad de que ambos países cuenten con información continua, simultánea y en tiempo real, las estaciones tendrán transmisión satelital, de modo que ambas Partes monitoreen la información y el funcionamiento general de las estaciones.

Artículo 9

Las Partes definirán un período de monitoreo conjunto de cuatro ciclos hidrológicos anuales que permitan determinar el balance hídrico, el comportamiento hidrométrico, la datación de las aguas, los flujos superficiales y subterráneos, y la influencia de las obras sobre el caudal, entre otros, utilizando una metodología científicamente válida y concordada.

Article 8

In order to establish the percentage of water freely available to each country and make progress in understanding the water system, the parties agree to implement a network of stations to monitor the flow and hydrometeorological variables in order to record precipitation (rain and snow), air temperature and other variables, as detailed below:

a. A meteorological station at the boundary crossing.
b. A hydrometric station at the border crossing.
c. A hydrometric station at the junction of the road next to the Orientales Wetlands (known as the South Wetlands in Bolivia) in Bolivian territory.
d. A meteorological station in the watershed at the east end of the system.
e. A meteorological station on the Bolivian slopes of the Inacaliri Volcano.
f. A meteorological station in the area of the wetlands found on the east spring.

Of the six proposed stations, two (a and b) will be located on the border crossing and will be binational, and four (c, d, e and f) will be located inside Bolivian territory.

In addition, the said network will form part of Chilean General Directorate of Water network, located on the Chilean side, near the international border crossing.

Additionally, the Parties agree to exchange data from other stations near the study area.

Given the remoteness of the network of stations and the need for both countries to have continuous, simultaneous, and real-time information, the stations will be set up with satellite transmission, so that both Parties can monitor the information and the overall functioning of the stations.

Article 9

The Parties shall define a joint monitoring period of four annual hydrological cycles to determine the water balance, hydrometric behavior, age of the waters, surface and groundwater flows, and influence of waterworks on the flow, among other parameters, using scientifically valid and agreed upon methodology.

La recolección, archivo y procesamiento de los datos, quedará a cargo de la Dirección General de Aguas (DGA) en Chile y del Servicio Nacional de Meteorología e Hidrología (SENAMHI) en Bolivia.

Artículo 10

Por el presente Acuerdo inicial, se establece un programa de monitoreo para determinar la calidad y la datación del agua, con toma de muestras dos veces al año, en invierno (julio) y verano (enero), en los sectores de bofedales y en el cruce de frontera.

Se establece, asimismo, que se complementarán los trabajos cartográficos del área del Silala o Siloli, mediante trabajos de terreno de apoyo técnico a las fotografías aéreas tomadas en conjunto el año 2001, para elaborar una cartografía de detalle, y se adquirirán imágenes satelitales, además de elaborarse modelos digitales de terreno.

Artículo 11

Las Partes elaborarán informes semestrales y un informe final al cabo de cuatro años, con los resultados de los estudios. Este informe final constituirá la base para el nuevo Acuerdo de largo plazo que establecerá los porcentajes de libre disponibilidad de cada país.

ASPECTOS INSTITUCIONALES

Artículo 12

El Estado Plurinacional de Bolivia a través del Ministerio de Medio Ambiente y Agua designará a la Prefectura del Departamento de Potosí o a otra persona jurídica de derecho público que actuará como el sujeto detentor de la autorización de uso de las aguas de libre disponibilidad boliviana del Silala o Siloli.

Bajo el marco del presente Acuerdo inicial, el seguimiento y operación técnica del uso y aprovechamiento del agua, por Bolivia, estará a cargo del sujeto cetentor arriba mencionado; por Chile, estará a cargo de la Dirección General de Aguas del Ministerio de Obras Públicas.

Las Partes se informarán mutuamente sobre cualquier modificación que establezcan respecto del régimen antes indicado.

Data collection, storage and processing shall be the responsibility of the General Water Directorate (DGA) in Chile and the National Service of Meteorology and Hydrology (SENAMHI) in Bolivia.

Article 10

Under this initial agreement, a monitoring program shall be established to determine the quality and the age of the water, taking samples twice a year, in winter (July) and summer (January), in the wetland area and the border crossing.

It is also herewith agreed that cartographic work in the Silala or Siloli area will be complemented through field work to provide technical support for the aerial photographs taken jointly in 2001 in order to develop a detailed cartography; also, satellite imagery shall be acquired and a digital terrain model developed.

Article 11

The Parties shall produce semi-annual reports and a final report after four years with the results of the studies. This final report will form the basis for the new long term Agreement that will establish the percentage of water freely available to each country.

INSTITUCIONAL ASPECTS

Article 12

The Plurinational State of Bolivia, through the Ministry of Environment and Water, will appoint the Prefecture of the Department of Potosi or a different public legal entity as the subject entitled to authorize the use of the water of the Silala or Siloli that is freely available to Bolivia.

Under the framework of this initial Agreement, the monitoring and technical operation of water use and utilization will be the responsibility of the aforementioned subject, for Bolivia, and the General Water Directorate, Ministry of Public Works, for Chile.

The Parties shall inform each other of any changes regarding the regime established above.

Artículo 13

El Ministerio de Medio Ambiente y Agua determinará el valor por metro cúbico que percibirá el Estado Plurinacional de Bolivia a título de compensación en función del volumen transferido, el que será acordado directamente con la persona jurídica de derecho público o privado interesada. Asimismo, determinará la periodicidad con que percibirá dicho valor y las garantías para asegurar la compensación.

Artículo 14

Para la determinación de la compensación el Ministerio de Medio Ambiente y Agua podrá tener en cuenta, entre otros, el valor promedio efectivamente pagado por metro cúbico de aguas crudas en la II Región de Chile.

Artículo 15

De conformidad con el presente Acuerdo, el Gobierno de Bolivia, declara que la persona jurídica, de derecho público o privado, que haya sido autorizada por el Ministerio de Medio Ambiente y Agua para el uso en territorio chileno de las aguas del Silala o Siloli de su libre disponibilidad, podrá aprovecharlas sin ninguna restricción o discriminación.

El Gobierno de Chile declara que no se opondrá a la aplicación de medidas que conforme al" ordenamiento jurídico boliviano y al presente Acuerdo, se apliquen al aprovechatario que no cumpla las obligaciones adquiridas con la persona jurídica de derecho públicc designada por el Ministerio de Medio Ambiente y Agua, en virtud def presente Acuerdo.

Las diferencias que pudiesen surgir entre una persona jurídica y el Estado Plurinacional de Bolivia en el marco de los Artículos 3 y 6 relativos a la autorización, y su cumplimiento o ejecución, serán resueltas según las normas aplicables en dicho Estado y las que establec ere la autorización para el aprovechamiento correspondiente, siendo competentes para estos efectos las instancias jurisdiccionales internas del Estado Plurinacional de Bolivia.

Article 13

The Ministry of Environment and Water shall determine the value per cubic meter to be allocated to the Plurinational State of Bolivia in compensation, depending on the volume transferred, which shall be negotiated directly with the relevant public or private legal entity. The Ministry shall also determine the payment frequency and guarantees to ensure compensation.

Article 14

To determine the compensation due, the Ministry of Environment and Water may take into account, inter alia, the average price currently paid per cubic meter of untreated water in Chile's Region II.

Article 15

In accordance with this Agreement, the Government of Bolivia hereby declares that the public or private legal entity authorized by the Ministry of Environment and Water to have the unencumbered right to use the waters of Silala or Siloli in Chilean territory, may use these waters without restriction or discrimination.

The Government of Chile declares that it will not oppose to the application of measures which, under Bolivian law and this Agreement, shall be applicable to users that do not meet the obligations undertaken with the public legal entity appointed by the Ministry of Environment and Water under this Agreement.

The differences that may arise between a legal entity and the Plurinational State of Bolivia under Articles 3 and 6 regarding authorization, compliance or enforcement, shall be resolved under the provisions applicable in that State and those by which authorization for appropriate use was established; the internal jurisdictional instances of the Plurinational State of Bolivia shall thus be regarded competent for this purpose.

Borrador de versión final (28 de julio 2009)

SOLUCIÓN DE DIFERENCIAS

Artículo 16

En caso de que en la aplicación o interpretación de este Acuerdo surgiere una diferencia, contingencia o asunto que requiera la atención conjunta de las Partes, cualquiera de ellas podrá convocar al Grupo de Trabajo Bolivia-Chile sobre el tema del Silala, creado por las Cancillerías de ambos Estados en 2004, para resolverla o darle una respuesta apropiada.

En los trabajos técnicos a que se refieren los artículos 7 a 11, las Partes se esforzarán en cooperar activamente, así como en alcanzar resultados que sirvan de referencia para futuros acuerdos. En caso de que, a pesar de los esfuerzos desplegados, no fuere posible ponerse de acuerdo sobre los volúmenes de agua de libre disponibilidad, entre otras materias, las Partes pondrán en ejecución mecanismos que permitan superar esas diferencias, con el apoyo de expertos si fuere necesario.

Sin perjuicio de ello, las Partes, de común acuerdo podrán solicitar en todo momento la asistencia de un organismo técnico o científico especializado y de renombre internacional, a fin de que aporte elementos que conduzcan a un arreglo entre las Partes.

Si no pudiere llegarse a un acuerdo a través de estos procedimientos respecto de la aplicación o interpretación del presente Acuerdo, cualquiera de las Partes podrá solicitar que se constituya una Comisión de Conciliación de tres miembros, para someter la diferencia a su conocimiento y recomendación.

En el plazo de treinta días después de recibida la solicitud, cada Parte designará un integrante de la Comisión de Conciliación. El tercero, que la presidirá, será designado de común acuerdo y no podrá ser nacional de ninguna de las Partes. En caso de desacuerdo sobre la persona a designar o si una de las Partes no designare en dicho plazo al miembro de la Comisión que le corresponde, cualquiera de las Partes podrá solicitar a la máxima autoridad de los siguientes organismos o programas internacionales según sus normas fundamentales constitutivas, que lo designe, según el siguiente orden sucesivo. En la Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura, UNESCO, el Director Ejecutivo; en la Organización Meteorológica Mundial, OMM, el Secretario General; en el Programa de las Naciones Unidas para el Medio Ambiente, PNUMA, el Director Ejecutivo; en la Organización Internacional de Energía Atómica, OIEA, el Director General; o en el Programa de las Naciones Unidas para el Desarrollo, PNUD, el Administrador. No será considerado un organismo o programa cuya

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DISPUTES SETTLEMENT

Article 16

If, any differences, contingencies or matters that require the Parties' joint attention arise in the application or interpretation of this Agreement, either Party may convene the Bolivia-Chile Silala Working Group, created by the Foreign Ministries of both States in 2004 to settle or provide a proper response.

In the completion of the technical works referred to in Articles 7 to 11, the Parties shall endeavor to actively cooperate and achieve results that serve as reference for future agreements. If, despite all efforts, it is not possible to agree on the volume of freely available water, among other matters, the Parties shall implement mechanisms to overcome these differences, with the support of experts where necessary.

Notwithstanding the above, the Parties may, by mutual agreement and at any time, request the assistance of an internationally recognized technical or scientific expert, in order to provide them with information that leads to a settlement between the Parties.

If it is not possible to reach an agreement regarding the application or interpretation of this Agreement through these procedures, either party may request that a three-member Settlement Commission be established to apply its knowledge and recommendations to the dispute.

Within thirty days after receiving the request, each party shall appoint a member for the Settlement Commission. The third member, who shall preside the commission, shall be appointed by mutual agreement and cannot be a national of either Party. In case of disagreement on the appointed person or if a Party fails to nominate a member to the Commission within that period, either party may request the highest authority of the following agencies or programs, based on their fundamental constitutional rules, to appoint the member in question, in the following order: The Executive Director of the United Nations Educational, Scientific and Cultural Organization (UNESCO); the Secretary-General of the World Meteorological Organization (WMO); the Executive Director of the United Nations Environment Program (UNEP); the Director General of the International Atomic Energy Agency (IAEA); or the Administrator of the United Nations Development Program (UNDP). An agency or program whose máxima autoridad sea nacional de una de las Partes, o cuando dicha persona haya trabajado al servicio de una de ellas.

En caso de que a pesar de la aplicación del procedimiento anteriormente mencionado no se llegare a entendimiento en algún aspecto específico, las Partes podrán someterlo al arbitraje.

En el nuevo Acuerdo de largo plazo se establecerá un mecanismo de solución de controversias.

VIGENCIA

Artículo 17

Este Acuerdo inicial tendrá una vigencia de cuatro años, y dará lugar a un nuevo Acuerdo una vez concluidos los estudios pertinentes. Si al cabo de los cuatro años no pudiera establecerse el Acuerdo de largo plazo, se prorrogará por períodos anuales.

El nuevo Acuerdo de largo plazo tendrá en cuenta los actos de autorización que se hubiesen adoptado durante la vigencia del presente Acuerdo inicial.

El presente Acuerdo entrará en vigor treinta días después de recibida la última Nota por la cual las Partes se comuniquen recíprocamente el cumplimiento de los requisitos internos correspondientes. Sin perjuicio de lo anterior, el segundo párrafo del Artículo 6 entrará en vigor al momento de su suscripción.

Después de transcurridos cuatro años, el presente Acuerdo podrá ser denunciado por cualquiera de las Partes, mediante una notificación escrita a la otra Parte, con seis meses de anticipación. La denuncia cobrará vigor a partir del cumplimiento de dicho plazo.

Suscrito en .....

maximum authority is a Party national, or a person that has worked in the service of one of them, shall not be taken into consideration.

If, despite the application of the abovementioned procedure, it is not possible to reach an agreement on some specific aspect, the Parties may submit the matter to arbitration.

The new long term Agreement shall establish a dispute settlement mechanism.

ENTRY INTO FORCE

Article 17

This initial Agreement will have a validity of four years and will lead to a new Agreement upon the completion of relevant studies. If the long-term Agreement cannot be reached after four years, the initial Agreement's validity shall be extended on an annual basis.

The new long-term Agreement shall take into account authorization acts that may have been adopted while this Agreement was valid.

This Agreement shall enter into force thirty days after receipt of the last Note by which the Parties notify each other of compliance of the relevant internal requirements. This notwithstanding, the second paragraph of Article 6 shall enter into force upon its signing.

Four years after its entry into force, this Agreement may be terminated by either party, by written notice to the other party, six months in advance. The termination will come into effect following said period.

Signed at ...

Annex 9

Initial Agreement [Silala or Siloli], Agreed Draft, Santiago, 13 November 2009

(Original in Spanish, English translation)

Borrador acordado el 13 de noviembre de 2009, en Santiago.

ACUERDO INICIAL [SILALA O SILOLI]

El Gobierno de la República de Chile y el Gobierno del Estado Plurinacional de Bolivia, en adelante "las Partes",

CONSIDERANDO

Que los Ministerios de Relaciones Exteriores de la República de Chile y del Estado Plurinacional de Bolivia constituyeron en 2004 un Grupo de Trabajo Bolivia – Chile sobre el tema del Silala, que plasmó sus resultados en las actas suscritas el 6 de mayo de 2004, el 20 de enero de 2005, el 10 de junio de 2008 y el 14 de noviembre de 2008;

Que el tema del Silala o Siloli fue incluido en el punto VII de la Agenda bilateral de 13 puntos adoptada por ambas Partes en julio de 2006 y que desde esa fecha, ellas se han esforzado en proponer fórmulas destinadas a superar las diferencias surgidas en torno al sistema hídrico del Silala o Siloli, y las características de sus aguas;

Que los estudios conjuntos realizados previamente no avanzaron hacia su conclusión respecto de la naturaleza de las aguas y las Partes consideran necesario continuar su realización conjunta;

Que los estudios realizados hasta el presente en forma individual, por cada una de las Partes, han aportado suficiente información para establecer el presente acuerdo inicial que servirá de base para un nuevo acuerdo de largo plazo, y que se concluirá teniendo en consideración los resultados de los estudios técnicos contemplados en el presente acuerdo, la continuación de los trabajos conjuntos iniciados en el año 2000, los aprovechamientos existentes y el uso sustentable de las aguas;

Que el presente acuerdo no se refiere a otros temas relativos al Silala o Siloli que a cada una de las Partes interese abordar en forma previa o al momento de negociar el nuevo Acuerdo de largo plazo;

Draft agreed to on 13 November 2009, in Santiago

INITIAL AGREEMENT [SILALA OR SILOLI]

The Government of the Republic of Chile and the Government of the Plurinational State of Bolivia, hereinafter "the Parties",

CONSIDERING

That the Ministries of Foreign Affairs of the Republic of Chile and the Plurinational State of Bolivia created a Bolivia-Chile Working Group on the Silala issue in 2004 and recorded the results attained in the minutes signed on 6 May 2004, 20 January 2005, 10 June 2008, and 14 November 2008;

That the Silala, or Siloli issue was included in point VII of the Bilateral Agenda of 13 Points, adopted by both Parties in July 2006, and that since that date, they have made efforts to propose formulas intended to overcome their differences regarding the Silala, or Siloli hydrologic system and the characteristics of its waters;

That the joint studies carried out previously did not move forward towards their conclusion regarding the nature of the waters and that the Parties consider it necessary to continue their joint implementation;

That the studies carried out to date by each of the Parties individually have provided sufficient information to reach this initial agreement, which shall serve as a basis for a new long term Agreement that will be concluded taking into consideration the results of the technical studies referred to herein, the continuation of the joint work started in 2000, and the present utilization and sustainable use of the waters of Silala;

That the present Agreement does not address other issues that each of the Parties might have an interest in addressing when negotiating the new long-term Agreement regarding the Silala, or Siloli;

Borrador acordado el 13 de noviembre de 2009, en Santiago.

Que el ambiente de mutua confianza que se ha desarrollado entre ambos países ha permitido acercar las voluntades para profundizar los entendimientos que los pueblos anhelan, formulando un acuerdo de mutuo beneficio sobre este punto de la agenda bilateral.

ACUERDAN

ASPECTOS GENERALES

Artículo 1

El presente acuerdo inicial establece el marco para trabajar conjuntamente con miras a avanzar en la convergencia de los diferentes puntos de vista que han surgido entre Chile y Bolivia sobre las aguas del Silala, considerando que:

a) Para Bolivia las aguas del Silala son de su total propiedad, provienen de decenas de manantiales ubicados en su territorio, y las obras de captación y conducción existentes son las que dan origen al actual escurrimiento superficial.

b) Para Chile las aguas del Silala escurren naturalmente por la frontera y constituyen un curso de agua sucesivo internacional, al cual se aplican los criterios sobre los usos equitativos y razonables, según el derecho internacional, donde Bolivia es Estado de curso Superior y Chile de curso inferior.

Artículo 2

El Acuerdo Inicial tendrá como propósitos, los siguientes:

1. Establecer un acuerdo bilateral para la preservación, sostenibilidad, uso y aprovechamiento del sistema hídrico del Silala o Siloli para beneficio de ambos países.

2. Realizar los estudios y mediciones que permitan determinar la naturaleza, el balance hídrico, el comportamiento hidrométrico, la datación de las aguas, los flujos superficiales y subterráneos, y la influencia de las obras civiles sobre el caudal, entre otros, utilizando una metodología científicamente válida y concordada, que sirva de base al establecimiento definitivo del porcentaje de las aguas de libre disposición de cada país.

3. Establecer un procedimiento mediante el cual el Estado Plurinacional de Bolivia autorice, conforme al artículo 3, que las aguas de su libre disponibilidad, captadas en su país, puedan ser conducidas a Chile y aprovechadas recibiendo una compensación.

2

That the atmosphere of mutual trust that has been developed between the two countries has helped bring together their will to deepen the understandings that both their peoples long for, formulating a mutually beneficial Agreement on this point of the bilateral agenda.

HEREBY AGREE

GENERAL ASPECTS

Article 1

This initial agreement establishes the framework to work together with a view to moving forward in the convergence of the different points of view that have emerged between Chile and Bolivia over the Silala waters, considering that:

a) To Bolivia, the Silala waters are of its complete property and come from dozens of springs located within its territory; and the existing abstraction and canalization works are responsible for giving rise to the current surface runoff.

b) To Chile, the Silala waters flow naturally across the border and constitute a successive international watercourse, to which the criteria on equitable and reasonable uses are to be applied, under International Law, situation in which Bolivia is an upstream State and Chile the downstream one.

Article 2

The initial Agreement shall have the following purposes:

1. To establish a bilateral agreement for the preservation, sustainability, use and exploitation of the Silala or Siloli water system for the benefit of both countries.

2. To carry out studies and measurements to determine the nature, water balance, hydrometric behavior, water dating, surface and groundwater flows, and the influence of civil works on the flow, among others, using a scientifically valid and agreed methodology that serves as the basis for the definitive establishment of the percentage of freely available waters for each country.

3. To establish a procedure by which the Plurinational State of Bolivia au thorizes, according to Article 3, that the freely available waters, abstracted in its country, be transported and used in Chile, within the framework of compensation.

Borrador acordado el 13 de noviembre de 2009, en Santiago.

Artículo 3

Por el presente acuerdo se establece que las aguas de libre disponibilidad de Bolivia y captadas en su país podrán ser conducidas para ser aprovechadas en Chile. En tal caso, el titular público boliviano de la autorización para el otorgamiento del uso de dichas aguas será compensado por las personas jurídicas de derecho público o privado que se constituyan en aprovechatarias de dichas aguas.

Para el otorgamiento del uso de dichas aguas de libre disponibilidad, el titular público boliviano considerará el derecho preferente de las personas jurídicas de derecho público o privado que actualmente estuvieren haciendo uso de dichas aguas en Chile. Este derecho preferente se ejercerá por un espacio de sesenta días a partir de la comunicación por vía oficial de la implementación de esta parte del Acuerdo.

Las personas jurídicas antes individualizadas deberán desarrollar las acciones que correspondieren en Chile, en caso de que esas aguas fueren a ser utilizadas en este país, pudiendo Bolivia caducar la autorización otorgada si no se concretaren esos propósitos en el plazo que hubiese fijado.

Artículo 4

Considerando la fragilidad del ecosistema del Silala o Siloli, por el presente Acuerdo las Partes se comprometen a mantener las condiciones de caudal y calidad del agua que dependan de las partes, y a cuidar que cualquier obra que emprendan a futuro individual o conjuntamente no afecte dicho caudal y calidad.

Artículo 5

Por este Acuerdo las Partes se comprometen a efectuar conjuntamente estudios complementarios sobre el sistema hídrico del Silala (Siloli), para lograr un mayor conocimiento sobre su funcionamiento y naturaleza.

Artículo 6

3

Article 3

By this agreement, it is established that the freely available waters of Bolivia and abstracted in that country may be canalized to be used in Chile. In such case, the Bolivian public holder of the authorization to award the use of said waters will be compensated by the public or private law legal entities that are established as beneficiaries of said waters.

To grant the use of said freely available waters, the Bolivian public holder will consider the preferential right of the public or private law legal entities that are currently making use of said waters in Chile. This preferential right will be exercised for a period of sixty days from the official communication of the implementation of this part of the Agreement.

The legal entities, previously individualized, must develop the corresponding actions in Chile, in case these waters are to be used in this country, and Bolivia may expire the authorization granted if these purposes are not fulfilled within the term that had been established.

Article 4

Considering the fragility of the Silala or Siloli ecosystem, by this agreement the Parties undertake to maintain the conditions and quality of the water for which either of the Parties is responsible, and ensure that any work undertaken individually or jointly does not affect said flow and its quality.

Article 5

Through this agreement, the Parties undertake to jointly carry out complementary studies on the Silala (Siloli) water system, in order to achieve a better understanding of its behavior and nature.

Article 6

Borrador acordado el 13 de noviembre de 2009, en Santiago

Teniendo en cuenta lo señalado en el artículo primero del presente acuerdo, las Partes establecen, como hipótesis de trabajo y mientras se realicen los estudios indicados en el artículo 2.2., que del volumen total del agua del Silala o Siloli, que atraviesa superficialmente la frontera, el 50% corresponde, inicialmente, al Estado Plurinacional de Bolivia, es de su libre disponibilidad y lo podrá utilizar en su territorio o autorizar su captación para su uso por terceros, incluyendo su conducción a Chile. Este porcentaje podrá ser incrementado a favor de Bolivia, en función de los resultados de los estudios conjuntos que se lleven a cabo en el marco del presente Acuerdo.

Tan pronto sea suscrito el presente Acuerdo las Partes se comprometen a instalar la estación hidrométrica mencionada en el Artículo 8, letra b), la cual registrará los volúmenes de agua en el cruce de frontera.

ASPECTOS TECNICOS

Artículo 7

A partir del presente Acuerdo inicial, las Partes implementarán en la zona una red de estaciones hidrometeorológicas que permitan obtener datos y realizar estudios conjuntos con vistas a la suscripción de un nuevo acuerdo de largo plazo.

Artículo 8

Con el propósito de establecer el porcentaje de aguas de libre disponibilidad de cada país y avanzar en la comprensión del sistema hídrico, se acuerda implementar una red de estaciones de medición de caudales y variables hidrometeorológicas para obtener registros de precipitación (líquida y nival), temperatura del aire y otras variables, según el siguiente detalle:

a. Estación meteorológica en el sector de cruce de frontera.
b. Estación hidrométrica en el sector de cruce de frontera.
c. Estación hidrométrica en el cruce del camino próximo a los bofedales orientales en territorio de Bolivia.
d. Estación meteorológica en la divisoria de aguas en el extremo Este del sistema.
e. Estación meteorológica en la ladera boliviana del volcán Inacaliri.
f. Estación meteorológica en la zona de bofedales de la vertiente oriental.

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Taking into account the provisions of the first article of this agreement, the Parties hereby establish, as a working hypothesis and while carrying out the studies indicated in Article 2.2, that of the total water volume of the Silala or Siloli that crosses the border on the surface, 50% corresponds, initially, to the Plurinational State of Bolivia, is freely available to it and may be used in its territory or authorized to be abstracted for the use of third Parties, including its conveyance to Chile. This percentage may be increased in favor of Bolivia, depending on the results of the joint studies carried out within the framework of this Agreement.

As soon as this agreement is signed, the Parties undertake to install the hydrometric station mentioned in Article 8, sub-paragraph b), which will record the volumes of water at the border crossing.

TECHNICAL ASPECTS

Article 7

Based on this initial agreement, the Parties will set up a network of hydrometeorological stations in the area in order to obtain data and carry out joint studies with a view to signing a new long term agreement.

Article 8

In order to determine the percentage of freely available water in each country and move forward in the understanding of the water system, the Parties hereby agree to implement a network of flow measurement stations and hydro-meteorological variables in order to obtain records of precipitation (rain and snow), air temperature and other variables, in accordance with the following detail:

a. A meteorological station at the border crossing.
b. A hydrometric station at the border crossing.
c. A hydrometric station at the junction of the road next to the Orientales Wetlands in Bolivian territory.
d. A meteorological station in the watershed at the eastern end of the system.
e. A meteorological station on the Bolivian slopes of the Inacaliri Volcano.
f. A meteorological station in the area of the wetlands found on the eastern spring.

De las seis estaciones propuestas, dos (a y b) se encontrarán en el cruce de frontera, y serán binacionales, cuatro (c, d, e y f) estarán ubicadas en territorio boliviano y serán de propiedad del Estado Plurinacional de Bolivia.

Además, formará parte de la red la estación de la Dirección General de Aguas de Chile, DGA, ubicada en el lado chileno, próxima al cruce del límite internacional.

Adicionalmente, las Partes se comprometen a intercambiar datos provenientes de otras estaciones próximas al área de investigación.

Dada la ubicación remota de la red de estaciones y la necesidad de que ambos países cuenten con información continua, simultánea y en tiempo real, las estaciones tendrán transmisión satelital, de modo que ambas Partes monitoreen la información y el funcionamiento general de las estaciones.

Artículo 9

Las Partes definirán un período de monitoreo conjunto de cuatro ciclos hidrológicos anuales que permitan determinar el balance hídrico, el comportamiento hidrométrico, la datación de las aguas, los flujos superficiales y subterráneos, y la influencia de las obras sobre el caudal, entre otros, utilizando una metodología científicamente válida y concordada.

La recolección, archivo y procesamiento de los datos, quedará a cargo de la Dirección General de Aguas (DGA) en Chile y del Servicio Nacional de Meteorología e Hidrología (SENAMHI) en Bolivia.

Artículo 10

Por el presente Acuerdo inicial, se establece un programa de monitoreo para determinar la calidad y la datación del agua, con toma de muestras dos veces al año, en invierno (julio) y verano (enero), en los sectores de bofedales y en el cruce de frontera.

Se establece, asimismo, que se complementarán los trabajos cartográficos del área del Silala o Siloli, mediante trabajos de terreno de apoyo técnico a las fotografías aéreas tomadas en conjunto el año 2001, para elaborar una cartografía de detalle, y se adquirirán imágenes satelitales, además de elaborarse modelos digitales de terreno.

Artículo 11

Of the six proposed stations, two (a and b) shall be located at the border crossing and shall be binational, and four (c, d, e and f) shall be located in Bolivian territory and shall be property of the Plurinational State of Bolivia.

In addition, the said network will form part of the Chilean General Directorate of Water [DGA, for its Spanish acronyms] network, located on the Chilean side, near the international border crossing.

Additionally, the parties agree to exchange data from other stations near the area studied.

Given the remoteness of the network of stations and the need for both countries to have continuous, simultaneous, and real-time information, the stations will be set up with satellite transmission, so that both parties can monitor the information and the overall functioning of the stations.

Article 9

The Parties shall define a joint monitoring period of four annual hydrological cycles to determine the water balance, hydrometric behavior, age of the waters, surface and groundwater flows, and influence of the works on the flow, among others, using scientifically valid and agreed upon methodology.

Data collection, storage, and processing shall be the responsibility of the General Directorate of Water (DGA) in Chile and the National Service of Meteorology and Hydrology (SENAMHI) in Bolivia.

Article 10

Under this initial Agreement, a monitoring program shall be established to determine the quality and the age of the water, taking samples twice a year, in winter (July) and summer (January), in the wetland area and the border crossing.

It is also herewith agreed that cartographic work in the Silala or Siloli area will be complemented through field works to provide technical support for the aerial photographs taken jointly in 2001 in order to develop a detailed cartography; also, satellite imagery shall be acquired and a digital terrain model developed.

Article 11

Las Partes elaborarán informes semestrales y un informe final al cabo de cuatro años, con los resultados de los estudios. Este informe final constituirá la base para el nuevo Acuerdo de largo plazo que establecerá los porcentajes de libre disponibilidad de cada país.

ASPECTOS INSTITUCIONALES

Artículo 12

El Estado Plurinacional de Bolivia a través del Ministerio de Medio Ambiente y Agua designará a la Prefectura del Departamento de Potosí o a otra persona jurídica de derecho público que actuará como el sujeto detentor de la autorización de uso de las aguas de libre disponibilidad boliviana del Silala o Siloli.

Bajo el marco del presente Acuerdo inicial, el seguimiento y operación técnica del uso y aprovechamiento del agua, por Bolivia, estará a cargo del sujeto detentor arriba mencionado; por Chile, estará a cargo de la Dirección General de Aguas del Ministerio de Obras Públicas.

Las Partes se informarán mutuamente sobre cualquier modificación que establezcan respecto del régimen antes indicado.

Artículo 13

El Ministerio de Medio Ambiente y Agua determinará el valor por metro cúbico que percibirá el Estado Plurinacional de Bolivia a título de compensación en función del volumen transferido, el que será acordado directamente con la persona jurídica de derecho público o privado interesada. Asimismo, determinará la periodicidad con que percibirá dicho valor y las garantías para asegurar la compensación.

Artículo 14

Para la determinación de la compensación el Ministerio de Medio Ambiente y Agua podrá tener en cuenta, entre otros, el valor promedio efectivamente pagado por metro cúbico de aguas crudas en la II Región de Chile.

The Parties shall produce semi-annual reports and a final report after four years with the results of the studies. This final report will form the basis for the new long-term Agreement that will establish the percentage of water freely available to each country.

INSTITUTIONAL ASPECTS

Article 12

The Plurinational State of Bolivia, through the Ministry of Environment and Water, will appoint the Prefecture of the Department of Potosi or a different public legal entity as the subject entitled to authorize the use of the water of the Silala or Siloli that is freely available to Bolivia.

Under the framework of this initial Agreement, the monitoring and technical operation of water use and utilization will be the responsibility of the aforementioned subject, for Bolivia, and the General Directorate of Water of the Ministry of Public Works, for Chile.

The Parties shall inform each other of any changes regarding the regime established above.

Article 13

The Ministry of Environment and Water shall determine the value per cubic meter to be allocated to the Plurinational State of Bolivia in compensation, depending on the volume transferred, which shall be negotiated directly with the relevant public or private legal entity. The Ministry shall also determine the payment frequency and guarantees to ensure compensation.

Article 14

To determine the compensation due, the Ministry of Environment and Water may take into account, inter alia, the average price currently paid per cubic meter of untreated water in Chile's Region II.

Borrador acordado el 13 de noviembre de 2009, en Santiago.

Artículo 15

De conformidad con el presente Acuerdo, el Gobierno de Bolivia, declara que la persona jurídica, de derecho público o privado, que haya sido autorizada por el Ministerio de Medio Ambiente y Agua para el uso en territorio chileno de las aguas del Silala o Siloli de su libre disponibilidad, podrá aprovecharlas sin ninguna restricción, o discriminación.

El Gobierno de Chile declara que no se opondrá a la aplicación de medidas que conforme al ordenamiento jurídico boliviano y al presente Acuerdo, se apliquen al aprovechatario que no cumpla las obligaciones adquiridas con la persona jurídica de derecho público designada por el Ministerio de Medio Ambiente y Agua, en virtud del presente Acuerdo.

Las diferencias que pudiesen surgir entre una persona jurídica y el Estado Plurinacional de Bolivia en el marco de los Artículos 3 y 6 relativos a la autorización, y su cumplimiento o ejecución, serán resueltas según las normas aplicables en dicho Estado y las que estableciere la autorización para el aprovechamiento correspondiente, siendo competentes para estos efectos las instancias jurisdiccionales internas del Estado Plurinacional de Bolivia.

SOLUCIÓN DE DIFERENCIAS

Artículo 16

En caso de que en la aplicación o interpretación de este Acuerdo surgiere una diferencia, contingencia o asunto que requiera la atención conjunta de la Partes, cualquiera de ellas podrá convocar al Grupo de Trabajo Bolivia-Chile sobre el tema del Silala, creado por las Cancillerías de ambos Estados en 2004, para resolverla o darle una respuesta apropiada.

En los trabajos técnicos a que se refieren los artículos 7 a 11, las Partes se esforzarán en cooperar activamente, así como en alcanzar resultados que sirvan de referencia para futuros acuerdos. En caso de que, a pesar de los esfuerzos desplegados, no fuere posible ponerse de acuerdo sobre los volúmenes de agua de libre disponibilidad, entre otras materias, las Partes pondrán en ejecución mecanismos que permitan superar esas diferencias, con el apoyo de expertos si fuere necesario.

Sin perjuicio de ello, las Partes, de común acuerdo podrán solicitar en todo momento la asistencia de un organismo técnico o científico especializado y de renombre internacional, a fin de que aporte elementos que conduzcan a un arreglo entre las Partes.

Si no pudiere llegarse a un acuerdo a través de estos procedimientos respecto de la aplicación o interpretación del presente Acuerdo, cualquiera de las Partes podrá solicitar que se constituya una

Article 15

In accordance with this Agreement, the Government of Bolivia hereby declares that the public or private legal entity authorized by the Ministry of Environment and Water to have the unencumbered right to use the waters of Silala or Siloli in Chilean territory, may use these waters without restriction or discrimination.

The Government of Chile declares that it will not oppose to the application of measures which, under Bolivian law and this Agreement, shall be applicable to users that do not meet the obligations undertaken with the public legal entity appointed by the Ministry of Environment and Water under this Agreement.

The differences that may arise between a legal entity and the Plurinational State of Bolivia under Articles 3 and 6 regarding authorization, compliance or enforcement, shall be resolved under the provisions applicable in that State and those by which authorization for the corresponding use was established; the internal jurisdictional instances of the Plurinational State of Bolivia shall thus be regarded competent for this purpose.

DISPUTE SETTLEMENT

Article 16

If, any differences, contingencies or matters that require the Parties' joint attention arise in the application or interpretation of this Agreement, either Party may convene the Bolivia-Chile Silala Working Group, created by the Foreign Ministries of both States in 2004 to settle them or provide a proper response.

In the completion of the technical works referred to in Articles 7 to 11, the Parties shall endeavor to actively cooperate and achieve results that serve as reference for future agreements. If, despite all efforts, it is not possible to agree on the volume of freely available water, among other matters, the Parties shall implement mechanisms to overcome these differences, with the support of experts where necessary.

Notwithstanding above, the Parties may, by mutual agreement and at any time, request the assistance of an internationally recognized technical or scientific organ, in order to provide them with information that leads to a settlement.

If it is not possible to reach an agreement regarding the application or interpretation of this Agreement through these procedures, either party may request that a three-member

Comisión de Conciliación de tres miembros, para someter la diferencia a su conocimiento y recomendación.

En el plazo de treinta días después de recibida la solicitud, cada Parte designará un integrante de la Comisión de Conciliación. El tercero, que la presidirá, será designado de común acuerdo y no podrá ser nacional de ninguna de las Partes. En caso de desacuerdo sobre la persona a designar o si una de las Partes no designare en dicho plazo al miembro de la Comisión que le corresponde, cualquiera de las Partes podrá solicitar a la máxima autoridad de los siguientes organismos o programas internacionales según sus normas fundamentales constitutivas, que lo designe, según el siguiente orden sucesivo. En la Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura, UNESCO, el Director Ejecutivo; en la Organización Meteorológica Mundial, OMM, el Secretario General; en el Programa de las Naciones Unidas para el Medio Ambiente, PNUMA, el Director Ejecutivo; en la Organización Internacional de Energía Atómica, OIEA, el Director General; o en el Programa de las Naciones Unidas para el Desarrollo, PNUD, el Administrador. No será considerado un organismo o programa cuya máxima autoridad sea nacional de una de las Partes, o cuando dicha persona haya trabajado al servicio de una de ellas.

En caso de que a pesar de la aplicación del procedimiento anteriormente mencionado no se llegare a entendimiento en algún aspecto específico, las Partes podrán someterlo al arbitraje.

En el nuevo Acuerdo de largo plazo se establecerá un mecanismo de solución de controversias.

VIGENCIA

Artículo 17

Este Acuerdo inicial tendrá una vigencia de cuatro años, y dará lugar a un nuevo Acuerdo una vez concluidos los estudios pertinentes. Si al cabo de los cuatro años no pudiera establecerse el Acuerdo de largo plazo, las Partes de mutuo acuerdo, podrán prorrogarlo por períodos anuales.

El nuevo Acuerdo de largo plazo tendrá en cuenta los actos de autorización que se hubiesen adoptado durante la vigencia del presente Acuerdo inicial.

El presente Acuerdo entrará en vigor treinta días después de recibida la última Nota por la cual las Partes se comuniquen recíprocamente el cumplimiento de los requisitos internos correspondientes. Sin perjuicio de lo anterior, el segundo párrafo del Artículo 6 entrará en vigor al momento de su suscripción.

Conciliation Commission be established to apply its knowledge and recommendations to the dispute.

Within thirty days after receiving the request, each party shall appoint a member for the Conciliation Commission. The third member, who will preside the commission, shall be appointed by mutual agreement and cannot be a national of either Party. In case of disagreement on the appointed person or if a Party fails to nominate a member to the Commission within that period, either party may request the highest authority of the following agencies or programs, based on their fundamental constitutional rules, to appoint the member in question, in the following order: The Executive Director of the United Nations Educational, Scientific and Cultural Organization (UNESCO); the Secretary-General of the World Meteorological Organization (WMO); the Executive Director of the United Nations Environment Program (UNEP); the Director General of the International Atomic Energy Agency (IAEA); or the Administrator of the United Nations Development Program (UNDP). An agency or program whose maximum authority is a Party national, or a person that has worked in the service of one of them, shall not be taken into consideration.

If, despite the application of the abovementioned procedure, it is not possible to reach an agreement on some specific aspect, the Parties may submit the matter to arbitration.

The new long-term Agreement shall establish a dispute settlement mechanism.

VALIDITY

Article 17

This initial Agreement will have a validity of four years and will lead to a new Agreement upon the completion of relevant studies. If the long-term Agreement cannot be reached after four years, the initial Agreement's validity shall be extended on an annual basis.

The new long-term Agreement shall take into account authorization acts that may have been adopted while this initial Agreement was valid.

This Agreement shall enter into force thirty days after receipt of the last Note by which the Parties notify each other of compliance of the relevant internal requirements. This notwithstanding, the second paragraph of Article 6 shall enter into force upon its signing.

Después de transcurridos cuatro años, el presente Acuerdo podrá ser denunciado por cualquiera de las Partes, mediante una notificación escrita a la otra Parte, con seis meses de anticipación. La denuncia cobrará vigor a partir del cumplimiento de dicho plazo.

Suscrito en .....

Four years after its entry into force, this Agreement may be terminated by either Party, by written notice to the other Party, six months in advance. The termination will come into effect following said period.

Signed at ...

Annex 10

Minutes of the First Part of the VIII Meeting of the Bolivia-Chile Working Group on the Silala Issue, October 2010 (unsigned)

(Original in Spanish, English translation)

ACTA DE LA PRIMERA PARTE DE LA VIII REUNIÓN DEL GRUPO DE TRABAJO BOLIVIA-CHILE SOBRE EL TEMA SILALA

En la ciudad de La Paz, a los treinta días del mes de septiembre y primero de octubre de 2010, sesionó en su primera parte la VIII Reunión del Grupo de Trabajo Bolivia - Chile sobre el tema Silala.

La Delegación de Bolivia fue presidida por el Sr. Rogel Mattos, Director General de Límites, Fronteras y Aguas Internacionales del Ministerio de Relaciones Exteriores de Bolivia. La Delegación de Chile, por su parte, fue presidida por el Sr. Anselmo Pommes, Director Nacional de Fronteras y Límites del Estado, del Ministerio de Relaciones Exteriores. La nómina de las respectivas delegaciones se adjunta a la presente Acta como Anexo 1.

Ambas delegaciones destacaron la importancia de la Reunión, que responde a un compromiso asumido por ambos países con ocasión de la XXII Reunión del Mecanismo de Consultas Políticas, efectuada en La Paz, el 14 de julio de 2010, en cuyo punto VII del Acta de dicha Reunión se señala que el "Grupo de Trabajo sobre la temática del Silala, se reúna nuevamente con el objetivo de conocer, analizar y responder todas las propuestas surgidas a raíz del proceso de socialización del Acuerdo Inicial".

Las Delegaciones efectuaron una lectura completa del texto borrador del Acuerdo Inicial, al que se le incluyeron las complementaciones sugeridas por la Delegación de Bolivia, y que son básicamente las siguientes:

1. La compensación económica por el uso de las aguas realizado por Chile (Artículo 1; inciso a).
2. La conducción por parte de Bolivia de las aguas de su libre disponibilidad (Artículo 3).
3. La elaboración del contrato respectivo en Bolivia bajo el marco de la legislación vigente (Artículo 3).
4. La introducción de un plazo para las actividades contempladas en el primer párrafo del Artículo 8.
5. La definición del punto de partida para el periodo de monitoreo conjunto al que se refiere el Artículo 9.
6. La referencia a la finalización de los estudios técnicos además de considerar los cuatro años en la cláusula de vigencia (Artículo 17).

En relación a las modificaciones planteadas por la Delegación Boliviana, la Delegación de Chile dio respuesta a las mismas de la siguiente forma:

- Respecto a la modificación referida al párrafo primero del Artículo 3, la Delegación chilena no coincidió con el sentido y redacción propuesta. De tal forma, esta Delegación quedó de estudiarla, para dar respuesta a la misma en la continuación de la presente Reunión.

1

MINUTES OF THE FIRST PART OF THE VIII MEETING OF THE BOLIVIA-CHILE WORKING GROUP ON THE SILALA ISSUE

In the city of La Paz, on the 30th day of September and the first of October 2010, the VIII Meeting of the Bolivia-Chile Working Group on the Silala issue met in its first part.

The Delegation of Bolivia was chaired by Mr. Rogel Mattos, General Director of Borders, Boundaries and International Waters of the Ministry of Foreign Affairs of Bolivia. The Delegation of Chile, for its part, was chaired by Mr. Anselmo Pommes, National Director of State Borders and Boundaries of the Ministry of Foreign Affairs. The list of the respective delegations is attached to this Minutes as Annex 1.

Both delegations highlighted the importance of the Meeting, which responds to a commitment assumed by both countries on the occasion of the XXII Meeting of the Political Consultation Mechanism, held in La Paz, on 14 July 2010, in which point VII of the Minutes of said Meeting it is indicated that the "Working Group on the Silala issue, meets again with the objective of knowing, analyzing and answering all the proposals arising from the process of socialization of the Initial Agreement."

The Delegations made a complete reading of the draft text of the Initial Agreement, to which the complements suggested by the Delegation of Bolivia were included, and which are basically the following:

1. The economic compensation for the use of the waters made by Chile (Article 1, paragraph a).
2. The channeling by Bolivia of the free available waters (Article 3).
3. The elaboration of the respective contract in Bolivia under the framework of the current legislation (Article 3).
4. The introduction of a deadline for the activities referred to in the first paragraph of Article 8.
5. The definition of the starting point for the joint monitoring period referred to in Article 9.
6. The reference to the completion of the technical studies in addition to considering the four years in the validity clause (Article 17).

In relation to the modifications proposed by the Bolivian Delegation, the Delegation of Chile responded to them as follows:

- Regarding the amendment referred to the first paragraph of Article 3, the Chilean Delegation did not agree with the proposed meaning and wording. In this way, this Delegation was supposed to study it, in order to respond to it in the continuation of this Meeting.

Respecto de las demás modificaciones propuestas por la Delegación de Bolivia, la Delegación de Chile manifestó su conformidad con las mismas, quedando incorporadas al texto borrador del Acuerdo Inicial. Respecto de la modificación planteada en el numeral 1 del párrafo anterior, cabe señalar que ésta constituye una precisión de la postura de Bolivia, por lo que la Delegación de Chile de igual forma complementó su posición, contenida en la letra b) del Artículo 1 del Acuerdo Inicial.

Como reflejo del proceso de consulta interna, la Delegación boliviana propuso la inclusión de un Artículo transitorio referido al monto y la forma de erogación por parte de Chile respecto del uso pasado de las aguas del Silala ("deuda histórica"), que diría lo siguiente:

> ***"Artículo Transitorio.-- En la XXIII Reunión del Mecanismo de Consultas Políticas Bolivia - Chile se definirá el monto y la forma de erogación por parte de la República de Chile respecto del uso pasado de las aguas del Silala".***

Respecto a la modificación consistente en la incorporación del Artículo Transitorio, la Delegación de Chile manifestó su disconformidad con la misma y con su incorporación en el texto borrador del Acuerdo Inicial, atendido a que la finalidad perseguida con la suscripción del citado Acuerdo es buscar una solución al tema del Silala o Siloli.

Como argumento para la inclusión del Artículo transitorio y en concordancia con el Artículo 1, inciso a), del texto borrador del Acuerdo Inicial, la Delegación boliviana expuso los fundamentos por los cuales considera que Chile tiene una deuda histórica por el uso pasado de las aguas del Silala. Los fundamentos presentados se refieren a la constatación del cambio del objeto de uso de la concesión que estaba destinada originalmente al uso del agua por locomotoras a vapor, debido a que a partir de los años 50s las locomotoras de vapor dejaron de ser utilizadas y estas aguas pasaron a ser destinadas a otros usos no autorizados por la autoridad boliviana competente.

Asimismo, la Delegación boliviana expuso que se realizaron obras de infraestructura en el área de los manantiales del Silala en su territorio que incrementaron el caudal para otros usos sin autorización boliviana.

Adicionalmente, la Delegación boliviana señaló que Chile regularizó derechos de agua bajo el mandato de su Código de Aguas de 1981, sin considerar los derechos bolivianos existentes sobre las aguas del Silala.

De igual manera, enfatizó que la concesión fue revocada el año de 1997 notificándose a las empresas respectivas en el territorio chileno. Se explicó que el Gobierno boliviano licitó las aguas del Silala estableciéndose una nueva concesión el año 2000 a la empresa DUCTEC SRL, la que emitió las facturas respectivas por el uso de las aguas del Silala a las empresas usuarias correspondientes,

> Regarding the other amendments proposed by the Delegation of Bolivia, the Delegation of Chile expressed its agreement with them, being incorporated into the draft text of the Initial Agreement. Regarding the modification proposed in paragraph 1 of the previous paragraph, it should be noted that this constitutes a clarification of the position of Bolivia, reason why the Delegation of Chile also complemented its position, contained in letter b) of Article 1 of the Initial Agreement.

As a reflection of the internal consultation process, the Bolivian Delegation proposed the inclusion of a transitory article referring to the amount and form of expenditure by Chile regarding the past use of the Silala waters ("historical debt"), which would read as follows:

> *"Transitory Article – At the XXIII Meeting of the Bolivia-Chile Political Consultation Mechanism, the amount and manner of expenditure by the Republic of Chile regarding the past use of Silala waters will be defined."*

Regarding the amendment consisting of the incorporation of the Transitory Article, the Chilean Delegation expressed its disagreement with it and its incorporation in the draft text of the Initial Agreement, given that the purpose pursued with the signing of the aforementioned Agreement is to seek a solution to the issue of Silala or Siloli.

As an argument for the inclusion of the Transitory Article and in accordance with Article 1, paragraph a), of the draft text of the Initial Agreement, the Bolivian Delegation explained the reasons why it considers that Chile has a historical debt for the past use of the waters from Silala. The fundaments presented refer to the verification of the change of object of use of the concession that was originally intended for the use of water by steam locomotives, because from the 50s steam locomotives stopped being used and these waters were destined to other uses not authorized by the competent Bolivian authority.

Likewise, the Bolivian Delegation explained that infrastructure works were carried out in the area of the Silala springs in its territory that increased the flow for other uses without Bolivian authorization.

In addition, the Bolivian Delegation pointed out that Chile regularized water rights under the mandate of its Water Code of 1981, without considering the existing Bolivian rights over the Silala waters.

Similarly, it was emphasized that the concession was revoked in 1997, notifying the respective companies in the Chilean territory. It was explained that the Bolivian Government tendered the Silala waters, establishing a new concession in 2000 to the Company DUCTEC SRL, which issued the respective invoices for the use of the Silala waters to the corresponding user companies, recibiendo como respuesta la negativa de pago por instrucciones de la Cancillería chilena.

Por lo tanto la Delegación boliviana señaló que existen obligaciones por parte de Chile respecto del uso de las aguas bolivianas del Silala usadas en el pasado y que éstas deberían ser compensadas económicamente ("deuda histórica").

La Delegación chilena reiteró su posición que está contenida en el Artículo 1 letra b) del borrador de Acuerdo Inicial respecto del Silala o Siloli. Por lo mismo, no procede discutir ni hacerse cargo de los planteamientos y elementos expuestos por la Delegación de Bolivia, citados en los párrafos precedentes.

En esta perspectiva, y respecto del primer planteamiento de Bolivia, la Delegación de Chile expuso que no procede pronunciarse respecto de eventuales deudas que pudieren existir con el Estado de Bolivia por uso de aguas del Silala o Siloli. En consecuencia, la Delegación de Chile se opuso a la inclusión de la cláusula transitoria sobre deuda histórica en el texto borrador de Acuerdo Inicial.

La Delegación boliviana, frente a la negativa de la Delegación chilena, señaló entonces que Bolivia se reserva el derecho de utilización de las aguas de libre disponibilidad bolivianas usándolas en su territorio o reconstituyendo las condiciones naturales del área de los manantiales del Silala.

La Delegación chilena consideró que este planteamiento no se condice con los propósitos que han llevado a la redacción actual del texto borrador de Acuerdo Inicial.

Se adjunta como Anexo 2 la versión del texto borrador de Acuerdo Inicial del 1º de octubre de 2010.

Como resultado del desarrollo de esta Reunión, ambas delegaciones, en orden a continuar perfeccionando el referido texto borrador del Acuerdo Inicial, acordaron efectuar la segunda parte de esta Reunión del Grupo de Trabajo sobre el Tema Silala, a la brevedad posible, antes de la realización de la XXIII Reunión del Mecanismo de Consultas Políticas Bolivia Chile, sugiriendo la Delegación boliviana que ésta se realice en el curso de los próximos quince días.

Se convino que en la continuación de esta Reunión participe también una comisión técnica compuesta por el Servicio Nacional de Meteorología e Hidrología de Bolivia (SENAMHI) y la Dirección General de Aguas de Chile (DGA), para avanzar en la definición de las cuestiones referidas a las especificaciones técnicas y metodológicas para la instalación de las estaciones de monitoreo a que se hace referencia en el Articulo 8 del texto borrador del Acuerdo Inicial. Para estos efectos, la Delegación boliviana entregó un borrador de cronograma con plazos y fechas tentativas para la instalación de las citadas estaciones, cuyo texto se adjunta como Anexo 3 de la presente Acta.

D. Rogel Mattos
Por la Delegación de Bolivia

D. Anselmo Pommes
Por la Delegación de Chile

receiving as a response the refusal to pay for instructions from the Chilean Foreign Ministry.

Therefore, the Bolivian Delegation indicated that there are obligations on the part of Chile regarding the use of Bolivian waters of Silala used in the past and that these should be economically compensated ("historical debt").

The Chilean Delegation reiterated its position that is contained in Article 1 letter b) of the draft Initial Agreement regarding the Silala or Siloli. For this reason, there is no need to discuss or acknowledge the proposals and elements presented by the Delegation of Bolivia, cited in the preceding paragraphs.

In this perspective, and with respect to the first approach of Bolivia, the Delegation of Chile stated that there is no need to rule on any debts that may exist with the State of Bolivia for the use of Silala or Siloli waters. Accordingly, the Delegation of Chile opposed the inclusion of the transitional clause on historical debt in the draft text of the Initial Agreement.

The Bolivian Delegation, faced with the refusal of the Chilean Delegation, indicated that Bolivia reserves the right to use Bolivian free-available waters by using them in its territory or by reconstituting the natural conditions of the area of the Silala springs.

The Chilean Delegation considered that this approach does not match the purposes that have led to the current drafting of the initial draft of the Initial Agreement.

Attached as Annex 2 is the draft text of the Initial Agreement of 1 October 2010.

As a result of the development of this Meeting, both delegations –in order to continue improving the draft text of the Initial Agreement– agreed to carry out the second part of this Meeting of the Working Group on the Silala Issue, as soon as possible, before the realization of the XXIII Meeting of the Bolivia-Chile Political Consultation Mechanism, suggesting the Bolivian Delegation that this be done during the next fifteen days.

It was agreed that in the continuation of this Meeting a technical commission composed of the National Service of Meteorology and Hydrology of Bolivia (SENAMHI) and the General Directorate of Water of Chile (DGA) should also participate, in order to move forward in the definition of the issues referred to the technical and methodological specifications for the installation of the monitoring stations referred to in Article 8 of the draft text of the Initial Agreement. For these purposes, the Bolivian Delegation submitted a draft schedule with timelines and tentative dates for the installation of the aforementioned stations, the text of which is attached as Annex 3 to this Minutes.

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D. Rogel Mattos	D. Anselmo Pommes
For the Delegation of Bolivia	For the Delegation of Chile

Sin perjuicio de lo tratado respecto al tema de Silala y con relación a los recursos hídricos compartidos Bolivia-Chile, las Delegaciones concordaron en la importancia que para ambos países representa avanzar en la identificación e inventario de dichos recursos.

Para ello, la Delegación de Chile sugirió proponer al Mecanismo de Consultas Políticas Bolivia-Chile la creación de un Grupo de Trabajo, definiendo su nombre en forma tentativa como "Grupo de Trabajo de Recursos Hídricos Compartidos Chile - Bolivia", con el objeto de hacer un inventario, avanzar en su conocimiento y evaluación y en una adecuada gestión de los mismos, en forma equitativa, racional y sustentable, con pleno respeto a la naturaleza jurídica de esos recursos.

Al respecto, la Delegación boliviana mencionó que considerará esta sugerencia y se pronunciará durante la continuación de la presente reunión.

A su vez la Delegación boliviana solicitó que respecto al río Lauca, se instalen estaciones hidrométricas conjuntas en un plazo de ciento veinte días.

Sobre el particular, la Delegación chilena indicó que considerará esta solicitud y responderá durante la continuación de la presente reunión.

La Delegación de Chile agradeció las especiales atenciones recibidas de parte de la Delegación de Bolivia.

D. Rogel Mattos Por la Delegación de Bolivia	D. Anselmo Pommes Por la Delegación de Chile

Without prejudice to what was discussed regarding the Silala issue and in relation to Bolivian-Chilean shared water resources, the Delegations agreed on the importance for both countries to move forward in the identification and inventory of these resources.

To this end, the Chilean Delegation suggested proposing to the Bolivia-Chile Political Consultation Mechanism the creation of a Working Group, tentatively defining its name as the "Chile-Bolivia Shared Water Resources Working Group", in order to make an inventory, move forward in their knowledge and evaluation and in an adequate management of them, in an equitable, rational and sustainable manner, with full respect for the legal nature of those resources.

In this regard, the Bolivian Delegation mentioned that it will consider this suggestion and will pronounce itself during the continuation of this meeting.

In turn, the Bolivian Delegation requested that, in relation to the Lauca River, joint hydrometric stations be installed within a period of one hundred and twenty days.

In this regard, the Chilean Delegation indicated that it will consider this request and will respond during the continuation of this meeting.

The Delegation of Chile thanked the special attentions received from the Delegation of Bolivia.

D. Rogel Mattos For the Delegation of Bolivia	D. Anselmo Pommes For the Delegation of Chile

ANEXO 1

VIII Reunión del Grupo de Trabajo Bolivia – Chile sobre el Tema Silala
30 de septiembre, 1º de octubre de 2010

DELEGACIÓN DE CHILE

1. Anselmo Pommes
   Director Nacional de Fronteras y Límites del Estado Subrogante
   DIFROL - Ministerio de Relaciones Exteriores
2. Jorge Canelas
   Cónsul General de Chile en Bolivia
3. Matías Desmadryl
   Director General de Aguas - Ministerio de Obras Públicas
4. Eleodoro Pempelfort
   Cónsul de Chile en La Paz
5. Carlos Ciappa P.
   Dirección General de Aguas - Ministerio de Obras Públicas
6. Alejandro Ahumada
   Dirección Nacional de Fronteras y Límites
   DIFROL - Ministerio de Relaciones Exteriores
7. T.S. Pablo Selamé
   Escritorio Bolivia – DIRAMESUR
   Ministerio de Relaciones Exteriores

ANNEX 1

VIII Meeting of the Bolivia-Chile Working Group on the Silala Issue
30 September, 1st October 2010

DELEGATION OF CHILE

1. Anselmo Pommes
   Acting National Director of State Borders and Boundaries
   DIFROL - Ministry of Foreign Affairs
2. Jorge Canelas
   Consul General of Chile in Bolivia
3. Matias Desmadryl
   General Director of Waters - Ministry of Public Works
4 Eleodoro Pempelfort
   Consul of Chile in La Paz
5. Carlos Ciappa P.
   General Directorate of Water - Ministry of Public Works
6. Alejandro Ahumada
   National Directorate of Borders and Limits
   DIFROL - Ministry of Foreign Affairs
7. T.S. Pablo Selame
   Desk of Bolivia - DIRAMESUR
   Ministry of Foreign Affairs

DELEGACION DE BOLIVIA

1. Rogel Mattos
   Director General de Límites, Fronteras y Aguas Internacionales
2. MC. Guadalupe Palomeque de la Cruz
   Directora General de Relaciones Bilaterales a.i.
3. Juan Carlos Alurralde
   Asesor del Ministro de Relaciones Exteriores
4. C. Mayra Montero
   Jefe de la Unidad de Aguas Internacionales
5. PS. Zandra Rodríguez
   Funcionaria de la Unidad de América
6. Andrés Vargas Zurita
   Funcionario de la Unidad de América
7. Aquiles Arce
   Director de Cuencas y Recursos Naturales, Viceministerio de Aguas
8. Luis Noriega
   Director del Área de Hidrología - SENAMHI
9. Jorge Bellot
   Funcionario de SERGEOTECMIN

OBSERVADORES

Celestino Condori
Presiden Comité Cívico Potosinista – CONCIPO

Daniel Berna
Honorable Alcalde de San Pablo de los Lipez

DELEGATION OF BOLIVIA

1. Rogel Mattos
   General Director of Boundaries, Borders and International Waters
2. MC. Guadalupe Palomeque de la Cruz
   Acting Director General of Bilateral Relations
3. Juan Carlos Alurralde
   Adviser to the Minister of Foreign Affairs
4. C. Mayra Montero
   Head of the International Waters Unit
5. PS. Zandra Rodriguez
   Officer of the America Unit
6. Andres Vargas Zurita
   Officer of the America Unit
7. Aquiles Arce
   Director of Watersheds and Natural Resources, Vice-Ministry of Waters
8. Luis Noriega
   Director of the Hydrology Area – SENAMHI
9. Jorge Bellot
   SERGEOTECMIN Official

OBSERVERS

Celestino Condori
President of the Civic Committee of Potosi - CONCIPO

Daniel Berna
Honorable Mayor of San Pablo de Los Lipez

Bolivia – Chile Diplomatic Correspondence

(Annexes 11 - 12)

Annex 11

Note Nº VRE-DGRB-UAM-018880/2011 from the Ministry of Foreign Affairs of Bolivia to the General Consulate of Chile in La Paz, 29 August 2011

(Original in Spanish, English translation)

ESTADO PLURINACIONAL DE BOLIVIA
MINISTERIO DE RELACIONES EXTERIORES

VRE-DGRB-UAM-018880/2011

EL MINISTERIO DE RELACIONES EXTERIORES – Dirección General de Asuntos Consulares, saluda muy atentamente al Honorable Consulado General de Chile y tiene a bien proponer realizar la segunda parte de la VII Reunión del Grupo de Trabajo Bolivia – Chile sobre el Tema Silala para el día 12 de septiembre de 2011, en la ciudad de La Paz, en forma previa a la XII Reunión del Grupo de Trabajo sobre Libre Tránsito Bolivia – Chile del día 13 de septiembre del año en curso, en atención a la conversación sostenida entre el Viceministro de Relaciones Exteriores, Embajador Juan Carlos Alurralde y el Director General de Países Limítrofes en Asuntos Regionales, Embajador Pedro Suckel, el día 11 de agosto del año en curso.

EL MINISTERIO DE RELACIONES EXTERIORES – Dirección General de Asuntos Consulares, hace propicia la oportunidad para reiterar al Honorable Consulado General de Chile las seguridades de su más alta y distinguida consideración.

MINISTERIO DE RELACIONES EXTERIORES
VICEMINISTERIO DE RELACIONES EXTERIORES
La paz - Bolivia

La Paz, 29 AGO 2011

Al Honorable
CONSULADO GENERAL DE CHILE
Presente.-

PLURINATIONAL STATE OF BOLIVIA
MINISTRY OF FOREIGN AFFAIRS

VRE-DGRB-UAM-018880/2011

THE MINISTRY OF FOREIGN AFFAIRS – General Directorate of Consular Affairs, attentively greets the Honorable Consulate General of Chile and wishes to propose to hold the second part of the VII Meeting of the Bolivia–Chile Working Group on the Silala Issue for 12 September 2011, in the city of La Paz, prior to the XII Meeting of the Working Group on Free Transit Bolivia–Chile of September 13th of the current year, in response to the conversation held between the Vice-Minister of Foreign Affairs, Ambassador Juan Carlos Alurralde and the General Director of Border Countries in Regional Affairs, Ambassador Pedro Suckel, on August 11th of this year.

THE MINISTRY OF FOREIGN AFFAIRS – Directorate General for Consular Affairs, avails itself of the opportunity to reiterate to the Honorable Consulate General of Chile the assurances of its highest and most distinguished consideration.

La Paz, 29 August 2011

Stamp: MINISTRY OF FOREIGN AFFAIRS VICE-MINISTRY OF FOREIGN AFFAIRS

To the Honorable
CONSULATE GENERAL OF CHILE
Hand Delivered.-

Annex 12

Note Nº VRE-DGRB-UAM-009901/2012 from the Ministry of Foreign Affairs of Bolivia to the General Consulate of Chile in La Paz, 24 May 2012

(Original in Spanish, English translation)

ESTADO PLURINACIONAL DE BOLIVIA
MINISTERIO DE RELACIONES EXTERIORES

VRE-DGRB-UAM-009901/2012

EL MINISTERIO DE RELACIONES EXTERIORES – Dirección General de Asuntos Consulares, saluda muy atentamente al Honorable Consulado General de la República de Chile y tiene a bien hacer referencia a su Nota Verbal Nº 199/39, mediante la cual observa la información difundida por la prensa entorno al anuncio efectuado por el Gobernador de Potosí, señor Félix González, sobre la construcción de una planta piscícola en el naciente de los manantiales del Silala, como el primero de tres proyectos de aprovechamiento de estas aguas, que incluirá además, la construcción de una represa y una planta embotelladora de agua mineral para el 2013.

Al respecto, el Ministerio de Relaciones Exteriores reitera firmemente y de manera fehaciente que las aguas del Silala son nacimientos o brotes naturales de aguas subterráneas que se originan y proceden de un acuífero o depósito subterráneo de formaciones geológicas que fluyen a la superficie de modo natural, debido a la erosión de las rocas volcánicas y que afloran como manantiales o vertientes dentro del territorio boliviano que no generan un cause, ni un curso natural, ni un sistema que integre el agua a un cause de las riberas para formar un río de curso sucesivo.

En consecuencia, lo que la República de Chile denomina "rio internacional" es en sí, resultado del producto humano de canalización artificial de aguas, que de manera natural, no hubiera podido ocurrir; motivo por el cual, las vertientes del Silala no pueden ser consideradas como rio internacional.

En este sentido, el Ministerio de Relaciones Exteriores reitera la posición del Gobierno de Bolivia manifestada en la "VIII Reunión del Grupo de Trabajo Bolivia – Chile sobre el tema del Silala", sin Acta suscrita, que se llevó a cabo en la ciudad de La Paz del 30 de septiembre al 1º de octubre de 2010, sobre la existencia de obligaciones por parte de Chile respecto del uso de las aguas bolivianas del Silala en el pasado y que éstas deberían ser compensadas económicamente ("Deuda Histórica"), debido al cambio del objeto de uso de la concesión que estaba destinada originalmente al uso del agua por locomotoras a vapor, las cuales dejaron de ser utilizadas a partir de los años 50s, y de esta forma, pasando estas aguas a ser destinadas a otros usos no autorizados por la autoridad boliviana competente.

Al Honorable
CONSULADO GENERAL DE LA
REPÚBLICA DE CHILE
Presente.-

Calle Junín Esq. Ingavi La Paz – Bolivia
Teléfonos (591-2) 2408330 – 2406884 - 2408900 -2409114 Fax No. (591-2) 2408642 Email: vre@rree.gov.bo

PLURINATIONAL STATE OF BOLIVIA
MINISTRY OF FOREIGN AFFAIRS

VRE-DGRB-UAM-009901/2012

THE MINISTRY OF FOREIGN AFFAIRS – General Directorate of Consular Affairs, very attentively greets the Honorable Consulate General of the Republic of Chile and kindly refers to its Verbal Note Nº 199/39, through which it observes the information disseminated by the press about the announcement made by the Governor of Potosi, Mr. Felix Gonzalez, regarding the construction of a fish farm in the source of the Silala water-springs, as the first of three projects for the use of these waters, which will also include the construction of a dam and a bottling plant for mineral water for 2013.

In this regard, the Ministry of Foreign Affairs firmly and irrefutably reiterates that the Silala waters are natural groundwater springs that originate and come from an aquifer or underground reservoir of geological formations that flow to the surface in a natural way, due to the erosion of volcanic rocks and that emerge as springs or streams within the Bolivian territory that do not generate a channel, nor a natural course, nor a system that integrates the water to a channel of the riverbanks to form a river of successive course.

Consequently, what the Republic of Chile denominates "international river" is in itself, result of the human product of artificial canalization of waters, which in a natural way it could not have happened; for this reason, the Silala water springs cannot be considered as an international river.

In this sense, the Ministry of Foreign Affairs reiterates the position of the Bolivian Government expressed at the "VIII Meeting of the Working Group Bolivia–Chile on the Silala issue," without a signed Act, which took place in the city of La Paz from 30 September to 1 October 2010, on the existence of obligations by Chile regarding the use of Bolivian waters of Silala in the past and that these should be economically compensated ("Historical Debt"), due to the change of the object of use of the concession that was originally destined to the use of water by steam locomotives, which stopped being used in the 50s, and in this way, passing these waters to be destined to other uses not authorized by the competent Bolivian authority.

To the Honorable
CONSULATE GENERAL
OF THE REPUBLIC OF CHILE
Hand Delivered.-

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ESTADO PLURINACIONAL DE BOLIVIA
MINISTERIO DE RELACIONES EXTERIORES

Por tanto, se insta a la República de Chile a seguir avanzando en un entendimiento común para que el Grupo de Trabajo sobre la temática del Silala se reúna nuevamente con el objetivo de conocer, analizar y responder, todas las propuestas surgidas a raíz del proceso de socialización del Acuerdo Inicial, tal como fue acordado en la "XXII Reunión del Mecanismo de Consultas Políticas Bolivia – Chile", celebrado en la ciudad de La Paz, del 12 al 14 de junio de 2010.

De igual forma, tomando en cuenta que hasta la fecha no se hizo efectiva ninguna visita de campo al terreno, se invita una vez más al Gobierno de Chile, a realizar una "Visita Conjunta" a dicha región, previa elaboración de una Agenda Técnica que considere las temporadas de estiaje, tal como fue manifestado por la delegación de Bolivia en la reunión sostenida entre autoridades gubernamentales de ambos países el 13 de septiembre de 2011.

Finalmente, el Ministerio de Relaciones Exteriores en concordancia de la cultura de diálogo que caracteriza al Estado Plurinacional de Bolivia manifiesta su predisposición de continuar explorando las instancias necesarias que conduzcan a un entendimiento común para seguir avanzando en el tratamiento del tema.

EL MINISTERIO DE RELACIONES EXTERIORES – Dirección General de Asuntos Consulares, hace propicia la oportunidad para reiterar al Honorable Consulado General de la República de Chile las seguridades de su más alta y distinguida consideración.

La Paz, 24 MAYO 2012

MINISTERIO DE RELACIONES EXTERIORES
VICEMINISTERIO DE RELACIONES EXTERIORES
La paz - Bolivia

Calle Junín Esq. Ingavi La Paz – Bolivia
Teléfonos (591-2) 2408330 – 2406884 - 2408900 -2409114 Fax No. (591-2) 2408642 Email: vre@rree.gov.bo

Therefore, the Republic of Chile is urged to continue moving forward in a common understanding so that the Working Group on the Silala issue meets again with the objective of knowing, analyzing and responding, all the proposals arising from the process of socialization of the Initial Agreement, as agreed in the "XXII Meeting of the Political Consultation Mechanism Bolivia–Chile," held in the city of La Paz, from 12 to 14 June 2010.

In the same way, taking into account that no field visits have been carried out to date, the Government of Chile is once again invited to carry out a "Joint Visit" to that region, after drawing up a Technical Agenda that takes into account the dry seasons, as it was manifested by the Delegation of Bolivia in the meeting held between governmental authorities of both countries on 13 September 2011.

Finally, the Ministry of Foreign Affairs in accordance with the culture of dialogue that characterizes the Plurinational State of Bolivia expresses its willingness to continue exploring the necessary instances that lead to a common understanding to continue moving forward in the treatment of the matter.

THE MINISTRY OF FOREIGN AFFAIRS – Directorate General of Consular Affairs, on this occasion reiterates to the Honorable Consulate General of the Republic of Chile the assurances of its highest and distinguished consideration.

La Paz, 24 May 2012

Stamp: MINISTRY OF FOREIGN AFFAIRS VICE-MINISTRY OF FOREIGN AFFAIRS

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Bolivian Official Documents

(Annex 13)

Annex 13

Bolivian Supreme Decree N° 24660, 20 June 1997

(Original in Spanish, English translation)

DECRETO SUPREMO Nº 24660

GONZALO SANCHEZ DE LOZADA
PRESIDENTE CONSTITUCIONAL DE LA REPUBLICA

CONSIDERANDO:

Que el Prefecto del Departamento de Potosí, ha revocado y anulado, mediante Resolución Administrativa 71/97 de 14 de mayo de 1997, la concesión sobre uso y aprovechamiento de aguas de las vertientes del "Silala" (Siloli), que la mencionada prefectura otorgó a la compañía "The Antofagasta (Chili), and Bolivia Railway Company Limited", exclusivamente para alimentación de sus locomotoras a fuerza de vapor, mediante proveído prefectural de 21 de septiembre de 1908, elevado a rango de escritura pública bajo el No. 48/1.908, y otorgada ante el Notario de Hacienda de Potosí, e inscrita en el departamento de Derechos Reales, bajo la partida 3, foja 3 vuelta del libro segundo de hipotecas de la Provincia Sud Lipez, en fecha 28 de octubre de 1908;

Que la Resolución Prefectural, se justifica plenamente con la desaparición del objeto, la causa y la finalidad de la concesión temporal del uso de las aguas, por factores sobrevinientes decisivos, tales como la conversión tecnológica de las locomotoras de la empresa concesionaria, eliminando su necesidad de agua, para la fuerza de vapor que antes las impulsaba, a lo que debe añadirse la inexistencia de la propia concesionaria como persona colectiva en actividad en el territorio boliviano;

Que se ha evidenciado el aprovechamiento indebido de dichas aguas por terceras personas ajenas a la concesión de su uso, con perjuicio para los intereses del Estado y en clara infracción de los artículos 136 y 137 de la Constitución Política del Estado;

Que corresponde al Poder Ejecutivo cumplir y hacer cumplir las resoluciones de organismos estatales como las prefecturas, en una correcta exégesis del artículo 96 numeral 12 de la Constitución Política del Estado.

EN CONSEJO DE MINISTROS

D E C R E T A:

ARTICULO UNICO.- Elévase a rango de Decreto Supremo la Resolución Administrativa 71/97 de 14 de mayo de 1997, dictada por el señor Prefecto del Departamento de Potosí.

- 2 -

SUPREME DECREE Nº 24660

GONZALO SANCHEZ DE LOZADA
CONSTITUTIONAL PRESIDENT OF THE REPUBLIC

CONSIDERING:

That the Prefect of the Department of Potosi has revoked and annulled, through Administrative Resolution Nº 71/97 of 14 May 1997, the concession on the use and exploitation of waters from the "Silala" (Siloli) water-springs; that the aforementioned Prefecture granted to the Antofagasta (Chili) and Bolivia Railway Company Limited, exclusively for powering its locomotives by steam power, through prefectural provision of 21 September 1908, raised to the rank of public deed under Nº 48/1.908, and granted before the Finance Notary of Potosi, and registered in the Department of Property Law, under heading 3, page 3 of the second book of mortgages of the South Lipez Province, dated 28 October 1908;

That the Prefectural Resolution is fully justified with the disappearance of the object, cause and purpose of the temporary concession for the use of waters, by decisive supervening factors, such as the technological conversion of the locomotives of the concessionaire company, eliminating their need for water, for the steam power that previously propel them, to which must be added the non-existence of the concessionaire itself as an active corporate in Bolivian territory;

That there has been evidence of the improper use of said waters by third Parties outside the granting of their use, with prejudice to the interests of the State and in clear violation of Articles 136 and 137 of the State Political Constitution;

That it corresponds to the Executive Power to comply with and enforce the resolutions of State agencies such as the Prefectures, in a correct non-existence of Article 96 numeral 12 of the State Political Constitution.

THE CABINET
DECREES:

SINGLE ARTICLE.- Raise to the rank of Supreme Decree the Administrative Resolution 71/97 of 14 May 1997, issued by the Prefect of the Department of Potosi.

Los señores Ministros de Estado en los Despachos de Relaciones Exteriores y Culto, Gobierno y de la Presidencia quedan encargados de la ejecución y cumplimiento del presente Decreto Supremo.

Es dado en el Palacio de Gobierno de la ciudad de La Paz, a los veinte de junio de mil novecientos noventa y siete años.

FDO. GONZALO SANCHEZ DE LOZADA, Antonio Aranibar Quiroga, Victor Hugo Canelas Zannier, Alfonso Erwin Kreidler Guillaux, José Guillermo Justiniano Sandoval, René Oswaldo Blattmann Bauer, Fernando Candia Castillo, Franklin Anaya Vásquez, Moisés Jarmúsz Levy, Jorge España Smith, MINISTRO SUPLENTE DE TRABAJO, Mauricio Antezana Villegas, Alfonso Revollo Thenier, Jaime Villalobos Sanjinés.

DECRETO PRESIDENCIAL Nº 24661

GONZALO SANCHEZ DE LOZADA
PRESIDENTE CONSTITUCIONAL DE LA REPUBLICA

CONSIDERANDO:

Que el Dr. Antonio Aranibar Quiroga, Ministro de Relaciones Exteriores y Culto, debe ausentarse del país a la ciudad de Quito-Ecuador, para asistir a la Reunión de Cancilleres del X Consejo Presidencial Andino, la misma que se realizará del 24 al 26 de junio de 1997.

Que de conformidad a lo dispuesto por el artículo 12 de la Ley 1493 de 17 de septiembre de 1993, es necesario designar al Ministro suplente para la continuidad administrativa del mencionado Despacho de Estado.

D E C R E T A :

ARTICULO UNICO.- Desígnase Ministro suplente de Relaciones Exteriores y Culto, al **Emb. EDUARDO TRIGO O'CONNOR D'ARLACH,** Secretario General Nacional, mientras dure la ausencia del titular.

Es dado en el Palacio de Gobierno de la ciudad de La Paz, a los veinte días del mes de junio de mil novecientos noventa y siete años.

FDO. GONZALO SANCHEZ DE LOZADA, Fdo. José Guillermo Justiniano Sandóval.

The Ministers of State in the Offices of Foreign Affairs and Worship, Government and Presidency are in charge of the implementation and fulfillment of this Supreme Decree.

It is given in the Government Palace of the city of La Paz on the twentieth day of June of one thousand nine hundred and ninety seven years.

Signed by GONZALO SANCHEZ DE LOZADA. Antonio Aranibar Quiroga, Victor Hugo Canelas Zannier. Alfonso Erwin Kreidler Guillaux, Jose Guillermo Justiniano Sandoval, Rene Oswaldo Blattman Bauer, Fernando Candia Castillo, Franklin Anaya Vasquez, Moises Jarmusz Levy. Jorge España Smith, ACTING MINISTER OF LABOR, Mauricio Antezana Villegas. Alfonso Revollo Thenier, Jaime Villalobos Sanjines.

[...]

Press Articles

(Annexes 14 - 16)

Annex 14

El Diario, *"The Silala is not a matter of discussion" for Chile*,
La Paz, 28 May 1996

(Original in Spanish, English translation)

Concesión fue renovada, según Vicecanciller chileno

El Silala "no es un tema de discusión" para Chile

Para Chile, el problema por el desvío del río Silala y la utilización ilegal de sus aguas es un asunto entre el Gobierno boliviano y la empresa ferrocarrilera que heredó un antiguo permiso de la prefectura potosina, sostuvo el vicecanciller chileno Mariano Fernández.

Según el diplomático --que eludió referirse a una eventual compensación por el uso de más de 100 años de agua dulce-- el permiso con la empresa heredera de los primeros derechos cedidos a la "The Antofagasta-Bolivian Railway", fue renovado legalmente.

Fernández abordó el tema en forma exclusiva con EL DIARIO y pudo advertirse que se había alistado para la eventualidad de hacerlo, puesto que papel en mano leyó un presunto documento original de concesión de las vertientes.

"Definitivamente es un problema de empresas y concesión de aguas-remarcó-. Le toca al Gobierno boliviano o al tribunal competente del lugar si está bien o no, la concesión de agua. No es un tema político".

En principio, descartó que se hubiera producido un desvío del cauce natural de los manantiales o se hubiera perpetrado un uso ilegal del agua.

"Hay una concesión del agua, conferida legalmente por el gobierno boliviano en su época, 1908, a la Bolivian Railway Company, que ha sido usado posteriormente por las empresas que han tomado el nombre anterior de la Bolivian Railway", señaló.

Fernández negó la posibilidad de que el permiso no fuera renovado, tras la desaparición de la primera empresa que logró el beneficio.

El Vicecanciller mostró un documento y leyó, a requerimiento de este diario algunos párrafos: "que la escritura de concesiones y consiguiente administración que fue en las vertientes del agua denominada Silala, existentes en la comprensión del cantón que tiene la provincia de Sud Lípez de este departamento, lo otorga el prefecto don René Calvo Arana en su carácter de superintendente de hacienda del departamento en favor de la Compañía Chilena Bolivian Company limitada".

Agregó que el mismo documennto fue suscrito en la ciudad de Potosí, el año de 1908.

"Se hizo la concesión de aguas, la compañía ferrocarilera todavía administra el agua, una parte del agua está destinada, según la misma concesión, al consumo humano", sostuvo.

HISTORIA DE SUCESIONES

Según Fernández, la concesión tuvo la virtud de tomar en utilizables las aguas que se perdían "sin beneficio para nadie".

"Yo no soy técnico en aguas ni es mi tema, pero sí le puedo decir lo siguiente, acá hay una cuestión entre una empresa, una concesión de agua de una empresa transferida legalmente a sucesivas empresas que han comprado los patrimonios de empresas anteriores, otorgadas legalmente por el gobierno boliviano y explotadas según los términos del convenio".

Más tajante aún, el Vicecanciller recalcó que el caso, para el gobierno de Chile, "no es un tema de discusión".

"Yo le estoy dando una explicación concedió al corresponsal de este matutino-, porque usted pregunta; pero este es un tema entre una empresa y el gobierno boliviano sobre una concesión de aguas".

"BOFEDALES"

Desde el punto de vista chileno, Fernández dio una descripción de la zona del río Silala y sus vertientes:

"Se trata de un cajón que caen (las aguas) y que no tienen otro uso si no se canalizan ...si no, se pierden en bofedales. No vive nadie, no lo utiliza nadie, está hecha la concesión...", dijo sin llegar a convencer sobre el justificativo.

Más adelante reiteró que el problema de una eventual compensación por el uso centenario de las aguas, estudiada aún por la Cancillería boliviana, se reduce a una negociación con la actual empresa que detenta el supuesto permiso.

"No hay más. La empresa hará uso del ejercicio legítimo de sus derechos donde corresponde al gobierno boliviano", advirtió.

Dijo que la sucesora de la antigua empresa ferroviaria se denomina "Ferrocarril de Antofagasta a La Paz, o algo así". Es una empresa privada, remarcó sin mencionar a la compañía Cruz Blanca, que fue la que dio los permisos para que sus trabajadores incursionaran en la frontera boliviana, en los alrededores del Silala, para limpiar los canales de desviación.

Respecto de las obras civiles construidas recientemente y que consolidan el ilegal dominio chileno de las aguas para abastecimiento de la población civil y no para las locomotoras, el diplomático sólo atinó a decir:

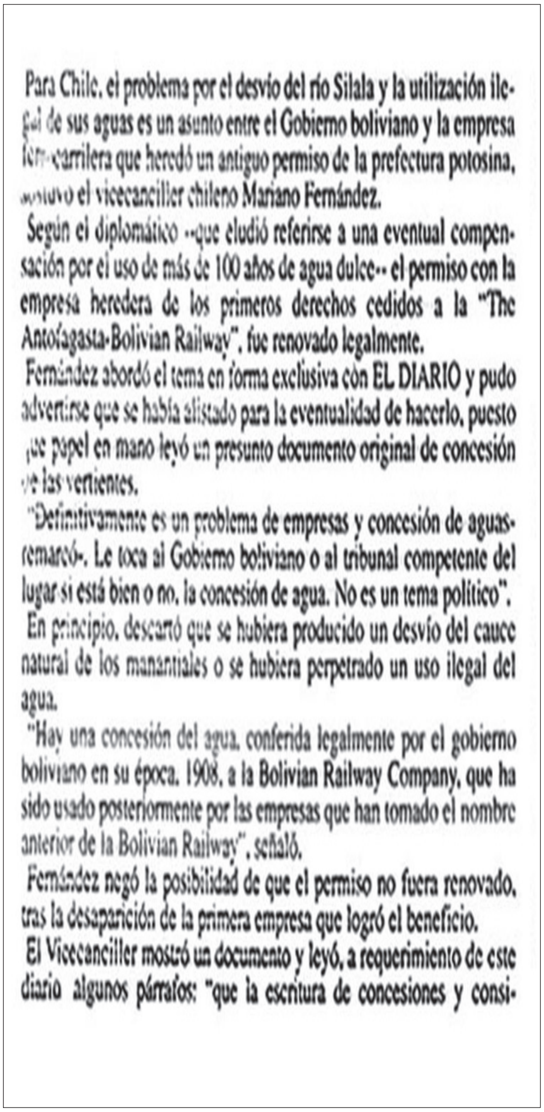
"Yo no tengo nada que ver con el tema, esta empresa, cuando tomó la concesión del agua, lo que hizo fue que en vez de perderse en bofedales se hicieron senderos de piedra para que el agua corriera de una manera más organizada. Datan de hace mucho tiempo".

Concesión fue renovada, según Vicecanciller chileno

El Silala "no es un tema de discusión" para Chile

The concession was renewed, according to the Chilean Vice-Chancellor

The Silala "is not a matter of discussion" for Chile



Para Chile, el problema por el desvío del río Silala y la utilización ilegal de sus aguas es un asunto entre el Gobierno boliviano y la empresa ferrocarrilera que heredó un antiguo permiso de la prefectura potosina, sostuvo el vicecanciller chileno Mariano Fernández.

Según el diplomático --que eludió referirse a una eventual compensación por el uso de más de 100 años de agua dulce-- el permiso con la empresa heredera de los primeros derechos cedidos a la "The Antofagasta-Bolivian Railway", fue renovado legalmente.

Fernández abordó el tema en forma exclusiva con EL DIARIO y pudo advertirse que se había alistado para la eventualidad de hacerlo, puesto que papel en mano leyó un presunto documento original de concesión de las vertientes.

"Definitivamente es un problema de empresas y concesión de aguas- remarcó-. Le toca al Gobierno boliviano o al tribunal competente del lugar si está bien o no, la concesión de agua. No es un tema político".

En principio, descartó que se hubiera producido un desvío del cauce natural de los manantiales o se hubiera perpetrado un uso ilegal del agua.

"Hay una concesión del agua, conferida legalmente por el gobierno boliviano en su época, 1908, a la Bolivian Railway Company, que ha sido usado posteriormente por las empresas que han tomado el nombre anterior de la Bolivian Railway", señaló.

Fernández negó la posibilidad de que el permiso no fuera renovado, tras la desaparición de la primera empresa que logró el beneficio.

El Vicecanciller mostró un documento y leyó, a requerimiento de este diario algunos párrafos: "que la escritura de concesiones y consi-

For Chile, the problem for the Silala River diversion and the illegal use of its waters is a matter between the Bolivian Government and the railroad company that inherited an old permit from the Potosi prefecture, argued the Chilean Vice-Chancellor Mariano Fernandez.

According to the diplomat, who avoided referring to an eventual compensation for the use of more than 100 years of fresh water, the permit with which the company inherited the first rights granted to "The Antofagasta–Bolivian Railway," was renewed legally.

Fernandez addressed the issue exclusively with EL DIARIO and it could be noticed that he had prepared himself for the eventuality of doing it, since paper in hand he read an alleged original document of concession of the springs.

"It is definitely a problem of companies and water concessions, he noted. It is up to the Bolivian Government or the competent court to determine if it is okay or not, the water concession. It is not a political issue." In principle, he ruled out that an illegal use of water had been perpetrated.

"There is a concession of water, legally conferred by the Bolivian Government in its time, 1908, to the Bolivian Railway Company, which has been subsequently used by companies that have taken the previous name of the Bolivian Railway ," he said.

Fernandez denied the possibility that the permit was not renewed, after the disappearance of the first company that achieved the benefit.

The Vice-Chancellor showed a document and read some paragraphs at the request of this newspaper: "that the writing of concessions and guiente administración que fue en las vertientes del agua denominada Silala, existentes en la comprensión del cantón que tiene la provincia de Sud Lípez de este departamento, lo otorga el prefecto don René Calvo Arana en su carácter de superintendente de hacienda del departamento en favor de la Compañía Chilena Bolivian Company limitada".

Agregó que el mismo documennto fue suscrito en la ciudad de Potosí, el año de 1908.

"Se hizo la concesión de aguas, la compañía ferrocarilera todavía administra el agua, una parte del agua está destinada, según la misma concesión, al consumo humano", sostuvo.

HISTORIA DE SUCESIONES

Según Fernández, la concesión tuvo la virtud de tomar en utilizables las aguas que se perdían "sin beneficio para nadie".

"Yo no soy técnico en aguas ni es mi tema, pero sí le puedo decir lo siguiente, acá hay una cuestión entre una empresa, una concesión de agua de una empresa transferida legalmente a sucesivas empresas que han comprado los patrimonios de empresas anteriores, otorgadas legalmente por el gobierno boliviano y explotadas según los términos del convenio".

Más tajante aún, el Vicecanciller recalcó que el caso, para el gobierno de Chile, "no es un tema de discusión".

"Yo le estoy dando una explicación concedió al corresponsal de este matutino-, porque usted pregunta; pero este es un tema entre una empresa y el gobierno boliviano sobre una concesión de aguas".

"BOFEDALES"

Desde el punto de vista chileno, Fernández dio una descripción de la

consequent administration that was on the water springs called Silala, existing in the understanding of the canton that has the province of South Lipez of this department, is granted by the Prefect Mr. Rene Calvo Arana in his capacity as Superintendent of Treasury of the department in favor of the Chilean company 'Bolivian Railway Company Limited.'"

He added that said document had been entered into in Potosi city, in 1908.

"The water concession was made, the railroad company still manages the water, part of the water is destined, according to the same concession, for human consumption," he said.

HISTORY OF SUCCESSIONS

According to Fernandez, the concession had the virtue of making use of the waters that were lost "without benefit for anyone."

"I am not a water technician nor is my subject, but I can tell you the following, here is a question between a company, a water concession of a company legally transferred to successive companies that have purchased the assets of previous companies, granted legally by the Bolivian Government and exploited according to the terms of the agreement."

Even more emphatic, the Vice-Chancellor stressed that the case, for the Government of Chile, "is not a matter of discussion."

"I am giving an explanation –granted to the correspondent of this newspaper– because you ask: but this is a topic between a company and the Bolivian Government about a water concession."

"BOFEDALS"

From the Chilean point of view, Fernandez gave a description of the zona del río Silala y sus vertientes:

"Se trata de un cajón que caen (las aguas) y que no tienen otro uso si no se canalizan ...si no, se pierden en bofedales. No vive nadie, no lo utiliza nadie, está hecha la concesión...", dijo sin llegar a convencer sobre el justificativo.

Más adelante reiteró que el problema de una eventual compensación por el uso centenario de las aguas, estudiada aún por la Cancillería boliviana, se reduce a una negociación con la actual empresa que detenta el supuesto permiso.

"No hay más. La empresa hará uso del ejercicio legítimo de sus derechos donde corresponde al gobierno boliviano", advirtió.

Dijo que la sucesora de la antigua empresa ferroviaria se denomina "Ferrocarril de Antofagasta a La Paz, o algo así". Es una empresa privada, remarcó sin mencionar a la compañía Cruz Blanca, que fue la que dio los permisos para que sus trabajadores incursionaran en la frontera boliviana, en los alrededores del Silala, para limpiar los canales de desviación.

Respecto de las obras civiles construidas recientemente y que consolidan el ilegal dominio chileno de las aguas para abastecimiento de la población civil y no para las locomotoras, el diplomático sólo atinó a decir:

"Yo no tengo nada que ver con el tema, esta empresa, cuando tomó la concesión del agua, lo que hizo fue que en vez de perderse en bofedales se hicieron senderos de piedra para que el agua corriera de una manera más organizada. Datan de hace mucho tiempo".

area of the Silala River and its springs:

"It is a ravine from which waters that would be useless if they were not canalized fall... and that have no other use if not canalized... if not, they are lost in bofedals. Nobody lives there, nobody uses it, the concession is made...", he said without convincing about the justification.

Later he reiterated that the issue of an eventual compensation for the centennial use of the waters –still studied by the Bolivian Foreign Ministry– is reduced to a negotiation with the current company that holds the alleged permit.

"There's no more. The company will make use of the legitimate exercise of its rights where it corresponds to the Bolivian Government," he warned.

He said that the successor of the old railway company is called "Railroad from Antofagasta to La Paz or something like that." It is a private company, he noted without mentioning the company Cruz Blanca, which was the one that gave the permits for its workers to venture into the Bolivian border, in the vicinity of Silala, in order to clean the diversion canals.

Regarding the civil works recently built and that consolidate the illegal Chilean dominion of the waters to supply the civil population and not for the locomotives, the diplomat only managed to say:

"I have nothing to do with the subject, this company, when it took the water concession, what was done is to prevent these waters from being lost into wetlands by building rock-canals for the water to run in a more organized fshion. These paths date back long ago."

Annex 15

El Mercurio, *"Clarification from the Chilean Chancellery: There is no conflict with Bolivia over the Silala River"*, Santiago, 17 May 1997

(Original in Spanish, English translation)

PRECISO CANCILLERIA CHILENA:

No Hay Conflicto con Bolivia por Río Silala

Mariano Fernández explicó que decisión boliviana de poner fin a una concesión de aguas de ese curso a una empresa chilena es un tema que corresponde resolver según las normas de los contratos internacionales.

El gobierno chileno precisó anoche que no existe ninguna controversia con el gobierno de Bolivia respecto del uso de las aguas del río Silala que abastecen a poblaciones del norte de nuestro país y precisó que el tema está sujeto a un contrato de derecho privado internacional, el que debe discutirse en esos términos.

Esta declaración surgió luego que la Prefectura Provincial de Potosí decidió poner término a la concesión de aguas que se entrega desde hace casi un siglo a la Compañía del Ferrocarril de Antofagasta.

Según precisó el Ministro subrogante de Relaciones Exteriores, Mariano Fernández, esto es un contrato de derecho privado internacional y por lo tanto sigue las reglas de todos los contratos.

En ese sentido, agregó corresponde a la Compañía del Ferrocarril Antofagasta-Bolivia entrar en contacto con quien otorgó la concesión para ver de qué manera se sigue adelante en este punto.

"Por ahora yo tengo que decir que no existe controversia entre el gobierno boliviano y el chileno en esta materia. El cónsul general de Chile en La Paz, embajador Oscar Fuentes, ha tenido contacto hoy (ayer) con el vicecanciller boliviano, Víctor Trigo, y estos contactos seguirán el lunes para precisar exactamente la situación que ha ocurrido en la zona".

Destacó que es importante en todo caso tener en cuenta que el río Silala es un curso internacional de agua que se rige por las leyes internacionales sobre esta materia, de tal manera que si no se alterara el discurrir natural de las aguas de un país a otro "esto no pasa a ser más que una discrepancia entre privados que tendrá que regularse de acuerdo a las leyes".

Según Fernández, si persistieran diferencias de opinión que pudieran en algún momento perturbar el flujo natural de agua, particularmente a los ríos San Pedro y Loa en Chile "me imagino que estimaremos necesario con el gobierno boliviano discutir algún tipo de régimen de agua más preciso con el objeto de evitar alteraciones de cualquier carácter".

Según una versión de la agencia Associated Press fechada en La Paz, las autoridades bolivianas anularon un contrato que permitía abastecer de agua de un sureño río de este país a varias poblaciones en Chile, se informó hoy.

La prefectura del departamento de Potosí anuló el contrato de concesión de las aguas del río Silala, que eran utilizadas para el abastecimiento de las poblaciones de Antofagasta, Calama y el desierto de Atacama en Chile, informaron las autoridades regionales.

El prefecto de Potosí, la principal autoridad política de esa región, Oscar Manzano, dijo que la resolución "debe ser refrendada por una comunicación oficial de la Cancillería de La Paz a la de Santiago a Chile a la (mayor) brevedad".

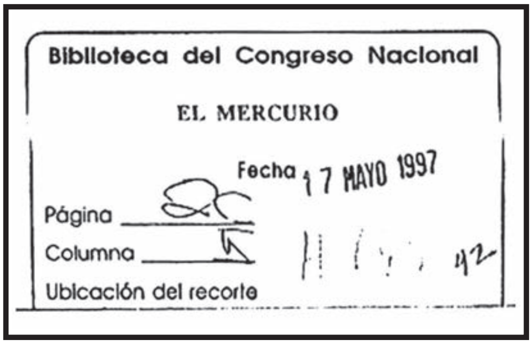
Manzano anotó que la decisión se debió a que no hay "motivaciones y razones para que se mantenga la mencionada concesión, otorgada hace 89 años a la empresa ferroviaria The Antofagasta and Bolivian Railway Company, que en la actualidad ya no existe".

Las aguas del Silala son recolectadas en un reservorio de sedimentación y pasan por tubería a otro ubicado en territorio chileno para ingresar a los sistemas de agua potable que abastecen a algunas poblaciones, de acuerdo a las autoridades bolivianas.

El río Siloli, conocido como Silala en nuestro país, penetra a Chile desde Bolivia a 4 kilómetros al sur del cerro Inacaliri —ubicado a unos 300 kilómetros al noreste de Antofagasta, sobre la frontera— y, posteriormente, corre unos 5 kilómetros hasta llegar como afluente del río Inacaliri, al cual surte con un caudal total de 250 litros por segundo.

Jaime Andrade, gerente de Asuntos Públicos de Codelco-Chuquicamata, reconoció que las aducciones de agua de la empresa consideran el caudal del Inacaliri, aunque estimó que los eventuales efectos serían mínimos, debido a que se consumen grandes cantidades de líquido, en un rango de una tonelada de mineral por una de agua.

En tanto, en la Empresa de Servicios Sanitarios de Antofagasta S.A. (Essan), desestimaron un efecto negativo sobre el suministro que entregan a la población de las cuatro principales ciudades de la II Región que son Antofagasta, Calama, Tocopilla y Mejillones, que suman más de 400 mil personas.



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Mariano Fernández explicó que decisión boliviana de poner fin a una concesión de aguas de ese curso a una empresa chilena es un tema que corresponde resolver según las normas de los contratos internacionales.

Clarification from the Chilean Chancellery:

There is no conflict with Bolivia over the Silala River

Mariano Fernandez explained that the Bolivian decision to end a water concession of that watercourse in favor of a Chilean company is a subject that must be resolved according to the rules of international contracts.

El gobierno chileno precisó anoche que no existe ninguna controversia con el gobierno de Bolivia respecto del uso de las aguas del río Silala que abastecen a poblaciones del norte de nuestro país y precisó que el tema está sujeto a un contrato de derecho privado internacional, el que debe discutirse en esos términos.

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The Chilean Government said last night that there is no controversy with the Government of Bolivia regarding the use of the Silala River waters that supply the northern populations of our country and said that the issue is subject to a contract of International Private Law, which should be discussed in those terms.

This declaration arose after the Provincial Prefecture of Potosi decided to put an end to the water concession that was granted almost a century ago to the Antofagasta Railway Company.

According to the acting Minister of Foreign Affairs, Mariano Fernandez, this is a contract of International Private Law and therefore follows the rules of all contracts.

In that sense –he added– it is up to the Antofagasta-Bolivia Railway Company to get in touch with the one who granted the concession to see how it is going to be from this point forward.

"For now I have to say that there is no controversy between the Bolivian Government and the Chilean Government in this matter. The Consul General of Chile in La Paz, Ambassador Oscar Fuentes, has had contact today (yesterday) with the Bolivian Vice-Chancellor Victor Trigo, and these contacts will continue on Monday to precisely specify the situation that has taken place in the area."

He stressed that it is important in any case to take into account that the Silala River is an international water course that is governed by international laws on this matter, in such a way that if the natural water flow from one country to another is not altered, "this will not be more than a discrepancy between private Parties that will have to be regulated according to law."

According to Fernandez, if differences of opinion persist that could at some point disturb the natural water flow, particularly to the San Pedro and Loa rivers in Chile "I imagine that we will consider it necessary with the Bolivian Government to discuss some type of more precise water regime in order to avoid alterations of any kind."

According to a version of the Associated Press dated in La Paz, it was reported today that Bolivian authorities annulled a contract that allowed to supply water from a southern river in this country to several towns in Chile.

Regional authorities informed that the Prefecture of the Department of Potosi annulled the concession contract for the waters of the Silala River, which were used to supply the populations of Antofagasta, Calama and the Atacama Desert in Chile.

El prefecto de Potosí, la principal autoridad política de esa región, Oscar Manzano, dijo que la resolución "debe ser refrendada por una comunicación oficial de la Cancillería de La Paz a la de Santiago a Chile a la (mayor) brevedad".

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The Prefect of Potosi, the main political authority of that region, Oscar Manzano, said that the resolution "should be endorsed by an official communication from the Foreign Ministry of La Paz to the Foreign Ministry of Santiago de Chile as soon as possible."

Manzano noted that the decision was made because there are no "motives and reasons why the aforementioned concession, granted 89 years ago to the Antofagasta and Bolivian Railway Company Limited, which currently no longer exists, should be maintained."

According to the Bolivian authorities, the Silala waters are abstracted in a sedimentation reservoir and pass through a pipeline to another reservoir located in Chilean territory to enter the drinking water systems that supply some populations.

The Siloli River, known as Silala in our country, enters Chile from Bolivia 4 kilometers south of the Inacaliri Hill –located about 300 kilometers northeast of Antofagasta, on the border– and then flows for about 5 kilometers until it reaches the Inacaliri River, which has a total flow of 250 liters per second.

Jaime Andrade, Public Affairs Manager of Codelco-Chuquicamata, acknowledged that the water conveyances of the company consider the flow of the Inacaliri [River], although he estimated that the possible effects would be minimal, because large amounts of liquid are consumed, in a range of one ton of mineral per one of water.

Meanwhile, in the Sanitary Services Company of Antofagasta S.A. (Essan), they dismissed a negative effect on the supply delivered to the population of the four main cities of the II Region that are Antofagasta, Calama, Tocopilla and Mejillones, which total more than 400 thousand people.

Annex 16

La Razón, "*Everything will be done after signing the initial agreement*", La Paz, 30 August 2009

(Original in Spanish, English translation)

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ENTREVISTA

DIPLOMACIA

El Ministro de Relaciones Exteriores ha adquirido experiencia en el mundo de la diplomacia. Este diálogo sobre el acuerdo del Silala muestra a una autoridad decidida a firmar el acuerdo, pero también discrepa al hablar de plazos para hacerlo.

"Todo se hará luego de la firma del acuerdo inicial"

DAVID CHOQUEHUANCA, el canciller de la República, defiende el avance de las negociaciones con Chile, cree que son la base para resolver el diferendo sobre el Silala.

¿Cuál es, desde el punto de vista de la Cancillería, el resultado de la consulta que hizo con sectores sociales de la región del Quetena sobre el preacuerdo del Silala?
Hay una reacción positiva y constructiva al proceso de socialización del acuerdo inicial. Una vez que lo conocen, nos dicen: "Métanle, estamos para defender el acuerdo". Nos dicen que se ha permitido que Chile se lleve el agua por más de 100 años sin pagar un solo centavo. He participado del Segundo Encuentro Nacional del Agua, en el que participan sectores de todos los departamentos, y allí pude explicar sobre el acuerdo inicial y se han manifestado para que se lleve adelante, también he estado con la COR de El Alto; todos, prácticamente todos, han respaldado el trabajo que el Gobierno ha hecho sobre el Silala. Después del 3 de agosto, cuando presentamos el documento, nos llega un voto resolutivo para que llevemos la firma de este acuerdo inicial. He estado en Ollagüe [illegible] y hay una respuesta positiva y algunos sorprendidos porque les explicamos el acuerdo inicial y, además, porque nunca antes el Canciller llegaba para explicarles. No hay letra chica, no hay cláusula secreta, yo les dije que si lo aprueban, vamos a firmar el mismo documento. [illegible] es importante. Esta mañana (la del miércoles 26) me preguntaban, qué va a pasar si el Senado no acepta el preacuerdo y yo les decía que no se trata de que el Senado no lo quiera, se trata de que el pueblo lo quiera.

¿Y cómo y cuándo llega a la conclusión?
Hay resoluciones que llegan a la Cancillería. La sociedad civil está organizada, los movimientos sociales, la COB, Conamaq, los fabriles, los mineros, los sectores que han hecho historia en este país, ellos son los que deciden qué rumbo va a tomar este país. Es importante recoger el aporte de los investigadores, porque este acuerdo inicial establece que en cuatro años, trabajaremos conjuntamente en un acuerdo de largo plazo, para que Chile pague el 100 por ciento de las aguas que pertenecen a Bolivia. En estos cuatro años, todos los bolivianos tendrán la oportunidad de construir el acuerdo de largo plazo.

> "Ahora, vamos a hacer este acuerdo y mañana vamos a tratar la deuda histórica y para esto igual necesitamos estudios"

¿Desde el punto de vista de la CPE y con criterio vinculante, la opinión de quién es valedera? ¿La opinión de los pueblos de Quetena o la del pueblo boliviano?
[illegible]

¿Cuál será el impacto inmediato y directo del acuerdo inicial sobre el Silala?
Ingresos frescos para Bolivia, que pueden permitir el desarrollo del sudeste potosino. Si uno va a al lugar, uno no entiende cómo es que los compañeros han podido sobrevivir. Estos ingresos podrían ayudar a que poco a poco trabajemos en programas para mejorar la condición de los pobladores. Además estaríamos sentando soberanía.

¿Cómo van a sentar soberanía en las Quetenas?
Haciendo que las aguas sean nuestras. Hoy, Chile no paga un solo centavo, al hacer que Chile respete nuestra soberanía. Si firmamos este convenio, vamos a llevar estudios de manera conjunta, que nos permitirán demostrar que tenemos manantiales.

¿Cuándo habla de sentar soberanía, está hablando de llevar desarrollo a las Quetenas?
Estoy hablando de establecer un marco jurídico para obligar a que Chile no haga uso arbitrario de las aguas, como decían los senadores durante el informe.

¿Cómo será administrado el dinero fresco que entre por la explotación del agua?
La Constitución dice que el Gobierno distribuirá equitativamente en las regiones con menos desarrollo, pero mi abuelo dice que lo primero que hay que hacer es que los chanchitos nazcan, luego los vendemos. Entonces, primero, resolvamos esto, luego se verá la distribución.

Entonces, vayamos a los chanchitos. El acuerdo inicial no establece con precisión que Chile debe pagar por el 50 por ciento de las aguas, ¿por qué el artículo 6 no establece con claridad que Chile debe pagar por ese 50 por ciento?
El artículo 6 dice que el 50 por ciento es de libre disponibilidad y el otro 50 por ciento está sujeto a estudios. Y dice también que ese porcentaje podrá ser incrementado en favor de Bolivia, una vez que terminen los estudios. Entonces, mientras se construye el acuerdo de largo plazo, vamos a trabajar en todas las precisiones con información fundada. Necesitamos información, no sabemos cuántos litros pasan a Chile por día. Este es el primer paso para que en cuatro años Chile pueda compensar.

Este acuerdo habla del 50 por ciento, pero no establece con claridad que va a pagar por ese 50 por ciento, ¿por qué?
Chile sí está dispuesto a hacerlo, una vez firmado el acuerdo, nosotros le damos 60 días de plazo. Ellos van a tener un plazo preferencial, los que hoy usan el agua sin pagar un solo centavo. El Ministerio del Agua hará que se regularicen o adecúen al acuerdo. Si no lo hacen, podemos disponer de ella, no olvides que el agua es el recurso natural más importante que los hidrocarburos.

Pero aclárame, ese acuerdo no dispone con precisión el pago.
Chile va a tener que compensar por las aguas y tienen 60 días para decidir, porque puede haber otras empresas que tengan interés en explotar las aguas.

¿Qué es lo que deben moni- [illegible]

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ENTREVISTA

¿[illegible] en estos 60 días?
[illegible] que están usando, es decir Codelco y Lakias. Ellos deben hacerlo y van a tener que pagar. Tienen ese plazo. El Ministerio del Agua va a establecer contratos, acuerdos, sobre cómo van a pagar. Vamos a tener que pedir boletas de garantías y cómo van a pagar. Habrá un proceso de acuerdo para pago de cada mes y normas sobre qué es lo que pasará si no cumplen.

En Chile, hay sectores que creen que el acuerdo inicial establece que cada país puede disponer libremente del 50 por ciento de las aguas. Es decir que Chile pagaría sólo por la parte adicional al 50 por ciento...
El acuerdo dice claro, que del 100 por ciento de las aguas, 50 por ciento es de libre disponibilidad de Bolivia y que en el otro 50 por ciento vamos a escuchar una investigación científica. Está dispuesto a compensar por el 50% de las aguas del Silala.

¿Cómo se llega a la cifra de 17 mil dólares?
No hay una cifra exacta. Cuando se estaba trabajando este acuerdo, el metro cúbico estaba en 0,65 dólares hoy está en 2,2 dólares en Chile. Entonces, el Ministerio del Agua va a tomar aquel precio como referencial. Mientras más tardemos en firmar este acuerdo, perdemos más.

En Chile, se esperaba que el acuerdo se firme el 10 de agosto.
Posiblemente, nosotros también. En este tema ha habido un proceso de participación, incluso podemos decir que pedimos autorización para el diálogo, hemos hablado con diferentes organizaciones sociales, la mayoría de ellas potosinas. Por eso, en Quetena, las organizaciones conocen el acuerdo inicial y nos han dicho, métanle, adelante.

En Quetena, les han pedido, no lo olvide Canciller, que se incluya la deuda histórica en este acuerdo.
Ellos también reflejan nuestra preocupación. No vamos a renunciar jamás a la deuda histórica, pero hemos separado, así como hemos establecido los 13 puntos en la agenda para tratar por separado la habilitación de los puertos, el tema comercial, el tema marítimo. Si vamos a tratar de abordar todos los temas, no vamos a llegar a un acuerdo, tendríamos que pasar muchos años, tal vez más de 100 años. Ahora, vamos a hacer este acuerdo y mañana vamos a tratar la deuda histórica y para esto igual necesitamos estudios.

¿En la negociación se ha hablado de la deuda histórica?
Se ha hablado, pero no está en el acuerdo y vamos trabajar sobre ello en estos cuatro años.

Canciller, no lo olvide el acuerdo inicial establece claramente que los cuatro años son para establecer la diferencia del 50 por ciento.
Nosotros queremos resolver en cuatro años el diferendo del Silala, tenemos que demostrar que son manantiales. No es sólo para que pague por el restante 50 por ciento.

Entonces, la deuda histórica será abordada en el futuro, no este acuerdo.
Si el pueblo boliviano está de acuerdo con este acuerdo, mañana mismo instalamos una comisión para la deuda histórica. Todo será después de la firma, la firma es para iniciar el proceso, firmamos y colocaremos los medidores de agua, para saber cuál exactamente es el aporte de las lluvias. Para la medición de la [illegible], vamos a constituir equipos de trabajo para saber de qué estamos hablando lo del manantial, y formaremos comisión para la deuda histórica.

Cómo va a resolver la cuestión interna, ahora. El MAS pide incluir el tema histórico en el actual acuerdo.
El tema de la deuda histórica tiene que estar resuelto en el acuerdo de largo plazo.

El 13 diciembre se realizarán las elecciones presidenciales también en Chile. Y por lo que se sabe es probable que el vencedor no sea un político afín al presidente Morales, como lo es ahora la presidenta Bachelet. ¿No es conveniente para el Gobierno firmar ahora el acuerdo? ¿No es oportuno ahora?
No vamos a politizar [illegible] el tema. Veremos cómo va madurando, cómo avanza el proceso de socialización. El acuerdo del Silala no está sujeto a la cuestión electoral, no hay desesperación.

En Chile se habló del 10 de agosto como plazo.
No hubo 10 de agosto, no tenemos plazo. Ahora, claro, yo mismo deseaba que este acuerdo debía ser firmado en agosto, mientras más demoremos, más le conviene a Chile. Los que no quieren que se firme el acuerdo, quieren que Chile siga beneficiándose. En el acuerdo dice que una vez terminados los estudios dice que se incrementará el porcentaje a favor de Bolivia y eso lo demostraremos.

¿Cuándo sabrá que tiene firmar el acuerdo?
Necesito la manifestación de los maestros rurales, de las amas de casa, de estudiantes, pero hasta ahora no he encontrado rechazo. Lo importante es que este tema es parte de la agenda nacional, hasta los niños hablan del tema, los profesores ordenan trabajos de investigación. Todo el mundo habla sobre el Silala, muchos de nosotros no sabíamos de este tema. Lo que no se ha logrado hacer, una política de Estado, ahora sí se está construyendo.

> "El acuerdo de largo plazo no será para 100 años ni para 40 años. Tenemos que tomar previsiones para construir un dique o para industrializar el agua. No nos vamos a amarrar"

¿Sobre la política de Estado, existe documentación para demostrar que el Silala es un manantial boliviano?
Hay varios estudios que nos permitieron negociar, pero los estudios científicos que haremos nos permitirán demostrar a la comunidad internacional que son aguas bolivianas. El estudio se hará en base al acuerdo.

Por la consulta que ha hecho, ¿ha encontrado alguna crítica que le lleve a modificar el acuerdo, antes de firmarlo?
Nos pidieron que paguen el 100% y que paguen con intereses. Han expresado sus preocupaciones, pero las vamos a tratar cuando vayamos al acuerdo de largo plazo. A los chilenos les hemos planteado el tema de la deuda histórica, pero nos han dicho que se necesitan estudios. Si reclamamos lo de la deuda histórica, vamos a demorarnos.

Qué asegura que este acuerdo será acatado por los chilenos.
Es que somos serios nosotros, antes ni siquiera se sentaron en la mesa de negociaciones. Porque los senadores de ahora dejaron pasar 100 años.

Usted sabe que si no se firma este acuerdo, no se avanza en la agenda 13.
No, no es cierto. Hay avances en cada punto, estamos trabajando, además no hay condicionamientos en ninguno de los 13 puntos. Cada uno tiene su propia dinámica.

¿Usted cree que este acuerdo debe ser firmado antes de diciembre?
Depende del pueblo. Incluso los senadores del MAS se han manifestado, han pedido referéndum. No nos oponemos. La CPE establece el mecanismo, en este momento no puedo decir, hay varias reacciones.

El acuerdo establece que las aguas podrán ser conducidas.
En la población de Quetena, un campesino decía que en cuatro años, los chilenos van a perforar pozos. Y el acuerdo dice que no se hacen perforaciones, por la sostenibilidad del Silala. No se toca nada. Si firma el acuerdo, Chile no toca nada, ni pozos ni nuevos canales, en estos cuatro años, pero también después.

El acuerdo establece que Bolivia puede disponer libremente del 50 por ciento de las aguas.
El acuerdo de largo plazo no será para 100 años ni para 40 años. En este momento, no estamos en condiciones para levantar un dique o para industrializar el agua, pero Bolivia ya da valor agregado a los recursos naturales, ya vamos a tener plata. Nuestras reservas internacionales subieron, ya tenemos platita, cuando estemos en condiciones vamos a tomar medidas. No nos vamos a amarrar en el acuerdo de largo plazo. Cuando tengamos [illegible], podemos determinar qué es lo que haremos con nuestras aguas. Tenemos que tomar previsiones, mientras no tengamos estas posibilidades para aprovechar nuestras aguas, Chile tiene que compensar.

ENTREVISTA

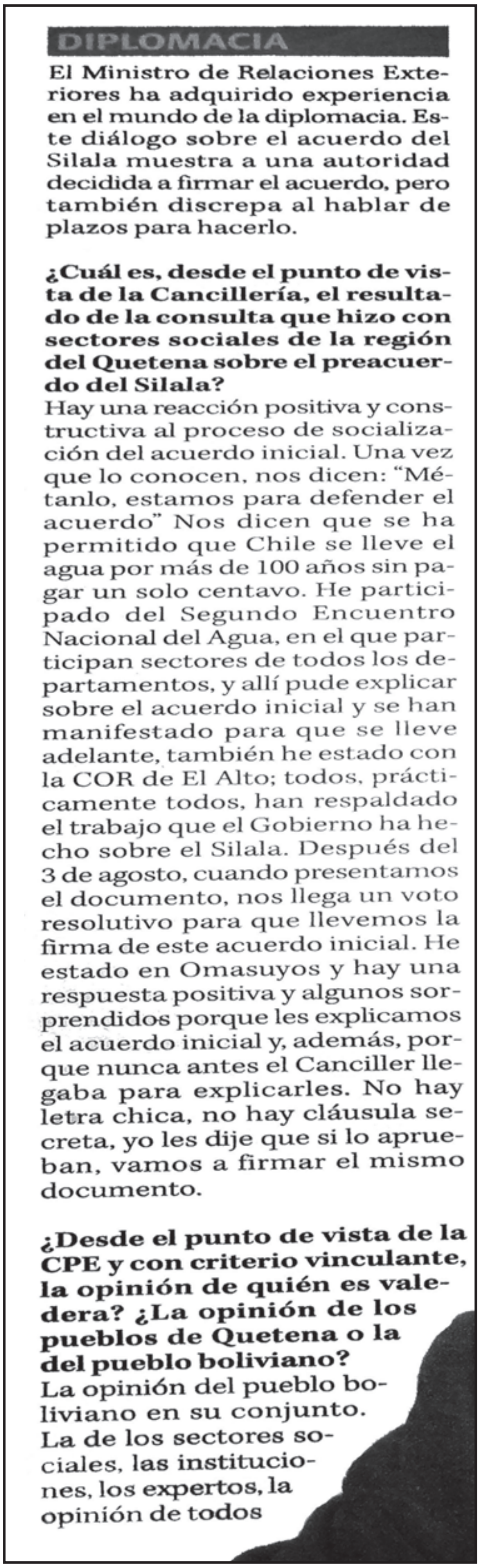
"Todo se hará luego de la firma del acuerdo inicial"

DAVID CHOQUEHUANCA, el canciller de la República, defiende el avance de las negociaciones con Chile, cree que son la base para resolver el diferendo sobre el Silala.

INTERVIEW

"Everything will be done after signing the initial agreement"

David Choquehuanca, the Foreign Minister of the Republic, defends the progress made in the negotiations with Chile. He believes these are the basis to solve the dispute over the Silala



DIPLOMACIA

El Ministro de Relaciones Exteriores ha adquirido experiencia en el mundo de la diplomacia. Este diálogo sobre el acuerdo del Silala muestra a una autoridad decidida a firmar el acuerdo, pero también discrepa al hablar de plazos para hacerlo.

¿Cuál es, desde el punto de vista de la Cancillería, el resultado de la consulta que hizo con sectores sociales de la región del Quetena sobre el preacuerdo del Silala?
Hay una reacción positiva y constructiva al proceso de socialización del acuerdo inicial. Una vez que lo conocen, nos dicen: "Méntanlo, estamos para defender el acuerdo" Nos dicen que se ha permitido que Chile se lleve el agua por más de 100 años sin pagar un solo centavo. He participado del Segundo Encuentro Nacional del Agua, en el que participan sectores de todos los departamentos, y allí pude explicar sobre el acuerdo inicial y se han manifestado para que se lleve adelante, también he estado con la COR de El Alto; todos, prácticamente todos, han respaldado el trabajo que el Gobierno ha hecho sobre el Silala. Después del 3 de agosto, cuando presentamos el documento, nos llega un voto resolutivo para que llevemos la firma de este acuerdo inicial. He estado en Omasuyos y hay una respuesta positiva y algunos sorprendidos porque les explicamos el acuerdo inicial y, además, porque nunca antes el Canciller llegaba para explicarles. No hay letra chica, no hay cláusula secreta, yo les dije que si lo aprueban, vamos a firmar el mismo documento.

¿Desde el punto de vista de la CPE y con criterio vinculante, la opinión de quién es valedera? ¿La opinión de los pueblos de Quetena o la del pueblo boliviano?
La opinión del pueblo boliviano en su conjunto. La de los sectores sociales, las instituciones, los expertos, la opinión de todos

DIPLOMACY

The Minister of Foreign Affairs has gained experience in the world of diplomacy. This dialogue regarding the Silala agreement shows an authority that is determined to sign the agreement, but also disagrees when talking about deadlines to do so.

What is the result of the consultation with social sectors of the Quetena region about the Silala pre-agreement from the Foreign Ministry's point of view?

There is a positive and constructive reaction to the process of socialization of the initial agreement. Once they know about it, they tell us: "Go ahead, we are here to defend the agreement." They tell us that Chile has been allowed to take the water for more than 100 years without paying a single cent. I have participated in the Second National Water Meeting, in which sectors from all departments participate, and there I was able to explain about the initial agreement and they have manifested to carry it forward, I have also been with the Regional Workers Central (COR for its acronym in Spanish) of El Alto; all, practically all, have supported the work that the Government has done regarding the Silala. After August 3rd, when we presented the document, we received a resolution vote so that we could sign this initial agreement. I have been to Omasuyos and there is a positive response and some were surprised because we explained the initial agreement and also because the Chancellor has never come to explain things to them. There is no small print, there is no secret clause, and I told them that if they approve it, we will sign the same document.

From the point of view of the State Political Constitution and with binding criteria, whose opinion is valid? Is the opinion of the people of Quetena or that of the Bolivian people valid?

The opinion of the Bolivian people as a whole. The opinions of social sectors, institutions, experts, the opinion of all

es importante. Esta mañana (la del miércoles 26) me preguntaban, qué va a pasar si el Senado no acepta el preacuerdo y yo les

> **Ahora, vamos a hacer este acuerdo y mañana vamos a tratar la deuda histórica y para esto igual necesitamos estudios**

decía que no se trata de que el Senado no lo quiera, se trata de que el pueblo lo quiera.

¿Y cómo y cuándo llega a la conclusión?
Hay resoluciones que llegan a la Cancillería. La sociedad civil está organizada, los movimientos sociales, la COB, Conamaq, los fabriles, los mineros, los sectores que han hecho historia en este país, ellos son los que deciden qué rumbo va a tomar este país. Es importante recoger el aporte de los investigadores, porque este acuerdo inicial establece que en cuatro años, trabajaremos conjuntamente en un acuerdo de largo plazo, para que Chile pague el 100 por ciento de las aguas que pertenecen a Bolivia. En estos cuatro años, todos los bolivianos tendrán la oportunidad de construir el acuerdo de largo plazo.

¿Cuál será el impacto inmediato y directo del acuerdo inicial sobre el Silala?
Ingresos frescos para Bolivia, que pueden permitir el desarrollo del sudeste potosino. Si uno va a al lugar, uno no entiende cómo es que los compañeros han podido sobrevivir. Estos ingresos podrán ayudar a que poco a poco trabajemos en programas para mejorar la condición de los pobladores. Además estaríamos sentando soberanía.

¿Cómo van a sentar soberanía en las Quetenas?
Haciendo que las aguas sean nuestras. Hoy, Chile no paga un solo centavo, al hacer que Chile respete nuestra soberanía. Si firmamos este convenio, vamos a llevar estudios de nanera conjunta, que nos permitirán demostrar que tenemos manantiales.

is important. This morning (on Wednesday 26th) I was asked, what will happen if the Senate does not accept the pre-agreement? And I

> **"Now, we are going to make this agreement and tomorrow we are going to deal with the historical debt and for this we need studies"**

told them it's not about the Senate not wanting it, it's about the people wanting it.

And how and when do we reach the conclusion?
There are resolutions that reach the Chancellery. The civil society is organized, the social movements, the Central Bolivian Workers (COB for its acronym in Spanish), the National Council of Ayllus and Markas of the Qollasuyo (CONAMAQ for its acronym in Spanish), the factory workers, the miners, the sectors that have made history in this country, they are the ones who decide what direction this country is going to take. It is important to gather the contribution of the researchers, because this initial agreement establishes that in four years, we will work together in a long-term agreement, so that Chile pays 100 percent of the waters that belong to Bolivia. In these four years, all Bolivians will have the opportunity to construct the long-term agreement.

What will be the immediate and direct impact of the initial agreement on Silala?

Fresh incomes for Bolivia, which may allow the development of south-eastern Potosi. If one goes to the place, one does not understand how the people have been able to survive. This income can help us to work little by little on programs in order to improve the condition of the inhabitants. In addition we would be establishing sovereignty.

How are they going to establish sovereignty in Quetena?

Making the waters ours. Today, Chile does not pay a single cent. By making Chile respect our sovereignty. If we sign this agreement, we will carry out joint studies, which will allow us to prove that we have springs.

¿Cuándo habla de sentar soberanía, está hablando de llevar desarrollo a las Quetenas?
Estoy hablando de establecer un marco jurídico para obligar a que Chile no haga uso arbitrario de las aguas, como decían los senadores durante el informe.

¿Cómo será administrado el dinero fresco que entre por la explotación del agua?
La Constitución dice que el Gobierno distribuirá equitativamente en las regiones con menos desarrollo, pero mi abuelo dice que lo primero que hay que hacer es que los chanchitos nazcan, luego los vendemos. Entonces, primero, resolvamos esto, luego se verá la distribución.

Entonces, vayamos a los chanchitos. El acuerdo inicial no establece con precisión que Chile debe pagar por el 50 por ciento de las aguas, ¿por qué el artículo 6 no establece con claridad que Chile debe pagar por ese 50 por ciento?
El artículo 6 dice que el 50 por ciento es de libre disponibilidad y el otro 50 por ciento está sujeto a estudios. Y dice también que ese porcentaje podrá ser incrementado en favor de Bolivia, una vez que terminen los estudios. Entonces, mientras se construye el acuerdo de largo plazo, vamos a trabajar en todas las precisiones con información fundada. Necesitamos información, no sabemos cuántos litros pasan a Chile por día. Este es el primer paso para que en cuatro años Chile pueda compensar.

Este acuerdo habla del 50 por ciento, pero no establece con claridad que va a pagar por ese 50 por ciento, ¿por qué?
Chile sí está dispuesto a hacerlo, una vez firmado el acuerdo, nosotros le damos 60 días de plazo. Ellos van a tener un plazo preferencial, los que hoy usan el agua sin pagar un solo centavo. El Ministerio del Agua hará que se regularicen o adecúen al acuerdo. Si no lo hacen, podemos disponer de ella, no olvides que el agua es el recurso natural más importante que los hidrocarburos.

Pero acláreme, ese acuerdo no dispone con precisión el pago.
Chile va a tener que compensar por las aguas y tienen 60 días para decidir, porque puede haber otras empresas que tengan interés en explotar las aguas.

¿Qué es lo que deben mani-

When you talk about establishing sovereignty, are you talking about bringing development to Quetena?

I am talking about establishing a legal framework to force Chile not to make arbitrary use of the waters, as the Senators said during the report.

How will the fresh money that comes in for the exploitation of water be administered?

The Constitution says that the Government will distribute [the resources] equitably in the regions with less development, but my grandfather says that the first thing that must be done is that the piglets are born, then we sell them. So, first, let's solve this, then we will discuss the distribution.

So, let's talk about piglets. The initial agreement does not establish with precision that Chile must pay for 50 percent of the waters, why does Article 6 not clearly state that Chile must pay for that 50 percent?

Article 6 says that 50 percent is freely available and the other 50 percent is subject to studies. And it also says that this percentage can be increased in favor of Bolivia, once the studies are finished. So, while the long-term agreement is being constructed, we will work on all the precisions with well-founded information. We need information, we do not know how many liters pass to Chile per day. This is the first step so that in four years Chile can compensate us.

This agreement speaks of 50 percent, but does not clearly state that it will pay for that 50 percent, why?

Chile is willing to do it, once the agreement is signed, we give it 60 days. They will have a preferential term, those who today use the water without paying a single cent. The Ministry of Water will make them regularize or adapt to the agreement. If they do not, we can dispose of the water. Don't forget that water is a more important natural resource than hydrocarbons.

Please clarify this, that agreement does not accurately establishes the payment.

Chile will have to compensate for the water and has 60 days to decide, because there may be other companies that have an interest in exploiting the waters.

Who are those who must

¿ festarse en estos 60 días?
Los que están usando, es decir Codelco o Luksic. Ellos deben hacerlo y van a tener que pagar. Tienen ese plazo. El Ministerio del Agua va a establecer contratos, acuerdos, sobre cómo van a pagar. Vamos a tener que pedir boletas de garantías y cómo van a pagar. Habrá un proceso de acuerdo para pago de cada mes y normas sobre qué es lo que pasará si no cumplen.

En Chile, hay sectores que creen que el acuerdo inicial establece que cada país puede disponer libremente del 50 por ciento de las aguas. Es decir que Chile pagaría sólo por la parte adicional al 50 por ciento...
El acuerdo dice clarito, que del 100 por ciento de las aguas, 50 por ciento es de libre disponibilidad de Bolivia y que en el otro 50 por ciento vamos a escuchar una investigación científica. Están dispuestos a compensar por el 50% de las aguas del Silala.

¿Cómo se llega a la cifra de 17 mil dólares?
No hay una cifra exacta. Cuando se estaba trabajando este acuerdo, el metro cúbico estaba en 0,65 dólares hoy está en 2,2 dólares en Chile. Entonces, el Ministerio del Agua va a tomar aquel precio como referencial. Mientras más tarde firmemos este acuerdo, perdemos más.

En Chile, se esperaba que el acuerdo se firme el 10 de agosto.
Posiblemente, nosotros también. En este tema ha habido un proceso de participación, incluso podemos decir que pedimos autorización para el diálogo, hemos hablado con diferentes organizaciones sociales, la mayoría de ellas potosinas. Por eso, en Quetena, las organizaciones conocían el acuerdo inicial y nos han dicho, métanle, adelante.

En Quetena, les han pedido, no lo olvide Canciller, que se incluya la deuda histórica en este acuerdo.
Ellos también reflejan nuestra preocupación. No vamos a renunciar, jamás, a la deuda histórica, pero hemos separado, así como hemos establecido los 13 puntos en la agenda para tratar por separado la habilitación de los puertos, el tema comercial, el tema marítimo. Si vamos a tratar de abordar todos los temas, no vamos a llegar a un acuerdo, tendrían que pasar muchos años, tal vez más de 100 años. Ahora, vamos a hacer este acuerdo y mañana vamos a tratar la deuda histórica y para esto igual necesitamos estudios.

manifest in these 60 days?

Those who are using [the water], i.e. Codelco or Luksic. They must do it and they will have to pay. They have that term. The Ministry of Water will establish contracts, agreements, on how they will pay. We are going to have to ask for guarantees and [establish] how they are going to pay. There will be a process of agreement for the payment of each month and rules on what will happen if they do not comply [with the payment].

In Chile, there are sectors that believe that the initial agreement establishes that each country can freely dispose of 50 percent of the waters. That is to say that Chile would pay only for the additional part besides that 50 percent....

The agreement clearly says that 100 percent of the waters, 50 percent is freely available in Bolivia and that in the other 50 percent we will listen to scientific research. They are willing to compensate for 50% of the Silala waters.

How do we get to the amount of 17 thousand dollars?

There is not an exact amount. When this agreement was being worked on, the cubic meter was at 0.65 dollars today, it is at 2.2 dollars in Chile. Then, the Ministry of Water will take that price as a reference. The longer we take to sign this agreement, the more we lose.

In Chile, the agreement was expected to be signed on August 10th.

Possibly, us too. In this issue there has been a process of participation, we can even say that we ask for authorization for dialogue, we have spoken with different social organizations, most of them from Potosi. That's why, in Quetena, the [social] organizations knew the initial agreement and they gave us the green light, they told us to go ahead.

In Quetena, they have asked –don't forget Chancellor– to include the historical debt in this agreement.

They also reflect our concern. We are not going to renounce the historical debt, ever, but we have separated it, just as we have established the 13 points on the agenda to deal separately with the enabling of ports, the commercial issue and the maritime issue. If we are going to try to address all the issues [at once], we will not reach an agreement, many years would have to pass by, maybe more than 100 years. Now, we are going to make this agreement and tomorrow we are going to deal with the historical debt and for this we need studies.

¿En la negociación se ha hablado de la deuda histórica?
Se ha hablado, pero no está en el acuerdo y vamos trabajar sobre ello en estos cuatro años.

Canciller, no lo olvide el acuerdo inicial establece claramente que los cuatro años son para establecer la diferencia del 50 por ciento.
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Entonces, la deuda histórica

será abordada en el futuro, no este acuerdo.
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Cómo va a resolver la cuestión interna, ahora. El MAS pide incluir el tema histórico en el actual acuerdo.
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¿Cuándo sabrá que tiene firmar el acuerdo?
Necesito la manifestación de los maestros rurales, de las amas de casa, de estudiantes, pero hasta ahora no he encontrado rechazo. Lo importante es que este tema es parte de la agenda nacional, hasta los niños hablan del tema, los profesores ordenan trabajos de investigación. Todo el mundo habla sobre el Silala, muchos de nosotros no sabíamos de este tema. Lo que no se ha logrado ha-

"El acuerdo de largo plazo no será para 100 años ni para 40 años. Tenemos que tomar previsiones para construir un dique o para industrializar el agua. No nos vamos a amarrar"

cer, una política de Estado, ahora sí se está construyendo.

¿Sobre la política de Estado, existe documentación para demostrar que el Silala es un manantial boliviano?
Hay varios estudios que nos permitieron negociar, pero los estudios científicos que haremos nos permitirán demostrar a la comunidad internacional que son aguas bolivianas. El estudio se hará en base al acuerdo.

Por la consulta que ha hecho, ¿ha encontrado alguna crítica

Has the historical debt been discussed in the negotiation?

It has been discussed, but it is not in the agreement and we are going to work on it in these four years.

Chancellor, do not forget that the initial agreement clearly states that the four years are to establish the difference of the 50 percent.

We want to resolve the Silala dispute in four years, we have to prove that they are springs. It's not just for [Chile] to pay for the remaining 50 percent.

Then, the historical debt will be addressed in the future, not in this agreement.

If the Bolivian people agree with this agreement, tomorrow we would constitute a commission [to address] the historical debt. Everything will be after the signature, the signature is to start the process, we will sign [the agreement] and we will include the water measurements, in order to know exactly what the contribution of the rains is. In order to measure the temperature, we will set up work teams in order to know if these are springs we are talking about, and then we will constitute a commission [to address] the historical debt.

Now, how will you solve the internal question? The MAS (Movement Towards Socialism – Governmental Party) asks to include the historical topic in the current agreement.

The issue of historical debt has to be resolved in the long-term agreement.

On December 13th the presidential elections will also take place in Chile. And as far as is known, it is likely that the winner is not a politician akin to President Morales, as President Bachelet is now. Is it not convenient for the Government to sign the agreement now? Is it not appropriate [to sign it] now?

We are not going to politicize or electoralize the issue. We will see how it progresses, how the process of socialization moves forward. The Silala agreement is not an electoral issue, there is no desperation.

"The long-term agreement will not be for 100 years or for 40 years. We have to take precautions to build a dam or to industrialize the water. We're not going to tie ourselves up"

In Chile, it was discussed that the deadline was August 10th.

There was no deadline of August 10th, we do not have a deadline. Now, of course, I myself wished that this agreement be signed in August; the longer we delay, the more it benefits Chile. Those who do not want the agreement to be signed, want Chile to continue benefiting. In the agreement it says that once the studies are finished, the percentage in favor of Bolivia will increase and we will demonstrate that.

When will you know you have to sign the agreement?

I need the manifestation of the rural teachers, of the housewives, of students, but until now I have not found rejection. The important thing is that this issue is part of the national agenda, even children talk about the subject, teachers order research [on this issue]. Everyone talks about the Silala, many of us did not know about this topic. What has not been achieved [in the past], a State policy, is now being built.

Regarding the State policy, is there documentation to prove that the Silala is a Bolivian spring?

There are several studies that allowed us to negotiate, but the scientific studies that we will carry out will allow us to prove to the international community that they are Bolivian waters. The study will be based on the agreement.

Regarding the consultation you have done, have you found any criticism

que le lleve a modificar el acuerdo, antes de firmarlo?
Nos pidieron que paguen el 80%, y que paguen con intereses. Han expresado sus preocupaciones, pero las vamos a tratar cuando vayamos al acuerdo de largo plazo. A los chilenos les hemos planteado el tema de la deuda histórica, pero nos han dicho que se necesitan estudios. Si incluimos lo de la deuda histórica, vamos a demorarnos.

Qué asegura que este acuerdo será acatado por los chilenos.
Es que somos serios nosotros, antes ni siquiera se sentaron en la mesa de negociaciones. Porque los senadores de ahora dejaron pasar 100 años.

Usted sabe que si no se firma este acuerdo, no se avanza en la agenda 13.
No, no es cierto. Hay avances en cada punto, estamos trabajando, además no hay condicionamientos en ninguno de los 13 puntos. Cada uno tiene su propia dinámica.

¿Usted cree que este acuerdo debe ser firmado antes de diciembre?
Depende del pueblo. Incluso los senadores del MAS se han manifestado, han pedido referéndum. No nos oponemos. La CPE establece el mecanismo, en este momento no puedo decir, hay varias reacciones.

El acuerdo establece que las aguas podrán ser conducidas.
En la población de Quetena, un campesino decía que en cuatro años, los chilenos van a perforar pozos. Y el acuerdo dice que no se hacen perforaciones, por la sostenibilidad del Silala. No se toca nada. Si firma el acuerdo, Chile no toca nada, ni pozos ni nuevos canales, en estos cuatro años, pero también después.

El acuerdo establece que Bolivia puede disponer libremente del 50 por ciento de las aguas.
El acuerdo de largo plazo no será para 100 años ni para 40 años. En este momento, no estamos en condiciones para levantar un dique o para industrializar el agua, pero Bolivia ya da valor agregado a los recursos naturales, ya vamos a tener plata. Nuestras reservas internacionales subieron, ya tenemos platita, cuando estemos en condiciones vamos a tomar medidas. No nos vamos a amarrar en el acuerdo de largo plazo. Cuando estemos en condiciones, podemos determinar qué es lo que hacemos con nuestras aguas. Tenemos que tomar previsiones, mientras no tengamos otras posibilidades para aprovechar nuestras aguas Chile tiene que compensar.

that leads you to modify the agreement, before signing it?

They asked us to make them pay 80%, and that they should pay with interests. They have expressed their concerns, but we will treat them when we address the long-term agreement. We have raised the issue of the historical debt to the Chileans, but they have told us that studies are needed. If we include the historical debt, we will cause a delay.

What ensures that this agreement will be honored by the Chileans?

It's just that we're serious, they did not even sit down at the negotiating table before. Because senators in the past let 100 years pass by.

You know that if this agreement is not signed, there is no progress in the Agenda of the 13 Points?

No, that is not true. There is progress at every point, we are working on this. In addition, there are no conditions in any of the 13 points. Each one has its own dynamics.

Do you believe that this agreement must be signed before December?

It depends on the people. Even the Senators representing the MAS [Governmental Political Party] have manifested on this issue, they have asked for a referendum. We do not oppose. The State Political Constitution the mechanism, at this moment I cannot say, there are several reactions.

The agreement states that the waters can be canalized?

In the town of Quetena, a farmer said that in four years, Chileans will drill wells. And the agreement says that drilling is not to be done, for the sustainability of Silala. Nothing is to be touched. If it signs the agreement, Chile does not touch anything, neither [drilling of] wells nor new canals, in the following four years, but also afterwards.

The agreement states that Bolivia can freely dispose of 50 percent of the waters?

The long-term agreement will not be for 100 years or for 40 years. At this moment, we are not in conditions to build a dam or to industrialize the water, but Bolivia already gives added value to natural resources, [soon] we are going to have money. Our international reserves went up, we already have money, when we are in conditions we will take measures. We're not going to tie ourselves up in the long-term agreement. When we are in conditions, we can determine what we will do with our waters. We have to take precautions, as long as we do not have other possibilities to exploit our waters, Chile has to compensate.

Technical Documents

(Annex 17)

Annex 17

Danish Hydraulic Institute (DHI), *Study of the Flows in the Silala Wetlands and Springs System*, 2018

(Original in English)

Contract CDP-I No 01/2018, Study of the Flows in the Silala Wetlands and Springs System

Product No. 2 – 2018

Final Report

Source: DIREMAR, 2017

Plurinational State of Bolivia, Ministry of Foreign Affairs, DIREMAR

July 16, 2018

This report has been prepared under the DHI Business Management System certified by Bureau Veritas to comply with ISO 9001 (Quality Management)

ISO 9001
Management System Certification
BUREAU VERITAS
Certification Denmark A/S

Approved by

X

Claus Skotner
Executive Director

Contract CDP-I No 01/2018, Study of the Flows in the Silala Wetlands and Springs System

Final Report

Prepared for	Plurinational State of Bolivia, Ministry of Foreign Affairs, DIREMAR

Source: DIREMAR, 2017

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Project number	11820137
Approval date	16 July 2018
Revision	3
Classification	Confidential

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Executive Summary

Background

DHI (the Consultant) has been contracted by the Government of the Pluri-national State of Bolivia (Directorate: DIREMAR) to execute the independent technical study: "Flow Analysis of the Silala Springs, Canal and Wetland System". The present report constitutes the final deliverable of the study.

The Silala springs and wetlands are located In the Bolivian Potosi Province 4-5 km from the border to Chile. The springs are fed by groundwater which in the natural state discharged into wetlands. In the early 20th century the Antofagasta-Bolivia Railway Company introduced a drainage network which today leads the water through manmade canals to a water intake on the Chilean side of the border. At present an ongoing dispute between Chile and Bolivia about the status and use of the Silala's waters has been brought for the International Court in The Hague.

Objective

The main objective of this technical study is to quantify the surface and subsurface flows of the Silala Wetland and Spring System, under current (modified) conditions as well as in their natural state, i.e. without the manmade canal and drainage network.

Approach

Surface flows can be measured directly while quantification of groundwater flows (often referred to as the hidden component of the water cycle) is more complex as it has to be derived from interpretation of geological (surface) maps and information on hydrogeological properties from boreholes and indicative geophysical methods.

To establish sufficient data for the flow quantification intensive data collection has been undertaken. The data collection included: surface flow monitoring, geological mapping; hydrogeological drilling and testing and analyses of top soils.

Although the groundwater discharge through the Silala Springs system originates from a larger upstream area, the quantification of the present flows as well as the impacts of the manmade canals can be confined to a much smaller area. This 'Near Field' area comprises only a few square kilometres in the Silala Valley from the international border to just upstream the Silala Northern and Southern Wetlands. The data collection as well as the technical analyses has therefore focused on this 'Near Field' area.

Historical information on flows and climate prior to the introduction of the canals is insufficient for proper quantification of the pre-canal flows. Therefore the approach adopted in this study has been:

- to perform a comprehensive analysis of the present (modified) flow system resulting in a trustworthy conceptual model of it including an understanding of its key hydrological and hydrogeological drivers and how these processes have been influenced by the canalization;
- to implement this conceptual system understanding in a mathematical model of the system and subsequently
- to use the measurements and the conceptual and mathematical models to quantify the present flows and finally
- Remove the canals in the mathematical model and apply it to quantify flows without the canals.

To supplement the analyses assessments of infiltration and recharge rates to the aquifers under the present climatic conditions have also been made.

Major Findings

The findings on the present surface flows in the system:

1. Despite independent continuous and simultaneous flow measurements on the Chilean and Bolivian side of the border, the actual canal flow at the border remains uncertain. Based on the records the cross-border surface flow is 160 -210 l/s.

2. The flow records both in Bolivia and in Chile have a large and constant base flow fraction indicating that the flow mainly originates from groundwater. The lack of clear seasonality in the records also confirms that surface runoff is not an important source.

3. Simultaneous propeller flow measurements carried out under this study have rather consistently recorded around 160 l/s at the border during May-Sept 2017. These measurements show that Northern and Southern wetlands contribute to around 40% and 60% of the confluence flow, respectively.

4. Inflows from identifiable springs in the Northern and Southern wetland have been found to account for roughly 60 % of the total canal flow at the confluence of the Northern and Southern canals, while diffuse groundwater inflows account for the remaining 40 %.

The findings on the present groundwater flows in the system:

5. The observed groundwater levels in the many boreholes established in the Silala "Near Field" and above show a clear flow direction of the groundwater from East to West. Together with the evidence from boreholes of a pervious and water holding aquifer this proves the presence of cross border groundwater flow into Chile.

6. While considerable uncertainty remains around the magnitude of the cross border groundwater flow the hydraulic gradients, ignimbrite aquifer thickness and hydraulic conductivity indicate that the flux is considerable, i.e. comparable to the present surface flow

7. The model results of the Near Field suggest the present cross border groundwater flows over a 450m wide section around the ravine to be in the order of 100 l/s.

8. Water sample analysis indicate a water age of up to 1,000 years and 11,000 years in the Northern and Southern wetlands, respectively, suggesting relatively long groundwater residence times in the aquifers and different recharge sources.

9. The model results confirm a coupled groundwater – surface water system within the Silala Near Field area extending across the border.

Our analyses show that in a situation without the manmade canals:

10. Without canals, both surface water and groundwater will cross the border. A reduction in surface flow of 30-40 % is estimated compared to current conditions. The estimate includes the effect in the Silala Near Field area hereunder the increased evapotranspiration and infiltration losses from the confluence to the border.

11. Without the canals, more water crosses the border as groundwater. The groundwater flow through a 450 m wide cross section at the border *increases* by 7-11 % from the present situation.

12. The evapotranspiration increases by 20-30 % by removing the canals and restoring wetlands. This, however, corresponds to a *reduction* of only 2-3 l/s in the combined cross border groundwater and surface water flow.

13. In a situation without the canals, it is *not possible* that all surface water discharged from the wetlands infiltrate from the confluence point to the border. The best estimate (based on detailed simulations) is that 8-12% of the flow may be lost to subsurface flow. At maximum 25 % may be lost.

14. The canals have changed the *amount* of discharge from the Silala springs but *not the direction* of natural outflow from the Silala wetlands. Also, in a situation without the canals, the discharge direction is towards Chile.

Other Contributions

DHIs approach has been guided by meeting the project objectives and assessing the effects of removing the canal and drainage network.

In the process a number of separate, yet substantial, analysis have been carried out and documented in the Final Report annexes. Apart from supporting the project conclusions, each annex represent a deliverable contributing to the description and an updated understanding of the climate and hydrological and hydrogeological characterization of the Silala wetlands.

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1 Introduction

1.1 The project

Through contract no. CDP-I Nº 001/2017 of 7 February 2017, the Office for the Protection of Silala Springs, Diresilala, contracted DHI for the realisation of the first part of this technical study of the flows of the Silala Wetland and Springs System.

Diresilala was subsequently integrated into DIREMAR, the Strategic Office for the Maritime Vindication, Silala and International Water Resources. DIREMAR signed new contracts with DHI (Contract Nos. CDP-I 15/2017and CDP-I 01/2018) for the execution of the remaining part of the study. The present report constitutes the final deliverable of the technical study of the flows of the Silala Wetland and Springs System.

The Silala Springs are located at altitudes from 4300 to 4400 m above sea level in the arid western part of the Potosi Department of Bolivia, a few kilometres from the border with Chile (see Figure 1). The Silala Springs System is fed by groundwater from sources further inside Bolivia and constitutes the only flowing surface water resource on the Bolivian side of the border within a distance of 20 kilometres.

The Silala Springs System in Bolivia is today a modified flow system in which a fine network of pipes and stone lined canals drains the Silala wetlands and conveys the water efficiently from the large number of individual springs in the Northern and Southern wetlands in Bolivia to a water intake on the Chilean side of the international border around 4 km downstream (see Figure 2).

Figure 1 Location of the Silala Springs System

1.1.1 Objectives

The project objective is to carry out a technical study of the flows of the Silala Wetland and Spring System, quantifying the surface and subsurface flows, both in their current condition and in their natural state, i.e. flows without the manmade canal and drainage network. The canalization was introduced by the Antofagasta Railway Company in the early 20th century to control the flow from the Silala Springs and use it to supply the steam locomotives on the Antofagasta-Bolivia Railway. The objective concerns and can be confined to a 'near field' area in the Silala Valley from the Bolivian-Chilean border to just upstream the Silala Northern and Southern wetlands located in Bolivia, approximately 3.5 km upstream of the border.

1.2 About this report

This report documents and concludes the study. This main part of the report summarizes the technical analyses and conclusions which are described in more details in the annexes A-G, each referring to one of the technical sections of the main report.

The report is structured as follows:

Section 1:	(this section): Provides an introduction and context to the overall study.
Section 2:	Describes the Silala Springs System, the hydrological area in which it is located. It also includes a summary of previous work relevant to understanding the hydrology and hydrogeology of the Silala area.
Section 3:	Contains our analyses of the most relevant climate components namely the precipitation, temperature and potential evaporation of the Silala area.
Section 4:	Presents the available information and our analyses of the present surface water flows of the Silala Springs and wetlands.
Section 5:	Includes the analyses and hydraulic characteristics of the wetlands and the top soils of the upstream area.
Section 6:	Contains our estimates of aquifer recharge and upland water balance under the present climate conditions and accounting for the soil types of the area.
Section 7:	Gives our conceptual hydrogeological understanding of the Silala Area as built from earlier studies and from the extensive hydrogeological field data collection program.
Section 8:	Describes the establishment and calibration of the integrated numerical surface water - groundwater model established in accordance with the conceptual understanding of the system (Section 4 and 7).
Section 9:	Presents the results of the modelled scenarios of the flow conditions of the Silala Springs System in natural conditions under the present climate but without the canalization.
Section 10:	Summarizes the conclusions and recommendations of the study.
Section 11:	Is the list of references.

1.3 Study approach and methodology

The canal system was established in the early 20th century by the Antofagasta-Bolivia Railway Company (FCAB) to provide water for the steam locomotives and has until recently been maintained by the company to keep it free of weeds and siltation.

In its current state, the main canal of the modified system carries a flow at the border of 160-210 l/s. It is the objective of this study to establish the rate of cross-border flow (if any) in a natural Silala system without the canals.

Very little information is available on the local climate and hydrology prior to the introduction of these canals and since climate can vary over time scales of decades, it is not possible to recreate exactly the original hydrological conditions before the canalization. Hence, the approach taken in this study is to analyse the present modified system in detail, establish a model capable of reflecting the factors through which the canalization has impacted the natural system and simulate the system under the present climate conditions but in its natural state without the canals.

Although the groundwater discharge through the Silala Springs originates from a larger upstream catchment, the relevant impacts of the introduced modifications are confined to and described through processes inside a 'Near Field' area in the Silala Valley from the international border to just upstream the Silala Northern and Southern wetlands (see Figure 2).

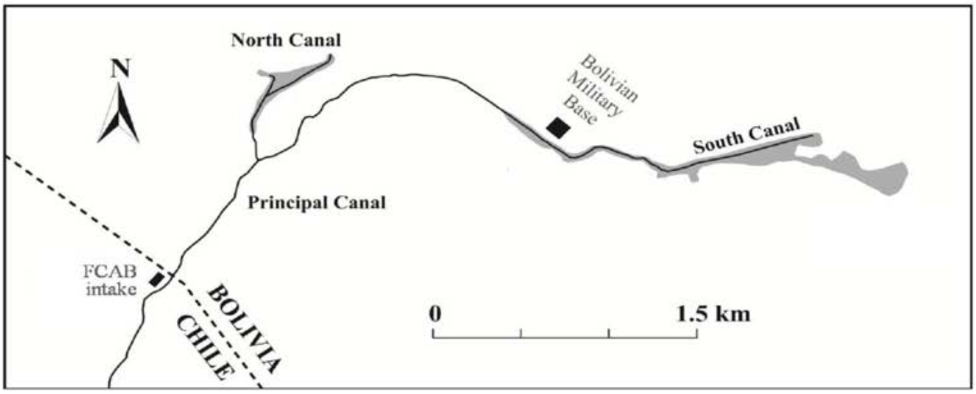

Figure 2 Approximate extent of the Silala Near Field. (Mulligan & Eckstein, 2011).

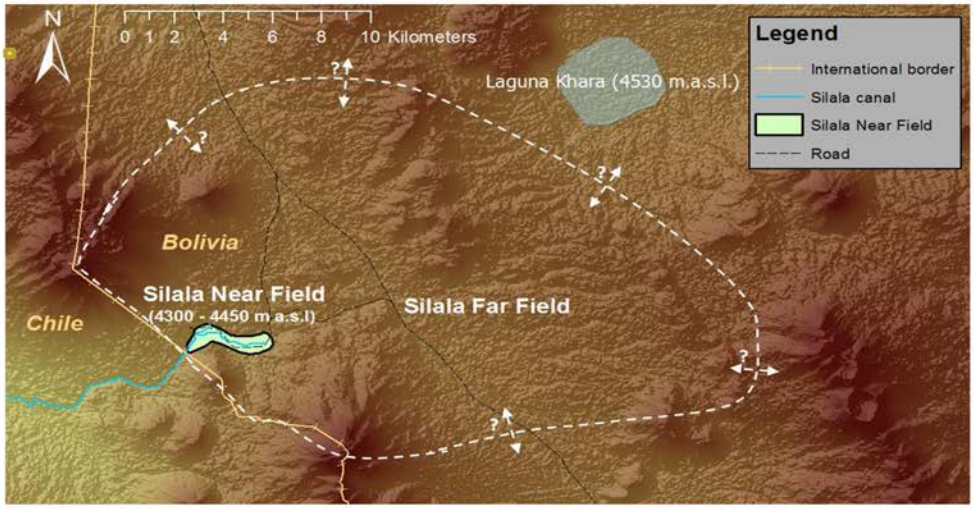

Figure 3 Approximate extents of the Silala Far Field.

Furthermore, it was not possible within the scope and time of this project to collect and process sufficient hydrogeological information to conduct a comprehensive analysis and determine the exact extent and flow conditions in the full upstream catchment supplying groundwater to the Spring. This larger catchment is referred to here as the Far Field, Figure 3. The approach adopted for this study has therefore been to concentrate the data collection program as well as the technical analyses on the Silala Near Field.

To improve the basis for the technical analyses, an intensive data collection program in the Silala Near Field was executed in parallel with the technical analyses. This data collection program included: surface geological mapping; surface flow monitoring, hydrogeological drilling and testing, soil sampling in the wetlands and geophysical transect monitoring. Its output data forms, together with previously collected information, the basis for the technical analyses of this study.

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2 The system and the area

Silala belongs to the high altitude Altiplano, a dry puna mountain zone in the transition to arid Atacama Desert climate. The topography and geology of the Altiplano are dominated by volcanoes and thick deposits of a pyroclastic density currents (Ignimbrites) (SERGEOMIN, 2003). Due to both climate and altitude, the vegetation is characterised by sparse and scattered grasses on the plains and volcano slopes. In valleys or low-lying depression areas, wetlands fed by mainly groundwater are found (Figure 4).

2.1 The wetlands

The Silala Springs System is an example of a type of high Andean wetlands described as cushion bogs (bofedales) with peat layers formed by Distichia cushions growing within 1-5 cm of the ground surface.

The wetlands are vulnerable and rely on a long-term steady and reliable water supply to maintain suitable hydrological conditions and with time build peat layers of organic deposits. In Silala, the extent of both the Northern and Southern Wetlands is controlled by the topography and groundwater discharges through springs.

Figure 4 Vegetation in and above the southern Silala wetland. *Source: DHI Field visit Feb. 2018*

The Silala Springs have been declared an area to be protected through the RAMSAR convention. The Convention's mission is the "conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". In line with the Convention, the Bolivian Government wants to restore the Silala Springs and Wetlands to its natural state. In addition, Silala is part of the Eduardo Abaroa Andean Fauna National Reserve.

2.2 The Silala Area

Silala has a desert climate with low precipitation, low temperatures but high potential evaporation. Outside the wetlands the vegetation is very sparse and top soils are coarse and sandy (Figure 4), originating from weathered or glacier eroded lava and ignimbrite formations.

The base rock formation consists of ignimbrite layers with a general inclination towards West and the valley in which the Silala springs, wetlands and canals are located has been identified as major faults in the Ignimbrites (SERGEOMIN, 2001).

As further described in Annex F on hydrogeology, the Ignimbrites are porous and fractured and have been found to have significant hydraulic conductivities. In some areas, the ignimbrites are found directly under the top soils, while in other parts of the area, they are superimposed by layers of lavas which have been deposited during later eruptions.

The potential groundwater heads, as found in the piezometer wells established by DIREMAR as part of this study, indicate a groundwater flow from higher eastern grounds towards the Silala Springs and further on towards the international border (Annex F).

2.2.1 The Silala catchment

Silala is a groundwater fed system where contributions from superficial catchment runoff are small in comparison to the stationary or slowly varying groundwater flow contribution (see Section 4).

The Chilean memorial (Alcayaga, 2017) has delineated a strictly topographical catchment for Silala upstream of the Inacaliri Police Station. Of this catchment, 59.1 km^2 contribute to the discharge at the international border. The recharge from rainfall over this (59.1 km^2) topographical catchment cannot, in itself, explain the observed cross-border flows (see Section 6). The hydrological catchment supplying groundwater to the Silala springs is therefore much larger.

This study has identified the likely hydrological catchment of 234.2 km^2 draining to the Silala springs through known groundwater faults and aquifers. This hydrological catchment has been used for the recharge and water balance assessments presented in this report. It was found that the recharge to the aquifers in this catchment can sustain a discharge in the same order of magnitude as the estimated cross border surface water and groundwater flows.

However, the estimates both of the transborder groundwater flows and of the catchment climate are uncertain and the exact extension of the real hydrological catchment (the Far Field) remains unknown, but the identified 234.2 km^2 catchment (shown in Figure 5) provides sufficient recharge to explain a substantial part of the cross-border flow.

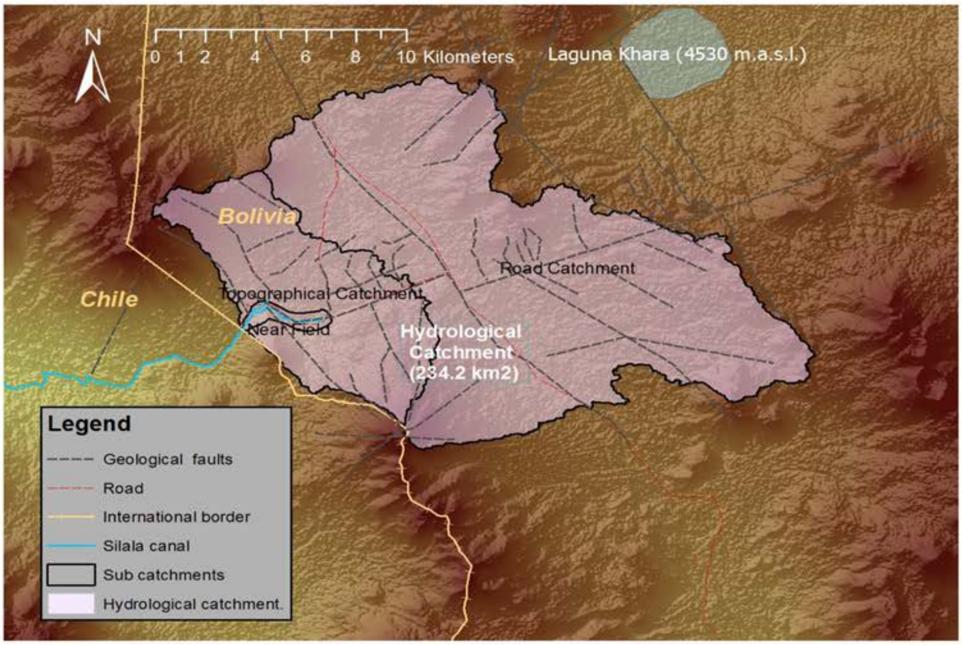

Figure 5 The hydrological catchment used as a basis for the recharge assessments and water balances of this study.

2.3 Historical descriptions of the Silala Spring System

During the construction of the railway line to Bolivia in 1909-1910, the Antofagasta and Bolivia Railway Company built a water pipeline from Silala to San Pedro in Chile to supply the steam locomotives.

In 1922, R. H. Fox, chief engineer for water works at the Antofagasta Bolivia Railway company, published an article on the water supply to the railway line (Fox, 1922) and described the water intake at Silala as "a small dam across the stream which has a daily flow (with very slight variation) of 11,300 m^3/day" (corresponding to 131 l/s). This is somewhat less than the current flow range of 160-210 l/s (see Section 4).

In 1928, the present detailed canalization was introduced. This fine masked network of pipes and rock lined canals was designed to drain the wetlands and convey the flows efficiently from the many identified springs at the banks or inside the wetlands to the pipeline intake close to the international Bolivian-Chilean border.

2.4 Processes through which the canalization may have affected the cross-border flows

The impacts of manmade interventions on the wetlands are clearly visible in the field and on aerial photos and satellite images provided by DIREMAR. The drainage and canalization work and more recent local decommissioning or modifications of some sections of the canals are all visible (Annex C).

The processes through which the canalization has affected the flow are:

- ***Increase of discharge emerging from springs and diffuse sources due to lowering of the hydraulic head loss by removal of peat or constraining rock cover.***

  Most of the upstream ends of the drainage network constructed within both the Northern and Southern wetlands, originate in an identifiable spring. At these spring discharge points, the soil and any underlying layers of coarser material or rocks have been completely removed. This enhances the spring flow rates by reducing the resistance to the emerging groundwater. Under natural conditions, less water would emerge on the surface while more would be retained underground. The direct connection from the spring to the drainage canal system conveys water more effectively out of the wetland system, reducing the amount of water retained in the wetland further compared to the natural situation.

- ***Decrease in actual evapotranspiration due to drainage and drying of wetlands.***

  Both the retention of water and the evapotranspiration processes within the wetland soils have been short circuited. The drainage canals cut through most of the wetlands not only efficiently conveying water from the springs but also lowering water levels along these canals. The effect of lowering water tables and soil water contents along canals is that the availability of water for the wetland vegetation is further reduced and evapotranspiration within the wetland decreased. The lower water levels will also reduce the overall area of the wetland retaining water, which will increase the downstream flow rates. Under natural conditions, the water would be travelling more slowly through the wetlands both above and below ground.

- ***Infiltration of surface water reduced in reaches with groundwater tables lower than the terrain level.***

  Although the canal lining is pervious, it may still reduce the water's contact to the surrounding soils, as compared to a free flowing natural channel, and reduce the seepage out of the canal. However, an even larger effect comes from the concentration of flow in a narrow canal cross section as compared to a natural situation with a broader flow area with higher infiltration to the underlying aquifers.

3 Climate

This section summarizes our best estimates of relevant climate parameters used in the catchment water balance studies described in Section 6 and in the detailed integrated groundwater / surface water studies of the Silala Nearfield (Section 8). Technical details on our climate analyses methodology and results are given in Annex B to this report.

3.1 Approach to the climate analyses.

Silala has a desert climate with highly variable precipitation from year to year. This means that the recharge to the aquifers may be dominated by the precipitation in a few rare wet years. Both an assessment of the average recharge and detailed flow analyses of the Silala Springs system therefore require consistent and reliable data, over many years, for local precipitation, potential evaporation and temperature.

The density of climate stations in the area is low and the harsh climate conditions in combination with the remote location of Silala reduce the accuracy of some records. Since the most relevant climate parameters (precipitation, potential evaporation and temperature) all vary significantly with location in mountainous areas, it is nevertheless important to make use of measured data within the area of interest.

Climate time series have been compiled for the hydrological catchment (Figure 5) by combining local ground based observations with the terrain information of the catchment. Where local ground observations have been found insufficient to represent the catchment area as a whole, satellite observations of the area have been used to supplement the ground data. This combination of ground based and remote sensing observations of the local area is considered the most reliable estimate for the Silala catchment compared to correlating with observations over long distances or importing data from other areas with different characteristics.

3.2 Precipitation

Precipitation is the single most important parameter in hydrological analyses and particularly in mountainous areas such as the Silala area, it varies significantly within short distances. Furthermore, the density of observation stations is often low in such remote areas, which further challenges the precipitation assessments.

The precipitation in the Silala catchment is mainly caused by convective activity in a north-east south-westerly direction with most of the precipitation occurring during the austral summer months, between December and March, and little precipitation during the winter months, from April until September.

In Silala, the two local stations are located at the military camp in the Southern Wetland and at the water intake on the Chilean side of the border, respectively. Unfortunately, both stations have record lengths that are too short to describe the interannual climate variation in the area.

A combination of ground station data from Inacaliri (5 km downstream of the border) and satellite based remote sensing data (CHIRPS) is considered the best estimate of long-term catchment rainfall and has been used in these analyses. The derived average catchment rainfall using this approach is 125 mm/year for 1969-2017. The inter-annual variation in precipitation is very high, ranging from close to 0 mm/year rainfall in 2009/2010 to over 300 mm/year in 1997 and 1999.

Snow has been recorded and observed in the Silala catchment during the austral winter months but is not captured in the weather station data or in the precipitation satellite data. Precipitation based on station data, such as the ones used by this study, is therefore likely to underestimate the actual precipitation, although it has not been possible to quantify the bias.

3.3 Temperature

Precipitation recorded as rain at stations at lower elevations fall as snow at higher elevations.Temperature records are used to calculate the formation and melting of snow in the catchment, at higher altitudes.

Temperature records for Silala for 1969-2010 have been constructed by repeating station data from Laguna Colorada and Silala. The annual average temperature for Silala is 2.2 °C with maximum and minimum daily temperatures between +19.6 °C and -19.6 °C.

3.4 Potential Evaporation

Strong winds and high radiation from the atmosphere result in a high potential for evaporation in the Silala catchment. The potential evapotranspiration (Et_0) is representative of the evaporating power of the atmosphere at a specific location and time and only depends on local climatic variables. It is important for the analyses of the recharge rates to aquifers and for the calculation of the wetland water losses through evapotranspiration, both in their present and in their natural state.

Actual evapotranspiration, on the other hand, is the amount of water that is actually evaporated from the soil and transpired by the plants. It is controlled by water availability and is therefore usually smaller than the potential evapotranspiration.

As precipitation events in the Silala basin are intermittent, actual evapotranspiration from most of the basin is only close to the potential rate for short periods of time just after rainfall. However, in the healthy parts of the wetlands, where water is readily available most of the year, actual evapotranspiration will be close to Et_0.

Potential evapotranspiration records (Et0) have been calculated using weather station data for three weather stations: Silala, Laguna Colorada and Sol de Manana. The resulting series has an annual potential evapotranspiration rate of 1472 mm/year ranging from around 2-2.5 mm/day in the austral winter months to 5-5.5 mm/day in the summer.

The compiled potential evapotranspiration series for Silala has been compared with daily records from the seven closest stations in Chile and found to be within the range given by these stations.

4 Surface waters

The surface water flows in the present system is described in this section. The spatial and temporal flow variation is analysed and a conceptual understanding of the system established and described. This understanding describes the processes affecting the surface flows at the border under current conditions. It also describes how the canalization has changed the hydrological/hydrogeological system and thus the impact on natural flows. This is essential to the development of a numerical model (which is described in Section 8 and 9).

The section also presents the outcome of analyses of the historical and recently surveyed flow data. The present flows at the border as well as the inflows and possible flow losses to and from the various sub parts of the system are quantified.

The actual detailed analyses of the present surface flows in the system is included in Annex C.

4.1 The canal system

Dense manmade drainage networks are in function in both the Southern and Northern wetlands. The drainage canals have been dug as 2nd order and 3rd order branches that collect water directly from the individual springs and drain these efficiently into the main canals which convey water to the border (Figure 6). The soil cover, typically in the depth range of 0.2 – 1.0 m, has been removed along the drainage canals down to the underlying bedrock and drainage canals depths vary significantly across the wetland areas. The drainage canals cut through most of the wetlands and apart from collecting spring water, they act as drains for water from within the wetland soils, which lowers the water table in the peat soils. Evidence of this is seen in the subsidence of the peat.

Without these canals more water would be retained over a longer period, both above and below the surface in a natural wetland system. The effect of lowering water tables and soil water contents along canals imply reduced availability of water for the wetland vegetation, creating corridors for invasive dryland grasses (Figure 7).

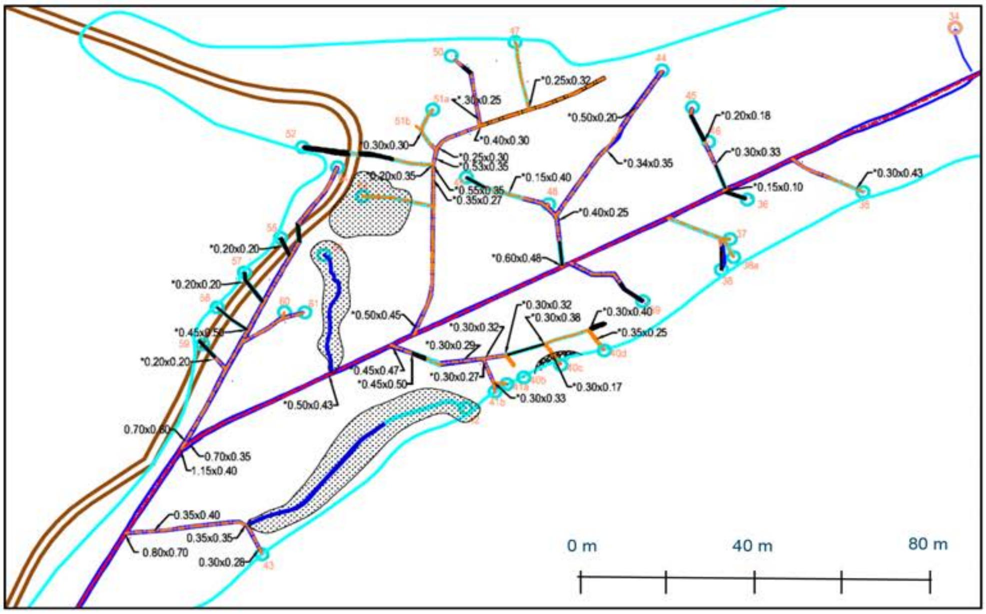

Figure 6 Map showing the details of parts of the manmade drainage network in the Northern wetland.

Figure 7 Main drain canal, Northern wetland. *Source: DIREMAR 2017.*

4.1.1 Excavations

Excavations are clearly visible not only at the springs and along drainage and main canals but also across large parts of the wetland areas. In the Northern wetland, drainage pipes linking up with the open canal drainage network are found. They have been installed by first excavating trenches. After laying down the pipes, they have been covered by soil leaving large parts of the wetland disturbed and dug through (Figure 8). Only smaller coherent patches of undisturbed soils and wetland vegetation are found in both wetlands. Especially in the Northern wetland, peat soils have been turned and peat in varying stages of decomposition is visible.

As a result of lowering the water table (because the spring water has now been diverted from the wetland through these pipes and these excavations), peat layers are exposed to aerobic conditions. This leads to a gradual degradation of the organic material. Subsidence can be observed as an impact of this drainage and peat degradation.

In contrast to these excavated areas, undisturbed wetlands develop an undulating surface with a continuous vegetation cover and open water visible at the surface.

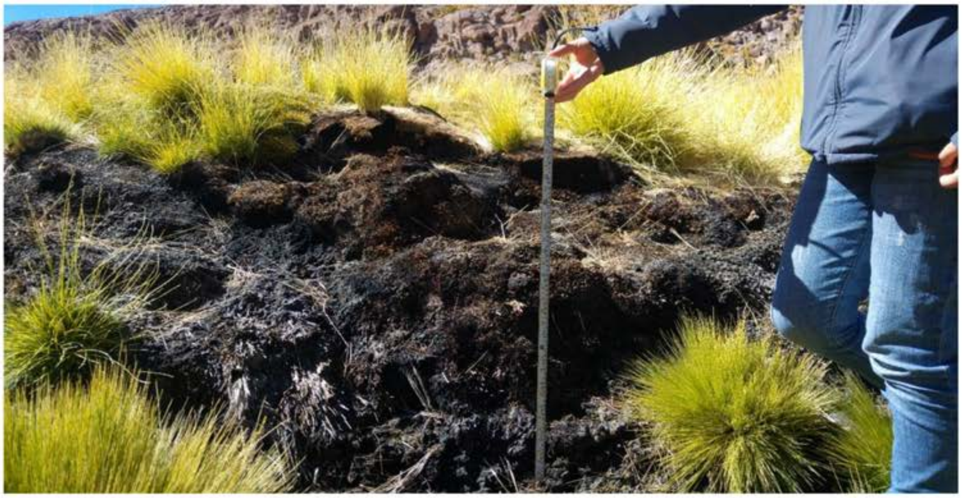

Figure 8 Photo of an excavated section and vertical peat profile at the edge of an undisturbed wetland patch in the Northern Wetland. *Source: DHI Field visit February 2017.*

4.1.2 Main canal

The Southern and the Northern main canals are also manmade and cut through the mid-section of the wetlands collecting water from the second and third order drainage network. They have been constructed in straight line sections with an approximately uniform slope (Figure 6). The main canals act as collectors for the surface drainage networks but also as local drains for the areas close to the channel. The main canal is lined by rocks for stability and to reduce resistance to flow. In most places, the canal bed sits directly on the underlying permeable base rock surface and as a result of the pervious canal lining, seepage in and out of the canal occurs along its entire length.

4.1.3 Later manmade changes

In recent years, the canal network has been changed and modified in sections of the Silala Wetland and Spring System. In parts of the Southern wetland, the canal and drains have been removed, filled in or blocked. This is visible as sections of the canal without any rock lining, rocks being piled up across the canal and drains, creating upstream water level rises and diversions to wetland sub-systems. The changes appear to be partial attempts at wetland restoration (Figure 9).

Figure 9 Canal modification diverting canal flow to wetland subsystem. DHI, 2017.

4.2 The observed flow distribution and the temporal flow variation

Continuous flow measurements for the Silala canal are available from two permanent gauging stations located lose to the international border in Bolivia and in Chile, respectively. These data have been supplemented by new measurements carried out by SENAMHI during 2017 of which the data from May to September 2017 have been available for this study. The field program includes simultaneous micro-propeller flow measurements (21 locations), spring flow measurements (20-33 springs) and continuous water level recordings behind weirs (six locations) which are converted to flows.

The long-term time series from the Bolivian and Chilean permanent flumes show mean flow rates around 160 l/s – 210 l/s, with the series from Chile generally showing flows 15-25 l/s lower than the Bolivian ones. The temporal variations in flow at both locations are generally not mutually correlated or correlated with seasons, climate or direct runoff events.

The flow data analysis in the two permanent flumes clearly shows that the flows are dominated by groundwater discharges which are relatively constant in time. The temporal variation observed in the two series are site-specific and cannot be explained by responses in neighbouring measurement locations or any climate or runoff events

Despite independent continuous and simultaneous flow measurements on the Chilean and Bolivian side of the border, the actual canal flow at the border remains uncertain (160 -210 l/s).

The distributed flow measurements have been used to calculate the spatial distribution of inflows over the canal system as presented in Figure 10. These measurements show that Northern and Southern wetlands contribute around 40% and 60% of the flow, respectively, and that a significant part of the flow in the Southern canal enters along the upper reaches of the southern ravine upstream of the confluence.

A vertical profile along the Southern canal is shown in Figure 11. The figure compares observed flows and canal levels with observed groundwater levels from (boreholes and spring levels). It is noted that the groundwater levels are higher than the bottom of the canal in the reaches with high flow increases. Similar profiles for the Northern and the Principal canals are shown in Figure 12 and Figure 13 respectively.

Inflows from identifiable springs in both the Northern and Southern wetland have been found to account for roughly 60 % of the total canal flow at the confluence between the Northern and Southern canals while diffuse inflows account for the remaining 40 %.

Smaller periodic daily flow variations have been detected at all of the seven continuous gauging sites during the winter of 2017. They cannot have been caused by wetland evaporation since this is highest at midday and would tend to reduce the flows at this time of the day. The flow variations may be from the freezing/melting of the water in the wetlands.

The flow measurements have provided valuable information regarding the spatial distribution of inflows and allowed a breakdown of water balances by reach. Although considerable flows (approximately 95 l/s) enter through the springs at the Northern and Southern wetlands, a large groundwater inflow contribution has been identified along the Southern Canal between C3-C5, especially along the upper reaches of the ravine, coinciding with a locally steep drop in topography and canal levels.

The different continuous flow measurements around C5-C7 just upstream the border revealed inconsistencies between the flow records and have not contributed to narrowing the canal flow range.

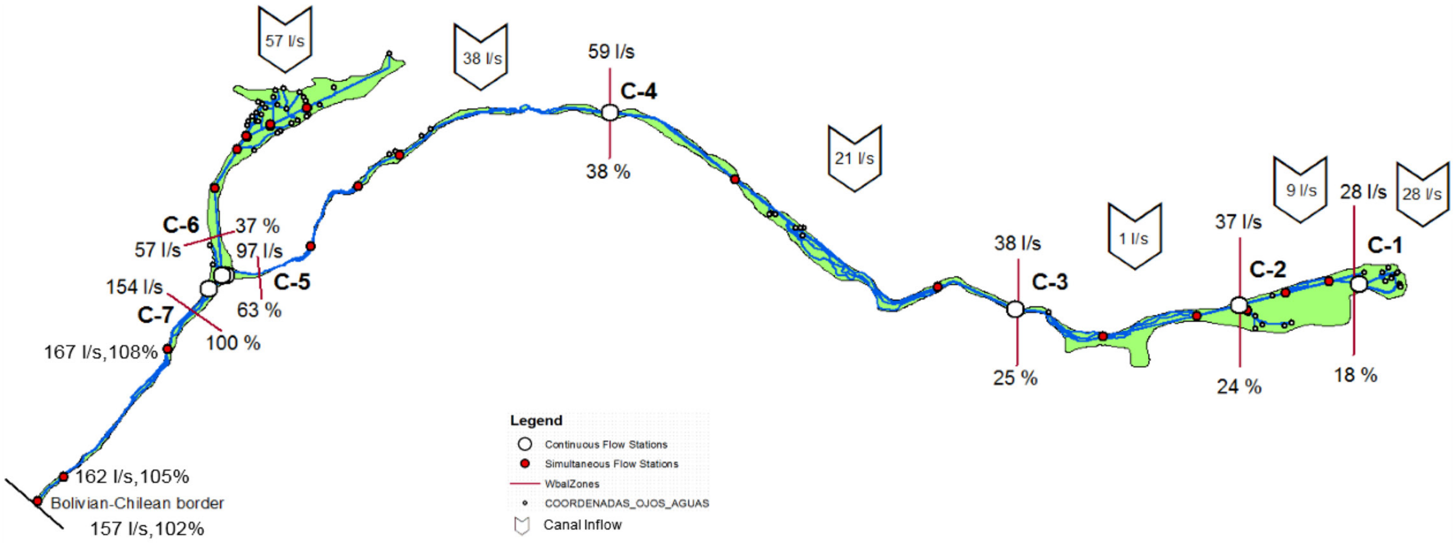

Figure 10 Mapping of flows and net inflows based on simultaneous mean canal flow measurements (in l/s, and percent of the flow at confluence point (the most reliable assessment point)

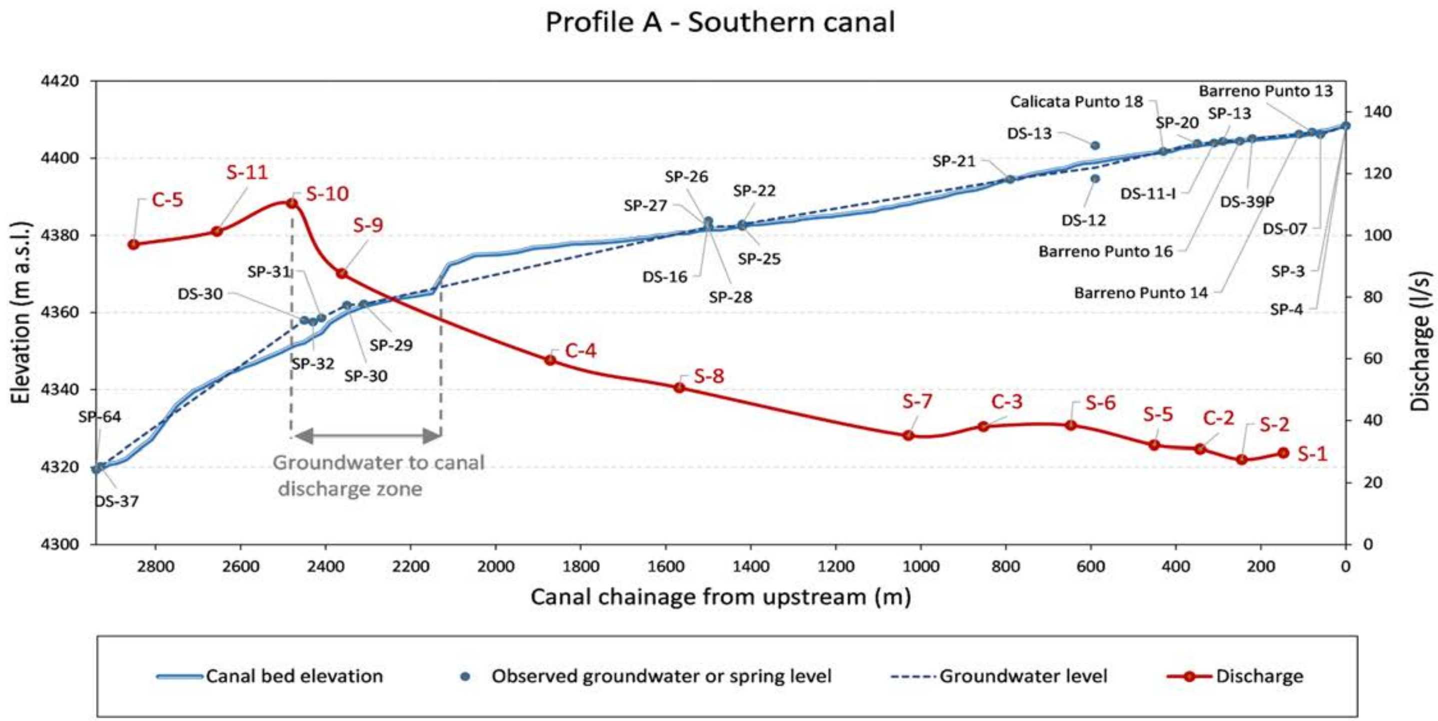

Figure 11 Southern canal profile (S-1 to C-5) comparing canal elevations and observed groundwater and spring levels with observed discharge (average of 10 campaigns)

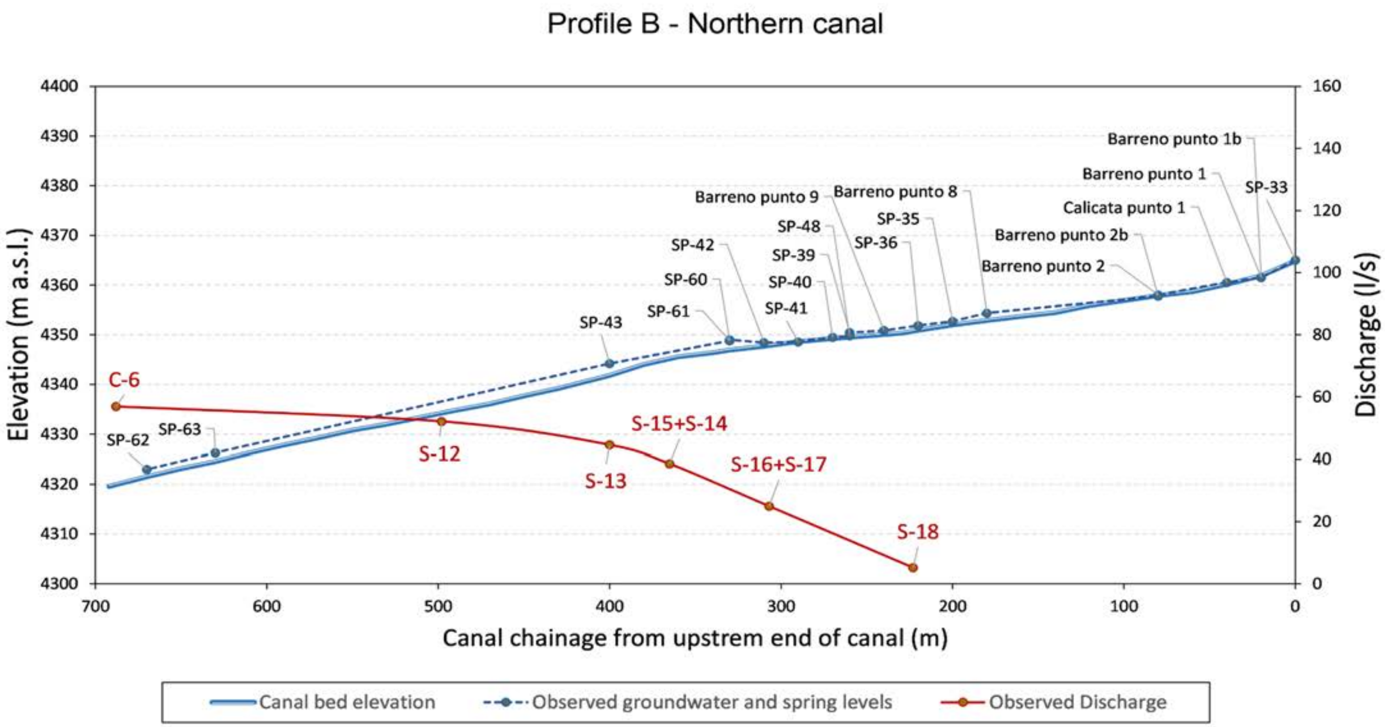

Figure 12 Northern canal profile (S-18 to C-6) comparing canal elevations and observed groundwater and spring levels with observed discharge (average of 10 campaigns)

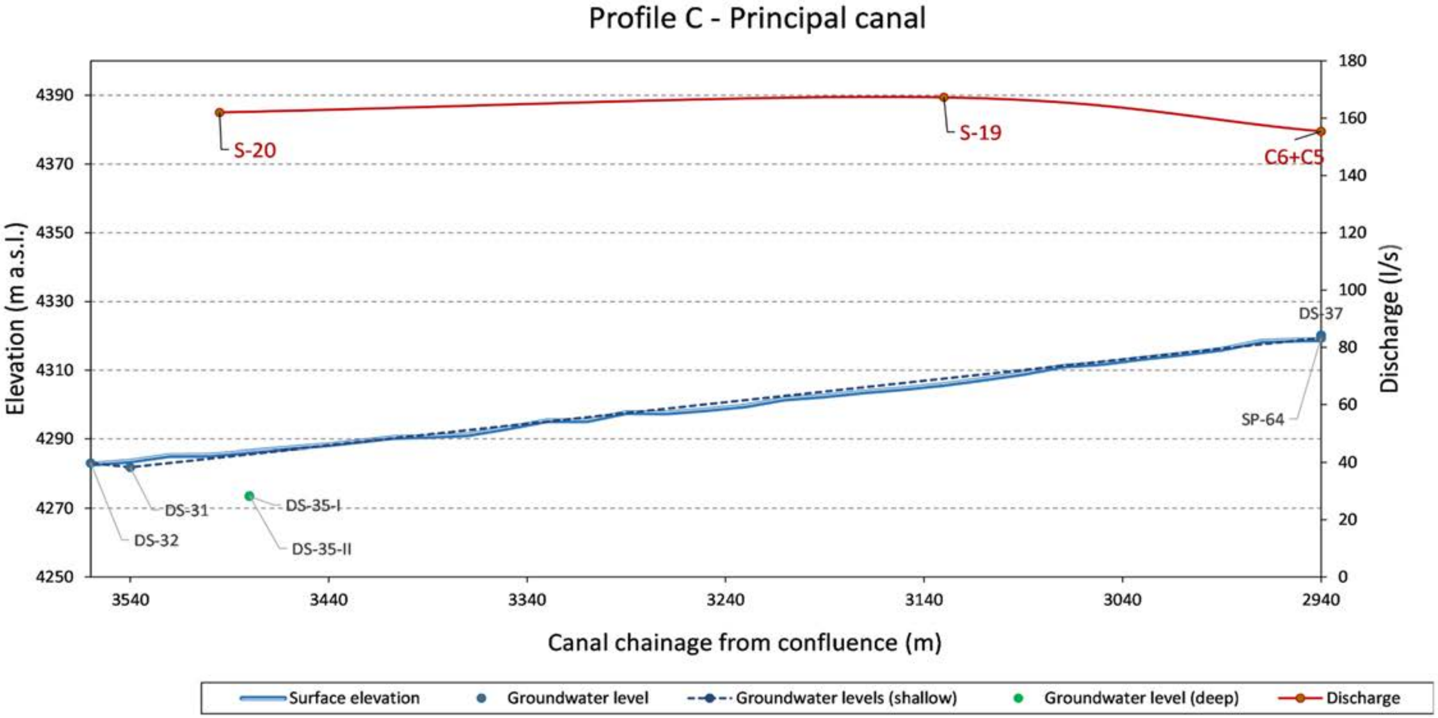

Figure 13 Principal canal from the confluence to the international border (C7 – S21) comparing canal elevations and observed groundwater and spring levels with observed discharge (average of 10 campaigns).

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5 Soil Analyses and hydraulic characteristics of the wetlands

A soil survey including a field survey, soil profile description, soil sampling and analysis has been undertaken by DIREMAR during 2017 and used by this study for the development of a conceptual understanding of the Silala wetlands and springs area and for further development of an integrated numerical surface water - groundwater model of the Silala wetlands:

Hand auger boreholes and trial pits were established in the wetland area and have mainly been used for observing the water table but have also provided soil samples for assessing soil properties. Diamond drilled boreholes have been established in the wetland area and borehole lithologies have been used for constructing geological profiles below the canal bed.

Soil properties have been assessed using pedo-transfer functions based on soil samples for both the Far Field area and the wetland area. Annex D to this report gives a brief summary of the soil data used and the soil profiles within the two wetlands. More comprehensive descriptions of the further analyses of the data are given in Annex E (on water balances) and Annex G (on the integrated surface water - groundwater model).

6 Upland water balance, contributing areas and sources

The scope of this study does not concern the origin of the water discharging through the Silala Springs System, which is not possible to determine due to lack of detailed hydrogeological information from the full hydrological catchment (the Far Field). Nevertheless, to better understand the hydrological processes driving the system, this section quantifies probable rates of infiltration recharge to the aquifers under the present climatic conditions, roughly assesses possible groundwater travel times to the springs and discusses the possible influence of fossil water and transbasin flows as further detailed in Annex E.

Based on a water balance, the origin of groundwater discharging the springs is discussed, i.e. whether this is a result of recharge from rainfall under current climatic conditions or there is a contribution from fossil groundwater formed under an earlier climate era.

Although important information is lacking such as the real extent of the contributing catchment (the Far Field) and the exact transborder groundwater flow, it is still possible to draw some conclusions on the possible sources and catchment areas, as described in detail in Annex E

The water balance and possible storage capacities of two catchments, referred to here as Catchment A and Catchment B, have been analysed:

Catchment A is the upper part (59.1 km^2) of the strictly topographical catchment (delineated by (Alcayaga, 2017)) that discharges to the Silala canal upstream of the international border. It includes the Near field as a sub-catchment. The larger hydrological Catchment B (234.2 km^2) includes Catchment A as a sub-catchment and an additional area (the ‘Road Catchment’) draining sub-superficially to the Silala Springs. Catchment B is considered hydrologically representative for the recharge conditions of the Far Field. The two catchments are illustrated in Figure 5.

Detailed distributed simulations of the rainfall-evaporation-infiltration processes in the two catchments have been undertaken and have resulted in long term average aquifer recharge rates (from infiltrated rain water) of 21 mm/y for Catchment A and 24 mm/y for Catchment B, respectively. Significant recharge takes place in a few wet years only.

The maximum active storage capacity of the aquifers of the two catchments have been roughly assessed and compared to the required storage volume of a system discharging solely fossil water or a mix of recharged and fossil water over a period of 5000 years corresponding to an approximate average water age from isotope analyses.

It was found that Catchment A (Alcayaga, 2017) is only capable of maintaining a discharge of 34-84 l/s, based on recharged water which is significantly less than the observed surface water across the border (160-210 l/s). Furthermore, this catchment does not have sufficient active groundwater storage capacity to sustain the remaining part of the observed surface discharge over the assumed discharge period from fossil water. This suggests that the area contributing water to the Silala Springs must be significantly larger than that of Catchment A.

The hydrological catchment, Catchment B, can sustain a flow of 151-374 l/s from recharged water which is in the same order of magnitude as the observed surface water (160-210 l/s) and estimated cross border groundwater flow in the order of (100-230 l/s) (Annex F and Annex H).

Overall, the analysis indicates that a large proportion of the water feeding the wetland is from recharge from rainfall and snow melt in the hydrological catchment.

However, the estimates (particularly of the cross border groundwater flows and the catchment climate) are uncertain and the possibility remains of the real contributing area (the Far Field) being different to the assumed hydrological catchment or of other sources also contributing to the Silala springs.

More specifically the water balance studies have established that:

- Despite the lack of vegetation, a large part of the precipitation (70--85%) of the precipitation falling outside the wetlands evaporates,
- The aquifer recharge is complex and takes place as a consequence of a few larger precipitation events. It also varies significantly from year to year (Figure 14). Hydrological simulations with a daily or finer temporal resolution and covering many years are necessary to capture this recharge pattern.
- The largest recharge rates are found at high altitudes around the top of the volcanoes where a larger fraction of the precipitation falls as snow, which also reduces the evaporation loss at these altitudes.

Exploratory groundwater simulations of Catchment B show long residence times for the water in the aquifers, although shorter than those indicated by the Isotope analyses. These simulations have not been able to capture the difference in water age in the two wetlands.

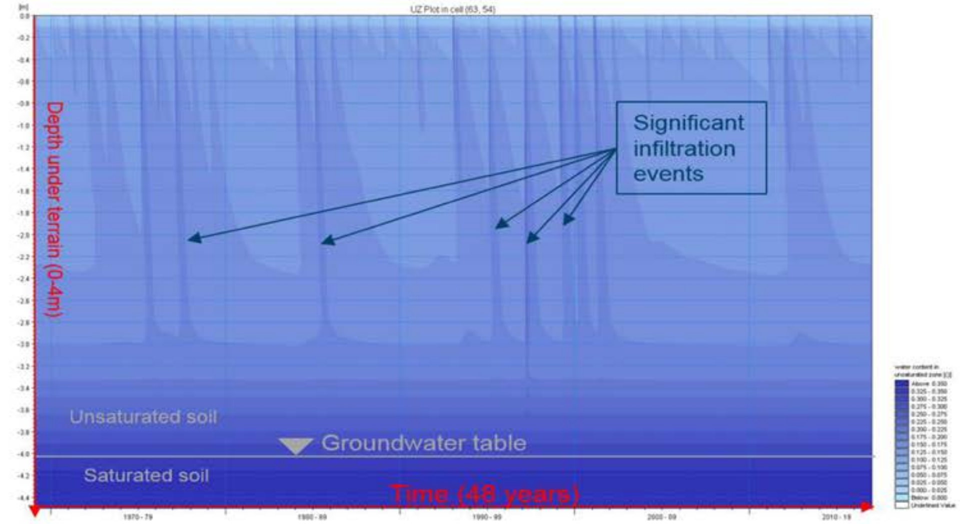

Figure 14 Modelled water content over time in a sandy soil column above the Silala wetlands. The colours show the content in the soil from light blue (dry soil) to dark blue (saturated soil) from the surface to the depth of 4 meters for the period 1969-2016.

7 Hydrogeology and groundwater

This section summarizes the findings of our hydrogeological analyses combining the previous geological and hydrogeological mapping; the results of the extensive hydrogeological characterisation program executed during 2017; the available hydro-chemical data and the knowledge on the surface water flows in the system. Our findings are compiled in a so called Hydrogeological Conceptual Model comprising a three-dimensional interpretation of the hydrogeological conditions in the Silala Near field ,i.e. the dominant water bearing fractures and formations along with their hydrogeological characteristics such as water levels, hydraulic conductivity and water holding capacity. The conceptual model forms the basis of the groundwater component of the integrated numerical model which is being used to determine surface water flows in a natural situation without the manmade canals.

In this section, we also present coarse assessment of the possible groundwater flow across the international border. More detailed technical description of our analyses and findings are given in Annex F.

7.1 Field surveys, objectives and main results

An extensive hydrogeological characterisation program in the Silala Near Field was executed by DIREMAR during the second half of 2017. The purpose of this program was to provide important insights into the hydrogeology of the site including groundwater levels, hydraulic properties, horizontal and vertical groundwater flow patterns.

The results of the program have together with existing geological, hydrogeological and hydro-chemical data been used to develop a Hydrogeological Conceptual Model (HCM) for the Silala Near Field. The HCM provides the foundation for understanding the Silala hydrogeology and the Silala Near Field groundwater flow component of the integrated hydrological model.

In porous media such as soil or weathered rock, groundwater flows in voids between grains or fragments, while in more compact rock formations, the flow takes place in fractures and faults. Hydrogeological formations with a highly developed and interconnected pattern of fractures react equivalently to a porous media.

Gradients in the groundwater water levels in both artesian and unconfined aquifers determine the direction of groundwater flow. Together with the hydraulic properties of the aquifers (conductivities and depths), they determine the local groundwater flow rates. Since both the groundwater levels and the hydraulic properties of the formations vary with the location and depth, it is never possible to obtain a complete picture of the groundwater conditions but approximations can be interpolated from point information (boreholes) and supplemented by geophysical measurements (e.g. electro resistivity measurements, which have been used in Silala).

Thirty-five piezometer boreholes with depths varying from 5m to 142m have been established for groundwater level monitoring, water sampling for laboratory analysis (see Figure 15). To estimate hydraulic conductivities of the aquifers 89 in-situ permeability tests were carried out in the thirty-five boreholes. Additionally, pumping tests, that provide hydraulic properties integrated over a larger area and therefore provide results more representative of the larger aquifer system, have been performed in the upstream end of the Southern wetland in borehole DS-4P.

An interpolated map of the groundwater levels in the Silala Near field (Figure 15) show gradients towards the wetlands, levels close to the terrain inside the wetlands and general gradient along the wetlands in the same directions as the bottoms of the ravines. Thus, the groundwater flow direction is towards Chile.

The difference in groundwater levels from the uppermost borehole to the Southern wetland and from the Southern wetland to the international border are 70 m and 120 m respectively. It is therefore not conceivable that the canalization with its rather limited excavation depth should have changed the *direction* of the groundwater flow.

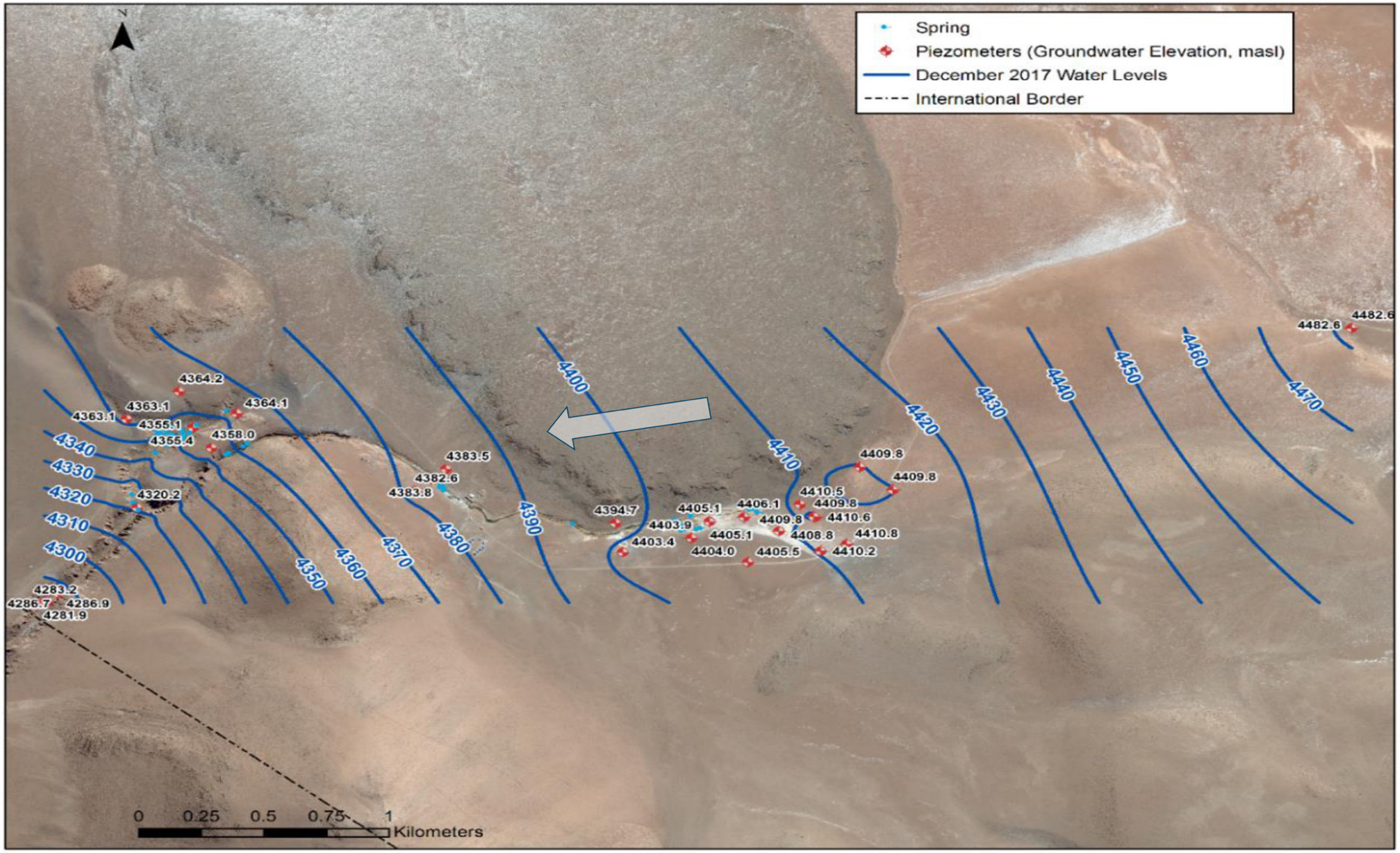

Figure 15 Borehole locations and groundwater level contours in the Silala Near field, interpolated form Piezometer wells spring elevations and wetland excavations for soil sampling. N.B. the contouring away from the wetlands and the boreholes are uncertain.

7.2 Conceptual Hydrogeological Model (HCM)

The data from hydrogeological characterisation program (the boreholes and electro resistivity transects) has been combined with previous Bolivian data (surface geological mapping, water quality, surface water flow rates) and borehole data and pumping test results from the Chilean side of the border (Arcadis 2017). The combined data have been used to develop the HCM of the Silala Near Field and to a lesser extent the Silala Far Field areas.

The conclusions of the combined data analyses regarding the conceptual groundwater flow system of the Silala Near Field include:

- Groundwater discharge is the principal source of water to the Silala spring system. Dominant sources of groundwater to the springs are:
    - Northeast trending structures including several large faults. These fault zones are brecciated and have elevated hydraulic conductivity relative to the surrounding materials and are interpreted to be transmitting groundwater over large distances (i.e. Silala Far Field or beyond);
    - A network of small apertures, northwest trending fractures act as conduits transmitting groundwater along strike;
- Pumping tests completed in the Southern Wetland indicate a transmissive ignimbrite aquifer with large-scale hydraulic conductivity estimated to be about 18 m/d and locally higher conductivity within the Silala Fault Zone (up to 54 m/d). These are higher than the 6.5 m/d estimated from the pumping tests in Chile near the border;
- Hydraulic test data indicate that:
    - Fractures in the ignimbrites are well connected over a large scale, and appear to control the flow characteristics of the aquifer.
    - The aquifers approximate a porous media;
- Groundwater head measurements indicate that groundwater is discharging to the Southern and Northern wetlands (gaining) but much further downstream the groundwater may be hydraulically disconnected from the Silala Canal at the Chilean-Bolivian border (disconnected losing stream);
- The hydrochemistry and age of the groundwater discharging into the Northern wetlands is significantly different from that of the Southern wetland (Figure 16). Water in the southern wetland was found to be considerably older than water in the northern wetland. Isotope analyses indicate the average age to be up to 1,000 years in the Northern and 11,000 years in the Southern wetland, respectively. Although such analyses may over-estimate the real water age (see Annex F), the age of the spring water is indeed very old. A likely interpretation of the difference in water chemistry and age is that this older water is derived from flow within the Silala Fault zone from a sub-regional to regional flow regime (i.e. the Silala Far Field), while the younger water in the Northern wetland is more likely to be derived from localised flow closer to the Silala Near Field. Hydrochemistry data also suggests that Laguna Khara (itself) is not a significant contributor to the groundwater discharge to the Silala Spring System.

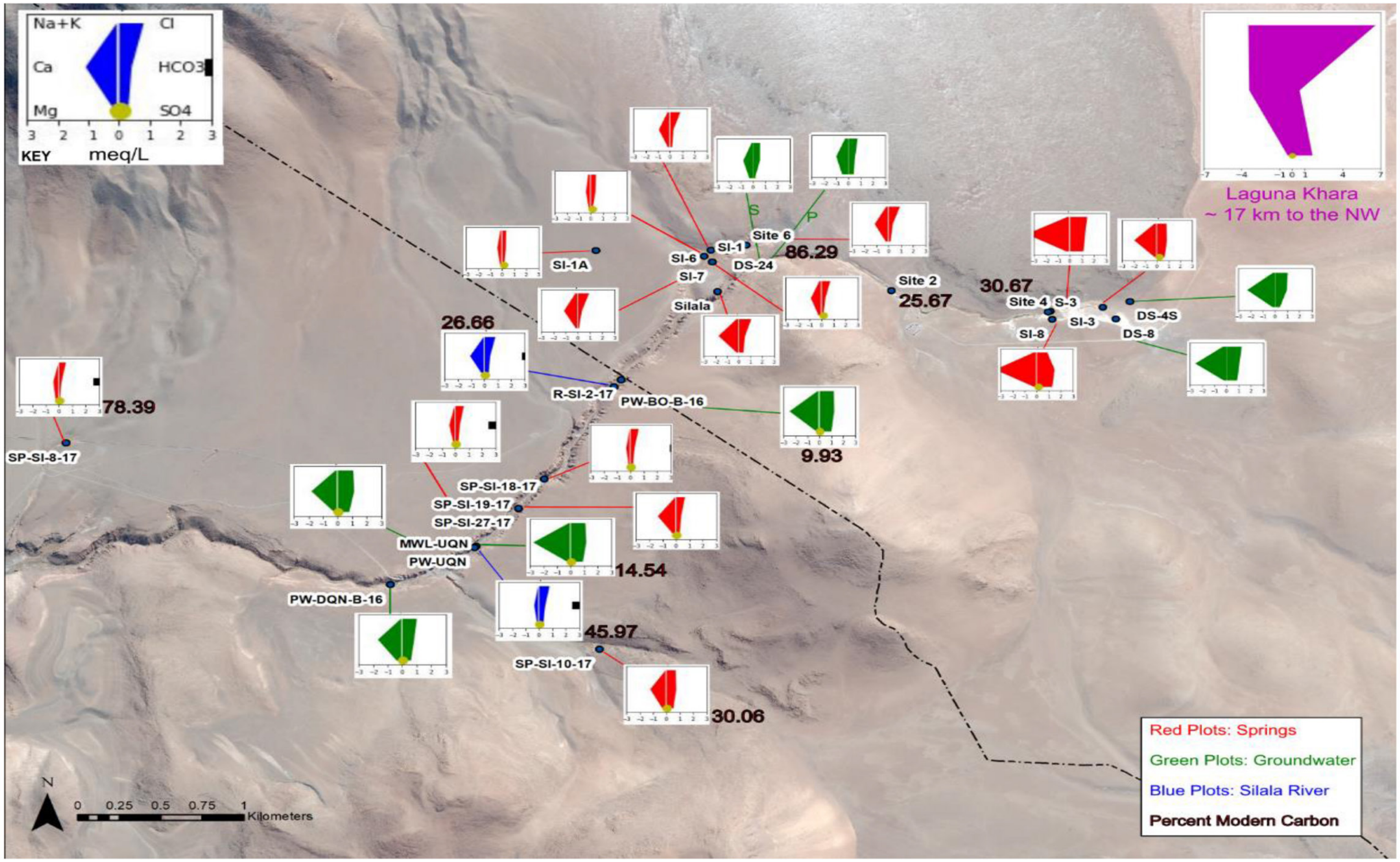

Figure 16 ^{14}C concentrations (fat black numbers) and stiff diagrams of water chemistry from Silala water sampling locations indicating spring water in the Northern Wetland and spring water from the Chilean right bank being significantly different than deeper ground water from the fault zone and spring water from the Southern Wetland.

The geological formations have been classified according to their hydrogeological characteristics which have resulted in 8 hydrogeological units (HGUs) (Table 1 and Figure 17). These 8 HGUs constitute the building blocks of the Conceptual Hydrogeological model, as illustrated in Figure 18.

Table 1 Hydrogeologic Units

Hydrogeologic Unit	Basic Lithology	Approximate Thickness (m)
HGU1	Colluvial deposits	1 to 10 m
HGU2	Glacial deposits, sandy loams	1 to 10 m
HGU3	Weathered lava flows	1 to 30 m
HGU4	Felsic volcanic sequences	Up to 600 m
HGU6 Upper	Ignimbrite deposits with a high degree of welding	Up to 150 m
HGU5	Ignimbrite deposits with a low degree of welding	10 to 120 m
HGU6 Lower	Ignimbrite deposits with a high degree of welding	Up to 300 m; assumed to be 300 m in the model
HGU7	Fault zones believed important for groundwater flow	50 to 100 m wide, depth to base of ignimbrite (assumed)
HGU8	Volcanic neck of Silala Chico	650 to 760 m diameter; depth to base of ignimbrite

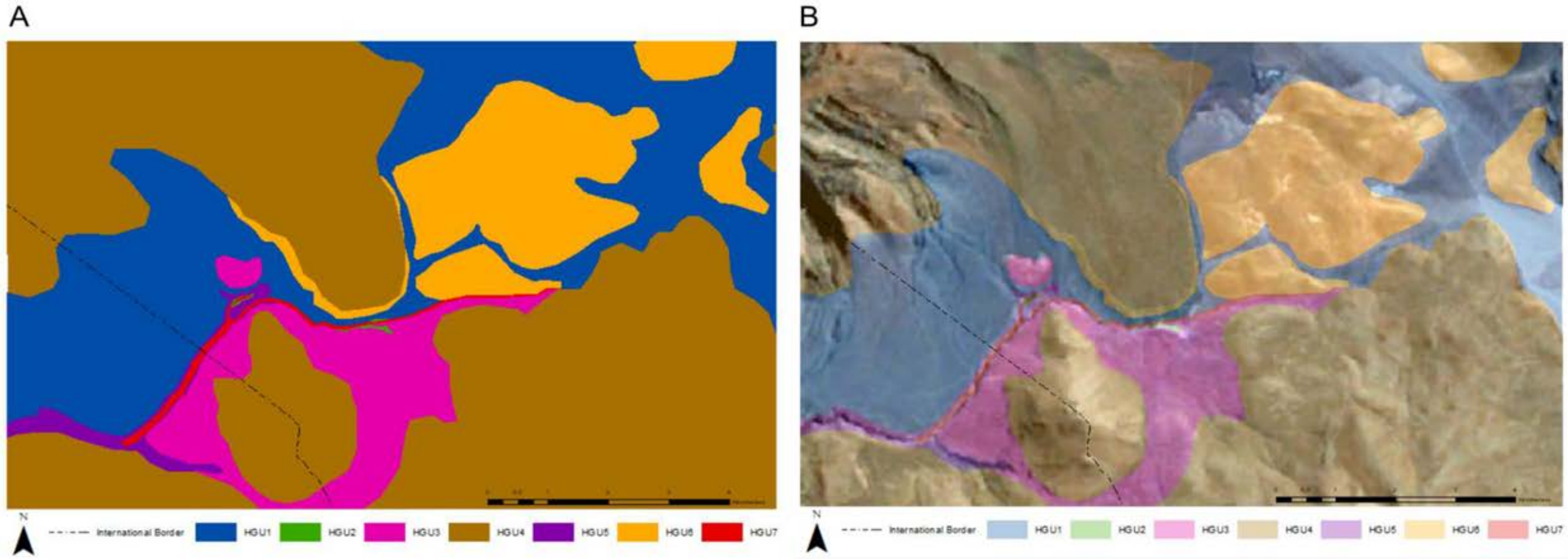

Figure 17 A) Delineation of hydrogeologic units (HGUs) in the Silala area. B) Silala site imagery overlaid by delineated HGUs.

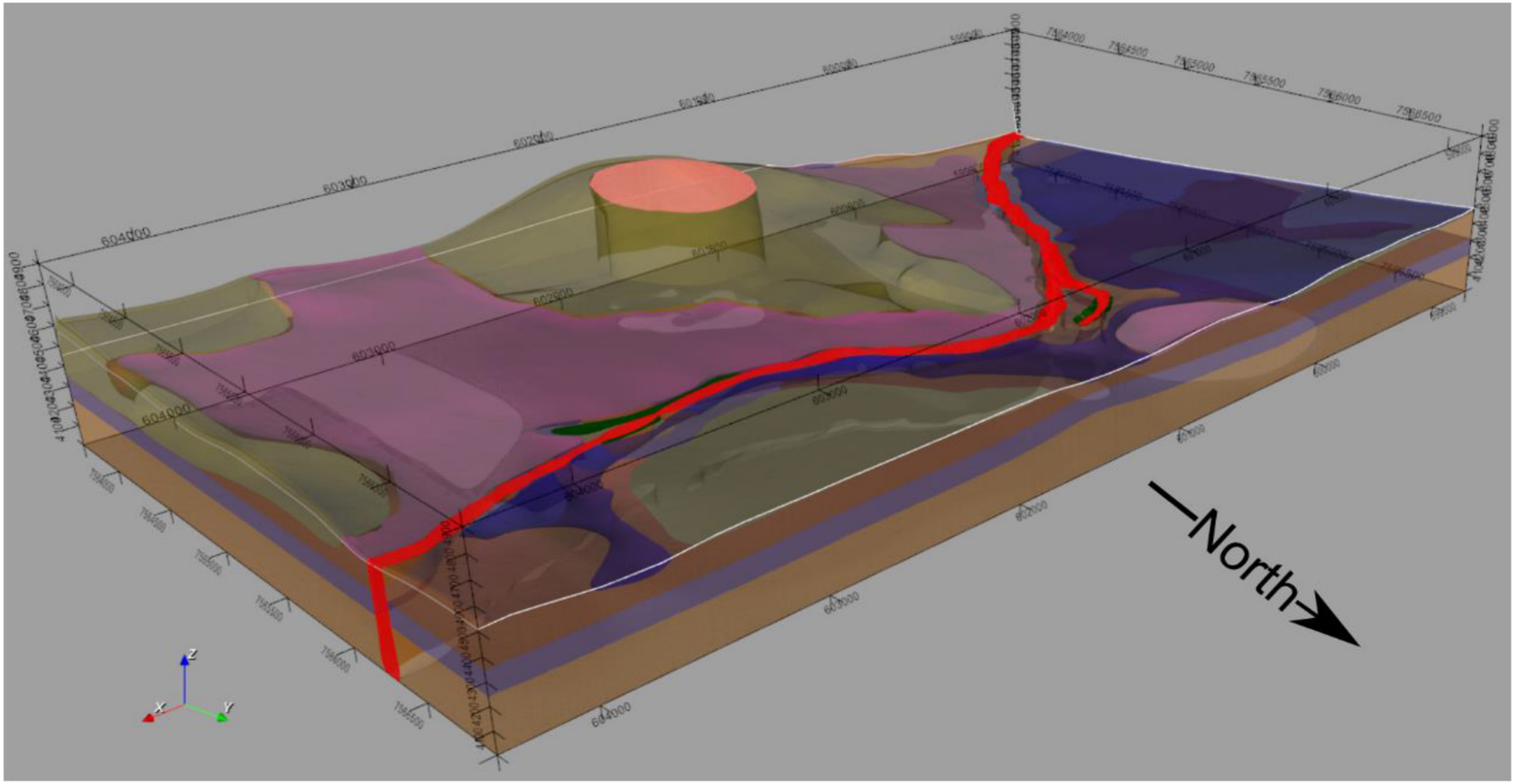

Figure 18 Hydrogeologic Framework Model rendered in 3D. The Silala Fault (HGU7) is highlighted in red. Remaining units are displayed with transparency for easier viewing of modelled subsurface.

7.3 Groundwater over the international border

There is considerable evidence to suggest that there is significant groundwater flow across the international border. The Chilean pumping tests confirm that permeable and saturated ignimbrite exists at the border to a depth of at least 117 m below ground surface. Furthermore, gradients in the groundwater levels both on the Bolivian and Chilean side of the border indicate groundwater flows from Bolivia to Chile.

While uncertainty remains around the exact value of transboundary groundwater flow into Chile, the hydraulic gradients, ignimbrite aquifer thickness and hydraulic conductivity indicate that the flux may be in the same order of magnitude as the observed surface flow.

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8 Integrated surface water - groundwater modelling

This section gives a brief overview of the numerical integrated surface water – groundwater model of the Silala Near Field developed for this study and its performance. A full technical documentation of the model establishment and its calibration is given in Annex G to this report.

8.1 Rationale and objective

An integrated hydrological modelling tool of the Silala Near Field area has been developed and used in scenario analysis with the objective to assess the differences between flow conditions in the present canalized situation and scenarios where the canals are removed. As explained in section 2.3 above, the processes through which the canals have affected the surface water flows are all related with surface water - groundwater interactions. An integrated numerical surface water - groundwater model is therefore needed to quantify these impacts.

8.2 Establishment of the integrated surface water - groundwater model

8.2.1 Implementation of the conceptual models

The total model area of the Silala Near Field is 2.7 km2 and the main elements of the model has been established in accordance with the conceptual models described in the previous sections.

All canals are represented in the hydrodynamic one-dimensional model in terms of cross sections and levels as surveyed in the field. Canal modifications as observed in the field has been included.

Flow and water ponding on terrain is described in the two-dimensional overland flow component in a 10 m by 10 m grid of the whole Near Field. The terrain levels of the overland flow model have been interpolated from the detailed drone survey of the area.

The unsaturated zone model calculates the evapotranspiration from the wetlands and all upland areas and has been established using standard parameters for the soil types found in the wetlands during the soil survey. This model uses the same grid resolution as the overland flow model.

The 3-D hydrogeological model developed from geological maps, geophysical transects and borehole data (Appendix F) is implemented in the numerical groundwater model. The hydrogeological units and their spatial extents defined in the hydrogeological model are represented. The numerical groundwater model applies three layers. The top layer has varying thickness and hydrogeological properties as it incorporates all surficial lense deposits (HGU 1 – HGU 4). The second layer includes the upper Silala ignimbrite (HGU 5) and the third layer represents the deep ignimbrite layer (HGU 6). The fault line (HGU 7) defined from the surface to a depth of 400 m cuts across the layers and introduces a high permeable flow zone along the canals. The same horizontal grid resolution of 10 m by 10 m as in the above models is used.

The boundary conditions to the model is Climate (precipitation, potential evaporation and temperature), ground water levels (as determined by the field observations) along the upper groundwater boundaries and constant groundwater gradient along the lower boundary.

8.2.2 Model calibration and performance

Model parameters have been adjusted iteratively in a calibration process to demonstrate that the model qualitatively describes the Silala Near Field hydrology in accordance with conceptual understanding and that the model results produced quantitatively matches the measured values.

It has been found that the overall results of the integrated model reproduce the important characteristics from the field observations in terms of:

- Significant groundwater inflows to the Silala Near Field area through the high permeable fault zone and upper Silala ignimbrite
- Overall groundwater flow towards the low-lying wetlands, the canals and the deep cut ravine sections.
- Groundwater feeding surface water by discharges to the springs, canal and drainage network
- Upstream gaining canal reaches versus the downstream neutral or loosing reach from the confluence to the border.
- Outflow of the Silala Near Field area as combined canal and groundwater flow at the border

The calibration against field data show that:

- The model simulates groundwater discharge to the canal system in terms of measured mean canal flow (C1-C7) reasonably well, i.e. 0 – 18 % deviation.
- The largest relative difference is found at upstream southern canal (C1-C3). From C4 to the downstream confluence and border area including the northern branch (C6), the model performs well with differences to the observations which are within the canal flow measurements uncertainty.
- The calibrated model water balance shows groundwater flow across the downstream model boundary in the order of 106 l/s compared to surface water flow of 150 l/s. The few groundwater observations in the cross section are from the ravine and insufficient to fully verify the model simulated flow. The width of the downstream model boundary is 450 m (with the ravine in the centre). For comparison, the rough hand calculation in Annex F assessed 230 l/s (or more), but over a much larger cross section and using less information.
- Evapotranspiration mainly occurs in the wetlands and along the canal riparian corridor. Due to the restricted total area the total ET losses correspond to only 10 l/s under current conditions.

In summary:

The numerical model is developed from the conceptual understanding and the field data collected. The calibrated model is able to simulate the canal flows (C1-C7) reaching approximately 150 l/s at the border.

The model results suggest a considerable groundwater flow component but it cannot be confirmed by measurements and is therefore more uncertain than surface water flows. However, the model results confirm a coupled groundwater – surface water system within the Silala Near Field area extending across the border.

The calibrated model is in reasonable agreement with the current conditions and therefore a sound basis for estimating the impacts of the canals.

9 Assessment of the natural flows

To address the main objective of this project, the following baseline and scenario models have been run:

1) **Baseline model**. Represents the current (2018) Silala Near Field area with the canal and drainage network. The surface water canal model includes both reaches which are more or less unchanged compared to the original canal construction but also reaches where the canal has been removed or blocked. The baseline scenario is used as a reference to estimate the magnitude of changes.

2) **No canal scenario**. The entire canal and drainage network included in the baseline model is removed. Surface water flow is not restricted to the narrow canal cross sections and the direction of flow is largely controlled by the surface topographical slope.

3) **Wetland restoration scenario**. By removing the canal and drainage network, the basis is created for restoration of the degraded wetlands and riparian corridors. The scenario considers the resurfacing and long-term peat accumulation in wetlands.

9.1 Flows in the natural wetlands without the canalization

According to the integrated model scenario results removing the canals and restoring wetlands will affect both groundwater and surface water and both inflows and outflows of the Silala Near Field area.

1. The simulated surface water flow at the downstream model boundary (located at the Bolivian-Chilean border) *reduces* by 31-40 % relative to the present situation.

2. The simulated groundwater flow at the downstream model boundary (located at the Bolivian-Chilean border*) increases* by 7-11 % relative to the present canalized situation

3. The total model boundary inflow at the upstream model boundary decreases by 10-15 %.

4. The evapotranspiration increases by 20-30 % by removing the canals and restoring wetlands. This increase amounts to 2-3 l/s in the situation without the canals and is included in the cross-border flow changes mentioned under point 1 and 2

5. For the confluence to border section, a maximum of 25 % of surface water may be lost to subsurface flows. Infiltration loss in this section is included in the cross-border flow changes mentioned under point 1 and 2.

6. All of the scenario results and local model analysis suggest that both surface water flow and groundwater flow should be expected at the border.

The flow impact percentages describe the model results ranges but not the uncertainty on model results. Model predictive uncertainty depends on a number of factors and uncertainty sources, e.g. limitations in input data, model structure, parametrisation and measurement errors. A strictly quantitative uncertainty analysis is not feasible and has not been attempted but model uncertainty should not be ignored in the interpretation of results.

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10 Conclusions

The findings on the present surface flows in the system:

1. Despite independent continuous and simultaneous flow measurements on the Chilean and Bolivian side of the border, the actual canal flow at the border remains uncertain. Based on the records the cross-border surface flow is 160 -210 l/s.
2. The flow records both in Bolivia and in Chile have a large and constant base flow fraction indicating that the flow mainly originates from groundwater. In the Bolivian records, this base flow fraction is around 160 l/s. The lack of clear seasonality in the records also confirms that surface runoff is not an important source.
3. Simultaneous propeller flow measurements carried out under this study have rather consistently recorded around 160 l/s at the border during May-Sept 2017. These measurements show that Northern and Southern wetlands contribute to around 40% and 60% of the confluence flow, respectively.
4. Inflows from identifiable springs in the Northern and Southern wetland have been found to account for roughly 60 % of the total canal flow at the confluence of the Northern and Southern canals while diffuse groundwater inflows account for the remaining 40 %.

The findings on the present groundwater flows in the system:

5. The observed groundwater levels in the many boreholes established in the Silala "Near Field" and above show a clear flow direction of the groundwater from East to West. Together with the evidence from boreholes of a pervious and water holding aquifer, this proves the presence of cross border groundwater flow into Chile.
6. While considerable uncertainty remains around the magnitude of the cross border groundwater flow the hydraulic gradients, ignimbrite aquifer thickness and hydraulic conductivity indicate that the flux is considerable, i.e. comparable to the present surface flow
7. The model results of the Near Field suggest the present cross border groundwater flows over a 450m wide section around the ravine to be in the order of 100 l/s.
8. Water sample analysis indicate a water age of up to 1,000 years and 11,000 years in the Northern and Southern wetlands, respectively, suggesting relatively long groundwater residence times in the aquifers and different recharge sources.
9. The model results confirm a coupled groundwater – surface water system within the Silala Near Field area extending across the border.

Our analyses show that in a situation without the manmade canals:

10. Without the canals, both surface water and groundwater will cross the border. A reduction in surface flow of 30-40 % is estimated compared to current conditions. The estimate includes the effect in the Silala Near Field area hereunder the increased evapotranspiration and infiltration losses from the confluence to the border.
11. Without the canals, more water crosses the border as groundwater. The groundwater flow through a 450 m wide cross section at the border *increases* by 7-11 % from the present situation
12. The evapotranspiration increases by 20-30 % by removing the canals and restoring wetlands. This, however, corresponds to a *reduction* of only 2-3 l/s in the combined cross border groundwater and surface water flow.

13. In a situation without the canals, it is *not possible* that all surface water discharged from the wetlands infiltrate from the confluence point to the border. The best estimate (based on detailed simulations) is that 8-12% of the flow may be lost to subsurface flow. At maximum 25 % may be lost.

14. The canals have changed the *amount* of discharge from the Silala Springs but *not the direction* of natural outflow from the Silala wetlands. Also, in a situation without the canals, the discharge direction is towards Chile.

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Glossary

Term	*Meaning/Definition*
Aquifer	Geological formation capable of storing, transmitting and yielding exploitable quantities of water.
Austral summer	Summer period in the Southern Hemisphere.
Basin	Area having a common outlet for its surface runoff.
Catchment	The whole of the land and water surface contributing to the discharge at particular stream cross section. This means that any cross section of a stream will have a unique catchment of its own. (Wilson, 1978).
Confined aquifer	Confined aquifers are aquifers that are overlain by a confining layer, often made up of clay or other geological formations with low permeability.
Depression, terrain depression or sink	A depression (or sink) is a low point in the terrain surrounded by higher ground in all directions. If the soil is impervious, the depression collects rain water from a local catchment. Surface water or groundwater inflows will accumulate in the depression until: - the water level reaches the nearest terrain threshold and runs off or - the evaporation from the depression is equal to its combined surface water groundwater inflows. However, a depression may also drain sub-superficially to lower lying areas through pervious soils, geological faults or groundwater aquifers.
Desert climate	Desert climate (in the Köppen climate classification BWh and BWk, sometimes also BWn), also known as an arid climate, is a climate in which precipitation is too low to sustain any vegetation at all, or at most a very scanty shrub and does not meet the criteria to be classified as a polar climate.
Digital elevation model (DEM)	Data files holding terrain levels often organised in a quadratic grid with a certain cell size (e.g. 30m by 30 m). They are very convenient tools for and often used as standard tools in Geographic Information Systems (GIS) for delineation of topographical catchment and for many other purposes.
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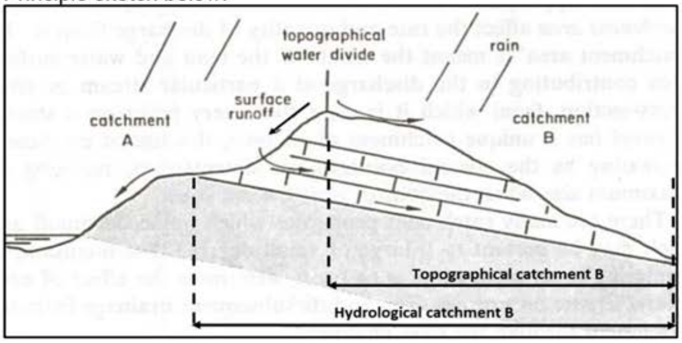
Evapotranspiration	Combination of evaporation from free water and soil surfaces and transpiration of water from plant surfaces to the atmosphere.
Food and Agriculture Organization of the United Nations (FAO)	Specialised agency of the United Nations that leads international efforts to defeat hunger. FAO is also a source of knowledge and information, and helps developing countries in transition modernise and improve agriculture, forestry and fisheries practices, ensuring good nutrition and food security for all.
Fossil Water	While all definitions of fossil water agrees that it is old water stored in aquifers or glaciers for thousands or millions of years, they do not strictly agree if the waters are non renewable (Definition 1) or if they have "just" infiltrated many years ago (Definition 2). In this report, definition 1 has been used. Definition 1: Oxford living Dictionary (https://en.oxforddictionaries.com/definition/fossil_water): Fossil water is water that has been contained in an aquifer, glacier etc. for a very long period of time (thousands or millions of years) and hence is not renewable. Definition 2: UNESCO defines fossil groundwater as water that infiltrated usually millennia ago and often under climatic conditions different from the present, and that has been stored underground since that time.
Geographic Information System (GIS)	A geographic information system (GIS) is a system designed to capture, store, manipulate, analyse, manage, and present spatial or geographic data.
Groundwater	Subsurface water occupying the saturated zone (i.e. where the pore spaces (or open fractures) of a porous medium are full of water).
Hydrogeological Conceptual Model (HCM)	The conceptual understanding of the individual components in a hydrologic system (i.e. groundwater, surface water, and recharge) and the processes involved between each component.
Hydrogeological Framework Model (HGFM)	A three-dimensional geologic model that defines the spatial extent of stratigraphic and structural features. The development of the HGFM incorporates topographic, geologic, geophysical, and hydrogeologic datasets.
Hydrological catchment	The hydrological catchment is the total area contributing to the discharge at a certain point. The hydrological catchment includes all the surface water from rainfall runoff, snowmelt, and nearby streams that run downslope towards a shared outlet, *as well as* the groundwater underneath the earth's surface. Since groundwater may cross the topographical divides a hydrological catchment to a point may be larger than the corresponding topographical catchment as indicated in the

	Principle sketch below. 
Infiltration	The movement of water from the surface of the land into the subsurface.
Penman-Monteith	Method for estimating reference evapotranspiration (Et0) from meteorological data. It is a method with strong likelihood of correctly predicting ETo in a wide range of locations and climates and has provision for application in data-short situations.
Recharge	Contribution of water to an aquifer by infiltration.
Reference evapotranspiration (Et_0)	The evapotranspiration per area unit under local climate conditions from a hypothetical grass reference crop with an assumed crop height of 0.12 m, a fixed surface resistance of 70 s m^{-1} and an albedo of 0.23. The reference surface closely resembles an extensive surface of green, well-watered grass of uniform height, actively growing and completely shading the ground. A good approximation to the maximum evapotranspiration that under a certain climate can evaporate from an area unit covered by an ever-wet short green vegetation (e.g. a wetland)
Remote sensing	Acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to on-site observation. In current usage, the term "remote sensing" generally refers to the use of satellite- or aircraft-based sensor technologies to detect and classify objects on Earth, including on the surface and in the atmosphere and oceans, based on propagated signals (e.g. electromagnetic radiation).
Satellite	Artificial body placed in orbit round the earth or another planet in order to collect information or for communication.
Sensitivity analysis	Sensitivity analysis is the study of how the uncertainty in the output of a mathematical model or system (numerical or otherwise) can be apportioned to different sources of uncertainty in its inputs.
Spatial variation	When a quantity that is measured at different spatial locations exhibits values that differ across the locations.
Spring	A spring is a place where groundwater emerges naturally from the rock or soil. The forcing of the spring to the surface can be the result of a confined aquifer in which the recharge area of the spring water table rests at a higher elevation than that of the outlet. Spring water forced to

	the surface by elevated sources are artesian wells. Non-artesian springs may simply flow from a higher elevation through the earth to a lower elevation and exit in the form of a spring, using the ground like a drainage pipe. Still other springs are the result of pressure from an underground source in the earth, in the form of volcanic activity. The result can be water at elevated temperature such as a hot spring.
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Weather station	A facility, either on land or sea, with instruments and equipment for measuring atmospheric conditions to provide information for weather forecasts and to study the weather and climate.
Wetland	A wetland is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil. Wetlands play a number of roles in the environment, principally water purification, flood control, carbon sink and shoreline stability.
Conceptual model	Representation and simplification of a real life, physical system e.g. a hydrological system by means of overall, key processes governing flow
Numerical model	A model solving governing equations of e.g. flow. Typically a computer program simulating state variables such as flow and water levels in time and space

Danish Hydraulic Institute (DHI), *Study of the Flows in the Silala Wetlands and Springs System*, 2018

Annex A: The Silala Catchment

(Original in English)

Contract CDP-I No 01/2018, Study of the Flows in the Silala Wetlands and Springs System

Product No. 2 – 2018 Final Report

Annex A : The Silala Catchment

Plurinational State of Bolivia, Ministry of Foreign Affairs, Diremar

July 16, 2018

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Annex C.	Surface waters
Annex D.	Soil analyses
Annex E.	Water balances
Annex F.	Hydrogeology
Annex G.	Integrated surface water – groundwater modelling
Annex H.	Natural flow scenarios
Annex I.	Questionnaire put by the Plurinational State of Bolivia to DHI

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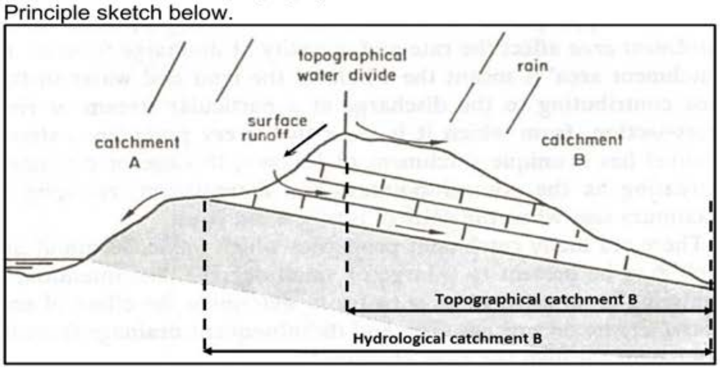
Hydrological catchment	The hydrological catchment is the total area contributing to the discharge at a certain point. The hydrological catchment includes all the surface water from rainfall runoff, snowmelt, and nearby streams that run downslope towards a shared outlet, *as well as* the groundwater underneath the earth's surface. Since groundwater may cross the topographical divides a hydrological catchment to a point may be larger than the corresponding topographical catchment as indicated in the Principle sketch below. 
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1 Introduction

This annex to DHI´s final report of the Study of the Flows in the Silala Wetlands and Springs System describes the location of the springs and gives a broad introduction to the geographical area in which they are located.

The main objective of this study, namely the quantification of the cross-border groundwater and surface flows at present and in a natural situation, can be confined to a study of the Near Field area close to the springs. However, DHI was asked to perform infiltration and water balance analyses based on the available data to assess the various theories on the origin of the spring water.

Therefore, this annex also discusses the possible extent of the hydrological catchment, the Far Field that may contribute to the discharge through the wetlands and springs. A possible hydrological catchment representative for the climate and infiltration in the area is delineated and has been used as a basis for the analyses of recharge and possible origin of the waters, as presented in Annex E and Annex F.

2 Location of the Silala Springs System and the area in general

The Silala Springs are **located** in the arid western part of the Potosi Department of Bolivia, a few kilometres from the border with Chile at altitudes of 4300-4400 m above sea level (see Figure 1).

The Silala Springs are fed almost entirely by groundwater that originates from an unknown Far Field area (Figure 2) as further described below. Figure 3 shows the Near Field of the Silala Springs where the discharge from the upper springs in the northern and southern wetlands are collected by a network of manmade canals. The flow of water is westward and the canals join into a principal branch that crosses the Chilean-Bolivian border about 4 km downstream of the Northern wetland at an elevation 150 m lower than the upper springs.

Figure 1 Location of the Silala Springs.

2.1 The Altiplano area and its wetlands

Silala belongs to the high altitude Altiplano, a dry puna mountain zone in the transition to arid Atacama Desert climate. The topography and geology of the Altiplano are dominated by volcanoes and thick deposits of a pyroclastic density currents (Ignimbrites) (SERGEOMIN, 2003). Due to both climate and altitude, the vegetation is characterised by sparse and scattered grasses on the plains and volcano slopes. In valleys or low-lying depression areas, wetlands fed by mainly groundwater are found (Figure 4).

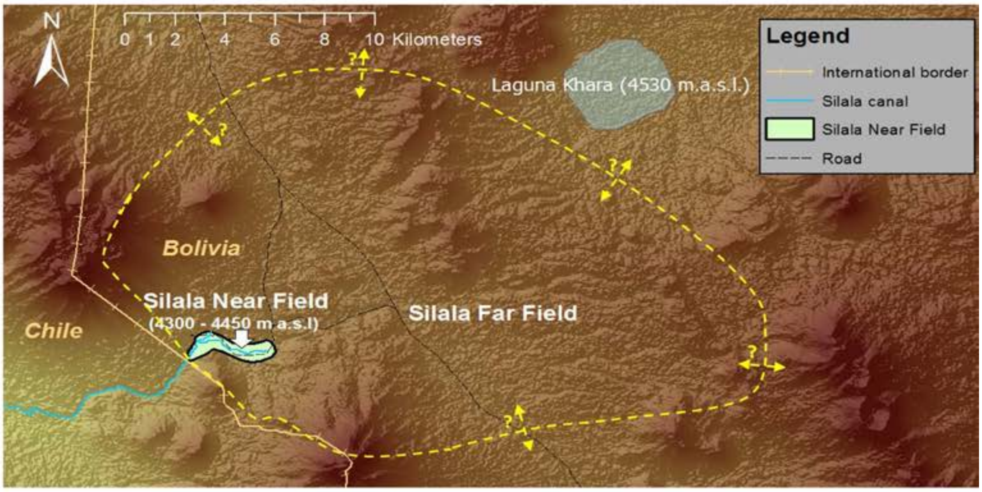

Figure 2 The Near field and far field of the Silala springs system.

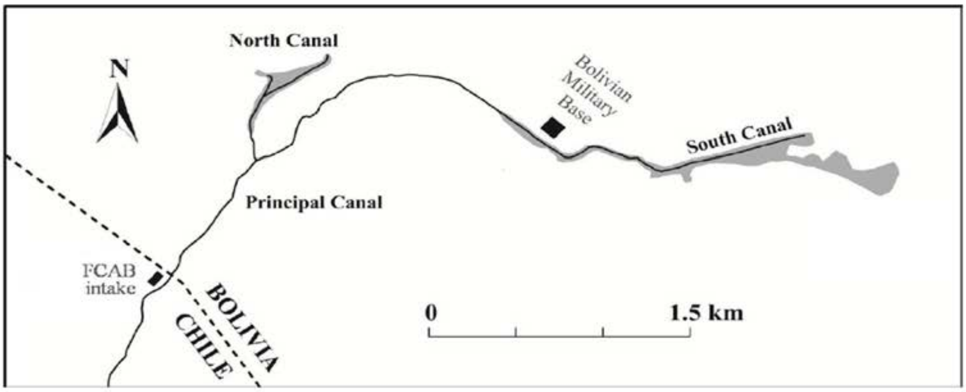

Figure 3 Approximate extent of the Silala Near field. (Mulligan, et al., 2011).

The Silala Springs System is an example of a type of high Andean wetlands described as cushion bogs (bofedales) with peat layers formed by Distichia cushions growing within 1-5 cm of the ground surface. Distichia is the dominant native species of the Andes wetlands at elevations between 3500 and 5000 m. Despite low growth rates, it creates peat layers up to several meters deep (G.Skrzypek, 2011). The Distichia wetland areas are comprised of micro-topographic variations of pools and lawns with a high water storage capacity. Due to the water retention properties, pools are generated by bofedale wetland vegetation in the region, even on sloping ground and without creation of any natural stream or narrowly confined flow features.

The wetlands are vulnerable and rely on a long-term steady and reliable water supply to maintain suitable hydrological conditions and with time build peat layers of organic deposits. In Silala and other bofedales in the Potosi region, groundwater provides this steady water supply. In Silala, the extent of both the Northern and Southern Wetlands is controlled by the topography and groundwater discharges through springs.

Figure 4 Vegetation in and above the Southern Silala wetland.

The Silala Springs have been declared an area to be protected through the RAMSAR convention. The Convention's mission is the "conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". In line with the Convention, the Bolivian Government wants to restore the Silala Springs and Wetlands to its natural state.

2.2 The Silala area

Silala has a desert climate with low precipitation, low temperatures but high potential evaporation. Outside the wetlands the vegetation is very sparse and top soils are coarse and sandy (Figure 5), originating from weathered or glacier eroded lava and ignimbrite formations.

The base rock formation consists of ignimbrite layers presumably deposited through several eruptions around 8 million years ago. The ignimbrite layers have a general inclination towards West, and the valleys in which the Silala springs, wetlands and canals are located have been identified as major fault lines in the ignimbrites (SERGEOMIN, 2003). One of these major fault lines continue upstream of the Southern wetland in direction ESE - WNW. Further away from the wetlands, perpendicular faults to this in direction NNW -SSE have been identified (SERGEOMIN, 2003).

As further described in Annex F, the Ignimbrites are porous, fractured and have been found to have significant hydraulic conductivities both in the main fault zones and in their fractured matrix. In some areas, the ignimbrites are found directly under the top soils, while in other parts of the area, they are superimposed by layers of lavas which have been deposited during later eruptions.

The potential ground water heads as found in the piezometer wells, established by DIREMAR as part of this study, indicate a groundwater flow from higher eastern grounds towards the Silala Springs and further on towards the international border (Annex F).

Figure 5 Soils in Silala's hydrological catchment (the Far Field).

3 Digital elevation models of the Silala catchment

Digital elevation models (DEMs) are state of the art tools for delineation of topographical catchments and have, in the absence of detailed topographic surveys of specific borehole elevations, also been used to determine terrain and groundwater levels at the boreholes, exploration pits and at the various springs.

Three different DEM's have been used for the Silala area:

1. NASA's SRTM model generated from a space shuttle radar mission has a horizontal resolution of approximately 30 m (NASA, 2017). This model is used by this project for analyses of the Far Field area. This DEM constitutes the background image of Figure 6.
2. A high resolution Digital Elevation Model (DEM) acquired by DIREMAR based on measurements taken during a drone flight in the last half of 2016 (IGM, 2016). This DEM, which covers the whole Near Field area except the downstream 350 meters close to the border, has a resolutions of 5 cm (horizontally) and 2 cm (vertically). The DEM, illustrated in grey scale in Figure 6, has been used for analyses and modelling of the Silala Near Field and for levelling of the hydrogeological field survey results.
3. The DEM used by (Alcayaga, 2017) to delineates a topographical catchment for the Silala for a location close to the Inacaliri Police station around 4 km downstream of where the Silala canal crosses the international border with Chile. This DEM has a horizontal resolution of 5 m.

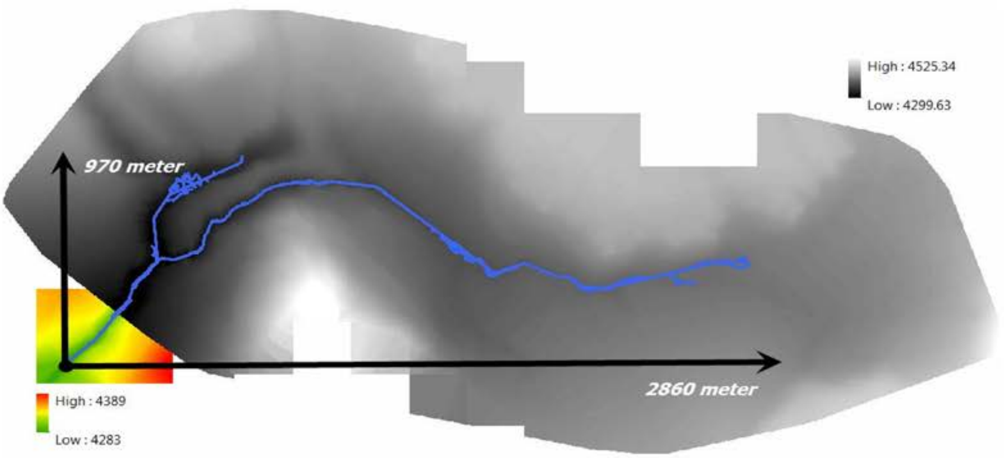

Figure 6 Topographical data used in the surface model. The coloured area was interpolated from 1 m contour lines received from DIREMAR (IGM, 2016). The remaining area is based on topographical raster information from the drone flight (IGM, 2016). The man-made drainage canals are shown as blue lines.

4 The topographical catchment of the Silala Springs

A topographical catchment is the area from which superficial runoff runs downhill and discharges into a point. The inflows to the Silala Springs are, however, dominated by groundwater flows and superficial runoff both in the catchment area and to the wetlands is negligible. Furthermore, there are geological indications of faults and water bearing ignimbrites crossing the topographical water divides (SERGEOMIN, 2003) as shown in Figure 7.

The topographical catchment for the point where the Silala canal crosses the Chilean-Bolivian border has been delineated using NASA's SRTM 30 m Digital Elevation Model (DEM). The topographical catchment is shown in Figure 7 and has an area of 59.1 km^2 (Table 1).

As reported in Annex E, water balance analyses has shown that the area of the topographical catchment is insufficient to sustain the measured cross border flows, and this catchment is therefore of less importance than the hydrological catchment, which is described in the following section.

The topographical catchment is described here for reference and for comparison with the analyses presented in the Chilean memorandum (Alcayaga, 2017) on catchment delineation.

Topographical catchments to the Silala may be delineated for any point on the canal. (Alcayaga, 2017) has delineated a topographical catchment for the Inacaliri Police station located at the canal around 5 km downstream of the international border (Figure 7). The Alcayaga catchment has been prepared from another DEM, but its area deviates only slightly from the area of the one delineated in this study (see Table 2). The deviances are insignificant considering the uncertainties related to the determination of the *hydrological* catchment in general (see Section 5 below).

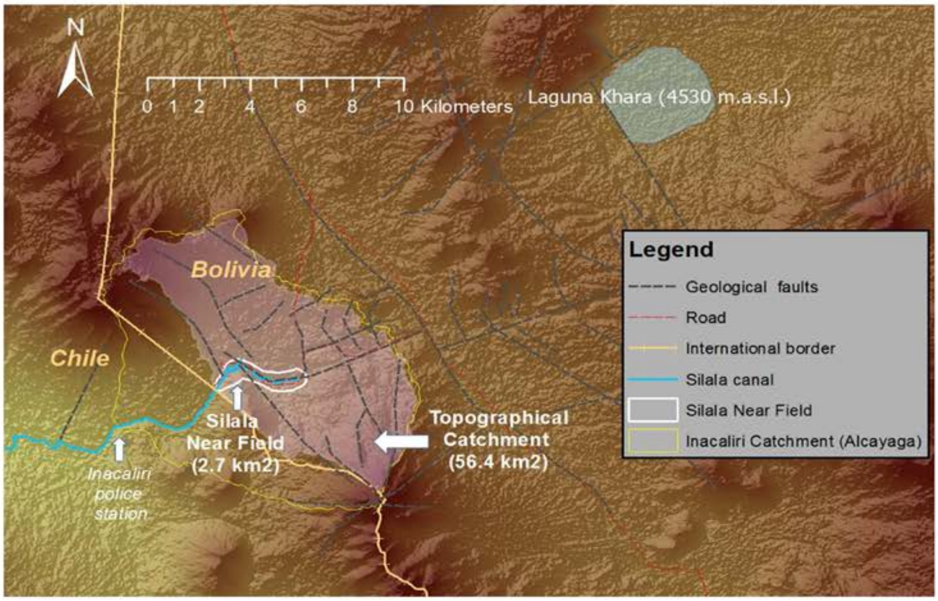

Figure 7 Silala topographical catchment insufficient to maintain the flow at the springs.

Table 1 Areas of various sub catchments that contributing to the Silala springs.

Name of catchment or sub catchment	Area (in km^2)
Near Field (sub catchment)	2.7
Topographical from the border less nearfield (sub catchment)	56.4
Topographical from the border incl. nearfield (sub catchment)	59.1
Road catchment (sub catchment)	175.1
Hydrological catchment	234.2

Table 2 Comparison between the topographical catchments for Silala at the Inacaliri police station (Chile) as delineated in this study and by (Alcayaga, 2017), respectively.

Assessment	DHI	Alcayaga	Difference*
Unit	km^2	km^2	%
Total area from the Inacaliri Police station	99.4	95.5	-3.9
Sub area in Bolivia**	69.1	69.0	-0.1
Sub area in Chile	30.3	26.5	-12.5
Catchment upstream of the border***	59.2	-	-

* Difference = (Alcayaga-DHI)/DHI*100

** Includes areas discharging to reaches of the canal downstream the border. These areas are no part of ***

5 The hydrological catchment of the Silala Springs

The hydrological catchment of the Silala Springs (the Far Field area) is the full area contributing to the discharge through the springs and canals on the Bolivian territory. This catchment is larger than the previously discussed topographical catchment and relevant for water balance estimates or the Silala Springs and to assess possible origins of the flows.

Upstream of the topographical catchment to the Silala Springs an area of 175.1 km² along the road between Tayka del Desierto and Laguna Colorada drains topographically towards minor depressions very close to the upstream boundary of Silala's topographical catchment.

Geological mapping (SERGEOMIN, 2003) has identified a major fracture zone crossing the topographical divide of the Silala topographical catchment. The hydrogeological field exploration as executed by Diremar in 2017 has found this fracture zone as well as the regional ignimbrite layers to have significant hydraulic conductivity and hydraulic gradients towards the Silala Springs (see Annex F). The fractures and ignimbrites will drain the "road catchment" area sub-superficially to the Silala and form a combined hydrological catchment as shown in Figure 8 with a total area of 234.2 km² (231.5 km² excluding the Near Field).

The hydrological catchment delineated in Figure 8 is assumed to be hydrologically representative for the precipitation, evaporation, soil types and infiltration rates of the Far Field and has been used for the water balance assessments (Annex E). Although it may not represent the exact extension of the Far Field, it has been found capable of generating water in an order of magnitude similar to the observed and modelled cross border flows.

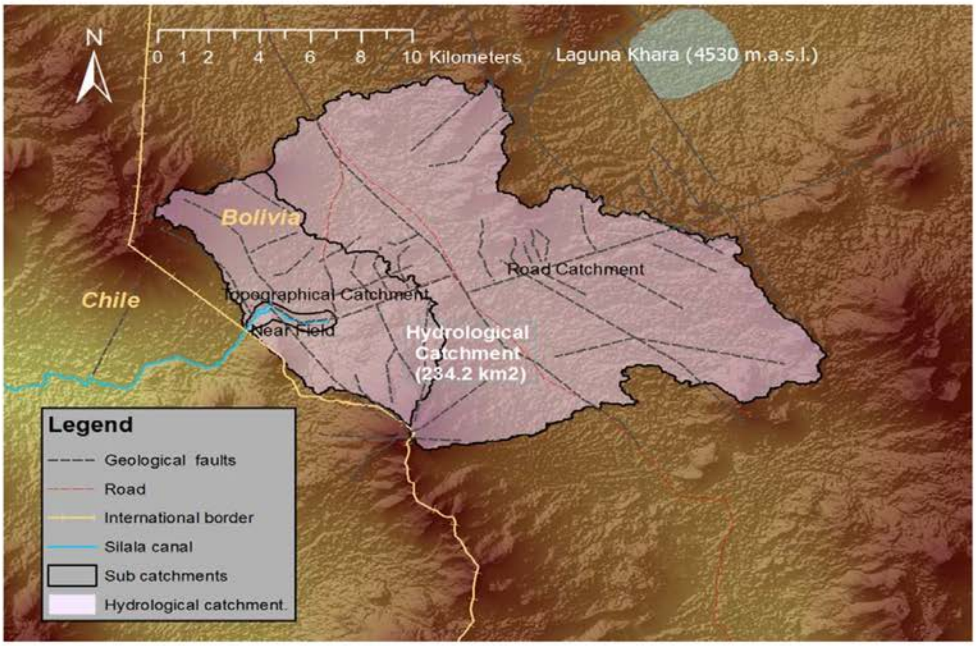

Figure 8 The hydrological catchment of the Silala Springs.

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Danish Hydraulic Institute (DHI), *Study of the Flows in the Silala Wetlands and Springs System*, 2018

Annex B: Climate Analysis

(Original in English)

Contract CDP-I No 01/2018, Study of the Flows in the Silala Wetlands and Springs System

Product No. 2 – 2018 Final Report

Annex B : Climate Analysis

Plurinational State of Bolivia, Ministry of Foreign Affairs, Diremar

July 16, 2018

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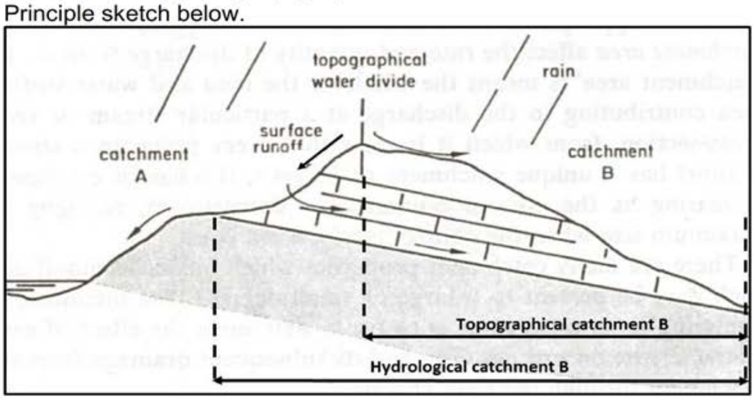
Glossary

Term	*Meaning/Definition*
Aquifer	Geological formation capable of storing, transmitting and yielding exploitable quantities of water.
Austral summer	Summer period in the Southern Hemisphere.
Basin	Area having a common outlet for its surface runoff.
Catchment	The whole of the land and water surface contributing to the discharge at particular stream cross section. This means that any cross section of a stream will have a unique catchment of its own. (Wilson, 1978).
Confined aquifer	Confined aquifers are aquifers that are overlain by a confining layer, often made up of clay or other geological formations with low permeability.
Depression, terrain depression or sink	A depression (or sink) is a low point in the terrain surrounded by higher ground in all directions. If the soil is impervious, the depression collects rain water from a local catchment. Surface water or groundwater inflows will accumulate in the depression until: - the water level reaches the nearest terrain threshold and runs off or - the evaporation from the depression is equal to its combined surface water groundwater inflows. However, a depression may also drain sub-superficially to lower lying areas through pervious soils, geological faults or groundwater aquifers.
Desert climate	Desert climate (in the Köppen climate classification BWh and BWk, sometimes also BWn), also known as an arid climate, is a climate in which precipitation is too low to sustain any vegetation at all, or at most a very scanty shrub and does not meet the criteria to be classified as a polar climate.
Digital elevation model (DEM)	Data files holding terrain levels often organised in a quadratic grid with a certain cell size (e.g. 30m by 30 m). They are very convenient tools for and often used as standard tools in Geographic Information Systems (GIS) for delineation of topographical catchment and for many other purposes.
Discharge	Volume of water flowing per unit time, for example through a river cross-section or from a spring or a well.
El Niño	El Niño is the warm phase of the El Niño Southern Oscillation (commonly called ENSO) and is associated with a band of warm ocean water that develops in the central and east-central equatorial Pacific (between approximately the International Date Line and 120°W), including off the Pacific coast of South America. El Niño Southern Oscillation refers to the cycle of warm and cold temperatures, as measured by sea surface temperature (SST) of the tropical central and eastern Pacific Ocean. El Niño is accompanied by high air pressure in the western Pacific and low air pressure in the eastern Pacific. The cool phase of ENSO is called "La Niña" with SST in the eastern Pacific below average and air pressures high in the eastern and low in western Pacific. The ENSO cycle, both El Niño and La Niña, causes global changes of both temperatures and rainfall.

Evapotranspiration	Combination of evaporation from free water and soil surfaces and transpiration of water from plant surfaces to the atmosphere.
Food and Agriculture Organization of the United Nations (FAO)	Specialized agency of the United Nations that leads international efforts to defeat hunger. FAO is also a source of knowledge and information, and helps developing countries in transition modernize and improve agriculture, forestry and fisheries practices, ensuring good nutrition and food security for all.
Geographic Information System (GIS)	A geographic information system (GIS) is a system designed to capture, store, manipulate, analyse, manage, and present spatial or geographic data.
Groundwater	Subsurface water occupying the saturated zone (i.e. where the pore spaces (or open fractures) of a porous medium are full of water).
Hydrogeological Conceptual Model (HCM)	The conceptual understanding of the individual components in a hydrologic system (i.e. groundwater, surface water, and recharge) and the processes involved between each component.
Hydrogeological Framework Model (HGFM)	A three-dimensional geologic model that defines the spatial extent of stratigraphic and structural features. The development of the HGFM incorporates topographic, geologic, geophysical, and hydrogeologic datasets.
Hydrological catchment	The hydrological catchment is the total area contributing to the discharge at a certain point. The hydrological catchment includes all the surface water from rainfall runoff, snowmelt, and nearby streams that run downslope towards a shared outlet, *as well as* the groundwater underneath the earth's surface. Since groundwater may cross the topographical divides a hydrological catchment to a point may be larger than the corresponding topographical catchment as indicated in the Principle sketch below. 
Infiltration	The movement of water from the surface of the land into the subsurface.
Penman-Monteith	Method for estimating reference evapotranspiration (Et0) from meteorological data. It is a method with strong likelihood of correctly predicting ETo in a wide range of locations and climates and has provision for application in data-short situations.
Recharge	Contribution of water to an aquifer by infiltration.

Reference evapotranspiration (Et_0)	The evapotranspiration per area unit under local climate conditions from a hypothetical grass reference crop with an assumed crop height of 0.12 m, a fixed surface resistance of 70 s m^{-1} and an albedo of 0.23. The reference surface closely resembles an extensive surface of green, well-watered grass of uniform height, actively growing and completely shading the ground. A good approximation to the maximum evapotranspiration that under a certain climate can evaporate from an area unit covered by an ever-wet short green vegetation (e.g. a wetland)
Remote sensing	Acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to on-site observation. In current usage, the term "remote sensing" generally refers to the use of satellite- or aircraft-based sensor technologies to detect and classify objects on Earth, including on the surface and in the atmosphere and oceans, based on propagated signals (e.g. electromagnetic radiation).
Satellite	Artificial body placed in orbit round the earth or another planet in order to collect information or for communication.
Sensitivity analysis	Sensitivity analysis is the study of how the uncertainty in the output of a mathematical model or system (numerical or otherwise) can be apportioned to different sources of uncertainty in its inputs.
Spatial variation	When a quantity that is measured at different spatial locations exhibits values that differ across the locations.
Spring	A spring is a place where groundwater emerges naturally from the rock or soil. The forcing of the spring to the surface can be the result of a confined aquifer in which the recharge area of the spring water table rests at a higher elevation than that of the outlet. Spring water forced to the surface by elevated sources are artesian wells. Non-artesian springs may simply flow from a higher elevation through the earth to a lower elevation and exit in the form of a spring, using the ground like a drainage pipe. Still other springs are the result of pressure from an underground source in the earth, in the form of volcanic activity. The result can be water at elevated temperature such as a hot spring.
Topographical catchment	A catchment delineated strictly by topographical divides of the terrain. The topographical catchment includes all the surface water from rainfall runoff, snowmelt, and nearby streams that run downslope towards a shared outlet. This is the correct catchment if all discharge is surface flow (i.e. no groundwater). The topographical catchment is often a good approximation to the catchment, particularly for larger catchments.
Weather station	A facility, either on land or sea, with instruments and equipment for measuring atmospheric conditions to provide information for weather forecasts and to study the weather and climate.
Wetland	A wetland is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil. Wetlands play a number of roles in the environment, principally water purification, flood control, carbon sink and shoreline stability.

1 Introduction

This annex to the final report of the study of the flows in the Silala Wetlands and Springs System documents an analysis of the climate of the Silala Springs System in Bolivia close to the Chilean border.

Silala has a desert climate with highly variable precipitation from year to year. As the water of the Silala Springs is very old and the observed discharge exhibits limited seasonality, climate influences on the spring discharge act over a long period of time (several years or possibly longer). An assessment of the recharge conditions in the Silala catchment as well as detailed analyses of the impact of the manmade canals in the Silala Springs nearfield therefore requires consistent and reliable climate data input, in the form of multi-year time series of precipitation, reference evapotranspiration (Et0) and temperature.

This annex presents the available climate data for the area including precipitation, evapotranspiration and temperature, and our analyses of their spatial and temporal variations. It gives our best estimates of long-term distributed climate series, to be used in the catchment water balance studies described in Annex E and in the detailed integrated groundwater - surface water studies of the Silala Nearfield, see Annex H and Annex G. The density of climate stations in the area is low and the harsh climate conditions in combination with the remote location reduces the accuracy of some records. Since the most relevant climate parameters (precipitation, potential evaporation and temperature) all vary significantly in mountain areas, it is however important to make use of local data.

The analysis is therefore based on the most reliable long-term climate series from locations close to the Silala wetland and springs system combined with satellite observations of the spatial variation of the most essential climate variables inside the catchment areas.

2 Precipitation

Daily records of precipitation are available for a number of stations in and around the Silala catchment in both Bolivia and Chile. Senamhi (the Bolivian secretariat for meteorology and hydrology) has provided data for three stations in Bolivia (SENAMHI, 2017) and station data has been extracted for six stations operated by Direción General de Aguas (DGA) in Chile. The stations are listed in Table 1 and the locations are shown in Figure 1.

It should be noted that station data for Laguna Colorada is both available for a period from 1979-2001 and more recently from 2010-2017. However, the new Senamhi weather station was out of order for part of the period from 2010 to2015. For the earlier period, the rainfall data looks reasonable with an annual average of 59 mm/year, although this seems low compared to the other longer records from DGA (see discussion below). For this analysis, the earlier data for Laguna Colorada from 1979-2001 have been used and the more more recent data have been disregarded.

The data record for Silala from Senamhi has large gaps in parts of the record and a full record is only available for 2012 and 2013. Furthermore, in 2012, only 17 mm/year was recorded compared to 248 mm/year at DGA Silala and Inacaliri. In 2013, rainfall was also low at 43 mm/year versus 80 mm/year at DGA Silala and 91 mm/year at DGA Inacaliri. While rainfall is expected to vary spatially, it seems strange that the recorded rainfall was so much lower given the close proximity of the stations and could possibly indicate a problem with the Silala rain gauge.

Table 1 Overview of weather stations with rainfall in Bolivia and Chile.

Station	Source	Distance from Silala (km)	Altitude (m.a.s.l)	Period	Years	Used in analysis
Silala***	Senamhi	0	4402	12/6/2013-30/9/2017	4.5	No
Laguna Colorada*	Senamhi	28	4278	1/11/1979-31/8/2001 18/9/2010-25/9/2017	22+ 6	Yes No
Sol de Manana	Senamhi	53	4916	1/1/2012-11/7/2017	5.5	No
Siloli***	DGA	2	4000	25/10/2012-1/8/2017	4.5	No
Inacaliri**	DGA	6	4040	1/2/1969-28/2/2017	48	Yes
Silala**	DGA	2	4305	1/1/2001-28/2/2017	16	Yes
Ollague	DGA	90	3707	1/1/1971-28/2/2017	46	No
Linzor	DGA	25	4100	1/11/1973-31/12/2015	42	Yes
Caspana	DGA	40	3246	12/6/2012-30/9/2017	4	No

**) Very large values for 2010-2017 – likely due to problems with new station*
***) Identical values for longer periods - not raw data but it looks like one station may have been gap filled with values from the other station by DGA*
****) Large gaps in the records*

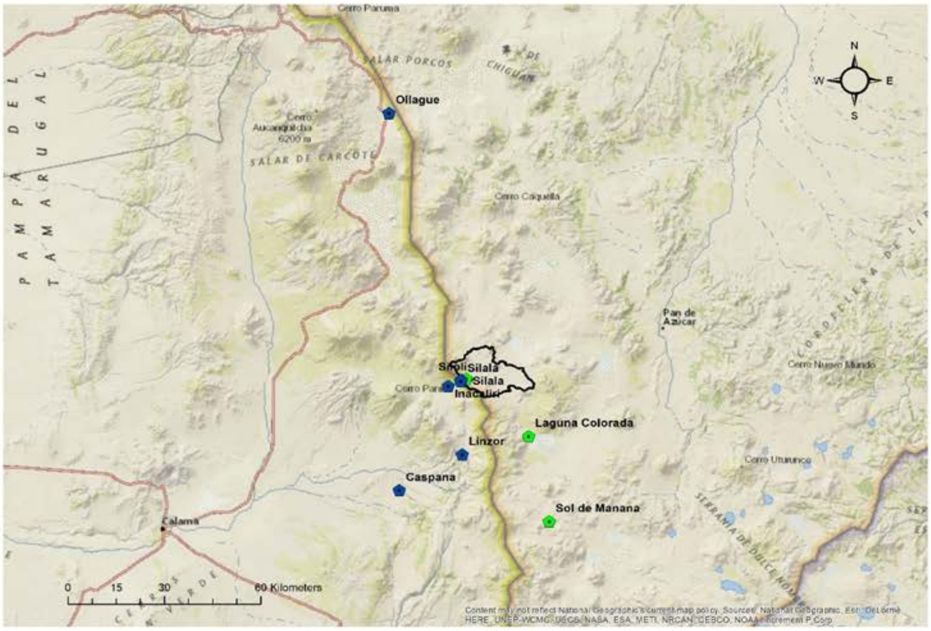


Figure 1 Locations of weather stations with rainfall data in Bolivia and Chile (Senamhi stations in green)

2.1 Annual average rainfall

As the stations in Bolivia generally only have a few years of rainfall and also have several gaps in the records, three stations from DGA in Chile and one long record at Laguna Colorada from Bolivia have been used for analysing the long-term variations in rainfall and to establish a long-term annual average rainfall for the Silala catchment. The other stations are located too far away from the catchment for the data to be representative of the climatology.

The DGA rain gauges at Inacaliri and Silala (hereafter named DGA-Silala) are located closest to the study area and both have long records. However, it was noted that, for some years after 2010, the rainfall is identical at the stations. This could indicate that one of the stations may not have been operating properly and some gap filling was undertaken.

The long-term average annual rainfall at DGA-Silala is 87 mm/year compared to 98 mm/year at Inacaliri for the period from 2001-2017 (16 years). The average rainfall at Inacaliri for the full data period from 1969-2017 (48 years) is 116 mm/year. The other two stations, Linzor and Laguna Colorada, have annual average rainfall of 152 mm/year for 1974-2015 and 59 mm/year for 1980-2000, respectively. However, the record at Laguna Colorada has large gaps for some years and if these years are removed from the calculation, the average rainfall is 64 mm/year. Figure 2 shows the annual rainfall for the four stations.

It is evident from the data that there are large variations in the average annual rainfall between stations. Particularly at Laguna Colorada the annual rainfall is very low compared with the stations located closer to the catchment whereas the rainfall at Linzor is much higher. As all four stations are located at approximately the same altitude, the differences in elevation do not explain the differences in annual rainfall. For the water balance estimation, the rainfall at DGA Inacaliri and DGA Silala are considered to be most representative of the catchment climate but the data from Linzor and Laguna Colorada have also been considered in a sensitivity analysis.

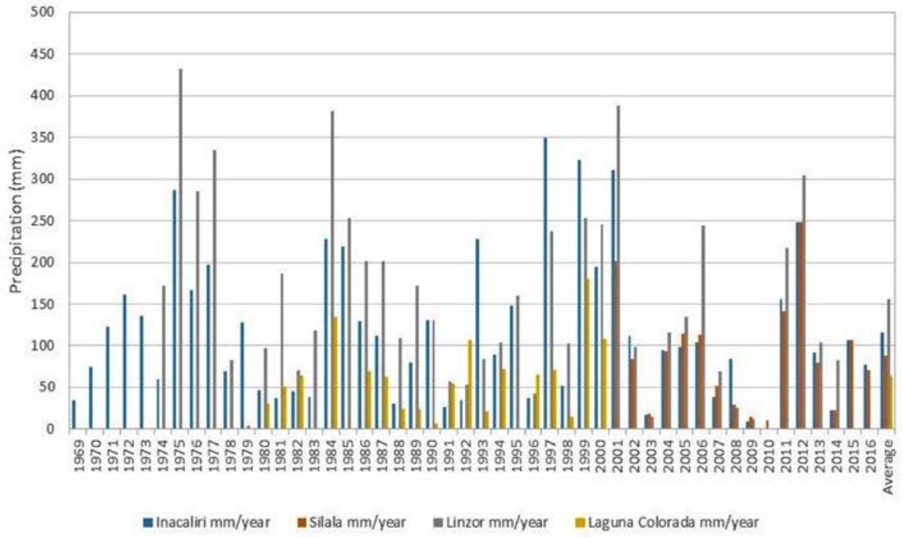


Figure 2 Annual precipitation at Inacaliri, Silala, Linzor and Laguna Colorada.

2.2 Annual and seasonal variation

The inter-annual variation in precipitation is very high, as illustrated in Figure 2 above and in Figure 3, which shows the annual rainfall at Inacaliri and Silala. The calendar years 2003, 2009 and 2010 were particularly dry years. Although the inter-annual variation may partly be explained by large-scale atmospheric variations such as the El Niño effect, all three years are only moderate El Nino years. On the other hand, 2015 was very strong but was not particularly dry in the records. Hence, the inter-annual variation in precipitation does not seem to have a very strong El Niño correlation. A similar inter-annual pattern is observed at the other DGA stations.

It is also interesting to note that the dry years seem to be drier after 2001 than for the previous period. Whether this and the detected generally lower average precipitation at Inacaliri is due to a general global long-term change in climate or whether it is a local decadal variation cannot be determined from the available data.

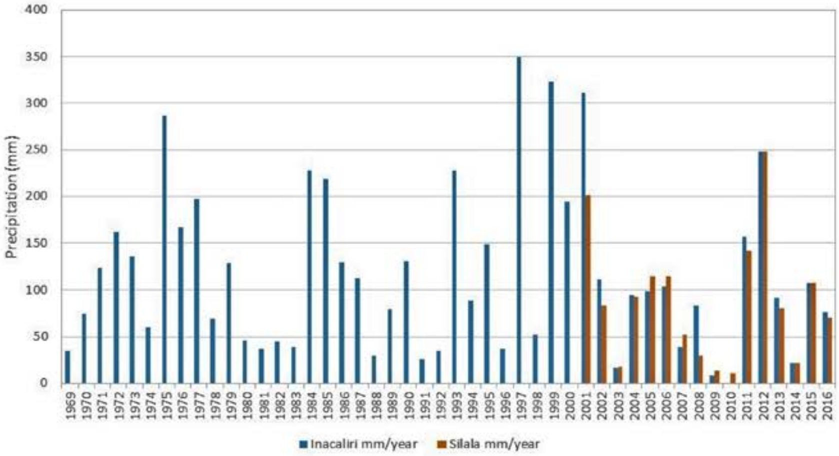


Figure 3 Annual precipitation at the Inacaliri and Silala gauges.

Most of the precipitation in the Silala catchment occurs during the austral summer months between December and March (Figure 4) and very little precipitation is observed during the winter months from April until September. Snow has been recorded and observed in the Silala catchment during the winter but this may not be captured adequately by the weather stations. In fact, the stations inspected on the Bolivian territory were not equipped with instruments suitable for catching snow. The station data from Inacaliri and DGA-Silala has some minor precipitation events during the winter month for some years but no winter precipitation has been observed at the two stations after 2005.

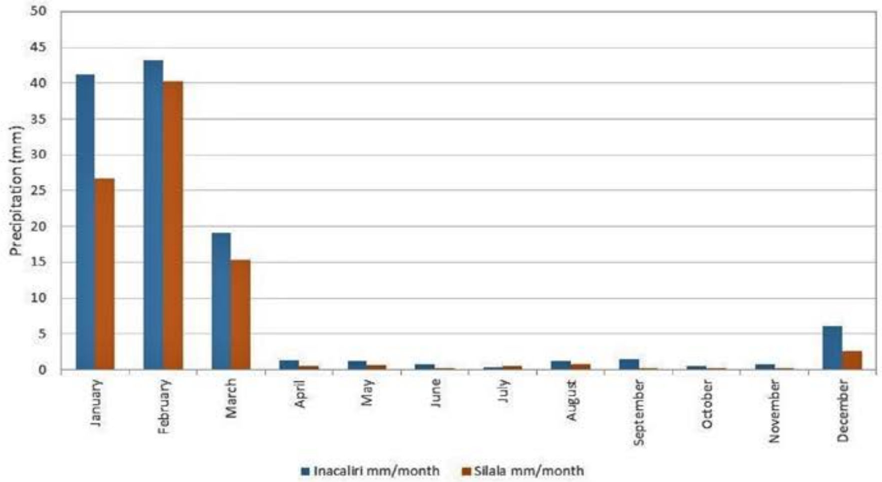


Figure 4 Monthly average precipitation at the Inacaliri (1969-2016) and Silala gauges (2001-2016).

2.3 Snow formation

In order to investigate the importance of snow events in more details, MODIS satellite data (https://modis.gsfc.nasa.gov/data/dataprod/mod10.php) was acquired, with a spatial resolution of 500 m showing the snow cover of the catchment on a daily basis from 2000-2017. Percentage snow cover in the Silala topographic catchment area indicates that some precipitation falls as snow during the winter months. Particularly large snow (wet) events were observed in July 2002, August 2011 and June 2013 (see Figure 5 and Figure 6). However, this was not observed in any of the rain gauge data. Only a small amount of precipitation was recorded at the Inacaliri station in 2002 and none during the other periods. While MODIS provides snow cover, it is not possible to reliably estimate snow depth or snow equivalent from the data alone but they indicate that the gauged precipitation underestimates total precipitation.

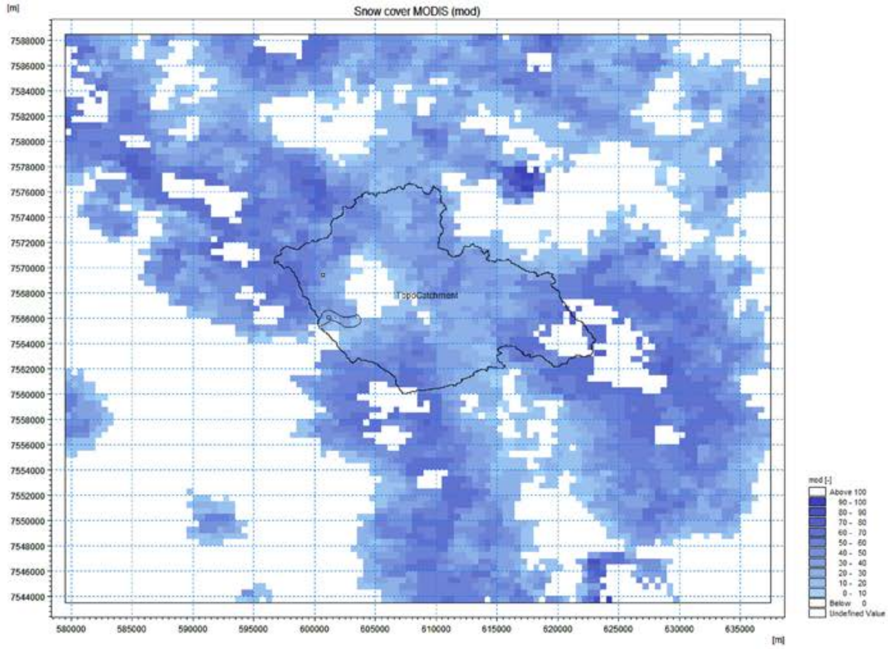


Figure 5 MODIS satellite snow cover in the Silala catchment in June 2013.

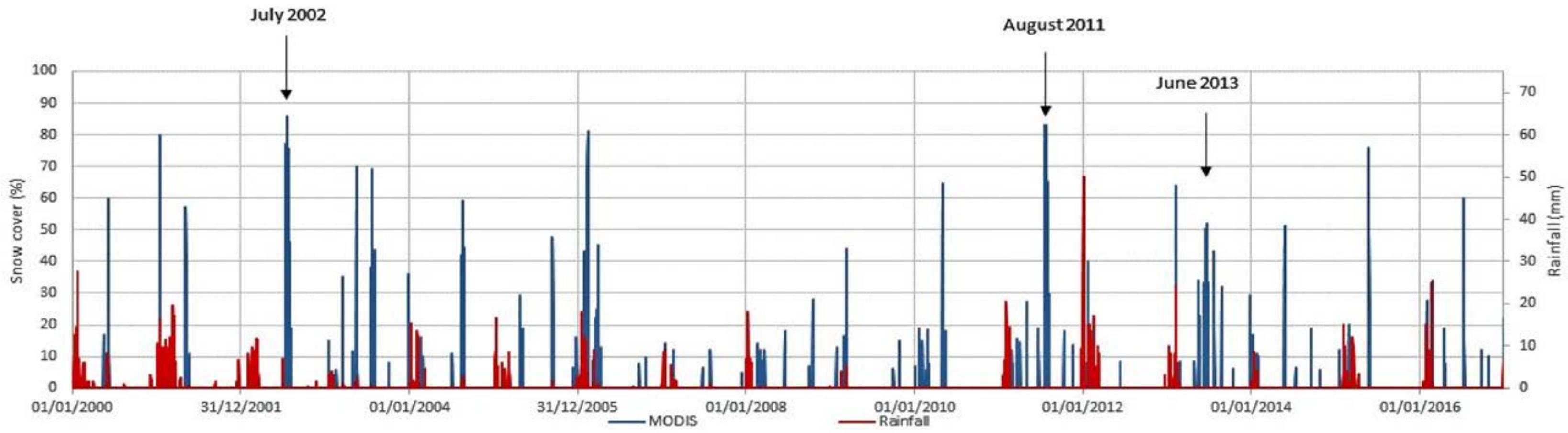


Figure 6 Comparison of satellite snow cover (blue) to the north of the wetland on the ridge with rainfall daily recorded at Inacaliri (red).

2.4 Spatial distribution of rainfall

Due to the limited number of rainfall stations with longer-term rainfall records in and around the Silala catchment area, it is difficult to make a reliable assessment of the spatial distribution of rainfall. Based on long-term rainfall records at a large number of DGA stations in Chile Muñoz, et al., 2017 has developed a simple rainfall-altitude relationship and used it, combined with local elevation data, to make an assessment of the annual average rainfall for the Silala catchment delineated by them. However, there is a large spread in the rainfall data at heights above 3,500 meters as illustrated in Figure 7. It was therefore decided to look at satellite data to see if a more reliable relationship could be established from a combination of station data and local satellite data.

Climate Hazards Group Infrared Precipitation with Station data (CHIRPS) was used for the analysis (http://chg.geog.ucsb.edu/data/chirps). The data consists of daily gridded values with a resolution of 0.05 degrees or approximately 5 km, covering a 30-year period starting in 1981. Other gridded remote sensing rainfall series were also considered for the analysis including TRMM (https://trmm.gsfc.nasa.gov), GPM (https://pmm.nasa.gov/GPM) and PGFv3 (http://stream.princeton.edu/LAFDM/WEBPAGE/) but since these have a much lower spatial resolution (0.25°, 0.1° and 0.25° compared with 0.05°), CHIRPS is considered the best source of distributed precipitation available for the Silala catchment. Furthermore, GPM data is only available for 2015-2017. Persiann data (http://chrsdata.eng.uci.edu/) with a resolution of 0.04 degrees was also considered but as the seasonal rainfall pattern looked unrealistic with rainfall all year the data set was disregarded. According to an analysis of satellite data for Chile performed by (Zambrano-Bifiarini, et al., 2017) PGFv3 and CHIRPS data perform best in the region due to the use of local rain gauges in the bias correction procedure to adjust estimates. It is unclear whether this also applies to Bolivia in the area of interest due to the scarcity of rain gauge data in this region but for the analysis, CHIRPS is currently assessed to be the best available satellite product for looking at the spatial variation of rainfall.

Like the ground station records in the area, the CHIRPS data does not record any precipitation outside the austral summer months. Hence, CHIRPS does not capture any snow events in the winter months. The spatial variation of long-term annual average rainfall indicates that the highest amount of rainfall is seen in the north-eastern part of the Silala catchment, reducing towards the south-west. This is consistent with the fact that precipitation in the basin is mainly caused by convective activity in a north-east south-west direction. More than 90% of the precipitation in the basin occurs between January and March, as a result of atmospheric moisture coming from the east. During the rest of the year, the atmospheric moisture in the air decreases due to dry winds from the west.

Based on the CHIRPS data within and near the Silala catchment, a relation between precipitation and altitude has be established (Figure 8 below). There is a fairly clear correlation in the data at lower altitude (on the Chilean side of the border) but a lot of scatter at elevations above 4000 m. This is similar to what was observed by (Muñoz, et al., 2017) (see Figure 7). Mountainous regions generally pose significant challenges in estimating the spatial variation in rainfall and in this case, a clear relation between altitude and rainfall could not be established.

As an alternative, the spatial distribution of long-term average rainfall was derived from CHIRPS data. Contours based on CHIRPS indicate an increasing amount of rainfall in a northeasterly direction (Figure 9) and no obvious altitude dependency. Annual average rainfall from CHIRPS was checked against station values in the region but no correlation was apparent. However, standard rainfall measurements have limited spatial support and often cannot accurately predict precipitation in certain locations due to the impact of wind, flawed installation, wetting losses, missing snow monitoring equipment and other errors. A map of terrain elevation (shaded) and rain-gauged annual mean rainfall by (Garraud, et al., 2003) shown in Figure 10 supports the tendency for higher rainfall in a north-easterly direction. Overall CHIRPS currently constitutes the best available data for assessing the spatial variation of rainfall given the lack of rain gauges in the catchment.

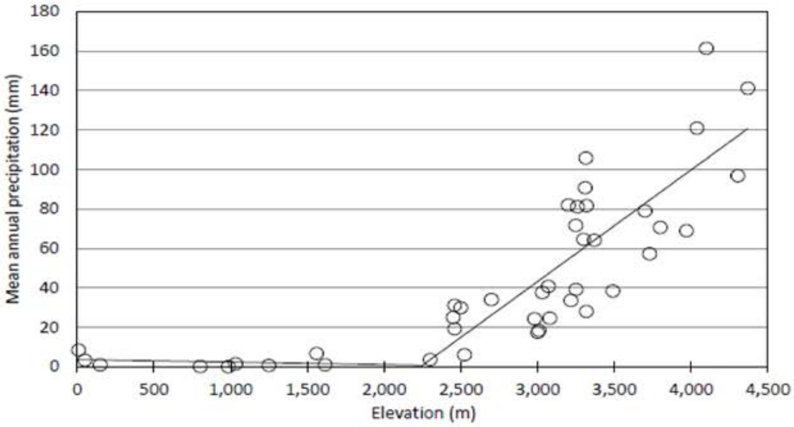


Figure 7 Mean annual precipitation gradients for the stations located in the Second Region, Chile taken from Muñoz et al., 2017.

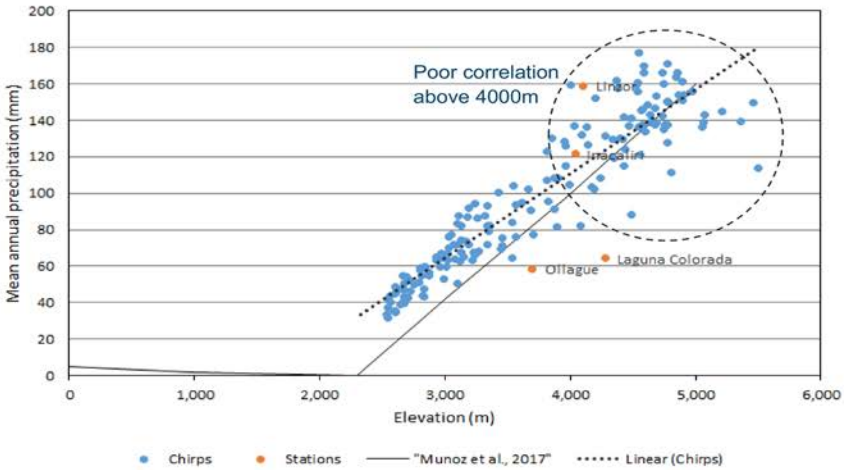


Figure 8 Regional annual average precipitation as a function of altitude based on CHIRPS data from 1981-2017 compared with station data at Silala, Linzor, Ollague and Laguna Colorada and precipitation-elevation relationship derived by Muñoz et al., 2017.

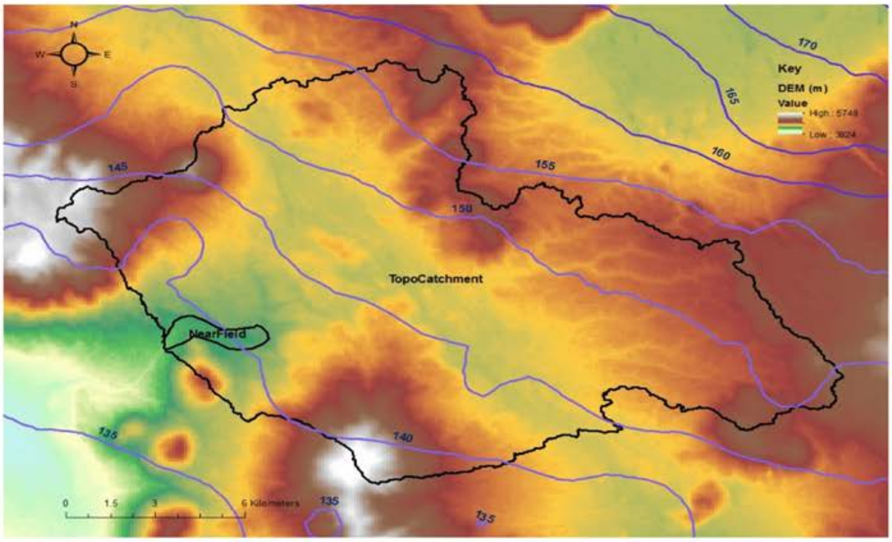


Figure 9 Contours of annual average precipitation over the Silala topographic catchment based on CHIRPS data from 1981-2017 and NASA 30 m DEM.

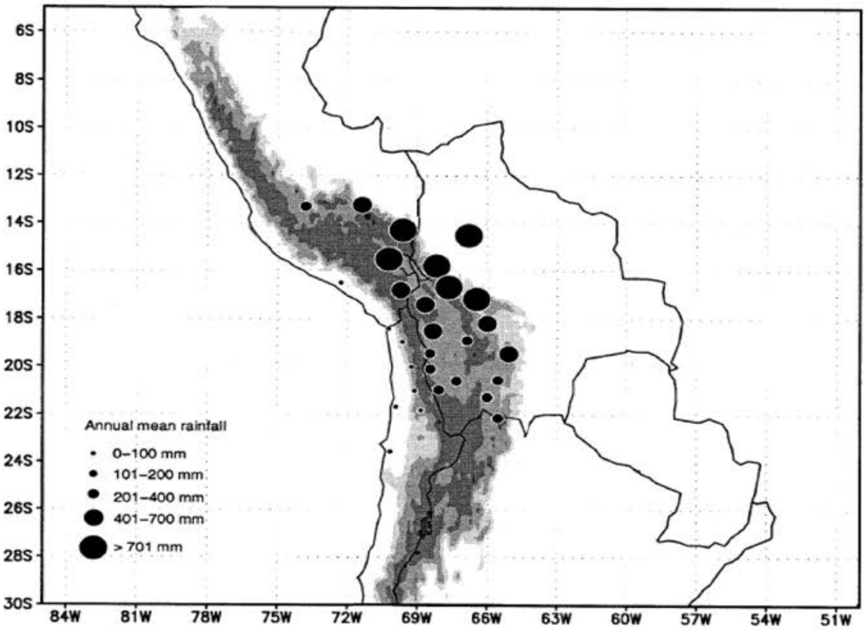


Figure 10 Terrain elevation (shaded) and rain-gauged annual mean rainfall over the central Andes and adjacent lowlands taken from Garraud et. *al.*, 2003

2.5 Catchment rainfall

As input to the water balance assessment, station data at DGA Inacaliri and DGA Silala was used in combination with the distribution from CHIRPS data to generate spatial precipitation distribution estimates across the basin over time. For comparison, the derived precipitation-altitude relation and long-term station data from the Inacaliri weather station was also used to produce an estimate. The combination of local ground station data and spatial variation from CHIRPS data is, however, deemed to give the best estimate of the daily precipitation over the catchment.

The average annual rainfall obtained from using Inacaliri and Silala combined with the CHIRPS rainfall distribution is 125 mm/year for Inacaliri (48 years) and 94 mm/year for Silala (16 years). The annual rainfall using Inacaliri for the shorter period from 2001-2016 is 101 mm/day. This is lower than the rainfall obtained using Inacaliri combined with the rainfall-altitude relation of 137 mm/year and the value derived by Muñoz et al., 2017 of 165 mm/year, which was based on Chilean regional data processed to represent a smaller catchment area the one used in our analyses. For comparison, the average annual precipitation based directly on area weighted CHIRPS data for the Silala catchment is 146 mm/year, about 20% higher than using the Inacaliri station data. Using Linzor and Laguna Colorada instead of Inacaliri or Silala the annual catchment rainfall is 164 mm/year and 64 mm/year, respectively .

It is clear from the analysis that catchment rainfall is uncertain due to the variation in station rainfall. The combination of station data from Inacaliri with CHIRPS data is currently deemed to provide the best estimate of long-term annual average rainfall due to the close vicinity of the station to the catchment and length of the record. However, data from the other stations have been included in the water balance assessment in a sensitivity analysis.

3 Evapotranspiration

Potential reference evapotranspiration records (Et_0) have been calculated using weather station data provided by Senamhi for three weather stations: Silala, Laguna Colorada and Sol de Manana listed in Table 2. Furthermore, daily potential evapotranspiration was collated for seven stations in Chile also included in the Table. Data for the Bolivian stations comprise of mean, max and minimum daily temperatures, mean relative humidity, solar radiation and wind speed, which have been used for estimating daily potential evapotranspiration rates. Due to their large distances from the Silala Springs, the potential evapotranspiration from the Chilean stations have been used only for reference to get a rough estimate of the likely range of evapotranspiration for comparison with the calculated values for the Bolivian stations.

Table 2 Overview of weather stations in Bolivia used for reference evapotranspiration (Et_0) estimation and Et_0 provided for stations in Chile.

Station	Source	Distance from Silala (km)	Altitude (m.a.s.l)	Period	Years
Silala	Senamhi	0	4402	15/6/2013-30/9/2017	4.5
Laguna Colorada	Senamhi	28	4278	18/9/2010-25/9/2017	6
Sol de Manana	Senamhi	53	4916	14/5/2011-11/7/2017	5.5
Socaire	DGA	177	3276	18/11/2010-18/5/2017	6.5
Toconao	DGA	130	2480	4/9/2010-18/5/2017	6.5
Caspana	DGA	40	3246	1/12/2012-18/5/2017	4.5
San Pedro de Atacama	DGA	104	2419	18/11/2010-18/5/2017	6.5
Chiu Chiu*	DGA	73	2560	3/9/2010-18/5/2017	6.5
Calama Rural	DGA	107	2248	11/9/2010-18/5/2017	6.5
Ollague*	DGA	90	3707	17/12/2010-18/5/2017	6.5

** Large gaps in the records*

Estimates have been derived using the Et_0 calculator, a software tool developed by the Land and Water Division of FAO (http://www.fao.org/land-water/databases-and-software/ Et_0-calculator/en/), which calculates reference evapotranspiration (Et_0) according to FAO standards based on temperatures, mean relative humidity, solar radiation and wind speed using the Penman-Monteith equation. The method is recognized worldwide for reliable approximations of Et_0 over a wide range of locations with different climates. It is physically based and explicitly incorporates both physiological and aerodynamic parameters.

3.1 Annual average reference evapotranspiration

Figure 11 shows the potential evapotranspiration estimates for the three locations in Bolivia. For Silala, the evapotranspiration is higher in 2013/14 than later years, which is due to an abrupt change in average wind speeds in 2014, from around 12 m/s to less than 5 m/s. This indicates some problems with the station. Unfortunately, it has not been possible to establish what has caused the change. For Laguna Colorada, reference evapotranspiration is generally higher than for the other two stations, which is mainly due to high average wind speeds of 15 m/s. At Sol de Manana, the average wind speed is less than half (7 m/s). This indicates that the potential evapotranspiration is highly sensitive to wind speeds in this region.

The average annual Et_0 ranges from 1268 mm/year at Sol de Manana to 1940 mm/year at Laguna Colorada with around 1472 mm/year at Silala. Compared to the range of Et_0 from nearby Chilean DGA stations (Figure 11), these values seem reasonable.

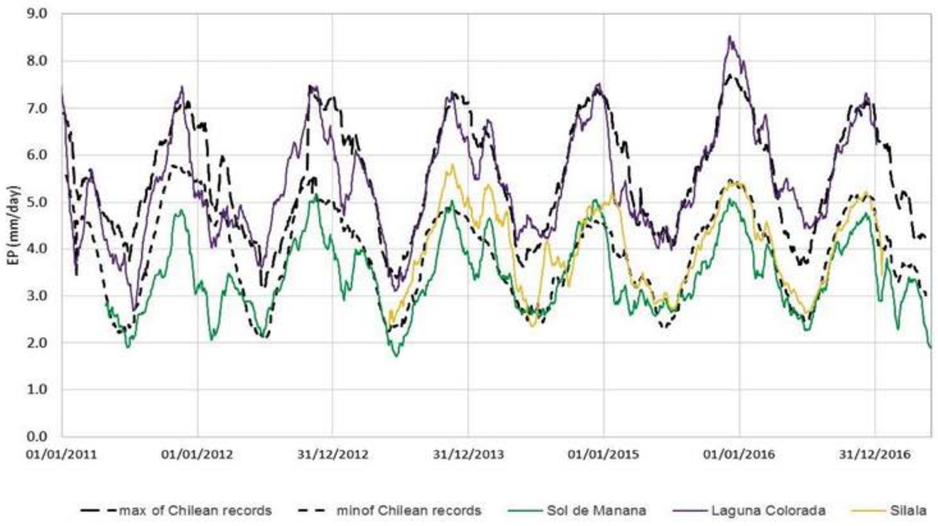


Figure 11 FAO reference Et_0 for Silala, Laguna Colorada and Sol de Manana (30 day moving averages) compared with the range (min to max daily values) of 7 nearby Stations from DGA Chile.

3.2 Spatial variation of reference evapotranspiration

The relationship between elevation and average annual evapotranspiration rates for the three Bolivian stations and five DGA stations is shown in Figure 12. Although a downward trend in evapotranspiration with elevation is detected, it is small (-100mm/1000m) corresponding to less than 7% change in EP rate of the Silala station, over the whole altitude range of the Silala catchment. Furthermore, the slope of the trend line is uncertain due to the large spread in the data. Consequently, the potential evaporation has been assumed to be uniformly distributed over the catchment.

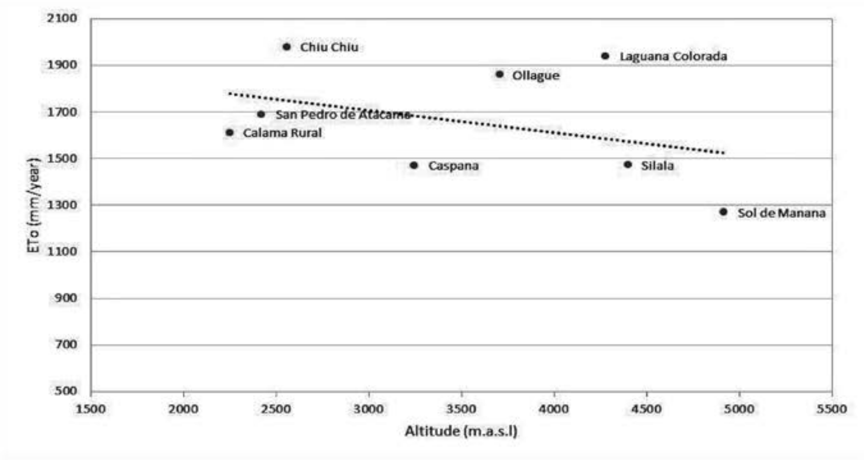


Figure 12 Regional annual reference Et_0 as a function of altitude.

3.3 Catchment reference evapotranspiration

Since the Silala station is located inside the catchment, the series from this station is deemed to be most representative for the catchment conditions. In order to use the data for the water balance assessment the time series had to be extended to cover a longer period corresponding to the period covered by rainfall at Inacaliri.

Two different approaches were employed. The first approach simply repeats the time series back in time to form a long multiyear time series. However, with this approach short-term anomalies in the data could result in unrealistic evapotranspiration in some years. In order to avoid this a second approach was used where an average evapotranspiration record was generated for one year by averaging the daily values and then calculating a 15-day moving average (see Figure 13 below). According to the graph, similar trends are apparent in the records for all three stations and this pattern is also observed in the raw data for individual years. The reference evapotranspiration for the average year was repeated to form a long record.

To account for the uncertainty illustrated by the rather large differences in ET_0 levels between the three Bolivian stations, a sensitivity analysis of the impact on the modelled groundwater recharge was undertaken for the water balance assessment. This was performed by looking at the effect of using the long average annual record at Silala repeated for the whole period compared with the series from Sol de Mañana and Laguna Colorada, respectively.

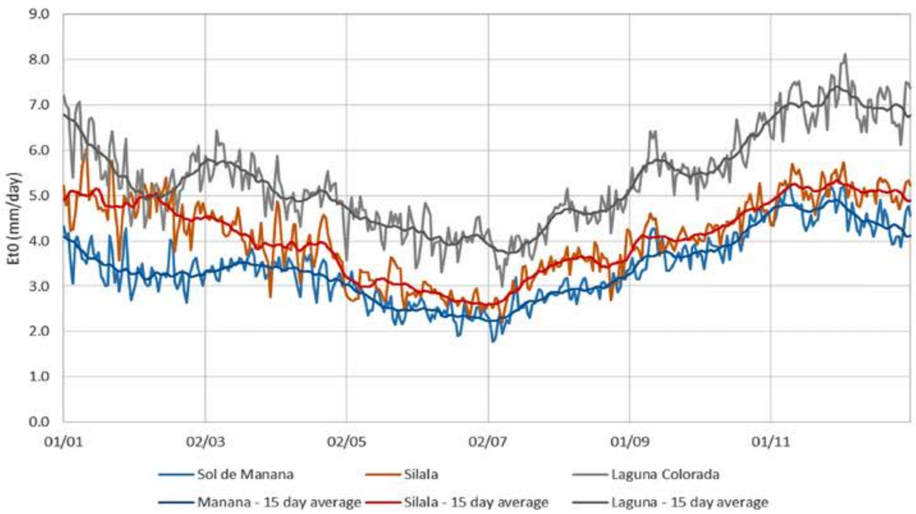


Figure 13 Average daily reference Et_0 for stations Silala, Laguna Colorada and Sol de Manana including 15 day- moving averages. An average value for each day of the year has been calculated for each station for the periods in Table 2.

4 Temperature

Daily temperature records for three Bolivian weather stations in Table 3 below have been used in the analysis and longer-term daily records have also been collected for two Chilean DGA stations: Inacaliri and Linzor. Hourly temperature data are available at Laguna Colorada.

Table 3 Overview of weather stations in Bolivia and Chile with temperature data.

Station	Source	Distance from Silala (km)	Altitude (m.a.s.l)	Frequency	Period	Years
Silala	Senamhi	0	4402	Daily	15/6/2013-31/7/2017	4.5
Laguna Colorada	Senamhi	28	4278	Daily Hourly	18/9/2010-25/9/2017 17/10/2010-25/9/2017	5.5 5.5
Sol de Manana	Senamhi	53	4916	Daily	14/5/2011-11/7/2017	6
Inacaliri	DGA	6	4040	Daily	8/1/1969-31/12/1981	13
Linzor	DGA	25	4100	Daily	28/1/1973-31/12/1986	14

4.1 Annual average temperature and spatial variation

The annual average temperature varies considerably between stations, with an average temperature at Inacaliri of 5.71 °C compared with 1.49 °C at Silala. The lowest average annual temperature of -0.4 °C was observed at Sol de Manana.

The temperature gradient based on this dataset as a function of elevation is illustrated in Figure 14. It should be noted that the average temperature was calculated for different time periods. However, the gradient is still quite clear from the graph. At an altitude between 4 and 5 kilometers, this corresponds to a reduction in temperature of 7.1 °C/km compared to 4.6 °C derived by Muñoz et al., 2017 who used station data for a larger region. 7.1 °C/km is also high compared to general global numbers of 4-6 °C/km but the regression of the nearby stations in Figure 14 seems to strongly support this lapse rate.

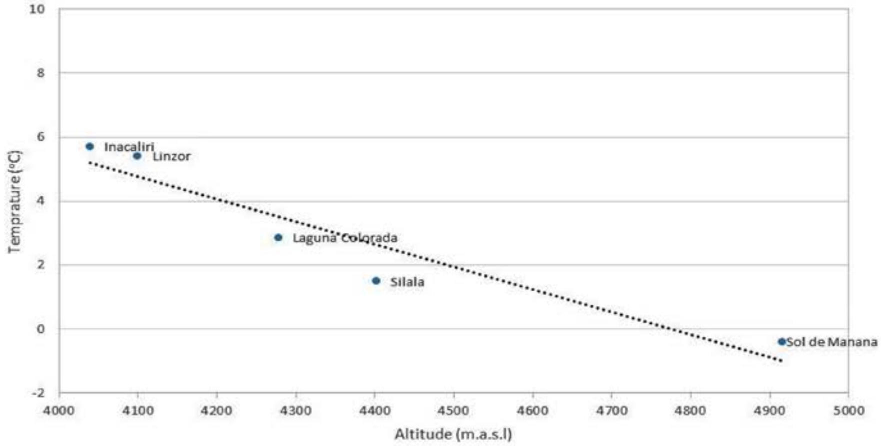


Figure 14 Annual mean temperature gradient as a function of altitude.

4.2 Catchment temperature

Based on the daily time series records from Inacaliri, Linzor, Silala and Laguna Colorada, a long-term time series of daily temperature for the period 1969-2017 representative for Silala has been constructed. However, data for the period 1986-2010 is not available and has therefore been gap-filled with data from Laguna Colorada and Silala from 2011-2016.

In order to be able to model snow formation and melting as accurately as possible, hourly temperature data has been used for the water balance assessment. Hourly data for Laguna Colorada for the period 2011-2016 was used for testing a diurnal model developed by De Wit et al. (1978) (Reference 18). Based on average, minimum and maximum daily temperature can be used for generating hourly data. This method was then used for converting daily data at Silala for 2016 into hourly data. As minimum and maximum values were not readily available for the Chilean stations, the hourly data from 2011-2016 based on Laguna Colorada and Silala data have been used for long-term water balance calculations.

An analysis of the temperature data showed that the annual average temperature is 2.2 °C with a minimum annual average temperature of 1.9 °C and maximum of 3 °C. Maximum daily temperatures are in the range 17.3-21.5 °C with an average of 19.6 °C. Minimum temperatures vary more between -24 °C to -16 °C with an average of -19.6 °C. Overall, the inter-annual temperature pattern is fairly similar.

It was therefore considered most reasonable to repeat the data for the period from 1969-2010 in order to generate a long-term temperature time series. Some variation in temperatures for specific years will not be captured and this could have some impact on snow formation for the earlier period. However, as some of the snow events in the austral winter months are not captured in the rainfall data, this is a more important influence on accuracy and may mean that infiltration rates using the rainfall data may be slightly underestimated for some years. For the water balance assessment, the long-term hourly record is used in combination with the temperature-altitude relationship to describe temperature across the catchment.

5 Summary

Climate time series have been determined for the Silala catchment by combining local ground based observations, from within the catchment or very close to it, with the terrain information of the catchment. Where local ground based data have been insufficient to construct reliable spatial climate variations satellite observations of the local area have been used. This combination of ground based and remote sensing observations of the local area is assessed to provide more reliable local estimates for the Silala catchment than trying to correlate observations over long distances for other catchments with different characteristics as presented by (Muñoz, et al., 2017).

The main findings of the analysis are summarised here:

- Rainfall for the hydrological catchment is highly uncertain due to a shortage of rainfall gauges in the area. The combination of station data from Inacaliri with satellite data (CHIRPS) is currently deemed to provide the best estimate of long-term annual average rainfall due to the close vicinity of the station to the catchment and length of the record. Average rainfall is 125 mm/year for Inacaliri (48 years) which is 25% lower than the 165 mm/year derived by Muñoz et al., 2017 for the smaller topographic catchment.

- Mountainous regions generally pose significant challenges in estimating the spatial variation in rainfall. Simple rainfall-altitude relationships could not be established with any certainty in the mountainous areas at heights above 3,500 meters. As an alternative, the spatial distribution of long-term average rainfall was derived from satellite data. This was deemed more reliable although it could not be verified by station data. Given the lack of long term raingauge observations in the catchment, its relatively high spatial resolution and long consistent record, the CHIRPS satellite data set currently constitutes the best available data for assessing the spatial variation of rainfall.

- The inter-annual variation in precipitation is very high and although the variation may partly be explained by large-scale atmospheric variations such as the El Niño effect, the correlation does not seem to be very strong. The precipitation in the Silala catchment is mainly caused by convective activity in a north-east south-westerly direction with most of the precipitation occurring during the austral summer months between December and March and very little precipitation during the winter months from April until September.

- Snow has been observed in the Silala catchment during the austral winter months and also recorded from satellites but is not captured by the existing weather stations as these are not generally equipped with snow monitoring equipment. Snow events were not captured by any of the rain gauges although satellite images and anecdotal evidence point to snow being of importance for precipitation. Gauging station rainfall is therefore most likely underestimated but it is not possible to quantify by how much based on available satellite information.

- Evapotranspiration (ET_0) from the Silala weather station (1472 mm/year) is assessed to be most representative for the catchment conditions being located inside the catchment. In order to use the data for a water balance assessment the time series have been extended to cover a longer period corresponding to the period covered by rainfall at Inacaliri (1969-2016).
- Long term average hourly temperature records at Silala have been constructed based on station data from Laguna Colorada and Silala for the period 2011-2016 which have been repeated to form a long-time series. An altitude temperature gradient of 7.1 °C/km was very clearly seen in the station data compared to 4.6 °C derived by Muñoz et al., 2017 who used station data for a larger region. The annual average temperature for the Catchments is assessed at 2.2 °C a temperature variation over the year from -24 °C to 21.5°C.

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Danish Hydraulic Institute (DHI), *Study of the Flows in the Silala Wetlands and Springs System,* 2018

Annex C: Surface Waters

(Original in English)

Contract CDP-I No 01/2018, Study of the Flows in the Silala Wetlands and Springs System

Product No. 2 – 2018 Final Report

Annex C: Surface Waters

Plurinational State of Bolivia, Ministry of Foreign Affairs, Diremar

July 16, 2018

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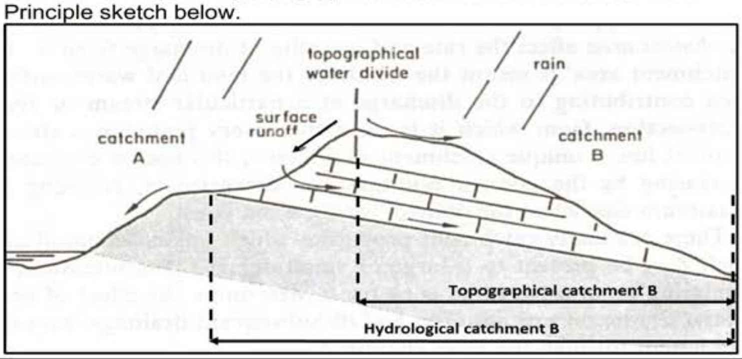
Glossary

Term	*Meaning/Definition*
Aquifer	Geological formation capable of storing, transmitting and yielding exploitable quantities of water.
Austral summer	Summer period in the Southern Hemisphere.
Basin	Area having a common outlet for its surface runoff.
Catchment	The whole of the land and water surface contributing to the discharge at particular stream cross section. This means that any cross section of a stream will have a unique catchment of its own. (Wilson, 1978).
Confined aquifer	Confined aquifers are aquifers that are overlain by a confining layer, often made up of clay or other geological formations with low permeability.
Depression, terrain depression or sink	A depression (or sink) is a low point in the terrain surrounded by higher ground in all directions. If the soil is impervious, the depression collects rain water from a local catchment. Surface water or groundwater inflows will accumulate in the depression until: - the water level reaches the nearest terrain threshold and runs off or - the evaporation from the depression is equal to its combined surface water groundwater inflows. However, a depression may also drain sub-superficially to lower lying areas through pervious soils, geological faults or groundwater aquifers.
Desert climate	Desert climate (in the Köppen climate classification BWh and BWk, sometimes also BWn), also known as an arid climate, is a climate in which precipitation is too low to sustain any vegetation at all, or at most a very scanty shrub and does not meet the criteria to be classified as a polar climate.
Digital elevation model (DEM)	Data files holding terrain levels often organised in a quadratic grid with a certain cell size (e.g. 30m by 30 m). They are very convenient tools for and often used as standard tools in Geographic Information Systems (GIS) for delineation of topographical catchment and for many other purposes.
Discharge	Volume of water flowing per unit time, for example through a river cross-section or from a spring or a well.
El Niño	El Niño is the warm phase of the El Niño Southern Oscillation (commonly called ENSO) and is associated with a band of warm ocean water that develops in the central and east-central equatorial Pacific (between approximately the International Date Line and 120°W), including off the Pacific coast of South America. El Niño Southern Oscillation refers to the cycle of warm and cold temperatures, as measured by sea surface temperature (SST) of the tropical central and eastern Pacific Ocean. El Niño is accompanied by high air pressure in the western Pacific and low air pressure in the eastern Pacific. The cool phase of ENSO is called "La Niña" with SST in the eastern Pacific below average and air pressures high in the eastern and low in western Pacific. The ENSO cycle, both El Niño and La Niña, causes global changes of both temperatures and rainfall.
Evapotranspiration	Combination of evaporation from free water and soil surfaces and transpiration of water from plant surfaces to the atmosphere.

Food and Agriculture Organization of the United Nations (FAO)	Specialized agency of the United Nations that leads international efforts to defeat hunger. FAO is also a source of knowledge and information, and helps developing countries in transition modernize and improve agriculture, forestry and fisheries practices, ensuring good nutrition and food security for all.
Geographic Information System (GIS)	A geographic information system (GIS) is a system designed to capture, store, manipulate, analyse, manage, and present spatial or geographic data.
Groundwater	Subsurface water occupying the saturated zone (i.e. where the pore spaces (or open fractures) of a porous medium are full of water).
Hydrogeological Conceptual Model (HCM)	The conceptual understanding of the individual components in a hydrologic system (i.e. groundwater, surface water, and recharge) and the processes involved between each component.
Hydrogeological Framework Model (HGFM)	A three-dimensional geologic model that defines the spatial extent of stratigraphic and structural features. The development of the HGFM incorporates topographic, geologic, geophysical, and hydrogeologic datasets.
Hydrological catchment	The hydrological catchment is the total area contributing to the discharge at a certain point. The hydrological catchment includes all the surface water from rainfall runoff, snowmelt, and nearby streams that run downslope towards a shared outlet, *as well as* the groundwater underneath the earth's surface. Since groundwater may cross the topographical divides a hydrological catchment to a point may be larger than the corresponding topographical catchment as indicated in the Principle sketch below. 
Infiltration	The movement of water from the surface of the land into the subsurface.
Penman-Monteith	Method for estimating reference evapotranspiration (Et0) from meteorological data. It is a method with strong likelihood of correctly predicting ETo in a wide range of locations and climates and has provision for application in data-short situations.
Recharge	Contribution of water to an aquifer by infiltration.
Reference evapotranspiration (Et_0)	The evapotranspiration per area unit under local climate conditions from a hypothetical grass reference crop with an assumed crop height of 0.12 m, a fixed surface resistance of 70 s m^{-1} and an albedo of 0.23. The reference surface closely resembles an extensive surface of green, well-watered grass of uniform height, actively growing and completely shading the ground. A good approximation to the maximum evapotranspiration that under a certain climate can evaporate from an

	area unit covered by an ever-wet short green vegetation (e.g. a wetland)
Remote sensing	Acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to on-site observation. In current usage, the term "remote sensing" generally refers to the use of satellite- or aircraft-based sensor technologies to detect and classify objects on Earth, including on the surface and in the atmosphere and oceans, based on propagated signals (e.g. electromagnetic radiation).
Satellite	Artificial body placed in orbit round the earth or another planet in order to collect information or for communication.
Sensitivity analysis	Sensitivity analysis is the study of how the uncertainty in the output of a mathematical model or system (numerical or otherwise) can be apportioned to different sources of uncertainty in its inputs.
Spatial variation	When a quantity that is measured at different spatial locations exhibits values that differ across the locations.
Spring	A spring is a place where groundwater emerges naturally from the rock or soil. The forcing of the spring to the surface can be the result of a confined aquifer in which the recharge area of the spring water table rests at a higher elevation than that of the outlet. Spring water forced to the surface by elevated sources are artesian wells. Non-artesian springs may simply flow from a higher elevation through the earth to a lower elevation and exit in the form of a spring, using the ground like a drainage pipe. Still other springs are the result of pressure from an underground source in the earth, in the form of volcanic activity. The result can be water at elevated temperature such as a hot spring.
Topographical catchment	A catchment delineated strictly by topographical divides of the terrain. The topographical catchment includes all the surface water from rainfall runoff, snowmelt, and nearby streams that run downslope towards a shared outlet. This is the correct catchment if all discharge is surface flow (i.e. no groundwater). The topographical catchment is often a good approximation to the catchment, particularly for larger catchments.
Weather station	A facility, either on land or sea, with instruments and equipment for measuring atmospheric conditions to provide information for weather forecasts and to study the weather and climate.
Wetland	A wetland is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil. Wetlands play a number of roles in the environment, principally water purification, flood control, carbon sink and shoreline stability.

1 Introduction

This annex to the final report of the study of the flows in the Silala wetlands and springs system documents the analyses of the present surface water flows of the Silala springs system in Bolivia close to the Chilean border.

Groundwater continuously discharges in the Silala wetlands and ravines as surface water through seepage faces and springs. In the present situation, the surface flow is collected by the artificial drainage and canal network and is conveyed through the manmade main canal across the border to Chile.

A key objective of the project is to quantify flows both under current conditions and under natural conditions assuming that the canals are closed and removed.

Data from canal flow measurements, May-September 2017 were received and analysed (the canal flow measurement campaign continued until December 2017). Proven and reliable measurement methods have been applied to reduce uncertainties and provide a solid basis for analysing the current Silala surface water flows.

In combination with hydrogeological information, collected in the groundwater field survey program (Annex E), the distributed pattern of canal inflows and losses, which has been derived from the flow measurements constitutes an important basis for the conceptual understanding of the system. An understanding which in turn has made it possible to establish and calibrate a numerical model and simulate the flows in a natural situation without the manmade canals as described in Annex G and Annex H to the main report.

Section 2 of this annex presents our conceptual understanding of the surface water system in Silala and how it has been changed by the man-made canalization. It also discusses the key factors and processes through which the channelization has influenced the surface flows in the system.

Section 3 describes and analyses the flow observations in the Silala system and assesses the present flow regime and its spatial and temporal variations. The surface flow analyses establish:

- The canal flow rate at the permanent border site including mean rates and temporal variations under current conditions
- The spatial distribution of canal flows and inflows, from the wetlands to the border, during the May-September 2017
- The temporal variation of surface water flows during May-September 2017
- Flow measurement and water balance consistency checks

The summary and conclusions of the surface water study are described in Section 4.

2 Conceptual understanding

Summary: This section presents our understanding of the surface water component of the Silala Wetland and Spring System and formulates a conceptual model based on this understanding. The conceptual model identifies the most important processes and factors affecting the surface flows at the border under the current conditions. As described in Annex G, these processes and factors have been represented appropriately in the numerical model to make it capable of simulating the flows in a natural system without the canals.

2.1 Overall description

The canal flow crossing the Bolivian-Chilean border is the focus of this study. To understand and describe the origin of water entering the canal and the hydrological processes, a definition of a 'Near Field' area and a 'Far Field' area have been adopted. The Near Field area covers all surface water features and immediate surroundings including springs, wetlands and canals as shown in Figure 1 .The source of these springs is groundwater originating from a larger upstream catchment, the Far Field area. The boundaries of this Far Field are uncertain and its area is still unknown as described in Annex A.

The Near Field area has been sub-divided into 5 zones that recognise the different hydrological characteristics and properties in each of these zones (See Figure 1). The characterisation is based on information collected through a series of field inspections and the data collection campaigns executed by DIREMAR during 2017. Starting at the border and moving upstream, the key characteristics and processes of each zone are described below.

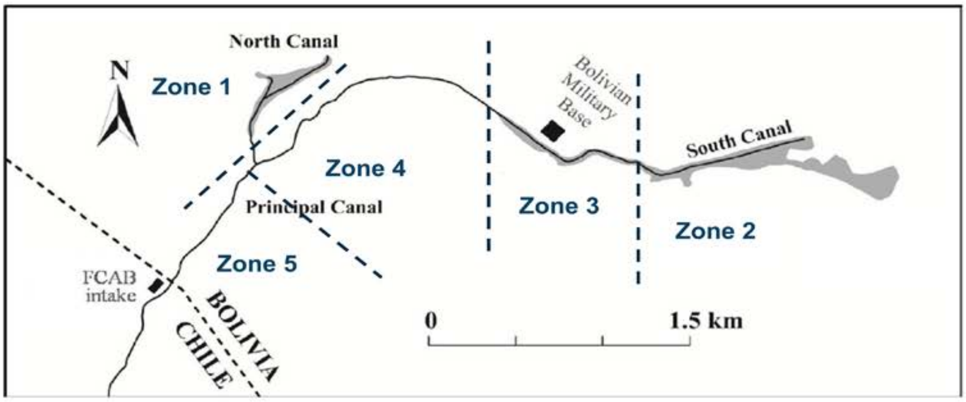


Figure 1 Approximate extent of the Silala Near field. (Figure slightly revised from (Mulligan, et al., 2011).

2.2 Near border zone (zone 5)

From the Bolivian-Chilean border and upstream to the confluence between the Northern Canal and Main Canal (Southern Canal), the Silala Canal runs through a relatively narrow ravine. Steep ignimbrite rock faces line the valley floor on each side (Figure 2). The valley floor is 10-20 m wide and the canal bed slope is rather steep and constant, dropping approximately 35 m along the 650 m reach. The canal is intact and the surface water level is confined within the canal cross sections. A narrow riparian zone with grassland vegetation can be observed along the sides of the canal. A shallow discontinuous soil layer is found along the canal. The outcropping rock is fractured, but no springs or inflows to the canal have been registered or recorded in this zone during recent or previous site visits. These characteristics of zone 5 suggest that inflows and outflows along the canal are limited and any losses are mainly due to seepage and evapotranspiration in close proximity of the canal.

Figure 2 Ignimbrite outcrops and vegetation hiding the canal in a typical section of zone 5 facing downstream.

2.3 Southern Canal Ravine (zone 4)

From the confluence between the Northern Canal and Main Southern Canal, the Main Southern Canal runs through a relatively narrow ravine. Steep ignimbrite rock faces line the valley floor on each side. The canal bed is still very steep, dropping approximately 55 m along the 1000 m reach but with varying slope. At the top of the ravine, a small waterfall of around 2 m discharges into a stretch with more gentle slopes where an inundated wetland with grass vegetation and ponded water covers the entire valley bottom (Figure 3). Further downstream again, the profile gets steeper with running water confined to the canal cross section. The Southern Canal Ravine is only 10-20 meters wide at the bottom and vegetation is in most of the zone confined to a narrow riparian zone with grassland vegetation along the canal. The outcropping rock is fractured and springs are found mainly on the left (northern) bank often more than a metre higher than the valley bottom.

Figure 3 Small wetland downstream of water fall in the Southern Canal Ravine.

2.4 Mid-section (zone 3)

The mid-section of the Southern Main Canal extends from the downstream boundary of the Southern Wetland, where the Silala Canal enters the upper reaches of the Silala Valley, to approximately 600 m downstream of the Military Camp where the canal enters the steeper and confined section of zone 4. The flow is generally not restricted to the canal in this section but extends over 30 m wide, shallow cross sections. The original manmade canal has been removed or blocked in some locations (Figure 4) and the more moderate slopes create a wide, mostly one-dimensional flow section encompassing pools, riparian zone, narrow wetlands and spring flow features. A number of minor loops where flow branches off, interacts with shallow inundated areas and re-joins the main canal, are found along the reach, in particular downstream of the Military Camp. Seven individual springs discharging into the canal have been registered along this reach. At the wide and shallow flow sections, the riparian zone, aquatic vegetation and open water surfaces spread across the width of the valley floor.

Figure 4 Blocked (and dry) reach of the main canal in zone 3 where the flow has been diverted to a flat wide cross section with manmade obstructions to restore wetland areas.

2.5 Wetlands (zone 1 and 2)

The Northern and Southern wetlands (bofedales) play a key hydrological role in relation to surface water flows. The extent and functioning of the wetlands are closely linked to the spring system discharges and the topography. Water availability and the distribution of water across the wetland determine the wetland features, which range from relatively dry land conditions along the wetland edges, drier patches along canal features and in parts of the wetland not receiving any inflows, grassland areas in partially disturbed (Figure 5) or fully drained areas and variably inundated undulating distichia areas with constant or regular access to water.

Figure 5 Drainage canals and vegetation in the upper end of the Southern wetland.

The less disturbed areas with no significant signs of excavations, canal construction or drainage are limited but are assumed to best resemble the original wetland conditions prior to canalisation.

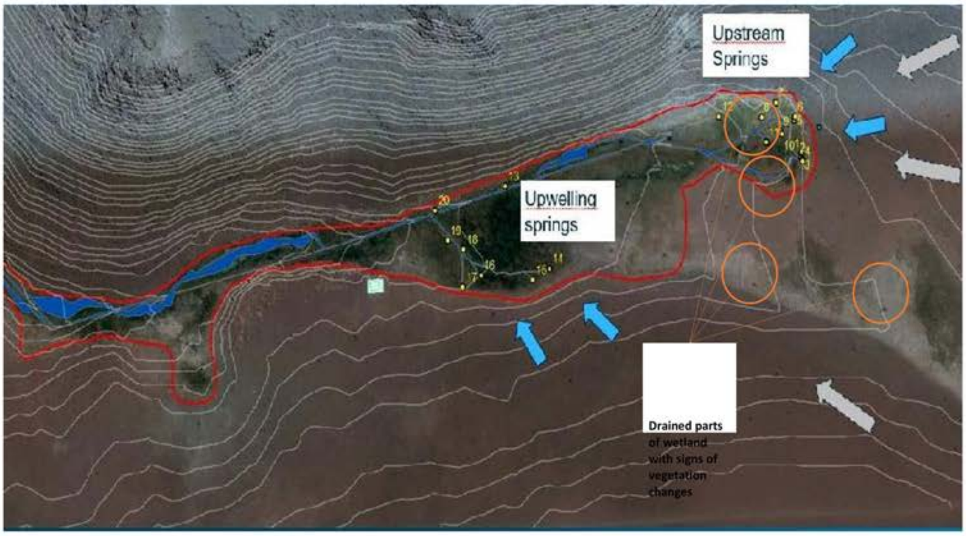


Figure 6 Southern wetland overview map showing extent (red polygon), canal network (blue line), springs (yellow dots) and overall flow directions by gray and blue arrows. Drained and drier wetland area with clear signs of vegetation changes are highlighted by orange circles.

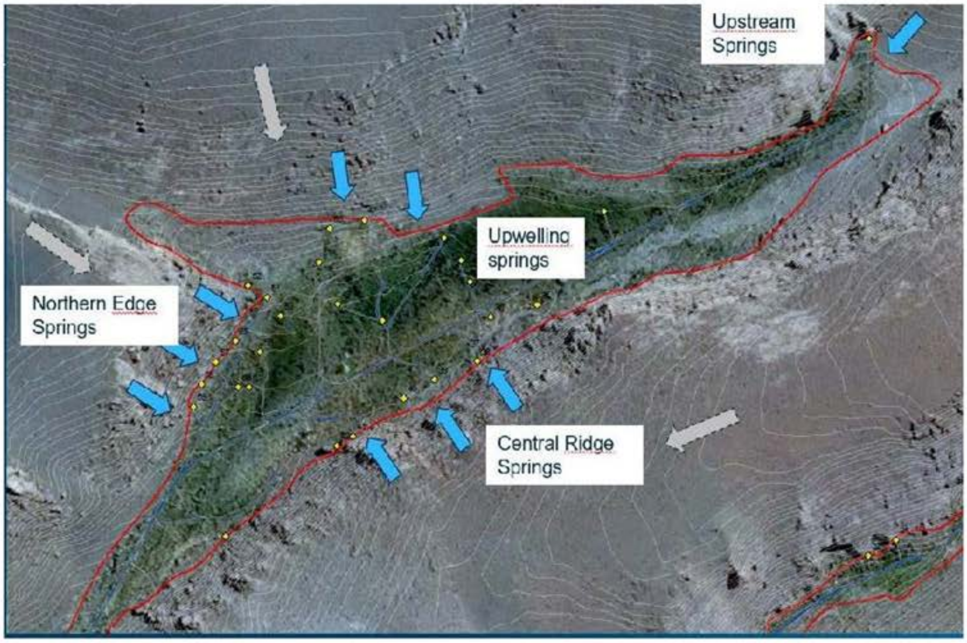


Figure 7 Northern wetland overview map showing extent (red polygon), canal network (blue line), springs (yellow dots) and overall flow directions by gray and blue arrows.

The wetlands have been formed in depression areas and over time sediments and peat soils have accumulated across these areas. The availability of water is reflected by the vegetation with a distinct transition at the edges of the wetlands to the surrounding dry land with little or no vegetation.

Figure 8 Northern wetland facing downstream. Exposed peat soil faces are visible along the canal.

In contrast to the dry areas with shallow sediment layers and outcropping base rock surrounding the wetland, the wetlands themselves have continuous vegetation cover (Figure 8). They exhibit thicker soil and peat layers and water tables have in boreholes both in the Northern and Southern wetlands been found at or just below ground surface.

Figure 9 shows the surface and subsurface structure of a typical hillslope element extending from the dryland into the wetland. As the ground elevations drop toward the wetland, the groundwater table reaches the surface and groundwater discharges through fractures and springs. In some areas along the edge of the wetlands, moist soil and vegetation are indicative of seepage faces which extend further up the slope above the springs.

Standpipes located in the lowest part of wetland cross sections indicate water level above ground level and thus upward directed groundwater pressure and flow. This is consistent with the springs along the wetland edges often being found at higher levels than the canals. In addition, a comparison of the gauged canal flows and gauged flows from the springs flows (Section 3.3) suggest a considerable diffuse inflow to the wetlands from the subsurface in addition to the visible and gauged springs.

If not routed directly from springs into the drainage system and into the main canal spring water passes through the wetland and peat soil layers. Water is transported into the peat layer by gravity (from higher springs) or by capillary rise or upward water pressure from groundwater in the highly weathered and fragmented upper part of the ignimbrite base rock underneath the peat.

From the saturated or partially saturated peat soils water is lost to the atmosphere by plant transpiration in the root zone, by soil evaporation and by evaporation from free water surface, such as shallow inundated areas or pools generated on the wetland surface.

Surface runoff may be created during high intensity precipitation events adding to the wetland inflows. There are, however, few signs of surface water morphological features such as erosion gullies or rill formation suggesting larger, regular surface inflows.

To quantify flows from the springs through the wetlands and the Near Field catchment to the border it is, as illustrated by the hillslope (Figure 9), necessary to address:

- Spring, drainage and canal flow distribution within the wetland area
- Interception and storage in the peat soil layer
- Subsurface interaction (seepage) between drainage network, canal, groundwater and unsaturated soil
- Surface water interaction and redistribution between drainage network, canals and inundated wetland areas
- Flow and water levels in the drainage and canal network

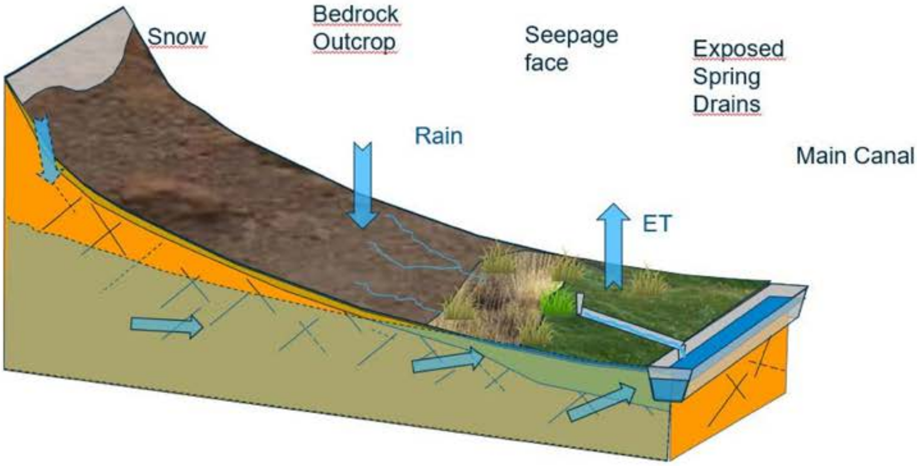


Figure 9 Typical wetland hillslope element.

2.6 Canalisation and manmade interventions

The impacts of manmade interventions on the wetlands are clearly visible in the field and on aerial photos and satellite images (e.g. Figure 8 and Figure 6). Both the drainage and canalisation work and more recent local decommissioning or modifications of sections of the canal are visible.

2.6.1 Exposed springs

Most of the upstream ends of the manmade drainage network constructed within both the northern and southern wetlands originate in a spring. At these spring discharge points, the soil and any underlying layers of coarser material or rocks have been completely removed to enhance both the emerging spring flow rates and effectiveness of surface water routing downstream. In the old natural wetland spring water emerging as individual springs or across larger seepage faces have been intercepted by coarse or fine sediments and organic deposits of the wetland. By excavating the soil and exposing the spring, the hydraulic resistance to the groundwater discharge into or below the wetland peat soil layer has been reduced.

By diverting the water directly into the manmade channels, the spring water is no longer retained in the wetland soils. This has reduced the size of wetlands, and decreased the amount of evaporation and transpiration, which has increased the wetland discharges in comparison with the situation prior to canalisation.

Figure 10 Photo showing exposed springs piped directly to the main canal.

2.6.2 Drainage networks, pipe, wetlands

A dense network of drainage canals is found in both the Southern and Northern wetlands. The drainage canals have been dug as 2nd order and 3rd order branches collecting the water at the individual springs and discharging it into the main canal. The original soil cover, typically in the depth range of 0.2 – 1.0 m, has been removed along the drainage canals down to the underlying bedrock.

The drainage canals cut through most of the wetlands and apart from collecting spring water, they hydraulically separate wetland sub-systems and lower water tables in the peat soils. The effect of this is a reduced availability of water for the wetland vegetation, creating corridors for invasive dryland grasses. Since a large part of the spring water no longer enters the wetland system, parts of the original wetland are suffering from lack of water or have already died.

Figure 11 Photo showing drain pipe.

2.6.3 Excavations

Excavations are clearly visible not only at the springs and along drainage and main canals but also across large parts of the wetland areas (Figure 12). In the Northern wetland, drainage pipes linking up with the open canal drainage network are found (Figure 11). They have been installed by excavating trenches. After laying down the pipes, they have been covered by soil leaving large parts of the wetland disturbed and dug through (Figure 10). Only smaller coherent patches of undisturbed soils and wetland vegetation are found in both wetlands. Especially in the Northern wetland, peat soils have been turned and peat in varying stages of decomposition is visible. As degradation of organic soil material is normally linked to subsidence of such soils, it is reasonable to assume that the natural terrain levels of the wetland have been higher than those of today. Higher terrain levels mean higher hydraulic resistance both to groundwater inflow to the natural wetland which will reduce the overland discharge of the natural wetland as compared to the canalized one.

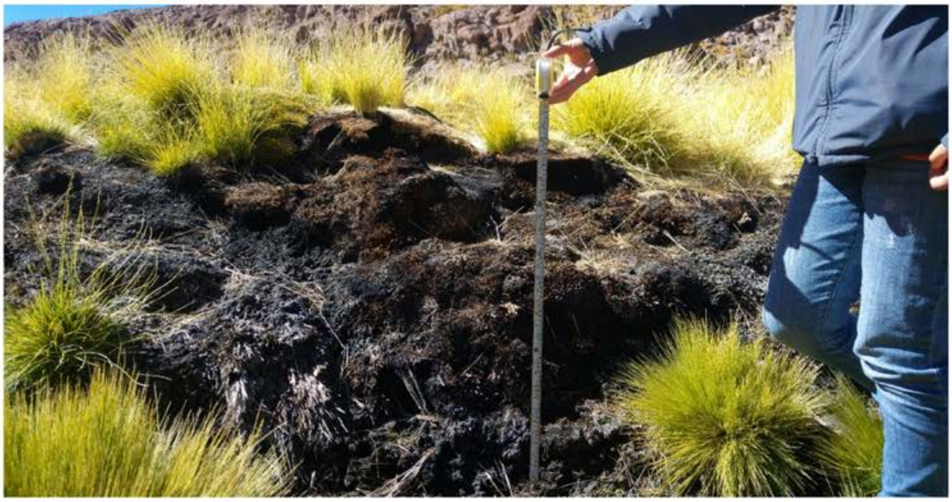


Figure 12 Photo of an excavated section and vertical peat profile at the edge of an undisturbed wetland patch in the Northern Wetland.

2.6.4 Main canal

The Main Southern Canal and the Northern Canal cut through the mid-section of the wetlands collecting water from the second and third order drainage network. They have been constructed in straight line sections with an approximately uniform slope and are lined by rocks for stability and to reduce resistance to flow. The canals have been excavated and the canal bed elevation as well as the observed canal water levels are below the topographical elevation of the adjacent areas. In most places, the canal bed sits directly on the underlying base rock surface and as a result of the pervious canal lining, seepage in and out of the canal occurs along its entire length. Therefore, the main canals act not only as collectors for the surface drainage networks but also as drains for the surrounding areas.

2.7 Later manmade changes

In recent years, the canal has been changed and modified in sections of the Silala Wetland and Spring System. In parts of the southern wetland, the canals and drains have been removed, filled in or blocked. This is visible as canal reaches without any rock lining, rocks being piled up across the canals and drains raising upstream water level and diverting canal water to wetland sub-systems. The changes appear to be partial attempts at wetland restoration. Despite these modifications the discharge of the wetlands still predominantly takes place through the canals. Apparently, the canal modifications were stopped several years ago. They can therefore be considered an integrated part of the present system and their possible impacts are already reflected in the flows observed during 2017 and before.

Figure 13 Canal modification. The stone lining of the canal has been removed from the sides and bottom of the canal and applied to block the canal and inundate a formerly drained part of the wetland.

2.7.1 Key factors and processes for the Silala Near Field area

A summary of the identified key factors influencing the discharge of the Silala Springs System is listed in Table 1

Table 1 Overview of key processes affecting flows

Silala Near Field sub-area	Process	Specifics
Zone 1 : Northern Canal, Northern wetland and Zone 2 : Main Canal, Southern wetland	1. Distributed spring inflows 2. Wetland interception and storage 3. Evapotranspiration in wetlands and riparian zone 4. Canal and drain system seepage gains/losses to soil and groundwater 5. Diffuse inflows by groundwater 6. Canal-wetland spills and redistribution (1-D / 2-D) 7. Inundated areas and free water surface evaporation	Attenuation by wetland storage Capillary rise of peat soils Canal spilling at canal blockages Transpiration from wetland vegetation Canal seepage
Zone 3 : Main Canal, middle section	1. Distributed spring inflows 2. Evapotranspiration in riparian zone 3. Canal seepage gains/losses to riparian fringe and groundwater 4. Canal-wetland spills and redistribution (1-D / 2-D) 5. Inundated areas and free water surface evaporation	Flow in wide flow section in non-canalised reaches Riparian zone water uptake and evapotranspiration
Zone 4 : Main Canal, narrow valley section and Zone 5 : Near border section	1. Distributed spring inflows 2. Evapotranspiration in riparian zone 3. Canal seepage gains/losses to riparian fringe and groundwater	Restricted canal flow Narrow riparian fringe interaction with canal Groundwater discharge in narrow valley section

2.8 Summary of manmade changes accounted for

In summary, the manmade changes impact the wetland hydrology and flows as well as the water balance of wetlands and Silala Canal discharges by:

- Excavations exposing springs reduce the hydraulic resistance, and potentially increases spring flow rates
- By diverting the spring water away from the wetlands into the drain network and canals, these manmade channels are lowering the water tables and drying out large parts of the wetland area. This means that less water is retained within the wetland and less water is lost through evapotranspiration from the wetland
- Outside the wetlands, where the natural flow would cover a wider shallower cross section the canalisation has constrained the flow to a narrow, deeper and straightened canal, which has smaller evaporation and seepage losses than the natural channel.
- The baseline model scenario reflects the Silala Springs System in its present state. It therefore also includes the recent modifications to the canal system, the impacts of

which are already reflected in the flow observations used for the model calibration. The natural scenario describes a system in its natural state without any canalization and has been established by removing all canals and excavations assuming that the discharge from the natural wetland takes place either as superficial runoff on top of the wetlands or in the beds of the ravines or as groundwater flow in the base rock as described in Annex H.

All the above processes and changes are simulated in the numerical model of the Silala Springs System to quantitatively assess not only the current Silala Wetland and Canal System flows but also the likely impacts of drainage and canalisation on flow rates compared to undisturbed (natural) conditions.

2.9 Implementation of the conceptual model in the numerical model

A surface water model has been built and subsequently coupled with sub-surface components, whole or partly saturated soils and vegetation of the wetlands and upland areas of the Near Field and a groundwater model of the saturated groundwater model based on the conceptual hydrogeological model described in Annex F. The numerical modelling tool used in flow assessments and scenario impact analysis is set up according to the conceptual surface water and groundwater models and the key processes identified in the conceptual models are represented in the physically based numerical model of the Silala Near Field area. Model input data and parameters have been derived from field data.

3 Simultaneous flow observations

3.1 Flow measurement overview

To gain full knowledge on the flow pattern in the canal system, the flow observations must reveal both the spatial and the temporal flow variations.

Determination of the spatial flow pattern (the inflow distribution and the gaining and loosing reaches) have to be based measurements at many points in the streams and at the springs. Since the flows in the system vary over the day the measurements should ideally be made at the same time at all points (*simultaneously*). The procedures for flow measurements have been designed to take the measurements as close in time as possible at the various points.

The flow measurement should be as exact as possible and the best accuracy is normally achieved at fixed weirs with well established hydraulic conditions such as the existing weir at the desiltation chambers. This weir and six new ones (established 2017) were equipped with automatic gauging equipment that allows for *continuous* measurements of flows with a high frequency (minutes) and the data from these gauging sites reveal the temporal flow variation over longer time periods as described in Sections 3.5 and 3.6 below.

Based on technical specifications prepared as part of this study, the Bolivian Secretariat for Meteorology and Hydrology (SENAMHI) was contracted by DIREMAR to carry out the surface flow measurement program. Simultaneous canal flow measurements were made at 21 fixed locations, continuous flow records collected at flumes installed during 2017 and the permanent flume flows recorded close to the Bolivian-Chilean border.

The flow measurements were carried out during May-Sept 2017. Figure 14 shows the 21 locations including springs (Ojos de Agua), of simultaneous flow measurement locations (S-1 – S-21) and continuous flume flow gauges (C-1 – C-7) (SENAMHI (a), 2017). Prior to the establishment of the flumes, simultaneous flow measurements have been carried out at both S-1 – S-21 locations and at the locations C-1 – C7 where six new flumes were later installed.

3.2 Simultaneous canal flow data

The simultaneous flow measurement program provides a snapshot of flows in many points of the canal network. In all, ten such surveys were performed during the campaign period. Initially twice a week and later monthly frequency, measuring at all locations within 2-3 days. Micro-propeller measurements in multiple points of the cross section provide a cross-sectional velocity profile, which is integrated to calculate the flow. The profile measurements have been carried out twice at each location to verify results and, if necessary, to take prompt on-site action to prevent errors.

Figure 15 shows the longitudinal flow profile along the Southern Canal with measurements from the 10 different surveys. A top end of the Southern wetland, the flow is approximately 30 l/s and increases to around 100 l/s at C-5 just upstream the confluence between the Northern and the Southern Canal. The measured simultaneous flow rates are approximately constant in time.

On the Northern Canal, the longitudinal flow profile on Figure 16 shows a total flow contribution around 57 l/s mainly entering below S18.

In the Principal Canal, between the confluence and the international border, the measurements (Figure 17) show some uncertainty as to the flows particularly in S19. The measurements may indicate a small flow increase at the start of the reach and a possible flow loss in the parts closer to the international border.

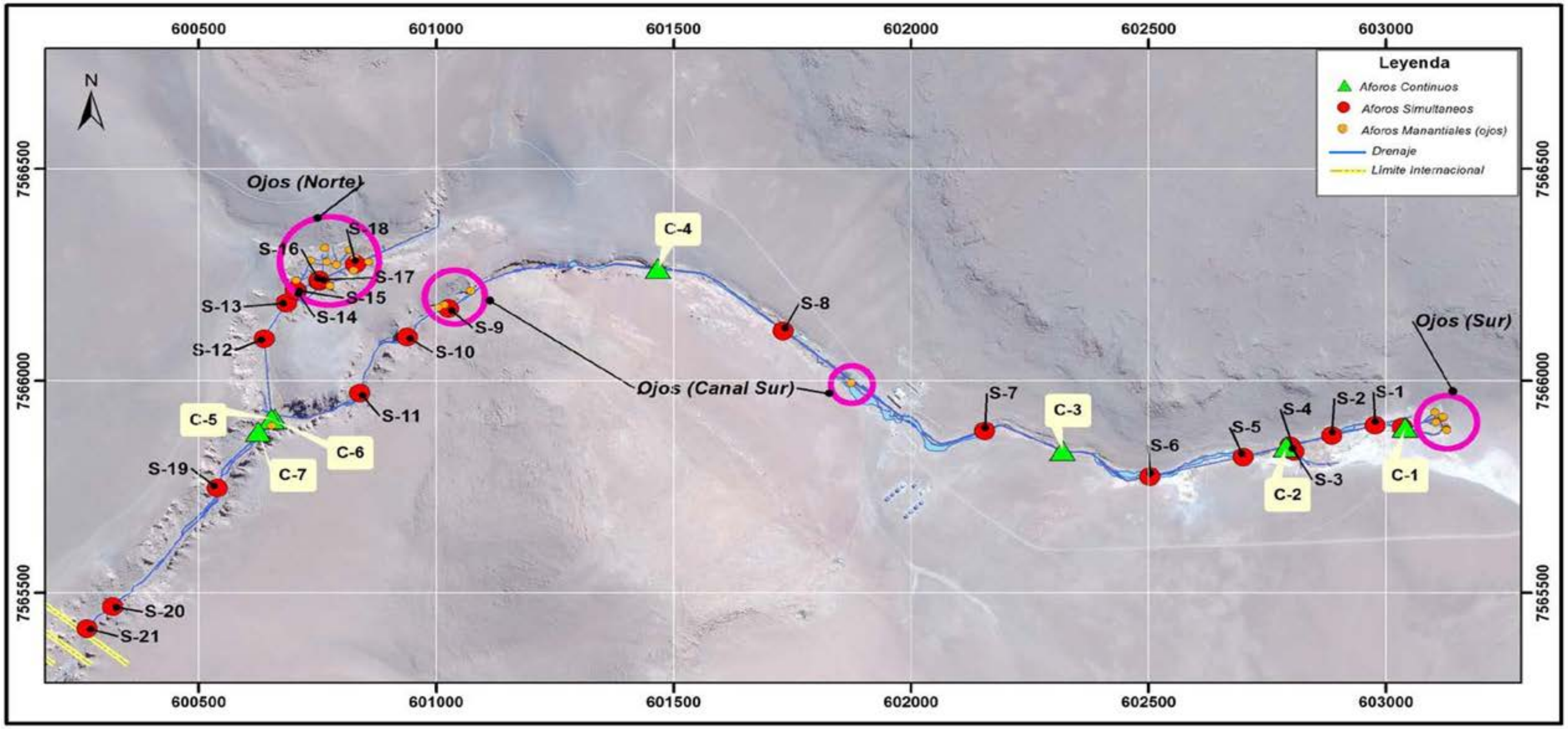
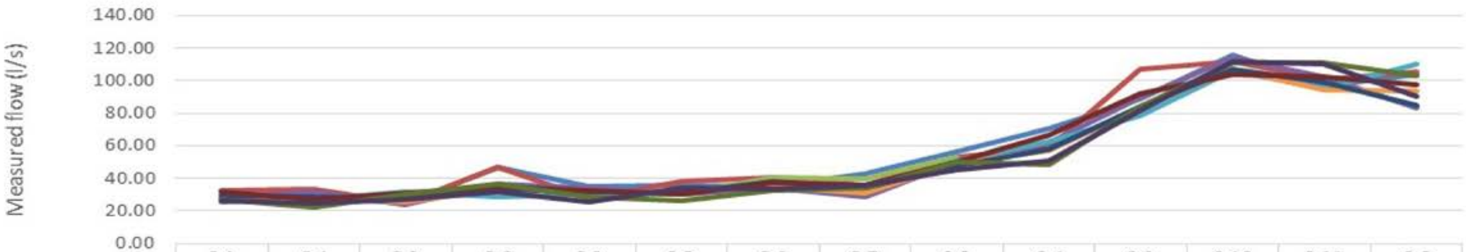


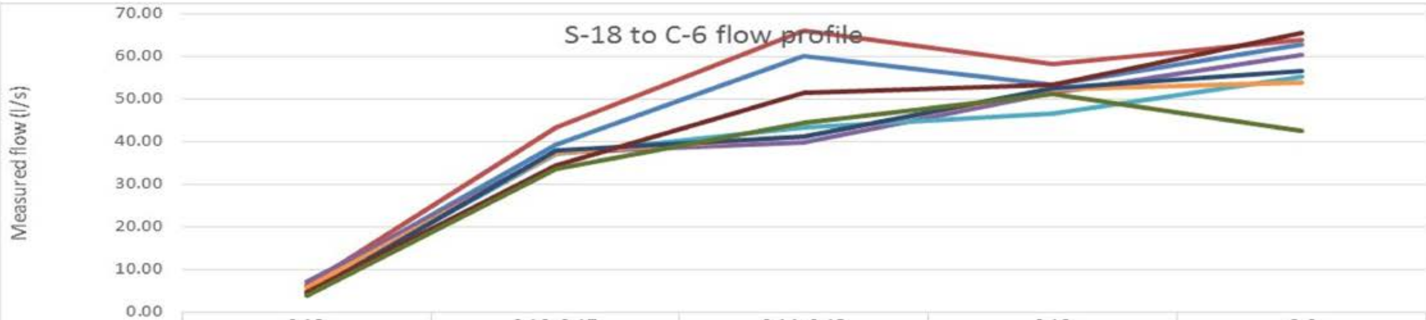
Figure 14 Overview of flow measurement locations (SENAMHI).

S-1 to C-5 flow profile



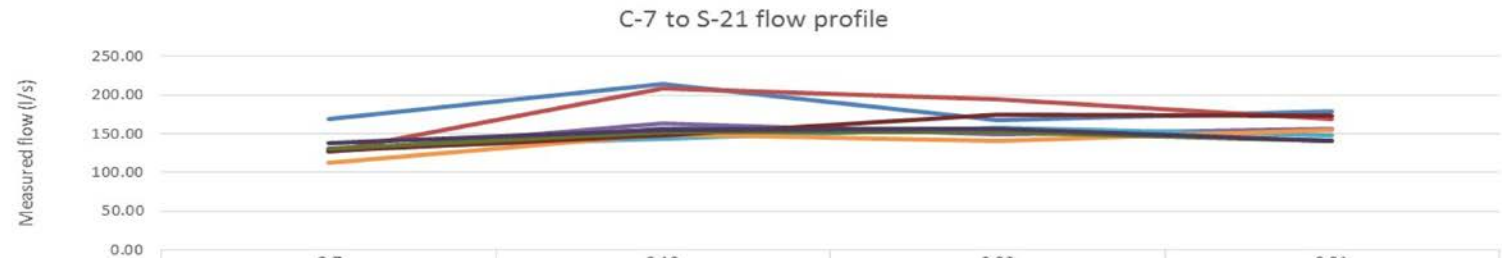
	S-1	C-1	S-2	C-2	S-3	S-5	S-6	S-7	S-8	C-4	S-9	S-10	S-11	C-5
May 6-7	25.80	28.35	24.45	47.05	34.95	36.10	34.75	42.95	56.40	70.35	88.45	115.40	96.95	103.65
May 12-14	33.00	33.60	24.50	46.90	28.10	38.30	40.60	35.70	53.10	58.80	107.05	111.65	101.05	105.75
May 15-17	32.50		28.10		31.05	30.30	40.25	39.70	53.10			114.95		
May 27-30	29.05	31.65	23.75	36.90	34.30	30.45	34.35	28.90	49.95	61.90	89.35	113.80	102.15	83.45
June 3-4	31.55	26.90	31.80	28.85	30.05	31.00	36.85	33.50	51.05	62.50	78.65	106.30	95.45	110.50
June 12-14	29.10	27.55	25.75	33.20		32.90	35.20	31.00	49.05	57.35	83.65	106.85	94.55	93.60
June 20-21	29.15	28.6	27.8	33.65	32.25	30.9	37.85	34.1	47.8	58.3	83.75	107.4	98.75	84.8
July 24-25	31.75	26.9	30.9	35.3	32.85	29.9	37.75	35.5	50.15	66.6	92.3	104	102.1	97.65
Aug 25-27	27.45	22.5	30.45	37	28.5	26.4	32.55	33.9	49.85	48.65	83.7	110.6	111.25	103.45
Sep 25-27	26.45	24.45	26.95	31.5	25.35	34.45	33.45	36.15	45.05	50.7	81.65	112.15	109.8	90.3

Figure 15 Longitudinal simultaneous flow profile Southern Canal (S1- C5)



	S-18	S-16+S-17	S-14+S-15	S-12	C-6
May 6-7	6.15	39.15	60.15	53.40	62.65
May 12-14	6.20	43.25	65.90	58.15	63.85
May 15-17					
May 27-30	7.05	37.40	39.70	51.35	60.40
June 3-4	4.85	37.05	43.15	46.60	55.15
June 12-14	5.60	37.35	41.25	52.30	53.85
June 20-21	3.95	37.95	41.20	52.45	56.65
July 24-25	4.55	34.45	51.40	53.35	65.35
Aug 25-27	3.80	33.65	44.45	51.05	42.50
Sep 25-27					

Figure 16 Simultaneous flow profiles, Northern Canal (S-18 to C-6).



	C-7	S-19	S-20	S-21
May 6-7	169.70	214.85	167.80	179.45
May 12-14	126.90	209.15	194.15	169.30
May 15-17	126.10			147.15
May 27-30	126.45	163.85	149.70	156.60
June 3-4	130.40	143.90	157.55	148.45
June 12-14	112.90	149.95	141.55	155.55
June 20-21	128.6000013	156.1000049	157.0999995	
July 24-25	128.4499988	148.3500004	175.4000038	173.2500046
Aug 25-27	130.55	152.05	152.95	141.55
Sep 25-27	138.25	155.05	157.1	141.3

Figure 17 Simultaneous flow profiles, in the Principal branch from the confluence to border (C-7 to S-21).

3.3 Simultaneous spring flow data

The program of simultaneous spring flow measurements was designed to assess flow rates at individual springs and the total spring flow contribution of sub-systems. By comparing the measured spring flows and canal flows, a measure of diffuse canal inflows has been derived. Diffuse inflows describe non-point or hidden inflows, e.g. seepage faces where a single spring was not clearly identifiable or the exchange of water between the surrounding groundwater and the channels through the sides or base of these channels.

Springs (Ojos de Agua) have been mapped across the entire Silala Near Field system. They include free flowing exposed springs, exposed springs with little or no flow and springs covered by soil and visible only by wet soil seepage faces. The first type is suitable for measurement of flow rates which has been carried out by collecting the spring discharge and deriving the flow rate from volume and time.

From May 2017 and onwards, only approximately 20 high-flow springs are included. Unfortunately, the spring locations selected for measurement and the applied spring-naming convention are not consistent for all of the 10 measurement campaigns during May-September 2017. This means that measured flow cannot be referred to the identical same locations.

Table 2 compares the canal flows at the 7 continuous stations (average of all 10 simultaneous campaigns) with the accumulated observed spring flows upstream of each of these locations (average of all campaigns) and shows approximate upstream diffuse net inflows by location estimated as the difference between measured mean canal flows and springs flows.

At the upstream reaches of the Southern Canal (C-1 – C-3), the measured spring flows are almost equal to the measured canal flow, which implies limited diffuse inflows. However, on the lower section (C4 – C5) where only a few springs have been mapped, a large diffuse inflow indicates significant groundwater discharge to the Southern Canal in the upper part of the ravine.

On the Northern Canal, the sum of spring flows accounts for 75-80 % of the canal flow, leaving 20-25 % for diffuse lateral net inflow. Similarly, derived total diffuse net inflows for the Southern Canal are expected to be in the order of 35-45 %.

The measurements of simultaneous canal flow and spring flow are associated with uncertainty. The spring flow measurement method is coarse and relies on capturing all of the spring flow within a given time interval, preventing any bypass flow. Measurements of canal flows suggest that the groundwater discharge is approximately constant. Consequently, spring flows should accordingly be approximately constant. However, for the most frequently measured spring, the flows vary between ± 40 % of the average value. The highest relative deviations are found for springs with low flow rates. The variation in measured flow is not consistent across the springs, suggesting that the variations are caused by measurement uncertainty and not hydrological temporal variations driven by, for example, climate.

Table 2 Canal flows by section, accumulated upstream spring inflows and derived diffuse inflows. The flows represent the average of all 10 campaigns.

Section	Measured spring flow (l/s)	Measured Canal Flow (l/s)	Difference, canal-springs (l/s)
C1, springs 1-12 (Zone 2)	23.8	27.8	4.0
C2, springs 1-20 (Zone 2)	41.2	36.7	-4.5
C3, springs 1-21 (Zone 2)	41.2	38.0	-3.2
C4, springs 1-22 (Zone 3)	45.2	59.5	14.3
C5, springs 1-32 (Zone 4)	56.9	97.0	40.1
C6, springs 33-64 (Zone 1)	46.1	56.9	10.8
C5+C6, springs 1-64	103.0	154.0	51.0

3.4 Spatial distribution of flows in the system

Figure 18, Figure 19 and Figure 20 show simultaneous flow measurements plotted along the Southern, the Northern and the Principal canals respectively, together with the elevation profiles. Since the measurement uncertainty in the individual point seems to be larger than the temporal flow variations between the campaigns (indicated by the many crossing lines in Figure 15-Figure 17), the flows at each point are represented as the average of the 10 measurement campaigns. The left axis shows elevations (m) of the canal bed and water levels (m.a.s.l) and the right axis shows flow rates (l/s). In addition, the elevations of the ground water levels as determined from spring elevations and boreholes along each of the profiles springs adjacent to the canal have been marked.

On the Southern canal branch (Figure 18), the mean flow in the Southern wetland increases from 30 l/s upstream at S-1 to 36 l/s downstream at S-6. On the upper canal reaches, the slope is almost constant and from S-6 to C-4, the canal flow increases at an approximately steady rate reaching 60 l/s at C-4. However, from C-4 to S-10, at the upper reach of the ravine, the surface elevation drops and the canal bed slope increases. According to the measurements, a significant inflow to the canal, in the order of 50 l/s, occurs along this section. Since only a few springs have been recorded, the majority of the canal flow increase is due to groundwater discharges through seepage entering the deepest section of the ravine as diffuse discharge to the canal. The spring water level elevations have been plotted as an indication of the groundwater table elevation along the canal. Between S-9 and S-10, the spring elevations are significantly above the canal level. This is indicative of a relatively high water level gradient from the groundwater towards the canal and consistent with the high inflow rates recorded.

The results suggest that the topography is a controlling factor of groundwater discharges to the canal. As the surface elevations drop, the groundwater table is forced closer to the surface, where it exchanges flow with springs, typically aligned with fractures, or directly to the canal. Larger scale hydrogeological features, such as faults, may play a role with respect to canal discharge patterns. On the steep canal section from S-10 to C-5, the mean flow decreases significantly by approximately 10 l/s, which is attributed to either canal losses or measurement errors.

On the Northern Canal branch (Figure 19), the slope is less variable. The increase in mean flow is relatively high from S-18 to S-13, 5 l/s to 45 l/s. This section is characterized by a dense drainage network distributed across the width of the wetland. This is also the section where the vast majority of the springs of the Northern wetland discharge into the drainage network. From S-13 to C-6, close to the confluence between the Southern and the Northern canals, the wetland is narrowly constrained by the ravine, with an approximately uniform canal bed slope. In this section, only a few springs have been mapped and the mean flow rate increases from 45 l/s to 57 l/s along a distance of approximately 300 m.

In the Principal Branch from the confluence to the border (Figure 20) the average flow increases slightly (around 8 %) from the confluence to S19 about one quarter of the distance to the border. From S19 to the border the flow rates seem to decrease slightly (to around 103 % of the confluence flow) before reaching the border. While groundwater levels are observed at terrain level near the confluence (borehole DS-35) the deeper groundwater levels are more than10 m below terrain in the ignimbrite layers close to the border. The canal could therefore be losing water to the groundwater in the lower parts of Principal Canal.

Figure 21 shows a map of canal flows and canal net inflows in the Silala Near Field area based on mean simultaneous flow measurements. The figure shows the flow at the continuous measurements stations (C1 – C7), the inflow between the stations and the percentage of flow relative to the downstream measurements, assuming that C7 flow equals the sum of C5 and C6 flows. The confluence point is seen as the point of the system with the most reliable flow determination and the confluence point has therefore been used as reference (100%). In the downstream principal reach flows first increases slightly (8%) and hereafter shows tendencies of a slight flow decrease indicating flows at the border to be only 2% higher than at the confluence. The flow assessment in this reach is however more uncertain which is the reason for not using the flow at the border as the reference.

The net inflows to the canal are all the flow contributions minus all flow losses. The contributions include: Inflows from springs, diffuse inflows along the canal or under wetlands and banks, runoff and direct precipitation. Precipitation and runoff are, however, deemed to be negligible in this case since precipitation is generally low in the winter months and the 10 campaigns which are executed at different dates show very similar flow patterns. The losses include evapotranspiration (from open water surfaces, wetlands and riparian areas) and seepage from canals and wetlands to the groundwater aquifers.

Approximately 97 l/s or 63 % of downstream C-7 flows originate from the Southern Canal and wetlands. Most of it (59 l/s) enters the canal on the C-3 – C-5 reach, which has relatively few mapped springs, and thus the increasing canal flow from upstream to downstream must be attributed to either diffuse seepage sources or groundwater discharging directly through the base of the canal at the deepest section of the canyon.

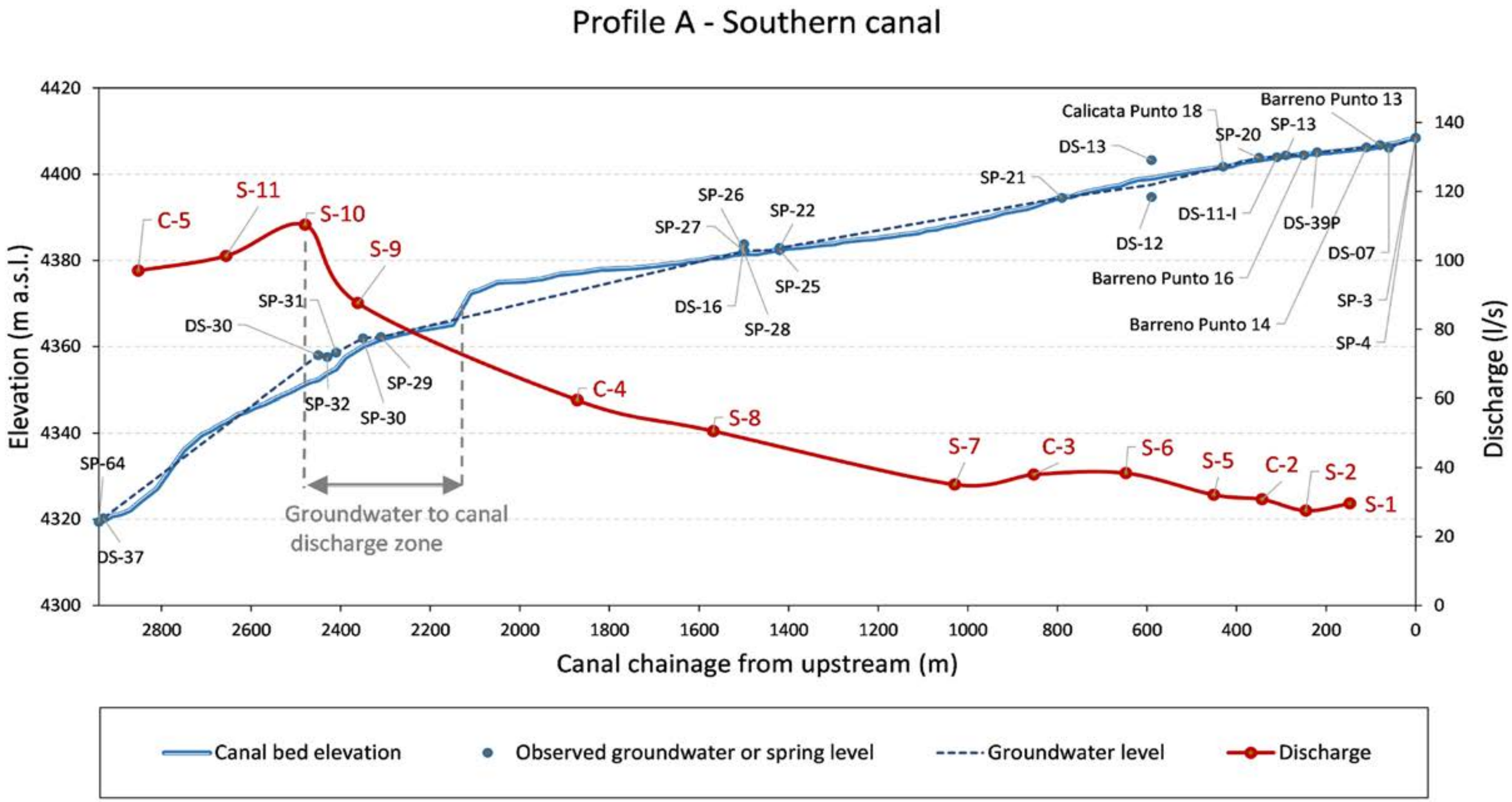


Figure 18 Southern canal profile (S-1 to C-5) comparing canal elevations and observed groundwater and spring levels with observed discharge (average of 10 campaigns).

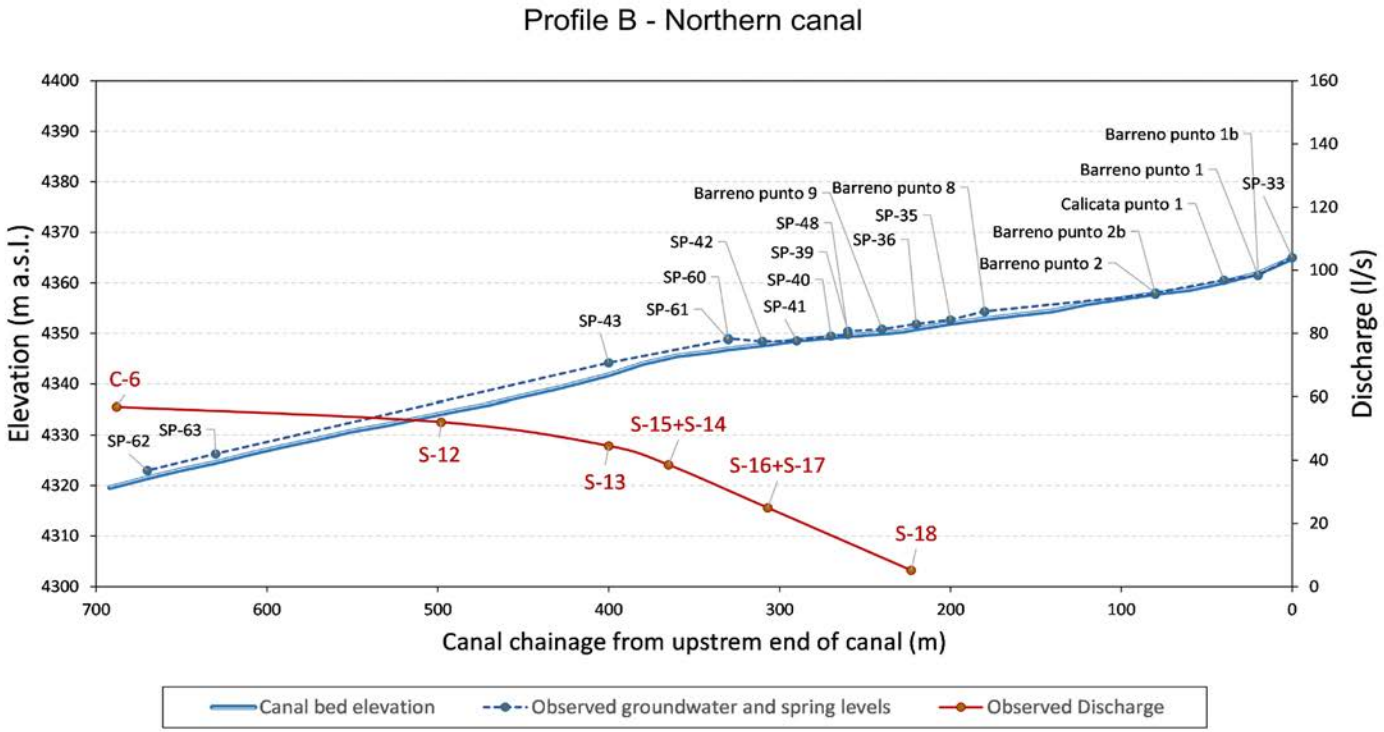


Figure 19 Northern canal profile (S-18 to C-6) comparing canal elevations and observed groundwater and spring levels with observed discharge (average of 10 campaigns).

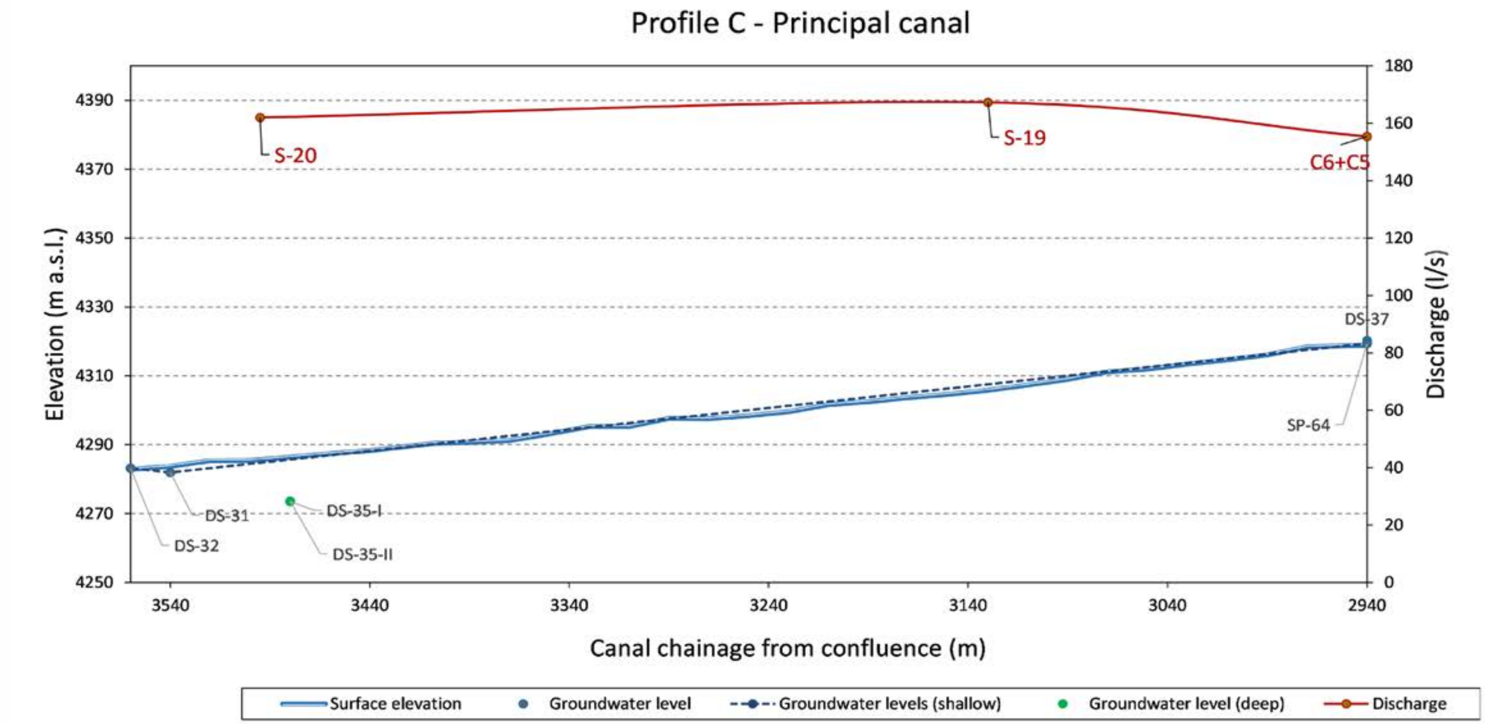


Figure 20 Principal canal from the confluence to the international border (C7 – S21) comparing canal elevations and observed groundwater and spring levels with observed discharge (average of 10 campaigns).

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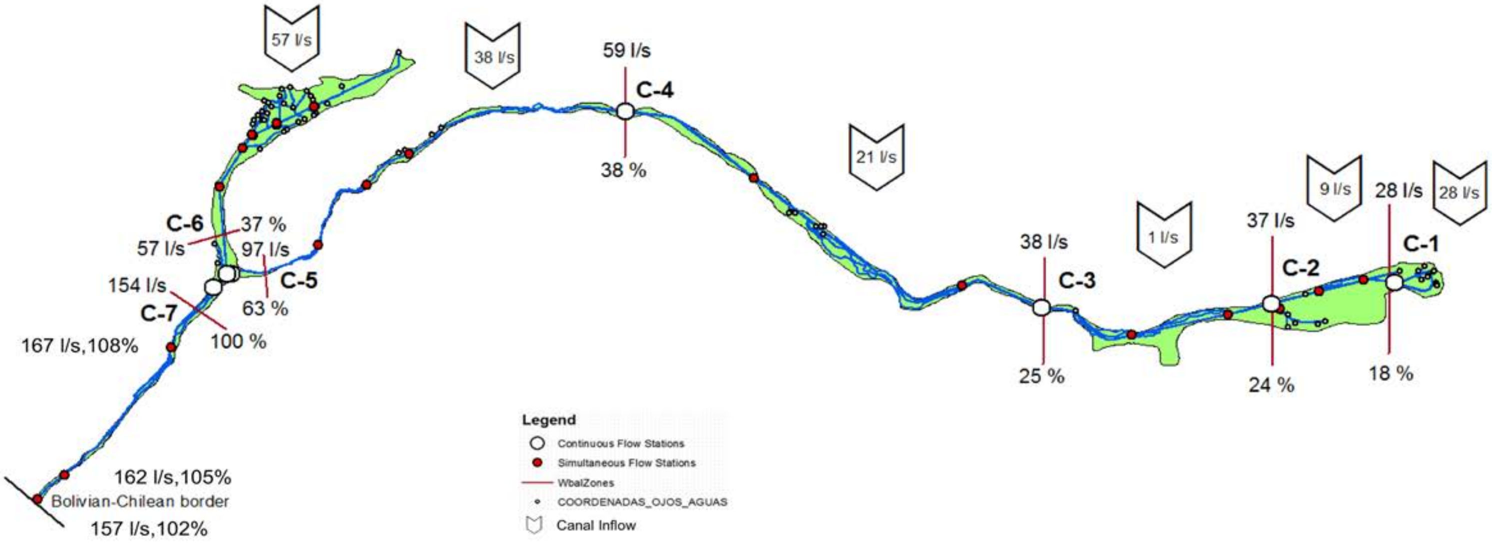

Figure 21 Mapping of flows and net inflows based on simultaneous mean canal flow measurements (in l/s).

3.5 Temporal flow variation

3.5.1 Long term Bolivian and Chilean flow records

Long-term time series of the flows in the Silala Principal canal are available at two locations, one at the old siltation chambers in Bolivia around 650 m upstream of the border and the other from Chile's Direción General Del Agua (DGA), just downstream of the border on the Chilean side. Given the locations and proximity (less than 1 km) of these permanent flumes, well correlated records should be expected from the two gauging sites. The hydrogeological study (Annex F) indicates low groundwater levels in parts of the reach between the two stations and therefore the canal may be losing water by seepage in these parts into the underlying groundwater.

At the Bolivian gauging site, a flume is constructed in a rectangular concrete trench along the old siltation chambers and equipped with a V-notch and automatic (electronic) water level registration by floater with resolution around one mm. Hence, the station should be almost ideal for measuring the narrow flow range of the canal. Water levels are measured both manually (twice a day) and automatically (hourly). During July 2017, the automatic floater was supplemented by a pressure sensor with an even higher temporal resolution. Each of the three water level series has been converted into flows by a formula relating specific water level observations to flows. Particularly for V-notch weirs, the standard formula is considered accurate within 3-5 %.

Both manual and automatic water level readings and corresponding flow records exist. A comparison of the available manual and automatic flow time series from the period August 2013- August 2017 is shown in Figure 22. The series is characterised by a constant base flow of around 160 l/s, which clearly indicates that the canal is fed almost entirely by groundwater. However, frequent abrupt changes in the calculated flows, sometimes from one-time step to the next, are also observed. The rapid fluctuations in flow originate from similar changes in the water level observations. It has, in general, not been possible to relate them to climatic conditions, runoff events or seasonality. It seems likely that these fluctuations must be attributed to uncertainty in water level observations, due to e.g. jamming of the float, ice or sediment deposition in the stilling canal. The automatically gauged water levels include sudden jumps of 0.5 cm or 1 cm, although the resolution of the instrument is 1 mm. This also indicates possible errors in the automated sensor registration. Despite the nearly ideal flow gauge conditions provided by the weir, the uncertainty is therefore substantial, roughly assessed at 25-30 % of the flow rate (corresponding to the unexplained abrupt fluctuations).

The Chilean flow time series also includes abrupt changes in flow. The Chilean flow series is generally approximately 15-25 l/s lower than the Bolivian series. Although both series show significant variations over time, 125-225 l/s for the Chilean series and 160-210 l/s for the shorter Bolivian series, neither shows any clear sign of seasonality or a good correlation to the flow series at the other station. Hence, the variation must be assigned to uncertainty in the measurements.

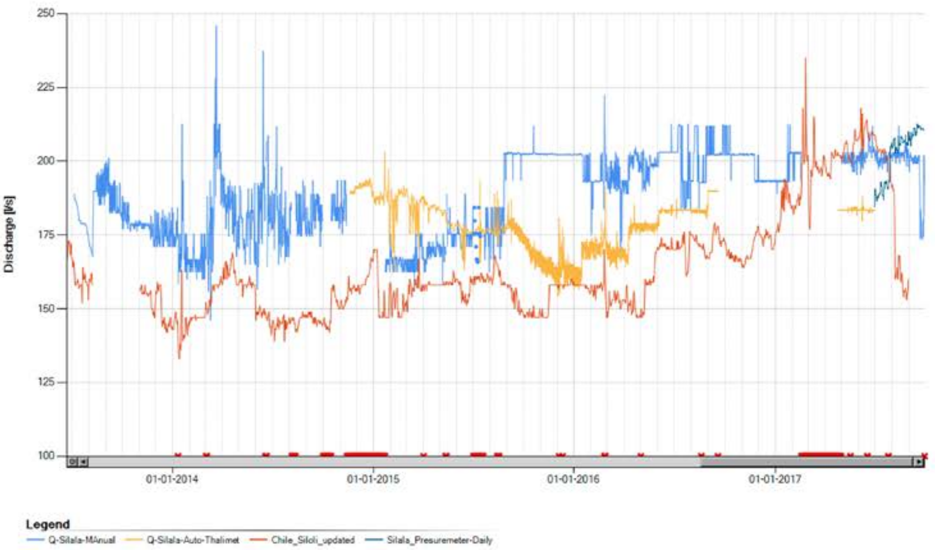

Figure 22 Long-term series of measured Silala Canal flows close to border, 2013-2017 blue curve: manual readings C7, yellow curve: automatic floater instrument C7, turquoise curve: daily average from the new pressure sensor C7; red curve daily data from DGA's Siloli station just downstream of the border.

The impacts on the Silala flows from direct rainfall runoff have been investigated by comparing the flow series with the Inacaliri rainfall station which has been found to be representative of the area (see Annex B). As seen in Figure 23, the impacts on the flow series even from large rainfall events are smaller variations (peaks) in the general flow regime corresponding to the direct runoff from less than one square kilometer. The peaks are all short in duration and may very well be explained by the direct rainfall on the wetlands and slopes of the ravines.

This confirms that by far the largest part of the catchment to the Silala Springs contributes to the surface water flows only through infiltration and groundwater discharge, which is in line with the absence of visible signs of recent overland flow in the catchment areas upstream the Near Field.

It is also noted that the rainfall impact is smaller than the uncertainty introduced by the observation problems giving abrupt changes in the measured flows.

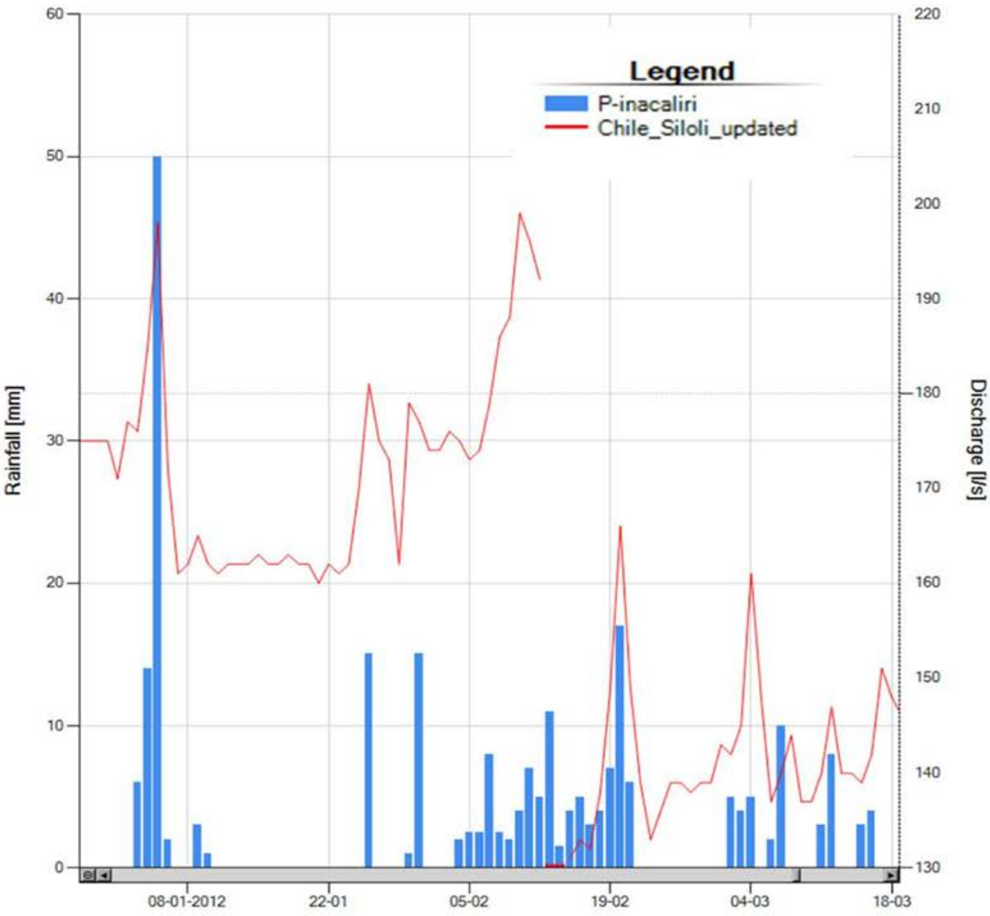

Figure 23 Impact on the flow series (red curve from direct rainfall runoff (blue columns).

3.6 Continuous flow data of installed flumes

During May-June 2017, SENAMHI installed and calibrated six additional flumes and V-notch weirs with the purpose of determining the flow rate at strategic locations in the canals of the Silala Springs System as exactly as possible (SENAMHI (b), 2017).

All the weirs are equipped with continuous, automated pressure sensors, which provide continuous records of high temporal resolution

The resulting time series cover the period July –Sept 2017. All series show a high base flow level superimposed with a smaller periodic daily variation peaking around midday.

Unfortunately, the base flow in all series exhibits abrupt jumps at certain dates and sometimes trends in the intermediate periods. None of these variations can be assigned to climatic events and must therefore be due to malfunctions of the equipment or other error sources. Due to these uncertainties and the short gauging period, the continuous records have not been used in the flow distribution calculation which has been based entirely on the simultaneous observations as described in the previous section.

Although the daily flow variations may play a role in the uncertainty of the simultaneous observations, they are too small to explain the spread in the simultaneous measurements at the locations. The flows peaks at midday at all stations and daily variations can therefore not be due to the daily variation in potential evaporation that peaks at the same time and therefore should result in low canal flows at mid-day. Instead the flow variation must be caused by other factors, maybe by freezing and thawing of the water in the wetlands.

The results from the two two-week periods, during which the data are most consistent, confirm contributions from the Southern and Northern wetlands to be approximately 60 % and 40 % of the confluence flow, respectively, and that the flow contribution in the ravine between C4 and C5 is a significant part of the flow at the confluence.

3.7 Data consistency and uncertainty

The canal flows have been measured for different periods, at different locations and by different methods. Comparison of the long-term flow records from the permanent flumes in Bolivia and Chile, respectively, shows significant differences in both the mean flow levels and temporal variation. None of the series from the two sites seems, however, to be free of gauging inconsistencies, which may be due to the remote locations and harsh climate.

The more short-term continuous and simultaneous flow measurements carried out in January-September 2017 exhibit inconsistencies both at the individual gauging points and also when cross-comparing the data. Figure 24 shows C-5, C-6 and C-7 flow measurements in July-September 2017. The measured continuous flows are significantly higher than the simultaneous flow measurements for all three locations and there are unexplained, but significant differences between the sum of C5 and C6 versus C-7 flows.

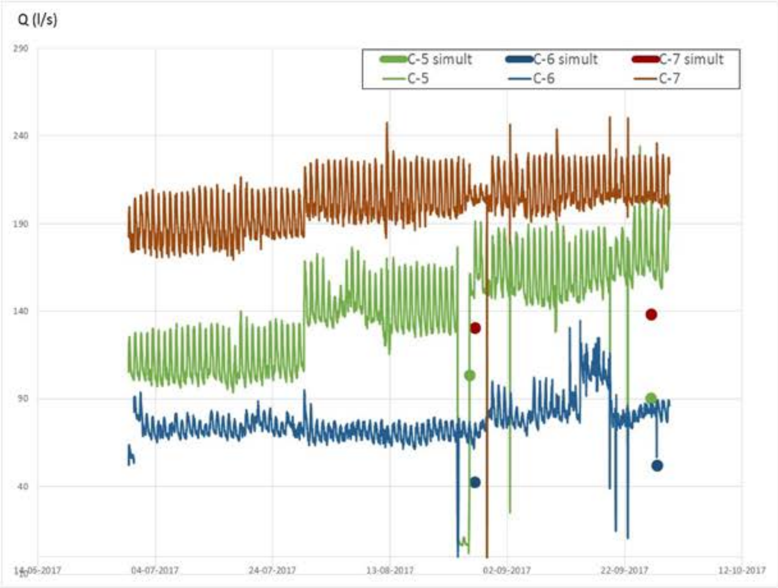

Figure 24 Continuous (shown as lines) and simultaneous (shown as circles) flow measurement data, July-September 2017.

4 Summary and conclusions

- The continuous Silala canal flow measurements are available from the two permanent gauging stations on Bolivian and Chilean territory immediately upstream and downstream of the border. These data have been supplemented by new measurements carried out by SENAMHI during January-September 2017. SENAMHI's field program includes simultaneous micro-propeller flow measurements (21 locations), spring flow measurements (20-33 Ojos De Agua) and six continuous flume water level recorders converted to flows.

- The long-term time series from the Bolivian and Chilean permanent flumes show mean flow rates around 160 l/s – 210 l/s with the series from Chile generally being 15-25 l/s lower than the Bolivian ones. The temporal variations in flow at both locations are generally not mutually correlated or correlated with seasons, climate or runoff events.

- The flow data analysis shows that the flows are dominated by groundwater discharges and approximately constant in time. The temporal variation observed in site-specific flow measurements cannot be explained by responses in neighbouring measurement locations or any climate or runoff events.

- Smaller impacts from rain events can be detected but reflect the runoff from a small area in the order of one square kilometre probably consisting of the wetlands and slopes to the ravines.

- The measured flows have been used to calculate the spatial distribution of inflows. The spring inflows to the Northern and Southern wetlands account for roughly 60 % of the total canal flow at the canal confluence. Diffuse inflows account for the remaining 40 %.

- The flow measurements also show that the Northern and Southern wetlands contribute to respectively around 40 % and 60 % of the confluence flow and that a significant part of the flow in the Southern canal enters along the ravine upstream of the confluence.

- The comparison of flow measurements shows significant differences and deviations, under what would be expected to be well-controlled flume measurements. The additional measurements carried out in May-September 2017 have not narrowed the flow range in the downstream reach between C-7 and the border. Despite independent continuous and simultaneous flow measurements on the Chilean and Bolivian side of the border, the actual canal flow at the border remains uncertain (160 -210 l/s).

- Smaller periodic daily flow variations have been detected at all of the seven continuous gauging sites during the winter of 2017. They cannot be caused by wetland evaporation but are likely to be the effect of freezing/melting of the water in the wetlands.

- The flow measurements have provided valuable information regarding the spatial distribution of inflows and allowed a breakdown of water balances by reach. Although considerable flows (approximately 95 l/s) enter through the springs at the Northern and Southern wetlands, a large groundwater inflow contribution has been identified along the Southern Canal between C3-C5, especially along the upper reaches of the ravine, coinciding with a locally steep drop in topography and canal levels.

- The different flow measurements around C5-C7 just upstream the border revealed inconsistencies between the flow records and have not contributed to narrowing the canal flow range.

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