INTERNATIONAL COURT OF JUSTICE

DISPUTE CONCERNING CERTAIN ACTIVITIES CARRIED OUT BY NICARAGUA IN THE BORDER AREA

(COSTA RICA v. NICARAGUA)

MEMORIAL OF COSTA RICA



VOLUME I

5 DECEMBER 2011

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CHAPTER I: INTRODUCTION

A. Origins of the Dispute

1.1. The present proceedings were commenced by an Application that was filed with the Registry on 18 November 2010. The case concerns breaches by Nicaragua of obligations owed to Costa Rica under the following:

- The Charter of the United Nations and the Charter of the Organization of American States;
- the Treaty of Territorial Limits between Costa Rica and Nicaragua of 15 April 1858 (the Treaty of Limits), in particular Articles I, II, V, VI and IX;[1]
- the arbitral award issued by the President of the United States of America, Grover Cleveland, on 22 March 1888 (the Cleveland Award);[2]
- the Pacheco-Matus Delimitation Convention of 27 March 1896;[3]

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[1] **Vol. II, Annex N° 1**. Treaty of Limits between Costa Rica and Nicaragua (Cañas-Jerez), San José, 15 April 1858. English translation: Costa Rican version submitted to Cleveland, Source: P. Perez Zeledón, *Argument on the Questions of the Validity of the Treaty of Limits between Costa Rica and Nicaragua (*Washington D.C.: Gibson Bros., Printers and Bookbinders, 1887), Document N° 1, pp. 185-190.

[2] **Vol. II, Annex N° 7**, Award of the Arbitrator, the President of the United States, upon the validity of the Treaty of Limits of 1858 between Nicaragua and Costa Rica, reprinted in United Nations, *Reports of International Arbitral Awards*, Vol. XXVIII (2006) pp. 207-211. The Award was given in English.

[3] **Vol. II, Annex N° 8**, Costa Rica-Nicaragua Delimitation Convention (Pacheco-Matus), San Salvador, reprinted in United Nations, *Reports of International Arbitral Awards*, Vol. XXVIII (2006) pp. 211-213.

- the first and second arbitral awards rendered by Edward Porter Alexander dated respectively 30 September 1897 and 20 December 1897 (the first and second Alexander Awards);[4]
- the Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900) also known as the Alexander Minutes.[5]
- the 1971 Convention on Wetlands of International Importance especially as Waterfowl Habitat (the "Ramsar Convention");[6]
- the judgment of the Court of 13 July 2009 in the *Case Concerning the Dispute Regarding Navigational and Related Rights (Costa Rica v. Nicaragua)*;
- the order of the Court of 8 March 2011 in the case concerning *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*;
- the International System of Protected Areas for Peace (SI-A-PAZ) and the Convention for the Conservation of the Biodiversity and Protection of the Main Wild Life Sites in Central America; and
- other applicable rules and principles of international law.

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[4] **Vol. II, Annexes N° 9, 10, 11 and 12**. The Alexander Awards are reprinted in United Nations, *Reports of International Arbitral Awards*, Vol. XXVIII (2007).

[5] **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900).

[6] **Vol. II, Annex N° 14**, Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar (Iran), 2 February 1971, as amended by the Paris Protocol of 3 December 1982, and Regina Amendments of 28 May 1987, 996 UNTS 246. Both Costa Rica and Nicaragua are parties to the Ramsar Convention. Costa Rica ratified the Convention on 9 April 1991 and Nicaragua and 24 September 1996. See **Vol. II, Annex N° 16**, Costa Rica through Law No. 7224 of 9 April 1991 and **Vol. II, Annex N° 18**, Nicaragua through Decree No.21-96 of 24 September1996, Official Gazette No. 206 of 31 October1996.

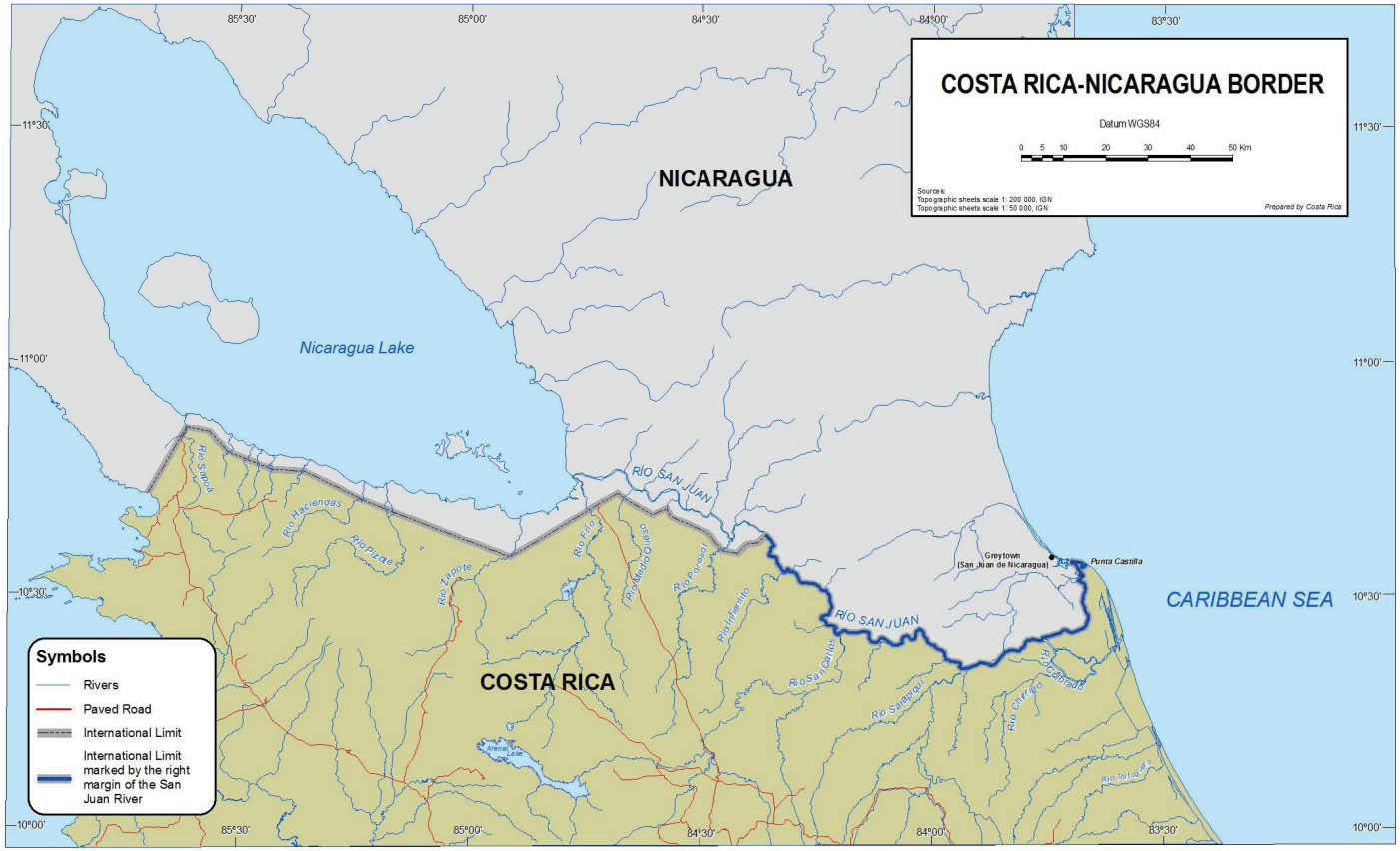
1.2. Costa Rica is a Central American Republic bounded on the north by Nicaragua and on the south by Panama. See **Sketch Map 1.1.** The San Juan River (hereafter "the San Juan") is a major river which flows between the two countries from Lake Nicaragua in a generally easterly direction to the Caribbean Sea; a length of about 205 kilometres. See **Sketch Map 1.2.**

Sketch Map 1.1



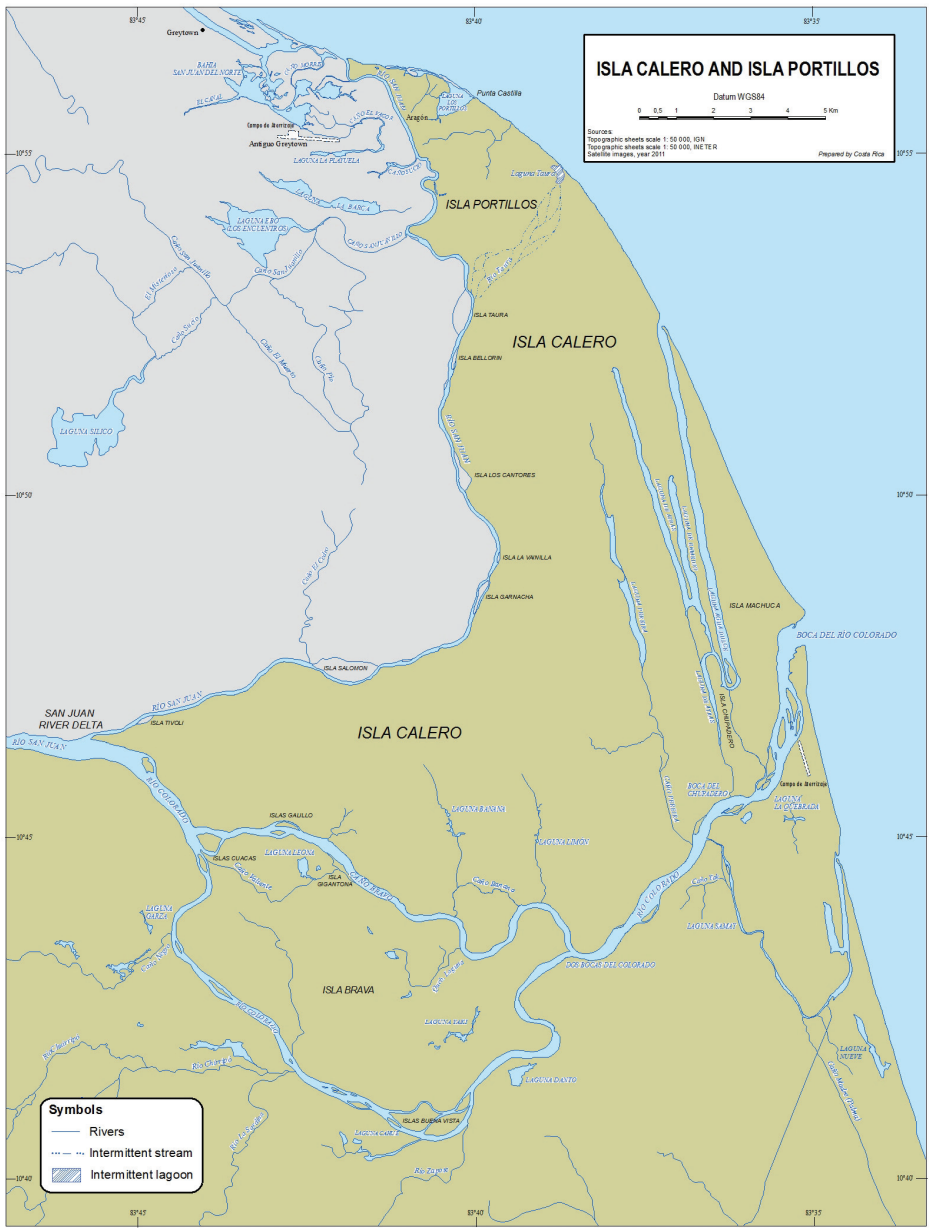
For illustrative purposes only

Sketch Map 1.2



For illustrative purposes only

Sketch Map 1.3



Sketch Map 1.3: Sketch Map of Isla Calero and Isla Los Portillos

1.3. Some 31.5 kilometres from its outlet in the Caribbean Sea, the San Juan branches out into the Colorado River, which runs south and west, entirely within Costa Rican territory, reaching the sea at Barra del Colorado, and the San Juan proper. The area situated between these two rivers is broadly referred to as Isla Calero. Included in this area, there is a smaller region to the north called Isla Portillos. See **Sketch Map 1.3**. Isla Portillos and its surrounding area is a unique and endangered biosphere; and has been designated a wetland of international importance pursuant to the Ramsar Convention – the *Humedal Caribe Noreste*.

1.4. In the relevant part, the boundary between Nicaragua and Costa Rica was established by the 1858 Treaty of Limits,[7] and settled and delineated by the award of President Cleveland in 1888 and by the Costa Rica-Nicaragua Demarcation Commission, including the awards issued for that Commission by General Alexander in 1897. The boundary was clearly fixed as following the right bank of the San Juan; thus encompassing the entirety of Isla Calero and Isla Portillos. Prior to January 2011, this boundary was recognised and maintained by both States for a period of more than a century.[8] See **Sketch Map 1.2**.

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[7] **Vol. I Annex N° 1**, Treaty of Limits between Costa Rica and Nicaragua, Article II.

[8] See for example the Sketch Map 2 of the Memorial of Costa Rica dated 29 August 2006 and Sketch Map 1 of the Counter-Memorial of Nicaragua dated 27 May 2007 in the *Case Concerning the Dispute Regarding Navigational and Related Rights (Costa Rica v. Nicaragua)* (**Vol. V, Annexes N° 195** and **197**).

1.5. The boundary line was marked by Alexander on a hand-drawn sketch map annexed to the minutes of the Delimitation Commission.[9] Alexander's original sketch is reproduced below:

Figure 1.1

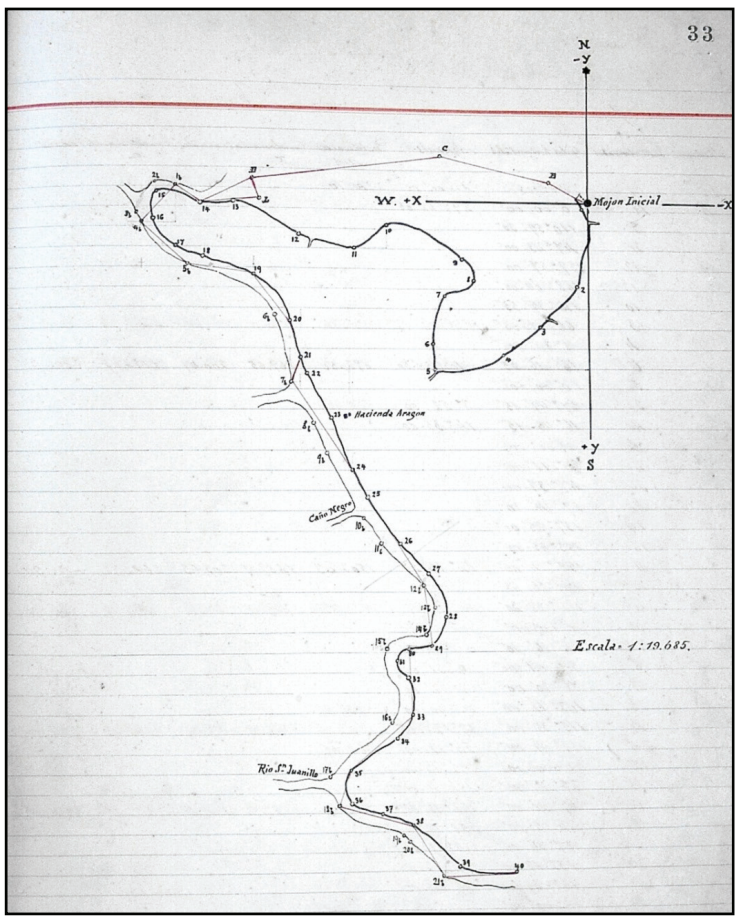

Figure 1.1: Hand-drawn sketch map describing the boundary starting at Punta de Castilla and following the course of the San Juan River, Alexander Minute N° X of 2 March 1898. Volume I, p. 33.

[9] **Vol. II, Annex N° 13**, Minute N° X of 2 March 1898, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, p. 33.

B. Scope of the Dispute

1.6. The present dispute encompasses three distinct but interrelated events; each stemming from unilateral and unlawful acts on the part of Nicaragua. As this Memorial will demonstrate, these acts amount to a serious breach of Costa Rica's right to territorial sovereignty and integrity and have also resulted in breaches of important obligations under international environmental law.

1.7. The first event took place on or about 18 October 2010, when Nicaragua caused its military and other personnel to be present on Costa Rican territory. It appears that Nicaragua's incursion into Isla Portillos was connected to works of dredging underway on the San Juan. After a brief withdrawal, on or about 1 November 2010 Nicaragua occupied Costa Rican territory for a second time, and the Nicaraguan army established more permanent camps on Isla Portillos. The presence of these camps and other Nicaraguan personnel in Costa Rican territory was strongly protested each time the incursions took place.[10]

1.8. The second event, taking place at the time of the second incursion, consisted of Nicaragua commencing, and, according to Nicaragua's own claim,[11] completing in January 2011, the construction of a new canal, or

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[10] **Vol. III, Annex N° 47**, Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, 21 October 2010, Ref: DM-412-10; **Vol. III, Annex N° 49**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, 1 November 2010, Ref: DM-429-10; **Vol. III, Annex N° 50**, Note from the Minister of Foreign Affairs and Worship of Costa Rica, to the Minister of Foreign Affairs of Nicaragua, 1 November 2010, Ref: DM-430-10.

[11] CR 2011/2 p. 19 (para 2) (McCaffrey): "the cleaning of the small channel, or "caño", of which Costa Rica complains was completed in late November of last year as we just heard from the Agent of Nicaragua."; CR 2011/4 p. 24 (para 25) (Reichler): "the *caño*…was completed last month".

"*caño*", aimed at joining Laguna Los Portillos[12] with the San Juan by deviating the waters of the San Juan from their natural historical course. This work has been undertaken entirely on Costa Rican territory. Furthermore, the construction of the artificial *caño* and the felling of trees linked to the artificial *caño*'s construction, has caused serious damage to *Humedal Caribe Noreste*, a protected wetland; some 6.72 hectares of old-growth forest and delicate ecosystems have been destroyed and the land where the artificial *caño* was dug out flooded.[13] The new *caño* attempts to sever the northernmost tip of Isla Portillos from the remainder of this territory, as seen on **Figure 1.2**.

Figure 1.2

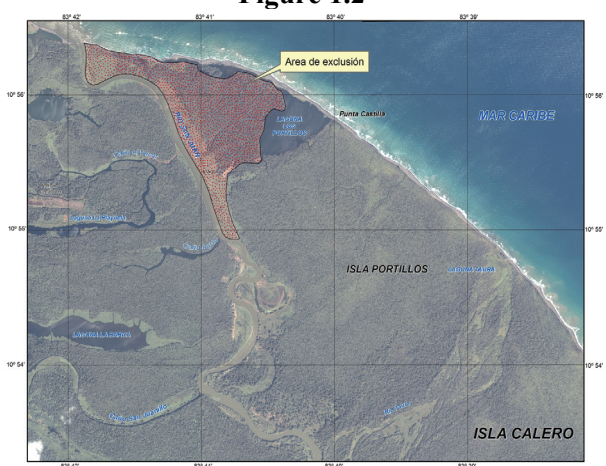

Figure 1.2: Satellite image showing the area of Isla Portillos that Nicaragua attempted to segregate.

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[12] Nicaragua refers to Laguna Los Portillos as "Harbor Head Lagoon", and the Court referred to this nomenclature in its Order for Provisional Measures (para 55). However, Costa Rica names this body of water Laguna Los Portillos, and will refer to it as such throughout the Memorial.

[13] **Vol. IV, Annex N° 155**, Ministry of Environment, Energy and Telecommunications of Costa Rica, "Assessment and Evaluation of the Environmental Situation in the Humedal Caribe Noreste within the Framework of the Order of the International Court of Justice", 28 October, 2011.

1.9. The third event, apparently intertwined with the previous two events, consisted of Nicaragua commencing a programme of dredging works on the San Juan. On 22 December 2008, the Nicaraguan Ministry of the Environment and Natural Resources approved a project that proposes to dredge a 42km length of the San Juan from the river's outlet in the Caribbean Sea to a site known as "Punta Chingo Petaca".[14] No details of Nicaragua's intended project were transmitted to Costa Rica in spite of Costa Rica's requests. The Nicaraguan government is also engaged in the cutting of meanders to alter the natural course and flow of the river. While Nicaragua may carry out works in its own territory, Nicaragua has failed to take account of applicable principles of environmental protection, including the requirement to prevent transboundary harm, and the relevant requirements set out in the 1888 Cleveland Award. Dredging sediments have been deposited on Costa Rican territory, and the works pose a significant risk to the primary rainforests and the fragile *Humedal Caribe Noreste.*

1.10. Costa Rica initially sought to resolve this dispute through diplomatic means. Costa Rica requested information regarding the dredging works[15]

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[14] **Vol. IV, Annex N° 165**, Affidavit of Hilda Espinoza Urbina, National Director of the Department of Environmental Quality at the Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 20 December 2010 (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011). See also **Vol. IV, Annex N° 160,** Resolution No. 038-2008, Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 22 December 2008, English translation by Nicaragua (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

[15] **Vol. III, Annex N° 41**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, 26 January 2006, Ref: DM-37-06; **Vol. III, Annex N° 42**, Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, 17 February 2006, Ref: MRE-DM-JI-262-02-06; **Vol. III, Annex N° 43**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, 5 May 2006, Ref: DM-187-06, **Vol. III, Annex N° 44**, Note from the Minister of Foreign Affairs of Nicaragua to the

and protested the incursion of Nicaraguan armed forces into Costa Rican territory. Costa Rica received no satisfactory response from Nicaragua.[16] Costa Rica therefore approached the Organisation of American States ("OAS") in accordance with Articles 21 and 62 of the OAS Charter and Article 52 of the UN Charter. An emergency Special Session of the Permanent Council convened on 3 November 2010 was followed by an inspection of Isla Portillos by the OAS Secretary-General on 5-8 November 2010. The Secretary-General issued four recommendations, including: "[i]n order to create a favourable climate for dialogue between the two nations, [the Governments of Costa Rica and Nicaragua] avoid the presence of military or security forces in the area…".[17] The Secretary-General's recommendations were adopted as a formal Resolution on 12 November 2010 by an overwhelming majority of OAS States.[18] Nicaragua's response was to state its immediate intention not to comply with the OAS Resolution.[19] Nicaragua's refusal to respond to the diplomatic process, refusal to remove its troops from Costa Rican territory and refusal to halt

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Minister of Foreign Affairs and Worship of Costa Rica, 8 May 2006, Ref: MRE-DM-JI-511-05-06; **Vol. III, Annex N° 45**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-637-9, 27 August 2009; **Vol. III, Annex N° 46**, Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, 12 July 2010, Ref: DM-AM-156-10.

[16] In response to Costa Rica's Diplomatic Note dated 21 October 2010, Nicaragua on 26 October 2010 simply rejected Costa Rica's protest (**Vol. III, Annexes N° 47** and **N° 48**). Nicaragua did not respond to Costa Rica's Diplomatic Note dated 1 November 2010 (**Vol. III, Annex N° 50)**.

[17] **Vol. III, Annex N° 53**, Resolution 978 (1777/10), Permanent Council of the OAS, 12 November 2010, Ref. OEA/Ser.G CP/INF 6134/10

[18] 22 votes in favour, two against (Nicaragua, Venezuela) with three abstentions.

[19] **Vol. III, Annex N° 112**, Statement of Denis Ronaldo Moncada, Nicaraguan Ambassador to the OAS, as reported in 'Call for troop withdrawal in Nicaragua, Costa Rica dispute', *CNN International*, 13 November 2010; See also **Vol. III, Annex N° 113**, English translation by Costa Rica of a speech given by President Ortega on national Nicaraguan television on 13 November 2010. [Extracts]

construction of the artificial *caño* or the felling of trees, made it necessary for Costa Rica to institute these proceedings and to apply to this Court for an Order for Provisional Measures.

1.11. Subsequent attempts to negotiate a solution proved fruitless. Nicaragua failed to attend an OAS sponsored bilateral meeting scheduled for 26 November 2010; continued with the construction of the artificial *caño* despite acknowledging that the matter was "*sub judice"* before the International Court of Justice;[20] and refused to comply with a second Resolution issued by the OAS Consultation Meeting of Foreign Ministers on 7 December 2010,[21] which called for compliance with the OAS Permanent Council Resolution of 12 November 2010.

1.12. At no time during the course of the diplomatic correspondence between the parties or during the meetings of the OAS did Nicaragua claim to have sovereignty over any part of Isla Portillos. Although ambiguous references to "Nicaraguan territory"[22] were made, it was not until the release of the "White Book"[23] on 26 November 2010 that Nicaragua for the first time announced its new claim to the territory of northern Isla Portillos; a

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[20] **Vol. III, Annex N° 65**, Note from the acting Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs of and Worship of Costa Rica, 30 November 2010, Ref: MRE-DGCPE-371-01-10.

[21] **Vol. III, Annex N° 67**, Resolution on the Situation between Costa Rica and Nicaragua, Twenty-Sixth Meeting of Consultation of Ministers of Foreign Affairs of the OAS, RC.26/RES. 1/10, 7 December 2010.

[22] **Vol. III, Annex N° 48,** Note from the acting Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, 26 October 2010, Ref: MRE/DVM/AJST/660/10/10.

[23] **Vol. II, Annex N° 30,** Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010).

claim made in response to Costa Rica instituting the present proceedings regarding the unlawful occupation of its territory and environmental damage.[24] Nicaragua officially confirmed this new claim during the hearing on Provisional Measures.[25]

C. The Order for Provisional Measures

1.13. On 18 November 2010, together with its Application instituting proceedings, Costa Rica applied to this Court requesting an Order for Provisional Measures, to prevent Nicaragua from stationing its armed forces and other personnel on Costa Rican territory, and to prevent further harm being caused to the protected *Humedal Caribe Noreste*, as this may have ultimately prejudiced Costa Rica's rights. In its Order, the Court made the following observations:

> "55. Whereas the rights claimed by Costa Rica and forming the subject of the case on the merits are, on the one hand, its right to assert sovereignty over the entirety of Isla Portillos and over the Colorado river and, on the other hand, its right to protect the environment in those areas over which it is sovereign; whereas, however, Nicaragua contends that it holds the title to sovereignty over the northern part of Isla Portillos…and whereas Nicaragua argues that its dredging of the San Juan river, over which it has sovereignty, has only a negligible impact on the flow of the Colorado river, over which Costa Rica has sovereignty;
>
> 56. Whereas, therefore, apart from any question linked to the dredging of the San Juan river and the flow of the Colorado river, the rights at issue in these proceedings derive from the sovereignty claimed by the Parties over the same territory …; and whereas the part of Isla Portillos in which the activities

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[24] CR 2011/1, pp. 2 (Brenes); 66 (Crawford).

[25] CR 2011/4, p. 8 (McCaffrey): "the dispute is about whether Nicaragua's sovereign territory embraces the area between the *caño* she recently cleaned and the River San Juan near its mouth."

> complained of by Costa Rica took place is *ex hypothesi* an area which, at the present stage of the proceedings, is to be considered by the Court as in dispute…;"[26]

And further:

> "Whereas the disputed territory is moreover situated in the "Humedal Caribe Noreste" wetland, in respect of which Costa Rica bears obligations under the Ramsar Convention; whereas the Court considers that, pending delivery of the Judgment on the merits, Costa Rica must be in a position to avoid irreparable prejudice being caused to the part of that wetland where that territory is situated; whereas for that purpose Costa Rica must be able to dispatch civilian personnel charged with the protection of the environment to the said territory, including the *caño*;…"[27]

1.14. On this basis, on 8 March 2011, the Court ordered Provisional Measures requiring that "each Party … refrain from sending to, or maintaining in the disputed territory, including the *caño*, any personnel, whether civilian, police or security;" but permitting Costa Rica to "dispatch civilian personnel charged with the protection of the environment to the disputed territory, including the *caño*, but only in so far as it is necessary to avoid irreparable prejudice being caused to the part of the wetland where that territory is situated".[28]

1.15. Nicaragua has failed to comply with the Court's Order, and has acted in such a way as to further aggravate the dispute. The relevant conduct in breach of the Order is detailed in Chapter VI of this Memorial.

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[26] Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua), Order, 8 March 2011, pp. 13-15 (paras. 55-56).

[27] Ibid., pp.19-20 (para. 80).

[28] Ibid., pp. 21-22 (para. 86).

D. The Territory of Isla Portillos

1.16. During the course of the hearing on Provisional Measures, Nicaragua claimed, without reference to any documentary record, that it was exercising sovereignty over northern Isla Portillos[29] and was thereby entitled to construct the artificial *caño*.[30] This claim arose some three months after Nicaragua began construction of the artificial *caño* in October 2011. Nonetheless, the Court was forced to acknowledge that as a result of this late claim, "the part of Isla Portillos in which the activities complained of by Costa Rica took place is *ex hypothesi* an area which, at the present stage of the proceedings, is to be considered by the Court as in dispute."[31] The Court therefore elected to use the term "disputed territory" to refer to the northern part of Isla Portillos: "the area of wetland of some three square kilometres between the right bank of the disputed caño, the right bank of the San Juan river up to its mouth at the Caribbean Sea and the Harbor Head lagoon".[32]

1.17. Costa Rica notes that the Court's use of the phrase "disputed territory" was strictly *ex hypothesi*, for the purposes of Provisional Measures. The Court expressly stated that:

> "…at this stage of the proceedings, the Court cannot settle the Parties' claims to sovereignty over the disputed territory and is not called upon to determine once and for all whether the rights which Costa Rica wishes to see respected exist, or

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[29] CR 2011/2 p. 13 (para. 25) (Argüello): "Nicaragua is not occupying Costa Rican territory. It is simply exercising the sovereignty over this small area that it has always exercised."

[30] CR 2011/2, p. 52 (para. 10) (Pellet): "Le conte du canal (que le Nicaragua serait d'ailleurs parfaitement en droit de creuser)…".

[31] Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua), Order, 8 March 2011, pp. 13-15 (paras. 55-56).

[32] Ibid.

> whether those which Nicaragua considers itself to possess exist."[33]

1.18. This "dispute" has only arisen as a result of Nicaragua's *ex post facto* claim to hitherto undisputed Costa Rican territory. The claim is fabricated, unsubstantiated and unsustainable. Costa Rica seeks reparation for the unlawful occupation of and damage to its territory.

1.19. The entirety of Isla Portillos has always been recognised as Costa Rican territory; a late and artificial claim to sovereignty on the part of Nicaragua to justify *ex post facto* its unlawful acts cannot be construed to mean that any genuine issues arise as to sovereignty over territory which has been and is lawfully in the possession of Costa Rica and under its jurisdiction.

1.20. As such, any use of the phrase "disputed territory" in the course of this Memorial is, in the manner of the Court, purely *ex hypothesi*, and without prejudice to Costa Rica's consistent and clear position regarding the status of Isla Portillos.

E. The Court's Jurisdiction

1.21. The Court has jurisdiction over the present dispute in accordance with the provisions of article 36, paragraph 2, of its Statute, by virtue of the operation of the following:

- Article XXXI of the American Treaty on Pacific Settlement, Bogotá, 30 April 1948 (the Pact of Bogotá) pursuant to Article 36(1) of the Statute of the Court;[34]

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[33] Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua), Order, 8 March 2011, p. 14 (para. 57).

[34] American Treaty on Pacific Settlement, Bogotá, 30 April 1948, 30 UNTS 84. Both Costa Rica and Nicaragua are parties to the Pact of Bogotá.

- The declarations of acceptance made respectively by the Republic of Costa Rica dated 20 February 1973, and by the Republic of Nicaragua dated 24 September 1929), pursuant to Article 36(2) of the Statute of the Court; and

- The official declaration of acceptance of the Court's jurisdiction contained in the Diplomatic Note from Manuel Coronel Kautz, Minister of Foreign Affairs by Law of the Republic of Nicaragua to Carlos Roverssi Rojas, Acting Minister of Foreign Affairs and Worship of the Republic of Costa Rica dated 30 November 2011, in which the Minister for Nicaragua stated:

> "Nicaragua considers that the matters … are *sub judice* before the International Court of Justice, reason for which it does not consider it proper to make comments about them outside from the mentioned forum."[35]

1.22. Nicaragua did not contest the jurisdiction of the Court to entertain the dispute at any stage during the Provisional Measures proceedings.[36] In its Order of 8 March 2011, the Court considered that "the instruments invoked by Costa Rica appear, prima facie, to afford a basis on which the Court might have jurisdiction to rule on the merits, enabling it to indicate provisional measures".[37]

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[35] **Vol. III, Annex N° 65**, Note from the acting Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, 30 November 2010, Ref: MRE-DGCPE-371-01-10.

[36] Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua), Order, 8 March 2011, p. 13 (para. 51).

[37] Ibid., p. 13 (para. 52)

F. The Structure of this Memorial

1.23. This Memorial is filed in accordance with the Court's Order of 5 April 2011 setting the date for submission of Costa Rica's Memorial as 5 December 2011.

1.24. The Memorial consists of five further Chapters, as follows: **Chapter II** sets out the geographical and historical context of the dispute. **Chapter III** addresses in detail the dispute before the Court, including Nicaragua's incursion and occupation of Costa Rican territory; the construction of the *caño*; the felling of trees; and Nicaragua's dredging program. In **Chapter IV**, Costa Rica will establish that Nicaragua has acted in breach of Costa Rica's right to territorial sovereignty. In **Chapter V**, Costa Rica will address Nicaragua's contravention of its obligations under international environmental law, including the obligation of consultation set out in the Ramsar Convention and Cleveland Award. In **Chapter VI**, Costa Rica will set out Nicaragua's failure to comply with the Court's Order for Provisional Measures of 8 March 2011. Finally, in **Chapter VII**, Costa Rica sets out the remedies that it seeks for Nicaragua's breaches of its obligations.

1.25. Attached to this Memorial are two hundred and thirty eight documentary annexes, two witness statements and nineteen expert reports. A list of annexes is provided at the end of this volume.

CHAPTER II: GEOGRAPHICAL AND HISTORICAL BACKGROUND

2.1. This Chapter describes the geography and history related to the Costa Rica-Nicaragua border area. While some of this information was provided to the Court during the hearing on Provisional Measures, a more complete version is set out here for the convenience of the Court. In this Chapter, **Part A** describes the geography of the San Juan and Colorado rivers, while **Part B** addresses the geography of the Costa Rican territory of Isla Portillos and Isla Calero. **Part C** explains the historical origin of the border; and finally **Part D** presents the area of Isla Portillos in the cartographies of both Costa Rica and Nicaragua.

A. The San Juan and the Colorado Rivers

2.2. The San Juan originates at the Lake of Nicaragua and flows some 205 kilometres in an easterly direction up to its outlet in the Caribbean Sea. A large percentage of the waters of the San Juan river basin originate from Costa Rican rivers **(see Sketch Map 1.2)**. For example, the Sapoa, Haciendas, Pizote, Zapote and Frío rivers feed into the Lake of Nicaragua, while the Medio Queso, Pocosol, Infiernito, San Carlos and Sarapiquí rivers discharge their waters directly into the San Juan. After the mouth of the San Juan at the Lake of Nicaragua, Costa Rican catchments alone account for about 83% of the San Juan's flow.[38]

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[38] **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of

2.3. Some 31.5 km inland of the San Juan's outlet into the Caribbean Sea, in an area known as the Colorado River Delta, the river branches out and divides into the Colorado River and the lower San Juan. The lower San Juan discharges into the Caribbean in the area near the Bay of San Juan del Norte, while the Colorado discharges in the area of Barra del Colorado, some 20 kilometres southeast of San Juan del Norte.

2.4. The "Environmental Impact Study for Improving Navigation on the San Juan de Nicaragua River"[39] presented by Nicaragua during the hearing on Provisional Measures, provides data on water flow and discharge levels of the San Juan River and its tributaries and branches. Based on measurements taken in August 2006, this study reports the San Juan's flow before the Colorado Delta at 1636 m³/second, of which 178 m³/second (approximately 11%) discharged through the lower San Juan to the Caribbean Sea.[40] Therefore, the remaining 1458 m³/second (approximately 89%) flows through the Colorado River and empties into the Caribbean Sea at Barra del Colorado.[41]

2.5. This proportion in the discharge of the San Juan's waters between the Colorado and lower San Juan branches after the Colorado Delta has been similar since the mid-nineteenth century. Col. Orville W. Childs surveyed the San Juan river between 1850 and 1851 and reported that the flow of the San Juan immediately above the Colorado, as gauged on 20 of August 1850, was 54,380 cubic feet per second [1539.87 m3/s], of which 42,056

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the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, p. II-11.

39 **Vol. IV, Annex N° 158** [excerpts], Corea y Asociados S.A. "*Estudio de Impacto Ambiental para el Mejoramiento de la Navegación en el río San Juan de Nicaragua*, September 2006 (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

40 Ibid., pp. 71-72.

41 Ibid., p. 72.

[1190.89 m3/s] passed through the Colorado to the ocean, and 12,324 [348.98 m3/s] through the lower San Juan.[42] Thus, according to this survey some 77% of the overall flow of the San Juan discharged through the Colorado River after the Delta, and the remaining 23% through the lower San Juan.

2.6. On 1873 another survey was made by Commander Lull of the U.S. Navy. He reported a water flow of the San Juan River below the mouth of the Sarapiqui River of 16,770 cubic feet per second [474.87 m3/s] (surveyed on 16 May 1873), of which 16,190 [458.45 m3/s] (surveyed on 19 May 1873) discharged through the Colorado and 607 [17.18 m3/s] through the lower San Juan (surveyed on 20 May 1873).[43] This resulted in some 96% of the San Juan's flow discharging through the Colorado River at that moment, and the remaining 4% through the lower San Juan.

2.7. The varying results of measurements of water flow and discharges in the 19th century can be explained by the limited accuracy of methods available at the time, but also because the results will vary according to the time of the year when the surveys are made, and other variables, such as precipitation. The percentages of discharges flowing through the Colorado and San Juan after the Colorado Delta are also contingent on the overall water flow level of the San Juan River: normally, a lower flow level of the San Juan will result in a smaller percentage of discharge through the San Juan after the Delta and a higher percentage of discharge through the

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42 **Vol. IV, Annex N° 139**, Orville W. Childs. "Report of the survey and estimates of the cost of constructing the inter-oceanic ship canal, from the harbor of San Juan del Norte, on the Atlantic, to the harbor of Brito, on the Pacific, in the State of Nicaragua, Central America, made for the American, Atlantic and Pacific Ship Canal Co., in the years 1850-51-52." (New York: WM. C. Bryant, Printers, 1852) p. 83.

43 **Vol. IV, Annex N° 140**, Nicaragua Canal Commission "Report of the Nicaragua Canal Commission, 1897-1899, Volume 1" p. 260.

Colorado. In spite of these variables, it becomes apparent that at least since 1850 similar results have been determined regarding the percentages of discharges flowing through the Colorado and San Juan rivers after the Colorado Delta, whereby something of the order of 10% goes to the Río San Juan and around 90% goes to the Río Colorado.[44]

B. Isla Portillos and Isla Calero

2.8. The Costa Rican territory located between the San Juan and the Colorado rivers is known as Isla Calero (See **Sketch Map 1.3**), which is located in the Province of Limón, Canton of Pococí, District of Colorado. It is referred to as an island because it is entirely surrounded by three water bodies: the San Juan and the Colorado rivers and the Caribbean Sea. In turn, this larger area is divided into two regions: Isla Calero proper, south of what was once the Taura River; and Isla Portillos, to the north of the Taura River. Isla Calero measures 151.6 km^2 and Isla Portillos 16.8 km^2. The Taura River, which used to divide Isla Portillos from Isla Calero, became an intermittent stream in the mid-twentieth century, rendering them into a single land mass.

2.9. The north tip of Isla Portillo is flanked to the East by a body of fresh water called Laguna Los Portillos. This lagoon is separated from the Caribbean Sea by a sandbar. The English version of its name derives from the fact that it became inaccessible to ocean going vessels and was referred to as the lagoon at the head of the harbour.

2.10. Nicaragua's proposed dredging program covers that part of the San Juan between its outlet in the Caribbean Sea and some 10 km above the bifurcation with the Colorado River, up to a place called Punta Petaca.

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[44] **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, p. II-26.

Figure 2.1, taken from the 2006 Environmental Impact Study submitted by Nicaragua during the hearing on Provisional Measures, shows the length of the San Juan that would be covered by the dredging program.[45] This map depicts the entirety of Isla Portillos as Costa Rican.

Figure 2.1

Mapa de Área del proyecto

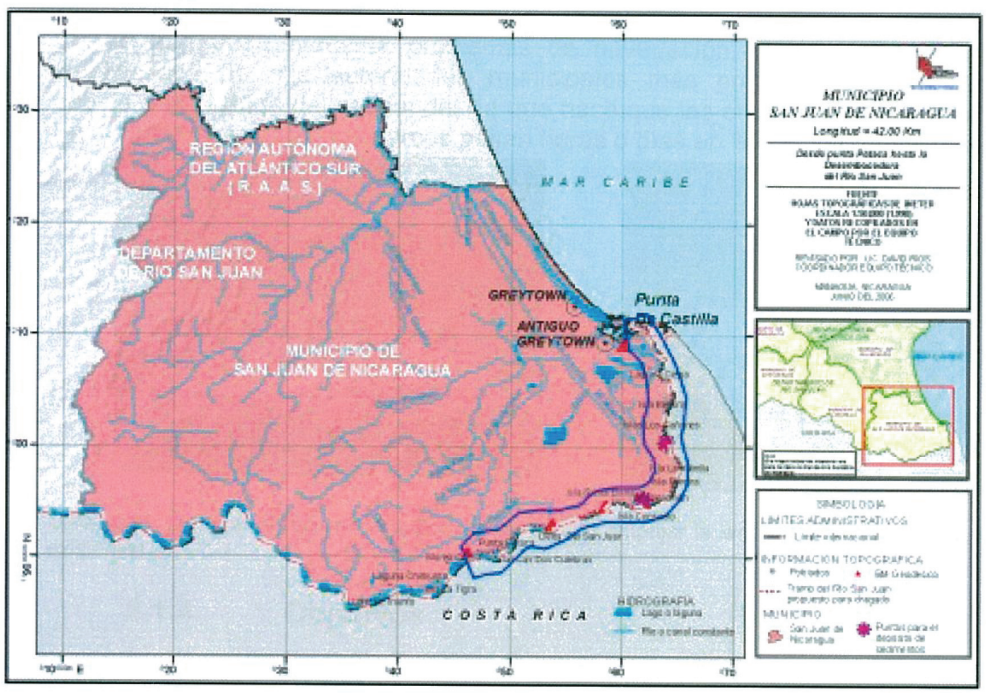

Figure 2.1: Area of dredging project, sketch map submitted by Nicaragua for the hearings on Provisional Measures

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[45] **Vol. IV, Annex N° 158** [excerpts], Corea y Asociados S.A. "*Estudio de Impacto Ambiental para el Mejoramiento de la Navegación en el río San Juan de Nicaragua*, September 2006 (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011), p. 6, Figure 2.2 Mapa del Área del proyecto.

2.11. In 1994, Isla Portillos was designated part of Costa Rica's Border Zone National Wildlife Refuge[46] (See **Figure 4.10**). In accordance with Costa Rican legislation, the Wildlife Refuge belongs to the Costa Rican state, although private individuals may obtain a *Permiso de Uso* (permits or titles to use) which entitle them to make use of the land in ways which are consistent with its character as a Wildlife Refuge. Plans registered with Costa Rica's Public Registry in 2006 that relate to Isla Portillos are included as **Annexes 216** to **221.**

2.12. Isla Portillos is also part of the *Humedal Caribe Noreste* (Northeast Caribbean Wetland) which, following Costa Rica's request, was designated as a Wetland of International Importance under the 1971 Ramsar Convention.[47]

2.13. In the area, both Costa Rica and Nicaragua have each registered territories as "Wetlands of International Importance". These wetlands are located to the northeast and southeast of their respective territories. On 20 March 1996, Costa Rica registered the *Humedal Caribe Noreste* wetland, an area that comprises over 75,000 hectares. The "Annotated Ramsar List of Wetlands of International Importance: Costa Rica" describes the region as follows:

> "Limón and Heredia; 75,310 ha; 10º30'N 083º30'W. The wetland includes lakes, grassmarshes, wooded swamps, gullies, streams and backwaters of large rivers as well as estuarine lagoons. The wetland area is the main stopover and entrance to Costa Rica for most Neotropical migratory

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[46] **Vol. II, Annex N° 29**, Ministry of Environment, Energy and Mines, Decree N° 22962-MIRENEM of 15 February 1994.

[47] **Vol. II, Annex N° 20**, Certificate of Incorporation issued by the President of the Permanent Council of the Ramsar Convention and its official notification to the Costa Rican Government, Gland, Switzerland, 6 August 1996. See also **Vol. V, Annex N° 199**, Humedal Caribe Noreste Map.

> birds, and the eagle *Morphnus guianensis,* the second largest bird of prey, has been recorded in the area. There are also several species of salamanders thought to be endemic to the area. The area is used largely for agriculture, and cattle ranching, tourism and fishing are also important activities. Ramsar site no. 811. Most recent RIS information: 1996."[48]

2.14. Nicaragua, for its part, registered on 8 November 2001 the wetland Refugio de Vida Silvestre Río San Juan. This wetland is described as follows:

> "Río San Juan, Atlántico Sur; 43,000 ha; ca.10°56'N 083°40'W. Wildlife Refuge, Biosphere Reserve. A long, slender, convoluted site that follows the course of the Río San Juan, which flows from Lake Nicaragua at 32m altitude along the Costa Rican frontier 200km to the city of San Juan del Norte on the Caribbean coast, and includes the coastline to the north as well, part of the Biosphere Reserve Indio Maiz, forming one of the two most extensive biological nuclei of the Mesoamerican Biological Corridor. The site comprises an array of wetland types, including estuary and shallow marine waters, coastal freshwater lagoon, and intertidal marsh, as well as permanent lakes, rivers, and pools, *inter alia*. Nearly all of the Ramsar Criteria are met, and four species of turtles, as well as the manatee Trichechus manatus, are supported. Ramsar site no. 1138. Most recent RIS information: 2001."[49]

2.15. The *Humedal Caribe Noreste* encompasses several Costa Rican wildlife reserves, such as the Border Zone National Wildlife Reserve, the Barra del Colorado National Wildlife Reserve, the Tortuguero National Park and the Tortuguero Protected Zone.[50] As it forms part of the *Humedal Caribe Noreste*, the Isla Portillos/Isla Calero area in particular is part of an

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[48] **Vol. IV, Annex N° 119**, The Annotated Ramsar List of Wetlands of International Importance, Costa Rica, 10 January 2000.

[49] Ibid.

[50] **Vol. V, Annex N° 199**, Map of the Humedal Caribe Noreste.

important international biological corridor that joins different protected areas in Costa Rica and Nicaragua (the San Juan River Wildlife Reserve, which as indicated above is also a Ramsar site). Together they are part of the Mesoamerican Biological Corridor. They are also protected under the SI-A-PAZ (International System of Protected Areas for Peace) agreement, signed at Puntarenas on 15 December 1990.[51]

C. Origin of the Costa Rica-Nicaragua Border

(1) The 1858 Treaty of Limits

2.16. The territorial limits between Costa Rica and Nicaragua were settled by the Treaty of Limits signed on 15 April 1858 by José María Cañas on behalf of Costa Rica and Máximo Jerez, on behalf of Nicaragua ("Treaty of Limits").[52] The Treaty of Limits was ratified by Costa Rica on 16 April 1858 and by Nicaragua on 26 April 1858.[53] On that same day the ratification instruments were exchanged by the two Presidents in the city of Rivas, Nicaragua.

2.17. Article II of the Treaty of Limits delimits a portion of the boundary as running along the right bank of the lower San Juan until its outlet in the Caribbean Sea, with all of the territory situated to the south of the right bank of the river, including Isla Portillos and Isla Calero, belonging to Costa Rica:

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[51] See paragraph 5.32.

[52] **Vol. II, Annex N° 1**, Treaty of Limits between Costa Rica and Nicaragua, San José, 15 April 1858.

[53] The Treaty was ratified by Nicaragua twice: by decree of President Tomas Martinez, President of the Republic of Nicaragua, reproduced in P. Pérez Zeledón, *Argument on the Question of the Validity of the Treaty of Limits between Costa Rica and Nicaragua* (Washington: Gibson Bros, 1887), 53-4 (hereafter Pérez Zeledón, *Argument*); and by the Constituent Assembly of the Republic of Nicaragua: *Gaceta de Nicaragua*, No. 15, 28 May 1858, cited in Pérez Zeledón, *Argument*, 55. **Vol. II, Annexes N° 2 and N° 3**.

> "The dividing line between the two Republics, beginning at the North Sea [Caribbean Sea], shall start at the extremity of Punta de Castilla, at the mouth of the river San Juan de Nicaragua, and shall run along its right bank to a point 3 English Miles distant from Castillo Viejo…"[54]

2.18. From that point, the boundary turns inland on both sides and runs across land areas until it reaches the common Bay of Salinas in the Pacific Ocean (see **Sketch Map 1.2**).[55]

2.19. Furthermore, the Treaty of Limits established Nicaragua's "dominion and sovereign jurisdiction over the waters of the San Juan", but at the same time asserted Costa Rica's navigational rights on the lower course of the river.[56] These features are relevant for the configuration of the border in the Isla Portillos area when the precise boundary was designated in 1897.

2.20. Article IV of the Treaty of Limits also established Costa Rica's and Nicaragua's joint ownership of the Bays of San Juan del Norte and Salinas.[57]

(2) The Cleveland Award of 1888

2.21. Despite more than a decade of observance of the Treaty by both countries, in 1870 Nicaragua began to challenge the validity of the Treaty of Limits.[58] In response, both countries agreed to submit the question of the validity of the Treaty of Limits to the arbitration of the President of the United States. To this end, on 24 November 1886 a treaty was signed by

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54 **Vol. I, Annex N° 1**, Treaty of Limits between Costa Rica and Nicaragua, Article II.

55 Ibid.

56 Ibid., Article VI.

57 Ibid., Article IV.

58 See **Vol. II, Annex N° 6**, Remarks made by the Government of Costa Rica to the Government of Nicaragua when the latter submitted to the Nicaraguan Congress its "points of doubtful interpretation": Minister of Foreign Affairs of Costa Rica, Lorenzo Montufar, to the Minister of Foreign Affairs of Nicaragua, Tomás Ayón, 1 February 1870, reproduced in Pérez Zeledón, *Argument*, 274-8.

Ascensión Esquivel, on behalf of Costa Rica, and José Antonio Román, on behalf of Nicaragua.[59] Pursuant to the terms of the 1886 Esquivel-Román Treaty, if the Treaty of Limits was found to be valid, the President of the United States would also decide any other point of doubtful interpretation raised by either party, and both countries would appoint commissioners to demarcate the boundary, as established in Article II of the Treaty of Limits.

2.22. Following the exchange of ratifications of the Esquivel-Román Treaty on 1 June 1887, the President of the United States of America, Grover Cleveland, accepted the duties of Arbitrator. On 22 June 1887, Nicaragua submitted to Costa Rica 11 points of doubtful interpretation.[60] Nicaragua questioned the location of the starting point of the boundary "at the mouth of the river", at the location of Punta de Castilla;[61] it questioned whether Costa Rica was obliged to contribute to the expense of keeping the Bay of San Juan and the San Juan River unobstructed and navigable;[62] it questioned whether Costa Rica could prevent Nicaragua from carrying out works of improvement, or whether Costa Rica had a right of indemnification for harm caused to Costa Rican territory as a result of the said works;[63] it questioned whether Costa Rica could prevent Nicaragua from deviating waters of the

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59 **Vol. II, Annex N° 4**, Costa Rica-Nicaragua, Convention to submit to the arbitration of the Government of the United States the question in regard to the validity of the Treaty of April 15, 1858 (Esquivel–Román), Guatemala, 24 December 1886, in P. Pérez Zeledón, *Argument on the Question of the Validity of the Treaty of Limits between Costa Rica and Nicaragua* (Washington, D.C., Gibson Bros, 1887), pp. 5-8.

60 **Vol. II, Annex N° 5**, Points which according to the Government of Nicaragua are Doubtful and Require Interpretation, 22 June 1887, in Pérez Zeledón, *Argument* pp. 9-11.

61 Ibid, §1.

62 Ibid, §4.

63 Ibid, §6.

San Juan;[64] and it questioned whether Nicaragua must first ask the opinion of Costa Rica before making grants for canal purposes across its territory.[65]

2.23. On 22 March 1888, President Cleveland rendered his Award (the "Cleveland Award").[66] The first article of the Cleveland Award declared the Treaty of Limits valid. The third article of the Award referred to each of the 11 points of doubtful interpretation presented by Nicaragua, some of which are relevant to the present proceedings. The Cleveland Award held that the boundary line began at the mouth of the San Juan River, at Punta Castilla, and that any accretion to Punta Castilla would be governed by the laws on that subject;[67] that Costa Rica is not obliged to contribute to the expenses incurred by Nicaragua in carrying out works of improvement on the San Juan;[68] that Costa Rica cannot prevent Nicaragua carrying out such works of improvement on Nicaraguan territory, provided such works of improvement do not result in harm to Costa Rican territory or impairment to Costa Rica's right to navigate the San Juan;[69] that Costa Rica may prevent Nicaragua from deviating the waters of the San Juan where such deviation would result in the destruction or serious impairment of navigation of the San Juan or any of its branches where Costa Rica has a right of navigation;[70] and that Nicaragua

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64 Ibid, §9.

65 Ibid., §10.

66 **Vol. II, Annex N° 7**, Award of the Arbitrator, the President of the United States, upon the validity of the Treaty of Limits of 1858 between Nicaragua and Costa Rica (Cleveland Award), Washington, D.C., 22 March 1888.

67 Ibid., Article III, §1.

68 Ibid., Article III, §4.

69 Ibid., Article III, §6.

70 Ibid., Article III, §9.

cannot make grants for canal purposes across its territory without first asking the opinion of Costa Rica.[71]

2.24. Pursuant to Article VII of the Esquivel-Roman Treaty, both countries agreed to accept the Cleveland Award unconditionally.[72] At no stage has Nicaragua ever challenged the validity of the Cleveland Award.

(3) The 1896 Pacheco-Matus Convention and the Alexander Minutes and Awards

2.25. Following the decision of President Cleveland that the Treaty of Limits was valid, and in accordance with Article X of the Esquivel-Román Treaty, on 16 June 1890, both countries began work on the demarcation of the boundary line. However, due to the differences as to how best to proceed with the demarcation, it was agreed that a joint Demarcation Commission should be established. Consequently, on 27 March 1896 a Convention was signed by Leonidas Pacheco, on behalf of Costa Rica, and Manuel Coronel Matus, on behalf of Nicaragua, setting out the details of the new Demarcation Commission (the "Pacheco-Matus Convention").[73] The Demarcation Commission was to comprise engineers appointed by the two parties,[74] and a neutral engineer-arbitrator to resolve any disputes between them. As stated in Article II of the Pacheco-Matus Convention:

> "The commissions created by the foregoing article shall be completed by an engineer whose appointment shall be

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71 Ibid., Article III, §10.

72 **Vol. II, Annex N° 4**, Costa Rica-Nicaragua, Convention to submit to the arbitration of the Government of the United States the question in regard to the validity of the Treaty of April 15, 1858 (Esquivel–Román), Guatemala, 24 December 1886.

73 **Vol. II, Annex N° 8**, Costa Rica-Nicaragua Delimitation Convention (Pacheco-Matus) San Salvador, 27 March 1896.

74 Ibid., Article I.

> requested by both parties of the President of the United States of America, and whose duties shall be limited to the following:
>
> Whenever in the carrying out of the operations the commissions of Costa Rica and Nicaragua shall disagree, the disputed point or points shall be submitted to the judgment of the engineer named by the President of the United Sates of America. The engineer shall have ample authority to decide any kind of dispute that may arise, and his decision shall be final as to the operations in question."[75]

2.26. According to Article IV of the Pacheco-Matus Convention, the demarcation works would start at the end of the boundary line "from the Atlantic Coast".[76]

2.27. Article V of the Pacheco-Matus Convention established the rule that the absence of the commissioners from either Costa Rica or Nicaragua would not prevent the commencement or continuation of the demarcation works, provided the other commission and the Arbitrator were present.[77]

2.28. Article VIII gives immediate binding force to the proceedings of the Demarcation Commission:

> "The minutes of the work, which shall be kept in triplicate and which the commissioners shall duly sign and seal, shall constitute, without the necessity of approval or any other formality on the parts of the signatory Republics, the proof of the final demarcation of their boundaries."[78]

2.29. The President of the United States appointed General Edward Porter Alexander as engineer-arbitrator. The Commissioners of Costa Rica and Nicaragua met with General Alexander in San Juan del Norte on 15 May

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75 Ibid., Article II.

76 Ibid., Article IV.

77 Ibid., Article V.

78 Ibid., Article VIII.

1897, and the work of the Demarcation Commission commenced.[79] By 24 July 1900, the Demarcation Commission had accomplished the task of demarcating the boundary line between Costa Rican and Nicaragua.

2.30. The complete Costa Rica-Nicaragua border, as determined by the Demarcation Commission, appears as **Figure 2.2.** This is a 1900 map bearing the signature of Engineer Lucas Fernandez, a Costa Rican member of the Demarcation Commission extracted in a 1954 Nicaraguan official publication by its Ministry of Foreign Affairs entitled "Juridical Situation of the San Juan River".

Figure 2.2

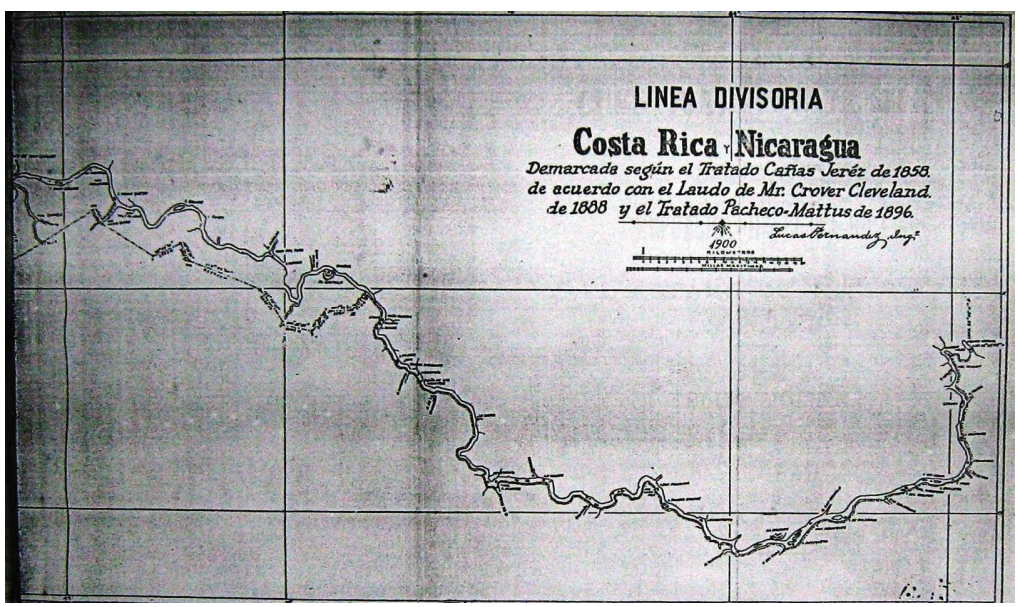

Figure 2.2. The complete Costa Rica-Nicaragua boundary as determined by the Demarcation Commission (1897-1900) Source: Ministerio de Relaciones Exteriores de Nicaragua, "Situación Jurídica del Río San Juan" (1954).

[79] **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, p. 3.

2.31. The complete records of the Demarcation Commission are contained in two handwritten volumes of Minutes (the "Alexander Minutes"), comprising twenty-seven "Proceedings" which record the precise markers indicating where the Costa Rica-Nicaragua boundary lies,[80] as well as the five Arbitral Awards rendered by General Alexander resolving the disagreements that had arisen between both countries during the demarcation process.[81]

2.32. Of the five Awards rendered by Alexander, the first and the second are of particular importance because they established not only the location of the starting point of the boundary at Punta Castilla, but also the boundary in the region of Isla Portillos and Laguna Los Portillos.

(a) First Award of E. P. Alexander of 30 September 1897

2.33. As recorded in Proceedings II of the Alexander Minutes dated 5 June 1897, the first point of contention that arose between the commissioners of Costa Rica and Nicaragua related to "the interpretation of the article establishing the initial point and the demarcation of the line to the second point".[82] This point of contention arose in part because by 1897 the "Punta de Castilla" referred to in Article II of the 1858 Treaty of Limits no longer existed. The situation was described in Alexander's First Award as follows:

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[80] **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900).

[81] First Alexander Award, San Juan del Norte, 30 September 1897; Second Alexander Award, San Juan del Norte, 20 December 1897; Third Alexander Award, San Juan del Norte, 22 March 1898; Fourth Alexander Award, Greytown, 26 July 1899; Fifth Alexander Award, Greytown, 10 March 1900. The first four of the Awards are reproduced in United Nations, *Reports of International Arbitral Awards*, Vol. XXVIII (2007): **Vol. II, Annexes N° 9, 10, 11** and **12**.

[82] **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, Proceedings II, p 4.

> "The exact spot which was the extremity of the headland of Punta de Castillo [sic] April 15, 1858, has long been swept over by the Caribbean Sea, and there is too little concurrence in the shore outline of the old maps to permit any certainty of statement of distance or exact direction to it from the present headland. It was somewhere to the northeastward, and probably between 600 and 1,600 feet distant, but it can not now be certainly located. Under these circumstances it best fulfills the demands of the treaty and of President Cleveland's award to adopt what is practically the headland of to-day, or the northwestern extremity of what seems to be the solid land, on the east side of Harbor Head Lagoon." [83]

2.34. The Costa Rican and the Nicaraguan commissions had differing views as to where the starting point of the boundary should be located. As stated in the Award: "The Costa Rican claim is located on the left hand shore or West Headland of the harbor; the Nicaraguan on the East Headland of the Taura branch"[84]. The claims forwarded by Costa Rica and Nicaragua can be appreciated in the map that accompanied this Award, both in its handwritten[85] (**Figure 2.3**) as well as in its printed[86] versions (**Figure 2.4**).

2.35. Engineer-Arbitrator Alexander issued his final decision on 30 September 1897. After analysing the arguments of both Costa Rica and Nicaragua, Alexander did not agree with the views of either commission. Rather, the Arbitrator considered that in line with the Treaty of Limits:

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[83] **Vol. II, Annex N° 9**, First Alexander Award, 30 September 1897, United Nations, *Reports of International Arbitral Awards*, Vol. XXVIII (2007), p. 220. The handwritten original text of the Award in English is recorded in the Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, Proceedings V, pp. 6-12. The handwritten version in Spanish is at **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, Proceedings VII, pp. 13-21.

[84] **Vol. II, Annex N° 9**, First Alexander Award, 30 September 1897, United Nations, *Reports of International Arbitral Awards*, Vol. XXVIII (2007), p. 216.

[85] **Vol. V, Annex N° 169**, Map of the bay of San Juan del Norte showing the starting point of the dividing boundary between Costa Rica [and] Nicaragua, compiled by the respective Commissions on 30 September 1897.

[86] **Vol. V, Annex N° 166**, United Nations, Reports of International Arbitral Awards, Volume XXVII (2007), p. 221.

> "Costa Rica was to have as a boundary line the right or southeast bank of the river, considered as an outlet for commerce, from a point 3 miles below Castillo to the sea. Nicaragua was to have her prized "sumo imperio" of all the waters of this same outlet for commerce, also unbroken to the sea…" [87]

2.36. Engineer Arbitrator Alexander noted that:

> "[t]his division brings the boundary line (supposing it to be traced downward along the right bank from the point near Castillo) across both the Colorado and the Taura branches. It can not follow either of them, for neither is an outlet for commerce, as neither has a harbor at its mouth. It must follow the remaining branch, the one called the Lower San Juan, through its harbor and into the sea. The natural terminus of that line is the right-hand headland of the harbor mouth."[88]

2.37. Having thus established the location of Punta de Castilla as the right-hand headland of the body of water that is today known as Laguna Los Portillos or Harbor Head Lagoon as the initial point of the boundary line (see **Figures 2.3** and **2.4**), Alexander then proceeded to designate the boundary line between Costa Rica and Nicaragua in that area in the following terms:

> "I have accordingly made personal inspection of this ground, and declare the initial line of the boundary to run as follows, to wit:
>
> Its direction shall be due northeast and southwest, across the bank of sand, from the Caribbean Sea into the waters of Harbor Head Lagoon. It shall pass, at its nearest point, 300 feet on the northwest side from the small hut now standing in that vicinity. On reaching the waters of Harbor Head Lagoon the boundary line shall turn to the left, or southeastward, and shall follow the water's edge around the harbor until it reaches the river proper by the first channel met. Up this channel, and

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87 **Vol. II, Annex N° 9**, First Alexander Award, 30 September 1897, United Nations, *Reports of International Arbitral Awards*, Vol. XXVIII (2007), p. 217.

88 Ibid.

up the river proper, the line shall continue to ascend as directed in the treaty."[89]

Figures 2.3 and **2.4** clearly portray this boundary.

Figure 2.3

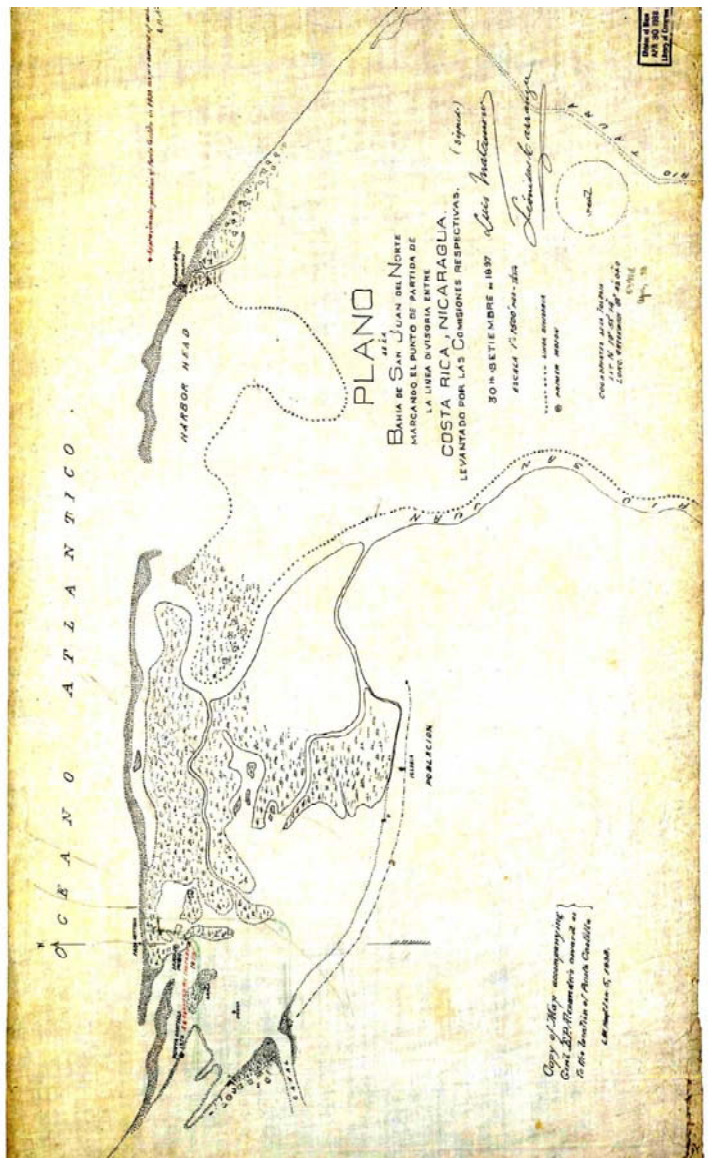

Figure 2.3: Hand drawn sketch map attached to Alexander's First Award

[89] Ibid., p. 220.

Figure 2.4

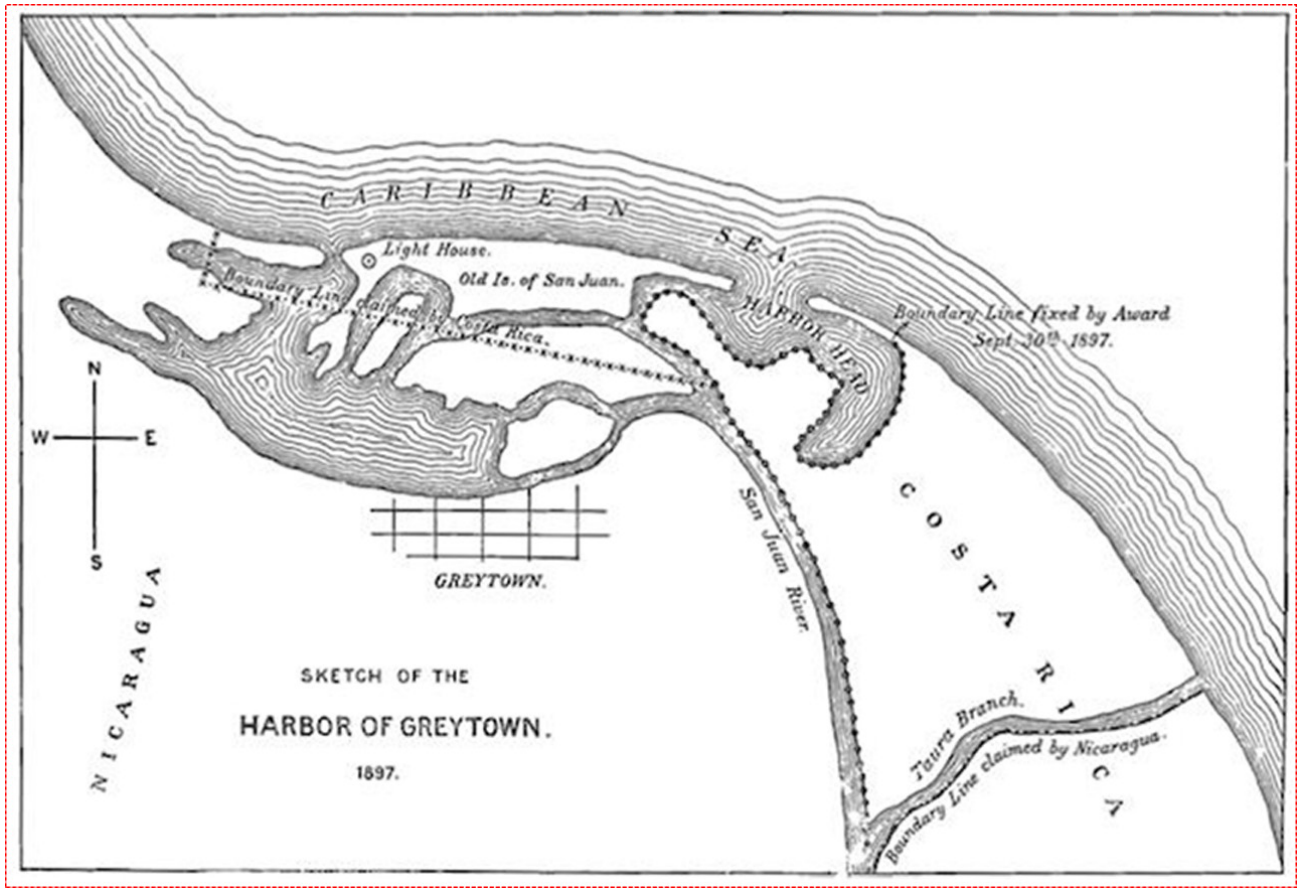

Figure 2.4: Printed sketch map attached to Alexander's First Award

(b) Second Award of E. P. Alexander of 20 December 1897

2.38. A second point of contention arose as a result of Nicaragua's position that it would be "useless" to record the precise course of the boundary line marked by the right margin of the San Juan River, from its starting point at Punta de Castilla up to the point 3 English miles before Castillo Viejo. Costa Rica argued in favour of a precise demarcated line being drawn. Proceedings VII of 7 December 1897 of the Alexander Minutes record the arguments of the parties as follows:

> "The Costa Rican Commission proposed measuring the line from its origins, then coastwise by Harbor Head, bordering the nearest channel to San Juan River and following its course to a point three miles downstream from Castillo Viejo: that the line be drawn, and the day-to-day operations be registered in minutes of the meetings.- The Nicaraguan committee expressed their objection to what they termed as useless work insofar as the Treaty and General E. P. Alexander's decision established the dividing line at the edge of the Harbor and the River, and that their alternative would be a variable rather than a fixed line, and that resulting data would not yield a true dividing line. Accordingly both commissions decided to abide by the arbiter's decision in this matter, presenting their respective arguments within a week.[90]

2.39. In his Award of 20 December 1897,[91] Alexander noted that:

> "The only effect obtained from measurement and demarcation is that the nature and extent of future changes may be easier to determine.

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[90] See **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, Proceedings VII, p. 14.

[91] **Vol. II, Annex N° 10**, Second Alexander Award, 20 December 1897, pp. 223-225. The handwritten English version is at **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, Proceedings VIII, pp. 21-24. The handwritten Spanish translation is at **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, Proceedings IX, pp. 24 - 27.

> There is no denying the fact that there is a certain contingent advantage to being always able to locate the original line in future. But there may well be a difference of opinion as to how much time and expense needs to be spent in order to obtain such a contingent advantage. That is the difference now between the two Commissions.
>
> Costa Rica wants to have that future capacity. Nicaragua feels that the contingent benefit is not worth the current expenditure."[92]

2.40. Engineer-Arbitrator Alexander's Second Award favoured Costa Rica's position. He took into account that Article III of the Treaty of Limits mandated that "measurements corresponding to this dividing line shall be taken in whole or in part by the Government commissioners, who shall agree on the time required for such measurements to be made".[93] He concluded that "the consequence of any disagreement on the question of whether the measurement is more or less accurate must be that the view of the party favoring greater accuracy should prevail."[94] Engineer-Arbitrator Alexander held:

> "I therefore announce my award as follows: the Commissioners shall immediately proceed to measuring the line from the starting point to a point three miles below El Castillo Viejo, as proposed by Costa Rica."[95]

2.41. After recording Alexander's Second Award, Proceedings VIII of the Alexander Minutes also recorded the official inauguration of "the monument that marks the location of the initial point for the boundary line between the

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92 **Vol. II, Annex N° 10**, Second Alexander Award, 20 December 1897, United Nations, *Reports of International Arbitral Awards*, Vol. XXVIII (2007), p. 224.

93 Ibid., p. 225.

94 Ibid., p. 225.

95 Ibid., p. 225.

State of Nicaragua and the Republic of Costa Rica".[96] Although the monument was not entirely complete, "the Portland cement base had already been erected at the spot designated by the first Arbitral Award".[97]

2.42. Proceedings X of the Alexander Minutes, dated 2 March 1898, records with great precision the process by which the boundary was measured in the area of Isla Portillos. Firstly, it records the location of the monument that constitutes the initial marker of the dividing line on the coast of the Caribbean Sea:

> "The coordinates of the Monument or initial marker, taking as origin the center of Plaza Victoria in San Juan del Norte, therefore, are = x = 4268.28 East; y = 2004.54 North; astronomical Meridian; which results that the distance from the above mentioned center of the plaza to the aforementioned (marker) monument is 4715 – 55 (four thousand seven hundred fifteen meters fifty-five centimeters) with a geodetic azimuth of sexagesimal 244° 50' 23" (two hundred forty-four degrees, fifty minutes, twenty-three seconds) = Therefore the bronze plate mentioned in Proceedings No. VI of October 2nd 1897 shall be sculpted, bearing the marker's coordinates and the following inscription = "This monument is located at a distance of 4715 - 55 with a geodetic azimuth of sexagesimal 244° 50' 23'' from the center of Plaza Victoria in San Juan del Norte" = It was also agreed to have reference markers emplaced in relation with the first monument, one on the opposite margin of the Harbor Head lagoon, at 1139 meters from the first in a location marked there, with an azimuth of 66° 41' 05"; and the other in the aforementioned center of Plaza Victoria in San Juan del Norte =… "[98]

2.43. After describing the dimensions and characteristics of the two reference markers, Proceedings X continues as follows:

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[96] **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, Proceedings VIII, p. 23.

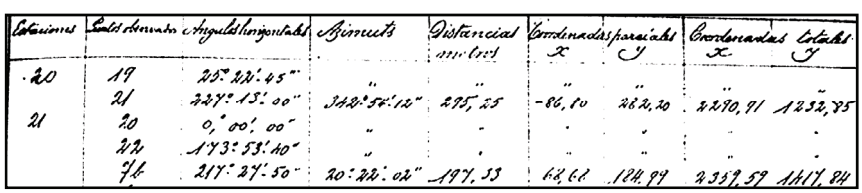
[97] Ibid.

[98] **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, Proceedings X, p. 31.

> "...in compliance with the Award issued by the Engineer Arbiter on December the 20th of 1897, the boundary line was measured as described in the Award of September 30th of 1897, starting from the initial marker, following around the Harbor and through the first channel met up to the river proper, and through this until pole No. 40 next to the source of the Taura River. Said operations and their results are shown in the following table = Survey of the right margin of the Harbor Head lagoon and of the San Juan River, which constitute the dividing line between Costa Rica and Nicaragua ="[99]

2.44. The survey of the perimeter is then described in a table that contains the station name, the observation points, horizontal angles, azimuths, distances, partial coordinates and total coordinates.[100] **Figure 2.5** extracts a segment of the table, which is recorded in pages 31-32 and 34-37 of Proceedings X, and is titled "Survey of the right margin of the Harbor Head lagoon and of the San Juan River, which constitutes the dividing line between Costa Rica and Nicaragua". This mapped course describes in a numerical manner the boundary between Costa Rica and Nicaragua that was marked following Alexander's First Award of 30 September 1897.

Figure 2.5



Estaciones	Puntos Observados	Angulos Horizontales	Azimuts	Distancias en metros	Coordenadas parciales X	Coordenadas parciales Y	Coordenadas totales X	Coordenadas totales Y
20	19	25° 22' 45"	"	"	"	"	"	"
	21	227° 15' 00"	342° 54' 12"	295,25	-86,10	282,20	2270,91	1232,85
21	20	0° 00' 00"	"	"	"	"	"	"
	22	173° 53' 40"	"	"	"	"	"	"
	7/6	217° 27' 50"	20° 22' 02"	197,53	68,60	184,99	2339,59	1411,84

Figure 2.5: Copy of a segment of the transcripts that accompany the Proceedings X of 2 March 1898. The coordinate values express in a two-dimensional table the location of each point of the geodetic survey in the local coordinate system created by the joint commission and approved by Alexander in his capacity as arbiter.

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99 Ibid., p. 31.

100 Ibid., pp. 31-32, 34-37.

2.45. It should be noted that, as clarified in a note included at the end of Proceedings X:

> "…in the columns entitled 'Points observed' the Arabic numerals accompanied by the letter "b" (abbreviation of "bis") correspond to points located in the territory of Nicaragua that were surveyed solely for the purpose of aiding the operations:- points whose numerals are not accompanied by the letter "b" are located on the dividing line between both countries.- The angles were obtained by calculating the average of various observations".- It was pointed out that, for greater clarity and with the permission of the Engineer Arbiter, it was agreed to include the results of the dividing line survey in the official records in small segments, instead of daily, which will also facilitate correcting the operations as necessary; and to position each point of the polygonal directrix linking them directly with the initial marker by rectilinear coordinates, whose zero or origin is assumed to be that monument."[101]

2.46. Proceedings X also include a sketch map with measurements that depict the precise topography of the area by linking all the points of the geodetic survey marked by the poles included in the table previously mentioned (**Figure 1.1**).[102] It can be clearly observed that this sketch map portrays the way the boundary was defined on the actual terrain. The sketch map is the visual representation of the border as defined by the different landmarks, coordinates, angles, distances and directions recorded in the actual text and tables of Proceedings X of 2 March 1898. The sketch map and its numerical coordinates are of great significance since, as will be seen, they have constituted the basis of Costa Rica's and Nicaragua's official cartography ever since.

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[101] **Vol. II, Annex N° 13**, Proceedings of the Costa Rica-Nicaragua Demarcation Commission (1897-1900), Volume I, Proceedings X, pp. 37-38.

[102] **Vol. V, Annex N° 166**.

2.47. The sketch map in **Figure 1.1** clearly shows the location of the initial monument, and the contour of the boundary line following the right margin of Laguna Los Portillos until it reaches the San Juan "by the first channel met". Clearly, the whole of Isla Portillos, including "Hacienda Aragón", were included on the Costa Rican side of the boundary.

2.48. Even if the above-mentioned sketch map did not exist, the numerical data contained in the tables of Proceedings X allows for the reconstruction of the precise contour of the boundary. **Figure 2.6** is an illustration of the sketch map reconstructed by linking the stations, observation points, horizontal angles, azimuths, distances, partial coordinates and total coordinates contained in Proceedings X.

2.49. The data contained in the Alexander Minutes is also a valuable source of information for determining with precision the extent to which the geomorphology of the area has changed over time. **Figure 2.7** taken from **Annex 153**[103] is a reconstruction of the data contained in Proceedings X of the Alexander Minutes, including the sketch map at page 33, superimposed onto a map of the area from 1899, and onto aerial photographs from 1961, 1997, and 2010. This figure shows that the original initial marker placed by the Demarcation Commission has disappeared under the sea; how the size and shape of Laguna Los Portillos has changed; and the significant reduction in the land mass at both the outlet of the San Juan and the Caribbean coast of both countries. However, it can be observed that the course of the San Juan has remained largely the same. The "channel" described in Alexander's First

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[103] **Vol. IV, Annex N° 153**, Jorge Fallas, "Sketch map of the 1898 boundary line between Costa Rica and Nicaragua in the San Juan River area and its accordance with the official cartography of Costa Rica (CRTM05) of 2010" (National University of Costa Rica, School of Environmental Sciences, Ambientico, 2011) p. 13.

Award can be seen running parallel to the coast. The complete study can be found in **Annex 153**.

Figure 2.6

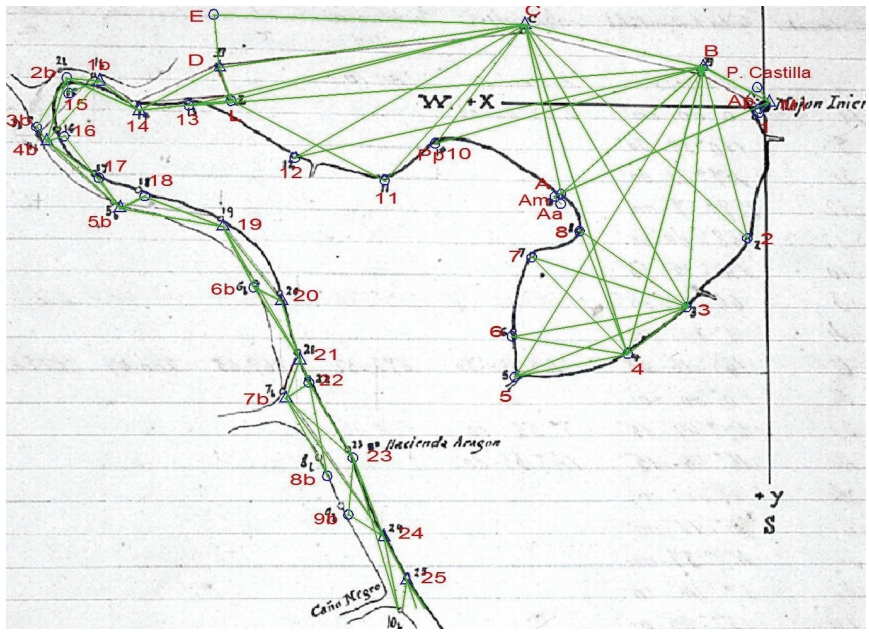

Figure 2.6: Reconstruction of the sketch map contained in Proceedings X based on the numerical information therein contained.

Figure 2.7

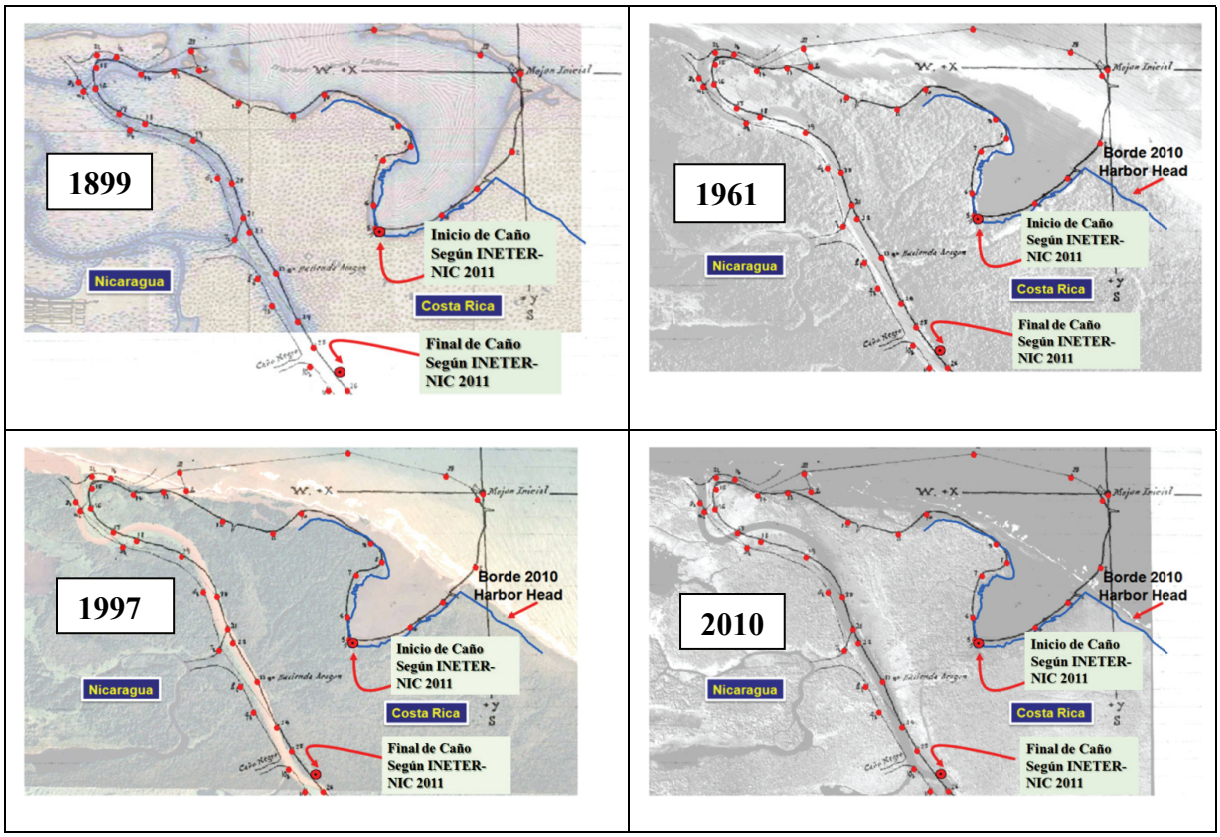

Figure 2.7 Reconstruction of the data contained in Proceedings X of the Alexander Minutes, superimposed onto a map of the area from 1899 and onto aerial photographs from 1961, 1997 and 2010.

D. The Area of Isla Portillos in Official Cartography

2.50. Until October 2010, both the Nicaraguan Institute of Territorial Studies (INETER) and the National Geographic Institute of Costa Rica (IGN), the respective institutions in charge of official cartography, had produced specific and concordant maps showing the boundary as it was demarcated by Engineer-Arbitrator Alexander and the Demarcation

Commission. **Figure 2.8** is an official map produced by Costa Rica's IGN in 1988, while **Figure 2.9** is a 1989 official map produced by INETER, both scale 1:50.000. Both maps match perfectly, in particular at the contour of the border line around Laguna Los Portillos. The maps also correspond with the sketch map contained in Proceedings X (**Figure 1.1**).

2.51. Nicaragua's official cartography since 1905 has also systematically reflected the boundary in the area of Isla Portillos as determined by the Demarcation Commission. For example, **Annexes 174**, **177** and **183** reproduce some Nicaraguan official maps produced in the years 1905,[104] 1967,[105] and 1980,[106] respectively.

2.52. The official cartography of Costa Rica has also portrayed the same boundary line. **Annexes 176**, **179, 180**, **181**, **182**, and **187** are official maps prepared by Costa Rica's National Geographic Institute in the years 1949,[107] 1970 (2),[108] 1977,[109] 1978,[110] and 1988,[111] respectively.

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[104] **Vol. V, Annex N° 174**, Government of Nicaragua "Mapa para uso de los Oficiales del Ejército de Nicaragua", 1905.

[105] **Vol. V, Annex N° 177**, República de Nicaragua "Mapa Oficial", 1967.

[106] **Vol. V, Annex N° 183**, Instituto Nicaragüense de Turismo INTURISMO "Nicaragua Libre-Año de la Alfabetización", 1980.

[107] **Vol. V, Annex N° 176**, Instituto Geográfico Nacional, "Mapa de Costa Rica", Edición provisional, 1949.

[108] **Vol. V, Annex N° 179**, Instituto Geográfico Nacional, "Punta Castilla", Hoja 3448 I, 1970; and **Vol. V, Annex N° 180** Instituto Geográfico Nacional, "Barra del Colorado" hoja CR2CM-3, 1970.

[109] **Vol. V, Annex N° 181**, Geográfico Nacional, "Costa Rica-Mapa Físico-Político" 1977.

[110] **Vol. V, Annex N° 182**, Instituto Geográfico Nacional, "Carta Aeronáutica de la República de Costa Rica", 1978.

[111] **Vol. V, Annex N° 187**, Instituto Geográfico Nacional, "Barra del Colorado" Hoja CR2CM-3, 1988.

Figure 2.8

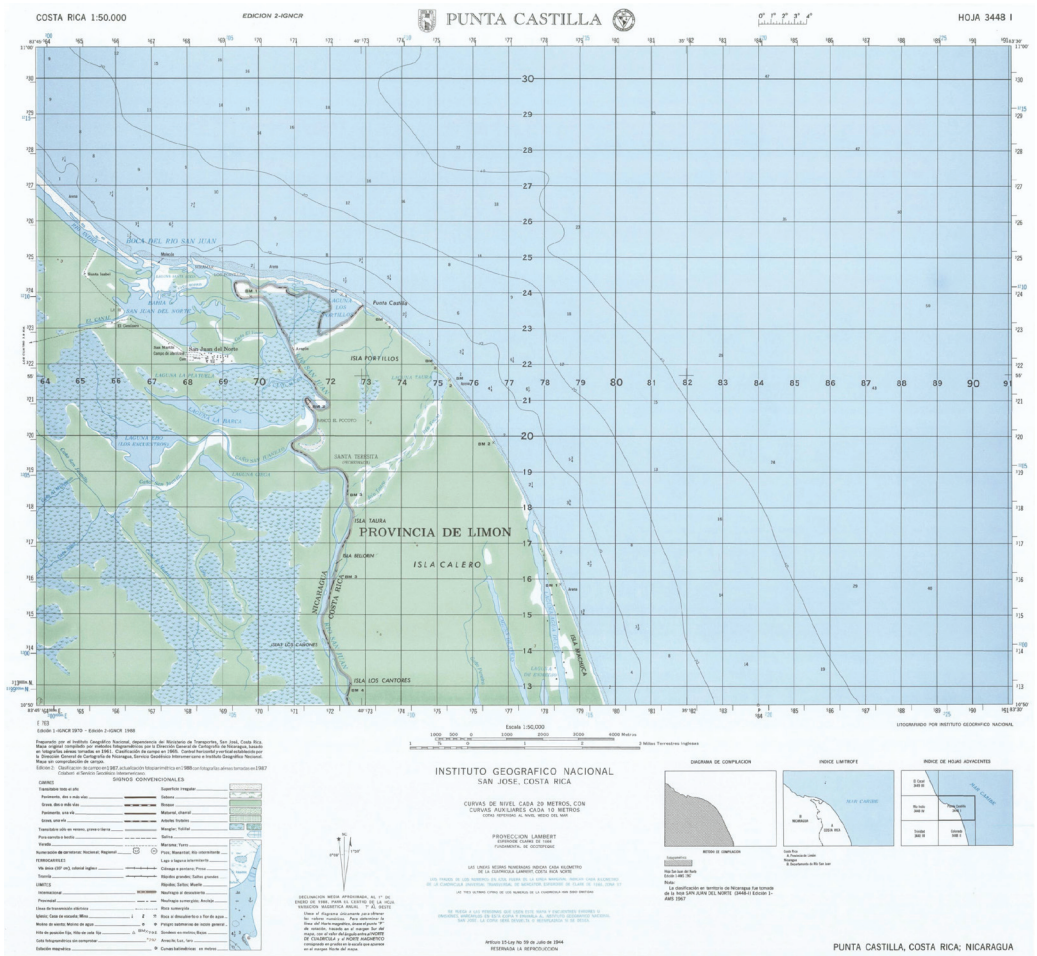

Figure 2.8: Official map produced by Costa Rica's IGN in 1988

Figure 2.9

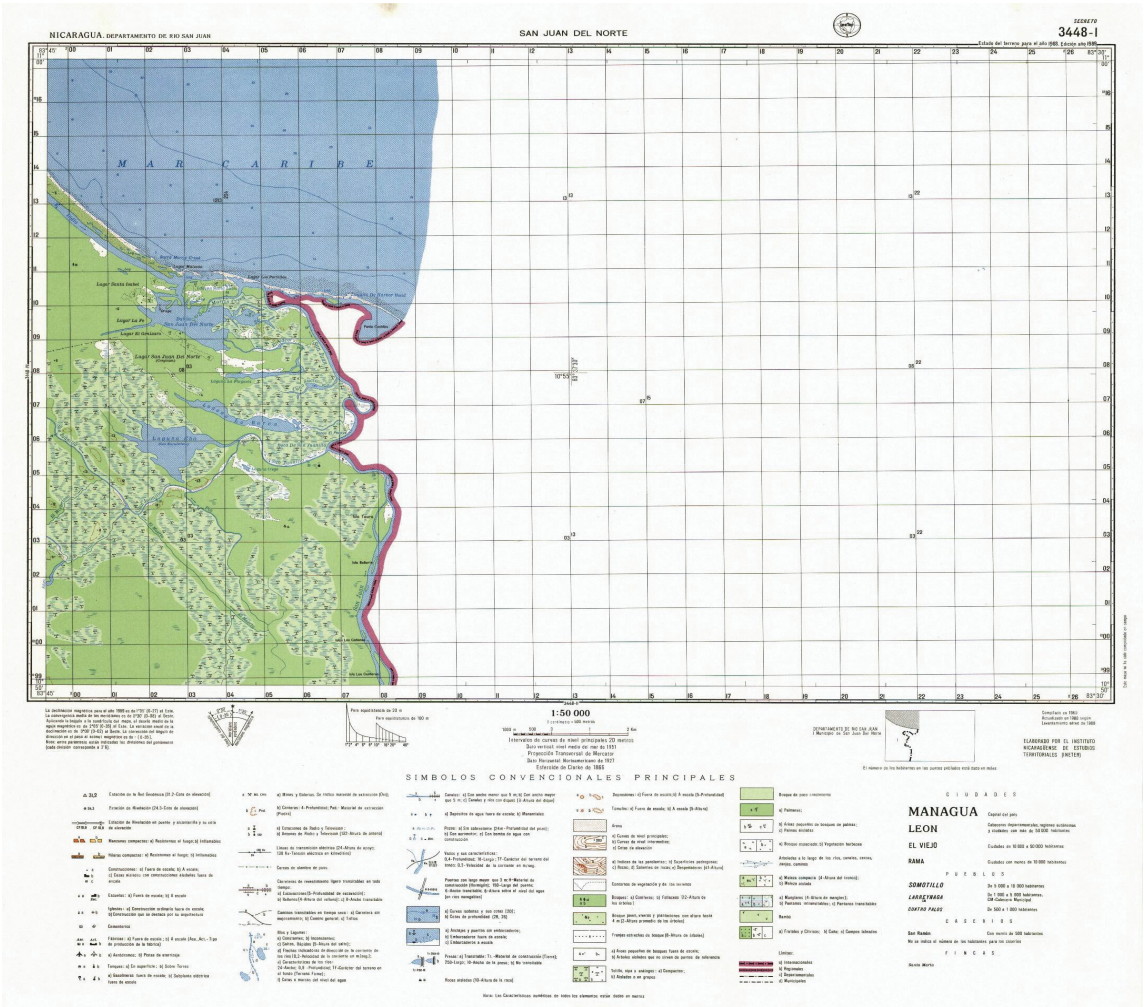

Figure 2.9: Official map produced by the INETER 1989

2.53. In addition to Nicaraguan and Costa Rican official cartography, the official maps of independent third parties also confirm that the entire area of Isla Portillos is Costa Rican. **Annexes 175, 222, 178, 184, 159,** and **189** are maps produced by different U.S. agencies in 1930,[112] 1966,[113] 1970,[114] 1987,[115] 1988,[116] and 2001,[117] respectively, which also portray the same boundary.

2.54. Until November 2010, all Nicaraguan official maps available to the public through the website for Nicaragua's INETER were also consistent with the Alexander records and Costa Rican cartography. This website was taken down in November 2010 after Costa Rica denounced Nicaragua before the Organization of American States, and remained "under construction" during the course of the oral hearings on Provisional Measures held in January 2011.[118] The website was re-opened to the public some days after the conclusion of the oral hearings, with "new" official cartography and a brand new section dedicated entirely to "Harbor Head".[119]

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[112] **Vol. V, Annex N° 175**, Geographic Branch- Military Intelligence Div-General Staff, United States of America "Limon", 1930.

[113] **Vol. V, Annex N° 222**, Army Map Services of the U.S. Corps of Engineers "San Juan del Norte" 1966.

[114] **Vol. V, Annex N° 178**, US Army topographic Command "Costa Rica" Joint Operations Graphic (Ground), 1970.

[115] **Vol. V, Annex N° 184**, U.S. Department of Defense, "Huetar" Hoja NC17-5, 1987.

[116] **Vol. V, Annex N° 185**, United States Defence Mapping Agency "Punta Castilla", 1988.

[117] **Vol. V, Annex N° 189**, U.S. Government National Imagery and Mapping Agency, "Laguna de Perlas to Rio Colorado", 2001.

[118] CR 2011/1, p. 23, para. 15 (Brenes); **Vol. II, Annex N° 33**, Screen shot of INETER website, 4 January 2011.

[119] **Vol. II, Annex N° 34**, Screen shot of INETER website, 14 November 2011. See also: **Vol. III, Annex N° 120**, El Nuevo Diario, "New Territorial Map including Harbor Head" 2 February 2011.

2.55. On 13 January 2011, in the course of the oral hearings on provisional measures, Nicaragua produced a "sketch map" with a unilaterally altered boundary.[120] Some days after the conclusion of the oral hearings, by the end of January 2011, this new map was included on INETER's website (**Figure 2.10**).[121]

2.56. It is nevertheless possible to access earlier versions of INETER's website which contain Nicaragua's official cartography before it was changed with new cartography with a unilaterally changed boundary. Costa Rica annexes screen shots of the former version of the INETER website and copies of the relevant maps taken from that website.[122] **Annex 190** is a 1997 map described as the "Political-Administrative Division of the Republic of Nicaragua",[123] published online on 29 January 2009. As can be seen, this map, in accordance with previous Nicaraguan official cartography, clearly shows the entirety of Isla Portillos as belonging to Costa Rica. Similarly, **Figure 2.11(**enlargement of relevant area) is a 2002 map titled "Physical and Geographical Map of the Republic of Nicaragua",[124] which also unequivocally portrays the whole of Isla Portillos as Costa Rican. **Annex 192** is a 2004 edition of a map labeled "Map of the Republic of

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120 Judges' Folder, 13 January 2011, Tab 3, CAG 2. See **Vol. V, Annex N° 214.**

121 **Vol. V, Annex N° 196**, Nicaraguan map of Punta de Castilla at 1:50.000 produced in January 2011.

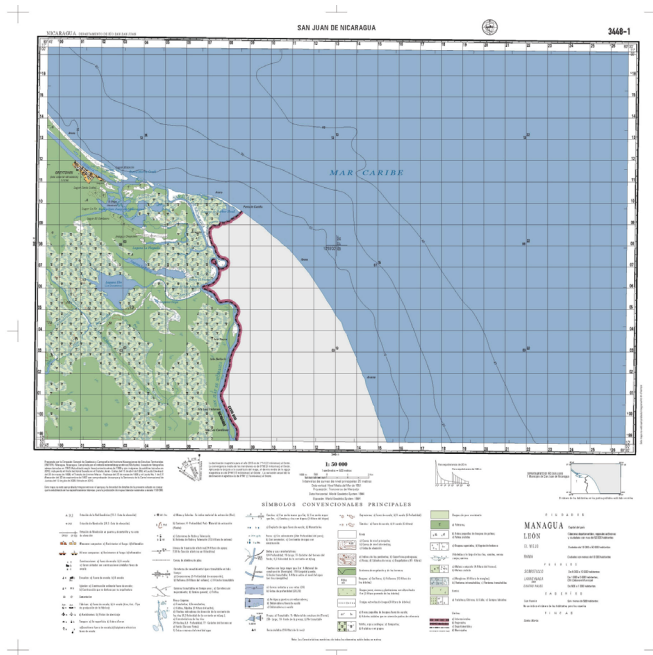
122 **Vol. II, Annex N° 31**, Screen grab of archived website of INETER, 15 October 2007, available at: http://web.archive.org/web/20071015035824/http://www.ineter.gob.ni/Direcciones/Geodesia/ SeccionMapas/Indice1.htm

123 **Vol. V, Annex N° 190** Political-Administrative Division Map of the Republic of Nicaragua, 1997, available at: http://web.archive.org/web/20090129110931/http://ineter.gob.ni/Direcciones/Geodesia/SeccionMapas/MapaNicaraguaPolitico2.htm

124 **Vol. V, Annex N° 191** Physical and Political Map of the Republic of Nicaragua, 2002, available at: http://web.archive.org/web/20090129110612/http://ineter.gob.ni/Direcciones/Geodesia/SeccionMapas/MapaNicaraguaFisico2.htm

Nicaragua",[125] which was available on the website on 1 December 2008. **Annex 193** is a 2003 map labeled "Department of Rio San Juan", Political-Administrative Division",[126] (see **Figure 4.2**) available online on 21 October 2007. This map shows Isla Portillos as Costa Rican, and notes that "[t]he boundaries were verified by the INETER Territorial Order General Directorate".

Figure 2.10



125 **Vol. V, Annex N° 192**, Map of the Republic of Nicaragua, 2004. A joint 2005 publication by Nicaragua's Army and Ministry of Defense, the "Book of Nicaragua's National Defense", reproduces the original 2004 edition of the "Map of the Republic of Nicaragua", available at: http://web.archive.org/web/20081201125336/http://www.ineter.gob.ni/Direcciones/Geodesia/SeccionMapas/MapaNicaraguaRelieve2.htm

126 **Vol. V, Annex N° 193**, Map of the Department of Rio San Juan, Political-Administrative Division, 2003, available at: http://web.archive.org/web/20071013030236/http://ineter.gob.ni/Direcciones/Geodesia/SeccionMapas/RioSanJuan2.htm

Figure 2.10: Unilaterally altered map produced by Nicaragua

Figure 2.11

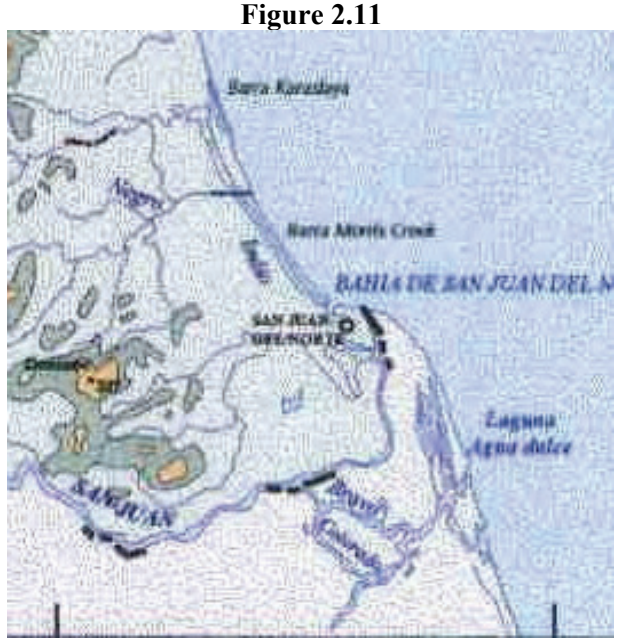


Figure 2.11: Enlargement of the relevant area in 2002 INETER Map

2.57. INETER's official description of the Costa Rica-Nicaragua boundary, as it appeared before access to the site was blocked, reads as follows:

> "The land border with Costa Rica begins at the extremity of Punta de Castilla at the mouth of the San Juan River in the Caribbean Sea. From this point the line continues on the right bank of Harbor Head Lagoon, up the channel that is parallel to the Caribbean coast, reaching the mouth of the Rio San Juan."[127] (emphasis added)

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[127] **Vol. II, Annex N° 32**, Screen grab of archived website of INETER, 12 April 2009, available at: http://web.archive.org/web/20090412122227/http://www.ineter.gob.ni/caracterizaciongeografica/capitulo4.html

As can be seen, the Nicaraguan institution in charge of national cartography clearly understood that the channel described in the First Award of Engineer-Arbitrator Alexander was that running parallel to the coast, and no other.

2.58. A similar description of the border can be found in the "Book of Nicaragua's National Defense", a 2005 official publication by Nicaragua's Army/Ministry of Defense[128]. This official publication by the Nicaraguan Army also reproduces the original 2004 edition of the "Map of the Republic of Nicaragua" presented in **Annex 192** referred to above. Not only the INETER, but Nicaragua's Army as well, had always understood that the channel described by Alexander is indeed the one running parallel to the coast, and thus that the entirety of Isla Portillos appertains to Costa Rica.

E. Conclusions

2.59. Surveys carried out on the San Juan River since 1850 and up to present times evidence that the Colorado branch has always discharged the largest percentage of the water flow, averaging about 90% of the San Juan's flow after the Delta.

2.60. The Costa Rican territory of Isla Calero/Isla Portillos, comprised between the San Juan and the Colorado rivers, is a Wetland of International Importance registered in 1996 by Costa Rica under the 1971 Ramsar Convention. It is a delicate estuarine ecosystem that supports species and subspecies of plants and animals that are vulnerable or under threat of extinction. It is also highly valued as a stronghold of the region's genetic and ecological diversity, as well as a obligatory stopover for migratory birds

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[128] **Vol. V Annex N° 194 ,** Army and Ministry of Defense of Nicaragua "Book of Nicaragua's National Defense", (2005), available at: http://web.archive.org/web/20101220211731/http://www.midef.gob.ni/doc/Libro_de_defensa.pdf

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from North America, providing shelter for over one million birds that come there to rest and feed.

2.61. The border in the area of Isla Portillos and Punta Castilla was delimited in 1897 by the Demarcation Commission, presided by the Arbiter-Engineer Edward P. Alexander. The complete proceedings of the work of the Commission, including the Arbitral Awards issued by Umpire Alexander, describe with absolute precision the exact contour of the boundary, which unequivocally locates the whole of Isla Portillos on Costa Rican territory.

2.62. Both Costa Rica's and Nicaragua's official cartography has reflected the boundary traced by the Demarcation Commission since 1897. Third party cartography also portrayed this same boundary. The website of Nicaragua's INETER contained official cartography with the same boundary until November 2010, when access to the site was blocked after Nicaragua had occupied the northern sector of Isla Portillos, and attempted to unilaterally alter the border.

2.63. In spite of Nicaragua's efforts to conceal its historic official cartography, it is still possible to access INETER's original web pages, which contain maps that portray the correct boundary as marked in 1897. All the official maps that were published on INETER's website include the totality of Isla Portillos as Costa Rican.

2.64. The new cartography currently available through INETER's web site, with a unilaterally changed boundary, has only been produced in 2011, after the hearings on Provisional Measures.

CHAPTER III: THE DISPUTE BEFORE THE COURT

A. Introduction

3.1. The present dispute has arisen before the Court as a result of certain activities undertaken by Nicaragua in the border area. In relation to a program of dredging works on the San Juan, Nicaragua has unlawfully entered, occupied and permanently damaged Costa Rican territory. Nicaragua also constructed an artificial *caño* across Costa Rican territory, joining the San Juan to Laguna Los Portillos and is redirecting the river's path in a straight direction towards the newly constructed *caño*. If Nicaragua continues its unlawful activities, the net result will be additional permanent damage to Costa Rican territory.

3.2. These activities are related, yet legally distinct from one another. Nicaragua is dredging the San Juan, ostensibly for the "improvement of navigation".[129] This work has resulted in the dumping of river sediments on both Costa Rican and Nicaraguan territory, both protected wetlands of international importance under the 1971 Ramsar Convention. Nicaragua has also initiated a process of cutting of meanders across the left, Nicaraguan, bank of the river in an attempt to markedly increase the flow velocity and water-carrying capacity of the San Juan.

3.3. In addition, Nicaragua entered and occupied Costa Rican territory in order to construct the artificial *caño*. During the occupation and in relation

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[129] **Vol. IV, Annex N° 165**, Affidavit of Hilda Espinoza Urbina, National Director of the Department of Environmental Quality at the Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 20 December 2010. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011). See also **Vol. IV, Annex N°160,** Resolution No. 038-2008, Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 22 December 2008, para. 2. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

to the construction of the artificial *caño*, Nicaragua felled a considerable portion of primary forest and caused other environmental damage.

3.4. As will be seen in Chapters IV and V, these activities are in breach of international law; both as regards the settled boundary between the parties, and as regards the international standards of environmental protection to which both parties are obliged to adhere. Moreover, the occupation of Costa Rican territory by Nicaraguan armed forces during the construction of the *caño* has not only resulted in the infringement of Costa Rica's right to territorial sovereignty, but has contributed to increased tensions between the two States and given rise to a situation in which there exists "a real and present risk of incidents liable to cause irremediable harm in the form of bodily injury or death".[130]

3.5. Nicaragua's works in the border region have altered the natural morphology of the river ecosystem, and have caused significant environmental harm to an internationally protected wetland on Costa Rican territory. Nicaragua's activities risk causing further significant environmental harm to Costa Rican territory, and affecting the flow of the Colorado River.

3.6. The present Chapter addresses the aspects of the dispute before the Court that have arisen by reason of the Nicaraguan works. **Part B** provides an overview of the salient facts for the purpose of the present proceedings. The remaining sections each address in greater detail different aspects of the dispute before the Court. **Part C** details Nicaragua's plan for dredging works on the San Juan. **Part D** concerns the incursion and occupation of Costa Rican territory by Nicaragua. **Part E** describes the construction of the

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[130] *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, Order, 8 March 2011, p. 18 (para. 75).

artificial *caño* by Nicaragua and the overall plan to reconfigure the morphology of the San Juan river basin.

B. Overview

3.7. In October 2010 the Government of Costa Rica received complaints from residents of an area known as Finca Aragón, Isla Portillos-Isla Calero, and other residents of the zone, to the effect that Nicaraguan soldiers had entered Costa Rican territory.

3.8. As a result of these complaints, the Ministry of Public Security of Costa Rica, in coordination with the Foreign Ministry, organized a flight over the area on 20 October 2010. As was documented through photographs,[131] a Nicaraguan dredger was anchored on the San Juan a few metres from the Costa Rican bank of the River, near the Caño Sucio, in the area of Finca Aragón. Nicaraguan military were observed standing on the dredger. It was also documented that a pipe several metres long had been set up between the dredger and a section of Finca Aragón on Costa Rican territory, through which sediment was passing and being deposited on the right bank of the San Juan. This was occurring without Costa Rica's consent.

3.9. On 21 October 2010 Costa Rica sent a note to Nicaragua protesting the dredging works being undertaken on the San Juan, and in particular the deposit of sediment on Costa Rican territory.[132] In a meeting between Costa Rica's Minister of Public Security and the Nicaraguan Ambassador,

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[131] **Vol. V, Annex N° 231**, Photograph of Nicaraguan dredger at the Costa Rican bank of the San Juan River, 20 October 2010.

[132] **Vol. III, Annex N° 47**, Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-412-10, 21 October 2010.

Nicaragua was informed that Costa Rica would send members of the police force to the area the next day.

3.10. On 22 October 2010, Costa Rican police inspected the area. They verified that the pipeline that was depositing the sediment on Costa Rican territory had been removed and was currently located in the San Juan River, and that the dredger remained anchored in the same place, a few metres from the Costa Rican bank of the San Juan. Some Nicaraguan military personnel were observed on the dredger. The Costa Rican police raised Costa Rica's flag at Finca Aragón.

3.11. That same morning, the State Prosecutor of Pococí, province of Limón, and officials from the Costa Rican Ministry of Public Security, together with representatives of the National System of Conservation Areas (SINAC) of the Ministry of Environment, Energy and Telecommunications (MINAET), and the Ministry of Foreign Affairs, visited the area. They verified that some 1688 m^3 of sediment had been deposited from a pipe connected to the dredger onto the area, that an area of 1.67 hectares of old-growth forest had been felled, and that a strip of land starting from the right bank of the San Juan and running north for some 500m had also been cleared in direct line with the Laguna Los Portillos.

3.12. Although the Costa Rican police and officials from the Costa Rican Ministries left the area, the Costa Rican Ministry of Public Security undertook regular overflights of the area in order to continue to monitor the situation. It was observed that the Nicaraguan dredger remained anchored near the Costa Rican bank of the San Juan River until 23 October 2010 when it was moved to a nearby area on the Nicaraguan left bank of the San Juan.

3.13. On 25 October 2010, Costa Rican personnel from SINAC again entered the area accompanied by Costa Rica's police, and carried out a

detailed survey of the damage caused at that time. In the inspection report produced in early December 2010, SINAC noted the following:

> "In what specifically concerns the felled forest section, it was primary forest where 197 trees were cut. These trees had diameters that ranged between 5 and 130 centimetres…in an area of 1.67 hectares. In an adjacent area that forms a band around the one where the forest was felled, and which measures approximately 4.08ha, the elimination of all undergrowth was also observed."[133]

3.14. The 25 October 2010 visit allowed the SINAC personnel to record all of the 197 trees that had been recently felled by Nicaragua, including their respective species, age and precise location. The SINAC personnel also observed that an area of approximately one quarter of a hectare of land on the Costa Rican bank of the San Juan was covered with sediment from the dredger. They also observed that trees and undergrowth had been felled in a direct line from the San Juan River to Laguna Los Portillos. It was noted that the Costa Rican flag remained in the place where it had been raised by the Costa Rican police.

3.15. Following verification of environmental damage to Costa Rican territory, the State Prosecutor of Pococí, province of Limon, opened a criminal case for the crime of violation of the Forestry Law. Proceedings were also commenced before the Environmental Administrative Tribunal.

3.16. In a note dated 26 October 2010 from the Acting Minister of Foreign Affairs of Nicaragua, Manuel Coronel Kautz, to the Minister of Foreign Affairs of Costa Rica, René Castro, Nicaragua rejected the allegations

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[133] **Vol. IV, Annex N° 145**, Costa Rica, Ministry of Environment, Energy and Telecommunications and Sistema Nacional de Áreas de Conservación: Area de Conservacion Tortuguero, "Appraisal of maximum average age of the trees felled in primary forest areas in the Punta Castilla, Colorado, Pococí and Limón sectors of Costa Rica, as a result of the Nicaraguan Army's occupation for the apparent restoration of an existing canal". December 2010, para. 3.

contained in the protest made by Costa Rica.[134] It remained studiously ambiguous about any territorial claim, arguing that the clean-up in the San Juan River had been undertaken on Nicaraguan territory. It protested what it called "repeated violations by troops of the Costa Rican armed forces to Nicaraguan territory" and demanded that such actions "not happen again".[135] In this same note, Nicaragua stated that it would continue the clean-up on the San Juan River while safeguarding "the boundaries and sovereignty of Nicaragua".[136]

3.17. On the same day, 27 October 2010, the Costa Rica police conducted a flyover of the area, and noted that the dredger which had been moved to the Nicaraguan left bank of the San Juan River was operating again. It was observed that trees had been felled in a meander on the left Nicaraguan bank of the San Juan.

3.18. On the afternoon of 31 October 2010, during a new flyover in the area of Finca Aragón, Costa Rica observed that the Costa Rican flag had been removed and the flag of Nicaragua had been placed near a ranch house located in the area, on Costa Rican territory. It was also observed that Nicaraguan military camps appeared to have been established in the area where sediment from the dredger had been deposited, on Costa Rican territory.

3.19. On 1 November 2010, the Costa Rican police authorities conducted a flyover of the area in order to verify the situation more accurately. They confirmed that the Nicaraguan flag had been hoisted at Finca Aragón in Isla

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134 **Vol. III, Annex N° 48**, Note from the acting Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DVM/AJST/660/10/10, 26 October 2010.

135 Ibid.

136 Ibid.

Portillos-Isla Calero, on Costa Rican territory. They also confirmed that on the locations where the sediment had been deposited, three temporary military structures had been erected. At another location in Finca Aragón, on Costa Rican territory, members of the Army of Nicaragua were photographed, some pointing their guns at the civilian Costa Rican aircraft (See **figure 3.1**).[137]

3.20. In the afternoon of the same day, 1 November 2010, the Ambassador of Nicaragua was presented with a diplomatic note from Costa Rica's Foreign Minister René Castro to Nicaragua's Foreign Minister Samuel Santos, responding to the allegations contained in the note signed by the Deputy Minister Manuel Coronel.[138] The Ambassador was also presented with a second diplomatic note in which Costa Rica protested the armed Nicaraguan incursion into Costa Rican territory and requested the immediate withdrawal of the Nicaraguan troops from its territory.[139] Nicaragua did not reply to either of these two diplomatic notes, nor did it withdraw its troops from Costa Rican territory or suspend its work on the San Juan.

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137 **Vol. V, Annex N° 233**, Photograph of Nicaraguan soldiers pointing guns at Costa Rican aircraft, 1 November 2010.

138 **Vol. III, Annex N° 49,** Note from the Minister of Foreign Affairs and Worship of Costa Rica, to the Minister of Foreign Affairs of Nicaragua, Ref: DM-429-10, 1 November 2010.

139 **Vol. III, Annex N° 50,** Note from the Minister of Foreign Affairs and Worship of Costa Rica, to the Minister of Foreign Affairs of Nicaragua, Ref: DM-430-10, 1 November 2010.

Figure 3.1



Figure 3.1: Photograph of Nicaraguan soldiers pointing guns at the Costa Rican aircraft, 1 November 2010

3.21. On 2 November 2010, the Government of Costa Rica, in accordance with Articles 21 and 62 of the Charter of the Organization of American States (OAS) called for the urgent convening of a Special Meeting of the Permanent Council on 3 November 2010 "due to the entry of the armed forces of the Republic of Nicaragua in Costa Rican territory in the area bordering the San Juan River."[140]

3.22. The Special Session of the OAS Permanent Council took place on 3 November 2010, as requested by Costa Rica. The Minister of Foreign

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[140] **Vol. III, Annex N° 51**, Note from the Permanent Representative of Costa Rica before the OAS to the President of the OAS Permanent Council, DE-065-10, 2 November 2010.

Affairs of the Republic of Costa Rica, Mr. René Castro, attended the meeting and made a presentation of the facts in the petition. Subsequently, the Permanent Representative of Nicaragua to the OAS, Ambassador Denis Moncada, delivered a speech arguing that no violation of Costa Rica's territorial integrity had occurred, and that Nicaraguan military and other personnel had always been on Nicaraguan territory during the course of conducting anti-drug trafficking activities.

3.23. During this Special Session, the President of the OAS Permanent Council informed that body that both Costa Rica and Nicaragua agreed to "open a space for the Secretary General to develop efforts aimed at overcoming the situation",[141] and that, in this context, they extended an invitation to the OAS Secretary General to visit their respective countries and report back the results of those visits to the Permanent Council.

3.24. The OAS Secretary General visited Costa Rica and Nicaragua from 5 to 8 November 2010 to hear the positions of both governments, obtain *in situ* information on the subject and take steps to achieve a peaceful solution to the situation. The delegation also included Dr. Dante Negro, Director of the International Law Department, Ms. Patricia Esquenazi, Director of Press, Mr. Antonio Delgado, a specialist in the Department of Political Affairs and Ms. Ana Matilde Perez-Katz, Advisor to the OAS Secretary-General. In both countries they held meetings with officials and conducted overflights of the area, from Nicaragua on 7 November 2010, and from Costa Rica on 8 November 2010. On the initiative of the OAS Secretary General, on 8 November 2010**,** the President of Nicaragua, Daniel Ortega, and the President of Costa Rica, Laura Chinchilla, had a telephone conversation with

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[141] **Vol III, Annex N° 52, "**Record of the special meeting held on 3, 4, 9, and 12 November 2010 CP/ACTA 1777/10", p. 2. Ref: OEA/Ser.G CP/SA.1777/10, 3 November 2010 (OAS Permanent Council).

OAS Secretary General, Mr. Insulza, and it was agreed that Nicaragua would withdraw its troops from Finca Aragón and that Costa Rica would not send their police as a necessary requirement in order to hold a binational meeting later that month.

3.25. The follow-up meeting of the OAS Permanent Council was scheduled for 4pm on 9 November 2010. In accordance with the agreement reached by the Presidents of Costa Rica and Nicaragua, the delegations of Costa Rica and Nicaragua met at 10am in the office of the OAS Secretary General to discuss and agree on a peaceful settlement, which included establishing a exclusion zone in the area of Finca Aragon, and defining an agenda and topics to be discussed during the VIII Bi-national Meeting. Both delegations exchanged their respective draft texts on the agreement which was expected to be signed that morning. However, at 10:30am the delegation of Nicaragua requested time to retire and study the Costa Rican proposal. The Nicaraguan delegation did not return to the negotiating table until 3:55pm, and with a very different text in hand than the one originally submitted. It became clear that the delegation of Nicaragua had no intention of withdrawing their troops or finding a peaceful solution to the situation.

3.26. During the session of the Permanent Council on the afternoon of 9 November 2010, OAS Secretary General Mr. Insulza presented his report on the visit to Costa Rica and Nicaragua,[142] which included four recommendations: to urgently address aspects of the bilateral agenda; to immediately renew conversations on aspects of the demarcation in accordance with existing treaties and awards; to avoid the presence of armed or security forces in the area in order to create a favourable climate for

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[142] **Vol. III, Annex N° 144,** OAS, Report by the Secretary General on His Visit to Costa Rica and Nicaragua, Ref: CP/Doc. 4521/10 corr.1. 9 November 2010.

dialogue; and to review and reinforce mechanisms of cooperation to prevent, control and address drug trafficking, organized crime and arms trafficking in the border area.

3.27. During that same meeting, the delegation of Nicaragua delivered a prepared statement in which they claimed there was a lack of clarity over the border and that Nicaraguan troops were stationed on Nicaraguan territory. Nicaragua also insisted that its military actions in the area were undertaken in order to combat drug trafficking. Costa Rica made another presentation rebutting these assertions, and it gave Nicaragua a period of 48 hours to vacate its territory and cease acts causing environmental damage in the area. That period would expire on 11 November 2010.

3.28. At the request of a group of countries wishing to make additional efforts to persuade Nicaragua to give way, this deadline was extended by 24 hours and the OAS Permanent Council meeting was re-scheduled for 12 November 2010. It was not possible to reach a bilateral solution to the problem because of Nicaragua's refusal to accept the recommendations of the OAS Secretary-General. Consequently, on 12 November 2010, the Permanent Council adopted the OAS Secretary-General's recommendations and submitted them to a vote. OAS Permanent Council resolution CP/Res. 978 (1777/10) titled "Situation in the border area between Costa Rica and Nicaragua"[143] was approved by an affirmative vote of 22 countries, with 3 abstentions, two negative votes (Nicaragua and Venezuela) and a no vote (Bolivia). In this resolution, the OAS Permanent Council endorsed the recommendations of the OAS Secretary General.

3.29. Following the vote, President Ortega made statements to the press accusing Costa Rica, Panama, Guatemala and Mexico of supporting drug

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143 **Vol. III, Annex N° 53,** Resolution 978 Permanent Council of the OAS.

trafficking.[144] He also indicated that Nicaragua would disregard the OAS resolution and would ask the International Court of Justice to grant Nicaragua navigational rights on the Colorado River,[145] a river belonging wholly to Costa Rica and over which Nicaragua has no navigational rights. In response, Cost Rica Minister René Castro sent a diplomatic note on 14 November 2010 to Foreign Minister Samuel Santos, protesting President Ortega's statements.[146]

3.30. In light of the serious environmental damage caused by Nicaragua to Costa Rica's *Humedal Caribe Noreste* and in compliance with its obligations under the Ramsar Convention, on 15 November 2010 the Government of Costa Rica addressed a request to the Secretary General of the Convention on Wetlands to send a Ramsar Advisory Mission to assess ecological changes in the wetland.

3.31. To comply with the OAS Secretary General's recommendations, on 17 November 2010, Costa Rica reiterated to Nicaragua its readiness to carry out the VIII Meeting of the Bi-national Commission on 26 and 27 November, in compliance with the agreements contained in this resolution and with the accompaniment of the OAS.[147] In the note verbale, Costa Rica proposed the following agenda for the meeting with Nicaragua:

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144 **Vol. III, Annex N° 113,** English translation by Costa Rica of a speech given by President of the Republic of Nicaragua, Daniel Ortega, on national Nicaraguan television on 13 November 2010.

145 Ibid. See also **Vol. III, Annex N° 114,** La Prensa, "Ortega to ask the ICJ for permission to navigate the River Colorado", 13 November 2010.

146 **Vol. III, Annex N° 54,** Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-453-10, 14 November 2010.

147 **Vol. III, Annex N° 55,** Note from the Ministry of Foreign Affairs and Worship of Costa Rica to the Ministry of Foreign Affairs of Nicaragua, Ref: DVM-DGPE/350-2010, 17 November 2010.

> "Develop a proposal and timetable for the demarcation of the border zone sections that so require, in accordance with existing treaties and awards.
>
> Review and strengthen mechanisms for cooperation to prevent, control and confront drug trafficking, organized crime and arms trafficking in the border.
>
> Report on the status of environmental agreements established in the VI and VII Binational Commission meetings, held in Managua and San Jose, respectively, in 2008".[148]

3.32. On the same day, 17 November 2010, Nicaragua responded through a note verbale[149] in which it reiterated its willingness "to discuss all points of the Agenda pending between both countries, according to the schedule established".[150]

3.33. On 18 November 2010, at the request of Costa Rica, the OAS Permanent Council adopted a resolution agreeing "to convene a Meeting of Consultation of Foreign Ministers at the headquarters of the Organization of American States in Washington, DC, at 11:00 am on Tuesday, December 7 2010",[151] in order to:

> "1. Hear the Report of the Secretary General and consider the situation in the border area between Costa Rica and Nicaragua; and
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> 2. Agree on appropriate measures to be adopted."[152]

3.34. Since Nicaragua had already announced that it would refuse to follow the recommendations of the OAS, on 18 November 2010 Costa Rica

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148 Ibid.

149 **Vol. III, Annex N° 56,** Note from the Ministry of Foreign Affairs of Nicaragua to the Ministry of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DM/1025/17/11, 17 November 2010.

150 Ibid.

151 **Vol. III, Annex N° 57,** Ref: OAS CP/RES. 979 (1780/10), 18 November 2010.

152 Ibid.

submitted an application initiating proceedings before the International Court Justice, which also included a request for provisional measures.[153]

3.35. To comply with the recommendations of the OAS Permanent Council, on 22 November 2010 Costa Rica's Deputy Foreign Ministry Carlos Roverssi sent a diplomatic note to Ambassador Patricio Zuquilanda, the OAS Representative in Costa Rica, requesting the Organization's presence at that meeting "under the terms established by the Permanent Council in that resolution".[154] This note stated that the said meeting would be held "prior to the withdrawal of Nicaraguan military and civilian personnel currently occupying Costa Rican territory."[155]

3.36. On 24 November 2010, by a note verbale sent by Costa Rica's Foreign Ministry to Nicaragua's Foreign Ministry, Costa Rica reiterated its willingness to carry out the VIII Meeting of the Commission "insofar as the recommendations of the OAS Secretary-General contained in resolution CP/RES.978 of 12 November are met, and in accordance with the agenda proposed in note DVM-DGPE/350-2010 of 17 November".[156] In this note verbale, Costa Rica proposed that the technical meeting take place on 26 November 2010 with the participation of the OAS, and the presidential meeting on 27 November 2010, with both meetings to take place at the INCAE Business School in the province of Alajuela, Costa Rica. This note also made clear

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153 *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, Application instituting proceedings of 18 November 2010.

154 **Vol. III, Annex N° 58**, Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to Ambassador Patricio Zuquilanda, the OAS Representative in Costa Rica, Ref: DVM 355-10, 22 November 2010.

155 Ibid.

156 **Vol. III, Annex N° 59**, Note from the Ministry of Foreign Affairs of Costa Rica to the Ministry of Foreign Affairs of Nicaragua, Ref: DVM-357-2010, 24 November 2010.

> "that the holding of meetings on Friday 26 and Saturday November 27 shall be subject to an on site report by the OAS technical team that verifies compliance with the resolution passed on 12 November by the Permanent Council, as well as with compliance with the conditions requested by the Government of Costa Rica that the work carried out by Nicaraguan civilians, with support from the army of this country in the area of Isla Portillos, be stopped. In particular, Costa Rica considers of utmost importance that the OAS technical team determines the exact area where the Costa Rican police can be emplaced. In this regard, the Government of Costa Rica is ready and willing to unilaterally proceed to comply fully with this recommendation."[157]

3.37. The same day, 24 November 2010, Costa Rica's Permanent Representative Ambassador Enrique Castillo, sent a diplomatic note to the OAS Secretary General, in which he stated that the "celebration of the planned activities within the framework of the VIII Meeting of the Bi-national Commission between Costa Rica and Nicaragua for Friday 26 and Saturday 27 November, 2010, shall be subject to the report that will make the OAS technical team in order to verify compliance with the agreements adopted by the OAS Permanent Council through resolution CP / Res. 978 of 12 November..."[158]

3.38. On the same day, 24 November 2010, by a note verbale, Nicaragua's Foreign Ministry responded indicating its willingness to carry out the meeting "according to the principle of unconditionality that characterizes this type of meetings".[159] The note added that

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157 Ibid.

158 **Vol. III, Annex N° 60**, Note from the Permanent Representative of Costa Rica before the OAS, to OAS Secretary General, José Miguel Insulza, Ref: DE-072-10, 24 November 2010.

159 **Vol. III, Annex N° 61,** Note from the Ministry of Foreign Affairs of Nicaragua to the Ministry of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DVMS/VLJ/0679/11/2010, 24 November 2010.

> "In relation to issues concerning the boundary dispute between our two sister Republics, the Ministry of Foreign Affairs of Nicaragua reiterates to the Ministry of Foreign Affairs and Worship of Costa Rica that, as agreed by the Council Powers of the Nicaraguan state in its two statements, dated 15 and 22 November, matters relating to this dispute have been transferred, as appropriate, to the International Court of Justice in The Hague, whose Judgment of July 2009 has been fully complied with by all instances of the Nicaraguan state."[160]

3.39. In response, on the same day of 24 November 2010, Costa Rica's Foreign Ministry sent a note verbale to Nicaragua, stating that it received with great satisfaction the announcement of the will of Nicaragua to participate in the meeting.[161] The note added that "Costa Rica is in the best position to hold this meeting as scheduled, once Nicaragua withdraws the troops that is has placed on Costa Rican territory, in a sector of Isla Portillos-Isla Calero, on the right margin of the San Juan River, in violation of the provisions of the Cañas-Jerez Treaty, the Cleveland Award and the Alexander awards, which delimit with precision the boundary between the two countries".[162] The note also stated that on that same day of 24 November 2010, the OAS in the person of its Secretary General was being asked to report if "the Government of Nicaragua has withdrawn the troops from the specified location and it is willing to comply with the other three point contained in the Council's resolution."[163]

3.40. The same note also stated that, "the Ministry of Foreign Affairs and Worship of Costa Rica clarifies that the situation between the two countries

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160 Ibid.

161 **Vol. III, Annex N° 62**, Note from the Ministry of Foreign Affairs and Worship of Costa Rica to the Ministry of Foreign Affairs of Nicaragua, Ref: DM-478-10, 24 November 2010.

162 Ibid.

163 Ibid.

is not a boundary dispute, but a violation of Costa Rican territorial integrity with illegal occupation by its armed forces and serious environmental damage".[164] Costa Rica reminded Nicaragua "that the terms of the judgment rendered by the International Court of Justice on 13 July 2009 are not being fully met by Nicaragua… Nicaragua's Decree No. 79-2009 is a clear violation of the content of the sentence. There are also reports that the free navigation of Costa Rica in the San Juan River, whose extent was set out in that judgment, are not being respected."[165]

3.41. On 25 November 2010, the Foreign Ministry of Costa Rica submitted a note to the OAS Mission in Costa Rica asking "that it proceeds to confirm whether the Republic of Nicaragua has complied with the withdrawal of its armed forces referred to in Permanent Council resolution CP/RES.978 of the 12th this month, since failure to do that would prevent the carrying out of the Binational Meeting".[166] The note also asks the OAS "to identify with precision area where the personnel of the Costa Rican Ministry of Security could have presence, so as to comply fully, even if unilaterally, with the recommendations of the Secretary General approved by the Permanent Council resolutions."[167] The note added that "This Ministry received today a note from the Ministry of Foreign Affairs of Nicaragua, reiterating its refusal to withdraw troops from our national territory, which if confirmed by the OAS, such failure would prevent the Government of Costa Rica to start the bi-national dialogue".[168]

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164 Ibid.

165 Ibid.

166 **Vol. III, Annex N° 63**, Note from the Ministry of Foreign Affairs and Worship of Costa Rica to the Mission of the OAS in Costa Rica, Ref: DVM-311-10, 25 November 2010.

167 Ibid.

168 Ibid.

3.42. The Eighth Meeting of the Bi-national Commission scheduled for 26 and 27 November 2010 did not take place. Whereas the Costa Rican delegation attended this meeting, Nicaragua did not send a delegation, nor did Nicaragua communicate to Costa Rica the reasons for its non-attendance. A delegation from the OAS General Secretariat headed by Ambassador Dante Caputo and including specialist Antonio Delgado, accompanied by the OAS Representative in Costa Rica, Ambassador Patricio Zuquilanda, was present in Costa Rica on the day scheduled for the meeting. On 26 November 2010, the OAS delegation conducted an overflight of the area, by which they could observe the camps of military troops on Costa Rican territory and serious environmental damage to Costa Rican territory.

3.43. On 26 November 2010, Nicaragua published its "White Book" on the website of the Nicaraguan Ministry of Foreign Affairs.[169] This publication is described on the website as having been prepared by a Special Commission nominated by the President of Nicaragua in order to present the position of Nicaragua to the Nicaraguan and international public.[170] It is essentially a propaganda document in which Nicaragua presents itself as "the offended party"[171]. Nicaragua appears to have made a territorial claim over the Costa Rican Isla Portillos for the first time in the "White Book", albeit in contradictory terms.[172]

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169 **Vol. II Annex N° 30**, Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010).

170 **Vol. II, Annex N° 36**, Screen shot of the website of the Ministry of Foreign Affairs of Nicaragua (MINREX), taken on 11 November 2011.

171 **Vol. II Annex N° 30**, Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010). p. 4.

3.44. At Costa Rica's request, the Ramsar Advisory Mission, composed of experts in the fields of limnology, hydrology, hydrogeology, geology, aquatic ecology, water resources and ecosystem management, and coordinated by Maria Rivera, Senior Advisor for the Americas of the Ramsar Convention, visited Costa Rica from 27 to 30 November 2010 to assess the changes in the ecological character of Isla Portillos, part of the *Humedal Caribe Noreste* Ramsar site. They held working meetings in San José with representatives of various state institutions to coordinate the information they needed for their work. During the course of those meetings, they were provided with a substantial body of documentary evidence, including recent satellite and aerial photographs, enabling them to fully accomplish their task. Overflights in the area that had been organised were not carried out given the bad weather conditions, but the Advisory Mission felt that the information that they already had obtained fully met their requirements.

3.45. The Ramsar Secretariat subsequently issued the "Ramsar Advisory Mission (RAM) No. 69 Report",[173] which noted as follows:

> - "According to the analysis of the technical information received from the Government of Costa Rica, there are changes in the ecological characteristics of the Humedal Caribe Noreste in the area of direct influence involving around 225 ha (2.25 km²) or 0.3% of the total wetland area (75,310 hectares, or 753 km²).
> - Aquatic system components, i.e. water quality, aquatic flora and fauna, and resident and migratory birds, would be the most affected.
> - Although the analysis carried out is confined to the HCN, it is clear from the information analysed that the Laguna

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[173] **Vol. IV, Annex N° 147**, Ramsar Secretariat, Ramsar Advisory Mission Report N° 69: Northeastern Caribbean Wetland of International Importance (Humedal Caribe Noreste), Costa Rica, 17 December 2010.

> los Portillos, located in the Refugio de Vida Silvestre Río San Juan Ramsar Wetland in Nicaragua, would be the most affected, with the hydraulic connection with the San Juan river.
>
> - If dredging operations continue in the San Juan River, the dredged sediments should not be deposited over the HCN wetland area.
> - Should the changes continue in magnitude and extent on the San Juan river (as per the current situation), it is likely that the medium- and long-term scenarios described will become a reality."[174]

3.46. On 29 November 2010, Costa Rica's acting Foreign Minister Carlos Roverssi Rojas sent a diplomatic note to Foreign Minister Samuel Santos,[175] in which he

> "remind[ed] the Republic of Nicaragua that the fundamental principle of good faith requires that once the International Court of Justice has received a request for provisional measures for its study, the parties should suspend all action on the field relating to the subject of the measures, to prevent the aggravation of the situation and provide an opportunity for the Court to hear the parties and decide on the merits of the requested measures, so as to avoid that the Court's decision is obstructed by a *fait accompli* situation. Consequently, and given that it has been verified that the Republic of Nicaragua is still occupying Costa Rican territory, and it has been confirmed that it continues to destroy sensitive areas of national wetlands, duly registered and recognized internationally, and considering that on 19 November 2010 the International Court of Justice set the dates 11 to 13 January 2011 to hear the parties in relation to the request for provisional measures made by Costa Rica, Costa Rica calls on Nicaragua to suspend all work on the Costa Rican territory

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174 **Vol. IV, Annex N° 147**, Ramsar Secretariat, Ramsar Advisory Mission Report N° 69: Northeastern Caribbean Wetland of International Importance (Humedal Caribe Noreste), Costa Rica, 17 December 2010, pp. 3-4

175 **Vol. III, Annex N° 64**, Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-488-10, 29 November 2010.

> occupied by Nicaragua, as well as in any other territory, and whose effects might cause an environmental damage by the actions that Nicaragua is carrying out in the area."[176]

3.47. On 30 November 2010, by means of a diplomatic note,[177] acting Foreign Minister Manuel Coronel Kautz, responded by stating that

> "Nicaragua considers that the issues raised by the Government of Costa Rica ... are *sub judice* before the International Court of Justice, and therefore does not consider appropriate to comment on them outside this forum. In this regard, Nicaragua reminds the Republic of Costa Rica that the International Court of Justice has fixed the days 11, 12 and 13 January 2011 to hear the parties in relation to the request for provisional measures made by Costa Rica on 18 November 2010. In relation to the claims made by Costa Rica in that note, Nicaragua considers that its position is and has been very clear and does not wish to enter into dispute letters on them. For that reason, Nicaragua reserves all its rights to respond to all the topics expressed in that note in due course before the International Court of Justice, the competent Judicial Organ of the United Nations to deal with these issues."[178]

3.48. On 2 December 2010, the OAS Secretary General Jose Miguel Insulza, sent a note to Costa Rica in response to the letter of 24 November 2010, in which Costa Rica expressed its readiness to hold the VIII Meeting of the Binational Commission and requested an indication of the area where the Costa Rican police could be positioned. Regarding the latter, the Secretary-General suggested "that it is best that the security forces of Costa Rica avoid being within 1 km of the area of this dispute. I understand that this initiative, which seeks to increase confidence between the parties,

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176 Ibid.

177 **Vol. III, Annex N° 65,** Note from the acting Minister of Foreign Affairs of Nicaragua the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DGCPE/371/01/10, 30 November 2010.

178 Ibid.

should not generate precedents or titles that can be used in an eventual dispute over sovereignty."

3.49. In accordance with the provisions of the Permanent Council resolution of 18 November 2010 to convene a Meeting of Consultation of Foreign Ministers at the headquarters of the OAS in Washington DC,[179] on 7 December 2010 the XXVI Meeting of Consultation of Ministers of Foreign Affairs was conducted. During the meeting, the Secretary General presented his report, which stated:

> "On Friday, November 26, Ambassador Dante Caputo, accompanied by specialist Antonio Delgado, flew over the area to report back to the Secretary General on compliance with this point.
>
> The following are the key elements noted by Ambassador Caputo from his observation:
>
> > *"In the area of the dispute, observations were conducted under good conditions of visibility and in greater detail than on the previous occasion.*[180] *My impression is that the area where trees have been felled is greater than during the previous observation, tents can be seen in the location, the Nicaraguan flag, and the entrance of the river course in the Río San Juan can be clearly distinguished – better than during our previous flyover. I photographed this entire area and these comments can be checked against the photos. I saw no members of the armed forces on the ground. That does not necessarily mean that there were none. In contrast, the military presence on board the dredger was obvious. It can be clearly seen in one of the photographs."*

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179 **Vol. III, Annex N° 57,** Ref: OAS CP/RES. 979 (1780/10), 18 November 2010.

180 Ambassador Caputo accompanied the OAS Secretary General in an overflight of the area on two earlier occasions, from Nicaraguan territory and from Costa Rican territory, on 7 and 8 November 2010, respectively.

Ambassador Caputo's photographs are attached to this report and were delivered with the following note:

> *"You can see…the San Juan, the river course that has been opened, the felled trees, the cleared area with tents and clothing out to dry, although no soldiers are to be seen, the dredger with three or four armed men in uniforms."*

In conclusion, everything seems to indicate a Nicaraguan presence still in the area, with certain evidence of a military presence. In addition, the felling of trees and the opening of a river channel in the area can be seen."[181] (See **figure 3.2**)

Figure 3.2



Figure 3.2: Photograph taken by Ambassador Dante Caputo 26 November 2010

[181] **Vol. IV, Annex N° 146**, Report of the OAS Secretary General, pursuant to resolution CP/Res.979 (1780), presented to the twentieth-sixth Meeting of Consultation of Ministers of Foreign Affairs, 7 December 2010.

3.50. On the same day of 7 December 2010, the XXVI Meeting of Consultation of Ministers of Foreign Affairs adopted a resolution, in which it resolved:

> "As a confidence-building measure, to call upon the parties to implement, simultaneously and without delay, the recommendations adopted through resolution CP/RES. 978 (1777/10), 'Situation in the Border Area between Costa Rica and Nicaragua,' of November 12, 2010."[182]

3.51. The Ramsar Advisory Mission published a report on 17 December 2010, setting out its findings on the changes in the ecological character of Isla Portillos, part of the *Humedal Caribe Noreste* Ramsar site, following its visit to Costa Rica from 27 to 30 November 2010.[183]

3.52. The oral hearings on Provisional Measures before the Court took place from 11 January 2011 to 13 January 2011. During the course of these hearings, Nicaragua stated before the Court that no Nicaraguan military personnel were located on the territory in question, and that "Nicaragua has no intention of stationing troops or personnel of any type in the swampland Nicaragua identifies as the area of Harbor Head and which coincides with the area Costa Rica alludes to with other names."[184] Furthermore, Nicaragua also informed the Court that all works on the newly built "*caño*" were finished, thus seeking to impose a *fait accompli*.

3.53. Nicaragua misinformed the Court about the presence of Nicaraguan military personnel on the territory in its Reply to a question put by Judge

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[182] **Vol. III, Annex N° 67**, Resolution on the Situation between Costa Rica and Nicaragua, Twenty-Sixth Meeting of Consultation of Ministers of Foreign Affairs of the OAS, RC.26/RES. 1/10. 7 December 2010.

[183] **Vol. IV, Annex N° 147**, Ramsar Secretariat, Ramsar Advisory Mission Report N° 69: Northeastern Caribbean Wetland of International Importance (Humedal Caribe Noreste), Costa Rica.

[184] CR 2011/4, p. 37, para. 15 (Argüello).

Bennouna. It stated that "Aucune troupe nicaraguayenne ne stationne actuellement dans la zone en question et le Nicaragua n'a pas l'intention d'y établir de poste militaire à l'avenir."[185] In a flyover of the area conducted by Costa Rican police on 19 January 2011, photographs were showing the continued presence of Nicaraguan troops on Isla Portillos and a marked increase in the size of their encampment since October 2010.[186] These photographs were annexed to Costa Rica's Comments on the Reply of the Republic of Nicaragua to the questions put by Judges Simma, Bennouna and Greenwood.[187]

3.54. By a letter dated 26 January 2011,[188] Nicaragua "protested" a flyover by what it claimed was a Costa Rican helicopter. However, Nicaragua did not indicate the coordinates of the alleged flyover, nor did it provide the registration of the helicopter. As Costa Rica conducted no flyover near the area, it rejected the Nicaraguan protest as groundless.[189]

3.55. On or about 1 February 2011, Nicaraguan authorities announced the publication of a new amended map titled "Political and Administrative Division Map", scale 1:750,000, and another one titled "Topographic Map",

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[185] Reply of the Republic of Nicaragua to the questions put by Judges Simma, Bennouna and Greenwood at the end of hearing on provisional measures requested by Costa Rica in the case concerning *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, 18 January 2011, Ref: 18012011-01.

[186] See **Volume V Annex 223.**

[187] Comments by Costa Rica on the Reply of Nicaragua to the questions put by Judges Simma, Bennouna and Greenwood Greenwood at the end of hearing on provisional measures requested by Costa Rica in the case concerning *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, 20 January 2011, Ref: ECRPB 017-11

[188] **Vol. III, Annex N° 69,** Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DM-DGA/101/01/11, 26 January 2011.

[189] **Vol. III, Annex N° 70,** Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-051-11, 31 January 2011.

scale 1:50,000. Both maps altered Nicaragua's official cartography to include the area under examination by the Court as being Nicaraguan.[190] Costa Rica promptly protested the publication of both maps.[191]

3.56. Following the rendering of an Order of the Court on Provisional Measures on 8 March 2011, Costa Rica immediately sought to comply with the Order by implementing the Measures indicated. On 18 March 2011, Costa Rica's Foreign Minister wrote to his Nicaraguan counterpart proposing the establishment of a bilateral commission to address the question of security.[192] The letter also proposed that Mexico and Guatemala act as facilitators. Nicaragua rejected the dates proposed by Costa Rica, but accepted that the meeting should take place.[193] Costa Rica promptly responded suggesting that the meeting could take place on 12 April 2011, in the city of Liberia.[194] Nicaragua responded accepting the date, but stating that it wished that the meeting to be held at the border post of Peñas Blancas.[195] This was accepted by Costa Rica.[196]

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190 **Vol. III, Annex N° 119**, El 19 Digital, "INETER presents updated official map that marks the border with Costa Rica", 1 February 2011; See also El Nuevo Diario, "New Territorial Map including Harbour Head", 2 February 2011.

191 **Vol. III, Annex N° 71,** Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-059-11, 2 February 2011.

192 **Vol. III, Annex N° 72,** Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-172-11, 18 March 2011.

193 **Vol. III, Annex N° 73,** Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DM/AJST/327/03/11, 24 March 2011.

194 **Vol. III, Annex N° 74,** Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-214-11, 29 March 2011.

195 **Vol. III, Annex N° 77,** Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DM/350/04/11, 1 April 2011.

3.57. In addition to the important issue of providing security in the region, as indicated by the Court, Costa Rica also proceeded to comply with the second Provisional Measure indicated by the Court's Order of 8 March. Accordingly, in coordination with the Ramsar Secretariat, Costa Rica organised a site visit to the area together with technical personnel appointed by the Ramsar Secretariat in order to determine any and all action needed to avoid that irreparable prejudice be caused to that part of the wetland ("Joint Environmental Mission"). Costa Rica duly and timely informed the Court and Nicaragua that the Joint Environmental Mission would take place from 5 to 7 April 2011.[197]

3.58. Nicaragua opposed the Joint Environmental Mission.[198] Any action to avoid irreparable prejudice being caused to that part of the wetland subject to the Order of the Court, required an on the ground assessment by those persons who the Court had expressly stated were entitled to enter the disputed territory for that very purpose. The Ramsar Secretariat shared the same understanding of the Court's Order: its agreement to accompany Costa Rica's personnel in charge of environmental protection was strictly within the scope of the Order. Costa Rica responded to Nicaragua on 4 April

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196 **Vol. III, Annex N° 80,** Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-225-11, 4 April 2011.

197 **Vol. III, Annex N° 75,** Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-DVM-217-11, 30 March 2011; See also, Note from the Ambassador of Costa Rica to the Kingdom of the Netherlands and Co-Agent to the Registrar, Ref: ECRPB-029-11, 1 April 2011.

198 **Vol. III, Annex N° 78,** Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DM/AJST/349/04/11, 1 April 2011. See also **Vol. III, Annex N° 84,** Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DVM/AJST/121/04/11, 8 April 2011.

2011,[199] stating clearly that the actions taken were fully within the terms of the Court's Order, and that Nicaragua had been given prior notice of those actions taking place.

3.59. The Nicaraguan Government's reaction was to send and to maintain in the area a group of "Sandinista Youth" and other Nicaraguans, with the purpose of intimidating the members of the Joint Environmental Mission. In spite of the intimidation, the site visit was carried out on 5 and 6 April 2011. On 5 April 2011, when the civilian helicopters transporting the members of the Joint Environmental Mission landed on the site of the inspection, they were met by numerous Nicaraguan persons who harassed them. Additionally, at least three vessels were stationed on the San Juan with a number of Nicaraguan persons on board who attempted to intimidate the members of the mission. On 6 April 2011, the helicopters transporting the members of the Joint Environmental Mission were prevented from landing by the Nicaraguans present on the site. Nevertheless, overflights of the area were carried out, as part of information gathering objectives of the visit. Despite the presence of persons sponsored by the Nicaraguan Government in the disputed territory, technical data and evidence was collected by the Mission.

3.60. From that date on until the submission of this Memorial, the Nicaraguan Government has maintained a regular presence in the disputed territory of hundreds of members of the "Sandinista Youth", a movement formally linked with and sponsored by the Government of Nicaragua. These persons seemingly have been charged with the task of performing additional works on the disputed territory, including digging a drainage ditch in the

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[199] **Vol. III, Annex N° 80,** Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-225-11, 4 April 2011.

wetland. Chapter VI of this Memorial deals in more detail with the violations by Nicaragua of the Court's Order on Provisional Measures which stem from the presence of these Nicaraguan persons on the disputed territory.[200]

3.61. On 12 April 2011, representatives of Costa Rica and Nicaragua, with the able assistance of the Deputy Ministers of Foreign Affairs of Mexico and Guatemala, held a meeting in the border area of Peñas Blancas, in order to discuss measures to increase security in the area referred to by the Court in its Order. The meeting reached a single agreement: to meet again in Guatemala in the first week of May 2011 in order to keep discussing a bilateral agenda on issues related to the fight against drug trafficking, organized crime and security.[201]

3.62. On 13 April 2011, Costa Rica communicated to Nicaragua a draft proposal on Police Actions.[202] The purpose of the proposal was to agree on an integrated far-reaching agenda for police and security actions along the border, including the area of Isla Portillos. Nicaragua did not react to the proposal.

3.63. On 6 May 2011, delegations from Costa Rica and Nicaragua met in the City of Antigua, Guatemala, facilitated by the Governments of Mexico and Guatemala. The outcome of the meeting was a mechanism agreeing,

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200 See paragraphs 6.3 to 6.24.

201 **Vol. III, Annex N° 85,** Peñas Blancas' Declaration (Costa Rica – Nicaragua), 12 April 2011.

202 **Vol. III, Annex N° 86,** Note from the Ministry of Foreign Affairs and Worship of Costa Rica to the Ministry of Foreign Affairs of Nicaragua, Ref: 0463-D.G.P.-2011, 13 April 2011.

mostly, to ways to facilitate operational communications on actions to combat crime and drug trafficking.[203]

3.64. On 30 May 2011, Costa Rica communicated to Nicaragua a number of actions it took to combat drug trafficking, as well as the fact that it would undertake certain operations along the common border.[204] Nicaragua did not acknowledge the Costa Rican letter nor has Nicaragua communicated any police or security actions to Costa Rica. This attitude signalled that Nicaragua was not interested in coordinating activities or sharing any information about anti-drug trafficking operations with Costa Rica. However, more recently and at Costa Rica's request,[205] Nicaragua appears to be willing to meet in a follow up meeting of the Mechanism of Coordinated Police and Security Actions between Costa Rica and Nicaragua agreed in Guatemala.[206]

3.65. Costa Rica has undertaken a number of measures to protect and monitor Costa Rican territory south of the "*caño*", together with the area designated by the Court in its Order on provisional measures as the "disputed territory". These activities include the establishment of a constant police presence on the ground and by air, including the procurement of satellite imagery. In addition, and in order to obtain a more comprehensive view of the area, Costa Rica is installing a video surveillance system and is making all the necessary arrangements to promptly have a permanent

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[203] **Vol. III, Annex N° 89,** Mechanism of Coordinated Police and Security Actions between Costa Rica and Nicaragua, Guatemala, 6 May 2011.

[204] **Vol. III, Annex N° 91,** Note from the Deputy Minister of Security of Costa Rica to the Chief of the Police of Nicaragua, Ref: 612-2011 DV-WN, 30 May 2011.

[205] **Vol. III, Annex N° 98 (a),** Note from the Deputy Minister of Public Security of Costa Rica to the Chief of the Police of Nicaragua, Ref: 1236-11 DV-WN, 7 November 2011.

[206] **Vol. III, Annex N° 98 (b),** Note from the Chief of the Police of Nicaragua to the Deputy Minister of Public Security of Costa Rica, 15 November 2011.

biological station south of the "caño". These actions were duly communicated to the Secretary General of the Ramsar Convention on Wetlands,[207] Nicaragua[208] and this Court.[209]

3.66. On 21 August 2011, Costa Rica became aware that a pipe connected to one of Nicaragua's three dredgers located in the area of the "Delta" just beyond the bifurcation of the Colorado River and the San Juan, had been placed on the right, Costa Rican bank of the San Juan. The pipe was attached to Costa Rican territory (See **Figure 3.3**). Effects from the dredging in that area are already visible. Erosion to the right bank, immediately adjacent to the location of one of the Nicaraguan dredgers in operation, is evident (See **Figure 3.4**). The picture opposite shows the erosion caused by Nicaragua's dredging activities. Costa Rica protested this damage caused to its territory in a note dated 23 August 2011, and requested an immediate explanation.[210] Nicaragua has not responded.

3.67. Before the filing of this Memorial, and approximately two weeks before Nicaragua's general elections, Nicaragua's Army Chief made groundless accusations against Costa Rica. The Army Chief claimed that Costa Rica intended to "kidnap" some of the Nicaraguan civilians stationed

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[207] **Vol. III, Annex N° 97,** Note from the Ambassador and Permanent Representative of Costa Rica to the Office of the UN in Geneva to the Secretary General of the Ramsar Convention on Wetlands, Ref: MPCR-ONUG/2011-740, 7 November 2011.

[208] **Vol. III, Annex N° 98 (a),** Note from the Deputy Minister of Public Security of Costa Rica to the Chief of the Police of Nicaragua, Ref: 1236-11 DV-WN, 7 November 2011.

[209] **Vol. III, Annex N° 99,** note from the Agent of Costa Rica to the Registrar of the International Court of Justice, Ref: DM-AM-565-11, 8 November 2011.

[210] **Vol. III, Annex N° 95,** Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-AM-466-11, 23 August 2011.

in the disputed territory by the Nicaraguan Government.[211] Nicaragua also claimed that Costa Rica had entered Nicaraguan air space some 48 times.[212] These accusations were made during the Nicaraguan Presidential elections and were clearly made for domestic political motives; this much is evident because Nicaragua did not formally communicate them to Costa Rica. Costa Rica rejected these accusations.[213]

Figure 3.3

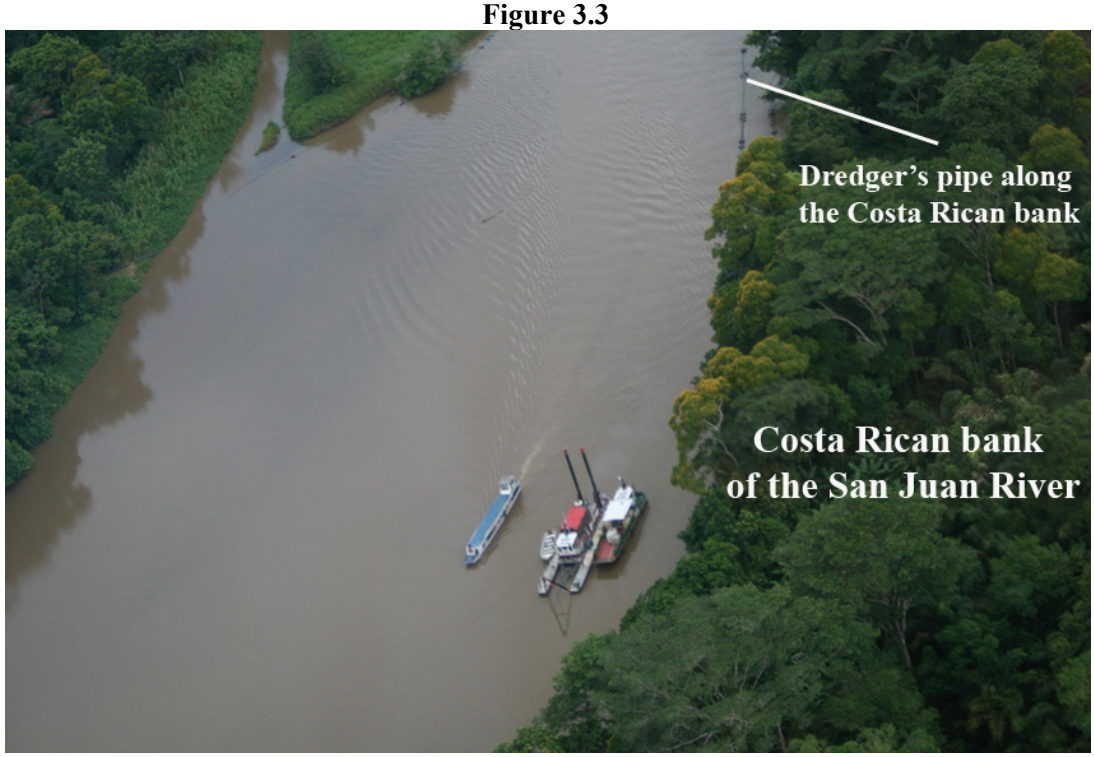

Figure 3.3: Pipe from Nicaraguan dredger attached to the Costa Rican bank of the river,7 July 2011

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211 **Vol. III, Annex N° 134**, El Nuevo Diario, "Disrespect to sovereignty", 18 October 2011.

212 **Vol. III, Annex N° 135,**, El Nuevo Diario, "Tico plot confirmed", 19 October 2011.

213 **Vol. III, Annex N° 136**, Ministry of Foreign Affairs and Worship, Press Release, "Costa Rica accuses Nicaragua of ploy to justify military presence in Isla Portillos", 19 October 2011.

Figure 3.4



Figure 3.4: Erosion affecting Costa Rican bank of the river, 22 August 2011

3.68. On 28 October, Costa Rica transmitted to the Secretariat of the Ramsar Convention the Report on the situation of the wetland in Isla Portillos,[214] following the Joint Environmental Mission carried out on 5-6 April 2011.[215] The Report outlines a number of actions that the personnel in charge of environmental protection deem necessary in order to avoid further irreparable damage from occurring. The Secretary General of the Ramsar Convention responded on 7 November informing Costa Rica its agreement with the Report.[216]

3.69. Other communications that relate to Nicaragua's breach of the Provisional Measures indicated by the Court are examined in Chapter VI of this Memorial. Nicaragua has not responded to any of Costa Rica's diplomatic communications in the last months.

C. Nicaragua's Dredging Works on the San Juan River

3.70. The order to commence dredging works was given by Nicaraguan President Daniel Ortega on 18 October 2010.[217] Nicaragua had planned to undertake dredging works on the San Juan as early as January 2006 when the State-owned and operated National Port Enterprise (*Empresa Portuaria Nacional* or EPN), submitted a request for an impact assessment. On 26 January 2006, following press statements regarding the possible dredging of the San Juan, and pursuant to paragraph 3(6) of the Cleveland Award, the

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214 **Vol. IV, Annex N° 155**, "Assessment and Evaluation of the Environmental Situation in the Humedal Caribe Noreste within the framework of the Order of the International Court of Justice". 28 October 2011.

215 See paragraph 3.59.

216 **Vol. IV, Annex N° 96**, Note from the Secretary General of the Ramsar Convention to the Minister of Foreign Affairs and Worship of Costa Rica, 7 November 2011.

217 **Vol. III, Annex N° 106**, El Nuevo Diario, "Dredging of the San Juan begins", 18 October 2010.

Minister of Foreign Affairs of Costa Rica requested that Nicaragua provide technical information in relation to the possible effects of any dredging on territory belonging to Costa Rica.[218] Of particular concern were the possible effects of dredging on the volume and flow of the Colorado River, the largest distributary of the San Juan, which flows wholly within Costa Rican territory.[219]

3.71. Nicaragua responded on 17 February 2006,[220] noting that infrastructure works were being carried out in the vicinity of San Juan de Nicaragua, but refusing to provide any technical information related to these or other works. On 5 May 2006, Costa Rica wrote to Nicaragua expressing its desire for navigation of the San Juan River to be facilitated along the San Juan, recalling that any works of improvement by Nicaragua on the San Juan had to be carried out without causing damage to Costa Rican territory.[221] Nicaragua responded to this note on 8 May 2006, accusing Costa Rica of interpreting its right of navigation of the San Juan too broadly.[222] It did not mention any plans to dredge the San Juan. Nicaragua did not appear to pursue any works on the San Juan during the course of the next three years.

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218 **Vol. III, Annex N° 41,** Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-37-06, 26 January 2006.

219 **Vol. II, Annex N° 7**, Award of the Arbitrator, the President of the United States, upon the validity of the Treaty of Limits of 1858 between Nicaragua and Costa Rica: "7. The branch of the River San Juan known as the Colorado River must not be considered as the boundary between the Republics of Costa Rica and Nicaragua in any part of its course."

220 **Vol. III, Annex N° 42**, Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DM-JI/262/02/06, 17 February 2006.

221 **Vol. III, Annex N° 43**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-187-06, 5 May 2006.

222 **Vol. III, Annex N° 44**, Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DM-JI/511/05/06, 8 May 2006.

3.72. On 25 August 2009, Nicaraguan newspaper *La Prensa* carried a story in which the "Executive President" of EPN, Mr Virgilio Silva, stated his intention to divert some 1,700m^3 per second of water from the Colorado River into the San Juan by means of a dredging operation.[223] This report was of significant concern to Costa Rica. Given that the Colorado River only carries – in total – between 1,400m^3 and 1,500m^3 per second,[224] Mr Silva's reported statements implied the complete devastation of the Colorado River.

3.73. On 27 August 2009, Costa Rica's Minister of Foreign Affairs wrote to his Nicaraguan counterpart, noting that if the reported figures were correct, "the damage that would occur as a result of the dredging works in the San Juan River [would be] grave and devastating."[225] The Minister went on to state:

> "It was precisely because of this concern that Costa Rica requested [of] Nicaragua, on 26 January 2006, the respective technical information about the dredging works in the San Juan River. Three years on, Nicaragua has not yet sent that information.
>
> In these circumstances, Costa Rica points out to the Government of Nicaragua that before the performance of any dredging work, environmental impact assessments must be carried out to determine that the works will not damage the wetlands, rivers and woodlands of Costa Rica, nor the Bay of San Juan del Norte. These assessments must also determine that there will be no impact on the current flow of the Colorado River, or of any other Costa Rican River."[226]

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223 **Vol. III, Annex N° 101**, La Prensa, "They are going after the flow of the San Juan", 25 August 2009.

224 See paragraph 2.4.

225 **Vol. III, Annex N° 45**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-637-9, 27 August 2009.

226 Ibid.

3.74. Despite Costa Rica repeating its request to be furnished with technical information regarding the dredging works and any relevant environmental impact assessment documents, Nicaragua simply did not respond.

3.75. On 12 July 2010, following a new announcement reported by the Nicaraguan press that Nicaragua's dredging program was to commence in the coming weeks, Costa Rica once again requested that an environmental impact assessment be undertaken prior to the instigation of any work, and that Nicaragua provide Costa Rica with technical information regarding the dredging.[227] However, Nicaragua's cone of silence descended once again. Nicaragua did not respond to this request.

3.76. At no time during the three years leading up to the order to commence dredging did Nicaragua provide Costa Rica with any information regarding the planned works. Nicaragua did not inform Costa Rica that an Environment Impact Study to the Court (EIS) for the dredging works had been conducted. It was not until January 2011, at the hearing for Provisional Measures and after a significant amount of work had occurred, that Nicaragua submitted, in the Judges' Folders, an incomplete copy of its EIS,[228] the missing part of which contains maps showing the relevant area of Isla Portillos as Costa Rican.

3.77. As Costa Rica came to learn in January 2011 during the oral hearings on provisional measures, on 25 January 2006 Nicaragua's Ministry

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[227] **Vol. III, Annex N° 46**, Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-AM-156-10, 12 July 2010.

[228] **Vol. IV, Annex N° 164**, Declaration of the Technical Manager of the National Port Company (EPN), Lester Antonio Quintero Gómez, 16 December 2010. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

of the Environment and Natural Resources (MARENA) received a request from the EPN for an "environmental permit" to dredge a 42 km stretch of the San Juan from Punta Petaca to the river's outlet in the Caribbean Sea.[229] Following this, on 9 March 2006, MARENA provided EPN with a Terms of Reference document setting out its requirements for an Environmental Impact Statement (EIS).[230] When Costa Rica repeated its request for information regarding dredging works on the San Juan on 5 May 2006,[231] Nicaragua was aware that a project was at that time in train. Yet on 8 May 2006, Nicaragua said nothing, refusing to provide any information to Costa Rica regarding the proposed works.[232]

3.78. Costa Rica has subsequently learned that on 7 August 2006, MARENA received a completed EIS from the EPN.[233] This document was allegedly

> "…made available to the public for review and commenting from 9-15 August 2006 at the offices of the MARENA Territorial Delegation for the San Juan River in San Carlos, the Town Hall of El Castillo, the Town Hall of San Juan del

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229 **Vol. IV, Annex N° 165**, Affidavit of Hilda Espinoza Urbina, National Director of the Department of Environmental Quality at the Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 20 December 2010. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

230 Ibid.; See also **Vol. IV Annex N° 159**, Specific Terms of Reference for the Preparation of the Environmental Impact Study for the Project "Dredging of the San Juan River". (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

231 **Vol. III, Annex N° 43**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-187-06, 5 May 2006.

232 **Vol. III, Annex N° 44**, Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DM-JI/511/05/06, 8 May 2006.

233 **Vol. IV, Annex N° 158** [excerpts], Corea y Asociados S.A. "*Estudio de Impacto Ambiental para el Mejoramiento de la Navegación en el río San Juan de Nicaragua*", September 2006 (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

> Norte, and MARENA's central offices in Managua. EPN had published notices of this availability in *La Prensa* and *El Nuevo Diario* [Nicaraguan national newspapers] on 7 August 2006".[234]

3.79. At no time did Nicaragua provide this information to Costa Rica, despite Costa Rica having repeatedly made such requests. Nicaragua has never provided Costa Rica with its EIS. The Nicaraguan EIS provided coordinates for the sites of sediment deposit. Some of these sites are located on Costa Rican territory along the right bank of the San Juan, including the site at Finca Aragón where sediment had already been deposited by Nicaragua.[235] (See **Sketch map 5.1**).

3.80. On 28 November 2008 MARENA issued a Technical Opinion regarding the proposed dredging works set out in the EIS. The two-year delay between the production of the EIS and the conclusion of the Technical Opinion has not been explained by Nicaragua.[236] The Technical Opinion describes the intended scope of the dredging project as follows:

> "The project consists in the cleaning and maintenance of the navigations channel along a section of 41,936.57 linear meters that extends from the site known as Punta Chingo Petaca to the mouth of the San Juan River. The project is located in the jurisdiction of the municipality of San Juan de Nicaragua,

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234 **Vol. IV, Annex N° 165**, Affidavit of Hilda Espinoza Urbina, National Director of the Department of Environmental Quality at the Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 20 December 2010, para. 16. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

235 **Vol. IV, Annex N° 158** [excerpts], Corea y Asociados S.A. "*Estudio de Impacto Ambiental para el Mejoramiento de la Navegación en el río San Juan de Nicaragua*", September 2006 (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011), p. 24.

236 **Vol. IV, Annex N° 165**, Affidavit of Hilda Espinoza Urbina, National Director of the Department of Environmental Quality at the Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 20 December 2010. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011). See also **Vol. IV, Annex N° 162**, MARENA, Technical Opinion Environmental Impact Study Project: Improvement of Navigation on the San Juan de Nicaragua River, 28 November 2008.

> Department of Rio San Juan, within the limits of the Rio San Juan Wildlife Reserve, in the agroforestry usage area. A cutter and suction dredge will be used to dredge the riverbed. For the effects of the environmental impact study the area of direct and indirect influence for the project has been calculated at 100 meters wide x 42,000 meters long, equivalent to 420 (hectares). The area of direct influence affected through the depositing of cleaning material has been calculated at 130.8 (hectares), this being the sum of the areas (m^2) of the 23 sites selected for depositing, plus the right of way or easement for the sediment discharge piping (0.069 hectares). The area directly affected by the restoration of the Rio San Juan navigation channel has been calculated at 126 hectares (30 meters wide x 42,000 meters long)."[237]

3.81. On 22 December 2008, MARENA issued Resolution No. 038-2008, approving the dredging works as proposed. Although the works were finally approved in December 2008, and had been in preparation for the two years previous, Nicaragua at no time formally advised Costa Rica of its plans to permit dredging works on the San Juan nor of its intention to deposit sediments on the Costa Rican bank of the San Juan.

3.82. Nicaragua's dredging program failed to comply with its own technical and procedural requirements pertaining to environmental protection. The works undertaken are outside the scope of the approval issued by MARENA. Neither Resolution No. 038-2008, nor the EIS upon which it was premised, address the impact of cutting meanders to straighten the course of the San Juan; something which Nicaragua has since done. Nor at any time was the use of three dredgers suggested or approved. The EIS stipulated that only "a cutter and suction dredge will be used to dredge the riverbed",[238] yet Nicaragua has now deployed three dredgers on the San

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237 Ibid., para 4.

238 **Vol. IV, Annex N° 158** [excerpts], Corea y Asociados S.A. "*Estudio de Impacto Ambiental para el Mejoramiento de la Navegación en el río San Juan de Nicaragua*",

Juan.[239] When during the hearings on provisional measures Costa Rica raised the issue about two different dredging projects being carried out on the San Juan, Nicaragua quickly dismissed those claims, by stating that the dredging project was being scaled down from its original form as contemplated in the EIS.[240] Nicaragua stated: "And speaking of dredgers, these too have been scaled down substantially from the ones contemplated in the EIS",[241] and indicated that if taken together, they could only dredge 600m^3 per hour. In fact the EIS had only authorized one dredger, not three or four.

3.83. Moreover, the environmental permit issued under Resolution No. 038-2008 had a limited life. The permit document records that: "This permit shall enter into force as of the date of delivery … and if the project is not executed in the next 18 months, it must be renewed, for which MARENA shall evaluate the conditions prevailing at the date thereof, being empowered to authorize its renewal provided no changes or variations of the original environmental parameters in the area of the project have occurred."[242] The dredging works were not commenced until 18 October 2010,[243] that is, 21 months after the permit was granted. Approval for the project had lapsed, yet (as far as the documentation submitted by Nicaragua

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September 2006 (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011), p. 18.

239 **Vol. III, Annex N° 133**, La Voz del Sandinismo: "Cleaning of the San Juan River advances according to projections", 23 August 2011.

240 CR 2011/4, 13 January 2011, p. 16, paras. 9-10 (Reichler).

241 Ibid., para. 11 (Reichler).

242 **Vol. IV, Annex N° 165**, Affidavit of Hilda Espinoza Urbina, National Director of the Department of Environmental Quality at the Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 20 December 2010. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011). See also **Vol. IV, Annex N° 160,** Resolution No. 038-2008, Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 22 December 2008.

243 **Vol. III, Annex N° 109**, La Prensa, "Costa Rica admits Nica right to dredge the San Juan", 20 October 2010.

shows) MARENA did not re-evaluate the project and did not issue a renewal of the environmental permit.

3.84. President Ortega appointed one Mr Edén Pastora to head the dredging operations. The first dredger was given the name *Soberanía* ("Sovereignty"). In a newspaper interview given on 30 November 2010, Mr Pastora explained the decision to dredge the San Juan as follows:

> "I spoke to [President Ortega] of the need for dredging; I said that that territory was [being] abandoned by God and us Nicaraguans. I asked him, 'Daniel, you know why we lost Nicoya and Guanacaste? Because we abandoned it! We have abandoned everything. And we are abandoning San Juan del Norte. When you're dead, I'm dead, your grandchildren and mine will say that San Juan del Norte was in Nicaragua.' He became serious, severe, hit the table and said, 'Go dredge that shit now.'"

When asked why the particular dredging route had been chosen, Mr Pastora explained:

> "I studied the [Alexander and Cleveland] awards and I made it easy to interpret…it was easy for me to interpret them because I know that area *in situ* [sic], channel by channel, lagoon by lagoon. I know where Punta Castilla is. I walked on the right bank of Harbour Head. Then I made it easy to interpret the awards…We started at that point…because the border is there. We started dredging by what was said once about the exchange of trade… Because there was a trade route! The awards say so, the story says so, the Cañas-Jerez Treaty. And to go back to how we were it had to be there. We are going to work along the river to make it navigable; it is not enough to do the three, four, first five kilometers. For it to be navigable we have dredged the first 33 kilometers, from the delta to its mouth at Punta de Castilla. And you have to clean the lagoons, and clean the channels. Redo everything as before... all as it was."[244]

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[244] **Vol. III, Annex N° 117,** Confidencial.Com, "Pastora: I interpreted the Alexander Award", 30 November 2010.

3.85. In a television interview, Mr Pastora noted that the purpose of the dredging and the associated artificial *caño* project was to "restore the Nicaraguan border river to its historic channel to the sea" and that the Treaty of Limits proves that Isla Portillos "is part of Nicaragua, not Costa Rica."[245] Such assertions were endorsed by President Ortega, who stated that the Colorado River

> "...was a river that did not have the same volume of flow as it currently has, and with the passing of time, obstructions that took place at this point kept deviating the waters of the San Juan River to the Colorado river. Thus, the Colorado River is fed in about 90% by Nicaraguan waters, what are these Nicaraguan waters? The waters that come from the north of our country, to drain the Managua lake, the great lake of Granada and then drain through the San Juan River."[246]

3.86. The clear implication in President Ortega's statement is that Nicaragua is entitled to reclaim its "Nicaraguan waters" from the Colorado River. The Nicaraguan "White Book" states:

- "Nicaragua has the right to dredge and make improvements in the San Juan River and to recover its original natural condition. As long as the river is not navigable as it was in 1858, Nicaragua has the right to use the branch of the Colorado River";[247]
- "The cleaning of the San Juan River has the objective of recovering the historical volume of the river, so as to improve

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[245] **Vol. III, Annex N° 111,** Report of interview with Edén Pastora on Nicaraguan television channel 100% Noticias, in: Tim Rogers, 'Nicaragua Denies Reports of Intrusion into Costa Rica' Tico Times, 2 November 2010.

[246] **Vol. III, Annex N° 113**, English translation by Costa Rica of a speech given by President of the Republic of Nicaragua, Daniel Ortega, on national Nicaraguan television on 13 November 2010 (excerpts).

[247] **Vol. II Annex N° 30**, Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010), p. 43.

navigation for the benefit of Nicaragua and all Central Americans, including Costa Ricans";[248] and

- "If Nicaragua dredges and cleans the bank of silt and sand that obstructs navigation in the San Juan River, the interests of Costa Rica will be harmed of course like the interests of Nicaragua were harmed in the middle of the nineteenth century when the strong winters of those years accumulated silt, sand and other sediments in the last 40 kilometers of the course of the San Juan River."[249]

3.87. Most concerning of all is Nicaragua's statement in the "White Book" that "[i]f Nicaragua dredges and cleans the bank of silt and sand that obstructs navigation in the San Juan River, the interests of Costa Rica will be harmed of course".[250] (Emphasis added)

3.88. On 17 July 2011, Mr. Edén Pastora made new statements about the scale of the dredging,[251] including the following remark: "…inasmuch we recover the flow [of the San Juan] as it was in 1800, they [the Costa Ricans] will be affected".[252] Costa Rica promptly requested clarification.[253] Once more Nicaragua has not responded.

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248 Ibid., p. 43.

249 Ibid., p. 45.

250 Ibid., p. 43.

251 **Vol. III, Annex N° 132,** La Prensa, "To eliminate the San Juan's 'bottleneck'", 17 July 2011.

252 Ibid.

253 **Vol. III, Annex N° 93**, Note from the Minister of Foreign Affairs of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-AM-422-11, 20 July 2011.

D. Nicaragua's Incursion and Occupation

3.89. Nicaragua first occupied Isla Portillos on or about 18 October 2010,[254] as documented on 20 October 2010 in photographs taken by Costa Rica's Ministry of Public Security during the course of an overflight inspection of the area.[255]

3.90. As soon as this situation was detected, Costa Rica issued a formal protest in the form of a note sent by the acting Minister of Foreign Affairs, Marta Nuñez Madriz, to the Nicaraguan Minister of Foreign Affairs, Samuel Santos Lopez, stating that "[t]hese series of events constitute an unacceptable violation of Costa Rica's sovereignty."[256] Costa Rica protested the presence of Nicaraguan personnel and activities unlawfully undertaken by Nicaragua on Costa Rican territory.[257]

3.91. An inspection of the area was carried out by police forces and personnel from the Costa Rican Government on 22 October 2010.[258] The environmental damage caused to the area was documented. The Costa Rican police raised Costa Rica's flag by a hut at Finca Aragón (See **Figure 3.5**). All Costa Rican personnel subsequently left the area.

3.92. On 25 October 2010, the Costa Rican police and the Ministry of

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254 *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, Application of the Republic of Costa Rica Instituting Proceedings, 18 November 2010, p. 3, para. 4.

255 **Vol. V, Annex N° 231**, photograph of Nicaraguan dredger at the Costa Rican bank of the San Juan River, 20 October 2010.

256 **Vol. III, Annex N° 47**, Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-412-10, 21 October 2010.

257 Ibid.

258 **Vol. IV, Annex N° 143**, Costa Rica, (SINAC) Ministry of Environment, Energy and Telecommunications Report, Ref: ACTo-RNVS-CyP-057-2010, 22 October 2010.

Environment undertook another visit to Finca Aragón, to carry out technical studies to determine the extent of the environmental damage. It was noted that the Costa Rican flag remained in the place where it had been raised by the Costa Rican police.

Figure 3.5



Figure 3.5: Photograph of the Costa Rican flag on Finca Aragón taken 22 October 2010.

3.93. Nicaragua sent a diplomatic note to Costa Rica, in which it denied that it had breached Costa Rican sovereignty

> "…because all of the activities aimed at combating drug trafficking, as well as the cleaning works of the San Juan River have been carried out on Nicaraguan territory, in accordance with the rights established in the Treaty of Limits

> Jerez-Cañas and additional instruments, Cleveland Award and the Alexander Awards."[259]

Nicaragua further noted that

> "Nicaragua, respectful of the principles of International Law will continue with the cleaning works of the river and will guard the boundaries and sovereignty of Nicaragua established in the Jerez-Cañas Treaty of Limits, and its instruments Cleveland Award and Alexander Awards. Similarly, Nicaragua will continue to safeguard and defend the boundaries and sovereignty in all of its national territory."[260]

Nicaragua was assiduously abstruse as to whether it now considered Isla Portillos to be Nicaraguan territory.

3.94. A new overflight conducted by the Costa Rican police on 31 October 2010 revealed that members of the Nicaraguan army had entered Finca Aragón and set up a military encampment with makeshift dwellings on the areas where sediment had been previously deposited. Nicaragua had also taken possession of a house on Finca Aragón. (See **Figures 3.6** and **3.7**). It was also observed that the Costa Rican flag previously raised on 22 October 2010 had been removed by the Nicaraguan troops, and a Nicaraguan flag hoisted in its place. The second incursion into Costa Rican territory marked the commencement of the Nicaraguan occupation of the area.

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[259] **Vol. III, Annex N° 48**, Note from the acting Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DVM/AJST/660/10/10, 26 October 2010.

[260] Ibid.

Figure 3.6



Figure 3.6: Photograph of Nicaraguan soldiers in Finca Aragon, 11 November 2010

Figure 3.7



Figure 3.7: Nicaraguan flag on Finca Aragon. 11 November 2011

3.95. In response to these developments, on 1 November 2010 Costa Rica sent two diplomatic notes to Nicaragua. The first note was in response to Nicaragua's note of 26 October 2010 and referred to the facts documented during the 22 October 2010 overflight. This note recalled that the boundary line had been demarcated in 1897-1900 by the commissions of Costa Rica and Nicaragua, in accordance with the Treaty of Limits, the Cleveland Award, and the Matus-Pacheco Convention.[261] In view of the previously uncontested boundary line between the two States, Costa Rica observed that

> "Therefore,… absolutely no doubt remains in reference that the actions denounced by Costa Rica…which is supported by photographic and audiovisual evidence under the possession of my country, occurred in Costa Rican territory. In particular it is clear that the problem does not originate from the lack of demarcation or lack of clarity regarding the border line in that region, given that the official mapping of the two countries as well as the proficient instruments that govern the subject – in particular the Alexander Minutes – do not allow room for error."[262]

3.96. The second note sent by Costa Rica to Nicaragua on 1 November 2010 was an immediate protest of the presence of Nicaraguan troops on Costa Rican territory:

> "the Government of Costa Rica has verified that armed troops of the Nicaraguan Army have entered the territory of the Republic of Costa Rica, specifically in the area of Finca Aragon, Isla Calero, in the Province of Limón. It is in this site precisely where the actions by Mr. Eden Pastora where carried out, which resulted in the violation of territorial sovereignty and environmental damage, as reported in Note-DM-412-10

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261 **Vol. III, Annex N° 49**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-429-10, 1 November 2010.

262 Ibid.

> of 21 October of this year, signed by Vice-Minister Marta Nuñez Madriz.
>
> According to information available, the Costa Rican flag which was located in the mentioned area was removed and replaced by a flag of the Republic of Nicaragua. It has also been confirmed that members of the Nicaraguan Army have installed themselves in the area mentioned above.
>
> For the Government of Costa Rica these actions constitute an unacceptable violation of its territorial integrity and sovereignty, and are absolutely indefensible by Nicaragua."[263]

This note informed Nicaragua that "the Government of Costa Rica will pursue the use of all resources provided by international law to solve this kind of situations and to ensure adequate protection of its territory."[264]

3.97. Nicaragua did not respond to either of these two notes. Consequently, Costa Rica made an urgent request on 2 November 2010 to convene a Special Session of the OAS Permanent Council of the Organization of American States (OAS), as described above.[265] On 3 November 2010, Costa Rica's Foreign Minister, René Castro, denounced Nicaragua's conduct to the OAS Secretary General and the members of Permanent Council, and requested intervention by the OAS. In response, the OAS Secretary General visited Costa Rica and Nicaragua from 5 to 8 November 2010 and participated in an overflight of the area.

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263 **Vol. III, Annex N° 50**, Note from Minister of Foreign Affairs and Worship of Costa Rica, to Minister of Foreign Affairs, Nicaragua, Ref: DM-430-10, 1 November 2010.

264 Ibid.

265 **Vol. III, Annex N° 51**, Note from the Permanent Representative of Costa Rica before the OAS, to the President of the OAS Permanent Council. Ref: DE-065-2010, 2 November 2010.

3.98. As result of this visit, the OAS Secretary General issued a Report[266] containing four recommendations intended to reduce tensions and create an atmosphere conducive to the carrying out of a bi-national meeting to resolve the issue. On 12 November 2010, the Permanent Council adopted Resolution 978 (1777/10), in which it endorsed the recommendations made by the OAS Secretary General,[267] including the recommendation that: "In order to create a favourable climate for dialogue between the two nations, [both States should] avoid the presence of military or security forces in the area, where their existence might rouse tension."[268] Not only was this recommendation disregarded by Nicaragua, which continued to station armed troops in the area, but the Nicaraguan President Daniel Ortega denounced the OAS and even accused some of its member States of aiding international drug traffickers.[269]

3.99. On 26 November 2010, Ambassador Dante Caputo, representing the OAS Secretary General, flew over the northernmost part of Isla Portillos in order to inspect the site of the occupation and the artificial *caño*. During the course of the visit he observed Nicaragua's military presence in Isla Portillos.[270]

3.100. On 7 December 2010, a Consultation Meeting of the OAS Ministers of Foreign Affairs was conducted, and a resolution ratifying the terms of the

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266 **Vol. IV, Annex N° 144**, OAS, Report by the Secretary General on his visit to Costa Rica and Nicaragua, CP/doc.4521/10 corr.1, 9 November 2010.

267 **Vol. III, Annex N° 53** OAS Permanent Council Resolution, Ref: OAS CP/RES 978 1777/10, 12 November 2010.

268 Ibid.

269 **Vol. III, Annex N° 115**, La Prensa, "Nicaragua will not obey request by OAS", 14 November 2010.

270 **Vol. IV, Annex N° 146**, Report of the OAS Secretary General, Pursuant to Resolution CP/Res. 979 (1780/10), Presented to the Twenty-Sixth Meeting of Consultation of Ministers of Foreign Affairs, 7 December 2010.

OAS Permanent Council's resolution of 12 November was approved. This resolution was ignored by Nicaragua, which maintained its military troops at Finca Aragón.

3.101. The risk of causing death or serious harm to persons that arose as a result of the presence of Nicaraguan armed forces in the area was recognised by the Court in its Order of 8 March 2011. The Court stated:

> "Whereas those written responses [to the questions put to the Parties by Judges Simma, Bennouna and Greenwood at the end of hearings on provisional measures] nevertheless also show that Nicaragua, while stating that '[t]here are no Nicaraguan troops currently stationed in the area in question' and that 'Nicaragua does not intend to send any troops or other personnel to the region' (see paragraph 71 above), does intend to carry out certain activities, if only occasionally, in the disputed territory, including the *caño* (see paragraph 72 above); whereas the Court recalls that there are competing claims over the disputed territory; whereas this situation creates an imminent risk of irreparable prejudice to Costa Rica's claimed title to sovereignty over the said territory and to the rights deriving therefrom; whereas this situation moreover gives rise to a real and present risk of incidents liable to cause irremediable harm in the form of bodily injury or death".[271]

3.102. The Court was unanimous when it ordered that: "Each Party shall refrain from sending to, or maintaining in the disputed territory, including the *caño*, any personnel, whether civilian, police or security".[272] However, Nicaragua maintained a presence in the territory, in contravention of the Court's authority and international law.

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[271] *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, Request for the Indication of Provisional Measures, Order of 8 March 2011, p. 18 (para. 75) (emphasis added).

[272] Ibid., p. 21, para. 86(1).

E. Completion of the Artificial Caño

3.103. As it eventuated, the dredging of the San Juan was not the sum total of Nicaragua's plans. The incursion and occupation were acts undertaken in furtherance of Nicaragua's plan to construct an artificial *caño*, which when coupled with the cutting of meanders across the left bank of the San Juan is intended to have the effect of reconfiguring the course and the velocity of the San Juan, and even the morphology of the river basin.

3.104. The construction of the *caño* was not, as Nicaragua has suggested, "a modest dredging and cleaning effort".[273] According to the affidavit of Hilda Espinoza, the Director of MARENA's Department of Environmental Quality, submitted by Nicaragua during the hearing for Provisional Measures,

> "On 28 August 2009, after MARENA had authorized the dredging project, EPN's legal representative, Virgilio Silva, submitted an application to expand the work approved in Resolution No. 038-2008 to include the 'manual cleaning of the *caño* (i.e. small channel) that connects the river to the Harbor Head Lagoon' – also known as the Harbor Head *Caño*. This addition was to include the removal with hand-held tools of the accumulated debris and overgrown vegetation that was impeding normal navigation in the Harbor Head *Caño*."[274]

3.105. This affidavit was dated 20 December 2010. It was produced by Nicaragua for the purposes of the oral hearings on provisional measures. It offers no support to Nicaragua's contention that it was carrying out a "modest dredging and cleaning effort". On the contrary, MARENA's

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[273] CR 2011/2, p. 8 (para. 3) (Argüello).

[274] **Vol. IV, Annex N° 165**, Affidavit of Hilda Espinoza Urbina, National Director of the Department of Environmental Quality at the Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 20 December 2010. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011), para. 22.

expansion of the works approved in its Resolution No. 038-2008 was for a "cleaning project" that measures 30 metres in width and 1,5 kilometres in length, across Costa Rican territory. At no point was Costa Rica made aware of Nicaragua's plans to "clean" any *caño* and even less to construct a new *caño* to artificially divide the northern part of Isla Portillos in two, cutting across Costa Rican territory and joining the San Juan to the Laguna Los Portillos.

3.106. According to the documents produced by Nicaragua after the event, the *caño* work was purportedly approved by MARENA as early as 30 October 2009. The works were not granted their own permit, but rather the permit for dredging of the San Juan was "expanded"[275] in Resolution No. 38-2008-A1, to encompass the following works:

> "According to the information submitted by the Proponent, the changes consist of cleaning a stream which connects the San Juan River with the Harbor Head Laguna in Nicaraguan territory, using manual equipment. The clean-up work shall be performed along a length of 1,560 linear metres with a maximum of 30 meters in width, with the starting point at reference coordinates North 1208638 and East 863133, and the end point at coordinates North 1209823 and East 863450. The clean-up work will be performed with a dredge on a section that has become sedimented, located at reference coordinates North 1208439 – East 863131, and (final) coordinates North 1208134 – East 863136 and North 1208138 – East 963196, with a width of 59 metres by 300 meters in length and 6 meters in depth. A total of 37,500m^3 of sediment will be removed in this activity, to facilitate navigation in these sections of the river."[276]

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[275] Ibid., para. 29.

[276] **Vol. IV, Annex N° 161**, Resolution No. 038-2008-A1, Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 30 October 2009. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

3.107. Costa Rica has learned that between 24 and 26 November 2010,[277] MARENA conducted a site visit and subsequently produced a "Technical Monitoring Report [on the] Project 'Improvement of the Navigability of the San Juan River'".[278] This Report was never transmitted to Costa Rica, but was submitted to the Court during the course of the hearing on Provisional Measures. In this Report, MARENA notes that "by way of monitoring, [it] organized and coordinated with others a monitoring inspection to verify the environmental compliance of the project located in the Municipality of San Juan de Nicaragua within the protected area '*Refugio de Vida Silvestre Rio San Juan*' [San Juan River wildlife reserve]."[279] However, according to the official registration documents lodged with the Ramsar Secretariat, the *Refugio de Vida Silvestre Rio San Juan* is a 43,000 hectare expanse located within the following coordinates: 10°56'N 083°40'W. The coordinates of the artificial *caño* as indicated in Resolution No. 38-2008-A1, are: 1208638 North, 863133 East, and 1209823 North, 863450 East. These coordinates placed the proposed site for the *caño* well outside the *Refugio de Vida Silvestre Rio San Juan* and in fact on Costa Rican territory (see **Figure 3.8**).

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277 **Vol. IV, Annex N° 165**, Affidavit of Hilda Espinoza Urbina, National Director of the Department of Environmental Quality at the Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 20 December 2010. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011), para. 30.

278 **Vol. IV, Annex N° 163,** Technical Monitoring Report [on the] Project 'Improvement of the Navigability of the San Juan River', MARENA, 24th to 26th November 2010. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

279 Ibid.

Figure 3.8

Location of the starting and ending points of the artificial channel acording to document DGCA N° 038-2008-A1

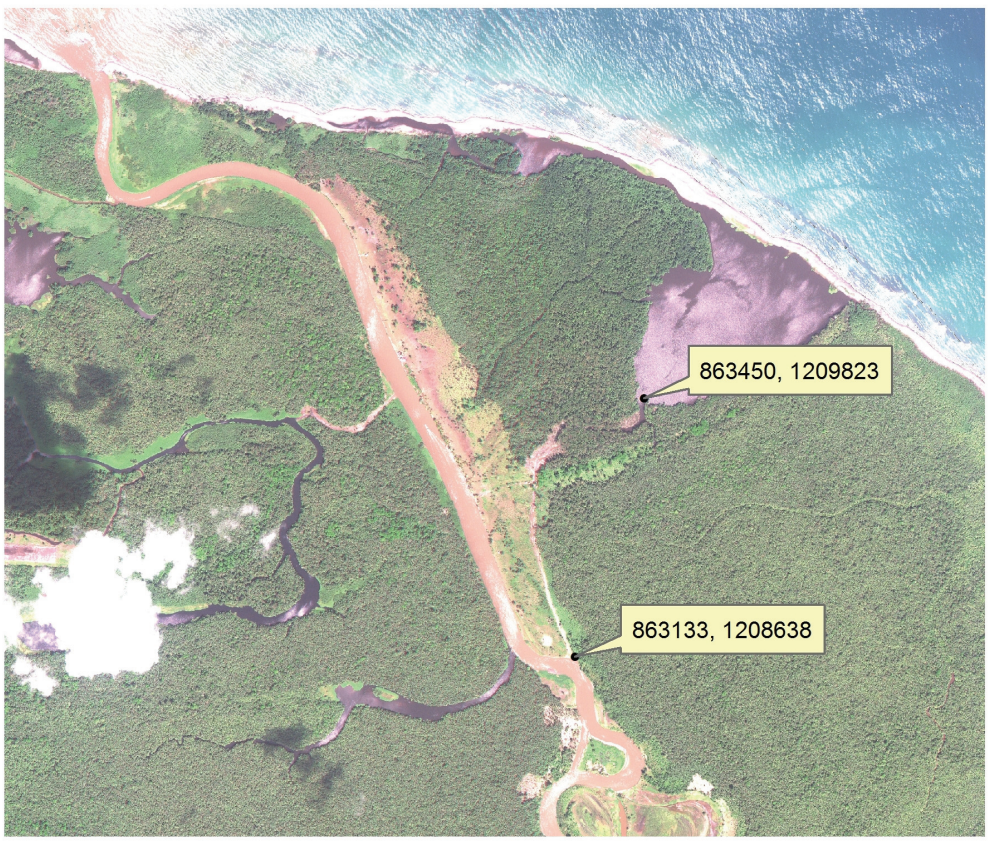

Figure 3.8: Satellite image including coordinates of Resolution 038-2008 A1

3.108. In any event, it is apparent that the "stream" to which Resolution No. 38-2008-A1 refers did not exist. A satellite photograph taken on 8 August 2010 and included in a report by the United Nations Institute for Training and Research (UNITAR) shows clearly that there is "[n]o evidence

of an ephemeral stream"[280] in the region where the *caño* would shortly come into existence (See **Figure 3.9** below).

Figure 3.9



Figure 3.9: Satellite image taken on 8 August 2010, included in UNITAR/UNOSAT report, 4 January 2011

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280 **Vol. IV, Annex N° 148,** UNITAR/UNOSAT, "Morphological and Environmental Change Assessment: San Juan River Area (including Isla Portillos and Calero), Costa Rica" (Geneva, 2011), 4 January 2011.

3.109. The overflights conducted by the Costa Rican Public Security aircraft on 20 and 22 October also show that at the time the caño did not exist. Rather, what was detected was the manual clearing of a 500 metre long strip of land. (see **Figures 3.10** and **3.11**)

Figure 3.10



Figure 3.10: Photograph of relevant area taken on 20 October 2010.

Figure 3.11



Figure 3.11 : Area where the *caño* was later constructed, 22 October 2010

3.110. By the beginning of November 2010, aerial photographs show that work related to the construction of this artificial *caño* was well underway. (See photographs opposite). Following Ambassador Dante Caputo´s site visit on 26 November 2010, he noted in his report to the Secretary General of the OAS that "the felling of trees and the opening of a river channel in the area can be seen."[281] The sudden appearance and increasing size of the artificial *caño* over the course of October-November 2010 is evident (See **Figure 3.12**).

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[281] **Vol. IV, Annex N° 146,**, Report of the OAS Secretary General, Pursuant to Resolution CP/Res. 979 (1780/10), Presented to the Twenty-Sixth Meeting of Consultation of Ministers of Foreign Affairs, 7 December 2010.

Figure 3.12



Figure 3.12: Photographs of the development of the caño taken on 1 and 14 November 2010

3.111. By December 2010, the artificial *caño* had markedly increased in size, and sediments from the San Juan were beginning to visibly wash out into the Laguna Los Portillos, causing a murky sedimentation of the lagoon.[282] (See **Figure 3.13**)

Figure 3.13



Figure 3.13: Aerial photograph taken on 5 December 2010 showing the flow of sediment to Laguna Los Portillos

3.112. The Ramsar Advisory Mission concluded that:

> "The construction of the artificial canal will transform the Laguna los Portillos [Harbor Head Lagoon] and wetland island... from an ecosystem with numerous habitats (structural heterogeneity) to a single, more extensive habitat dominated by the condition imposed by the San Juan River …The partial flooding of the wetland due to the construction of the artificial canal and the clearing of vegetation would alter the distribution and abundance of terrestrial species

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[282] **Vol. IV, Annex N° 148,** UNITAR/UNOSAT, "Morphological and Environmental Change Assessment: San Juan River Area (including Isla Portillos and Calero), Costa Rica" (Geneva, 2011), 4 January 2011.

> through the loss of habitat and reduction in food supply and shelter; [it would isolate an important zone of wetland] from the remainder of the wetlands located on the Isla Portillos, turning it into a barrier for terrestrial fauna with restricted mobility."[283]

3.113. UNITAR notes that between 19 November and 14 December 2010:

> "The new channel has increased to an average diameter of 15m, showing a 5m increase ... This increase of channel width was likely due to erosion as new water flow cuts into the soil. Removal of vegetation along the channel has helped facilitate the erosion processes as it develops. This high rate of erosion is additionally facilitated with the high velocity of water flowing in from the San Juan River. As a result the banks of the channel appear to have also increased in width from the erosion process to an average of 23m in width. It is likely that as the water cuts through the soil, the existing banks will continue to widen as sediment washes out into Los Portillos lagoon."[284]

3.114. In Chapter V of this Memorial, Costa Rica will discuss further the intended and potential impacts of the construction of the *caño* on Costa Rican territory, as well as the wider dredging program.

F. Conclusions

3.115. As set out in this Chapter, the activities carried out by Nicaragua in the border area entail:

- A failure to notify and cooperate with Costa Rica with respect to the carrying out of a programme of dredging on the San Juan River and the cutting of meanders on the left Nicaraguan bank

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283 **Vol. IV, Annex N° 147,** Ramsar Secretariat, Ramsar Advisory Mission Report N° 69: North-eastern Caribbean Wetland of International Importance (Humedal Caribe Noreste), Costa Rica, 17 December 2010, pp. 30-31.

284 **Vol. IV, Annex N° 148,** UNITAR/UNOSAT, "Morphological and Environmental Change Assessment: San Juan River Area (including Isla Portillos and Calero), Costa Rica" (Geneva, 2011), 4 January 2011, p. 2.

of the San Juan, that risk causing serious damage to Costa Rican territory.

- The dumping of sediment on the right Costa Rican bank of the San Juan causing damage to Costa Rican territory.
- The felling of primary old-growth forest and the clearing of vegetation on Costa Rican territory.
- The digging of an artificial *caño* across Costa Rican territory, connecting the waters of the San Juan to those of Laguna Los Portillos.
- The unlawful incursion by Nicaraguan armed forces on Costa Rican territory, the removal of a Costa Rican flag, the hoisting of a Nicaraguan flag, and the establishment of a Nicaraguan military presence thereon housed in makeshift dwellings erected by Nicaragua.
- The threat to use force by members of the Army of Nicaragua located on Costa Rican territory against civilian Costa Rican aircraft conducting an overflight of the area.
- The continued occupation of Costa Rican territory by Nicaraguan armed forces despite regional efforts to resolve the situation peacefully, and notwithstanding assurances to the contrary made by Nicaragua before the Court.
- The sending to and maintaining of Nicaraguan civilians in the area;
- A failure to cooperate, and even to communicate, with Costa Rica in order to take steps towards peacefully resolving the present dispute;

- A failure to cooperate, and even to communicate, with Costa Rica in order to undertake anti-drug trafficking and anti-crime measures in the border area.

CHAPTER IV: NICARAGUA'S BREACHES OF COSTA RICA'S TERRITORIAL SOVEREIGNTY

A. Introduction

4.1. The present chapter will show that Nicaragua has openly occupied Isla Portillos, recognised as belonging to Costa Rica in particular by the Alexander Award of 30 September 1897 and never before claimed by Nicaragua. Nicaragua has fabricated an entirely artificial territorial dispute in order to justify its occupation of territory that is uncontestably Costa Rican. Nicaragua's conduct flies in the face of fundamental principles of international law as well as bilateral instruments that constitute the foundations of the Costa Rican-Nicaragua relations, notably the Treaty of Limits, the Cleveland Award, the Alexander Awards and the Minutes of the Demarcation Commission.

4.2. On particular, this chapter will address:

- The established boundary in the relevant area, as determined by the Treaty of Limits and interpreted and demarcated by the Alexander Awards and the bi-national Commission of Demarcation (**Part B**);
- The consistent application of the boundary delimitation by both sides until the Nicaraguan occupation, and its internationally recognised character (**Part C**);
- The Nicaraguan military incursion and occupation of October 2010 (**Part D**);
- The *ex post facto* Nicaraguan claim of sovereignty and its inconsistencies (**Part E**);

- The open defiance of the Nicaraguan occupation and its attempt to modify the border to the principle of stability and finality of boundaries (**Part F**); and
- The consequent disregard of Costa Rican territorial integrity through Nicaragua's unlawful conduct (**Part G**).

B. The Treaty of Limits as interpreted by the Alexander Awards and the Demarcation Commission clearly established Isla Portillos as Costa Rican

4.3. As the Court is aware,[285] the Treaty of Limits delimited the boundary between Costa Rica and Nicaragua. Article II of the Treaty of Limits unambiguously provides that the boundary is located "at the mouth of the San Juan River" and that "the right bank of this river constitutes the boundary" until the point situated at three English miles from Castillo Viejo,[286] a point where the boundary turns inland on both sides.

4.4. Article II must be read in the context of the other relevant provisions of the same Treaty. In addition to determining that the waters of the San Juan are Nicaraguan, the Treaty of Limits established that

- Costa Rica has a perpetual right of free navigation on the San Juan, for the purposes of commerce, from the mouth of the river at the Caribbean Sea to a point located three English miles from Castillo Viejo;[287]

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285 *Navigational and Related Rights (Costa Rica v. Nicaragua)*, judgment of 13 July 2009, para. 19.

286 **Vol. II, Annex N° 1**, Treaty of Limits between Costa Rica and Nicaragua, (Cañas-Jerez) San Jose, 15 April 1858, Article II.

287 Ibid., Article VI

- The Bay of San Juan del Norte (as well as the Salinas Bay) is common to both Republics, and both have the obligation to contribute to its defense;[288]
- "Under no circumstances the Parties shall be allowed to commit any act of hostility against the other in the San Juan, even in the case of war";[289]
- Until Nicaragua recovered the entire possession of the Port of San Juan del Norte (which occurred on 30 January 1860) Punta Castilla was used and possessed by Nicaragua and Costa Rica in common, and for as long as this lasted, the whole course of the Colorado River marked the limit; while the port of San Juan del Norte "shall remain a free port", Costa Rica could not charge Nicaragua custom duties at the port of Punta Castilla.[290]

4.5. As the Court is also aware,[291] Nicaragua declared the Treaty of Limits "null and void", a claim that was rejected in the Cleveland Award. The Cleveland Award also dealt with some points contested by Nicaragua and expressly confirmed the determination of the boundary established by the Treaty of Limits. The following two paragraphs of the Cleveland Award are relevant in this regard:

> "5. The boundary line between the Republics of Costa Rica and Nicaragua, on the Atlantic side, begins at the extremity of Punta de Castilla at the mouth of the San Juan de Nicaragua River, as they both existed on the 15th day of April 1858."

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288 Ibid., Article IV.

289 Ibid., Article IX.

290 Ibid., Article V.

291 *Navigational and Related Rights (Costa Rica v. Nicaragua)*, judgment of 13 July 2009, para. 20.

> "7. The branch of the River San Juan known as the Colorado River must not be considered as the boundary between the Republics of Costa Rica and Nicaragua in any part of its course."[292]

4.6. As noted in Chapter II of this Memorial, following the Cleveland Award, and in accordance with the Treaty of Limits,[293] a bi-national Demarcation Commission was constituted by the 1896 Pacheco-Matus Convention.[294] It was further agreed to request the President of the United States of America to appoint an engineer in the role of umpire to decide any dispute that should arise between the parties. Article 2 of the 1896 Convention reads: "The engineer shall have ample authority to decide any kind of dispute that may arise, and his decision shall be final as to the operations in question".[295] The President appointed General Edward Porter Alexander.

4.7. Between 1897 and 1900, the Commissioners of both countries acting together with General Alexander accomplished the task of demarcating the boundary in its entirety. General Alexander rendered five awards.[296] The complete proceedings of the Demarcation Commission, including the five

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292 **Vol. II, Annex N° 7**, Award of the Arbitrator, the President of the United States, upon the validity of the Treaty of Limits of 1858 between Nicaragua and Costa Rica, Washington D.C., 22 March 1888.

293 **Vol. II, Annex N° 1**, Treaty of Limits between Costa Rica and Nicaragua, (Cañas-Jerez) San Jose, 15 April 1858, Article III.

294 **Vol. II, Annex N° 8**, Costa Rica-Nicaragua Delimitation Convention (Pacheco-Matus), San Salvador, 27 March 1896.

295 Ibid., Article 2.

296 **Vol. II, Annex N° 9**, First Award of the Umpire EP Alexander in the boundary question between Costa Rica and Nicaragua. The First Alexander Award was first published in John Basset Moore, *History and Digest of the International Arbitration to Which the United States has been a Party* (Washington DC: Government Printing Office, 1898), vol. V, p. 5074. The five Alexander Awards are reprinted in H. LaFontaine, *Pasicrisie Internationale 1794-1900: Histoire Documentaire des Arbitrages Internationaux* (1902, repr. 1997, Martinus Nijhoff, The Hague) and the first four awards are reproduced in United Nations, *Reports of International Arbitral Awards*, Vol. XXVIII (2007).

Arbitral Awards and 27 Minutes recording the complete work of the Commission and the precise points where the boundary would run, are contained in two volumes. Article 8 of the 1896 Pacheco-Matus Convention provides that:

> "[t]he minutes of the work, which shall be kept in triplicate and which the commissioners shall duly sign and seal constitute, without the necessity of approval or any other formality on the parts of the signatory Republics, the proof of the final demarcation of their boundaries."[297]

4.8. The first Award rendered by Alexander defined the boundary at its starting point in the Caribbean region and examined the territory now claimed by Nicaragua. Before the Arbitrator, Nicaragua claimed Isla Portillos in its entirety, arguing that the boundary ran along the Taura river (see **Figures 2.3**[298] and **2.4**[299]). For its part, Costa Rica advanced a claim that was based on what it considered to be the situation in 1858. The Arbitrator rejected both claims. His first Award states:

> "I have accordingly made personal inspection of this ground, and declare the initial boundary to run as follows, to wit:
>
> Its direction shall be due northeast and southeast, across the bank of sand, from the Caribbean Sea into the waters of Harbor Head Lagoon. It shall pass at its nearest point, 300 feet on the northwest side from the small hut now standing in that vicinity. On reaching the waters of Harbor Head Lagoon, the boundary line shall turn to the left, or southeastward, and shall follow the water's edge around the harbor until it reaches the river proper by the first channel met. Up this channel, and up

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297 Ibid., Article 8.

298 **Vol. V, Annex N° 169**, Map of the Bay of San Juan del Norte showing the starting point of the dividing boundary between Costa Rica [and] Nicaragua, compiled by the respective Commissions on 30 September 1897.

299 **Vol. V, Annex N° 167,** UNRIIA, Vol. XXVIII, p. 221. See also Map reprinted in John Basset Moore, *History and Digest of the International Arbitrations to Which the United States has been a Party*, vol. V, Washington, 1898, Government Printing Office, p. 5074.

> the river proper, the line shall continue to ascend as directed in the treaty."[300]

4.9. The first Alexander Award was then accurately represented in the form of a sketch map. The measurements were precisely recorded. Alexander's hand-drawn sketch map, which forms part of the Minutes (see **Figure 1.1**) depicts the course of the boundary from Punta Castilla, the bank of Laguna Los Portillos, the first channel and the river bank.[301] The map prepared by the Commissioners and also attached to the First Alexander Award also depicts the course of the boundary decided by the Arbitrator in the same way (see **Figure 2.4**) The geographic coordinates and other data were recorded in the Minutes. There is not the slightest doubt that the Award placed the portion of Isla Portillos now claimed by Nicaragua as constituting part of Costa Rican territory. There is no other possible interpretation, in view of the specific coordinates and the visual depiction of the boundary established by the Arbitrator and the Commissioners in an authoritative way, as a part of the decision process itself.

4.10. Indeed, the map attached to the Award and the sketch maps that were interspaced throughout the pages of the Minutes themselves are constitutive elements of a legal title, to use the words of the Court in a well-known passage related to the legal weight of maps, the maps in question amount to "document(s) endorsed by international law with intrinsic legal force for the purpose of establishing territorial rights".[302] In its analysis of the legal value of cartography, the Court made a distinction between maps in

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300 See UNRIAA, Vol. XXVIII, p. 220.

301 **Vol. II, Annex N° 13**, Proceedings of the Costa Rica – Nicaragua Demarcation Commission (1897-1900). Minute N° X of 2 March 1898. Volume I, p. 33.

302 *Frontier Dispute (Burkina Faso/Mali), Judgment, I.C.J. Reports 1986*, p. 582, para. 54. See also: *Kasikili/Sedudu Island (Botswana/Namibia), Judgment, I.C.J. Reports 1999,* p. 1098, para. 84; *Sovereignty over Pulau Ligitan and Pulau Sipadan (Indonesia/Malaysia), Judgment, I.C.J. Reports 2002,* p. 667, para. 88.

general and those having the capacity of constituting a legal title. The Court explained that

> "in some cases maps may acquire such legal force, but where this is so the legal force does not arise solely from their intrinsic merits: it is because such maps fall into the category of physical expressions of the will of the State or States concerned. This is the case, for example, when maps are annexed to an official text of which they form an integral part".[303]

This statement applies to the sketch-map drawn by the Arbitrator to visually depict his first arbitral award, and to the map attached to that award, which was drawn by the Commissioners.

4.11. The second Alexander Award is also relevant to the present case. The Costa Rican commissioners proposed to measure the boundary starting at Punta Castilla and following the path described by the First Alexander Award. They also proposed to produce a map, and requested that all works should be recorded and published in the records of the work of the Demarcation Commission. In contrast, the Nicaraguan commissioners did not consider it appropriate to proceed with measuring the boundary and mapping it "because the left bank of the Harbour and of the river formed the boundary and that therefore the dividing line was subject to change and not permanent".[304] Alexander decided to mark out the boundary with the utmost precision, in line with Costa Rica's position, since "the consequence of any disagreement on the question of whether the measurement is more or less accurate must be that the view of the party favouring greater accuracy should

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303 Ibid.

304 **Vol. II, Annex N° 10**, Second Award of the Umpire Alexander in the boundary question between Costa Rica and Nicaragua, San Juan del Norte, 20 December 1897, reported in United Nations, *Reports of International Arbitral* Awards, Vol. XXVIII (2007), p. 224.

prevail".[305] He held that "the Commissioners shall immediately proceed to measuring the line from the starting point to a point three miles below El Castillo Viejo, as proposed by Costa Rica."[306] The Commissioners proceeded in accordance with what was decided by the Arbitrator. Their measurements were registered in the Minutes of the Commission.[307] These measurements also reaffirm the boundary line as decided in the first Alexander Award, i.e. by placing Isla Portillos in its entirety on the Costa Rican side of the boundary.

4.12. There is no doubt about the location of the first channel met. Its precise location is described in the text and depicted in the map prepared by the Commissioners attached to the first Award, and it is depicted in the sketch-map drawn by Alexander to visually represent his decision. The coordinates were recorded in the Minutes of the Commission. This "first channel met" runs along Laguna Los Portillos (Harbor Head Lagoon) and a thin sand bank opposite it, between the lagoon and the sea.

4.13. The sketch map drawn by Alexander and attached to the minutes of the Demarcation Commission,[308] like several other maps produced at that time,[309] shows the San Juan river branching out into two, right at the northeasternmost tip of Isla Portillos. One of the branches ran left, into the

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305 Ibid.

306 Ibid., pp. 532-533. The original Spanish text reads at page 532: "según el Tratado y el Laudo General E.P. Alexander, el límite divisorio lo forma la margen derecha del Harbour y del río...". The United Nations translation incorrectly reports this as "according to the Award by General E.P. Alexander, the left bank of the Harbor and of the river", whereas it should read "according to the Award by General E.P. Alexander, the right bank of the Harbor and of the river".

307 **Vol. II, Annex N° 13**, Proceedings of the Costa Rica – Nicaragua Demarcation Commission (1897-1900). Minute N° X of 2 March 1898.

308 See paragraph 1.5.

309 See paragraphs 2.49 to 2.52.

Bay of San Juan del Norte (belonging to both Costa Rica and Nicaragua). The other branch turned right, into the Harbor Head Lagoon. It is this branch to which Alexander referred as the "first channel met". This was the situation at the time that the Award was rendered and at the time of the work of the Commission, which ended its functions in 1900. This situation continued uncontested until the occupation of Nicaragua of the relevant area, as the relevant cartography and photography for this period attest.[310] For illustrative purposes, a satellite photograph taken on 2009 is shown on **Figure 4.1** opposite.

Figure 4.1

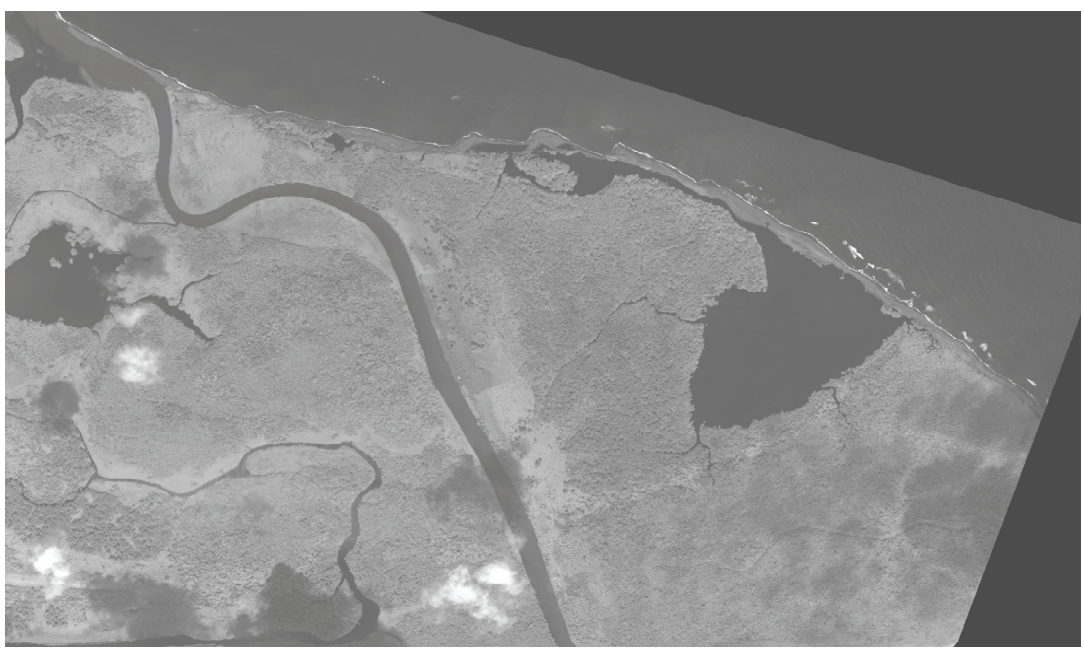

Figure 4.1 : Satellite image of the relevant area 2009

[310] See **Vol. IV, Annex N° 153**, (Fallas, Jorge) "Sketh Map of the 1898 boundary line between Costa Rica and Nicaragua in the San Juan River area and its accordance with the official Cartography of Costa Rica (CRTM05) of 2010" (National University of Costa Rica, School of Environmental Science, Ambientico, 5 August 2011).

4.14. The boundary established by the Treaty of Limits was determined by the Arbitrator in a precise and detailed manner, and it has binding effect. In line with the Treaty of Limits, the Arbitral Award traced the fluvial boundary from the starting point of Punta Castilla, along the right river bank from the mouth of the San Juan, until it reaches the geographic point situated three English miles from Castillo Viejo. According to this boundary line, the waters of the San Juan and the land on the left-hand side of the San Juan are Nicaraguan, and all territory lying to the right of the San Juan, including its bank, is Costa Rican.

4.15. The first channel mentioned by Alexander was located *at the mouth* of the river. As will be seen below, the new Nicaraguan claim defies not only the Alexander Award, but also the basic rationale underpinning the delimitation process governed by the Treaty of Limits. Indeed, according to Nicaragua "[t]he dispute is about whether Nicaragua's sovereign territory embraces the area between the *caño* she recently cleaned and the River San Juan near its mouth".[311] However, "*near the mouth* of the San Juan" (emphasis added) is not the wording of the Treaty of Limits, nor the Alexander Awards. On the contrary, the Treaty explicitly designates the boundary "*at the mouth* of the San Juan" and recognises a perpetual right of free navigation to Costa Rica "*between the said mouth* and the point, three English miles distant from Castillo Viejo" (emphasis added). It is apparent that Nicaragua's current claim, based on the artificial *caño* it constructed in late 2010, does not place the boundary at the mouth of the San Juan.

4.16. Furthermore, if one follows this new Nicaraguan claim, the outcome would be alleged Nicaraguan sovereignty over both banks of the San Juan in

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311 CR 2011/4, p. 8, para. 2 (McCaffrey).

the Eastern part of the river where it flows into the Caribbean Sea. This outcome is clearly in contradiction with the Treaty of Limits, which only envisaged Nicaraguan sovereignty over both banks of the river in the Western part of the river from the point located three English miles from Castillo Viejo to the Lake of Nicaragua. It would also be in contradiction with other provisions contained in the Treaty of Limits:

- First, that Costa Rica has a perpetual right of free navigation on the San Juan from the point 3 English miles from Castillo Viejo until the Caribbean Sea. If one follows Nicaragua's line of argument, the section of the San Juan between the artificial *caño* and the Caribbean Sea would no longer be the boundary and Costa Rica's right of free navigation would also be "deviated" through the *caño*.[312]

- Second, the San Juan del Norte Bay is common to both States. If Nicaragua's argument were followed, it would mean that Costa Rica would not have a direct water access to the common bay, a possibility that would be at odds not only with the letter and spirit of the Treaty of Limits, but also with the very notion of commonality.

4.17. To sum up, the first Alexander Award established with binding effect the precise line of the boundary in the relevant area. According to this Award the territory of Isla Portillos now claimed by Nicaragua indisputably falls within Costa Rican sovereignty.

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[312] According to Nicaragua, Costa Rica "owns the right bank of the *caño* and enjoys navigation rights in it" (CR 2011/4, p. 21, para. 18 (Reichler).

C. The consistent application of the boundary delimitation by both sides prior to 2010, and its internationally recognised character

4.18. The boundary between Costa Rica and Nicaragua, as determined by the Alexander Awards and the Demarcation Commission, establishing Costa Rican sovereignty over Isla Portillos, has been acknowledged and – until late 2010 – consistently respected by both States, and is internationally recognised. This respect of the boundary line is striking given that throughout the twentieth century there have been difficulties in the bilateral relations between the two States, leading to the adjudication of disputes before international courts, including the Court. This constant recognition of the boundary was ruptured in October 2010, when Nicaragua occupied the northern part of Isla Portillos, constructed an artificial *caño* across it, and claimed that a different boundary exists in the area.

4.19. Until this present dispute arose, the conduct of the parties showed a common and constant understanding of the decision made by General Alexander. Moreover, Costa Rica has asserted its sovereignty over Isla Portillos in different ways and Nicaragua has never claimed its sovereignty over Isla Portillos. On the contrary, Nicaragua constantly and unambiguously recognised in different ways Costa Rican sovereignty over the area it now claims. In particular, this Part will address:

(1) The consistent recognition of Costa Rican sovereignty by the official cartography of both countries.

(2) The exercise of Costa Rican sovereignty.

(3) The new Nicaraguan argument that it exercised sovereignty over the area now claimed.

(4) The internationally recognised character of the boundary now challenged by Nicaragua.

These points will be addressed in turn.

(1) The official cartography of both States has constantly shown Isla Portillos as Costa Rican

4.20. For more than a century the official cartography of both States has clearly shown the boundary as decided by Alexander and demarcated by the bi-national Commission. In other words, the northern part of Isla Portillos has always been depicted by the official cartography of both States as being Costa Rican. Additionally, this official cartography of both States has never depicted a channel in the location of the artificial *caño* constructed by Nicaragua.

4.21. Vol. V of the Annexes contains abundant examples of the official cartography of both countries since 1898 and until just before this dispute arose, systematically establishing the boundary in plain conformity with the Alexander Award. Chapter II of this Memorial includes several of them as Figures. At no time did either party unilaterally or jointly consider that the "first channel" designated by Alexander had disappeared, or that a new channel had appeared and was the new "first channel met" for the purposes of designating the boundary.

4.22. The same conclusion is reached in the expert report of Professor Colin Thorne, which is Appendix 1 to this Memorial.[313] After reviewing all available historical maps, Professor Thorne concludes:

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[313] **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of

> "4. … prior to construction of the 'Caño' in November 2010, no distributary of the Río San Juan had ever drained into the southern tip of the Harbor Head Lagoon since that lagoon was created by division of the Bay of San Juan del Norte into two discrete water bodies sometime between 1825 and 1832.
>
> 5. Other than the eastern distributary draining into the far north-west corner of the Harbor Head Lagoon between 1850 and 1980, the only other channels identified as draining into the Harbor Head Lagoon prior to November 2010 are small wetland watercourses carrying runoff generated by local rainfall. This includes the narrow inlet at the southern tip of the Harbor Head Lagoon, which is a remnant of the former Bay of San Juan del Norte rather than a fluvially-formed channel. This, and the other minor watercourses that now drain to the southern part of the Harbor Head Lagoon, are not and never have been distributaries of the Río San Juan."[314]

4.23. Nicaragua has tried to reason around its own cartographical evidence, which goes against its late territorial claim for the reasons set out above, by arguing that its official cartography includes statements that the maps in question were not "verified on the ground".[315] These statements do not affect the legal weight to be attributed to the official cartography of Nicaragua for the following four reasons:

- The inclusion of statements to the effect that maps have not been "verified on the ground" does not constitute a disclaimer. Usually, when States or international organizations reserve their position on their official maps with respect to the depiction of boundaries thereon, they use formulas expressly referring to those boundaries, e.g. that the map is not authoritative on matters of boundaries. For instance, the United Nations cartography contains the following

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the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, pp. I-2—I-33.

[314] Ibid., p. I-33.

[315] CR 2011/2 p.11 para. 20 (Argüello Gómez), Answer of Nicaragua to Judge Greenwood's question, 18 January 2011.

disclaimer: "The boundaries and names shown and the designations used on this map do not imply official endorsement of acceptance by the United Nations".[316] The Court also has had occasion to examine a typical disclaimer in official maps produced by a State in which it was stated that "the map must not be considered an authority on the delimitation of international or other boundaries"[317]. There is no similar reservation relating to the boundaries depicted on Nicaraguan maps.

- Indeed, the reference included in *some* Nicaraguan maps makes it clear that the reason they were not "verified on the ground" is because these maps were drafted on the basis of aerial photographs. This method of producing maps can lead to errors in toponymy, but not errors in the geographical depiction of territory. The physical features portrayed on maps, such as rivers, coastlines and so forth, are clearly visible from aerial photographs and they do not require on-site verification. This is the case of the Nicaraguan maps. Indeed, the Nicaraguan official map of the area at the smallest scale of 1:50,000 perfectly corresponds with satellite photographs, as well as with Costa Rica's maps (see **Figures 2.8** and **2.9** in Chapter II). The boundary line in the area is not a geometrical line; it follows the right bank of the San Juan, the "first channel met" and right bank of Laguna Los Portillos. As the Court recalled, the Boundary Commission in the *Eritrea/Ethiopia* case, rejecting the argument of the existence of a disclaimer in maps, said:

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316 See any map included in the United Nations Cartographic Section at: http://www.un.org/Depts/Cartographic/english/htmain.htm.

317 *Sovereignty over Pedra Branca/Pulau Batu Puteh, Middle Rocks and South Ledge (Malaysia/Singapore), ICJ Reports 2008*, p. 95, para 271.

> "The map still stands as a statement of geographical fact, especially when the State adversely affected has itself produced and disseminated it, even against its own interest."[318]

This is precisely what happens with the Nicaraguan maps. With the addition that Nicaragua's official cartography has precisely chosen to put the boundary following the exact depiction of Laguna Los Portillos, the first channel and the San Juan riverbank.

- The 2011 Nicaraguan official map showing the new "boundary" now claimed to follow the so-called "Caño del Puerto" also contains the same wording: "the map has not been verified on the ground".[319] For this reason alone, the argument developed by Nicaragua in order to justify its longstanding recognition of the true boundary fails.

- Not all Nicaraguan maps contain a statement to the effect that they were "not verified on the ground". A telling example is the 2003 official map of the San Juan River Department, the Department under whose jurisdiction the claimed territory should form part if Nicaragua's argument would be followed (see **Figure 4.2**). As a matter of course, it shows the territory now claimed by Nicaragua as being Costa Rican. It contains the following sentence: "The limits were verified by the General Directorate of Territorial Management INETER", the institution in charge of official Nicaraguan cartography.[320]

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[318] Decision regarding Delimitation of the Border between the State of Eritrea and the Federal Democratic Republic of Ethiopia, 13 April 2002, p. 28, para. 3.28.

[319] See paragraph 2.53.

[320] **Vol. V, Annex N° 193**, Departamento de Río San Juan, División político-administrativa (Department of Rio San Juan Political-Administrative Division) Nicaragua, Instituto Nicaragüense de Estudios Territoriales (INETER), April 2003.

Figure 4.2

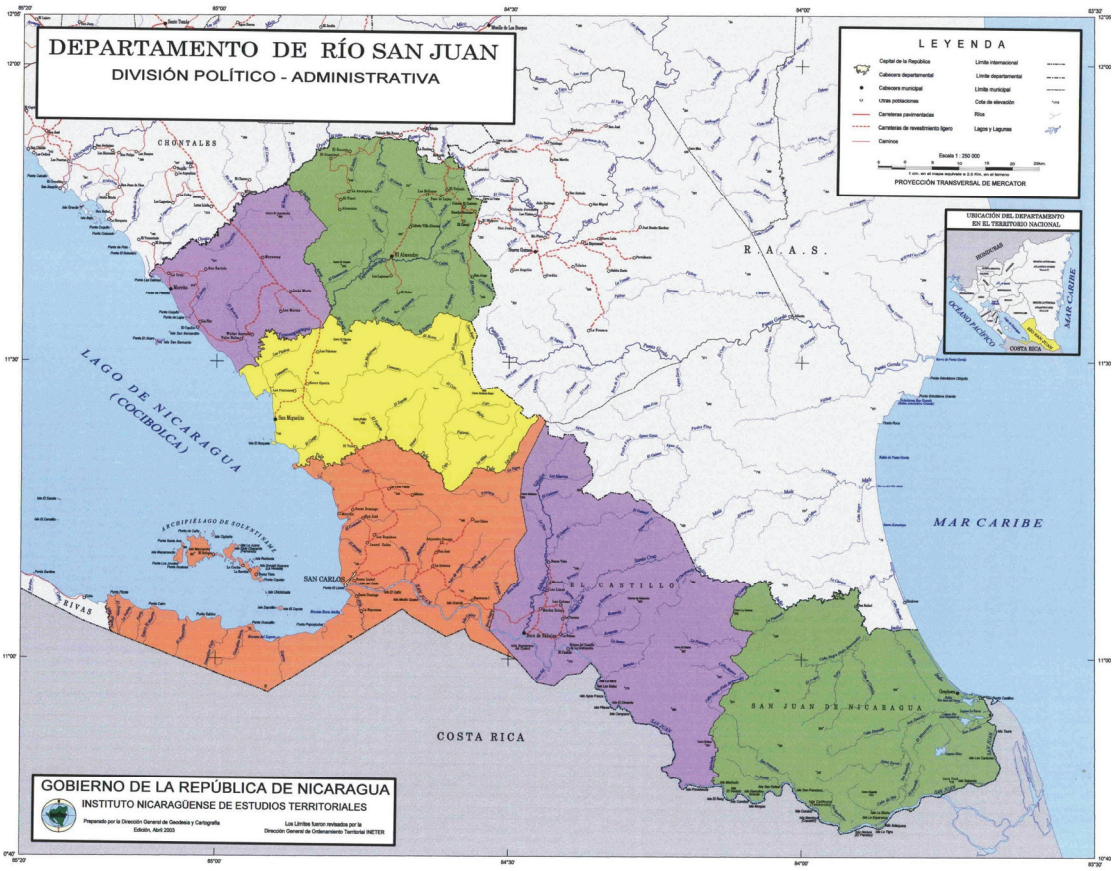

Figure 4.2: Map of the San Juan River Department 2003

4.24. The map produced by Nicaragua on the last day of the oral hearings on provisional measures,[321] and officially released in Nicaragua in or about on 1 February 2011[322] (see **Figure 2.10**), cannot erase the previous and constant acceptance for over a century of the existing boundary. It is a self-

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321 **Vol. III, Annex N° 214,** Judges' Folder, 13 January 2011, Tab 3, CAG 2.

322 **Vol. III, Annex N° 120**, El Nuevo Diario, "New Territorial Map including Harbour Head", 2 February 2011.

serving map produced after the institution of these proceedings and it has been duly protested by Costa Rica.[323]

4.25. Nicaragua has produced in the brief period of two months contradictory versions of the purported new boundary that supposedly follows a pre-existing channel at the location of Nicaragua's artificial *caño*. In its "White Book" of 26 November 2010, Nicaragua attempted to articulate legal reasons in support of its unlawful conduct with respect to the artificial *caño* for the first time.[324] However, Nicaragua's White Book is inherently inconsistent in itself; it presents two different depictions of where the purported "caño" runs. Neither of these coincides with the new "official map" scale 1:50,000 produced by Nicaragua in late January 2011. Indeed, the Nicaraguan White Book contains a map depicting what Nicaraguan calls "the Costa Rican claim" over the northern part of Isla Portillos[325] (see **Figure 4.3**). It also contains a purported location of where the "caño" runs according to the description in Alexander's First Award[326] (see **Figure 4.4**). However, these maps and representations do not correspond to one another, nor to the new boundary line claimed by Nicaragua during the hearings on provisional measures less than two months later; a boundary line that purportedly follows the course of the artificial *caño* Nicaragua was constructing at the time the map in the White Book was produced. Nicaragua has also inconsistently ascribed different names to its artificial *caño*. In the

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323 **Vol. III, Annex N° 71**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, 2 February 2011, DM-059-11.

324 See Answer of Nicaragua to the question raised by Judge Simma, 18 January 2011.

325 **Vol. II, Annex N° 30**, Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010), pp. 15-17.

326 Ibid., pp. 4 and 60.

White Book the artificial *caño* is called "Caño Harbor Head".[327] On the new map Nicaragua produced some two months later, it is called "Caño del Puerto".[328]

Figure 4.3

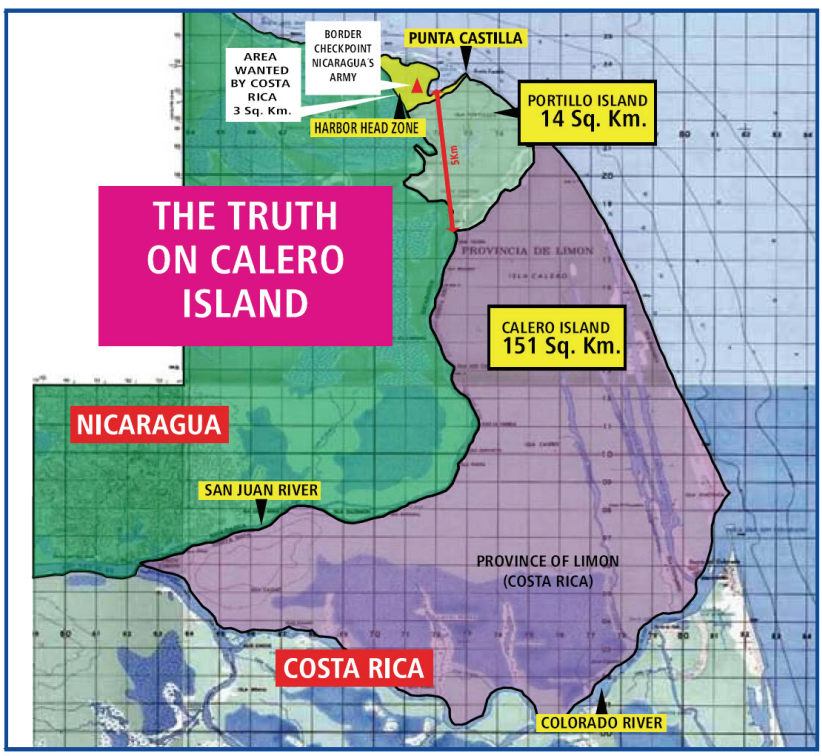

Figure 4.3: Map of the "Costa Rican claim" according to Nicaragua's White Book.

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327 Ibid., pp. 4 and 60.

328 **Vol. V, Annex N° 196**, Nicaraguan map of Punta de Castilla at 1:50.000 produced in January 2011.

Figure 4.4



Figure 4.4: Purported location of where the "caño" runs, according to Nicaragua's White Book.

This alone attests to the lack of seriousness and artificiality of the Nicaraguan claim.

4.26. Further cartographic evidence was presented before this Court by the parties in the *Navigational and related rights (Costa Rica v. Nicaragua)* case. The maps presented by both parties showing the relevant area are consistent: all portray the boundary in its correct position, with Isla Portillos depicted as Costa Rican. See the following maps produced by Nicaragua in its pleadings:

- *Nicaragua Sovereignty over the Whole Course of the San Juan*

de Nicaragua River (See enlargement, **Figure 4.5**);[329]

- *The Sarapiqui Route Envisioned before 1858*;[330]
- *Costa Rican Tourism Route from 1990s to the Present*;[331]
- *The Indio Maíz Biological Reserve (Dark Green) and the San Juan River Wildlife Refuge (Yellow)*;[332]
- *Alleged Locations where Costa Rican Public Vessels Navigated*.[333]

Figure 4.5

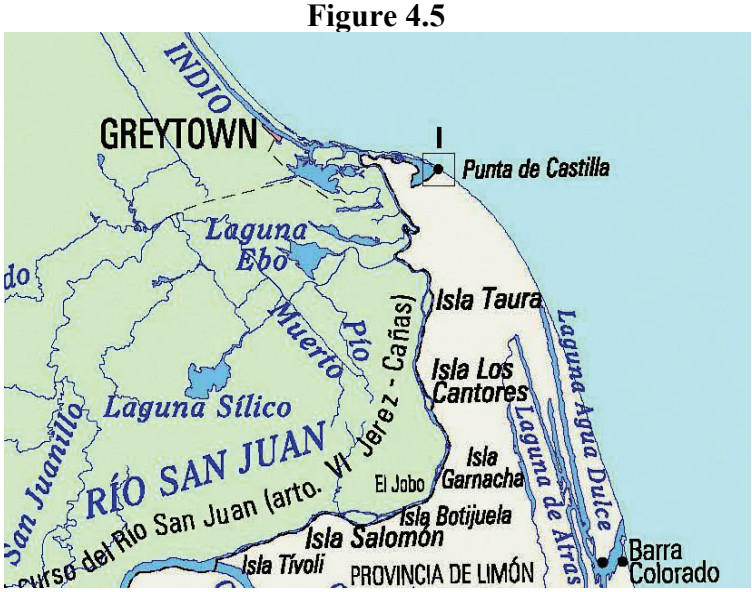

Figure 4.5: Sketch Map submitted by Nicaragua, enlargement of the relevant area: *Nicaragua's Sovereignty over the Whole Course of the San Juan de Nicaragua River*. NCM Sketch map 1, Case over Navigational and Related Rights.

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329 **Vol. V, Annex N° 197**, Sketch-map N° 1 NCM, p. 265.

330 **Vol. V, Annex N° 200**, Sketch-map N° 1 NR, p. 116.

331 **Vol. V, Annex N° 201**, Sketch-map N° 3 NR, p. 175.

332 **Vol. V, Annex N° 202**, Sketch-map N° 4 NR, p. 181.

333 **Vol. V, Annex N° 203**, Sketch-map N° 8 NR, p. 256.

4.27. Nicaragua referred to a reservation formulated in a footnote of its Counter-Memorial in the *Navigational and Related Rights* case.[334] It concerned Sketch-Map N° 5 of Costa Rica's Memorial in that case. Indeed, this sketch-map, although rightly depicting the boundary in the relevant area, nevertheless colours the bar of sand corresponding to the northern bank of the first channel also extending above Laguna Los Portillos in the same colour as the colour used for Costa Rican territory (see **Figure 4.6**).

Figure 4.6

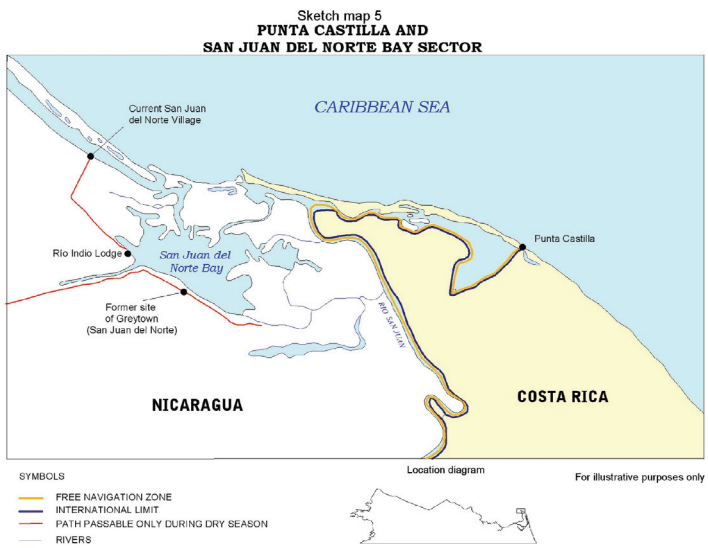

Figure 4.6: CRM Sketch map 5, case concerning Navigational and Related Rights

4.28. It is understandable that the reservation referred to this colouring of the sandbar, and not Nicaragua's later claim over the northern part of Isla Portillos that it has raised in the present proceedings. The fact that Nicaragua in the *Navigational and Related Rights* case produced its own maps which

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334 NCM, vol. I, p. 9, footnote 14. *(Dispute concerning Navigational and Related Rights (Costa Rica v. Nicaragua)*

depicted the boundary in accordance with the First Alexander Award of 1897 further confirms that the Nicaraguan reservation made with respect to Sketch-Map N° 5 of the CRM in no way was related to its new claim.

4.29. On the last day of the oral hearings on provisional measures, Nicaragua produced four maps and two photographs which allegedly support its territorial claim.[335] In its reply to Judge Simma's question, Nicaragua produced additional maps. Not one of these maps lends the slightest weight in support of Nicaragua's claim. For over more than a century, the respondent has only managed to produce nine general maps of Nicaragua to allegedly support its claim. Not one of these maps is specific to the area concerned. Most of them are unofficial maps. All of them are characterised by their large scale and hence their poor accuracy of the geographic configuration of rivers and coasts. Four of them (the publication date of one is unknown; the others were published in the 1920s) depict the boundary at the Taura River, rather than any supposedly existing *caño* north of it.[336] As is well known, the Taura River was the boundary claimed by Nicaragua before Alexander, and his arbitral award rejected this claim. These maps also show other inaccuracies, for example the area below and bordering the Lake of Nicaragua is depicted as belonging to Costa Rica even though according to the work of the Demarcation Commission and Alexander they belong to Nicaragua.

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[335] See CR 2011/4, 13 January 2011, pp. 8-9, para. 3 (McCaffrey).

[336] **Vol. V, Annex N°s 204, 205, 206 and 207**: Reply of the Republic of Nicaragua to the questions put by Judges Simma, Bennouna and Greenwood, 18 January 2011, Maps Nos. 4 (191?), 5 (1923), 8 (1920), 9 (1924).

4.30. The third map submitted by Nicaragua on the last day of the oral hearings is a 1971 provisional map of Costa Rica at a scale of 1:500,000.[337] It contains a material error. As explained by the acting Director of the National Geographic Institute,[338] the error occurred during the printing process outside of Costa Rica. In no way it follows any purported *caño*. Moreover, as explained in the same note, more detailed cartography takes precedence over less detailed maps: the 1970 map, scale 1:50,000,[339] prevails over the 1:500,000 map of 1971. It is essential to recall that, as shown in Chapter II, the relevant maps for the area of San Juan del Norte/Punta Castilla produced and used by both States and third parties until late 2010, clearly depict the boundary following the true "first channel met" as designated by Alexander, and they do not show the artificial *caño* constructed by Nicaragua.

4.31. The fourth map produced by Nicaragua on the last day of the oral hearings is the "US Engineer Office Nicaragua Canal Survey 1929-1931 General Map".[340] It is not an official map of either Nicaragua or Costa Rica. Rather, it is "general" and it purports to show the "*Ruta del Canal*", i.e. a new plan to construct an inter-oceanic canal. The enlargement accurately depicts the geographic configuration of the area, without any channel in the location of the artificial *caño.* However, the boundary line depicted is clearly

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337 **Vol. V, Annex N° 198,** "Costa Rica", Mapa Físico-político, escala 1:500.000, Edición Provisional, 1971.

338 **Vol. III, Annex N° 68,** Note by Ms Marta E. Aguilar, Acting Director, National Geographic Institute, 18 January 2010 (sic), Republic of Costa Rica, Comments on the Reply of Nicaragua, 20 January 2011.

339 **Vol. III, Annex N° 179**, Costa Rica**,** Instituto Geográfico Nacional, *Punta Castilla*, scale 1:50.000, 1970.

340 **Vol. V, Annex N° 213**, Republic of Nicaragua, Judges' Folder, 13 January 2011, Tab 1, MsCaA and McCa B. Also reproduced in the Reply of the Republic of Nicaragua to the questions put by Judges Simma, Bennouna and Greenwood, 18 January 2011, Map N° 6.

incorrect because it does not follow any geographic feature, and it even cuts Laguna Los Portillos into two, thereby attributing the southern half of it to Costa Rica. This is not the only inaccuracy: the boundary above Lake Nicaragua does not follow the boundary demarcated by the Demarcation Commission and designated by General Alexander. It is an extremely inaccurate map and highly unreliable evidence.

4.32. Moreover, Nicaragua has accepted that the maps and geographical material depicting the border as agreed since 1897 are accurate. As a matter of fact, the outcome of the first meeting of the Sub-commission on Limits and Cartography to negotiate a maritime delimitation agreement between both countries, held in November 2002, included among its relevant a number of maps and cartographical aids,[341] all of which depicted the border as stipulated by Alexander. It is striking that among all official maps, the official cartography of Costa Rica and Nicaragua was included, particularly the 1:50.000 cartography charts. In addition, all other relevant charts, prepared by the Defense Mapping Agency of the United States of America, were also officially included. Specifically on the area in question, the following maps and charts were included:

- *Chart 28110. Central America – East Coast. NICARAGUA COSTA RICA, Laguna Perlas to río Colorado. Mercator Projection, World Geodetic System (WGS), 1:175 000. Prepared and Published by National Imagery and Mapping Agency of the United States Government, Second Edition, 2001.*
- *Chart LORAN C. 28006. Caribbean Sea. Southwest Part. Mercator Projection, World Geodetic System (WGS),*

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[341] **Vol. III, Annex, N° 100,** Minutes of the Sub-Commission on Limits and Cartography First Meeting, 7 November 2002, point I.1, p.p. 2-3.

1:200 000. Prepared and Published by Defense Mapping Agency, Hydrographic/Topographic Center, second edition, 2001.

- *Topographic sheets scale 1:250 000 of the Americas Series, for the Caribbean Sea.*
- *Nautical Chart Cabo Gracias a Dios to Puerto Colombia No. 26,000.*
- *INETER (Nicaragua) Topographic sheets scale 1:50 000.*
- *Instituto Geográfico Nacional (Costa Rica), Punta Castilla sheet, 1: 50 000.*

4.33. The simple fact is that all these maps and charts depict the entirety of Isla Portillos as Costa Rican territory. It is noted with respect to the first of the above listed maps and charts, Chart 28110, that the US Department of State took care to include a note centered under the chart stating that "The international boundary between Costa Rica and Nicaragua follows the right bank of the Río San Juan, in accordance with the Cañas-Jerez Treaty of 1858."

4.34. Four remaining maps produced by Nicaragua in its answer to Judge Simma are also large-scale maps and they simply do not correspond to the geography of the area. It is not even clear whether they depict Laguna Los Portillos at all, even less any *caño* that could constitute the alleged "first channel" linking the Lagoon with the San Juan. The boundary on these maps seems to follow the San Juan until its mouth, without depicting any part of the strip of land over Laguna Los Portillos as being Nicaraguan.[342]

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[342] **Vol. V Annex N°s 208**, **209**, **210**, **211**, and **212**, Republic of Nicaragua, Judges' Folder, 13 January 2011, Tab 1, MsCaA and McCa B. Also reproduced in the Reply of the

4.35. Finally, the two photographs produced by Nicaragua in court on 13 January 2011 in no way depict any *caño* as invoked by the respondent.[343] Nor does the sketch-map of the Costa Rican Public Registry, related to a Use Permit request in the area claimed by Nicaragua.[344] In all these graphic representations of the area, Nicaragua was obliged to chart the course of the alleged *caño* by superimposing a new bold line drawn in a bright colour onto the maps to identify where the *caño* is supposedly located for the Court. A comparison below of the photographs and the sketch-map of the Land Registry with those produced by Nicaragua is enough to reveal that they do not demonstrate the existence of a natural channel at the location of the subsequently constructed *caño* by Nicaragua. (See **Figures 4.7**, **4.8** and **4.9**)

4.36. The cartographic evidence submitted by Nicaragua does not cast any doubt on the constant understanding of the location of the boundary and the situation on the ground by both parties. Rather, the fact that Nicaragua needs to rely on this kind of cartography and a wildly imaginative reading of two photographs only confirms the intrinsic artificiality of the Nicaraguan claim. Finally, it can be asked: why, if the alleged *caño* was "visible" through satellite photographs taken from 1997 to 2007, did Nicaragua continue to depict the boundary in its correct position – and not along the *caño* – in its maps, including those submitted to the Court in the *Navigational and Related Rights* case? The answer is simple: there was no channel prior to the construction of an artificial *caño* by Nicaragua in late 2010.

Republic of Nicaragua to the questions put by Judges Simma, Bennouna and Greenwood, 18 January 2011, Maps N° 7, 10, 11, 12 and 13.

343 **Vol. V Annex N° 237**, Republic of Nicaragua, Judges' Folder, 13 January 2011, Tab 1, McC4 and McC5.

344 **Vol. V Annex N° 215**, Republic of Nicaragua, Judges' Folder, 13 January 2011, Tab 1, McC11.

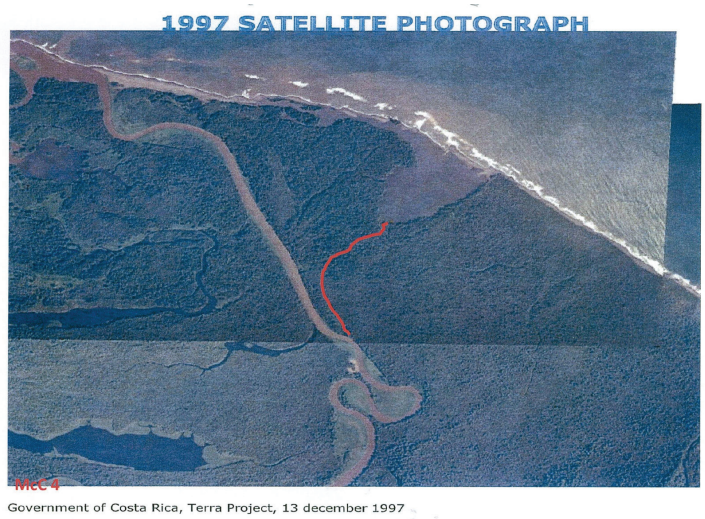
4.37. The cartographic material mentioned above constitutes sound evidence of the way that the parties commonly interpreted not only the First Alexander Award but also the evolution of the situation on the ground from the rendering of the Award until the end of 2010 when Nicaragua decided to challenge the existing boundary. To borrow the words of the Court in another case, the official, constant and coherent Nicaraguan official maps for over a century "tend to confirm that [Nicaragua] considered that [the northern part of Isla Portillos] fell under the sovereignty of [Costa Rica]".[345]

[345] *Sovereignty over Pedra Branca/Pulau Batu Puteh, Middle Rocks and South Ledge (Malaysia/Singapure)*, ICJ Reports 2008, p.95, para. 272.

Figure 4.7: 1997 Satellite photograph

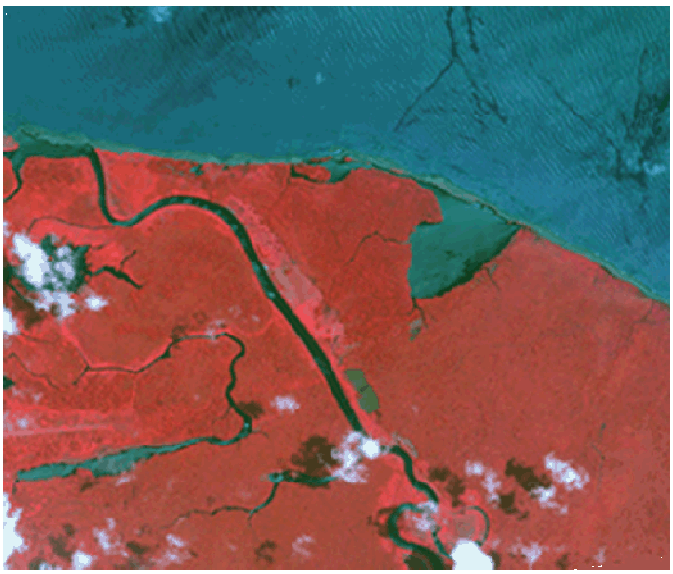


Original version



Nicaragua's version

Figure 4.8: 2007 Satellite photograph

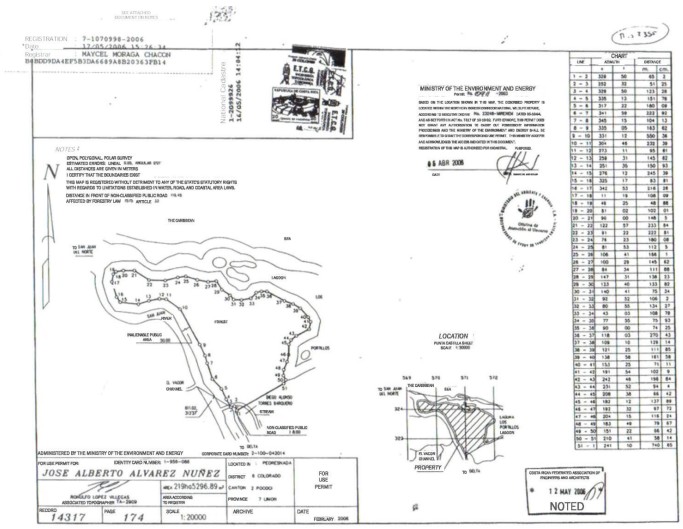
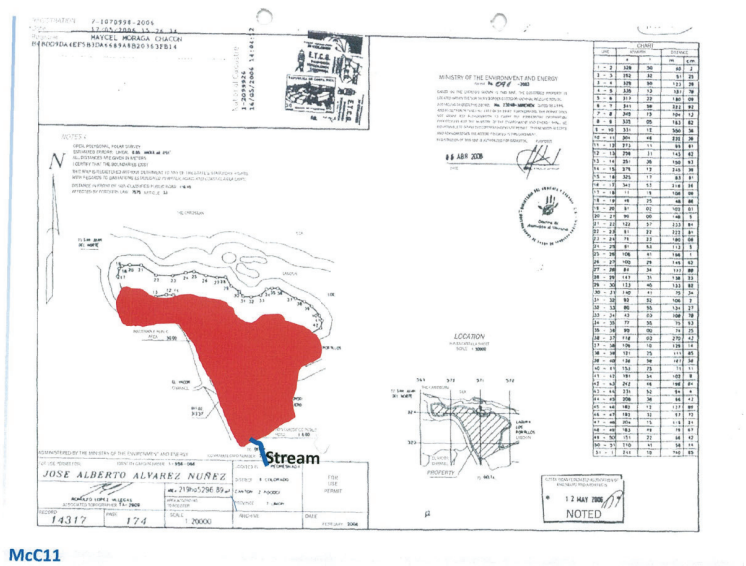


Original Version



Nicaragua's version

Figure 4.9: Permit of use

	Original translated version
	Nicaragua's version

(2) The border at the Isla Portillos region had never been challenged by Nicaragua

4.38. In its attempt to justify its unlawful occupation of Costa Rican territory, Nicaragua attempted to create the impression that there might have been doubts as to where the border in the region of Punta Castilla runs, and that this had been discussed by both countries. For example, during the course of the Hearings on Provisional Measures, Nicaragua referred to Point 3 of the minutes of a bi-national meeting that took place in October 2006.[346] This same argument was presented in Nicaragua's responses to some of the questions posed by the Court during the final day of the Hearings. In its response to Judge Simma's first question, Nicaragua argued that:

> "Before the hearings and for many years Costa Rica was aware that the border had not been settled and that Nicaragua was interested in doing so. This subject was addressed at the meetings of the Bilateral Commission dating back to 1994 and the last meeting in which this subject was raised was in October 2006".[347]

Nicaragua's "White Book" also recurred to this argument, referring expressly to the marker densification process started in 1994.[348] It also referred to the Final Minutes of a Bilateral Meeting signed on 3 October 2008.[349]

4.39. However, as Costa Rica pointed out in its "Comments on the Reply of Nicaragua", at the 1994 bilateral Commission meeting no issue relating to

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[346] CR 2011/2, 11 January 2011, p. 12, para. 21 (Arguello).

[347] Reply of the Republic of Nicaragua to the questions put by Judges Simma, Bennouna and Greenwood at the end of hearing on provisional measures requested by Costa Rica in the case concerning *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)* 18 January 2011, p. 1

[348] **Vol. II, Annex N° 30**, Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010), p. 54.

[349] Ibid., p. 71.

the settling of the land boundaries was addressed, but rather the issue of the land boundary densification process — a totally different matter — which also expressly excluded the portion of the boundary constituted by the right margin of the San Juan River.[350] The actual text of the Joint Communiqué signed by the Presidents of Costa Rica and Nicaragua in Rivas on 29 May 1994 read:

> "The Presidents coincided in the importance for both countries of the landmark densification process throughout the whole common border, from Marker II until Marker XX…"[351]

4.40. Indeed, the process undertaken between 1994 and 2004 was the establishment of additional boundary pillars in between the original ones placed by the Demarcation Commission, and from Marker II to Marker XX. As explained in Chapter II of this Memorial, Marker I was located at Punta Castilla, while Marker II corresponds to the point located "three English Miles before Castillo Viejo", after which the right margin of the San Juan River ceases to be the boundary. The boundary densification process deliberately excluded the 141 km marked by the San Juan River, and certainly the area of Punta Castilla and Isla Portillos. This fact is further evidenced by the Nicaraguan White Book, which includes two charts detailing the 119 additional pillars that were placed between 1994 and 2004, all of which were placed between Markers II and XX. [352] The reason why the

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350 Comments on the Reply of Nicaragua, para. 6

351 Spanish original: "Los Presidentes coincidieron en la importancia que tiene para los dos países la Densificación de Mojones a todo lo largo de la frontera común, desde el hito II hasta el hito XX…" Comunicado Conjunto de los Presidentes de las Repúblicas de Costa Rica, ingeniero José María Figueres Olsen y de Nicaragua, señora Violeta Barrios de Chamorro, con motivo de su encuentro en las poblaciones fronterizas de la Cruz y San Juan del Sur, (San Juan del Sur, Rivas, 29 May 1994). Comments on the Reply of Nicaragua, para. 7.

352 **Vol. II, Annex N° 30**, Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010), p. 71.

whole portion of the boundary constituted by the right margin of the San Juan River lacks markers is quite obvious: as Arbitrator Alexander explained in this Second Award, the boundary is not fixed, but depends on the actual course of the San Juan.

4.41. Finally, the 2006 bilateral Commission meeting did not address issues on the "settling of borders".[353] What was discussed and agreed to at this meeting was to "organize, within the first semester of 2007, a working program to restore and reposition the main border landmarks as well as the reference landmarks installed in conformity with the Cañas-Jérez Treaty of Limits of 1858 and the Alexander Awards."[354] Another agreement was that IGN and INETER would exchange geospatial and thematic data.[355]

4.42. In conclusion, there had never been doubt as to where the boundary between Costa Rica and Nicaragua ran in the area of Isla Portillos.

(3) Costa Rica's exercise of sovereignty over Isla Portillos had never been challenged before the occupation

4.43. Costa Rica has exercised sovereign authority over the area now claimed by Nicaragua in a public and precise way. This evidence is public in character, it relates to both national and international levels, it is specific to

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353 Costa Rica Comments on the Reply of Nicaragua to the questions put by Judges Simma, Bennouna and Greenwood Greenwood at the end of hearing on provisional measures requested by Costa Rica in the case concerning *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, 20 January 2011, Ref: ECRPB 017-11, para. 8

354 Spanish original: "Las Delegaciones acordaron la necesidad de organizar, dentro del primer semestre de 2007 un programa de trabajo de restauración y reposición de los hitos fronterizos fundamentales, así como de los hitos fronterizos de referencia instalados de conformidad con el Tratado de Límites Jeréz-Cañas de 1858 y los Laudos Alexander", Costa Rica Comments on the Reply of Nicaragua to the questions put by Judges Simma, Bennouna and Greenwood Greenwood at the end of hearing on provisional measures requested by Costa Rica in the case concerning *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, 20 January 2011, Ref: ECRPB 017-11, para. 8.

355 Ibid.

the area concerned, and it precedes the critical date. Costa Rica has adopted national legislation that applies specifically to the relevant area, particularly with regard to its environmental protection. In addition to the agreement on the protection of the border area (SI-A-PAZ) concluded between Costa Rica and Nicaragua in 1990 and examined in Chapter V of this Memorial,[356] and the registration of Isla Portillos within the area designated as the *Caribe Noreste* Wetland under the RAMSAR Convention,[357] Costa Rica issued Executive Decree No. 22962,[358] which establishes the Wild Life Refuge Border Corridor in an area of 2 kilometres from the borderline along the entire boundary. Article 1 of the Decree states:

> "Let it be declared a Wild Life Refuge the border corridor made up by the lands comprehensive of an area of 2,000 m (meters) wide along the border with Nicaragua, from Punta Castilla in the Caribbean Sea to the Pacific Ocean, according to what is stipulated in the Cañas-Jerez Treaty of Limits of 15 April 1858."[359]

Naturally, this includes the entirety of Isla Portillos (See **Figure 4.10**). The Costa Rican province of Limón has jurisdiction over the area and within it, the canton of Pococí.

4.44. Costa Rica registered in its cadastre *Permiso de Uso* plans (permits or titles to use) by individuals in the area concerned. The cadastre is a registry with open access to the public. Indeed, it is even possible to consult

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356 See paragraph 5.32.

357 See paragraphs 2.12 and 2.13.

358 **Vol. II, Annex N° 29**, Ministry Environment, Energy and Mines, Decree No. 22962-MIRENEM, San José, 15 February 1994.

359 Ibid., article 1.

it online.[360] The following *Permiso de Uso* plans were registered with respect to the relevant area:

- Costa Rica, Catastro Nacional, Permiso de uso a: José Alberto Alvarez Nuñez, Protocolo T° 14317, F° 174;[361]
- Costa Rica, Catastro Nacional, Permiso de uso a: Diego Alonso Torres Barquero, Protocolo T° 14317, F° 174;[362]
- Costa Rica, Catastro Nacional, Permiso de uso a: David Jonathan Torres Barquero, Protocolo T° 14317, F° 182;[363]
- Costa Rica, Catastro Nacional, Permiso de uso a: Pedro Soto Torres, Protocolo T° 14317, F° 182;[364]
- Costa Rica, Catastro Nacional, Permiso de uso a: Fidel Barquero Arias, Protocolo T° 14317, F° 174;[365]
- Costa Rica, Catastro Nacional, Permiso de uso a: Andrés Espinosa Neira, Protocolo T° 11457, F° 46.[366]

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360 See: http://www.registronacional.go.cr.

361 **Vol. V, Annex N° 216**.

362 **Vol. V, Annex N° 217**.

363 **Vol. V, Annex N° 218**.

364 **Vol. V, Annex N° 219**.

365 **Vol. V, Annex N° 220**.

366 **Vol. V, Annex N° 221**.

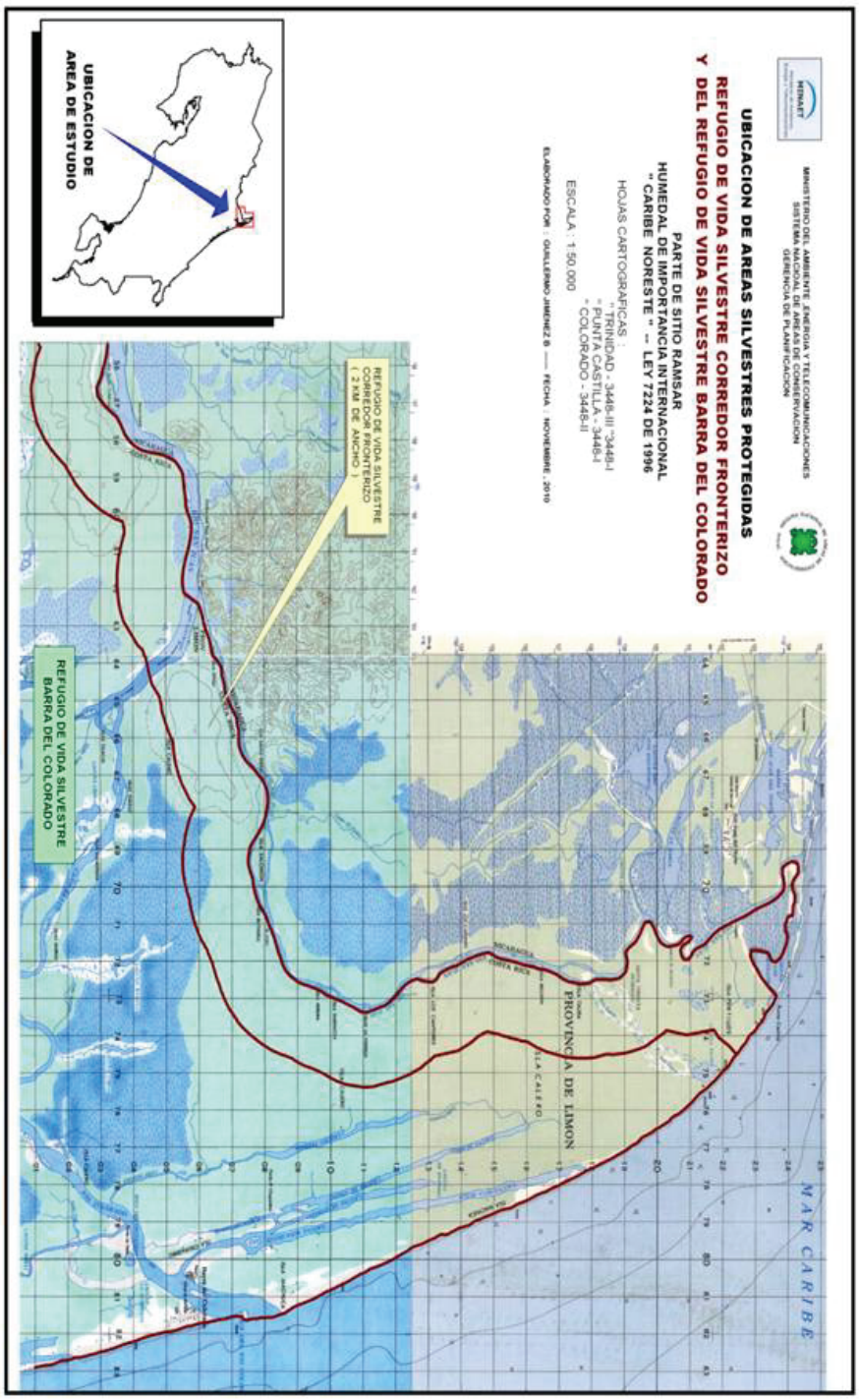
MINAET
MINISTERIO DEL AMBIENTE, ENERGIA Y TELECOMUNICACIONES
SISTEMA NACIONAL DE AREAS DE CONSERVACION
GERENCIA DE PLANIFICACION
UBICACION DE AREAS SILVESTRES PROTEGIDAS
REFUGIO DE VIDA SILVESTRE CORREDOR FRONTERIZO
Y DEL REFUGIO DE VIDA SILVESTRE BARRA DEL COLORADO
PARTE DE SITIO RAMSAR
HUMEDAL DE IMPORTANCIA INTERNACIONAL
" CARIBE NORESTE " -- LEY 7224 DE 1996
HOJAS CARTOGRAFICAS :
" TRINIDAD - 3448-III -3448-I
" PUNTA CASTILLA - 3448-I
" COLORADO - 3448-II
ESCALA : 1:50.000
ELABORADO POR : GUILLERMO JIMENEZ B. ---- FECHA : NOVIEMBRE, 2010
UBICACION DE
AREA DE ESTUDIO
REFUGIO DE VIDA SILVESTRE
CORREDOR FRONTERIZO
(2 KM DE ANCHO)
REFUGIO DE VIDA SILVESTRE
BARRA DEL COLORADO
MAR CARIBE
PROVINCIA DE LIMON

Figure 4.10

4.45. The grant of possession deeds of land is a concrete, direct and clear manifestation of sovereignty.[367] These deeds constitute evidence of a State's understanding of the scope of its territory sovereignty at the moment the deeds are granted, since by definition a State only grants land deeds in what it considers to be its territory. In the *El Salvador/Honduras* case, the Chamber of the Court considered the "republican titles" (land grants made to Indian communities or to individuals after independence) as a way to elucidate the *uti possidetis juris* of 1821 applicable to the case or as *effectivités*.[368]

4.46. Nicaragua has never protested against the grant of these possession deeds by the Costa Rican authorities, even though they are available on file at the public registry. As a matter of course, Nicaragua has never granted any deeds in the relevant area, nor has it ever adopted legislation or any other regulation specific to the area that it now claims as falling under its sovereignty.

4.47. Furthermore, it is recalled that "Finca Aragón" (Aragon Farm) existed at the time of the first Alexander Award. It appears on the sketch-map drawn by the Arbitrator.[369] Nicaragua has never asserted that this farm was on its territory. This is even evidenced by the reproduction in Nicaragua's "White Book" of an article published in the Costa Rican

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[367] See for instance *Minquiers and Ecrehos, Judgment of 17 November 1953, I.C.J. Reports 1953*, p. 65.

[368] *Land, Island and Maritime Frontier Dispute Case (El Salvador/Honduras; Nicaragua: Intervening), judgment, I.C.J. Reports 1992*, p. 395, paras. 55-56. For a concrete example of the application of the Chamber's reasoning, see the case of the title of Dulce Nombre de la Palma, at p. 429-430, para. 112.

[369] See paragraph 1.5.

press,[370] which stated that a family reported to the Costa Rican authorities that Edén Pastora forcefully entered the "Finca Aragón" and took over the farm by force. The Nicaraguan comment to this press article is confined to criticising the Costa Rican government for having given credence to the authors of the complaint, who it alleged are drug traffickers,[371] but it does not say a word about the fact that this event occurred on Nicaraguan territory. If Nicaragua followed its own line of argument, then "Finca Aragón" would – according to Nicaragua – be located on Nicaraguan territory. This would have been an important assertion to raise in its "White Book", rather than questioning the credibility of the complaint.

4.48. Costa Rica has also exercised its sovereignty at the international level. Costa Rica included the relevant area within the *Humedal Caribe Noreste*, which pursuant to Article 2 of the Ramsar Convention,[372] was designated by Costa Rica for inclusion in the List of Wetlands of International Importance maintained by the Ramsar Convention Secretariat. It was this designation that led the Ramsar Convention Secretariat to give full support to Costa Rica's request that a technical team travel to Costa Rica in December of 2010, in order to assess the impact of the Nicaraguan occupation of the northern part of that wetland, where Isla Portillos is located.

4.49. Nicaragua has also registered a wetland of international importance with the Ramsar Convention Secretariat in the immediate vicinity of the

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370 **Vol. III, Annex N° 110**, La Nación, "Family reports Nicaraguan chief invasion", 22 October 2010.

371 **Vol. II, Annex N° 30**, Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010), p. 27.

372 **Vol. II, Annex N° 14**, Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar (Iran), 2 February 1971, as amended by the Paris Protocol of 3 December 1982 and Regina Amendments of 28 May 1987, 996 UNTS 245.

Costa Rican territory, called "Refugio de Vida Silvestre Río San Juan". Significantly, Nicaragua included Laguna Los Portillos in this wetland, but *not the territory it now claims*. Moreover, Nicaragua has never protested against the inclusion by Costa Rica of the northern part of Isla Portillos in its *Humedal Caribe Norte*.

4.50. Some of these elements were before the Court at the provisional measures stage. The Court took them into account in adopting the second provisional measure, ordered on 8 March 2011. As the Court explained:

> "Whereas the disputed territory is moreover situated in the "Humedal Caribe Noreste" wetland, in respect of which Costa Rica bears obligations under the Ramsar Convention; whereas the Court considers that, pending delivery of the Judgment on the merits, Costa Rica must be in a position to avoid irreparable prejudice being caused to the part of that wetland where that territory is situated; whereas for that purpose Costa Rica must be able to dispatch civilian personnel charged with the protection of the environment to the said territory, including the *caño*, but only in so far as it is necessary to ensure that no such prejudice be caused".[373]

4.51. Despite all these assertions of sovereignty by Costa Rica, Nicaragua remained silent in a situation in which it had a duty to react if it really considered that it was the sovereign. "[S]ilence may also speak, but only if the conduct of the other State calls for a response".[374] Case law is constant in this regard. The arbitral award in the *Guatemala/Honduras Borders* case stated: "assertions of authority by Guatemala… show clearly [her]

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[373] *Certain activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, Request for the Indication of Provisional Measures, Order of 8 March 2011, para. 80.

[374] *Sovereignty over Pedra Branca/Pulau Bat Puteh, Middle Rocks and South Ledge (Malaysia/Singapore), Judgment,* ICJ Reports 2008, p. 51 para. 121.

understanding that this was her territory. These assertions invited opposition on the part of Honduras if they were believed to be unwarranted".[375]

4.52. The arbitral award in the *Dubai/Sharjah* case confirms that:

> "… a State must react, although using peaceful means, when it considers that one of its rights is threatened by the action of another State. Such a rule is perfectly logical as lack of action in a situation like this can only mean two things: either the State does not believe that it really possesses the disputed right, or for its own private reasons, it decides not to maintain it".[376]

4.53. The words used by the Court in 1984 with regard to the Nicaraguan Government's silence vis-à-vis the UN official publications considering it as having accepted the jurisdiction of the Court can be transposed here:

> "Having regard to the public and unchanging nature of the official statements concerning Nicaragua's commitment under the Optional-Clause system, the silence of its Government can only be interpreted as an acceptance of the classification thus assigned to it. It cannot be supposed that that Government could have believed that its silence could be tantamount to anything other than acquiescence".[377]

4.54. In sum, the Costa Rican *effectivités* confirm its title derived from the Treaty of Limits as interpreted and applied by the First Alexander Award, and also interpreted in a continuous manner by the official cartography of both countries since then.[378] Nicaraguan lack of reaction contrasts to the

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375 UNRIAA, Vol. II, p. 1327

376 *Dubai/Sharjah Border Arbitration (Dubai/Sharjah)*, I.L.R., 1993, Vol. 91, p. 623.

377 *Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America), Jurisdiction and Admissibility, Judgment, I.C.J. Reports 1984,* p.401, para. 39.

378 *Frontier Dispute, Judgment, I.C.J. Reports 1986,* pp. 586-587, par. 63. See also: *Land, Island and Maritime Frontier Dispute (El Salvador/Honduras: Nicaragua intervening), Judgment, I.C.J. Reports 1992,* p. 398, para. 61; *Land and Maritime Boundary between Cameroon and Nigeria (Cameroon* v. *Nigeria: Equatorial Guinea intervening), Judgment, I.C.J. Reports 2002,* p. 353, para. 68, p. 354, para. 70 and p. 415, para. 223; *Sovereignty over*

prompt Costa Rican reaction when Nicaragua proceeded to occupy the territory in October 2010,[379] in an action that lead to the institution of these proceedings only some weeks after. On the one hand, Costa Rica has responded promptly to the Nicaraguan occupation of its territory, as it is expected a sovereign would react. On the other hand, Nicaragua's silence in light of concrete manifestations of sovereignty by Costa Rica specifically related to the territory it now claims – together with the publication of its own official maps showing the territory as Costa Rican – can only be interpreted as an absence of sovereignty on its part and an admission of Costa Rican sovereignty.

(4) The new Nicaraguan argument that it exercised sovereignty over the area now claimed

4.55. For the first time during the oral hearings on provisional measures, Nicaragua advanced the argument that it had previously exercised sovereignty over the area it now claims.[380] The only evidence submitted to sustain this claim concerned alleged military patrols in the area. No weight can be attributed to this evidence for a number of reasons. First, Nicaragua only provided affidavits of military personnel, nearly all of them in service, and these affidavits were only provided by the military personnel once the case was pending before the Court.[381] Second, all these statements are vague

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Pulau Ligitan and Pulau Sipadan (Indonesia/Malaysia), Judgment, I.C.J. Reports 2002, p. 678, para. 126; *Frontier Dispute (Benin/Niger), Judgment, I.C.J. Reports 2005,* pp. 120-121, para. 47 and p. 127, para. 77.

379 See paragraphs 3.10 to 3.13.

380 CR 2011/2, p.12, para. 23 (Argüello Gomez), pp.27-28, para. 25 (McCaffrey).

381 Nicaragua, Documentation, *Document N° 1: Affidavit by M. Gregorio de Jesús Aburto Ortiz, Major Police Commissioner of the Nicaraguan National Police*, 15 December 2010, p. 1; *Document N° 2: Affidavit by M. Luis Fernando Barrantes Jiménez*, *Major Police Commissioner of the Nicaraguan National Police*, 15 December 2010, p. 1; *Document N° 3: Affidavit by M. José Magdiel Pérez Solis*, *Major Police Commissioner of the Nicaraguan National Police*, 15 December 2010, p. 1; *Document N° 4: Affidavit by M. Douglas Rafael*

as to the precise location of the alleged *caño* in which these patrols were supposedly carried out. There are several in the area, particularly in the vicinity of San Juan del Norte. The affidavits refer to Laguna Los Portillos area but none of them identify the artificial *caño* now claimed by Nicaragua as constituting the boundary. Third, they refer to activities carried out since the end of the 1970s. If they had referred to the alleged *caño* claimed as the boundary, this would have contradicted the UNOSAT/UNITAR report, which after examining satellite imagery from the last 30 years, shows that there was no *caño* at the location of the artificial one constructed by Nicaragua.[382]

4.56. Nicaragua has placed considerable emphasis on enforcement actions it has supposedly carried out to combat crime in the border area. Unsurprisingly, Nicaragua is unable to produce any evidence of concrete action related to the territory now it claims. Not a single report of an arrest, a prosecution or a judgment with respect to these alleged actions has been furnished by Nicaragua. This lack of evidence, and the absence of a reference to the existence of any such evidence, contrasts with the widely publicised judicial action carried out by Nicaragua against criminal activities in the Reserva Indio Maíz, which is adjacent and does not include – as the

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Pichardo Ramírez, *Major Police Commissioner of the Nicaraguan National Police*, 15 December 2010, pp. 1-2; *Document N° 6: Affidavit by M. Suban Antonio Yuri Valle Olivares*, *Mayor* [sic] Police *Commissioner of the Nicaraguan National Police*, 15 December 2010, p. 1; Documentation submitted to the Court on 4 January 2010, *Document N° 7: Affidavit by M. Juan Francisco Gutiérrez Espinoza*, *Military in active duty*, 15 December 2010, p. 1; Documentation submitted to the Court on 4 January 2010, *Document N° 8: Affidavit by M. Norman Javier Juárez Blanco*, *active Military*, 15 December 2010, p. 1; Documentation submitted to the Court on 4 January 2010, *Document N° 8: Affidavit by M. Denis Membreño Rivas*, *Military in active duty*, 15 December 2010, p. 1; *Document N° 8: Affidavit by M. Manuel Salvador Mora Oritz*, *Military in retirement*, 15 December 2010, p. 1.

[382] **Vol. IV, Annex N° 148,** UNITAR/UNOSAT, "Morphological and Environmental Change Assessment: San Juan River Area (including Isla Portillos and Calero), Costa Rica" (Geneva, 2011), 4 January 2011.

Court is well aware – the Costa Rican territory of Isla Portillos now claimed by Nicaragua.[383]

4.57. This desperate attempt by Nicaragua to invoke something that could justify its unilateral action cannot have any possibility of success even if it could be proved that from time to time Nicaraguan soldiers or police entered Costa Rican territory. This action would simply be incursions into foreign territory made in a covert way that cannot be considered acts of possession *à titre de souverain*, which, by definition, must be *nec vi, nec clam, nec precario*. All these actions – if ever existed – essentially lack these conditions.

D. The Nicaraguan military invasion and occupation of October 2010

4.58. Chapter III of this Memorial has provided a detailed description of the events leading to Nicaraguan invasion and occupation of the Costa Rican territory of Isla Portillos and the harm caused on it.[384]

4.59. Nicaragua first occupied the Costa Rican territory of Isla Portillos, and only later did it claim sovereignty over this area. The answer Nicaragua provided to the question raised by Judge Simma is unambiguous in this regard. Judge Simma asked:

> "Before the hearing of 11 January 2011, did Nicaragua ever make, or attempt to make, Costa Rica aware of its claim according to which the course of the boundary does not follow that documented on all existing—including Nicaraguan—maps, but 'reaches the river proper by the first channel met'—that is the First Alexander Award of 1897—this clause being

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383 See for example: **Vol. III, Annex N° 104,** "PGR achieves 8 guilty sentences in cases of environmetal crime", 12 January 2010.

384 See paragraphs 3.82 to 3.110.

interpreted as referring to the 'Caño Harbor Head'?".[385]

4.60. Nicaragua's answer conceded the following:

> "On 26 November 2010, Nicaragua published a white book that explains among other things the legal reasoning of Nicaragua's claim to the area in dispute. This reasoning is totally in harmony with the statements made during the hearings. So at least from that date Costa Rica and the whole international community were aware of the basis of the claims of Nicaragua."[386]

4.61. This propaganda booklet ("White Book") was published on 26 November 2010, a month after the Nicaraguan occupation of Costa Rican territory began. Nicaragua went even further, admitting that it made no attempt to raise the issue with Costa Rica. In its response to Judge Simma's second question Nicaragua contended that "there was no need to negotiate a new course of the boundary since this is clearly spelled out in the Alexander Awards."[387] This even contradicts Nicaragua's answer to Judge Simma's first question, where Nicaragua says at paragraph 3: "Before the hearings and for many years Costa Rica was aware that the border had not been settled and that Nicaragua was interested in doing so."

4.62. Nicaragua's answers unequivocally confirm that it never made any attempt either to negotiate a new course of the boundary, nor to inform Costa Rica that in its view, the official cartography of both States was wrong, or even to change its official cartography. It also confirms that Nicaragua never communicated to Costa Rica any intention of doing so. It clearly shows that Nicaragua unilaterally proceeded to apply on the ground its new position

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385 CR 2011/4, p. 40.

386 Reply of the Republic of Nicaragua to the questions put by Judges Simma, Bennouna and Greenwood at the end of hearing on provisional measures requested by Costa Rica in the case concerning *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, 18 January 2011, Ref: 18012011-01.

387 Ibid.

with regard the location of the boundary, without any prior notification to its neighbour.

4.63. In order to impose its new views concerning the location of the boundary on Costa Rica, Nicaragua resorted to using its Armed Forces. The Nicaraguan army occupied a territory that was not under the control of Nicaragua before its military personnel entered the area and set up camp, and a territory that was publicly and officially acknowledged by Nicaragua to be Costa Rican up until this action took place.

4.64. Nicaragua openly admits the military character of its action in its "White Book". It claims that "the army of Nicaragua has carried out its military actions in the zone of Harbour Head and River of the same name, a sovereign and unquestionable territory of Nicaragua".[388] The map that illustrates this claim in that booklet depicts the occupied area of Isla Portillos as "Zone claimed by Costa Rica 3 km2", which includes a "border control post of the Nicaraguan Army"[389] that never existed prior to the occupation, as is clear from the evidence presented in the earlier *Costa Rica v. Nicaragua* case before the Court, and as the judgment in that case shows on sketch-map N°2.[390] There has been a military border post in nearby San Juan del Norte, but not in the area occupied by Nicaragua in 2010.

4.65. It is not an exaggeration to qualify Nicaragua's military action as being in breach of Article 2, paragraph 4, of the Charter of the United Nations, and Article 22 of the Charter of the Organization of American States (OAS), even though no hostilities erupted. Article 3(a) of the

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388 **Vol. II, Annex N° 30**, Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010), p. 15.

389 Ibid.

390 *Navigational and Related Rights (Costa Rica v. Nicaragua)*, Judgment of 13 July 2009, p. 17.

Definition of Aggression, annexed to United Nations General Assembly resolution 3314 (XXIX) provides as an example of aggression "[t]he invasion or attack by the armed forces of a State of the territory of another State, or any military occupation, however temporary, resulting from such invasion or attack, or any annexation by the use of force of the territory of another State or part thereof".[391] In the present case, it has been demonstrated that prior to the action conducted by the Nicaraguan army in October 2010, this territory was considered by both parties as Costa Rican, and Nicaragua did not advance any claim of sovereignty prior to unlawfully entering and occupying the territory. It is admitted in the "White Book" by Nicaragua that the action had a military character and that it installed a so-called "boundary post" in an area in which there previously was none. It is also demonstrated that it was only after undertaking this military action that Nicaragua claimed that the occupied territory falls under its sovereignty. This conduct is nothing less than an invasion of foreign territory and an attempt at annexation.

4.66. Nicaragua's military presence on Costa Rican territory constitutes an act of occupation. Nicaragua has been, through the acts of its army, in possession of territory over which it had never previously exercised jurisdiction or control. The fact that its troops have not encountered armed resistance is no obstacle to qualifying this situation as one of occupation, in conformity with Article 2 of the Fourth Geneva Convention of 1949.[392]

4.67. The Declaration on Principles of International Law, contained in General Assembly resolution 2625 (XXV), provides a clear summary of the

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[391] Definition of Aggression, annexed to United Nations General Assembly resolution 3314 (XXIX), 14 December 1974.

[392] Geneva Convention relative to the Protection of Civilian Persons in Time of War, 75 UNTS 287, entered into force on 21 October 1950.

actual state of the law on this issue: "The territory of a State shall not be the object of military occupation resulting from the use of force in contravention of the provisions of the Charter".[393] The Charter of the OAS, for its part, contains an even more specific right. Article 21 provides as follows: "The territory of a State is inviolable; it may not be the object, *even temporarily*, of military occupation or of other measures of force taken by another State, directly or indirectly, on any grounds whatever"[394] (emphasis added).

4.68. The nature of the Nicaraguan invasion and occupation of Costa Rican territory cannot be disguised under the veil of a subsequent claim of sovereignty. Nicaragua's conduct is not only in contradiction with fundamental principles of international law, such as the prohibition of the threat or the use of force and respect for the territorial integrity of other States, but it also constitutes a violation of a bilateral obligation set out in Article IX of the Treaty of Limits, which reads as follows:

> "Under no circumstances, and even in case that the Republics of Costa Rica and Nicaragua should unhappily find themselves in a state of war, neither of them shall be allowed to commit any act of hostility against the other, whether in the port of San Juan del Norte, or in the San Juan river, or the Lake of Nicaragua."

4.69. The conduct of Nicaragua is in breach of this prohibition. This conduct includes the unlawful incursion of the Nicaraguan army on Costa Rican territory from the San Juan, the establishment there of a camp and military "border post", threatening Costa Rican helicopters and Costa Rican civilians therein with armed force from this territory, and more generally,

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[393] United Nations General Assembly resolution 2625 (XXV), Declaration on Principles of International Law concerning Friendly Relations and Co-operation among States in accordance with the Charter of the United Nations, 24 October 1970.

[394] Charter of the Organization of American States, 119 UNTS 3, entered into force 13 December 1951.

claiming *ex post facto* that these actions are taking place on Nicaraguan territory.

E. The ex post facto Nicaraguan claim of sovereignty and its inconsistencies

4.70. Nicaragua contends that since this is a fluvial boundary, changes in the course of the river can modify the boundary itself and this is what actually happened in the relevant area, which had not been surveyed since the time of the Alexander Award.[395] This argument is intrinsically flawed for the simple reason that the *caño* Nicaragua invokes as the boundary, is an *artificial caño*, *unilaterally constructed* by Nicaragua in late 2010. Consequently, any discussion about the legal scope of natural changes in fluvial boundaries is purely theoretical.

4.71. In order to rebut Nicaragua's claim, however, and for the purpose of showing that even in this field Nicaragua's arguments are inconsistent, Costa Rica will address this issue.

4.72. There has been abundant discussion in legal doctrine and practice about the effects of natural changes in fluvial delimitation.[396] For some, the same rules of Roman Law on *alluvio* and *avulsio* should be applied in international law. In other words, if natural changes are gradual, they are

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[395] CR 2011/2, pp. 11-12, paras. 16-22 (Argüello Gomez); pp. 20-23, paras. 6-13 (McCaffrey).

[396] See H. Grotius, *De jure belli ac pacis*, book II, chap. III, XVI-XVIII, E. de Vattel, *Le droit des gens*, 1758, book I, chap. XXII, para. 268; H. Dipla, 'Les règles de droit international en matière de délimitation fluviale: remise en question?' *R.G.D.I.P.*, 1985, vol. 89, 589-624, pp. 611-615; D. Bardonnet, 'Les frontières terrestres et la relativité de leur tracé (Problèmes juridiques choisis)', *R.C.A.D.I.* 1976-V, vol. 153, pp. 90-95; L. Caflisch, 'Règles générales du droit des cours d'eau internationaux', *R.C.A.D.I.*, 1989-VII, vol. 219, pp. 81-84; A. Pellet, 'Les problèmes posés par l'alluvionnement', in: B. Auresscu & A. Pellet (eds), *Actualité du droit des fleuves internationaux* (Paris: Pedone, 2010), pp. 53-57. A leading case in this matter has been the *Chamizal* arbitral award of 15 June 1911 between Mexico and the United States of America, UNRIAA, Vol. XI, p. 309.

able to modify the course of the boundary and must be taken into consideration. If, on the contrary, natural changes are the result of sudden action, they cannot modify the course of the river boundary. In the *Land, Island and Maritime Frontier Dispute Case*, the Court – explaining El Salvador's position with regard to an abrupt change in the course of the Goascarán River – distinguished the process of "avulsion", in which the stream suddenly leaves its old bed and forms a new one, to that of erosion and accretion, which occurs slowly, concluding that "different legal rules may apply" to these two different situations.[397] Indeed, in the present case, the Arbitral Awards applicable to the parties govern the matter.

4.73. In his second arbitral award, Engineer-Arbitrator Alexander referred to the impact that natural changes on the river could have in the future of the Costa Rican/Nicaraguan fluvial delimitation. Alexander explained as follows:

> "Today's boundary line must necessarily be affected in future by all these gradual or sudden changes. But the impact in each case can only be determined by the circumstances of the case itself, on a case-by-case basis in accordance with such principles of international law as may be applicable."[398]

4.74. Alexander was aware of the debate related to the impact of gradual or sudden changes in fluvial delimitation. At that time, the question was being discussed between the United States of America and Mexico, and the outcome was the adoption in 1884 of the Convention related to the boundary

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[397] *Land, Island and Maritime Frontier Dispute Case (El Salvador/Honduras; Nicaragua: Intervening), Judgment, I.C.J. Reports 1992*, p. 546, para. 308.

[398] **Vol. II Annex N° 10**, Second Award of the Umpire EP Alexander in the boundary question between Costa Rica and Nicaragua, 20 December 1897, UNRIAA, Vol. XXVIII, p. 224.

on the Rio Grande and the Rio Colorado.[399] This Convention laid down rules for the determination of the boundary, taking into consideration gradual changes, disregarding others such as the abandonment of the existing riverbed, and maintaining the boundary on the original channel even if another one was deepened. Artificial changes produced by obstructions, dredging or by cutting waterways were also disregarded as ways of producing changes to the boundary.[400]

4.75. There is no need to decide whether international law deals with natural accretion of land in its two forms, recognizing alluvion as a means of changing the course of boundaries, and not avulsion. In any event, we are not here in a situation of accretion, which by definition implies that a landmass, such as an island, is adjoined to the bank of a river. It is uncontroversial that Isla Portillos is today separated from the left Nicaraguan bank of the San Juan by the river itself, as it was in 1858 at the time of the

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[399] Convention between the United States of America and the United States of Mexico touching the boundary line between the two countries where it follows the bed of the Rio Grande and the Rio Colorado, 12 November 1884, reprinted in: UNRIAA, Vol. XI, p. 323.

[400] Ibid., Articles Articles I to III, pp. 323-324. Article I reads: "The dividing line shall forever be that described in the aforesaid treaty and follow the center of the normal channel of the river named, notwithstanding any alterations in the banks or in the course of those rivers, provided that such alterations be effected by natural causes through the slow and gradual erosion and deposit of alluvium and not by the abandonment of an existing river bed and the opening of new one." Article II reads: "Any change wrought by the force of the current, whether by the cutting of a new bed or when there is more than one channel by the deepening of another channel than that which marked the boundary at the time of the survey made under the aforesaid treaty, shall produce no change in the dividing line as fixed by the surveys of the International Boundary Commissions in 1852; but the line then fixed shall continue to follow the middle of the original channel bed, even though this should become wholly dry or be obscured by deposits." Article III reads: "No artificial change in the navigable course of the river, by building jetties, piers, or obstructions which may tend to deflect the current or produce deposits of alluvium, or by dredging to deepen another than the original channel under the treaty when there is more than one channel, or by cutting waterways to shorten the navigable distance, shall be permitted to affect or alter the dividing line as determined by the aforesaid commissions in 1852 or as determined by Article I hereof and under the reservation therein contained; but the protection of the banks on either side from erosion by revetments of stone or other material not unduly projecting into the current of the river shall not be deemed an artificial change."

Treaty of Limits, and during the period of 1897 to 1900, at the time of the work of Umpire-Arbitrator Alexander and the Demarcation Commission. Isla Portillos simply constitutes – and has always constituted – part of the right bank of the San Juan, Costa Rican territory.

4.76. Another question is whether there have been changes in the configuration of the banks of the river and its tributaries and channels. Alexander left room for the possibility that the boundary that he clearly designated between Costa Rica and Nicaragua may shift as a result of these natural changes. In his Second Award, he noted that the particular geography in the region was susceptible to such natural changes:

> "It should be noted, for a clearer understanding of the question at hand, that the San Juan river runs through a flat and sandy delta in the lower portion of its course and that it is obviously possible that its banks will not only gradually expand or contract but that there will be wholesale changes in its channels. Such changes may occur fairly rapidly and suddenly and may not always be the result of unusual factors such as earthquakes or major storms. Examples abound of previous channels now abandoned and banks that are now changing as a result of gradual expansions or contractions."[401]

4.77. The geographic configuration of the area located on both banks of the lower course of the San Juan, at and near the point where the river enters into the Caribbean Sea, has undergone gradual changes over a long period of time. These changes are evident upon an analysis of a series of successive satellite photos taken of the area (see for example **Figure 2.7** in Chapter II). What is striking from this evidence is that the overall direction and configuration of the river and its banks in the relevant area has remained largely unchanged.

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401 **Vol. II Annex N° 10**, Second Award of the Umpire EP Alexander in the boundary question between Costa Rica and Nicaragua, 20 December 1897, UNRIAA, Vol. XXVIII, p. 224.

4.78. What emerges from the evidence is that there have been minor, gradual changes in the course of the San Juan and its banks. The boundary has followed these changes. Undoubtedly, when Alexander referred to the possibility that changes could affect the river boundary demarcation, he did *not* mean that the boundary – which he took care to designate – could be *unilaterally* modified by one party through *artificial* means, such as the unlawful construction of an artificial *caño* on the other party's territory.

4.79. Conscious of the obvious legal difficulties that the construction of an artificial *caño* on Costa Rican territory would encounter, Nicaragua has advanced the argument according to which it claims that it has merely "cleaned" a purportedly pre-existing channel. Nicaragua wishes to argue that by virtue of the existence of this supposedly pre-existing channel (in reality, the artificial *caño*), the boundary has been altered to follow its course, rather than the lower course of the San Juan and the true "first channel met" by Alexander. According to Nicaragua, the artificial *caño* is now the "first channel met". Nicaragua has raised this argument of a purported pre-existing channel only *ex post facto* to its occupation of Costa Rican territory and to the beginning of its very construction.

4.80. To date, and despite the matter being discussed at some length during the proceedings on provisional measures, including the submission of answers by Nicaragua to specific questions raised by members of the Court, the Respondent has been unable to indicate, even less to elicit proof of, a date on which the purportedly pre-existing channel was in existence prior to its so-called 'cleaning' operation.

4.81. Nicaragua has been evasive in addressing the question of the existence at the time of the First Alexander Award of a supposedly pre-existing channel. This attitude is understandable, in view of the intrinsic

weakness of its claim. Neither of the two logical possibilities is of any help to Nicaragua. On the one hand, if the 2010 Nicaraguan artificial *caño* existed in 1897, it is clear that it was not chosen by Alexander as the "first channel met", and hence it was not chosen as the boundary between the parties. On the other hand, if the Nicaraguan constructed *caño* did not exist at that time, it is obvious that Alexander could not have chosen it as the boundary. The inescapable consequence is that the artificial *caño* now claimed by Nicaragua as the boundary *was not* the "first channel met" of the boundary decided with binding effect by the Alexander Award.

4.82. As a matter of fact, it is materially impossible that a *caño* could have existed on the same site where the artificial one was constructed by Nicaragua from November 2010 onwards. **Figure 4.11** is an illustration taken from a report entitled "*Age approximation of trees cut in the Area Under Costa Rica's Environmental Management located on the causeway of the artificial channel built on a portion of territory of Calero Island to connect the San Juan River with Los Portillos Lagoon*", which documents the location, species, diameter and estimated age of several of the trees cut down by Nicaragua between October and December 2010.[402] This study concludes that on the site of the *caño* there are at least some 21 trees with ages ranging between 211 and 264 years. These trees therefore already existed by the time of the signing of the Treaty of Limits in 1858, and certainly were in existence in 1897 when the boundary was demarcated in that area. Moreover, the age of these trees makes clear that they existed in the location of the artificial *caño* throughout the twentieth century and the

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[402] **Vol. IV Annex N° 154**, Costa Rica, Ministry of Environment, Energy and Telecommunications and Sistema Nacional de Áreas de Conservación (SINAC) Report "Age approximation of trees cut in the area under Costa Rica's environmental management located on the causeway of the artificial channel built on a portion of territory of Calero Island the San Juan River with Los Portillos Lagoon", August 2011.

first decade of the twenty-first century until Nicaragua chopped them down. Their existence begs the simple question: how could a purported *caño* have ever emerged or existed where the stumps of these trees are now located?

4.83. Nicaragua's claim of sovereignty also faces further insurmountable obstacles in simple logic. There are two possibilities, both of which undermine Nicaragua's reasoning: either 1) the boundary does not follow natural changes such as the appearance or disappearance of new channels, in which case Nicaragua's claim fails from the outset; or 2) the boundary must follow natural changes, even if this amounts to a substantial change of sovereignty. If one follows Nicaragua's reasoning, after the Alexander Award there was a change leading to a new "first channel" at the location of the (artificial) caño, replacing the lower course of the San Juan and the first channel designated by Alexander. If this was indeed the case, then if this new "channel" dries up and ceases to exist to the extent that an extensive 'cleaning' operation must be undertaken, including the removal of hundred-year-old trees, the boundary was changed, once again, and it cannot be unilaterally re-opened by artificial means. Nicaragua cannot proceed to revive the existence of an old channel in order to re-establish an old boundary line, as the head of the dredging operation and Nicaragua's Agent invoked this was the case (*quod non*).[403] By asserting that it "cleaned" an existing channel, Nicaragua is in effect recognising that the alleged new channel was not transporting water anymore, and hence it could not be considered as a channel linking the lagoon to the San Juan.

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[403] **Vol. III, Annex N° 117,** Confidencial.Com, 'Pastora: I interpreted the Alexander Award', 30 November 2010. See also CR 2011/2, pp. 11, paras. 17 (Argüello Gomez)

Figure 4.11

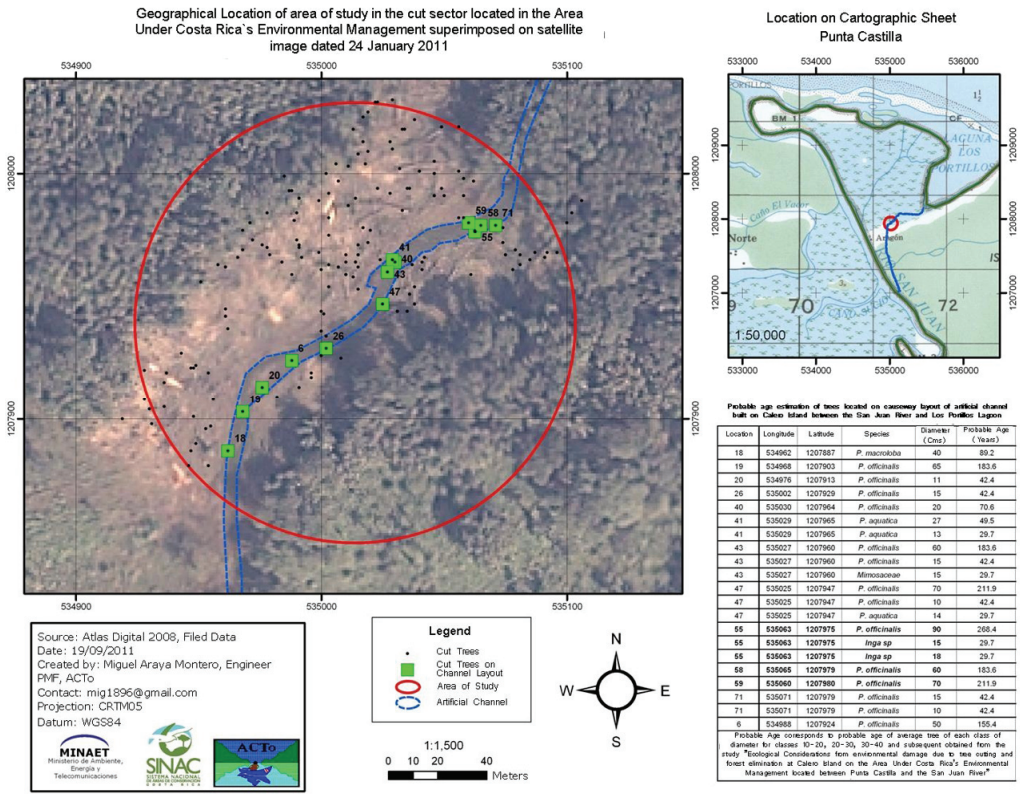

Figure 4.11: Graphic depicting the location of trees felled on the path of the artificial "caño".

4.84. In its answer to the question raised by Judge Greenwood, Nicaragua is indirectly suggesting that Costa Rica could have clogged up the artificial *caño*, an activity at which, according to Nicaragua's answer, Costa Rica "has shown expertise".[404] The ground for this peculiar assertion of Nicaragua's reply is that Costa Rica attempted to block and unblock a channel located

404 Reply of the Republic of Nicaragua to the questions put by Judge Greenwood at the end of hearing on provisional measures requested by Costa Rica in the case concerning *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, 18 January 2011, Ref: 18012011-01.

entirely on Costa Rican territory in the late nineteenth century.[405] Nicaragua quoted from a report dated 16 March 1906 by a Costa Rican official, Mr. Jose Solórzano, in which he mentioned decisions taken by Costa Rica to block and unblock a certain "Caño Pereira".[406] "Caño Pereira" is a channel located entirely on Costa Rican territory, which runs off the Colorado River, and which is not connected to the San Juan. Nicaragua's attempt to draw a parallel between attempts by the Costa Rican authorities in the late nineteenth and early twentieth centuries to block and unblock a natural channel, located entirely on Costa Rican territory, with Nicaragua's recent unlawful conduct on Costa Rican territory to construct an artificial *caño*, fails because any work carried out by Costa Rica on "Caño Pereira" in the past is simply irrelevant. Costa Rica strongly rejects the indirect allegation made by Nicaragua. It is furthermore evident that Costa Rica could not have blocked a non-existent *caño*.

4.85. It is curious that Nicaragua, in the case concerning *Navigational and related rights*, accused Costa Rica of felling trees in the area but remained absolutely silent about any purported blockage of any *caño*.[407] This is all the more surprising if – according to Nicaragua – the waters of this imaginary *caño* were indeed Nicaraguan.

4.86. Finally, reference is made to the attached Expert Report by Professor Colin Thorne. The morphological conditions in Harbor Head Lagoon make clear that there has never been a *caño* connecting the San Juan to the Lagoon

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405 **Vol. III Annex N° 40**, Report of Jose Solórzano to the General Inspector of the Treasury, 16 March 1906, Archivo Nacional de Costa Rica, *Dispute concerning Navigational and Related Rights (Costa Rica v. Nicaragua)*, CRM, Vol. 6, Annex No. 214.

406 Written Reply of Nicaragua to Judges' Questions, 18 January 2011, REF: 18012011-01, pp. 9 and 10.

407 NR, para. 4.53. (*Dispute concerning Navigational and Related Rights (Costa Rica v. Nicaragua*)

in the area where Nicaragua built the artificial *caño*.[408]

4.87. To sum up, Nicaragua has been unable to elaborate a serious and coherent claim with regard to a purported change in the geography in the region, purportedly creating a new channel that would be the "first channel met" in line with the First Alexander Award. This new "first channel" is nothing more than an artificial *caño* unlawfully constructed by Nicaragua on Costa Rican territory. There has been no natural change in the geography of the region leading to the emergence of a new "first channel met", and even if this would have naturally occurred, this could not have lead to a modification of the course of the boundary, as explained in the section that follows.

F. The principle of stability and finality of boundaries: its open defiance by Nicaragua

4.88. The Court has played a significant role in affirming and reaffirming the importance of the principle of stability and finality of boundaries. A neat formulation of the logic underpinning this fundamental principle provided by the Court reads as follows:

> "In general, when two countries establish a frontier between them, one of the primary objects is to achieve stability and finality. This is impossible if the line so established can, at any moment, and on the basis of a continuously available process, be called in question, and its rectification claimed, whenever any inaccuracy by reference to a clause in the parent treaty is discovered. Such a process could continue indefinitely, and finality would never be reached so long as possible errors still remained to be discovered. Such a

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408 **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, pp. I-31, I-32, I-33.

> frontier, so far from being stable, would be completely precarious."[409]

4.89. As important as the case law of the Court is for consistently reaffirming this principle,[410] the Court was by no means the first international judicial forum to identify the principle and to recognise its importance. Nor was the Court's predecessor, the Permanent Court of International Justice, the first to articulate this fundamental principle, although an application of the principle of stability and finality of boundaries can be found in the *Mosul* case.[411] Indeed, it was none other than Engineer-Arbitrator Alexander who, in his decision dated 22 March 1898, issued the following sage warning:

> "Borders are intended to maintain peace, thus avoiding disputes over jurisdiction. In order to achieve that goal, the border should be as stable as possible. Obviously, such a state of affairs would be unacceptable to residents and property owners close to the borders of the two countries, if the line that determines the country to which they owe allegiance and must pay taxes, and whose laws govern all their affairs, was there one minute and not there the next, because such border line would just generate conflicts instead of preventing them. The difficulties that would arise, for example, if certain lands and forests and their owners and residents or people employed in any capacity thereon, were required to be Costa Rican in dry season and Nicaraguans in the rainy season and

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409 *Temple of Preah Vihear (Cambodia v. Thailand), Merits, Judgment, I.C.J. Reports 1962*, p. 34.

410 See also *Aegean Sea Continental Shelf (Greece v. Turkey), I.C.J. Reports,* p. 36, para. 85; *Territorial Dispute (Libyan Arab Jamahiriya/Chad), Judgment, I.C.J. Reports 1994*, p. 37, para. 72. For arbitral awards referring to this principle: *Dispute between Argentina and Chile concerning the Beagle Channel,* UNRIAA, Vol. XXI, p. 88-89, para. 18; *Delimitation of the maritime boundary between Guinea-Bissau and Senegal,* UNRIAA, Vol. XX, p. 144, para. 63.

411 *Interpretation of Article 3, Paragraph 2, of the Treaty of Lausanne, Advisory Opinion, 1925, P.C.I.J., Series B, No. 12*, p. 20.

> alternatively of either nationality during the intermediate seasons are self evident".[412]

4.90. During the oral hearings on the request for provisional measures, Nicaragua attempted to undermine the principle in general and this passage in particular, claiming that the principle did not apply to the delta of the San Juan, and it confined the application of the above quotation to the banks of the San Juan, irrespective of changes in water levels.[413] Alexander's dictum is however clear and general in scope. It establishes the rationale of the principle of stability and finality of boundaries in a similar way as the Court later developed the principle. It applies fully to the region concerned.

4.91. The final proceedings of the demarcation commission on 24 July 1900 clearly define once again the boundary from Punta Castilla as the right bank of Laguna Los Portillos, referred to as "Harbor Head Lagoon", and continuing along the right bank of the first channel found there, and then along the right bank of the San Juan, "all of the above in compliance with the geodetic operations and layout plans included in the respective proceedings".[414] As abundantly explained in this Memorial, those geodetic operations and layout plans cast no doubt on the location of the "first channel met". The commissioners and Alexander declare in those final proceedings: "With this demarcation all the matters that the Republics of Nicaragua and Costa Rica have had between them until now due to

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412 **Vol. II, Annex N° 11**, Third award of the Umpire EP Alexander, under the Convention between Costa Rica and Nicaragua of 8 April 1896 for the demarcation of the boundary between the two Republics, decision of 22 March 1898, UNRIAA, Vol. XXVIII, p. 228.

413 CR 2011/4, p. 12, para. 13 (McCaffrey).

414 **Vol. II, Annex N° 13**, Proceedings of the Costa Rica – Nicaragua Demarcation Commission (1897-1900). Vol. II, Final Proceedings, Minute N° XXVII.

undefined borders are settled."[415] This formal statement refers to the idea of finality established by the principle.

4.92. The notion of stability contained in the principle also applies to boundaries following natural features. As the arbitral award on the Chilean application for revision and subsidiary interpretation of the arbitral award in the *Laguna del Desierto* case stated, "as a legal concept the stability of frontiers does not depend on possible changes which may occur in the ground across which the frontiers run, changes which constitute a strictly physical phenomenon".[416] The notion of stability of boundaries means that the geographical features that were designed to be the boundary and identified as such will continue to determine the territory attributed to each party as a result of the delimitation, even if they suffer natural changes and the boundaries follow them. As a result of the first Alexander award, Isla Portillos was declared Costa Rican. If a waterway appears on Costa Rican territory and flows into the San Juan or into Laguna Los Portillos, this waterway will *not* constitute a branch of the San Juan or "the first channel met", indicating where a new boundary should run. Rather, this would simply be a waterway on Costa Rican territory. The "first channel met" has already been identified by a binding arbitral award, and henceforth the parties have respected this boundary for more than a century.

4.93. By contesting an established boundary decided by an arbitral award more than a century ago, and openly recognised since then by both parties; by advancing a claim of an alleged modification of the boundary after having attempted to impose its claim on the ground without previously notifying its neighbour of its new position; and by occupying the territory

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415 Ibid., Art. 2.

416 *Application for revision and subsidiary Interpretation of the Award of 21 October 1994 submitted by Chile (Argentina, Chile)*, UNRIAA, Vol. XXII, p. 165, para. 54.

newly claimed, Nicaragua has acted in clear contradiction to the principle of stability and finality of boundaries. Nicaragua has done so despite the fact that it itself invoked before the Court and before Costa Rica this very principle on 15 October 2010, at the same time that it began carrying out its illegal action on Costa Rican territory.[417]

G. Nicaragua has openly violated its obligation to respect the territorial integrity of Costa Rica

4.94. Despite having breached other international obligations vis-à-vis Costa Rica over the course of many years – as this Court ascertained in its judgment of 13 July 2009 – this is the first time that Nicaragua has openly challenged the scope of Costa Rican territorial sovereignty, peacefully recognized for more than a century. Its attempts to physically change the course of the boundary through the construction of an artificial *caño*, occupying Costa Rican territory and trying to annex this territory, constitute violations of the principle of respect for the territorial integrity of States.

4.95. Costa Rica has the right that its territorial integrity be respected. The Court recently emphasized that the principle of territorial integrity "is an important part of the international legal order", and that it applies in inter-State relations.[418] As the Permanent Court observed: "the first and foremost restriction imposed by international law upon a State is that – failing the existence of a permissive rule to the contrary – it may not exercise its power in any form in the territory of another State".[419] By sending its Army and

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[417] *Territorial and Maritime Dispute (Nicaragua v. Colombia)*, Application by Costa Rica for Permission to Intervene, CR 2010/16, pp. 27-28, paras. 32-34 (Reichler).

[418] *Accordance with international law of the unilateral declaration of independence in respect of Kosovo*, Advisory Opinion of 22 July 2010, para. 80

[419] *The Case of the S.S. "Lotus", Judgment No. 9, 1927, P.C.I.J., Series A, No. 10*, p. 18.

citizens, by preventing Costa Rica from continuing to exercise its sovereignty over the occupied territory, by sending and encouraging members of the Sandinista Youth to stay in the area, even after the Order of the Court of 8 March 2011 indicating provisional measures, Nicaragua has acted in open defiance of this principle.

4.96. As the Court emphasized more than sixty years ago, "[b]etween independent States, respect for territorial sovereignty is an essential foundation of international relations".[420] This is not a boundary dispute in which the parties have advanced their claims and elaborated them at length over time. This is not a case in which the parties realised that part of their boundary has not been delimited. When Nicaragua accomplished its action, it had openly and unambiguously accepted the existence of the boundary in that area for more than a century. Nicaragua's disregard for the territorial integrity of Costa Rica not only affects the rights of the Applicant, but it also poses a serious threat to stability and peace in international relations if this dangerous precedent does not meet with unequivocal condemnation.

H. Conclusions

4.97. The developments above show that:

- There exists in the area that forms the object of the present dispute a boundary delimited by a treaty (the Treaty of Limits), and precisely determined on the ground by an arbitral award (the first Alexander Award) in the framework of the functions of a bi-national Demarcation Commission, with binding effect.
- Without a shadow of doubt, this boundary places Isla Portillos in its entirety on Costa Rican territory.

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[420] *Corfu Channel (United Kingdom* v. *Albania), Merits, Judgment, I.C.J. Reports 1949*, p. 35

- Costa Rica and Nicaragua's official cartography have consistently placed Isla Portillos in its entirety on the Costa Rican side of the boundary. Only after the institution of these proceedings has Nicaragua produced a new, self-serving official map with its new claim over the northern part of Isla Portillos erroneously depicted as Nicaraguan.
- Costa Rican *effectivités* at the national and international levels and the lack of Nicaragua's reaction thereto confirm Costa Rican title.
- Nicaraguan claim is an *ex post facto* and artificial one, designed with the purpose of disguising its attempt to modify the natural configuration of the boundary.
- Until Nicaragua's occupation of Costa Rican territory in October 2010, there were no Nicaraguan *effectivités* in the relevant area. Even if the Nicaraguan army would have carried out some activities in the area – as Nicaragua claims – these activities could not qualify as *effectivités* since they would have not been made *public.* At the most, they would constitute *effectivités contra legem* and they are unable to bring about any transfer of territorial sovereignty.
- Factual evidence demonstrates that the *caño* constructed by Nicaragua had never previously existed. The presence of trees with ages exceeding 200 years on the *caño*'s causeway proves that it is materially impossible for the *caño* to have existed at least since the time of the signing of the 1858 Treaty of Limits.
- Nicaraguan conduct can be qualified as an invasion and occupation of Costa Rican territory, and consequently, an

infringement of the obligation not to threaten to use or to use force in international relations, a violation of the territorial integrity of Costa Rica and a violation of Article 9 of the Treaty of Limits.

CHAPTER V: NICARAGUA'S BREACHES OF THE ENVIRONMENTAL PROTECTION REGIME

A. Introduction

5.1. This chapter addresses the damage caused or threatened to cause to Costa Rica's environment and to the morphology of the San Juan River basin by Nicaragua's construction of an artificial *caño*, felling of primary forest, its dredging operations on the San Juan, and associated activities. It also addresses Nicaragua's failure to act in accordance with procedural requirements of the regime established to prevent environmental harm being caused to the territory of either State, and Costa Rica's right to oppose activities that risk causing potential harm to its territory.

5.2. In **Part B**, Costa Rica will set out the obligation of Nicaragua to notify and consult Costa Rica where activities carried out on Nicaraguan territory may result in harm to Costa Rican territory and Nicaragua's breaches of this obligation.

5.3. **Part C** will address the substantive environmental protection regime, including the obligations of the parties in respect of activities carried out in or around the San Juan and the *Humedal Caribe Noreste*, pursuant to the Ramsar Convention, other bilateral and multilateral treaties and other applicable rules of international law.

5.4. **Part D** will detail, as breaches of this regime, the dredging works carried out by Nicaragua and the activities carried out by Nicaragua in Costa Rican territory in relation to the construction of the artificial *caño*, including the dumping of sediments, the felling of trees, and the removal of soil, sandbanks and undergrowth. In relation to these matters, Costa Rica relies

particularly on the report of an expert in river morphology, Professor Colin Thorne, which is **Appendix 1** to this Memorial.

B. Obligation of Nicaragua to Notify and Consult

(1) Introduction

5.5. That States are under a procedural obligation to notify and consult in respect of those activities which carry a risk of environmental harm to neighbouring States is an uncontroversial rule of general international law, extending from the *Lac Lanoux* arbitration[421] to Principle 19 of the Rio Declaration, which states that:

> "States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith."[422]

5.6. The ILC reiterated this formulation in Article 8(1) of its Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, noting that "the State of origin shall provide the State likely to be affected with timely notification of the risk and [environmental impact] assessment and shall transmit to it the available technical and all other relevant information on which the [environmental impact] assessment is based."[423] The Court in the *Pulp Mills* case recalled its statements in the *Gabčíkovo-Nagymaros* judgment, that…

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421 *Lac Lanoux*, (1957) 24 ILR 101, 119.

422 Report of the United Nations Conference on the Human Environment, Rio Declaration on Environment and Development, 1992, UN doc. A/CONF.151/26 (Vol. I), Principle 19.

423 Report of the International Law Commission on the work of its 53rd Session, 2001, *Official Record of the General Assembly*, *Fifty-sixth Session*, *Supplement No. 10*, UN doc. A/56/10.

> "in the field of environmental protection, vigilance and prevention are required on account of the often irreversible character of damage to the environment and of the limitations inherent in the very mechanism of reparation of this type of damage"[424]

and subsequently observed that

> "…vigilance and prevention is all the more important in the preservation of the ecological balance, since the negative impact of human activities on the waters of the river may affect other components of the ecosystem of the watercourse such as its flora, fauna, and soil. The obligation to co-ordinate, through the Commission, the adoption of the necessary measures, as well as their enforcement and observance, assumes, in this context, a central role in the overall system of protection of the River Uruguay established by the 1975 Statute. It is therefore of crucial importance that the Parties respect this obligation."[425]

5.7. While the obligation of consultation in that case arose from the 1975 Statute of the River Uruguay, the Court's reasoning is equally apposite to the general principle.

5.8. Thus, while Nicaragua is under a general obligation to notify and consult Costa Rica in respect of any works on the San Juan which may result in harm to Costa Rican territory, further, specific, obligations to do so arise out of the Ramsar Convention and the Convention on the Conservation of Biodiversity and Protection of Priority Wildlife Areas in Central America, both of them in force as between the two States parties to the present dispute. Each of these is addressed in turn, below.

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[424] *Gabčíkovo-Nagymaros Project (Hungary/Slovakia)*, Judgment, I.C.J. Reports 1997, p. 78 (para 140).

[425] *Case Concerning Pulp Mills on the River Uruguay (Argentina v. Uruguay)*, Judgment, 20 April 2010 (para 188).

(2) Duty to Consult: Ramsar Convention

5.9. The Ramsar Convention sets out clear requirements regarding consultation and coordination of activities in respect of wetlands. Article 5(1) states that:

> "The Contracting Parties shall consult with each other about implementing obligations arising from the Convention especially in the case of a wetland extending over the territories of more than one Contracting Party or where a water system is shared by Contracting Parties. They shall at the same time endeavour to coordinate and support present and future policies and regulations concerning the conservation of wetlands and their flora and fauna."

5.10. At the 7th meeting of the Conference of the Contracting Parties to the Convention on Wetlands, held in Costa Rica on 10-18 May 1999, the Contracting Parties agreed official guidelines for the implementation of Article 5 of the Convention. These guidelines were appended to Resolution VII.19 (1999), and are binding on all the Parties to the Ramsar Convention.[426] The guidelines note that the Ramsar Convention has…

> "always recognized that a fundamental obligation of Contracting Parties pursuant to Article 5 was cooperation in the management of so-called shared wetlands. The concept of shared wetlands, now regularly referred to as international wetlands, is a relatively simple one, meaning those wetlands which cross international boundaries. …As the Convention has recognized and responded to the need to manage wetlands as part of river basins, so has the interpretation of international cooperation been expanded to include those situations where a wetland in one Contracting Party is within the water catchment of another Contracting Party and where the actions of the Contracting Parties within the catchment

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426 With the exception of Turkey, which registered a reservation concerning the content of the last part of paragraph 8 of the preamble of the Resolution and of sections 1.1(b), 2.1.1, 2.1.2 and items A2 and A3, together with the title, of the box containing Section A, of the Guidelines. Turkey declared that it does not consider Resolution VII.19 legally binding as far as those particular points are concerned.

> area may result in changes to the ecological character of the wetland. …A similar situation can arise with coastal wetlands, where the actions or inactions of one Contracting Party may adversely impact on the wetlands of another."[427]

5.11. In the *Pulp Mills* case,[428] the Court observed that Article 36 of the 1975 Statute of the River Uruguay imposed on the parties an obligation of coordination and the implementation of "necessary measures to avoid any change in the ecological balance".[429] The similarity of this requirement with that contained in Article 5(1) is striking. The Court stated:

> "In the opinion of the Court, the obligation to notify is intended to create the conditions for successful co-operation between the parties, enabling them to assess the plan's impact on the river on the basis of the fullest possible information and, if necessary, to negotiate the adjustments needed to avoid the potential damage that it might cause."[430]

5.12. The underlying obligation on parties to instruments dealing with environmental issues that traverse national boundaries is that no unilateral activity can take place on a site where damage may be inflicted onto a shared ecosystem. Where there is a risk that such damage may occur, there is a duty to consult and mitigate. This obligation has not been complied with by Nicaragua in any way in the present case. In particular:

- Nicaragua has completely failed to consult with Costa Rica in respect of its planned dredging works;

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427 Ibid., §2.1, paras 7-8.

428 *Case Concerning Pulp Mills on the River Uruguay (Argentina v. Uruguay)*, Judgment of 20 April 2010.

429 Statute of the River Uruguay, UNTS Vol. 1295, No. I-21425, p. 340. Cited by the Court in: *Case Concerning Pulp Mills on the River Uruguay (Argentina v. Uruguay)*, Judgment of 20 April 2010, p. 26 (para 52).

430 *Case Concerning Pulp Mills on the River Uruguay (Argentina v. Uruguay)*, Judgment, 20 April 2010 (para 113).

- Nicaragua failed to provide Costa Rica with a copy of the Environmental Impact Study ("EIS") produced in 2006;
- Nicaragua failed to notify the Ramsar Secretariat of any changes that wetlands along the proposed dredging path are likely to suffer.[431]

Nicaragua's breach of this latter obligation also renders it impossible for Costa Rica's right to be in turn informed by the Ramsar Secretariat of these proposed changes to be respected, as stipulated in Article 3.2 of the Convention.[432]

(3) Convention on the Conservation of Biodiversity and Protection of Priority Wildlife Areas in Central America

5.13. The Convention on the Conservation of Biodiversity and Protection of Priority Wildlife Areas in Central America was signed in Managua, Nicaragua, on 5 June 1992, by Costa Rica, El Salvador, Guatemala, Honduras, Panama and Nicaragua.[433] As the Preamble demonstrates, the Convention reflects the Central American countries desire "to protect and conserve the natural regions of aesthetic interest, historical value and scientific importance, which represent unique ecosystems of regional and world importance, and that they may have the potential to provide sustainable development for our societies"[434]

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431 **Vol. II, Annex N° 14**, Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar (Iran), 2 February 1971, as amended by the Paris Protocol of 3 December 1982 and Regina Amendments of 28 May 1987, Article 8(2)(c).

432 Ibid., Article 3(2).

433 **Vol. II, Annex N° 23**, Convention for the Conservation of the Biodiversity and Protection of the Main Wild Life Sites in Central America, 5 June 1992.

434 Ibid.

5.14. Article 13(g) of the Convention establishes the obligation of information sharing:

> "In order to fully comply with this Agreement they should: (…) Facilitate the exchange of information between national institutions, and between the countries of the Central American region, and other international organizations"[435]

5.15. Article 33 of the Convention is particularly important, because it establishes the obligation to share information related to acts which may be particularly damaging to biological resources. It states:

> "The exchange of information, based on reciprocity, should be promoted regarding actions that could be undertaken in territories under their jurisdiction that are potentially harmful to biological resources, in order that the affected countries may assess the most appropriate bilateral or regional measures"[436]

5.16. The object and purpose of the Convention is to oblige the Central American parties to the Convention not only to physically preserve valuable natural resources, but also to notify and consult with neighbouring States whose environment may be affected by potentially harmful actions. This permits those States affected to take the appropriate bilateral or regional measures in sufficient time to prevent harm from occurring. These measures encapsulate what Costa Rica understands to be the inherent right of each State to either mitigate potential harm, or to reject and oppose any activities that may place their national territories and natural resources at risk of serious harm.

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435 Ibid., Article 13 (g).

436 Ibid., article 33.

(4) Breach of Duties to Notify and Consult

5.17. The obligation to consult under the Ramsar Convention Article 5(1) is intended to ensure State cooperation in the management of wetland ecosystems which traverse international borders. Nicaragua has breached its obligations under Article 5(1) by failing to consult with Costa Rica about the effects of its dredging program and by not endeavouring to coordinate with Costa Rica on its planned works – works which clearly will affect and have affected the natural equilibrium of the shared wetland. In particular, the following conduct on the part of Nicaragua evidences its failure to comply with Article 5(1):

- Nicaragua neglected to inform the Ramsar Secretariat that the works of dredging and construction of the artificial *caño* were to take place in the area where two major internationally protected wetlands converge and it made no efforts to coordinate its activities with the Secretariat;
- Nicaragua refused to provide Costa Rica with any information regarding the planned works, and it did not inform Costa Rica of the results of its EIS so as to provide Costa Rica with the opportunity to consider the impact of its proposed works on Costa Rican territory;

5.18. As set out in Chapter III, as early as 26 January 2006, Costa Rica raised concerns with Nicaragua that Nicaragua's planned dredging activities – reported in the press – may adversely impact on the water level of the Colorado River of Costa Rica, and it requested technical information related

to the planned dredging.[437] Costa Rica repeated its request for information on 5 May 2006.[438] Following press reports on plans by Nicaragua to deviate water from the Colorado River, in August 2009 Costa Rica once again requested technical information on the projected impact of the proposed works on Costa Rican territory, and it reminded Nicaragua of its obligation to undertake an environmental impact assessment before proceedings with any such works.[439] Costa Rica repeated this request in July 2010 and was again ignored.[440]

5.19. The Nicaraguan EIS was not provided to Costa Rica. It was only on 4 January 2011, one week before the hearings on Provisional Measures were scheduled to take place in the present proceedings that Nicaragua submitted this EIS to the Court.[441]

5.20. Nicaragua's disregard of any harm to Costa Rican territory that Nicaragua's activities may cause is evident from the following passage contained in the Nicaraguan *White Book*:

> "If Nicaragua dredges and cleans the bank of silt and sand that obstructs navigation in the San Juan River, the interests of Costa Rica will be harmed of course like the interests of Nicaragua were harmed in the middle of the nineteenth century when the strong winters of those years

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437 **Vol. III, Annex N° 41**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-37-06, 26 January 2006.

438 **Vol. III, Annex N° 43**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-187-06, 5 May 2006.

439 **Vol. III, Annex N° 45**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-637-09, 27 August 2009.

440 **Vol. III, Annex N° 46**, Note from acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-AM-156-10, 12 July 2010.

441 CR 2011/2 pp. 16-7 (para 39) (Argüello).

> accumulated silt, sand and other sediments on the last 40 kilometers of the course of the San Juan River."[442]

5.21. Nicaragua is clearly in breach of Article 5(1) of the Ramsar Convention insofar as it has failed to consult Costa Rica prior to commencing activities in the region of the San Juan where it approaches the Caribbean Sea.

5.22. Nicaragua is also in breach of its obligation under general international law to notify and consult with a neighbouring State in regard to activities that risk damaging that State's territory. States are under an obligation to ensure that such activities within their jurisdiction and control do not cause damage to the environment of other States or areas beyond their national jurisdiction.[443] Stemming from this obligation, a proper environmental impact assessment is a prerequisite. A State is obliged, as a matter of general international law, to assess the extent to which activities within its jurisdiction will cause harm to other States, particularly in areas or regions of shared environmental conditions, and to consult with neighbouring States about the environmental implications of the planned activities. As noted in the Stockholm Declaration of the United Nations Conference on the Human Environment, "[r]ational planning constitutes an essential tool for reconciling any conflict between the needs of development and the need to protect and improve the environment."[444]

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442 **Vol. II, Annex N° 30**, Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010), p. 45, (emphasis added)

443 Report of the United Nations Conference on the Human Environment, Rio Declaration on Environment and Development, 1992, A/CONF.151/26 (Vol. I), Principle 2; see also Principle 21.

444 Declaration of the United Nations Conference on the Human Environment, Stockholm, 16 June 1972, Principle 14.

5.23. The necessity of a proper environmental impact assessment in order to prevent or minimise transboundary harm is now a well recognized requirement of general international law: the Court recently had the occasion to declare it,[445] it is embodied in a number of instruments,[446] and it is also a requirement of treaties to which Nicaragua is a party, including the Convention on Biological Diversity (CBD). CBD Article 14 requires that:

> "1. Each Contracting Party, as far as possible and as appropriate, shall:
>
> (a) Introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects and, where appropriate, allow for public participation in such procedures;
>
> (b) Introduce appropriate arrangements to ensure that the environmental consequences of its programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account;
>
> (c) Promote, on the basis of reciprocity, notification, exchange of information and consultation on activities under their jurisdiction or control which are likely to significantly affect adversely the biological diversity of other States or areas beyond the limits of national jurisdiction, by encouraging the

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445 *Case Concerning Pulp Mills on the River Uruguay (Argentina v. Uruguay)*, Judgment, 20 April 2010, pp. 60-61 (para 204).

446 See for example the Principles of Conduct in the Field of the Environment for the Guidance of States in the Conservation and Harmonious Utilization of Natural Resources Shared by Two or More States, GA Res 34/186, 18 December 1979, Principle 5; the World Charter for Nature, 28 October 1982, A/Res/37/7, paras. 11 (b) and (c); Report of the United Nations Conference on the Human Environment, Rio Declaration on Environment and Development, 1992, UN doc. A/CONF.151/26 (Vol. I), Principle 17; the ILC Draft Articles on Prevention of Transboundary Harm from Hazardous Activities of 2001, *Official Record of the General Assembly*, *Fifty-sixth Session*, *Supplement No. 10*, UN doc. A/56/10, Article 7; and 1987 Goals and Principles of Environmental Impact Assessment of the United Nations Environment Programme, UNEP/WG.152/4 Annex (1987), document adopted by UNEP Governing Council at its 14th Session (Dec. 14/25 (1987)).

> conclusion of bilateral, regional or multilateral arrangements, as appropriate;"[447]

5.24. The Court made clear in the *Pulp Mills* case that an environmental impact assessment is a requirement under general international law:

> "it is the view of the Court that it is for each State to determine in its domestic legislation or in the authorization process for the project, the specific content of the environmental impact assessment required in each case, having regard to the nature and magnitude of the proposed development and its likely adverse impact on the environment as well as to the need to exercise due diligence in conducting such an assessment. The Court also considers that an environmental impact assessment must be conducted prior to the implementation of a project. Moreover, once operations have started and, where necessary, throughout the life of the project, continuous monitoring of its effects on the environment shall be undertaken."[448]

5.25. Costa Rica's complaint in this regard is that the Nicaraguan EIS conducted in relation to the dredging works on the San Juan is incomplete, as it did not consider the transboundary impacts of those works.

5.26. Thus, the failure of Nicaragua is twofold: first, Nicaragua at no point advised Costa Rica that it was intending to commence the dredging works in accordance with Article 5(1), nor did it provide Costa Rica with a copy of the relevant EIS documents. Second, Nicaragua's EIS in respect of the works on the San Juan is manifestly inadequate, insofar as it fails to take account of potential transboundary impacts that the dredging works might have.

5.27. Nicaragua has breached similar obligations under the Convention on the Conservation of Biodiversity and Protection of Priority Wildlife Areas in

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[447] Convention on Biological Diversity, Rio de Janeiro, 5 June 1992, 1760 UNTS 79.

[448] *Case Concerning Pulp Mills on the River Uruguay (Argentina v. Uruguay)*, Judgment, 20 April 2010, para. 205 (emphasis added).

Central America are accounted for. Articles 13 (g) and 33 of the Convention set out basic rules of notification and consultation. These rules were agreed to allow member countries that maybe affected by potentially harmful activities in the territory of another member to take all necessary measures to mitigate or to prevent those harmful activities from taking place. Nicaragua's omissions fall clearly outside the duties imposed by the Convention. Nicaragua has breached its international obligations set forth in the aforementioned Convention by not cooperating with or informing Costa Rica of its intended activities in the border region, despite Costa Rica's requests for information of the particularly harmful activities Nicaragua has carried out and continues to carry out in the border area.

C. The Environmental Protection Regime

(1) Overview

5.28. In addition to its breaches of procedural obligations, Nicaragua has breached its obligations in respect of the substantive environmental protection regime established for the protection of the fragile San Juan river basin. Nicaragua has caused actual damage to Costa Rica's territory, through both activities undertaken on its own territory (i.e. dredging of the San Juan up to the right bank of the river) and by acts undertaken whilst in occupation of Costa Rica's territory.

5.29. In respect of the former, the obligation not to *cause* transboundary harm (as opposed to the obligation merely to notify and consult about the *risk* of harm) is a recognised rule of general international law. As the Court noted in the *Legality of the Threat or Use of Nuclear Weapons* Advisory Opinion:

> "The existence of the general obligation of States to ensure that activities within their jurisdiction and control respect the

> environment of other States or of areas beyond national control is now part of the corpus of international law relating to the environment."

5.30. And as set out in the *Trail Smelter* arbitral award:

> "[U]nder the principles of international law…no State has the right to use or permit the use of its territory in such a manner as to cause injury…in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence."

5.31. In respect of the latter, any and all acts causing environmental harm undertaken on Costa Rica's territory while in unlawful occupation of that territory, whether or not such acts amount to harm of "serious consequence", are in themselves inherently unlawful.

5.32. Yet Nicaragua is bound by more than simply general standards of international law. As will be seen in Part 2 of Section D, the Ramsar Convention establishes a standard of protection with respect to wetlands of international importance, which Nicaragua's acts (both internal and whilst in occupation) contravene. Part 3 sets out Nicaragua's obligations in respect of the bilateral agreements which form part of the regime for the protection of the environment – the International System of Protected Areas for Peace (SI-A-PAZ) and the Convention on the Conservation of Biodiversity and Protection of Priority Wildlife Areas in Central America, which Nicaragua has failed to give effect to. Part 4 examines the scope of the 1888 Cleveland Award and it will demonstrate Nicaragua's obligation not to undertake works of improvement on the San Juan that would "result in the occupation, flooding or damage of Costa Rica territory, or in the destruction or serious

impairment of the navigation of the said River [San Juan] or any of its branches".[449]

(2) Ramsar Convention: General Standard of Protection

5.33. The 1971 Ramsar Convention highlights the fundamental ecological function of wetlands as regulators of water regimes and as habitats supporting a diverse and characteristic flora and fauna, especially waterfowl. The Preamble to the Convention notes that wetlands constitute a resource of great economic, cultural, scientific, and recreational value, the loss of which would be irreparable; and the importance of ensuring the conservation of wetlands and their flora and fauna by combining far-sighted national policies with coordinated international action.[450] The very purpose of the Ramsar Convention is the protection of vulnerable ecosystems, and the provision of a registration mechanism by which States parties agree to uphold such principles of environmental protection in particular internal regions.

5.34. As set out in Chapter II, both Costa Rica and Nicaragua have registered territories as "Wetlands of International Importance", specifically the *Refugio de Vida Silvestre Río San Juan* (Nicaragua) and the *Humedal Caribe Noreste* (Costa Rica). Together, these wetlands form part of an ecosystem which includes both sides of the final 31.5 kilometres of the course of the San Juan, before it empties into the Caribbean Sea. As emphasized by Judge Sepúlveda-Amor in his Separate Opinion appended to the Order on Provisional Measures:

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[449] **Vol. II, Annex N° 7**, Award of the Arbitrator, the President of the United States, upon the validity of the Treaty of Limits of 1858 between Nicaragua and Costa Rica, para. 3(6).

[450] **Vol. II, Annex N° 14**, Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar (Iran), 2 February 1971, as amended by the Paris Protocol of 3 December 1982 and Regina Amendments of 28 May 1987, Preamble.

> "It must be recalled that the Humedal is intimately linked to both the Refugio de Vida Silvestre Corredor Fronterizo and the Refugio de Vida Silvestre Río San Juan Ramsar site. The fact that these wetlands are interconnected means that their environmental protection requires a wider bilateral collaboration and the full assistance of the Ramsar Secretariat."[451]

5.35. Although the *Humedal Caribe Noreste* and the *Refugio de Vida Silvestre Río San Juan* are legally distinct areas, in environmental terms the ecosystems form part of a whole, thus, change or damage to one part of the wetland ecosystem will necessarily impact the rest.

5.36. The area in question is best described as

> "...a mosaic of channels and shallow water bodies (lagoons), grass marshes, and wooded swamps fed by the Río San Juan. At the coast, a geomorphologically-active system of sand bars, spits, and barrier beaches separates the freshwater and brackish wetlands from the Caribbean Sea except where it is breached by rivers; principally, the Río San Juan and the Río Colorado. The main supply of freshwater comes from the basin and sub-basins of the Río San Juan, which is distributed unequally at the Delta with most of the discharge flowing south in the Río Colorado and a much smaller proportion flowing north in the Río San Juan, due to regional geological and neotectonic controls on the morphology of the rivers and the Delta. These rivers are linked to a groundwater system that maintains the high phreatic surface in the superficial aquifer. Tides in the Caribbean Sea influence water levels in the estuaries and coastal lagoons, especially during periods of low river flow, controlling the position and gradient of the halocline and generating a supply of salt water to water bodies close to the coast."[452]

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[451] *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, Request for the Indication of Provisional Measures, Order of 8 March 2011, Separate Opinion of Judge Sepúlveda-Amor, para 4.

[452] **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of

5.37. The contracting parties, in ratifying the Ramsar Convention, have undertaken to promote the conservation of and commit to the protection of the relevant wetlands of international importance, and not merely those located within their own boundaries. In particular, contracting parties are obliged to:

- Designate suitable wetlands within their territory for inclusion in a List of Wetlands of International Importance;[453]
- Formulate and implement their planning so as to promote the conservation of the wetlands included in the List; as far as possible ensure the wise use of wetlands in their territory; and inform the Ramsar Secretariat at the earliest possible time if the ecological character of any wetland in its territory and included in the List has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference;[454] and
- Promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening.[455]

5.38. Article 2(2) of the Convention notes that wetlands must be selected for inclusion in the List "on account of their international significance in terms of ecology, botany, zoology, limnology or hydrology." The emphasis

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the San Juan River and the environmental impacts on Costa Rican territory", Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham.

453 **Vol. II, Annex N° 14**, Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar (Iran), 2 February 1971, as amended by the Paris Protocol of 3 December 1982 and Regina Amendments of 28 May 1987, Article 2(1).

454 Ibid., Articles 3 and 8.

455 Ibid., Article 4.

of the Convention on the general protection of wetland environments is notable in the requirement of Article 3(1) that parties not only promote the "wise use of wetlands in their [own] territory", but also the conservation of any and all of the protected wetlands included in the List. The entirety of the *Humedal Caribe Noreste* and the *Refugio de Vida Silvestre Río San Juan* benefits from the protection afforded by the Ramsar Convention, and as such, both parties are obliged to their protection.[456]

5.39. Nicaragua's plan to undertake substantial dredging works that would impact on two Ramsar protected sites without the necessary environmental safeguards in place, and the felling of primary forest as well as the construction of an artificial *caño* through a Ramsar protected site located on foreign territory, are clearly contrary to the object and purpose of the Ramsar Convention as set out in its Articles 2 to 4; that is, to conserve and protect wetlands of international importance. Moreover, Nicaragua has failed to notify the Ramsar Secretariat of its intention to undertake these works and of their estimated impact on those wetlands, which in itself is a breach of Article 8(2)(c) of the Ramsar Convention.[457] Nor has Nicaragua sought to consult with the Ramsar Secretariat on mechanisms by which it might minimize, or compensate for, the damage that it is causing to those wetlands.

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[456] Further on the ecological value of wetlands see **Vol. IV, Annex N° 157**, Aguilar-González, B. et. al. 2011. "A Summary of Actual and Potential Environmental Service Losses Due to the Current Ecological Conflict in the Portillos/Calero Island Region in the Caribe Noreste Wetland in Northeastern Costa Rica", San José, Costa Rica: Fundación Neotrópica, p. 11.

[457] **Vol. II, Annex N° 14**, Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar (Iran), 2 February 1971, as amended by the Paris Protocol of 3 December 1982 and Regina Amendments of 28 May 1987, Article 8(2)(c).

(3) SI-A-PAZ and the Convention on the Conservation of Biodiversity and Protection of Priority Wildlife Areas in Central America

5.40. Nicaragua is also bound by other regional agreements and arrangements on environmental protection, specifically the 1990 SI-A-PAZ agreement (that sought to implement an International System of Protected Areas for Peace) and the 1992 Convention on the Conservation of Biodiversity and Protection of Priority Wildlife Areas in Central America.[458]

5.41. The SI-A-PAZ agreement, signed at Puntarenas on 15 December 1990, pursues a policy of cooperation in the protection of the environment and for the implementation of sustainable development policies, particularly of the border region between Costa Rica and Nicaragua. Points 7 to 10 of the SI-A-PAZ Preamble state the object and purpose of the agreement:

> (7) The largest example of a tropical rainforest located along Central America's Caribbean coast will be fully protected in the SI-A-PAZ;
>
> (8) The area has an extraordinary diversity of habitats such as rainforests and riversides, rivers, lagoons and wetlands, as well as a vast wealth and diversity of fauna, and major potential for ecotourism;

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[458] The Convention is in force, see: <http://www.sica.int/busqueda/busqueda_basica.aspx?IdCat=&IdMod=3&Idm=1&IdmStyle=1>. Nicaragua ratified the Convention on 29 September 1995, by decree No. 49-95, published in Nicaragua's Official Gazette No. 198, on 23 October 1995, see **Vol. II, Annex N° 19**. Costa Rica ratified the Convention by Law 7433 of 7 September 1994, published in Costa Rica's Official Gazette No. 193, on 11 October 1994. See **Vol. II, Annex N° 17**

> (9) The area is inhabited by marginalized rural groups that have been unable to achieve sustainable development due to a lack of financial resources and technical advice;
>
> (10) There is an interest and the political will to put into practice projects for national and sustained management of natural resources, with respect for the sovereign rights of each country, in order to improve the quality of life of the local populations and those of both countries in general.[459]

5.42. Article 1 of the Agreement specifically declares SI-A-PAZ as the conservation project with the highest priority in both countries.[460] This agreement is still in force, and from the outset it established coordinated efforts to protect the border's area natural resources. In the spirit of this agreement, Nicaragua ought not to carry out any activities that would imply the deterioration of the natural resources, including its forests, wetlands, rivers and lagoons. This obligation has been breached by Nicaragua's actions, as set out above.

5.43. The Convention on the Conservation of Biodiversity and Protection of Priority Wildlife Areas in Central America, set out above, further obliges Nicaragua to preserve and protect areas of significant biodiversity in the region. Article 1 of the Convention states:

> "The objective of this Agreement is to conserve, to the best possible degree, the biological, land, and coastal and

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[459] **Vol. II, Annex N° 22**, Agreement over the Border Protected Areas between Costa Rica and Nicaragua (International System of Protected Areas for Peace SI-A-PAZ Agreement), 15 December 1990.

[460] Ibid.

> marine diversity of the Central American region in order to benefit the present and future generations".[461]

5.44. Article 10 of the Convention outlines, with remarkable clarity, the obligations of each contracting State:

> "Each member state of this regional framework makes a commitment, in accordance with its capacities, national programmes and priorities, to take the necessary measures to ensure the conservation of biodiversity, and its sustainable use, as well as the development of its components within its national jurisdiction, and to cooperate, as much as possible, in border and regional actions."[462]

5.45. Article 18 of the Convention underlines the geographical areas covered by the Convention:

> "Within this Agreement, priority will be given to developing and strengthening protected border areas in the following land and coastal regions, known as : … International System of Protected Areas for Peace (SI-A-PAZ)."[463]

5.46. It is clear that a significant regime of substantive environmental protection exists, a regime which Nicaragua is obliged to give effect to. However, it is clear—for the reasons already given—that Nicaragua has failed in its obligations in this respect.

(4) Treaty of Limits as interpreted by the Cleveland Award

5.47. All activities in the border region must be carried out within the scope of the provisions of the Treaty of Limits, as interpreted by the Cleveland Award. The Cleveland Award determined not only the validity of

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461 Ibid., Article 1.

462 Ibid., Article 10.

463 Ibid., Article 18.

the Treaty of Limits and confirmed Costa Rica's rights of navigation on the San Juan, but also responded to 11 points of "doubtful interpretation" raised by Nicaragua.[464] One of these points was whether...

> "Costa Rica can prevent Nicaragua from executing, at her own expense, the works of improvement [in the San Juan]? Or, shall she have any right to demand indemnification for the places belonging to her on the right bank, which may be necessary to occupy, or for the lands on the same bank which may be flooded or damaged in any other way in consequence of the said works?"[465]

5.48. At paragraph 3(6) of the Award, President Cleveland found that:

> "The Republic of Costa Rica cannot prevent the Republic of Nicaragua from executing at her own expense and within her own territory such works of improvement, *provided* such works of improvement do not result in the occupation or flooding, or damage of Costa Rica territory, or in the destruction or serious impairment of the navigation of the said river or any of its branches at any point where Costa Rica is entitled to navigate the same. The Republic of Costa Rica has the right to demand indemnification for any such places belonging to her on the right bank of the river San Juan which may be occupied without her consent, and for any lands on the same bank which may be flooded or damaged in any other way in consequence of works of improvement."[466]

5.49. As such, while President Cleveland found that Costa Rica could not prevent Nicaragua from executing works of improvement within her own territory, that is, on the San Juan River but excluding its right bank, such works of improvement are conditional upon there being no resulting

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464 **Vol. II, Annex N° 5**, Nicaragua, Department of Foreign Relations, 'Points Which, According to the Government of Nicaragua, Are Doubtful and Require Interpretation', 22 June 1887, reproduced in P. Pérez Zeledón, Argument on the Question of the Validity of the Treaty of Limits between Costa Rica and Nicaragua (Washington, D.C.: Gibson Bros, 1887), 9-11.

465 **Vol. II, Annex N° 7**, Award of the Arbitrator, the President of the United States, upon the validity of the Treaty of Limits of 1858 between Nicaragua and Costa Rica, 10.

466 Ibid (emphasis in original).

occupation or flooding of, or damage to neighbouring Costa Rican territory. President Cleveland's emphatic use of the word "provided" is crucial; it refers to the preconditions underpinning Nicaragua's right to execute works of improvement on the San Juan.

5.50. The Oxford English Dictionary defines "provided" as follows: "[o]riginally in legal and formal use: with the provision or condition (that); it being provided, stipulated, or arranged (that). In later use more generally: on the condition, supposition, or understanding (that)."[467] The same definition of "provided" was in use at the time of the Cleveland Award. The Oxford English Dictionary from that period, known then as A New English Dictionary, defined "provided" as "[w]ith the provision or condition (that); it being provided, stipulated, or arranged (that): used chiefly in legal and formal statements; also, in general used, more loosely: [o]n condition, supposition, or understanding (that)."[468] Other dictionaries published in the United Kingdom from around this period contain similar definitions.[469] A dictionary published on the other side of the Atlantic Ocean at the time of the Cleveland Award is even more categorical that the term "provided" refers to an established condition: "[t]his (or it) being understood, conceded, or established; on (this) condition; on these terms: in this sense always

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467 Oxford English Dictionary Online, http://www.oed.com/.

468 James A. H. Murray (ed.), *A New English Dictionary* (Oxford: Clarendon Press, 1888-1933), Vol. VII, Pt. II, p. 1522.

469 Webster's Complete Dictionary of the English Language of 1847 defines "provided" as "[o]n condition; by stipulation; with the understanding": Chauncey A. Goodrich and Noah Porter (eds), *Dr. Webster's Complete Dictionary of the English Language* (London: Bell and Daldy, 1847), p. 1054; Chamber's English Dictionary of 1872 defines "provided" as "[o]n condition: upon these terms: with the understanding.": James Donald (ed), *Chamber's English Dictionary* (W. & R. Chambers: London and Edinburgh, 1872), p. 630; Cassell's English Dictionary of 1891 defined the verb "to provide" as "[t]o foresee; to procure or prepare beforehand; to furnish; to lay down as a preliminary condition": John Williams (ed.), *Cassell's English Dictionary* (Cassell & Company, Limited: London, Paris, Melbourne, 1891), p. 700;

introducing a clause of condition or exception and followed by *that* (expressed or understood)."[470] The term "provided" in Paragraph 3(6) of the Award was employed to make clear that Nicaragua's right to conduct works of improvement on the San Juan is subject to the condition of not occupying, flooding or damaging Costa Rican territory.

5.51. During the oral hearing on the request for the indication of Provisional Measures, Nicaragua argued that Costa Rica had no right to prevent Nicaragua from carrying out works of improvement on the San Juan; all it had (at most) was a right of indemnification for any occupation, flooding or damage to its territory caused by Nicaragua. Counsel for Nicaragua stated:

> « La République du Costa Rica *ne peut pas* empêcher» de tels travaux, Monsieur le président ; elle ne le peut pas ! Elle n'a pas un droit ; elle a une *obligation* de *ne pas* empêcher […] quand bien même il y aurait préjudice *(quod non)*, le Costa Rica ne pourrait pas empêcher le dragage ; tout au plus pourrait-il prétendre à une indemnisation, conformément aux termes tout aussi exprès et tout aussi ignorés par les avocats du Costa Rica du même point 3.6 de la sentence Cleveland. »[471]

5.52. Nicaragua contends that it has the right to inflict harm, "buying it off" with the payment of compensation. Such an interpretation would allow Nicaragua the right to cause damage to its neighbour, with, at most, indemnification to be sought after the event. This is an intolerable reading, converting a safeguard for Costa Rica into a permissive license for Nicaragua. On this matter, the Court considered:

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[470] William D. Whitney (ed.), *The Century Dictionary* (New York: The Century Co., 1889-91), Vol. IV, p. 4804.

[25] CR 2011/2 pp. 56-57 (para 14) (Pellet).

> "...whereas Costa Rica contends that it has the right to request the suspension of the dredging operations on the San Juan river if they threaten seriously to impair navigation on the Colorado river or to damage Costa Rican territory; whereas, relying on the second sentence of paragraph 6 of the third clause of that Award, quoted above, Nicaragua argues that, if any damage results from the works to maintain and improve the San Juan river, Costa Rica can only seek indemnification, and therefore that Costa Rica, in the event of risk of harm, cannot obtain by means of provisional measures a remedy which the Award would exclude on the merits; whereas Costa Rica responds that indemnification is not the only remedy available to it; whereas at this stage of the proceedings, the Court finds that the rights claimed by Costa Rica are plausible;"[472]

5.53. To repeat, paragraph 3(6) of the Cleveland Award establishes a conditional and limited right on the part of Nicaragua to conduct works on the San Juan. The right of Costa Rica not to have its territory flooded or occupied or damaged in any way is the foundation of this part of Award. Nicaragua has only the right to conduct works of improvement on the San Juan if and to the extent that those works do not result in any damage to, occupation or flooding of Costa Rican territory. As a corollary, if Costa Rica's territory is occupied, flooded or damaged, the Award also grants Costa Rica the right to demand an indemnification for any damage that works on the San Juan, carried out on Nicaragua's own territory, causes. But Costa Rica's rights and remedies are not limited to the right to request indemnification after its territory has been occupied, flooded or damaged; Nicaragua has no right to cause harm to Costa Rican territory from the outset. If Costa Rica can demand an indemnity from Nicaragua for damage inflicted to Costa Rican territory, it has the right equally not to be so

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[26] Order of 8 March 2011, p. 14 (para 59) (emphasis added).

damaged in the first place; with the resultant right to resist any damage or harm that may be caused to its territory.

5.54. In a further argument made by Nicaragua during the oral phase on Provisional Measures, Nicaragua affirmed:

> « […] C'est pourtant celui-ci qui est pertinent ; d'abord parce qu'il en résulte que la sentence Cleveland envisage expressément et la possibilité de travaux d'amélioration (et nul ne conteste que c'est ce dont il s'agit) et le risque d'un dommage, ce qui interdit de considérer que la demande remplit la désormais très fameuse condition du *fumus boni juris* ; et, ensuite parce que cette disposition dit pour droit que, si ce risque se réalisait, la seule réparation envisageable serait l'indemnisation. »[473]

Again Nicaragua misses the point of the Award. The core point of President Cleveland's decision is that the works of improvement Nicaragua can carry out in the San Juan can only be conducted "provided" these do not cause harm to Costa Rica.

5.55. Under general international law sovereignty does not give license to injure another State's territory. *A fortiori* Nicaragua can have no right to conduct "works of improvement" over the course of the San Juan River which harm Costa Rica's territory or rights and which Costa Rica has the right to oppose. Nicaragua's formulation means that its right to carry out works of improvement on the San Juan, even when harming Costa Rica, takes precedence over Costa Rica's rights not to be harmed. There is no basis for this view in the Cleveland Award, or in general international law.

5.56. At stake is not only the current dredging program but the entire border regime. Permitting Nicaragua to harm first and pay later would open the door for new depredations against Costa Rica, as Nicaragua has indeed

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473 CR 2011/4 pp. 32 (para 20) (Pellet) (footnotes omitted).

foreshadowed.[474] The result would be a conflicted border region, open to any form of transboundary harm accompanied by the promise of later payment, if at all. This is to rewrite the entire border regime at Costa Rica's expense.

5.57. Nicaragua will no doubt argue that its dominion over the waters of the San Juan would be curtailed if Costa Rica is allowed to protect itself by preventing Nicaragua from carrying out works of improvement over the river. However, this is not what Costa Rica has been advocating. Since 2006, Costa Rica repeatedly asked Nicaragua to furnish to it all the necessary studies (which Nicaragua refused to provide) to make sure that Costa Rica's territory would not be harmed. Costa Rica does not oppose Nicaraguan works of improvement, provided no material harm will be suffered by Costa Rica.[475]

5.58. Under these circumstances, Nicaragua's unilateral program of dredging and related works is unlawful, and Costa Rica has the right to the suspension of those works until it is made clear that Costa Rica's territory, including the Colorado River, will not be harmed.

5.59. In the following sections, Costa Rica sets out the evidence of damage caused or likely to be caused by Nicaragua to Costa Rican territory by the dredging works carried out on the San Juan, and by the construction of the artificial *caño* on Costa Rican territory.

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474 **Vol. II, Annex N° 30**, Government of Nicaragua "The San Juan de Nicaragua River: The Truths that Costa Rica Hides" (2010), p. 45. See also **Vol. III, Annex N° 128,** La Prensa, "Hydroelectric Brito, amid fears and benefits", 11 April 2011; and **Vol. III, Annex N° 129,** La Prensa, "The drawbacks of the Brito Project", 11 April 2011.

475 **Vol. III, Annex N° 43**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-187-06, 5 May 2006. See also **Vol. III, Annex N° 137,** Castillo, Enrique, "Our cause": Article by the Minister of Foreign Affairs and Worship of Costa Rica, 21 September 2011, La Nación.

D. Environmental Damage Caused by Nicaragua

5.60. As Costa Rica set out in Chapter III, Nicaraguan army troops entered and occupied Costa Rican territory in October 2010 in connection with certain dredging activities on the San Juan and the construction of an artificial *caño* from the San Juan to Laguna Los Portillos. As a consequence, Nicaragua has destroyed part of a fragile wetland containing primary forest on Costa Rican territory.

5.61. As established in Chapter IV, the mere fact of Nicaragua's unlawful presence on this territory is in breach of the established boundary regime and general international law. All damage that results directly from this occupation is inherently unlawful.

5.62. Stemming directly or indirectly from Nicaragua's actions in the border region, the following damages, but not limited to these, have been, are being or will continue to be caused to Costa Rican territory:

(1) the deposit of sediment from the San Juan on Costa Rican territory;

(2) the felling of primary forest in Costa Rican territory, specifically in a wetland of international importance, and the unlawful removal of the cut wood from Costa Rica territory;

(3) the removal of soil and the destruction of undergrowth on Costa Rican territory; and its deposit in turn into the wetland;

(4) the attempted deviation of the San Juan through an artificial *caño* constructed on Costa Rican territory;

(5) the fundamental alteration in the character of the river basin morphology, including deviation of the San Juan from its natural course through the cutting across of meanders, and an increase in the

velocity of the San Juan leading to a risk of substantial alterations in the natural ecological balance.

(1) Dumping of Sediments

5.63. During the course of the dredging works taking place on the San Juan adjacent to Isla Portillos, Nicaragua deposited river sediment on the right bank of the San Juan, i.e. on Costa Rican territory. Nicaragua's intention to deposit its dredging sediments on the Costa Rican bank is evident from the intended scope of the dredging project. Twenty-four listed sites designated for sedimentary deposits, were detailed in the "Environmental Impact Study" prepared by Corea y Asociados on September 2006.[476] However, in MARENA's resolution No. 038-2008, issued on 22 December 2008, approving the environmental permit for the dredging, 27 listed sites were approved.[477] The precise Universal Transverse Mercator coordinates for the dredging deposit sites were listed in a table as part of MARENA's approval, but no explanations were given justifying the added sites.

5.64. The twenty-seven sites designated for sedimentary deposits are plotted on **Sketch Map 5.1.** The red dots show the sites added in resolution No. 038-2008. It is immediately apparent that several sites are on the right,

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476 **Vol. IV, Annex N° 158** [excerpts], Corea y Asociados S.A. "*Estudio de Impacto Ambiental para el Mejoramiento de la Navegación en el río San Juan de Nicaragua*", September 2006 (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011), p. 197.

477 **Vol. IV, Annex N° 160,** Resolution No. 038-2008, Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 22 December 2008 (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011), para. 2.

Costa Rican, bank of the San Juan. Photographs of the sediment deposits are annexed.[478]

5.65. By 17 December 2010, the dredging deposits in Isla Portillos were estimated to amount to approximately 1,688m^3.[479] During the site visit conducted by Costa Rican personnel in charge of environmental protection, together with a technical mission of the Ramsar Secretariat on 5 and 6 April 2011, no changes were observed in this area, and the damage caused by the sediment deposition was deemed as irreversible.[480]

5.66. The deposit of river sediments in the wetland has in itself an irreversible effect. The sediment dries up the land where the deposits are made, and causes an immediate change to the biological composition of the site. The wetland cannot be restored to its previous condition, due to the change in the ecological characteristics of the components of the ecological processes of the wetland (biological, chemical and physical). The permanent nature of the damage caused by sediment dumping is confirmed in the report submitted to the Ramsar Secretariat dated 28 October 2011.[481]

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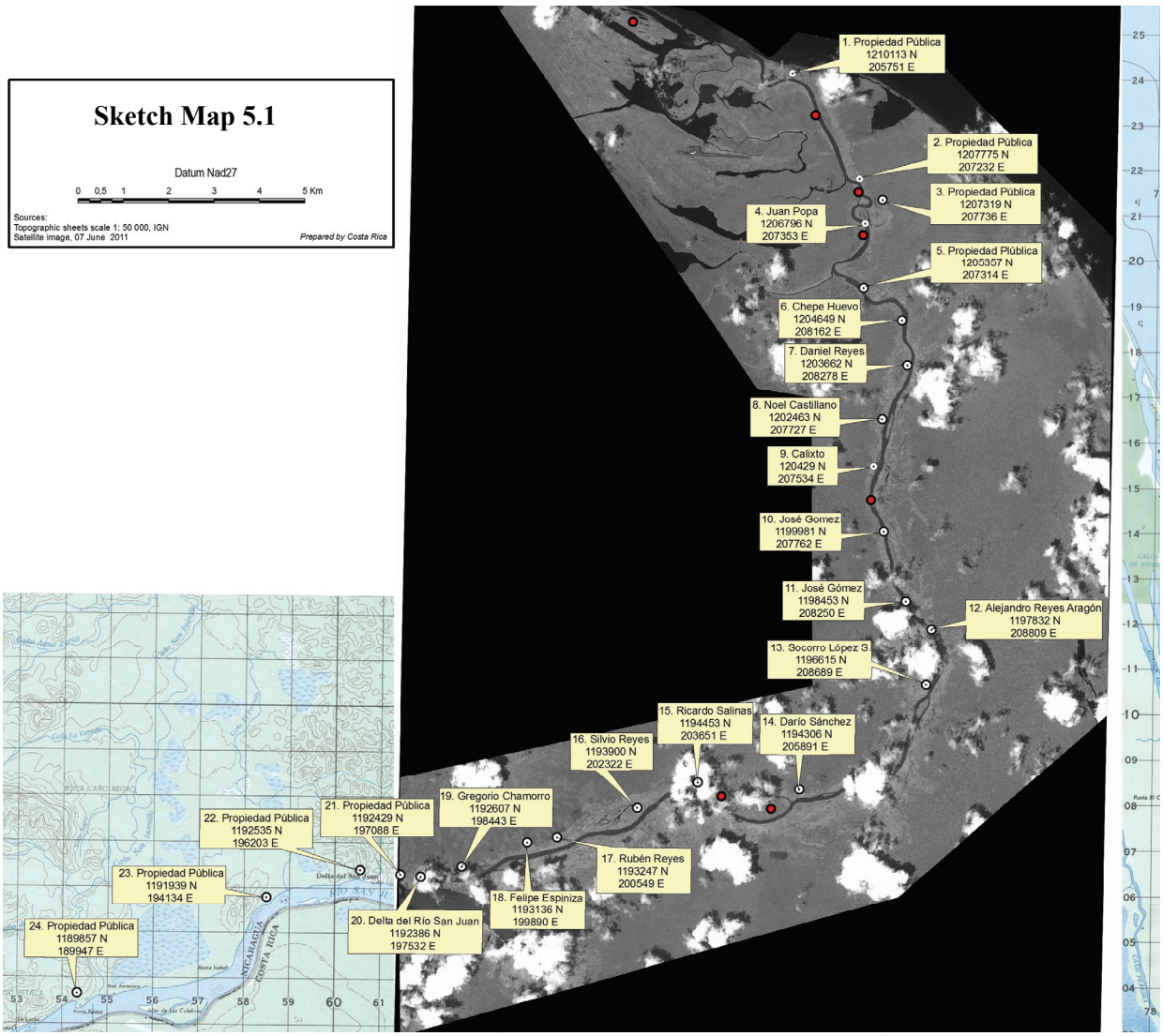
478 **Vol. V, Annexes N° 225**, Photographs of sediments deposited in Isla Portillos.

479 **Vol. IV, Annex N° 147**, Ramsar Secretariat, Ramsar Advisory Mission Report N° 69: Northeastern Caribbean Wetland of International Importance (Humedal Caribe Noreste), Costa Rica, p. 25.

480 **Vol. IV, Annex N° 155**, Ministry of Environment, Energy and Telecommunications of Costa Rica, Technical Report to Ramsar: "Assessment and evaluation of the Environmental situation in the Humedal Caribe Noreste within the framework of the Order of the International Court of Justice", 28 October 2011, p. 38.

481 Ibid.

Sketch Map 5.1



Sketch Map 5.1: Location of sediment deposit sites according to Nicaragua's EIS

(2) Felling of Trees

5.67. The felling of trees in preparation for the construction of the artificial *caño* took place from approximately October to December 2010. The chronological progression of the *caño* construction was outlined in Chapter III. For present purposes, it suffices to set out the damage that resulted.

5.68. Nicaragua has not denied that it has felled a significant number of trees in the region; it conceded that "[t]o be sure, trees were felled",[482] and it has admitted to felling at least 180 of them.[483] The actual number of trees felled is higher than this figure. In its 22 October 2010 Report, MINAET noted that "a large area … was felled …and where the forest was completely eliminated, with a large number of trees knocked down and a pile of cut wood."[484] Following the inspection carried out on 5 and 6 April 2011, and with the aid of satellite images that allow measurement of the areas where trees were also felled after October 2010, a new estimate places the total number of felled trees at around 292.[485] Indeed, satellite image analysis and the April 2011 inspection established that two new areas that previously had been cleared of undergrowth were felled. One of these areas is located in a sector right next to the Laguna Los Portillos. As at the date of filing this

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482 CR 2011/2, pp. 45-46, para 44 (Reichler).

483 Ibid.

484 **Vol. IV, Annex N° 143**, Costa Rica, (SINAC) Ministry of Environment, Energy and Telecommunications Report, Ref: ACTo-RNVS-CyP-057-2010, 22 October 2010, para 7.

485 **Vol. IV, Annex N° 155**, Ministry of Environment, Energy and Telecommunications of Costa Rica, Technical Report to Ramsar: "Assessment and evaluation of the Environmental situation in the Humedal Caribe Noreste within the framework of the Order of the International Court of Justice", 28 October 2011, pp. 43-46.

Memorial, the total area of felled forest amounts to 2.48 hectares.[486] The remaining area of cut undergrowth is 3.27 hectares. Together, these cleared and felled areas amount to some 5.75 hectares.[487]

5.69. In a report produced by SINAC in December 2010, based on the varying diameters of the felled trees, their age ranged between 24 and 309 years old, with an average age of between 29.7 and 247.6 years. [488] SINAC observed that "the presence of trees on site that are over 200 years old can be proven, which implies the forest has existed for at least as long as that."[489]

5.70. Moreover, it is notable that stumps of at least 20 trees of different species of trees felled by Nicaragua are located in the middle of the supposedly pre-existing *caño.*[490] Based on the diameter measurement of the largest tree stumps, trees of more than 250 years old were located where the artificial *caño* now runs;[491] as the following photographs make clear:

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486 Ibid., p. 43-44.

487 Ibid., pp. 49, 51.

488 **Vol. IV, Annex N° 145**, Costa Rica, Sistema Nacional de Áreas de Conservación Area de Conservación Tortuguero (SINAC), "Appraisal of maximum average age of the trees felled in primary forest areas in the Punta Castilla, Colorado, Pococi and Limon sectors of Costa Rica, as a result of the Nicaraguan Army's occupation for the apparent restoration of an existing canal", December 2010, p. 9.

489 Ibid.

490 **Vol. IV Annex N° 154**, Costa Rica, Ministry of Environment, Energy and Telecommunications and Sistema Nacional de Áreas de Conservación (SINAC) Report "Age approximation of trees cut in the area under Costa Rica's environmental management located on the causeway of the artificial channel built on a portion of territory of Calero Island the San Juan River with Los Portillos Lagoon", August 2011, p. 7.

491 Ibid.

Figure 5.1



Figure 5.2



Figures 5.1 and **5.2**: Photographs of tree stumps on the causeway of the artificial *caño*, 5 April 2011

5.71. Felling of the trees not only constitutes damage in and of itself, but it results in further damage to the ecology of the region, in particular the local groundwater supply. As noted by Ramsar in its Advisory Mission N° 69 Report:

> "if deforestation continues, water retention in the soils above groundwater level will diminish and therefore the local aquifer recharge will also diminish. Although it is clear that this effect will be very localized to the island and to the south of the southern edge of the artificial canal, this would lead to consequent changes in the dynamics of the aquifer with respect to the surface run-off and changes in the island's flora."[492]

5.72. Furthermore, as noted in this same report, the felling of trees in a sensitive wetland ecosystem with high rates of rainfall has "an irreversible

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[492] **Vol. IV, Annex N° 147**, Ramsar Secretariat, Ramsar Advisory Mission Report N° 69: Northeastern Caribbean Wetland of International Importance (Humedal Caribe Noreste), Costa Rica, p. 26.

impact on vegetation cover in the wetland (trees and undergrowth)" with the loss of "soil and seed bank". This damage is exacerbated by the fluvial erosion.[493]

5.73. Costa Rica's independent expert report concurs with these findings. Professor Thorne points out that: "Primary forest is irreplaceable and the environmental functions it performs and ecological services it provides cannot be replaced by planting replacement trees in mitigation."[494] He further notes that:

> "clearing the path for the 'Caño' involved destroying hundreds of trees, including some over 200 and perhaps 250 years old, that are irreplaceable and were providing outstanding habitat and valuable ecological services in an area of primary wetland forest"[495]

5.74. In addition to felling nearly 300 trees, Nicaragua has also removed the cut wood from Costa Rican territory, thereby unlawfully appropriating Costa Rican natural property.

(3) Removal of Soil and Destruction of Undergrowth

5.75. Nicaragua has also removed soil and destroyed undergrowth on Costa Rican territory in order to make way for its artificial *caño*. After felling the trees, construction of the artificial *caño* proceeded with the destruction of undergrowth to create paths of cleared land across Isla Portillos. Parts of these cleared paths were later excavated, allowing underground water to rise to the surface, and the waters of the San Juan and

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493 Ibid., p. 29.

494 **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, p. I-59.

495 Ibid.

the Laguna Los Portillos to enter the artificial *caño*. **Figures 5.3** and **5.4** show the progressive removal of soil and undergrowth by Nicaragua:

Figure 5.3



Figure 5.3: Photograph of the *caño* digging activities, 8 November 2010

Figure 5.4



Figure 5.4: Photograph of the *caño* digging activities, 11 November 2010

5.76. During the site visit of 5 and 6 April 2010, Costa Rican personnel in charge of the protection of the environment managed to collect data to make a preliminary estimate of the volume of soil extracted by Nicaragua while digging the artificial caño. The data collected demonstrates that approximately 5,815m^3 of soil was removed and deposited on both sides of the *caño*.[496] Costa Rica's independent expert suggests that this is an underestimate. Professor Thorne states:

> "In fact, this is likely to be an under-estimate because by April 2011 the width and depth of the 'Caño' had already been reduced from their December maxima through siltation and the accumulation of organic debris. Had the dimensions been measured on 19 November 2010, when the width estimated from a satellite image was 10m, it is likely that the volume calculated would be nearly double that estimated in April 2011 and could have exceeded 10,000 m^3. A proportion of this sediment must have been washed into the Harbor Head Lagoon, where excessive sediment loads would have damaged the aquatic and benthic environments."[497]

5.77. As such, while the amount of dug soil that has been deposited on both sides of the artificial *caño* is around 5,800m^3, the true extent of the amount of soil removed to make way for the artificial *caño* could be as much as 10,000m^3. Not only does this soil removal cause direct damage, but as Professor Thorne notes, "disturbance on this scale would certainly disrupt sub-surface, terrestrial and aquatic processes, habitats, and species".[498]

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496 **Vol. IV, Annex N° 155**, Ministry of Environment, Energy and Telecommunications of Costa Rica, Technical Report to Ramsar: "Assessment and evaluation of the Environmental situation in the Humedal Caribe Noreste within the framework of the Order of the International Court of Justice", 28 October 2011, pp. 33, 92.

497 **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, p. I-59.

498 Ibid. p. I-60.

5.78. Nicaragua has not denied that it has carried out the removal of soil and the destruction of vegetation on Isla Portillos. It confines its argument to claiming that this activity occurred on Nicaraguan territory, a claim without merit as established in Chapter IV. Regarding the building of the artificial *caño* across Costa Rican territory, Nicaragua argued before the Court during the hearings on Provisional Measures that "[v]egetation was cleared only on the Nicaraguan side of the channel",[499] and that "[w]hat is important here is that the allegedly wrongful conduct cited in the Request for Provisional Measures – the felling of trees, the removal of vegetation and the deposit of extracted sediments – has occurred on the left bank of the *caño*, the side that Nicaraguan considers its own."[500] However, the reports and photographic evidence demonstrate clearly that both (Costa Rican) sides of the artificial *caño* were impacted.

5.79. These activities of removing undergrowth and soil have caused harm to Costa Rican territory, as the very removal of undergrowth and soil from a previously undisturbed wetland has significantly changed the ecological characteristics of the wetland.[501]

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499 CR 2011/2, p.32, para 7 (Reichler).

500 Ibid., p. 45, para 43 (Reichler).

501 See **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham. See also **Vol. IV, Annex N° 155**, Ministry of Environment, Energy and Telecommunications of Costa Rica, Technical Report to Ramsar: "Assessment and evaluation of the Environmental situation in the Humedal Caribe Noreste within the framework of the Order of the International Court of Justice", 28 October 2011, and **Vol. IV, Annex N° 147**, Ramsar Secretariat, Ramsar Advisory Mission Report N° 69: Northeastern Caribbean Wetland of International Importance (Humedal Caribe Noreste), Costa Rica.

(4) Deviation of the San Juan into Harbor Head Lagoon

5.80. The purpose of constructing the artificial caño is to deviate waters from the San Juan through this caño and into Laguna Los Portillos. Nicaraguan officials have acknowledged this in public statements.[502] However, it is also evident from the scale of the artificial caño as originally planned by Nicaragua. The artificial caño was authorized to be 30m wide.[503] The area of trees felled by Nicaragua in Isla Portillos also constitutes a strong indication of the scale of the artificial caño that Nicaragua planned to construct. Nicaragua undertook this task of felling trees by working from both ends of the future *caño*, from a location starting at the Costa Rican bank of the San Juan, and from a location starting at the Costa Rican bank of Laguna Los Portillos. As can be observed from the following photographs, the clearing of primary forest at the first location, beginning from the Costa Rican bank of the San Juan and moving inland, measured close to 100m in width and 200m in length (**Figure 5.5**). At the second location, beginning on the banks of Laguna Los Portillos and moving inland across Costa Rican territory, the clearing of primary forest measured approximately 70m in width and approximately 80m in length (**Figure 5.6**). The eventual plan was to connect these two vast areas of cleared forest together, and to excavate the land therein, to create a substantial artificial *caño* across Costa Rican territory (**Figure 5.7**).

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[502] **Vol. III, Annex N° 117,** Confidencial.com (Nicaragua), "Pastora: I Interpreted the Alexander Award", 30 November 2010.

[503] **Vol. IV, Annex N° 161**, Resolution No. 038-2008-A1, Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 30 October 2009. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

Figure 5.5



Figure 5.5: Felled area near the right bank of the San Juan River, photograph of 22 October 2010.

Figure 5.6



Figure 5.6: Felled area adjacent to the south shore of Laguna Los Portillos, 18 November 2010

Figure 5.7



Figure 5.7: The two felled areas near the San Juan river and Los Portillos lagoon indicate Nicaragua's eventual plan of digging a straight canal connecting both.

5.81. Nicaragua was unable to complete the artificial *caño* on the scale that it first envisaged. Following the initiation of the present proceedings before the Court by Costa Rica on 18 November 2010, the Nicaraguan plan to construct a wide artificial *caño* appears to have been scaled back, and it proceeded to construct an artificial *caño* on a smaller scale, of narrower width and with a different direction.

5.82. Despite the smaller scale of the artificial *caño*, Nicaragua's original plan to deviate the waters of the San Juan nevertheless had and continues to have a real possibility of succeeding. By constructing an artificial *caño*

linking the San Juan to Laguna Los Portillos, Nicaragua created a new passage through which to deviate the waters of the river, leading to the eventual drying up of the lower course of the San Juan which empties out into the Caribbean Sea, and affecting the environment on both sides of this stretch of the San Juan. The cutting through of meanders in the area does in fact carry the San Juan's waters directly to the mouth of the artificial caño. It is not an exaggeration to say that this attempt to deviate the course of the San Juan risks causing substantial changes to the environment in the region; indeed that is its point. It is not, as Nicaragua has suggested, "a modest dredging and cleaning effort".[504] It is a calculated incision into Costa Rican territory intended to have serious and permanent consequences for the surrounding environment.

5.83. The expert report of Professor Thorne shows that the artificial *caño* is rapidly silting up, which in itself is a strong indication there was never a natural water course in that area. Professor Thorne notes that "although the channel of the 'Caño' that was dug in early-November 2010 grew initially, it was unable to carry the sediment load supplied by the Río San Juan (plus that derived from channel scour) and so, inevitably, it silted".[505]

5.84. Professor Thorne's report considers the precise conditions of the artificial *caño*:

> "The short-term behaviour of the 'Caño' indicates that the concentration of sediment in the flow it receives from the Río San Juan is sufficiently high to overwhelm the channel's capacity to convey all of the sediment it receives from the river to the Harbor Head Lagoon. Lack of sufficient capacity

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[504] CR 2011/2, p. 8, par. 3 (Argüello Gómez).

[505] **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, p. I-64.

> to transport the sediment received from the Río San Juan was compounded in December 2010 by the supply of additional sediment through erosion of the steep, unvegetated banks of the freshly-cut channel. Although the banks appear to have stabilised due to vegetation regrowth during summer 2011, the characteristically high-sediment concentrations in the Río San Juan mean that it is unlikely that the 'Caño' will develop the sediment-transport capacity necessary for its channel to become sustainable. It is actually much more likely that the channel will silt progressively, eventually developing the form of a vegetated swale in the floodplain that frequently features standing water but which conveys discharge to the Harbor Head Lagoon only during rare, extreme floods. In this case, the artificial connection between the Río San Juan and the Lagoon that was created in November 2010 will be short-lived and the longer-term impacts of the 'Caño' on the Río San Juan will, like the short-term impacts, be small or negligible.
>
> An important proviso to this prediction is that the wetland and floodplain disturbed by construction of the 'Caño' are allowed to recover naturally. The prediction that future impacts are likely to be negligible would no longer be valid in the event that further actions were to be taken to re-excavate or enlarge the channel linking the Río San Juan to the Harbor Head Lagoon that was created in November 2010. In this context, it should be noted that the corridor cleared through the forest to make way for the 'Caño' has been made sufficiently wide to accommodate most if not all of the discharge of the Río San Juan. This reduces the flow and erosion resistances of the forest and wetland, increasing the possibility of further diversion of flow through the channel triggering an avulsion of the Río San Juan that would divert the river along the course of the 'Caño' and into the Harbor Head Lagoon.
>
> This would be highly damaging to the river and its environment and there are compelling reasons why any plan to re-excavate or enlarge the 'Caño' should be resisted."[506]

5.85. Professor Thorne's expert opinion concludes that "had the tipping point been reached, the short-term impacts on the current channel of the Río

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[506] Ibid. p. I-63

San Juan would have been serious and, in the longer-term, decline of the historically-stable course in favour of a new course along the alignment of the 'Caño' would have had catastrophic impacts on the ecosystem the river currently supports both in its channel and the Greytown Lagoon."[507]

5.86. The environmental impact of the construction of the artificial *caño* is also set out in the report of the Ramsar Secretariat dated 28 October 2011,[508] which confirms the conclusions of Professor Thorne.[509]

5.87. Notwithstanding the harmful effects of Nicaragua's construction of the smaller-scale artificial *caño*, Costa Rica apprehends that Nicaragua may seek to continue with its plan to construct a *caño* on the scale originally anticipated. The administrative record of Nicaragua's activities in the border region only reaffirms suspicion regarding the true intention underlying these works. The cutting of meanders at the place right before the San Juan reaches the *caño* is a strong indication of Nicaragua's intention to deviate the San Juan through the *caño* permanently. The report of Professor Thorne notes that the alignment of the river in this way "could erode and open-up the mouth of the 'Caño', while its momentum would drive more of the discharge through the enlarged mouth and along the artificial channel, especially during flood events."[510] Professor Thorne further observes that:

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507 Ibid.

508 See **Vol. IV, Annex N° 155**, Ministry of Environment, Energy and Telecommunications of Costa Rica, Technical Report to Ramsar: "Assessment and evaluation of the Environmental situation in the Humedal Caribe Noreste within the framework of the Order of the International Court of Justice", 28 October 2011, pp. 30-33.

509 **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, pp. I-66, I-65.

510 Ibid., p. I-82

> "In this scenario, not only would the impacts of the cut-offs on river processes, morphology, habitats, and ecosystems be realised, but so would the impacts of diverting a substantial proportion of the river's discharge into the 'Caño' and thence to the Harbor Head Lagoon.
>
> In the 'worst-case' scenario, the diverted water might scour the 'Caño' sufficiently for the balance of flow at the bifurcation to reach the tipping point, triggering an avulsion of the greater part of the flow to a new course emptying to the Caribbean Sea via a semi-permanent breach in the barrier beach at the Harbor Head Lagoon.
>
> The rapid and unprecedented changes to hydrologic, hydraulic, sedimentary, nutrient, water quality, and salinity conditions resulting from such a radical shift in the flow would certainly cause serious and irreversible morphological and environmental degradation; not only in the channel and micro-delta of Río San Juan, the area of the Greytown Lagoon currently fed by water and sediment flows in the Río San Juan, and the coastal zone that presently receives freshwater, silt, and nutrients supplied by the river on its natural alignment; but also the Harbor Head Lagoon, wetland of the Isla Portillos, and the coastal zone [...]"[511]

5.88. Nicaragua's original 2006 EIS offers no indication that Nicaragua intended to build, as it did, or clean, as it claims it did, a *caño* connecting the San Juan and Laguna Los Portillos. As a matter of fact, neither the Laguna Los Portillos, nor the territory of Isla Portillos were assessed in the 2006 EIS document, much less was either area subjected to any environmental analysis, particularly the effect that the waters of the San Juan river would have on the fragile conditions of the lagoon, or the effects that the building of the *caño*, or the removal of soil and vegetation, could have on the wetland in the territory of Isla Portillos.

5.89. The 2006 EIS failed to address a number of key issues, including the necessary evaluation of the cross-border effects of the dredging program on

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511 Ibid.

Costa Rican territory. Moreover the EIS had already expired by the time the dredging operations started. But what is most salient is the fact that the October 2009 modification of the EIS, allowing Nicaragua to clean up (that is, construct) the artificial *caño* across Isla Portillos, did not fulfil any particular environmental requirement. EPN submitted a request to MARENA in October 2009, to "clean up" the *caño*, but no environmental analysis or any particulars regarding the details of the work plan about the cleaning of the caño were mentioned. For example, there is no indication as to why nearly 5 hectares of primary forest needed to be cleared, nor any explanation as to why nearly 2.5 hectares of old-growth forest needed to be devastated, nor any mention of replanting 10 trees for each one chopped down, nor any acknowledgement of the devastation such works would cause or the utter inappropriateness, from and environmental perspective, of planting juvenile trees in place of old-growth forest. There is also no assessment regarding the effects of the water of the San Juan coming into the Laguna Los Portillos or whether or not the increased flow would breach the sand bar dividing the Lagoon and the Caribbean Sea, not to mention the effect that such a breach could have on the waters of the Lagoon. These significant failures are all the more surprising given that MARENA's 2008 approval of the EIS stated that in the last leg of the San Juan, before its mouth in the Caribbean Sea, no dredging materials could be dumped there because of the fragile character of the environment at that location.[512] The only notable information that is contained in MARENA's permit extension was the dimension of the works, but that was all. Accordingly, MARENA approved the extension of the dredging project to include the "cleaning" of a

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[512] See also **Vol. IV, Annex N°160,** Resolution No. 038-2008, Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 22 December 2008 (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011). para. 16.

caño, with no other information than its proposed width (30m), and its length (1560m).[513]

5.90. The 2006 EIS foresaw the dredging of the river up to 30m wide, coincidentally the same width EPN requested for the cleaning of the *caño*. The path of the felled trees was nearly 100m wide. All these facts indicate that the project was not directed at cleaning any *caño*, but rather at deviating the entire San Juan across Isla Portillos, through Laguna Los Portillos, just as Eden Pastora has stated publicly.[514]

5.91. Thus, the permit extension issued by MARENA simply and summarily rubber stamped Nicaragua's blue print for the deviation of the San Juan River across Costa Rican territory. The fact that these works where never subjected to any environmental examination is highlighted by the fact that MARENA did not even consider the impact that the deviated waters of the San Juan would have on the Laguna Los Portillos, a point stressed by Ramsar.[515] There is not even information calculating the volume of water that would pass through the *caño* connecting the river with the lagoon.

5.92. It may be noted that MARENA's official website lists the environmental projects that are under review or that have been given permission by MARENA. The site lists the projects according to the year, the area where the project is located and its category. No such records exist for the EIS in respect of the dredging of the San Juan in 2006, and nothing is

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513 **Vol. IV, Annex N° 161**, Resolution No. 038-2008-A1, Ministry of the Environment and Natural Resources of Nicaragua (MARENA), 30 October 2009. (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011).

514 **Vol. III, Annex N° 117,** Confidencial.com (Nicaragua), "Pastora: I Interpreted the Alexander Award", 30 November 2010.

515 **Vol. IV, Annex N° 147**, Ramsar Secretariat, Ramsar Advisory Mission Report N° 69: Northeastern Caribbean Wetland of International Importance (Humedal Caribe Noreste), Costa Rica, 17 December 2010, p.p. 26-28.

registered regarding the permit extension in respect of the *caño* in 2009. The images of this website, and attached to this Memorial,[516] clearly show that neither project is listed.

5.93. In conclusion, the overwhelming evidence is that a *caño* connecting the San Juan River to the Laguna Los Portillos never previously existed. The construction by Nicaragua of the artificial *caño* has resulted in variable degrees of environmental harm, from the direct damage to the area of the *caño* itself, to the prospect of a significantly destructive outcome if Nicaragua does eventually carry out its intentions to deviate the San Juan into Laguna Los Portillos.

(5) Dredging and Cutting of Meanders: Changes to River Basin Morphology

5.94. For some time, Nicaragua has been gratuitously claiming that silting problems in the lower San Juan are the fault of Costa Rica.[517] The claim is that Costa Rica's actions in the broader river basin cause large sediments loads to flow into the San Juan, which later sit on the lower San Juan riverbed; this has prompted Nicaragua to carry out the dredging program as a remedial measure.[518] Yet this suggestion has never been supported by any evidence. The results of a comprehensive analysis of the geology, hydrology

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516 **Vol. II, Annexes N° 37, 38 and 39,** "Draft Environmental Assessment", MARENA'S official website for listed projects.

517 CR 2011/2, p. 9, paras. 6 and 7 (Argüello Gómez).

518 **Vol. III, Annex N° 116,** Confidencial.com (Nicaragua), "The southern border changes with the river", 28 November to 4 December 2010.

and sediment dynamics in the San Juan river basin shed light on the true situation of the lower San Juan.[519]

(a) Geology of the lower San Juan

5.95. It is convenient to highlight the most important aspects of the scientific evaluation by Professor Colin Thorne. His overall conclusion is that the lower San Juan River has not been and cannot be the bigger stream that forks out of the San Juan in the area of Delta. Geological conditions that control the position and morphology of the Delta dictate that the Colorado River has been and will continue to be the larger river.

5.96. To this end, the expert report of Professor Colin Thorne makes the following relevant findings:

> "In the geological-tectonic map of the Caribbean region published by Case and Holcombe (1980), the Hess Escarpment Fault is an important geological feature within the Caribbean Plate [...]. The fault intersects the coast of Central America close to the Delta of the Río San Juan and Río Colorado.
>
> At the coast, the Hess fault merges with the Santa Elena Fault to form a major tectonic limit between two contrasting types of the Earth's crust [...]. North of the Hess-Santa Elena Fault System lies the Chortis Block, which is continental and transitional crust, while south of it is the Caribbean Plateau, which is thickened, oceanic crust [...].[520]
>
> [...]
>
> It is not a coincidence that the Delta, where the San Juan River bifurcates into the larger, Río Colorado to the south and

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519 See **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, Part II, p. II-1.

520 Ibid., p.p. II-4, II-5

> smaller Río San Juan to the north, is located precisely on the line of the Hess-Santa Elena Fault. In fact, the geology and, particularly, the tectonic history of the area explain both the existence and recent (last ~200 years) hydrologic and geomorphic evolution of the Delta.
>
> In Figure II.6, it can be seen that the river approaches the Delta from the southwest along the northern edge of the Hess-Santa Elena Fault zone, being confined on both sides by high ground. At the Delta, the Río San Juan continues to follow the trend of the fault, but the larger part of the flow spills to the southeast (into the wide, low and subsiding plain on the Caribbean Plateau) through a gap in the higher ground within the fault zone, forming the Río Colorado."[521]

5.97. His conclusions are twofold:

> "as geological controls and neotectonics naturally oppose growth of the Río San Juan branch at the Delta (in fact, they promote its long-term decline), dredging the Río San Juan downstream of the Delta cannot be considered as any form of 'restoration' to a more natural condition; and
>
> it follows that, dredging intended to attract flow away from the Río Colorado and into the Río San Juan represents an attempt to artificially alter the natural condition and fight the long-term, geological trend at the Delta."[522]

5.98. Nicaragua's dredging and construction of the artificial *caño* may nonetheless result in serious consequences for the hydrological behaviour of both the lower San Juan and the Colorado rivers, as well as other ecological damages, as will be detailed below.

(b) Sediment dynamics

5.99. Around 83% of the water supplied by the catchment downstream of Lake Nicaragua, that feeds the San Juan, comes from Costa Rica.[523] It

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521 Ibid., pp. II-8

522 Ibid., p. II-10

523 Ibid., p. II-15

follows that most of the sediment load that reaches the San Juan also is fed in this way. However, the sediments coming from this basin tend to originate as a result of the steep, unstable slopes and fragility of soils due to their volcanic origin, which are also susceptible to extreme events like earthquakes and prolonged rain. This produces a large sediment load.[524] The character of these sediment dynamics was confirmed in a study sponsored by the Organization of American States in 1997.[525]

5.100. While there is some sediment contribution resulting from farming and other human activities, these have a minor effect on the overall sediment yield that Costa Rican tributaries deposit in the San Juan. Professor Thorne's report confirms this:

> "Both theoretical considerations and available data demonstrate that, in comparison to natural drivers of erosion such as high relief, steep slopes, erodible volcanic soils, and extreme events (earthquakes, volcanic eruptions, hurricanes, and other intense rainfall events), anthropogenic influences are likely to be relatively minor. This explains, for example, why the percentage of the measured and calculated sediment yields supplied by sheet erosion in arable or over-grazed fields lower down in the sub-catchments is small and much more of the load is derived from the upper and middle reaches of sub-basins draining the Central Mountains of Costa Rica."[526]

5.101. As such, sediments carried into the San Juan via Costa Rican rivers are the result of natural processes that have taken place for millions of years. Nicaragua has no basis to support any allegation of Costa Rica deliberately silting the lower San Juan.

5.102. The conclusion reached by Professor Thorne is as follows:

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524 Ibid., p. II-16

525 Ibid.

526 Ibid., p. II-18

> "sediment accumulation in the Río San Juan downstream of the Delta is not caused by excessive concentrations of sediment in the San Carlos and Sarapiquí (or indeed any of the Costa Rican tributaries), but is the consequence of natural geological controls and neotectonic influences. The scale and power of the natural phenomena responsible for conditioning fluvial processes and controlling morphological evolution in the Río San Juan and Río Colorado are such that attempting to reverse their effects is likely to be futile. The geology and neotectonics of the region will continue affecting this deltaic system for centuries, with or without the dredging.
>
> Viewed in this light, dredging the Río San Juan downstream of the Delta can only ever provide short-term, temporary relief from navigation problems because it works *against* the natural tendency for sedimentation in this reach. Insights gained through logical consideration of the geology, hydrology, sediment dynamics, geomorphology, and environment of the Río San Juan and the Delta reveal that maintaining navigation in the Río San Juan for vessels with drafts greater than, say about 1 m, will require not a single, capital operation but repeated dredging and the removal of hundreds of thousands of cubic metres of sediment year after year."[527]

(c) Damage caused or likely to be caused by the dredging operations and cutting of meanders

5.103. The region where the dredging operations are taking place encompasses important areas committed to environmental protection. Wetlands generally are of critical importance as they provide ecosystem services and regulatory support that underpin the management of water resources. Under the Ramsar Convention, the wetlands are recognized also for their intertidal mud capacity for carbon fixation.[528] This is also confirmed

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[527] Ibid., p. II-28

[528] See 8th Meeting of the Conference of the Contracting Parties to the Convention on Wetlands (Ramsar, Iran, 1971),Valencia, Spain, 18-26 November 2002, Resolution VIII.32, para. 4.

by Aguilar – Gonzalez, who shows that wetlands "are one of the most carbon capturing ecosystems globally".[529]

5.104. In the report of the Ramsar Secretariat, dated 17 December 2010, the reason why the *Humedal Caribe Noreste* was included in the list of Wetlands of International Importance, is set out:

> "As a unique or representative wetland, being a natural wetland characteristic of the Costa Rican Caribbean coastal zone.
>
> It supports species and subspecies of plants and animals that are vulnerable or under threat of extinction. Furthermore, it is highly valued as a stronghold of the region's genetic and ecological diversity.
>
> It is an obligatory stopover for migratory birds from North America, providing shelter for over one million birds that come to rest and feed."[530]

5.105. The report further considers the ecological features of the wetland, as follows:

> "The Humedal Caribe Noreste is composed of a mosaic of water bodies and courses fed by the San Juan river delta, encircled by a sandbank that separates the wetlands from the Caribbean Sea, giving rise to lagoons, grass marshes and/or wooden swamps. The main water supply comes from the San Juan River, with groundwater supply that maintains the superficial aquifer level."[531]

5.106. The export report of Professor Thorne makes a similar assessment of the environmental conditions of the wetland. Professor Thorne states:

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[529] **Vol. IV, Annex N° 157**, Aguilar-González, B. et. al. 2011. "A Summary of Actual and Potential Environmental Service Losses Due to the Current Ecological Conflict in the Portillos/Calero Island Region in the Caribe Noreste Wetland in Northeastern Costa Rica", San José, Costa Rica: Fundación Neotrópica, p.12.

[530] **Vol. IV, Annex N° 147**, Ramsar Secretariat, Ramsar Advisory Mission Report N° 69: Northeastern Caribbean Wetland of International Importance (Humedal Caribe Noreste), Costa Rica, 17 December 2010, p. 14.

[531] Ibid.

> "When evaluating the environmental functioning of the Isla Calero, it is important to understand that the aquatic system provides two sources of food through nutrient and carbon cycling. The first is *autochthonous*; that is, derived from the primary production of aquatic vegetation present in bodies of water. The second is *allochthonous*; that is, stemming from incorporation of organic matter supplied from terrestrial vegetation. This illustrates one of several functional links between the aquatic and terrestrial environments that are real, complex, and vital to the sustainability of ecosystems and natural resources in the Isla Calero."[532]
>
> Indeed, it is the high degree of environmental heterogeneity and inter-linkage that allows the area to provide a rich range of valuable aquatic, riparian, seasonally-flooded, and terrestrial habitats. It is no exaggeration to say these properties underpin the wealth of flora and fauna found in the Isla Calero.

5.107. It is apparent that the dredging works are not "a modest dredging and cleaning effort in order to recover part of the original water flow of the San Juan river and improve navigation".[533] There is no possibility of recovering any "original" water flow, as the geology demonstrates that the lower San Juan has historically carried only approximately 10% of the water from the point where is branches from the Colorado River;[534] the amount of water it carries today.

5.108. As has been noted in this Memorial,[535] Nicaragua plans to deploy three dredges in or near the area where the San Juan branches from the Colorado River; some or all of these dredgers have been working there

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[532] **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, p. II-19.

[533] CR 2011/2, p. 8, para 3 (Argüello Gómez).

[534] See paragraph 2.57.

[535] See paragraph 3.81.

continuously since July 2011, despite Nicaragua's own EIS authorizing the operation of only one dredge.[536] Both aerial and satellite photographs show the areas where sediments are being deposited. Some of these deposits are reaching far inside primary forests on the Nicaraguan bank. An UNOSAT report dated 8 November 2011, estimates that the dredging operation only in the area of Delta, measures approximately 450 m. by 100 m. and it is associated with 3 large depositional sites (See **Figure 5.8**), each site covering an area of 5,500 m^2.[537] Hence, just the deposition of sediment from less than half kilometer in length of the San Juan, has required an area of nearly 2 hectares to disposed of the sediments extracted. The removal of such a large amount of sediment, in the course of dredging only in less than half a kilometre of the projected 42 kilometres that the dredging program encompasses, demonstrates that Nicaragua intends to dredge far more than the 1 million cubic metres of sediment stated to the Court.[538] It appears that Nicaragua will remove twice or even three times that load.

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536 **Vol. IV, Annex N° 158** [excerpts], Corea y Asociados S.A. "*Estudio de Impacto Ambiental para el Mejoramiento de la Navegación en el río San Juan de Nicaragua*", September 2006 (Documents submitted by Nicaragua to the Court during the Hearings on Provisional Measures, January 2011), p. 18.

537 **Vol. IV**, **Annex N° 150,** UNITAR/UNOSAT, "Morphological and Environmental Change Assessment: San Juan River Area (including Isla Portillos and Calero), Costa Rica" Update 4, 8 November 2011, p. 2.

538 CR 2011/2, p. 17, para. 40 (Argüello Gómez).

Figure 5.8



Figure 5.8: Photograph of sediment deposits on the Nicaraguan side of the River San Juan, 29 June 2011

5.109. As a result of the dredging works, the Costa Rican bank of the San Juan is starting to erode, as **Figure 3.4** demonstrates. It has been assessed that this "bank and Costa Rican territory are at risk of damage and/or erosion due to vessel movements and mechanical contact with the bank. Also the bank could certainly be destabilized if the dredger removes sediment from close to the bank or disturbs sensitive bank vegetation."[539] Costa Rica has gathered evidence showing that Nicaragua did place dredging pipes along

[539] See **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, p. II-30.

the right bank, which are believed to have been used to extract material from that margin, thus weakening it and allowing erosion to take its course, as the **Figure 3.4** demonstrates. Costa Rica requested a full explanation but Nicaragua has not responded.[540]

5.110. Costa Rica has also requested from Nicaragua information about the scale of the works resulting from the deployment of 3 dredges.[541] Again Nicaragua did not respond.

5.111. The Nicaragua EIS estimated that the removal of sediment from the bed of the river would amount to 1.6 million cubic metres of sediment. Such a figure suggests that Nicaragua intended to remove approximately 10 times the annual sediment load that it is estimated the San Juan carries.[542] Professor Thorne estimates that:

> "While the calculations performed by the ICE are subject to uncertainty, they are nevertheless indicative of the degree to which the dredging programme will perturb sediment transport in the Río San Juan and sediment dynamics in the river's fluvial system. Disruption to sediment dynamics on this scale is almost certainly sufficient to trigger non-linear, dynamic, process-response mechanisms, leading to complex morphological responses with environmental impacts and ecological responses that are significant at both the local- and system-scales."[543]

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[540] See paragraph 3.65.

[541] **Vol. III, Annex N° 95,** Note from the acting Minister of Foreign Affairs of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-AM-466-11, 23 August 2011.

[542] See **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, p. II-34.

[543] Ibid., p. II-35.

5.112. If Nicaragua decides to continue to carry out its significant dredging operation, major changes in the morphology of the lower San Juan can be expected to occur. Professor Thorne observes that:

> "The cumulative effects of dredging at multiple sites distributed throughout the river may be sufficient to produce significant morphological responses at the reach-scale. Dynamic morphological responses to the dredging programme are more difficult to predict because feedback loops operating in the fluvial system may diffuse or magnify them through time and space, which could necessitate further dredging to maintain or enlarge the navigation channel. Also, there exists the possibility that diverting water into the 'Caño' and cutting off one or possibly two meander bends could interact synergistically, moving the Delta closer to its geomorphic tipping point and leading to significant increase in the discharges of water and sediment carried by the Lower Río San Juan – an unlikely but perhaps not impossible scenario."[544]

5.113. As to the short term impacts, which could gravely affect the ecological features of the entire *Humedal Caribe Noreste*, the following may be mentioned:

> "damage or destruction of bedforms and benthic ecological communities; disturbance to aquatic ecosystems; artificial changes to flow depths and velocities; over-steepening of banks due to bed lowering; and mechanical damage to banks and riparian areas by: vessel manoeuvring and mooring, installation and removal of spoil pipes, and burial of floodplain soils and plants at spoil disposal sites."[545]

5.114. Long term impacts are clearly more difficult to estimate, because they are associated with the scale of the works that are being executed by Nicaragua. However, should Nicaragua complete, to plan, the entire program

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544 Ibid., p. IV-3.

545 Ibid., p. II-39 (formatting removed).

of dredging and related works, the outcome could be seriously damaging. On a worst case scenario, it is foreseen that:

> "[...] the increased energy slope (due to shortening the length of the river by cutting off meanders and re-routing the river to the Harbor Head Lagoon), coupled with reduction in energy losses (due to cutting off bends and removing shoals), could produce an increase in sediment-transport capacity sufficient to trigger bed degradation that would migrate upstream as a knickpoint in the river's longitudinal profile. Bed lowering would over-steepen the banks and allow erosion to undermine the roots of trees growing on the bank top, negating their effectiveness in reinforcing the bank, and making it likely that they would destabilise the bank through wind throw and surcharging. As a result, a wave of instability involving bed scour, knickpoint migration and bank retreat would migrate upstream through the reach, generating secondary waves of instability in its wake – a phenomenon termed 'complex response' (Schumm, 1977). The morphological outcome would probably still be for the channel to eventually recover to its pre-disturbance condition, but the environmental impacts and ecological consequences of the morphological adjustments involved in its doing so would be serious, long-lived, and possibly irreversible."[546]

5.115. The straightening of the San Juan, by the cutting of meanders, is directed at increasing the velocity of the waters of the river. As stated in the UNITAR/UNOSAT Report of 4 January 2011:

> "In the satellite imagery from 19 November and 14 December 2010 there is an apparent active attempt to redirect the San Juan River by straightening a meander approximately 400m upstream of the new river channel. In both imagery dates a large trench is clearly being cut into the meander. An apparent dredging boat is visible in both satellite image dates. From November to December 2010 the trench increased 22m in length to a total of 68m. If completed this cut in the meander will redirect the San Juan River approximately 175m to the west, and will likely significantly increase the water

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546 Ibid., p. II-41

> velocity downstream. Such a velocity increase will also increase the amount of water entering the new channel, thus likely widening the channel due to an acceleration of the erosion process resulting from the increased water velocity and inflow."[547]

5.116. Artificial changes to the morphology of the river pose a risk to the wetland in Isla Portillos, noted by the report of the Ramsar Secretariat:

> "The trophic state of the wetland, where grass marshes and/or wooded swamps predominate, is fundamentally controlled by the superficial aquifer level, by maintaining a stable groundwater level, with variations related to the precipitation-evaporation balance. Receiving the water supply from the waters of the San Juan River via the artificial canal would alter the water balance, initially increasing the superficial aquifer level and reducing production of vegetation by flooding the vegetation… the trophic state of the wetland will be reduced."[548]
>
> "The partial flooding of the wetland due to the construction of the artificial canal and the clearing of vegetation would alter the distribution and abundance of terrestrial species through the loss of habitat and reduction in food supply and shelter."[549]
>
> "The flooding of the area of the artificial canal would leave an important zone of the wetland (approx. 200 ha) isolated from the remainder of the wetlands located on the Isla Portillos, turning it into a barrier for terrestrial fauna with restricted mobility."[550]

5.117. Meanders on deltaic rivers are natural features. They not only accommodate hydraulic forces and sediment dynamics, but also contributes

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547 **Vol. IV**, **Annex N° 148,** UNITAR/UNOSAT, "Morphological and Environmental Change Assessment: San Juan River Area (including Isla Portillos and Calero), Costa Rica", 4 January 2011, p. 2.

548 **Vol. IV, Annex N° 147**, Ramsar Secretariat, Ramsar Advisory Mission Report N° 69: Northeastern Caribbean Wetland of International Importance (Humedal Caribe Noreste), Costa Rica, 17 December 2010, p. 29.

549 Ibid., p. 31.

550 Ibid.

to the ecological developments along the course of the river, its banks and nearby areas. Furthermore, the

> "...occurrence of an artificial cut-off is not appropriately synchronised with the natural sequence of bend initiation, growth, and cut-off in a reach. Consequently, its effect is to perturb the meandering pattern, triggering process-response mechanisms and morphological changes that are rapid and unprecedented. Unsurprisingly, biota are unaccustomed to these changes and the more vulnerable species may fail to adapt quickly enough to survive."[551]

5.118. Re-aligning the course of the San Jun brings with it the potential to destabilise the river, resulting in morphological responses and ecological consequences that are difficult to foresee. A list of these is included in the expert report of Professor Thorne appended to this Memorial.[552]

5.119. In these circumstances the risk of damage to the Colorado river, and to Costa Rica's lagoons, rivers, herbaceous swamps and woodlands is real and undeniable. The dredging operations are threatening the wildlife refuges in Laguna Maquenque, Barra del Colorado, Corredor Fronterizo and the Tortuguero National Park, including Nicaragua's own wetlands and protected areas.

E. Conclusions

5.120. This Chapter has demonstrated the breaches by Nicaragua of the environmental protection regime. In the first part, it has been seen how Nicaragua has failed to comply with its obligations in respect of procedure: no notice of the dredging works was provided to Costa Rica, and no

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551 **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, p. I-78.

552 Ibid., p. I-79.

consultation entered into. This is an act in breach of general international law, but also of Article 5 of the Ramsar Convention and the obligations of consultation set out in the 1992 Convention on the Conservation of Biodiversity and Protection of Priority Wildlife Areas in Central America.

5.121. Furthermore, Nicaragua is in breach of its substantive obligations arising under the Ramsar Convention, the 1990 bilateral agreement SI-A-PAZ (International System of Protected Areas for Peace), the 1992 Convention on the Conservation of Biodiversity and Protection of Priority Wildlife Areas in Central America and the Treaty of Limits (as interpreted by the Cleveland Award) not to cause harm to Costa Rica's protected wetland territory. Costa Rica has established its right not to have its territory occupied, or flooded or damaged, in accordance with the terms of the Cleveland Award.

5.122. In spite of the substantive obligations of environmental protection owed by Nicaragua, the following noted damage has occurred, or is at serious risk of occurring. As summarised by Professor Thorne:

> "Construction and operation of the 'Caño' had impacts in the Harbor Head Lagoon and wetlands in the Isla Portillos that were immediate and adverse. ... In the Isla Portillos wetland, construction of the 'Caño' led to disturbance and habitat loss, including the destruction of at least 292 mature trees, some with ages in excess of 200 years, and changes to the topography, surficial hydrology, and shallow aquifer beneath the wetland resulting from digging of the channel. The TVE for loss of natural capital and ecological services related to destruction of the trees is estimated to exceed $1.5 million. Re-excavating or enlarging the 'Caño' might lead to breaching of the barrier beach that currently separates the Harbor Head Lagoon from the Caribbean Sea, triggering changes in the surficial and sub-surface hydrology, salinity and trophic state of the lagoon and surrounding wetland, and collapse of the ecosystem in the northern Isla Portillos that could be irreversible.

> Naturally-high sediment and nutrient concentrations in the Río San Juan, together with the mobility of the sand bed, are likely to have limited impacts of increased turbidity, reduced water quality and disturbance to the benthos that are customarily associated with dredging. Even so, mechanical and sediment-related disturbance to the environment and ecosystem at each dredging site are inevitable and the extent of the dredging programme is sufficient that cumulative effects and morphological responses may yet produce environmental impacts that extend beyond the site to at least the reach-scale. The evidence assembled and assessed in this Report suggests that the morphological, environmental, and ecological risks associated with continuing the dredging programme are serious. It also emphasises the necessity of avoiding any future actions that might increase the probability that further dredging, straightening, and diversion of the Río San Juan might interact synergistically to destabilise the natural division of flows at the Delta, due to the potentially dire environmental and ecological consequences for the Isla Calero should this occur."[553]

5.123. When damage to Costa Rica's territory has been perpetrated by Nicaragua, Costa Rica has the corresponding right to compensation and reparation. This is addressed in Chapter VII of this Memorial.

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553 **Vol. I, Appendix N° 1**, "Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory" Scientific Report Prepared by Prof. Colin Thorne of the University of Nottingham, p. IV-3-4.

CHAPTER VI: BREACHES BY NICARAGUA OF BINDING DECISIONS OF THE COURT

A. Introduction

6.1. In the context of the present dispute, Nicaragua continues to act contrary to binding decisions of the Court. Nicaragua has breached the First, Second and Third Provisional Measures indicated by the Court in its Order with respect to the conduct of the "Sandinista Youth", public officials and journalists on the northern part of Isla Portillos to which the Provisional Measures apply. Nicaragua has also acted contrary to the judgment of the Court in the case of *Dispute regarding Navigational and Related Rights (Costa Rica v. Nicaragua)*[554] by impeding Costa Rica's treaty right of free navigation of the San Juan.

6.2. **Part B** of this Chapter addresses Nicaragua's breaches of the Court's Order for Provisional Measures, in particular as a result of the incidents that occurred on the occasion of the inspection conducted by Costa Rican personnel charged with the protection of the environment in consultation with members of the Ramsar Secretariat on 5-6 April 2011 (the "Joint Environmental Mission"), and thereafter. **Part C** addresses Nicaragua's breaches of the Court's Judgment of 13 July 2009, in particular with respect to the impediment of the right of free navigation of the San Juan by a Costa Rican primary school teacher and Costa Rican journalists. This also constitutes a breach of Costa Rican right to free navigation as declared by the 1858 Treaty of Limits.

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554 *Dispute regarding Navigational and Related Rights (Costa Rica v. Nicaragua),* Judgment, I.C.J. Reports 2009, p. 213.

B. Nicaragua's Breaches of the Court's Order for Provisional Measures

(1) Factual background

6.3. On 18 November 2010 Costa Rica applied to the Court for an Order for Provisional Measures. This request was premised upon Nicaragua's ongoing refusal to withdraw its armed forces and other personnel from northern Isla Portillos, and its refusal to desist from construction of the *caño* and other works in the area. Costa Rica sought to prevent Nicaragua from stationing its armed forces and other personnel on previously undisputed Costa Rican territory, and to prevent further harm being caused to this part of the protected *Humedal Caribe Noreste*.

6.4. During the course of the hearings on Provisional Measures, Nicaragua for the first time articulated its new claim to sovereignty over the north of Isla Portillos.[555] The Court recognized that "the title to sovereignty claimed by Costa Rica over the entirety of Isla Portillos is plausible":[556] It did not make the same acknowledgement in respect to the claim to sovereignty by Nicaragua. Instead it stated that while "there are competing claims over the disputed territory", the presence of Nicaraguan armed forces and civilian workers on Isla Portillos created "an imminent risk of irreparable prejudice to Costa Rica's claimed title to sovereignty over the

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555 CR 2011/2 p. 13 (para 25) (Argüello): "Nicaragua is not occupying Costa Rican territory. It is simply exercising the sovereignty over this small area that it has always exercised."

556 Ibid., p. 14, para. 58.

said territory and to the rights deriving therefrom".[557] On this basis it indicated the following Provisional Measures:

> "(1) Unanimously,
>
> Each Party shall refrain from sending to, or maintaining in the disputed territory, including the *caño*, any personnel, whether civilian, police or security;
>
> (2) By thirteen votes to four,
>
> Notwithstanding point (1) above, Costa Rica may dispatch civilian personnel charged with the protection of the environment to the disputed territory, including the *caño*, but only in so far as it is necessary to avoid irreparable prejudice being caused to the part of the wetland where that territory is situated; Costa Rica shall consult with the Secretariat of the Ramsar Convention in regard to these actions, give Nicaragua prior notice of them and use its best endeavours to find common solutions with Nicaragua in this respect;
>
> (3) Unanimously,
>
> Each Party shall refrain from any action which might aggravate or extend the dispute before the Court or make it more difficult to resolve;
>
> (4) Unanimously,
>
> Each Party shall inform the Court as to its compliance with the above provisional measures."[558]

6.5. In accordance with paragraph 86(2) of the Court's Order, Costa Rica coordinated with the Secretariat of the Ramsar Convention to arrange for an Advisory Mission to visit the *Humedal Caribe Noreste* area of Isla Portillos on 5 and 6 April 2011. Costa Rica informed Nicaragua of its intention to

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[557] Ibid., p. 18, para. 75.

[558] Ibid., p. 21, para 86.

conduct this Mission on 30 March 2011,[559] and advised the Court of the planned visit on 1 April 2011,[560] in accordance with paragraph 86(4) of the Court's Order. Nicaragua responded through a diplomatic note of 1 April 2011 expressing its opposition to the joint Ramsar/Costa Rica mission.[561]

6.6. On 4 April 2011, officials from the Costa Rican Ministry of Environment, Energy and Telecommunications met with the delegates of the Ramsar Secretariat to settle an appropriate mandate and work plan for the Joint Environmental Mission.[562] The delegations agreed that the purpose of the Joint Environmental Mission was to gauge the contemporary state of the wetland and collect technical and scientific data in order to prevent further irreparable damage from being caused to the wetland. The delegations intended that this information would place them in a position to determine the preventative measures required to avoid irreparable harm to the wetland pending the outcome of these proceedings, to implement relevant monitoring activities, and if necessary to plan restorative works. Also on 4 April, Costa Rica responded Nicaragua's diplomatic note dated 1 April 2011, refuting the arguments posited by Nicaragua, and attaching the Minutes of the meeting

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559 **Vol. III, Annex N° 75**, Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-DVM-217-11, 30 March 2011.

560 Note from the Ambassador to the Kingdom of the Netherlands and Co-Agent of Costa Rica, to the Registrar of the International Court of Justice, Ref: ECRPB-029-11, 1 April 2011.

561 **Vol. III, Annex N° 78,** Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DM/AJST/349/04/11, 1 April 2011.

562 **Vol. IV, Annex N° 151**, Minutes of the Coordination Meeting, Technical Advisory Mission of the Secretariat of the Ramsar Convention and Representatives of the Ministry for the Environment, Energy and Telecommunications, 4 April 2011.

between the officials from the Costa Rican Ministry of Environment, Energy and Telecommunications and the delegates of the Ramsar Secretariat.[563]

6.7. On 5 April 2011, the Nicaraguan newspaper *La Prensa* reported that some 100-150 Nicaraguan members of the "Sandinista Youth" (the youth organisation of the *Frente Sandinista de Liberación Nacional* (FSLN), the political party in power in Nicaragua)[564] had recently established a camp on the Finca Aragón, that is, on the northern part of Isla Portillos to which the Provisional Measures apply, with the intention of protesting the Joint Environmental Mission. The newspaper noted that "[t]he members of the Sandinista Youth are gathered in the ranch house on the farm Los Aragón… [which] faces the Indio Maíz river, the basin of which is located over a kilometre north of Harbor Head, even though the family Aragón registered it as being on Costa Rican territory".[565] The report also observed that:

> "[F]or this protest the youth received the full support of the Central Government, a situation which occurs only in humanitarian emergencies… There, young people are given food and water provided by sales in San Juan del Norte, as when a state of emergency is declared.
>
> They also have a full time ambulance boat from the Greytown Health Centre, and even express visits from journalists arriving in Air Force helicopters, for reporting the movilization.
>
> These measures are only seen in Nicaragua in cases of disaster.

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563 **Vol. III, Annex N° 80**, Note from the acting Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-225-11, 4 April 2011.

564 See **Vol. III, Annex N° 102**, El 19 Digital, 'Guardabarranco Youth Movement in favour of environmental protection', 29 August 2009.

565 **Vol. III, Annex N° 123**, La Prensa (Nicaragua), 'Army provides support for July 19 Sandinista Youth in River San Juan', 5 April 2011.

> However, this is a case of government support for an organization that belongs to the Sandinista National Liberation Front (FSLN), the party in power. [...]
>
> The routine of the youth on the Aragón farm is so important for the Government of Nicaragua that it authorized the delay of the flight back from the River San Juan to Managua so that pro-ruling party media could cover the arrival of at least 80 protesters to the area, which goes against Nicaraguan Army rules to not make flights so close to nightfall."[566]

6.8. On the same day, members of the Joint Environmental Mission were taken by helicopter to northern Isla Portillos. Some remained behind to observe from their vantage point on the southern bank of the *caño*.

6.9. As the Joint Environmental Mission proceeded, the "Sandinista Youth" aggressively protested the presence of the Mission and verbally abused the delegates. A significant number tracked the course of the Joint Environmental Mission by boat along the San Juan, and landed on the territory north of the artificial *caño* in an attempt to intimidate and disturb members of the Joint Environmental Mission and to prevent them from completing their collection of information.[567] The delegates from the Ramsar Secretariat were visibly upset and distressed by the acts of harassment and hostility committed by the "Sandinista Youth and other Nicaraguans"; however, the Joint Environmental Mission was still able to collect technical information and to observe the relevant area.

6.10. There was significant media interest in the Joint Environmental Mission from both Costa Rican and Nicaraguan press. When the delegates of the Joint Environmental Mission arrived in the area it became apparent

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[566] Ibid. (emphasis added).

[567] **Vol. V, Annex N° 235,** Photo of Nicaraguan nationals landing at Isla Portillos during the Joint Environmental Mission, 5 April 2011. See also **Vol. V, Annex N° 238,** Photo of Nicaraguan nationals harassing members of the technical environmental mission.

that in addition to the "Sandinista Youth", a number of members of the Nicaraguan media were present on the northern side of the *caño*, waiting to record the conduct of the Joint Environmental Mission. Costa Rica took steps to ensure that no Costa Rican journalist, or other Costa Rican who was not a member of the Joint Environmental Mission, was present north of the artificial *caño* at any time.

6.11. On 6 April 2011, as the helicopter carrying the members of the Mission approached a suitable landing area in northern Isla Portillos, approximately 50 to 60 Nicaraguan persons prevented its landing. Given the safety risks these acts presented, the delegation decided that it would be unsafe to attempt to land the helicopter and therefore suspended further activities on the ground; instead conducting a flyover of the general area.[568] Following the suspension of the Joint Environmental Mission, on 6 April 2011, Costa Rica protested the acts of harassment suffered by the members of the Joint Environmental Mission as well as the incursion by Nicaragua into the territory north of the artificial *caño*.[569] Costa Rica also denounced Nicaragua's actions to all the member States of the United Nations[570] and to the Court.[571]

6.12. On 7 April 2011, officials from the Costa Rica Ministry of Environment, Energy and Telecommunications and the Ramsar Secretariat

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568 **Vol. IV, Annex N° 152**, Minutes of the Coordination Meeting, Technical Advisory Mission of the Secretariat of the Ramsar Convention and Representatives of the Ministry for the Environment, Energy and Telecommunications, 7 April 2011.

569 **Vol. III, Annex N° 81**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-235-11, 6 April 2011.

570 **Vol. III, Annex N° 76,** Note from the Permanent Mission of Costa Rica before the United Nations to Permanent Missions to the United Nations and Permanent Observer Missions to the United Nations, Ref: ECR-258-2011, 8 April 2011.

571 Note from the Ambassador to the Kingdom of the Netherlands and Co-Agent of Costa Rica, to the Registrar of the International Court of Justice, Ref: ECRPB-029-11, 8 April 2011.

delegation met to conclude the Joint Environmental Mission. It was agreed that on the basis of the technical information collected, a report and work plan comprising management, monitoring and where necessary, restorative work to prevent irreparable environmental damage to the wetland, would be submitted to the Secretariat of the Ramsar Convention.[572]

6.13. Nicaragua sent Costa Rica two notes dated 7 April 2011 related to the Joint Environmental Mission. In one note, signed by Nicaragua's Minister of Foreign Affairs, it asked Costa Rica not to carry out the environmental mission and vowed to comply with the Court`s Order. [573] The other communication was a note verbale, through which Nicaragua protested alleged "violations of Nicaraguan airspace undertaken on the 5th and 6th of April 2011 by aircraft coming from Costa Rican territory."[574] Nicaragua's arguments were rejected by Costa Rica.[575]

6.14. On 8 April 2011, Costa Rica received another diplomatic note from Nicaragua, which acknowledged the presence of Nicaraguan persons north of the *caño*, but stated that:

> "The Nicaraguan authorities do not have the obligation to contain or impede the legitimate expression of Nicaraguans feelings. No criminal acts where committed, similar to the attack suffered by the Nicaraguan Embassy in San Jose, Costa

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572 **Vol. III, Annex N° 152**, Minutes of the Coordination Meeting, Technical Advisory Mission of the Secretariat of the Ramsar Convention and Representatives of the Ministry for the Environment, Energy and Telecommunications, 7 April 2011.

573 **Vol. III, Annex N° 82**, Note from the acting Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs of Costa Rica, Ref: MRE/DVM/AJST/117/04/11, 7 April 2011.

574 **Vol. III, Annex N° 83**, Note from the Ministry of Foreign Affairs of Nicaragua to the Ministry of Foreign Affairs of Costa Rica, Ref: MRE/DGAJST/150/04/11, 7 April 2011.

575 See para 6.19.

> Rica on 12 November 2010, that would have required the intervention of Nicaragua's Public Forces."[576]

6.15. The Chief of the Nicaraguan Army, the Nicaraguan Deputy Minister of the Environment and the Nicaraguan President had earlier publicly expressed their full support of the activities carried out by the "Sandinista Youth". The Chief of the Nicaraguan Army, General Julio César Avilés, confirmed on 6 April 2011 that the Nicaraguan civilians received assistance and encouragement from the Nicaraguan Army. The Nicaraguan newspaper *El Nuevo Diario* reported General Avilés statements as follows:

> " … 'I applaud the attitude of these boys and girls who have done this, it is a highly patriotic attitude, and I feel proud of them in so far as this situation was brought about by Costa Rica, such a quantity of girls and boys have appeared and they have traveled to the area to protect the wetlands.' … 'I must highlight the strong will of them to stay at this place, and we acknowledge this' said Avilés, who noted that one of the missions of the Army is to guarantee the security of the boys and girls from natural and external risks in the area. 'We are going to protect them, we cannot let anything happen to them, absolutely nothing can happen to these comrades', said the military boss." [577]

6.16. Likewise the Nicaraguan Deputy Minister of the Environment, Roberto Arquistain, was reported as stating that: "we are waving flags for them (the Costa Ricans) so they can see where Nicaragua is".[578] Deputy Minister Arquistain travelled with the Sandinista Youth to their camp in the

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[576] **Vol. III, Annex N° 84**, Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DVM/AJST/121/04/11, 8 April 2011.

[577] **Vol. III, Annexes N° 126 (a) and (b)**, El Nuevo Diario (Nicaragua), 'Ticos continue inspection, rejected by Nicaragua, in disputed area' and 'General Avilés aplaudes the "heroic deed" of the 19 July Sandinista Youth', 6 April 2011.

[578] **Vol. III, Annex N° 125**, La Jornada, 'Costa Rican plan to stay, says General Aviles', 6 April 2011.

disputed territory and highlighted the support given to the "Sandinista Youth" by Nicaraguan Government.[579]

6.17. On 7 April 2011, *El Nuevo Diario* reported President Ortega's statements that the "youngsters" had a right to demonstrate and that "[w]e are obliged to defend our territory, and the Army has an obligation to protect the area [of the Harbour Head wetland].[580] On 28 April 2011, Deputy Minister Arquistain was again reported praising and encouraging the presence of Nicaraguan persons in the relevant territory.[581]

6.18. On 13 April 2011, Costa Rica submitted to the Court a further report, setting out Nicaragua's conduct and breaches of the Order for Provisional Measures.[582] On that same date, Costa Rica transmitted to Nicaragua the minutes of the 7 April 2011 meeting between officials from the Costa Rican Ministry of Environment, Energy and Telecommunications and the Ramsar Secretariat delegation, as well as a proposal for a draft Police Action Protocol on security and the fight against drug trafficking.[583]

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579 Ibid.

580 **Vol. III, Annex N° 127**, El Nuevo Diario (Nicaragua), 'The Army would capture Costa Rican pilots if they land', 7 April 2011.

581 **Vol. III, Annex N° 130,** Multinoticias canal 4, 'Deputy head of Marena praises youth work in San Juan de Nicaragua', 28 April 2011.

582 Note from the Ambassador to the Kingdom of the Netherlands and Co-Agent of Costa Rica, to the Registrar of the International Court of Justice, Ref: ECRPB-030-11, 13 April 2011.

583 **Vol. III, Annex N° 86**, Note from the Ministry of Foreign Affairs and Worship of Costa Rica to the Ministry of Foreign Affairs of Nicaragua, Ref: 0463-D.G.P.-2011, 13 April 2011.

6.19. Costa Rica responded to Nicaragua's notes of 7 and 8 April 2011 on 15 April 2011.[584] Costa Rica reaffirmed the terms of its previous protest to Nicaragua,[585] and stated:

> "The above statement is based on the fact that firstly, the mere presence of these people in the area violates the provisions of paragraph 86 (1) of the Order, but also because their actions of harassment to the technicians sent by the Secretariat of RAMSAR Convention and the Costa Rican civilian personnel in charge of environmental protection who entered the area on 5 April, and their attempt to impede the entry scheduled for 6th, sought to prevent Costa Rica from complying with what was mandated in paragraph 86 (2) of the Order. These actions also clearly contravene what was mandated in paragraph 86 (3) of the Order, since these are actions whose sole outcome is the aggravation of the dispute. Costa Rica possesses the necessary evidence that documents the actions of harassment suffered by the Ramsar and Costa Rican technicians."[586]

This note also reminded Nicaragua that in spite of its claim that Nicaraguan security personnel had been withdrawn from the northern part of Isla Portillos as of late November 2010, the Government of Costa Rica had evidence that on 19 January 2011 Nicaraguan troops and military camps remained in the area.[587] Costa Rica concluded:

> "Finally, while Nicaragua is trying to justify the illegal presence of many Nicaraguans in the area indicated by the Court as a spontaneous act, the fact is that Nicaragua had, as a minimum, the obligation to take action to prevent such acts, which are absolutely contrary to what was mandated by the Court in its Order of 8 March. Therefore, this excuse put forward by Nicaragua is not acceptable for Costa Rica. Costa

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584 **Vol. III, Annex N° 87**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-255-11, 15 April 2011.

585 Ibid.

586 Ibid.

587 Ibid. See also **Vol V. Annex 223.**

> Rica, while fully adhering to its previously formulated protest, urges the Government of Nicaragua to stop these illegal actions, which contribute to aggravating the situation.[588]

6.20. On 13 May 2011, Costa Rica sent another diplomatic note to Nicaragua to protest the presence of these Nicaraguan persons on Isla Portillos and the obstruction and impediment to the Joint Environmental Mission that their presence caused.[589] Nicaragua did not reply; nor did it reply to a further note of 19 July 2011.[590] Costa Rica advised the UN Security Council of Nicaragua's actions on 5 July 2011. On 17 August 2011, Costa Rica protested to Nicaragua, once again, for sending a new group of Nicaraguan civilians to the disputed territory.[591]

6.21. On 8 October 2011, President Ortega was reported as offering a "proposal to the government and people of Costa Rica to work together in restoring the Harbor Head wetland".[592] No such "proposal" has ever been forthcoming through formal channels. President Ortega noted that in the meantime "this area is in the process of recovery thanks to groups of young Sandinistas who come regularly to the place to work on environmental tasks".[593]

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588 Ibid. See also **Vol. III, Annex N° 88**, Note from the Ministry of Foreign Affairs of Costa Rica to the Ministry of Foreign Affairs of Nicaragua, Ref: DJO-217-11, 15 April 2011.

589 **Vol. III, Annex N° 90**, Note from the Minister of Foreign Affairs and Worship of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-AM-299-11, 13 May 2011.

590 **Vol. III, Annex N° 92**, Note from the Minister of Foreign Affairs and Worship of Costa Rica the Minister of Foreign Affairs of Nicaragua, Ref: DM-AM-414-11, 19 July 2011.

591 **Vol. III, Annex N° 94**, Note from the acting Minister of Foreign Affairs of Costa Rica to the Minister of Foreign Affairs of Nicaragua, Ref: DM-AM-461-11, 17 August 2011.

592 **Vol. III, Annex N° 107,** El 19 Digital, 'Nicaragua tells Costa Rica there are no reasons to play the drums of war', 8 October 2011.

593 Ibid.

6.22. Before the submission of this Memorial, and in the context of the lead-up to the Nicaraguan General Elections, the Nicaraguan Army Chief made a groundless accusation that Costa Rica planned to "kidnap" Nicaraguan civilians stationed in Isla Portillos.[594] In this connection, the General was quoted as saying:

> "… 'The work the youngsters have carried out is very noteworthy. I think all Nicaraguans should feel represented by them because they have been out there in an area where the only interest is to try to contribute to conserving the environment', he pointed out. Aviles declared that the military chiefs in that territory had been warned of the Costa Ricans' intentions. He likewise stated that the Army was keeping watch over the youngsters in the area, as is its duty to do so."[595]

The Army Chief's statement confirms the continuing support provided by the Nicaraguan Government to Nicaraguan nationals present on the relevant area. **Figure 6.1** shows the location where the Sandinista Youth have established their campsite at Isla Portillos [596].

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[594] See paragraph 3.66.

[595] **Vol. IV, Annex N° 108**, El 19 Digital, "Costa Rica looking to provoke Nicaragua", 18 October 2011.

[596] See **Vol. V, Annexes 224**.

Figure 6.1

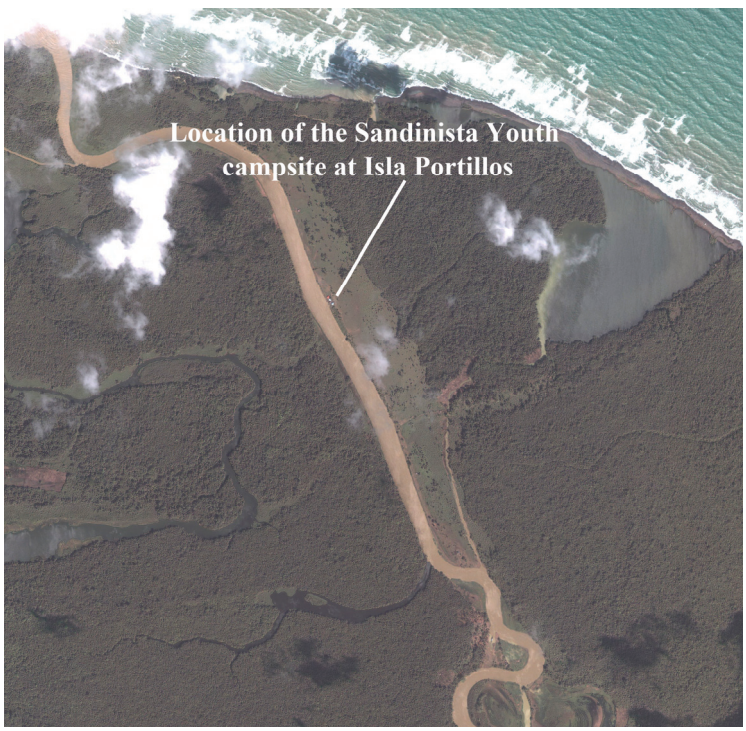

Figure 6.1: Location of the campsite of the Sandinista Youth at Isla Portillos.

6.23. The fact that their presence is supported and maintained by Nicaragua's highest authorities is confirmed by the young persons stationed on Isla Portillos themselves. In a propaganda video annexed to this Memorial entitled "The Truth about a Contingent", members of the "Sandinista Youth" expressly acknowledge that their presence on the relevant area is a direct response to a request made by the President of

Nicaragua, Daniel Ortega.[597] For example, one of the leaders of the youth, identified as Maykelin García, head of the 14th Contingent of the Sandinista Youth, states in the video that:

> "There are 82 of us young people, 27 from Chontales, 30 from Boaco, 15 young people from Agraria and 8 from Zelaya Central [...] It's Commander Daniel Ortega's initiative. He wants us, as young people involved in the different movements that make up the Sandinista Youth organization, to be defending the sovereignty of our San Juan River."[598]

Meylin González, another member of the Sandinista Youth in charge of the El Rama Contingent, also expressed her gratitude towards Nicaraguan President Daniel Ortega for sponsoring their presence at the disputed area:

> "My Mum asked me what I was going to do there, that if it was so far away it was very dangerous, risks of accidents and all that. From the moment they told me we were coming I felt so excited, I thought 'Wow, I'm going to go to the San Juan River'. I told her it was an opportunity our Commander Daniel was giving us, and that we were never going to have that opportunity again because this had never happened before, and then she said yes, but be careful, and then she had to give me permission to come here."[599]

A common argument voiced by those who were interviewed in the video is that they are defending Nicaragua's sovereignty over the region. Meylin González, in charge of the El Rama Contingent, stated it very clearly:

> "Everything you see here around you, everything on this island is very important for the Nicaraguans, and we defend it because everything here is ours. As members of the Sandinista Youth we are brave and it doesn't matter where we have to go to defend our sovereignty, we'll be there as the Sandinista

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597 **Vol. III, Annex N° 138**, (Excerpts) Roberto Salinas G. (Director) "The Truth about a Contingent (Managua, July 2011). Video documentary: transcription of audio. The video's full length version is included in Complete Copies of Certain Annexes.

598 Ibid.

599 Ibid.

> Youth... and we're always ready and willing to do whatever it takes to carry out the missions that our Commander Daniel Ortega sends us on".[600]

6.24. The Sandinista Youth are carrying out works in this internationally protected wetland, including planting crops, raising cattle, and digging drainage ditches. The video "The Truth about a Contingent" shows persons engaged in different tasks such as pulling out plants, shovelling dirt and moving and milking cows, among others. One of those interviewed, Héctor Mairena from the Universidad Agraria, confirmed the intention of drying out parts of the wetland:

> "We are taking soil samples in this part of the territory, because if we look closely we can see the soil is green with a high iron content, and reddish colour, and the trampling of cattle creates pools, so it's a sampling to see if we can somehow drain the soil, and if the sampling works then we can implement it in the area to avoid excess water and see if we can also implement planting some types of crops."[601]

These actions carried out by the Sandinista Youth contrast dramatically with one of the main recommendations included in the report following the 5-6 April 2011 visit to the wetland:

> "In the short, medium and long term, the human presence, accompanied by subsistence production activities in the area currently known as the Area Under the Costa Rican Environmental Administration, constitutes a factor that is to the detriment of the recovery of the ecosystem."[602]

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600 Ibid.

601 Ibid.

602 **Vol. IV, Annex N° 155**, Ministry of Environment, Energy and Telecommunications of Costa Rica, "Assessment and Evaluation of the Environmental Situation in the Humedal Caribe Noreste within the Framework of the Order of the International Court of Justice", 28 October, 2011, p. 68.

(2) Breach of the First Provisional Measure

6.25. The maintenance of these Nicaraguan persons, be they "Sandinista Youth" or otherwise, on territory subject to the Order on Provisional Measures, and the sending of them to the relevant area by and on behalf of Nicaragua, is in breach of paragraph 86(1) of the Court's Order, and also paragraph 86(3) insofar as their presence has aggravated the dispute and contributed to a situation of hostility and heightened tension between the two countries.

6.26. The first Provisional Measure ordered by the Court reads as follows:

> "Each Party shall refrain from sending to, or maintaining in the disputed territory, including the *caño*, any personnel, whether civilian, police or security;"[603]

This Provisional Measure is broad in scope. Each party is prevented from "sending to" or "maintaining in" the relevant area any personnel whatsoever. Furthermore, the term "personnel" is not limited to police, security or military forces.

6.27. "Civilian" may be defined as "a person who is not professionally employed in the armed forces; a non-military person" or "a person who is not a member of a specified profession or group".[604] It is a general term covering all persons not otherwise a member of an identifiable group – specifically here, army or police.

6.28. As such, paragraph 86(1) should be interpreted to mean that each party must refrain from sending to or maintaining in the relevant territory

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603 *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, Order, 8 March 2011, p. 21, para 86(1) (emphasis added).

604 Oxford English Dictionary Online, http://www.oed.com/.

any person, whether a civilian, a State employee, or a member of the police or security forces. It is submitted that the word "personnel" does not limit the scope of paragraph 86(1) and, in the context of a dispute over a fragile wetland, should not be interpreted to mean that only staff or employees of the Nicaraguan State are prevented from being present in the relevant area. In particular, the term "personnel" clearly encompasses organised groups such as the "Sandinista Youth", a derivative organisation of the ruling political party, FSLN, and a group that has received direct encouragement and logistical support from high ranking Nicaraguan officials, including the Deputy Minister of the Environment, the Chief of the Nicaraguan Army, personnel of the Nicaraguan Ministry of Health, the Nicaraguan President, and the Minister of Communication.

6.29. Paragraph 86(1) cannot be taken to mean that a person could be permitted to be present in the relevant territory with State encouragement and material support, so long as that person is not directly employed by the State. Such a restrictive interpretation would render the Court's Order ineffective and open to abuse.

6.30. Noting that "this situation … gives rise to a real and present risk of incidents liable to cause irremediable harm in the form of bodily injury or death",[605] the Court prohibited Nicaraguan and Costa Rican personnel entering the relevant area, subject to the exception provided in paragraph 86(2) of the Order. Under paragraph 86(1), both parties are under an obligation to prevent any and all persons from entering or maintaining a presence in the disputed territory – with the sole exception of Costa Rican

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[605] *Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)*, Order, 8 March 2011, p. 18 (para 75).

civilian personnel charged with environmental protection envisaged in paragraph 86(2).

(a) Nicaragua breached the First Provisional Measure by "sending" public officials to the relevant area and "maintaining" there the "Sandinista Youth"

6.31. According to the terms of paragraph 86(1), it is a breach of the Order for Nicaragua to "send to" or "maintain in" the disputed territory, any person, be they civilian, military or otherwise. The natural meaning of the phrase "to send", in the general sense, is to cause a person to go to a destination. The Oxford English Dictionary defines "send" as: "[t]o order or direct to go or to be conveyed... To commission, order, or request (a person) to go *to* or *into* a place or to a person. Chiefly, to dispatch as a messenger or on an errand."[606] Separately, "maintain" is defined as: "[t]o support, assist, and related uses... To give one's support to, defend, uphold, promote (a cause, something established, one's side or interest, etc.)."[607] The first Provisional Measure is not limited to acts which are committed pursuant to the "instructions of, or under the direction or control of"[608] Nicaragua. Rather, to prove a breach of the obligation contained in the first Provisional Measure, it is sufficient that Nicaragua sent or maintained its civilians in the relevant area.

6.32. Nicaragua has breached the obligation not to send to or maintain civilians in the relevant area. It *sent* Nicaraguan journalists and public

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606 Oxford English Dictionary Online, available at: http://www.oed.com/.

607 Ibid.

608 ILC Articles on the Responsibility of States for Internationally Wrongful Acts, annexed to General Assembly resolution 56/83, 12 December 2001, Article 8.

officials to the relevant area "in Air Force helicopters".[609] It was reported that:

> "The Army provided military helicopters to transport media and public officials to the area where the young persons had set up camp and from where they set off to protest in boats to the area where the Costa Ricans and Ramsar were carrying out "their inspection."[610]

6.33. Nicaragua maintained the presence of the "Sandinista Youth" in the relevant area by ensuring that they had shelter, food supplies, and access "at all hours" to an emergency boat from the Greytown Health Centre.[611] The Nicaraguan newspaper *La Prensa*, noted that the youth received the support of the Central Government, a situation which "only occur in Nicaragua in case of a catastrophe".[612]

(b) Nicaragua breached the First Provisional Measure by sponsoring the presence in the relevant area of Nicaraguan public officials, journalists and members of the "Sandinista Youth" and facilitating their obstruction of the Joint Environmental Mission

6.34. As reported in a leading Nicaraguan newspaper on 6 April 2011, and not contradicted by Nicaragua at any time, "public officials" from Nicaragua travelled in a Nicaraguan military helicopter to the relevant area where the Sandinista Youth had set up camp at Finca Aragón, on Costa Rican

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609 Ibid.

610 **Vol. III, Annexes N° 126 (a) and (b)**, El Nuevo Diario (Nicaragua), 'Ticos continue inspection, rejected by Nicaragua, in disputed area' and 'General Avilés aplaudes the "heroic deed" of the 19 July Sandinista Youth', 6 April 2011.

611 **Vol. III, Annex N° 123**, La Prensa (Nicaragua), 'Army provides support to 19 July Sandinista Youth in River San Juan', 5 April 2011.

612 Ibid.

territory.[613] This act is in clear breach of the Court's Order, which provided that no Nicaraguan persons of any kind were to be present in the relevant area.

6.35. The conduct of members of the "Sandinista Youth" in their harassment and obstruction of the Joint Environmental Mission are attributable to Nicaragua on the basis of Article 8 of the ILC's Articles on State Responsibility. This is because the "Sandinista Youth" acted under the instruction, direction or control of Nicaragua. Members of the "Sandinista Youth" acted as auxiliaries to the Nicaraguan government; they acted for Nicaragua, whether or not they formed part of the official structure of the State.

6.36. As noted above, the "Sandinista Youth" are the youth organization of Nicaragua's ruling party, the FSLN.[614] That the Nicaragua Government issued instructions to the "Sandinista Youth" is evident from the statement of the Nicaraguan Deputy Minister for the Environment that around 100 members of the ruling Sandinista Party would be waiting for the Joint Environmental Mission, demonstrating and waving Nicaraguan flags on the disputed territory so that Costa Rica could "see where Nicaragua is".[615]

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613 **Vol. III, Annexes N° 126 (a) and (b)**, El Nuevo Diario (Nicaragua), 'Ticos continue inspection, rejected by Nicaragua, in disputed area' and 'General Avilés aplaudes the "heroic deed" of the 19 July Sandinista Youth', 6 April 2011.

614 **Vol. III, Annex N° 123**, La Prensa (Nicaragua), 'Army provides support to 19 July Sandinista Youth in River San Juan', 5 April 2011.

615 **Vol. III Annex, N° 124**, Inside Costa Rica (Costa Rica), 'Ramsar Inspects the Area of Conflict Despite Protests by Nicaragua', 6 April 2011; See also **Vol. III, Annex N° 125**, La Jornada, 'Costa Ricans plan to stay, says General Aviles', 6 April 2011.

(c) Nicaragua's failure to act with due diligence in breach of the Court's First Provisional Measure

6.37. Whether or not the conduct of Nicaraguan public officials and the "Sandinista Youth" can be attributed to Nicaragua, it would nonetheless be in breach of its obligation of compliance with paragraph 86(1) of the Provisional Measures Order. As the Court has previously noted:

> "When the Court finds that the situation requires that [provisional] measures of this kind should be taken, it is incumbent on each party to take the Court's indication seriously into account."[616]

However, it is apparent that Nicaragua refused to take serious heed of the Court's Order. In the present case, the primary obligation "not to send to or maintain in the disputed territory" has as its substantive goal a general prohibition on citizens from either Party entering the disputed territory. As such, it encompasses a corollary obligation to ensure that that no one *is sent* to or *maintained* in the territory, and to not knowingly permit the presence of any persons in the territory. This is an obligation of due diligence. Furthermore, the underlying object and purpose of the Court's order is to avoid the presence of Nicaraguan armed forces and civilian workers in Isla Portillos, because such presence creates "an imminent risk of irreparable prejudice to Costa Rica's claimed title to sovereignty over the said territory and to the rights deriving therefrom".[617] The imminent risk of irreparable prejudice to Costa Rica's sovereignty over the disputed territory does not cease merely by Nicaragua withdrawing its armed forces. The ongoing risk is very much alive, as demonstrated by the fact that Nicaragua continues to

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616 *Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America)*, Judgment, I.C.J. Reports 1986, p. 144, para. 289.

617 Ibid., p. 18, para 75.

circumvent the decision of the Court by sending civilians to the area with the intention of challenging the Court's order and attempting to prejudice Costa Rica's title and rights to that territory, all with the full support and encouragement of the Nicaraguan Government.

6.38. Thus Nicaragua has breached its due diligence obligation to prevent members of the Sandinista Youth from entering and remaining in the relevant area contrary to the Court's Order on provisional measures. Nicaragua was fully aware of the acts and intentions of the "Sandinista Youth"; it encouraged them to act accordingly; and it had the capacity to influence the action of the members of the Sandinista Youth, the youth arm of the political party in power.

6.39. Nicaragua attempted to disavow its responsibility of due diligence by means of a diplomatic note from the Ministry of Foreign Affairs. Nicaragua stated:

> "The Nicaraguan authorities do not have the obligation to contain or impede the legitimate expression of Nicaraguans feelings. No criminal acts were committed…"[618]

But Nicaragua did have an obligation to ensure the effective implementation and application of paragraph 86(1); whether or not the acts of the "Sandinista Youth" were contrary to its national law.

6.40. In the *United States Diplomatic and Consular Staff in Tehran* case, the Court found the Iranian Government responsible for its failure "altogether to take any 'appropriate steps'" in response to the taking of

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[618] **Vol. III, Annex N° 84**, Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs of Costa Rica, Ref: MRE/DVM/AJST/121/04/11, 8 April 2011.

hostages in the US Embassy, and that this failure was "due to more than mere negligence or lack of appropriate means".[619]

6.41. Similarly, Nicaragua made "no apparent efforts"[620] to deter or prevent the "Sandinista Youth" from entering the disputed territory, or to discourage them from remaining therein. On the contrary, Nicaraguan officials encouraged and praised the actions of the "Sandinista Youth".[621] For example:

- the Chief of the Nicaraguan Army, General Aviles, stated "I applaud the attitude of these boys and girls who have done this, it is a highly patriotic attitude".[622]
- the Nicaraguan Deputy Minister of the Environment, Roberto Arquistain expressly stated that the operation was mounted by the Nicaraguan government;[623] and gave praise and encouragement to the presence of the "Sandinista Youth".[624]
- President Ortega's stated that the "youngsters" had a right to demonstrate and to "defend this wetland"; and that: "[w]e are

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619 *Case Concerning United States Diplomatic and Consular Staff in Tehran (United States of America v. Iran)*, 1980 I.C.J. Reports 1980, p. 31, para 63.

620 *Case Concerning United States Diplomatic and Consular Staff in Tehran (United States of America v. Iran)*, I.C.J. Reports 1980, p. 3, 12, para 16.

621 **Vol. III, Annexes N° 126 (a) and (b)**, El Nuevo Diario (Nicaragua), 'Ticos continue inspection, rejected by Nicaragua, in disputed area' and 'General Avilés aplaudes the "heroic deed" of the 19 July Sandinista Youth', 6 April 2011.

622 Ibid.

623 **Vol. III, Annex N° 125**, La Jornada 'Costa Rican plan to stay, says General Aviles', 6 April 2011.

624 **Vol. III, Annex N° 130,** Multinoticias canal 4, 'Deputy head of Marena highlights work in San Juan de Nicaragua', 28 April 2011.

obliged to defend our territory, and the Army has an obligation to protect the area (of the Harbour Head wetland)".[625]

- Nicaragua's First Lady and Minister of Communication, Rosario Murillo, stated how proud she is of the work of the Sandinista Youth taken to defend the environment of Nicaragua, and of the boys and girls located on the San Juan River.[626]

6.42. Isla Portillos is an area of wetlands and old-growth rainforests. The region is protected pursuant to the Ramsar Convention and is almost entirely uninhabited. Without the assistance provided by Nicaragua,[627] it is extremely unlikely that a group of "students" could have accessed the disputed territory so as to stage their protest.

6.43. It is also clear that once Nicaraguan civilians were present in the relevant area, Nicaragua did not consider their presence or their subsequent actions unlawful, and it took no measures to discourage their continuing breach of the Court's Order. Rather than condemning these unlawful acts, Nicaragua attempted to justify the unlawful presence of Nicaraguan persons in the relevant area by arguing that they were expressing their "injured feelings" and that "[n]o criminal acts were committed".[628]

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625 **Vol. III, Annex N° 127**, El Nuevo Diario (Nicaragua), 'The Army would capture Costa Rican pilots if they land', 7 April 2011.

626 **Vol. II, Annex N° 35**, Website of the Sandinista Youth organization:

http://juventudsandinista.blogia.com/2011/051001-nos-sentimos-muy-orgullosos-del-trabajo-de-la-juventud-sandinista.php

627 **Vol. III, Annex N° 123**, La Prensa (Nicaragua), 'Army provides support to 19 July Sandinista Youth in River San Juan', 5 April 2011.

628 **Vol. III, Annex N° 84,** Note from the Minister of Foreign Affairs of Nicaragua to the Minister of Foreign Affairs and Worship of Costa Rica, Ref: MRE/DVM/AJST/121/04/11, 8 April 2011.

6.44. In conclusion, Nicaragua breached the First Provisional Measure by "sending" to and "maintaining" in the relevant area Nicaraguan nationals. It may also be considered in breach of the First Provisional Measure by virtue of the fact that the acts of public officials, the "Sandinista Youth", and Nicaraguan journalists, who were present in the relevant area, are attributable to Nicaragua. In any event Nicaragua would nonetheless still be internationally responsible for its failure to act to ensure the effectiveness of the first Provisional Measure.

(3) Nicaragua's Breach of the Second Provisional Measure

6.45. By its attempts to impede the visit of the Joint Environmental Mission to the disputed territory, as well as through actions carried out by the Sandinista Youth at the Humedal Caribe Noreste, such as drying out the wetland, raising cattle and crops and planting trees, Nicaragua is in breach of the second Provisional Measure.

6.46. Paragraph 86(2) thus sets out the only exception to the first Provisional Measure. Pursuant to the terms of paragraph 86(2), it is only Costa Rican civilian personnel charged with the protection of the environment who are permitted to be present in the disputed territory and take actions necessary to avoid irreparable prejudice to that part of the wetland, in coordination with the Ramsar Secretariat.

6.47. Costa Rica has complied with the terms of paragraph 86(2). It coordinated with the Ramsar Secretariat to arrange an inspection of the disputed territory, and advised Nicaragua of the intended dates for the inspection. The inspection was conducted solely to establish the necessary measures for the avoidance of irreparable prejudice to the protected wetland.

6.48. By contrast Nicaraguan personnel have not only been dispatched to the territory, but their presence was directed at harassing the Mission and was intended to impede activities necessary to avoid irreparable prejudice being caused to the wetland. The presence of some 100 to 150 people in an otherwise generally uninhabited wetland represents by itself a threat to the ecosystem.

(4) Nicaragua's Breach of the Third Provisional Measure

6.49. The third Provisional Measure ordered by the Court deals with non-aggravation of the dispute.

6.50. By sending members of the "Sandinista Youth" to stay in the relevant area of the provisional measures, by accomplishing different tasks in this area and by preventing the Joint Environmental Mission to fulfil its role, Nicaragua has aggravated the dispute.

6.51. In these circumstances, Nicaragua was also under an obligation, pursuant to paragraph 86(3), to monitor the situation from its own territory to ensure that its civilians did not interfere with the conduct of the Joint Environmental Mission and otherwise worsen the dispute.

6.52. Moreover, Nicaragua has engaged in conduct which further aggravated the dispute by clearly stating its intention to use military force in the relevant territory. Nicaraguan newspaper *El Nuevo Diario* reported the head of the Nicaraguan Army General Avilés stating: "We are going to protect [the "Sandinista Youth"], we cannot let anything happen to them, absolutely nothing can happened to these comrades..."[629] In addition, General Avilés has stated: "obviously they [Costa Rica] do not know what a

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[629] **Vol. III, Annexes N° 126 (a) and (b)**, El Nuevo Diario (Nicaragua), 'Ticos continue inspection, rejected by Nicaragua, in disputed area' and 'General Avilés aplaudes the "heroic deed" of the 19 July Sandinista Youth', 6 April 2011.

war is" and are provoking "in an attempt to test the patience of the Nicaraguans".[630] General Avilés has also threatened to capture anyone flying over or landing in the disputed territory.[631] President Ortega has similarly threatened the use of armed force in the region, stating that: "[w]e are obliged to defend our territory, and the Army has an obligation to protect the area (of the Harbour Head wetland)".[632]

6.53. In light of the evidence set out above, it is apparent that Nicaragua has acted in such a way as to aggravate the dispute before the Court in contravention of paragraph 86(3) of the Court's Order.

C. Nicaragua's Breaches of the Court's 2009 Judgment

6.54. In relation to the ongoing occupation of Costa Rican territory, Nicaragua has persisted in its denial of navigational rights to Costa Rican individuals travelling on the San Juan for the purposes of commerce, in breach of Article VI of the 1858 Treaty of Limits, as declared by the Court's 13 July 2009 Judgment, pursuant to which

> "Costa Rica has the right of free navigation on the San Juan River for purposes of commerce; [and]… the right of navigation for purposes of commerce enjoyed by Costa Rica includes the transport of passengers".[633]

6.55. For example, on 22 October 2010, journalists from the Costa Rican "Extra News Group", travelling on a paid boat trip from the hamlet of Fátima, entered the San Juan and proceeded to stop at the nearest Nicaraguan

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630 **Vol. III, Annex N° 127**, El Nuevo Diario (Nicaragua), 'The Army would capture Costa Rican pilots if they land', 7 April 2011.

631 Ibid.

632 **Vol. III, Annex N° 127**, El Nuevo Diario (Nicaragua), 'The Army would capture Costa Rican pilots if they land', 7 April 2011.

633 *Case Concerning the Dispute Regarding Navigational and Related Rights (Costa Rica v. Nicaragua)*, Judgment of 13 July 2009, pp. 52-53 (para. 156).

army post, known as "El Delta", where the Colorado River branches out from the San Juan. The journalists intended to travel to Isla Portillos, in order to report on Nicaragua's occupation of that territory.

6.56. Once at the post, the Nicaraguan army detained the journalists, alleging that Costa Rican journalists were not allowed to navigate the San Juan, that they required a special permit, and that they should have first reported to the army post at the mouth of the Sarapiqui, river, ostensibly the only post that could authorise Costa Rican navigation on the San Juan, despite the 13 July 2009 Judgment deciding otherwise. The journalists were informed that they were forbidden to navigate the San Juan, and that they should return to Costa Rica. The journalists were threatened: Nicaragua's military personnel informed them that if they again attempted to navigate the San Juan not only would they would be detained and their personal safety would not be assured.[634]

6.57. Nicaragua gave no explanation for impeding the navigation of the journalists. There were no unusual circumstances: the journey was undertaken during the day, it was done in accordance with the condition prescribed by the Court, no emergencies had been declared, and Nicaragua had not notified Costa Rica of any particular reason why Costa Ricans could not navigate the San Juan. Costa Rica considers that this is a breach of Costa Rica's navigational rights. Affidavits obtained by the journalists in relation to this incident are annexed.[635] **Sketch Map 6.1** shows the journalists' point of departure and the location of the Nicaraguan posts.

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634 **Vol. II, Annexes N° 27 and 28**, Affidavits of Franklin Gutierrez Mayorga and Jeffrey Prendas Arias.

635 Ibid.

6.58. In a separate incident, the sole teacher at the "El Jobo" Primary School on Isla Calero was required by the Nicaraguan Army personnel to obtain a letter from the Nicaraguan Ministry of Foreign Affairs authorizing navigation on the San Juan in order to reach the school.[636] Not having such a letter, the teacher's use of the river to travel to the school was hindered. The impossibility to use the San Juan gave rise to the decision to close the school at El Jobo and relocate it near Delta Costa Rica. **Sketch Map 6.2** shows the change of location of the former school at El Jobo.[637]

6.59. There have also been reports from inhabitants of villages along the San Juan suggesting that Nicaraguan army officers have occasionally forbidden them from navigating the San Juan for the purposes of meeting basic requirements of everyday life, such as allowing children to travel to school.

6.60. The Court, in its Judgment of 13 July 2009, stated that "the inhabitants of the Costa Rican bank of the San Juan river have the right to navigate on the river between the riparian communities for the purposes of the essential needs of everyday life which require expeditious transportation".[638] By impeding navigation by the Costa Rican teacher and other riparians, Nicaragua not only breaches the riparian's right to meet their essential needs of everyday life, but also breaches Costa Rica's navigational rights

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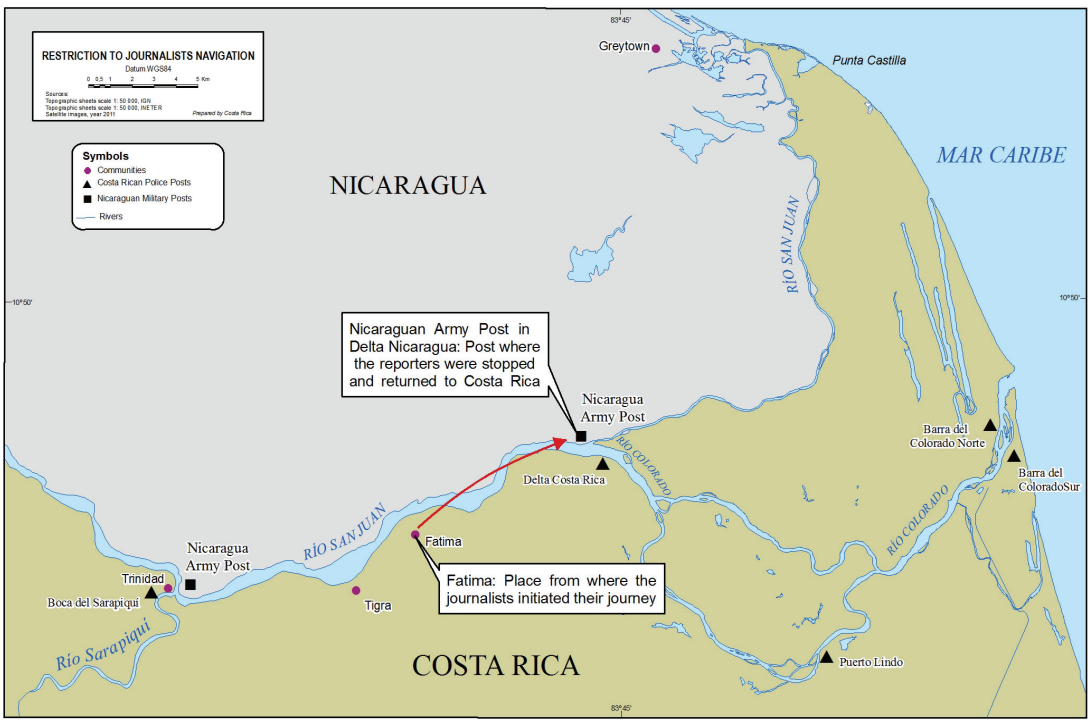
636 **Vol. III, Annex N° 121**, La Nación, 'Nica Army impedes teacher access to Isla Calero', 16 February 2011.

637 **Vol. III, Annex N° 122**, La Nación, 'MEP will relocate the school located in Isla Calero', 17 February 2011; **Vol. III, Annex N° 131**, La Nación 'Border School started lessons with a 100 days delay', 18 May 2011.

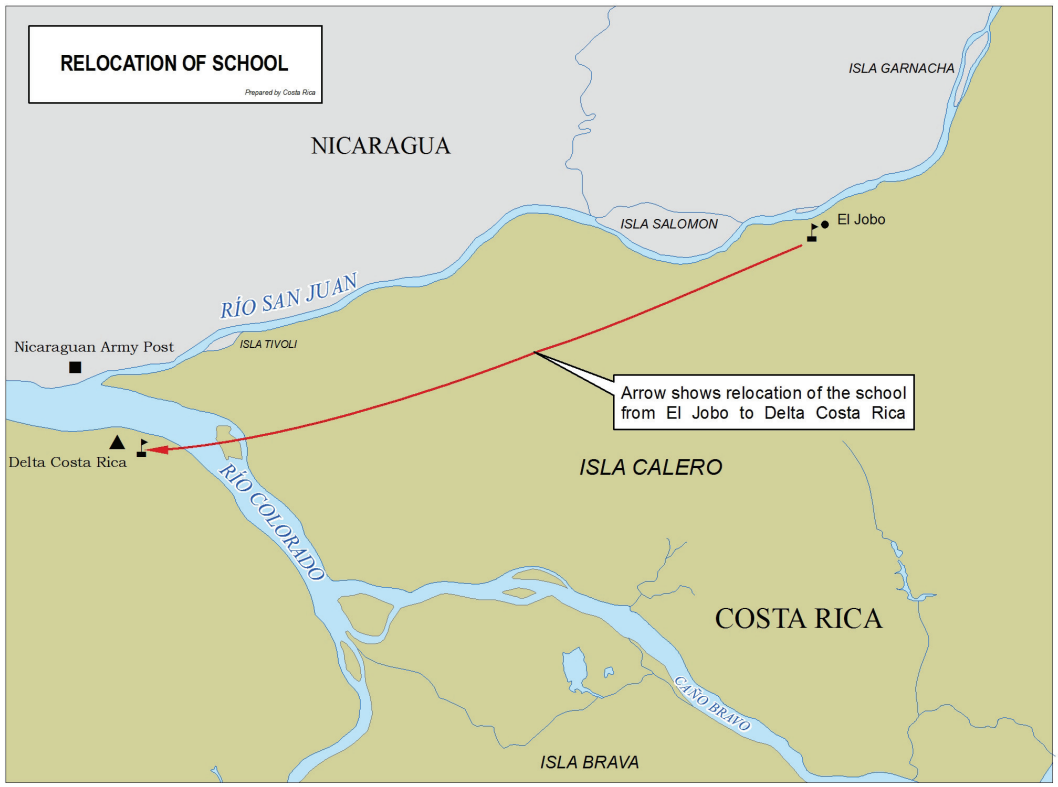
638 *Case Concerning the Dispute Regarding Navigational and Related Rights (Costa Rica v. Nicaragua)*, Judgment of 13 July 2009, pp. 52-53 (para. 156).

Sketch Map 6.1



Sketch Map 6.1: Nicaraguan Army post where Costa Rican journalists were stopped.

Sketch Map 6.2



Sketch Map 6.2: Relocation of El Jobo School

D. Conclusions

6.61. To summarise, Nicaragua has acted contrary to two binding decisions of the Court: the Order for Provisional Measures of 8 March 2011, rendered in the context of the present proceedings, and the Court's Judgment of 13 July 2009 in the earlier case of *Dispute regarding Navigational and Related Rights (Costa Rica v. Nicaragua)*.

6.62. Nicaragua breached three Provisional Measures indicated by the Court in paragraphs 86(1), (2) and (3) of its Order. It has done so by "sending" and "maintaining" members of the Sandinista Youth on the northern part of Isla Portillos; through the conduct of Nicaraguan public officials, Nicaraguan journalists and members of the Sandinista Youth, which is attributable to Nicaragua; and in any event, by failing to exercise due diligence to prevent the presence of these persons on the relevant area (including their harassment of the Ramsar Mission).

6.63. Nicaragua has also acted contrary to the Court's Judgment of 13 July 2009 by unlawfully impeding Costa Rica's right of free navigation on the San Juan, notably by preventing a Costa Rica primary school teacher and Costa Rican.

CHAPTER VII: REMEDIES

7.1. In Chapters IV-VI of this Memorial, Costa Rica has demonstrated how Nicaragua has, by its acts and omissions, breached numerous of its international obligations. In particular, Nicaragua has failed to comply with its obligations in respect of the boundary between Nicaragua and Costa Rica (Chapter IV); its obligations in respect of the environmental protection regime – specifically under the Ramsar Convention and the Cleveland Award (Chapter V) – and its obligations to comply with the decisions of this Court and notably its Provisional Measures order (Chapter VI).

7.2. The present chapter formulates the remedies sought by Costa Rica as a consequence of the internationally wrongful acts. In particular, Costa Rica requests the following:

- a declaration of the extent of Nicaragua's breaches of its obligations;
- the cessation of any internationally wrongful acts that continue to be committed by Nicaragua;
- reparation by Nicaragua for damage caused as a result of those breaches, and
- appropriate guarantees of non-repetition by Nicaragua of its wrongful conduct.

7.3. Costa Rica's primary purpose in instituting these proceedings has been to obtain the withdrawal of Nicaragua from Costa Rican territory, the stopping of the construction of an artificial *caño* and other works by Nicaragua on territory under Costa Rican sovereignty and the insurance that Nicaragua will respect that sovereignty. A second purpose has been to seek to ensure Nicaragua's compliance with its procedural and substantive obligations with respect to the dredging works in this sector of the river.

Notwithstanding the Provisional Measures ordered by the Court on 8 March 2011, Nicaragua has not undertaken a complete withdrawal from the northern part of Isla Portillos. It continues to claim this territory as being Nicaraguan; it has sponsored the presence of members of the Sandinista Youth and other individuals in the area, some of whom caused further environmental damage; through its military it has issued threats to Costa Rican civilian and police personnel to prevent them from carrying out their work, including that related to the compliance of the Provisional Measures order. Moreover, it continues a dredging program, without consultation, exchange of information or response to requests, one which appears aimed at causing significant harm to Costa Rica. A first step to obtain Costa Rica's purposes is through a declaratory judgement. Costa Rica requests the Court to adjudge and declare that Nicaragua is in breach of its international obligations as particularised in Chapters IV, V and VI of this Memorial. As the Permanent Court of International Justice has said, such a declaration serves:

> "to ensure recognition of a situation at law, once and for all and with binding force as between the Parties; so that the legal position thus established cannot again be called in question in so far as the legal effects ensuing therefrom are concerned."[639]

7.4. In particular, in respect of the boundary regime, Costa Rica has established beyond the slightest doubt that there exists in the area that forms the object of the present dispute before the Court a boundary delimited by the Treaty of Limits, and precisely determined on the ground by the first Alexander Award, and that this boundary places Isla Portillos in its entirety on Costa Rican territory. On this basis, Nicaragua's conduct amounts to an

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639 *Interpretation of Judgments Nos. 7 and 8 (Factory at Chorzów)*, P.C.I.J. Series A, No. 13 (1926), p. 20.

invasion and occupation of Costa Rican territory, a breach of the territorial integrity of Costa Rica and of Article 9 of the Treaty of Limits.

7.5. In respect of the environmental protection regime, the Court is requested to adjudge and declare that, by its conduct *inter alia* in chopping down trees, depositing sediment, clearing areas of land, sponsoring occupation of the wetland and conducting of its dredging program,

- Nicaragua has breached its obligation to consult with Costa Rica on any activity which may adversely impact the *Humedal Caribe Noreste* pursuant to Article 5(1) of the Ramsar Convention;
- Nicaragua has breached its obligations of conservation arising under the Ramsar Convention as well as bilateral agreement SI-A-PAZ and the Convention for the Conservation of the Biodiversity and Protection of the Main Wild Life Sites in Central America and under general international law;
- Nicaragua has breached its obligations pursuant to paragraph 3(6) of the Cleveland Award, insofar as Nicaragua is not permitted to conduct works on the San Juan which result in flooding, damage to or occupation of Costa Rican territory.

7.6. In respect of the Court's order for Provisional Measures dated 8 March 2011, the Court is requested to adjudge and declare that Nicaragua has breached sub-paragraphs 86(1), (2) and (3), *inter alia* by sending to and maintaining officials and other persons in the area in question.

7.7. In respect of the Court's decision dated 13 July 2009 and Costa Rica's rights of navigation on the San Juan, as established by the 1858 Treaty of Limits, the Court is requested to adjudge and declare that

Nicaragua has infringed these rights, *inter alia* by the conduct particularised in Chapter VI of this Memorial.

7.8. To the extent that the conduct of Nicaragua specified above is continuing at the date of judgment, the Court is requested to adjudge and declare that Nicaragua should forthwith cease such conduct.

7.9. As stated by the Permanent Court:

> "[i]t is a principle of international law that the breach of an engagement involves an obligation to make reparation in an adequate form. Reparation therefore is the indispensable complement of a failure to apply a convention and there is no necessity for this to be stated in the convention itself."[640]

Consequently, the Court is requested to determine the reparation which must be made by Nicaragua. This reparation must be determined by reference to the damage suffered by Costa Rica.

7.10. Costa Rica seeks pecuniary compensation from Nicaragua for all damages caused by the unlawful acts that have been committed or may yet be committed, these damages to include moral damages for insult to the Costa Rican flag, and to be assessed in a separate phase of the proceedings.

7.11. In addition, Nicaragua's demonstrable bad faith in its conduct – *inter alia* seeking coercively and without colour of right to reroute a boundary river across Costa Rican territory – compels Costa Rica to request the Court to order measures by way of a guarantee of non-repetition. In addition to the remedies requested above, this should take the form of an order of the Court that Nicaragua shall:

1. cease all dredging activities on the San Juan in the area between the point of bifurcation of the Colorado River and the San Juan

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640 *Factory at Chorzów, Jurisdiction*, P.C.I.J., Series A, No. 9 (1926), p. 21.

and the outlet of the San Juan in the Caribbean Sea ('the area'), pending:

(i) an adequate environmental impact assessment;

(ii) notification to Costa Rica of further dredging plans for the area, not less than 3 months prior to the implementation of such plans;

(iii) due consideration of any comments of Costa Rica made within 1 month of notification.

2. not engage in any dredging operations or other works in the area if and to the extent that these may cause significant harm to Costa Rican territory (including the Colorado River) or its environment, or to Costa Rica's rights under the Cleveland Award.

7.12. Such an order would act as an essential guarantee against further deliberate violations of international law on the part of Nicaragua.

SUBMISSIONS

For these reasons, and reserving the right to supplement, amplify or amend the present submissions:

1. Costa Rica requests the Court to adjudge and declare that, by its conduct, Nicaragua has breached:

(a) the obligation to respect the sovereignty and territorial integrity of the Republic of Costa Rica, within the boundaries delimited by the 1858 Treaty of Limits and further defined by the Demarcation Commission established by the Pacheco-Matus Convention, in particular by the first and second Alexander Awards;

(b) the prohibition of use of force under Article 2(4) of the UN Charter and Articles 1, 19, 21 and 29 of the Charter of the Organization of American States;

(c) the obligation of Nicaragua under Article IX of the 1858 Treaty of Limits not to use the San Juan to carry out hostile acts;

(d) the rights of Costa Rican nationals to free navigation on the San Juan in accordance with the 1858 Treaty of Limits, the Cleveland Award and the Court's judgment of 13 July 2009;

(e) the obligation not to dredge, divert or alter the course of the San Juan, or conduct any other works on the San Juan, if this causes damage to Costa Rican territory (including the Colorado River), its environment, or to Costa Rican rights in accordance with the Cleveland Award;

(f) the obligation to consult with Costa Rica about implementing obligations arising from the Ramsar Convention, in particular the obligation to coordinate future policies and regulations concerning the conservation of wetlands and their flora and fauna under Article 5(1) of the Ramsar Convention; and

(g) the Court's Order for Provisional Measures of 8 March 2011;

and further to adjudge and declare that Nicaragua is:

(h) obliged to cease such breaches and to make reparation therefore.

2. The Court is requested to order, in consequence, that Nicaragua:

(a) withdraw any presence, including all troops and other personnel (whether civilian, police or security, or volunteers) from that part of Costa Rica known as Isla Portillos, on the right bank of the San Juan, and prevent any return there of any such persons;

(b) cease all dredging activities on the San Juan in the area between the point of bifurcation of the Colorado River and the San Juan and the outlet of the San Juan in the Caribbean Sea ('the area'), pending:

(i) an adequate environmental impact assessment;

(ii) notification to Costa Rica of further dredging plans for the area, not less than 3 months prior to the implementation of such plans;

(iii) due consideration of any comments of Costa Rica made within 1 month of notification.

(c) not engage in any dredging operations or other works in the area if and to the extent that these may cause significant harm to Costa Rican territory (including the Colorado River) or its environment, or to impair Costa Rica's rights under the Cleveland Award.

3. The Court is also requested to determine, in a separate phase, the reparation and satisfaction to be made by Nicaragua.

Agent of Costa Rica

5 December 2011

CERTAIN ACTIVITIES CARRIED OUT BY NICARAGUA IN THE BORDER AREA (COSTA RICA *v.* NICARAGUA)



Report

Assessment of the physical impact of works carried out by Nicaragua since October 2010 on the geomorphology, hydrology and sediment dynamics of the San Juan River and the environmental impacts on Costa Rican territory

Prepared by

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on behalf of

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October 2011

Preface

Terms of Reference

This Report reflects the honest belief of the author with respect to issues and questions posed to him by representatives of the Government of Costa Rica. Specifically, it responds to the following matters and questions in the Terms of Reference for this Report:

The 'Caño'

1. Identify whether the channel known as the 'Caño' that extends from the Río San Juan to the Harbor Head Lagoon is an established waterway or is recently constructed. To the extent that the 'Caño' is recently constructed, please provide an estimate of when it was constructed and explain the means by which it is possible to establish this fact.
2. Identify changes to the morphology of the Río San Juan which have resulted from the presence of the 'Caño'.
3. Identify potential effects to the surrounding wetland as a result of further dredging of the 'Caño'.

Nicaragua's Dredging Programme

4. Identify and outline the effect of dredging on river morphology.
5. Identify and analyse the effect of Nicaragua's dredging programme on the following:

    a. sedimentation in the Río San Juan;
    b. morphology of the Río San Juan; and
    c. flow and morphology of the Colorado River.

6. Identify and describe any resulting or expected changes to the morphology of the Río San Juan resulting from the cutting of meanders.

General

7. Please identify any other environmental impacts that have, will or might result from either the presence of the 'Caño' or the dredging of the Río San Juan.

Colin R. Thorne, BSc PhD – Qualifications

The author of this report is Professor Colin Reginald Thorne. Since 1990, Professor Thorne has held the Chair of Physical Geography at the University of Nottingham, United Kingdom (UK). He holds BSc and PhD degrees in Environmental Science from the University of East Anglia, UK. He has over 35 years of professional experience, including appointments at Colorado State University; the University of London; the U. S. Army Corps of Engineers, Waterways Experiment Station; and the U. S. Department of Agriculture, Agricultural Research Service,

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Cover Photograph: The naturally clear water of the Harbor Head Lagoon is discoloured by sediment-laden river water diverted to it from the Río San Juan by the 'Caño' on 5 December 2010.

Executive Summary

ES.1 Background and approach

On 18 November 2010, the Republic of Costa Rica initiated proceedings against the Republic of Nicaragua before the International Court of Justice. In this connection, Costa Rica formed a technical team that includes experts in hydrology, sedimentology, geomorphology, and environmental impact analysis.

The author of this Report, Professor Colin Thorne, was requested to provide his independent assessments of issues related to hydrology, sediment dynamics, geomorphology, and environmental assessment arising from works carried out by Nicaragua to:

1. construct a channel (the 'Caño') between the Río San Juan and the Harbor Head Lagoon in the northern sector of the Isla Portillos; and
2. perform a programme of dredging and straightening in the Río San Juan between the Delta and the Bay of San Juan del Norte, which has potential environmental impacts on Costa Rican territory.

These assessments fall within the framework of the case "Certain Activities Carried Out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)," which is before the International Court of Justice.

The basis for the author's assessments are his education and training in environmental science and international experience in the application of fluvial geomorphology as part of technical studies performed to assess the impacts of human actions on watercourses.

In conducting the assessments, the approach adopted by the author combined:

- reconstruction of the geological and geomorphological histories of the Bay of San Juan del Norte, Harbor Head Lagoon, Río San Juan, and Delta (including the surrounding wetlands), using available maps and satellite images;
- examination of contemporary photographic, textual, and quantitative evidence (provided by Costa Rican and Ramsar technical specialists) pertaining to recent anthropogenic activities in and around the Lower Río San Juan, Harbor Head Lagoon, 'Caño', and Delta;
- scrutiny of documents submitted to the International Court by the Republic of Nicaragua; and
- consideration of the author's first-hand observations of the study area, made during a helicopter over-flight of the Lower Río San Juan, boat tour of the Río Colorado, and field inspection of the Delta (all performed within Costa Rican territory) on 7 July 2011.

ES.2 The Harbor Head Lagoon

Assessment and interpretation of historical maps dating from the late-18th century and aerial photographs and satellite images dating from 1961 established that the Harbor Head Lagoon

evolved into a discrete water body when the much larger Bay of San Juan del Norte was bisected by north-easterly extension of the micro-delta of the Río San Juan between the late-18th and mid-19th centuries. Early maps clearly establish that inception of the micro-delta created a narrow pocket of open water at the southern tip of what would later become the Harbor Head Lagoon. This feature can be identified in maps made during the mid-19th century as well as more recent satellite images, and contemporary aerial and ground photographs. It now forms a narrow inlet that is linked to the surficial hydrological system, carries runoff generated by local rainfall, and is inundated by backwater effects from the Harbor Head Lagoon. That said, the inlet has the appearance of, and could easily be mistaken for, a channel. In fact, the historical analysis reported here demonstrates that this inlet is actually a remnant of the Bay of San Juan del Norte that has never been a distributary of the Río San Juan.

Based on this assessment, it must be concluded that while distributaries of the Río San Juan have drained to the northwest corner of the Harbor Head Lagoon, no channel has linked the river to the southern tip of the Harbor Head Lagoon since the genesis of that water body over 230 years ago.

ES.3 The 'Caño'

With respect to the 'Caño', the evidence assembled and assessed in this Report includes photographs taken during multiple over-flights, field investigations performed by technical specialists from the National System of Conservation Areas (SINAC) and Ramsar, and scientific analyses using methods of estimating the ages of trees that are well-established in the region. This evidence provides a sound basis from which to establish its origin, the key dates in its construction; the areal extent; numbers, species, and ages of trees cut down to clear its path; the extent and quantity of soil excavated to create its channel; and its post-construction deterioration.

The channel of the 'Caño' that extends about 1,208 m from the right bank of the Río San Juan to the head of the inlet at the southern tip of the Harbor Head Lagoon is an artificial ditch. Preparatory work to clear a path for the 'Caño' began sometime prior to October 2010 and involved clearing about 5.75 ha of primary forest. The channel of the 'Caño' was excavated to a width of around 10 m by removal and dumping of around 5,800 m^3 of soil between 1 and 19 November 2010.

During December 2010, the 'Caño' conveyed flood water and sediment from the Río San Juan into the Harbor Head Lagoon, driving erosion that widened its channel to around 15 m. However, flow recession, siltation, and vegetation regrowth between January and July 2011 led to progressive reductions in the width (to 5 m or less) and depth of the channel of the 'Caño'. This behaviour is consistent with its unnatural origin and indicates that the 'Caño' is likely to be unsustainable.

The short-term impacts of the 'Caño' on the hydrology, hydraulics, sediment dynamics, and morphology of the Río San Juan were minor because, even at its peak in December 2010, the 'Caño' diverted only a few percent of the river's discharge. This is also likely to be the case in the future provided that no further work is performed to re-excavate or enlarge its channel.

Conversely, construction and operation of the 'Caño' certainly had impacts in the Harbor Head Lagoon and wetlands in the Isla Portillos that were immediate and adverse. Within the Harbor Head Lagoon, expected impacts reported by the Ramsar team include increased inflows of sediment-laden river water that altered turbidity, nutrient balance, water quality, benthic conditions, and salinity. Resultant changes in habitats and the trophic chain are likely to impact both aquatic flora and fauna as well as resident and migratory birds, leading to reductions in reproductive success and biodiversity, and increases in vulnerability, morbidity, and mortality.

In the wetland, disturbance during construction was accompanied by habitat loss that included the destruction of at least 292 mature trees, some with ages in excess of 200 years, and changes to the topography, surficial hydrology, and the shallow aquifer beneath the wetland resulting from digging of the channel. Based on the tree types and ages involved, the Total Value Estimate (TVE) for the loss natural capital and ecological services related to destruction of the 292 trees felled in October 2010 to make way for the 'Caño' is estimated to have exceeded $1.5 million. This does not reflect solely the commercial value of the trees as lumber, but includes their value as natural capital and the ecosystem services they were providing prior to their destruction.

Deterioration of the 'Caño' during 2011 suggests that its impacts are unlikely to spread in the medium- and long-terms provided that not attempt is made to re-excavate or enlarge its channel. However, further work on the 'Caño', undertaken as part of a concerted effort to divert a substantial proportion of flow in the river into the Harbor Head Lagoon could lead to breaching of the barrier beach that separates the Harbor Head Lagoon from the Caribbean Sea, changes in the surficial and sub-surface hydrology, salinity and trophic state of the lagoon and surrounding wetland and collapse of the ecosystem in the northern Isla Portillos that could be irreversible. The annual value of the ecological services provided annually by natural capital in the northern Isla Portillos has been estimated to exceed $0.6 million and, under this 'worst-case' scenario, a large proportion of these services could be lost.

ES.4 Meander cut-off(s)

In October 2010 activities also began on the left bank of the Río San Juan at a meander bend located about 400 m upstream of the mouth of the 'Caño'. First, a corridor of vegetation was cleared across the neck of the bend and by late-February 2011, a pilot channel had been dredged along that corridor, to cut off the bend. There is also some evidence that vegetation was cleared along a tributary channel and in a strip of forest on the left bank at a second bend upstream of the one cut off between October 2010 and February 2011, possibly in preparation for another cut-off.

Cutting off meanders disturbs wildlife, disrupts the fluvial system, and may generate medium- to long-term morphological instability including degradation upstream and aggradation downstream, and bank erosion where re-aligned flows impinge against the banklines.

Given the low-gradient, limited stream power and erosion-resistant banks of the Río San Juan, reduce the river's morphological sensitivity and this should limit the environmental and ecological impacts of a single cut-off. However, this would no longer be a safe assumption if the

second bend were also to be cut off because this would align flow in the Río San Juan with the mouth and heading of the 'Caño', promoting synergistic interaction of the cut-offs with the channel that could lead to more water being diverted out of the natural course and into the Harbor Head Lagoon and, perhaps leading to a 'worst-case' scenario in terms of the potential for irreversible morphological, environmental, and ecological impacts felt throughout the northern part of Isla Portillos.

ES.5 The Río San Juan

The catchment context for Nicaragua's dredging programme was investigated through a documentary study of the geology, hydrology, fluvial geomorphology, environment, and ecosystem of the Río San Juan.

The course of the river approaching the Delta follows the line of the Hess-Santa Elena fault. The morphology and unequal division of discharges at the Delta itself are also geologically controlled. Regional geology and neotectonics dictate that the Río Colorado receives about 90% of the discharge because this river flows into a broad, subsiding coastal plain. Only about 10% flows to the lower Río San Juan which is constrained by the higher ground of the uplifting, Chortis Block to the north. Available hydrological records are limited and subject to uncertainty but provide no evidence that the balance of flows at the Delta has changed substantially since the mid-19th century.

Sub-basins supplying water and sediment to the Río San Juan from the south (in Costa Rica) are larger, have higher headwaters and receive more rainfall than those draining from the north (in Nicaragua). Consequently, they naturally supply most (about 83%) of the runoff generated by the catchment downstream of Lake Nicaragua. These sub-basins are also steeper, they have naturally-erodible (mostly volcanic) soils and are subject to extreme events including landslides, volcanic eruptions, earthquakes, and hurricanes; all of which promote high-sediment yields. Consequently, the headwater sub-basins of Costa Rican rivers like the San Carlos and the Sarapiqui have, throughout the Quaternary (i.e., the last 2.5 million years), supplied most of the sediment carried to the Delta by the Río San Juan. While deforestation and agricultural intensification may have elevated sediment yields locally, there is no evidence to suggest that sediment loads in the main river have increased significantly due to anthropogenic impacts.

Below the Delta, the Río San Juan and Río Colorado support a linked system of distributaries, swamps, flooded forests, lakes, and coastal lagoons that makes up the wetlands of the Isla Calero that are part of the 'Humedal Caribe Noreste' (HCN), which was designated in 1996 as a wetland of international importance under the Ramsar Convention. The wetland in the area that could be indirectly impacted by dredging, straightening, and diverting the Río San Juan provides habitats for a wide array of plants, birds, fish, amphibians, reptiles, and mammals, including many iconic and endangered species. Natural capital in the indirectly impacted area also provides ecological services with an annual value estimated to exceed $33 million that include:

- flood alleviation,
- drought mitigation,

- groundwater recharge,
- retention and recycling of sediments and nutrients,
- water purification,
- biodiversity reservoirs,
- aquatic and wetland products, and
- recreation and tourism (especially ecotourism).

ES.6 Nicaragua's dredging programme

According to documents submitted to the International Court of Justice by Nicaragua, the intention of the dredging programme undertaken between the Delta and the Bay of San Juan del Norte is to create a navigation channel with dimensions of, "*20 meters wide on the bottom, 30 meters wide on the surface, and 2 meters deep*" (Republic of Nicaragua (2011), Annex 11). This will involve removing approximately 1.6 million m^3 of bed material (Republic of Nicaragua (2011), Annex 7), which equates to around ten times the annual sand load of the Río San Juan below the Delta calculated using Einstein's sediment-transport equation. Dredge spoil will be disposed of at twenty-three sites distributed along the length of the northern (left, Nicaraguan) bankline, resulting in about 130 ha of the Río San Juan floodplain being buried by up to 1.1 m of sediment removed from the channel bed.

Based on application of the Chezy Equation for steady, uniform flow (first formulated in 1775) in conjunction with an estimate of the Manning roughness coefficient (developed in 1890) and ignoring any morphological change, it is predicted that dredging the river would lead to an increase in discharge of only 20 to 50 m^3/s (Republic of Nicaragua (2011), Document 18). This suggests that the loss of discharge in the Río Colorado would be negligible. However, application of the U. S. Army Corps of Engineer's Hydraulic Engineering Center River Analysis System (HEC-RAS) hydrodynamic model (with a gradually-varied flow assumption and allowing for channel widening) indicates that dredging by 1 m could change the division of flow at the Delta by 4%, rising to 9% for 2 m of bed lowering.

ES.7 Impacts of the dredging programme on the Río San Juan, Río Colorado, and wetlands

Naturally high sediment and nutrient concentrations in the river are likely to limit impacts on turbidity and water quality that are customarily associated with dredging. Even so, mechanical and sediment-related disturbance to the morphology, environment, and ecosystem of the river at each dredge site are inevitable and the extent of the dredging programme is sufficient that cumulative effects may produce impacts that extend beyond the site at least to the reach-scale.

A further risk is that dredging too close to the edge of the channel over-steepens the banks to trigger channel widening and instability. Once triggered, dynamic process-response mechanisms inherent to the fluvial system could produce morphological adjustments that are impossible to

predict in detail, but which could amplify rather than dampen the impacts of dredging on channel forms, habitats, and ecosystems.

It is unlikely, but not impossible, that the impacts of the dredging programme might interact synergistically with those of renewed attempts to divert flow into the 'Caño' by straightening its course through meander cut-offs and enlarging the channel linking the Río San Juan to the Harbor Head Lagoon. In this context, synergy might stem from the increased energy slope that results from shortening the length of the river by straightening and diverting it into the Harbor Head Lagoon interacting with reduced energy losses (due to cutting off bends and removing shoals) and reduced sediment loads (due to sediment trapping in the dredged channel at the Delta) to trigger flow acceleration and channel degradation that would further steepen the channel. In a 'worst-case' scenario, the balance of flows at the Delta might reach a geomorphic tipping point, allowing the Río San Juan to capture a substantial proportion of the flow that should naturally flow to the Río Colorado.

Such an outcome would lead to adverse environmental impacts and serious losses of natural capital throughout the Río Colorado, including its distributary channels, swamps, seasonal lakes, and estuarial and lagoonal systems, as well as, in the coastal zone that it feeds with freshwater and sediment.

The area of wetland potentially affected by these indirect impacts would include not only the Isla Portillos, but the Isla Calero as well – that is, a substantial portion of the HCN. Risks to species include the possibility of extinction for those already threatened or endangered, while the NPVs of losses of natural capital and damage to ecosystem services under this unlikely, but perhaps not impossible scenario, would be measured in tens of millions of dollars.

The evidence assembled and assessed in this Report suggests that the morphological, environmental, and ecological risks associated with continuing the dredging programme are serious. It also emphasises the necessity of avoiding any future actions that might increase the probability that the cumulative effects of dredging, straightening, and diverting the Río San Juan might act synergistically to destabilise the natural division of flows at the Delta, due to the potentially dire environmental and ecological consequences for the Isla Calero should this occur.

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PART I. THE LOWER RÍO SAN JUAN, THE HARBOR HEAD LAGOON, AND THE 'CAÑO'

I.1 Study approach

The availability of a series of multiple historical maps dating back as far as the late-18th century, coupled with a sequence of cloud-free, remotely-sensed images beginning in 1961 and extending up to the summer of 2011 make it possible to reconstruct the geomorphic history of the lower reaches of the Río San Juan and the associated features of the wetlands and coast with a high degree of confidence. All these maps and images have been in the public domain for decades or more and their provenance and originality is well-established. However, to date, the long and semi-continuous record they provide has not been used systematically to chronicle the morphological history of the area.

In addition to the historical maps and remotely-sensed images, the author was supplied with photographic, textual, and quantitative evidence pertaining to recent activities in and around the Lower Río San Juan, the Harbor Head Lagoon and, particularly, the 'Caño'. These materials are derived from programmes of aerial reconnaissance, field inspection and photography, and data collection on the ground conducted by Costa Rican investigators and representatives of the Ramsar Convention, between October 2010 and July 2011.

Finally, the author took part in a helicopter over-flight of the Lower Río San Juan, Harbor Head Lagoon, and 'Caño' to view its current morphology first-hand, on 7 July 2011. Although the aircraft remained in Costa Rican air space at all times, the over-flight afforded clear views of the river, coast, lagoon, 'Caño', and surrounding wetlands.

The account and conclusions reported here are based on the author's independent inspection and interpretation of a chronologically-arranged sequence of maps and satellite images, coupled with consideration and analysis of the photographs, textual accounts, and data derived from the field investigations mentioned above. All available maps and remotely-sensed images were examined (Table I.1), although for illustrative purposes only a selection are reproduced here and described in detail in the text.

Table I.1. Historical maps examined in this study.

Date	Description	Source*	Image in this Report
1780	Puerto de San Juan de Nicaragua by John Campbell	Bolaños Geyer (2000, pp. 21)	
1787	Plano del Puerto de San Juan de Nicaragua	Bolaños Geyer (1999, pp. 43)	Figure I.1
1832	San Juan de Nicaragua by George Peacock	Bolaños Geyer (1999, pp. 44)	Figure I.2
1834	Harbour at the mouth of the river San Juan de Nicaragua – HMS Thunder	Aguirre Sacasa (2002, N112, CD filename: nic_vau_011)	
1834	Harbour at the Mouth of the River San Juan de Nicaragua by Commander Richard Owen	Bolaños Geyer (1999, pp. 45)	Figure I.3
1838	Puerto y Boca del Río San Juan de Nic	Aguirre Sacasa (2002, N107, CD filename: nic_vau_026)	
1840	Harbour of San Juan de Nicaragua by George Peacock 1832 actualizado a 1840		Figure I.4
1848	San Juan de Nicaragua Mapa de Peacock actualizado	Bolaños Geyer (2000, pp. 99)	
1849	San Juan de Nicaragua Mapa de Peacock actualizado by Barnett and Wheeler	Bolaños Geyer (2000, pp. 100)	
1850	Greytown Harbor by Commander Nolloth	Bolaños Geyer (1999, pp. 46)	Figure I.5
1850	Greytown Harbor Nolloth	Aguirre Sacasa (2002, Plate 54, N46, CD filename: nic016_Greytown)	
1853	Greytown Harbor (John Richards)	Aguirre Sacasa (2002, N11, CD filename: nic013_Greytown)	
1856	Greytown Harbor (John Scott)	Aguirre Sacasa (2002, Plate 56, N47, CD filename: nic015_Greytown)	
1865	P C F West	Aguirre Sacasa (2002, Plate 57, N48, CD filename: nic014_Greytown)	Figure I.6
1872-73	San Juan de Nicaragua or Greytown by Hatfield and Lull	Bolaños Geyer (2000, pp. 117)	
1872	Greytown Harbor (James Miller)	Aguirre Sacasa (2002, Plate 58, 49, CD filename: nic012_Greytown)	
1884	Passmore and Climie	Aguirre Sacasa (2002, Plate XVI, N53, CD filename: nic_vau_060)	
1888	W J Maxwell	Aguirre Sacasa (2002, Plate XVII, N54, CD filename: nic_vau_062)	
1890	San Juan del Norte or Greytown by A W J Maxwell (1888) (updated in 1890 by H. Elmer) (Pilar Saborio)	UK Hydrographic Office (1890)	Figure I.7
1890-95	Harbour of San Juan del Norte or Greytown	US Hydrographic Office	
1895	Greytown Harbor a partir de Peacock 1832 muestra crecimiento barra de arena para Nicaragua Canal Board	Aguirre Sacasa (2002)	
1897-99	Greytown Harbor, Map 3, sheet 1	Aguirre Sacasa (2002, N18, CD filename: nic_sub_083)	
1897	Mapa del Laudo Alexander		Figure I.8
1898	Greytown Harbor surveyed by officers of U S S Newport		
1899	Map of Greytown Harbor Nicaragua Canal Commission, Map 4 (E S Wheeler)	Aguirre Sacasa (2002, N44, CD filename: nic_reg_011b)	Figure I.9
1903	Greytown to Colorado – Canal Interoceanico-LBC	Aguirre Sacasa (2002, N41, CD filename: nic_sub_158)	
1923	Location for a Permanent Entrance to the R S J Lewis M Haupt	Aguirre Sacasa (2002, N109, CD filename: nic_vau_012)	

*Aguirre Sacasa, Francisco Xavier (2002). Un Atlas Histórico de Nicaragua;
Bolaños Geyer, Alejandro (1999). Campana Rota, Camalotes, Tumbas y Olvido; and
Bolaños Geyer, Alejandro (2000). Sepultado en el Olvido.

I.2 Historical account of the morphological evolution of the Lower Río San Juan, Laguna San Juan del Norte, Greytown Harbor, and Harbor Head Lagoon since the late-18th century, and construction of the 'Harbor Head Caño' in 2010

1787

Although older maps are available, the first available map that includes a scale, north point, and labels clearly identifying key morphological features including the mouth of the Río San Juan and Punta de Arenas, is the "Plano del Puerto de San Juan de Nicaragua en Mayo de 1787" (Figure I.1). The salient features to note in this simple but clear map are that Río San Juan reaches the coast at the centre of the Bay of San Juan del Norte, which is at that time a single, large, open bay. This places the Río San Juan to the west of the present location of the Harbor Head Lagoon, on a heading that has not changed substantially in the subsequent 224 years.

The coastline within the bay is crescent-shaped and, while the spit of which Punta de Arenas is the tip is broad in width, its westward extent is limited to only about a quarter of the width of the mouth of the bay. A small, alluvial micro-delta may be identified as a single lobe and one island interrupting the crescent formed by the shoreline and extending north-northeast a short distance from where the Río San Juan enters the bay.

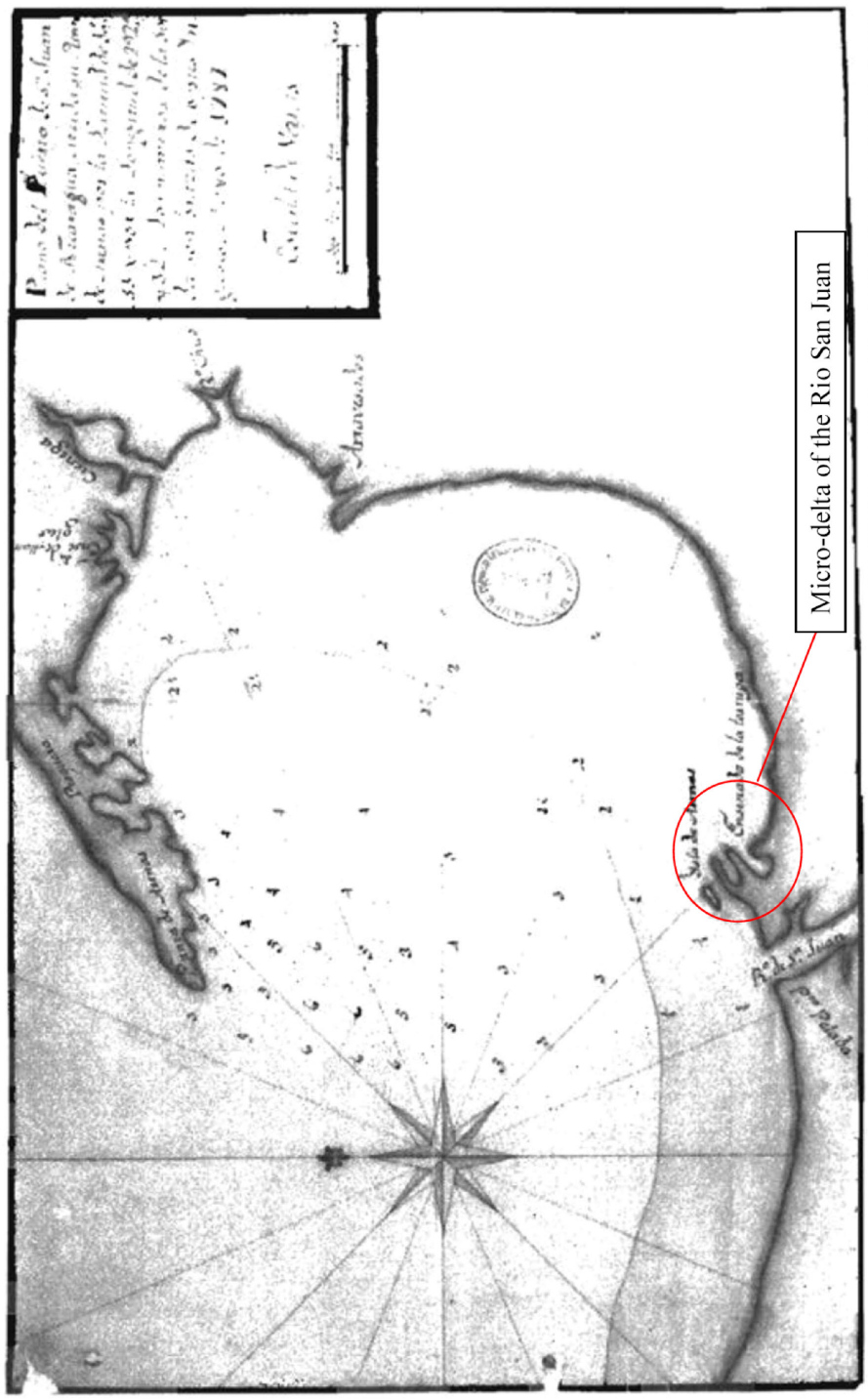


Figure I.1. Map of 1787 – Puerto de San Juan de Nicaragua (annotated from Bolaños Geyer (1999)).

1832

The map produced by George Peacock, based on his survey in 1832 (Figure I.2), clearly illustrates several substantial morphological changes. The spit, now labelled Isla de Castilla, has accreted westward so that its tip (Punta de Castilla) is located more than halfway across the mouth of the bay. The crescent-shaped shoreline within the bay is still visible, but the small micro-delta that was present in 1787 has accreted markedly to form a larger depositionary lobe extending over a mile north-northeast from the point where the Río San Juan enters the bay. The main channel of the Río San Juan (Paso de las Canoas) enters the bay to the west of the lobe, where deposition of its sediment load is evident in the form of multiple islands that together form a new lobe that is beginning to advance westwards immediately north of the settlement labelled 'San Juan' (later renamed Greytown).

The characteristic shape of what is later to become the Harbor Head Lagoon can be discerned in the eastern part of the Laguna San Juan del Norte. The south-eastern margin of the Harbor Head Lagoon is formed by the much older shoreline of the Laguna San Juan del Norte. The north-western margin is the eastern (right-hand) edge of the alluvial lobe. This part of the bay is separated from the Caribbean Sea by the Isla de Castilla spit. It follows that the water bodies that later became the Harbor Head Lagoon and Greytown Harbor were originally the eastern and western halves of the much larger Bay of San Juan del Norte, respectively.

Their genesis as separate features had begun in the late-18th century through growth of the micro-delta built by the Río San Juan (see Figure I.1). In other versions of Peacock's map, the part of the Bay of San Juan del Norte to the northwest of the advancing delta of the Río San Juan is labelled *FONDEADERO* (meaning anchorage). This suggests that the eastern two thirds of the Bay of San Juan del Norte were already becoming unnavigable due to lack of access (it was isolated from the Caribbean Sea by the spit and Isla de Castilla) and alluvial siltation.

This explains the origins of the names subsequently given to the two parts of the Laguna (see Figure I.6, the Map of 1865). The western part became 'Greytown Harbor', while the eastern remnant that was inaccessible to ocean-going vessels became known as the Harbor Head Lagoon; literally, the lagoon at the head of the harbor. Hence, what later became the Harbor Head Lagoon was, in 1832, that part of the bay trapped between the river's growing micro-delta to the west and the static shoreline of the Bay to the east.

The depositional lobe being built by the Río San Juan features multiple distributary channels, but in 1832 none of them drains into the eastern part of the Bay of San Juan del Norte that was destined to evolve into the Harbor Head Lagoon.

Figure I.2. Map of 1832 – San Juan de Nicaragua by George Peacock (annotated from Bolaños Geyer (1999)).

1834

This map is reproduced in this account because it illustrates the location and orientation of the Harbor Head Lagoon more accurately than the Peacock map drawn just 2 years previously. It is also important because it reveals the nature and origin of the narrow, forked inlet (circled in red in Figure I.3) at the southern tip of the Harbor Head Lagoon. This is not a distributary of the Río San Juan or indeed a stream channel at all, but a narrow pocket formed between the advancing micro-delta of the Río San Juan and the ancient, static shoreline of the Bay of San Juan del Norte.

The long-term stability of the shoreline in the southern part of the Harbor Head Lagoon is demonstrated by the fact that the same feature can be discerned in the satellite image of 1961 (Figure I.10). The difference between an inlet and a channel is subtle morphologically, but highly-significant morphogenetically because, had this inlet been linked to the Río San Juan, sediment-laden river water draining to the lagoon would have quickly silted it, to accrete and change the shape of the shoreline. This reinforces the fact that none of the distributaries of the Río San Juan that existed in 1834 drained to the southern part of the Harbor Head Lagoon.

1840

This map is an updated version of Peacock's map of 1832 that correctly represents the shape and orientation of the Harbor Head Lagoon and illustrates continued, westward extension of the Isla de Castilla spit (Figure I.4). It also shows that the narrow inlet at the southern tip of the Harbor Head Lagoon remained stable. This map also shows a secondary channel linked to the right flank of the Río San Juan that delimits an area of floodplain marked as 'Monkey Island'. The map makes it clear, however, that this channel comes nowhere near to intersecting either the shoreline of the Harbor Head Lagoon or the narrow inlet.

1850

The main morphological development evident in the map of 1850 (Figure I.5) is that the distributary channels within the eastern lobe of Río San Juan's micro-delta have been abandoned by the river, in favour of one channel flowing north-northwest along the axis of the river approaching the bay and a second channel that branches to the west (labelled A and B in Figure I.5, respectively).

As abandoned channels crossing the eastern lobe no longer convey water and sediment except during extreme floods, and because there are no other distributary channels connecting the Río San Juan to the eastern part of the Bay of San Juan del Norte, accretionary advance of the micro-delta in that part of the bay has slowed. Conversely, sedimentation to the north and west has led to the advance of the micro-delta just north of Greytown, pushing the depositional front further west and northwest towards the Isla de Castilla. The outcome is for the river's delta to bisect the Bay of San Juan del Norte, further separating the Harbor Head Lagoon (in the east) from Greytown Harbor (in the west). The spit and Isla de Castilla show little morphological change and Punta Arenas appears to be at about the same location as in 1840. The map indicates that no distributaries linked the Río San Juan to the Harbor Head Lagoon in 1850.

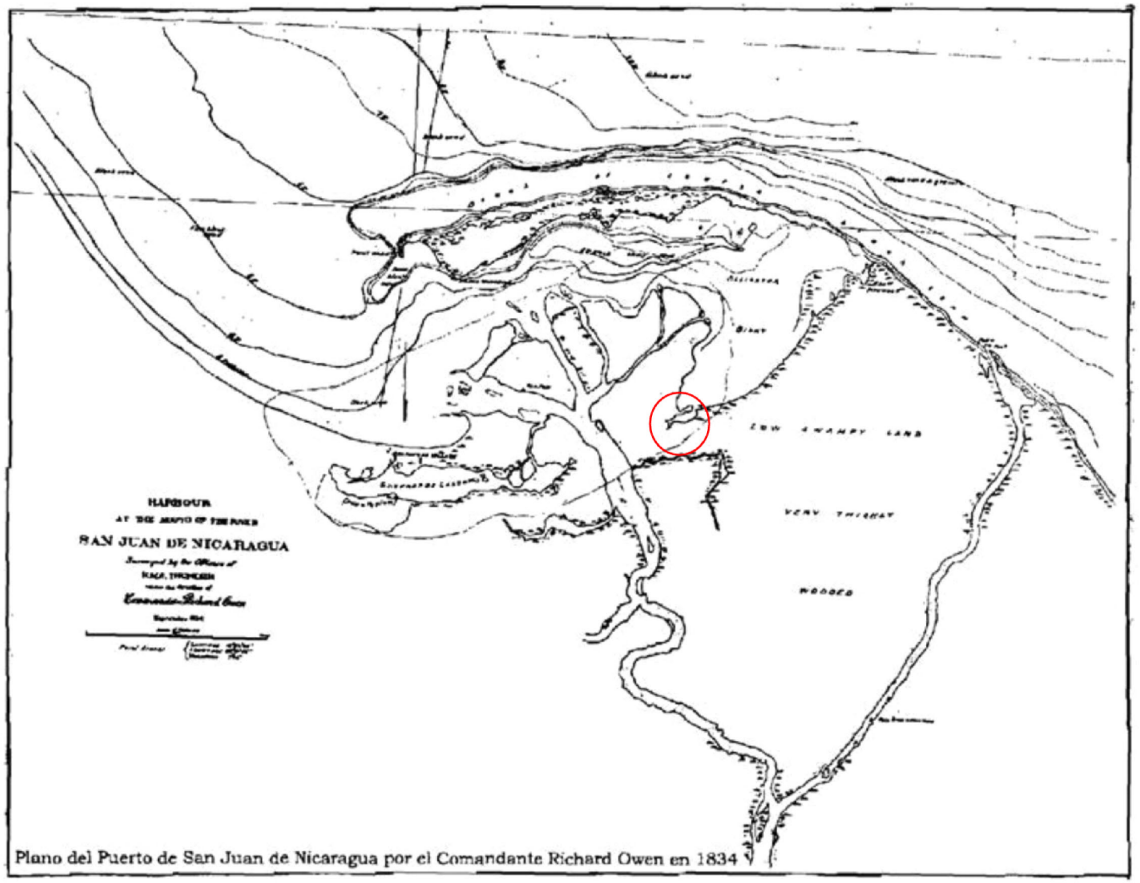


Figure Notes: Red circle highlights a narrow, forked inlet at the southern tip of the Harbor Head Lagoon. This is not a distributary of the Río San Juan or a stream channel, but a narrow pocket formed between the advancing micro-delta and the ancient, static shoreline of the Bay of San Juan del Norte.

Figure I.3. Map of 1834 – Harbour at the Mouth of the River San Juan de Nicaragua by Richard Owen (annotated from Bolaños Geyer (1999)). Note more accurate representation of the shape and orientation of the Harbor Head Lagoon than in Peacock's map of 1832 (Figure I.2).

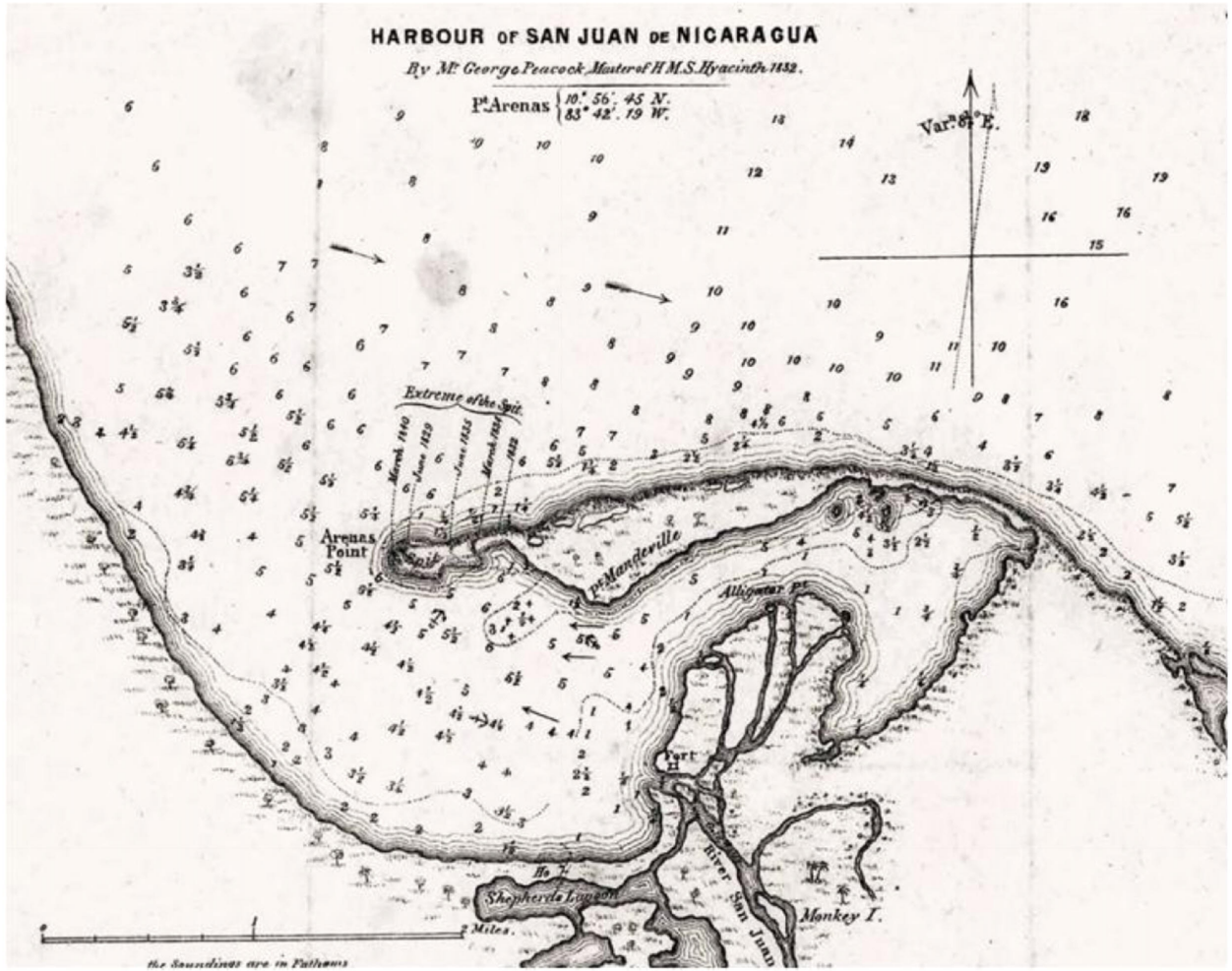


Figure I.4. Harbour of San Juan de Nicaragua by George Peacock 1832 (updated in 1840). Note that channel surrounding Monkey Island does not connect the Río San Juan to the Harbor Head Lagoon or link to the inlet at the southern tip of the Harbor Head Lagoon.

Figure Note: See text for explanations of labels.

Figure I.5. Map of 1850 – Greytown Harbor by Commander Nolloth (annotated from Bolaños Geyer (1999)).

1865

In this map, continued northward extension of the micro-delta along the axis of the main distributary (labelled A and named as the 'Lower San Juan River' in Figure I.6) has effectively bisected the Laguna San Juan del Norte, creating two, almost equally-sized water bodies (Figure I.6). That this was recognised at the time is evident from the fact that the east and west parts of the bay are, for the first time, named individually as the Harbor Head Lagoon and Greytown Harbor, respectively.

Where it meets the southern flank of the Isla de Castilla, the main channel of the Río San Juan forms a 'T-shaped' bifurcation. The main channel curves to the west and splits into two sub-channels (labelled A1 in Figure I.6), delivering most of water flow and sediment load into Greytown Harbor. The smaller distributary at the 'T-shaped' bifurcation (labelled A2 in Figure I.6) spills eastwards from the outer bank of the main channel to enter the northwest corner of the Harbor Head Lagoon.

Alluvial deposition in Greytown Harbor is also driven by the western branch of the Río San Juan, which is labelled B and named as 'Animas Channel' in Figure I.6. This has caused the delta to advance markedly westwards and divide into multiple distributaries (labelled B1, B2 and B3 in Figure I.6) north of Greytown. There has also been rapid westward advance of the spit, which now reaches almost to the western edge of the bay, virtually closing it.

While morphological change has been rapid in Greytown Harbor, little has changed in the Harbor Head Lagoon. Lack of morphological change in the Harbor Head Lagoon is unsurprising given that:

- both the main channel and the western branch of the Río San Juan empty into Greytown Harbor;
- no channels are shown in the map as linking the Río San Juan to the southern part of the Harbor Head Lagoon; and
- the Harbor Head Lagoon is closed to the Caribbean Sea by the Isla de Castilla spit, which is a barrier beach with respect to the Harbor Head Lagoon.

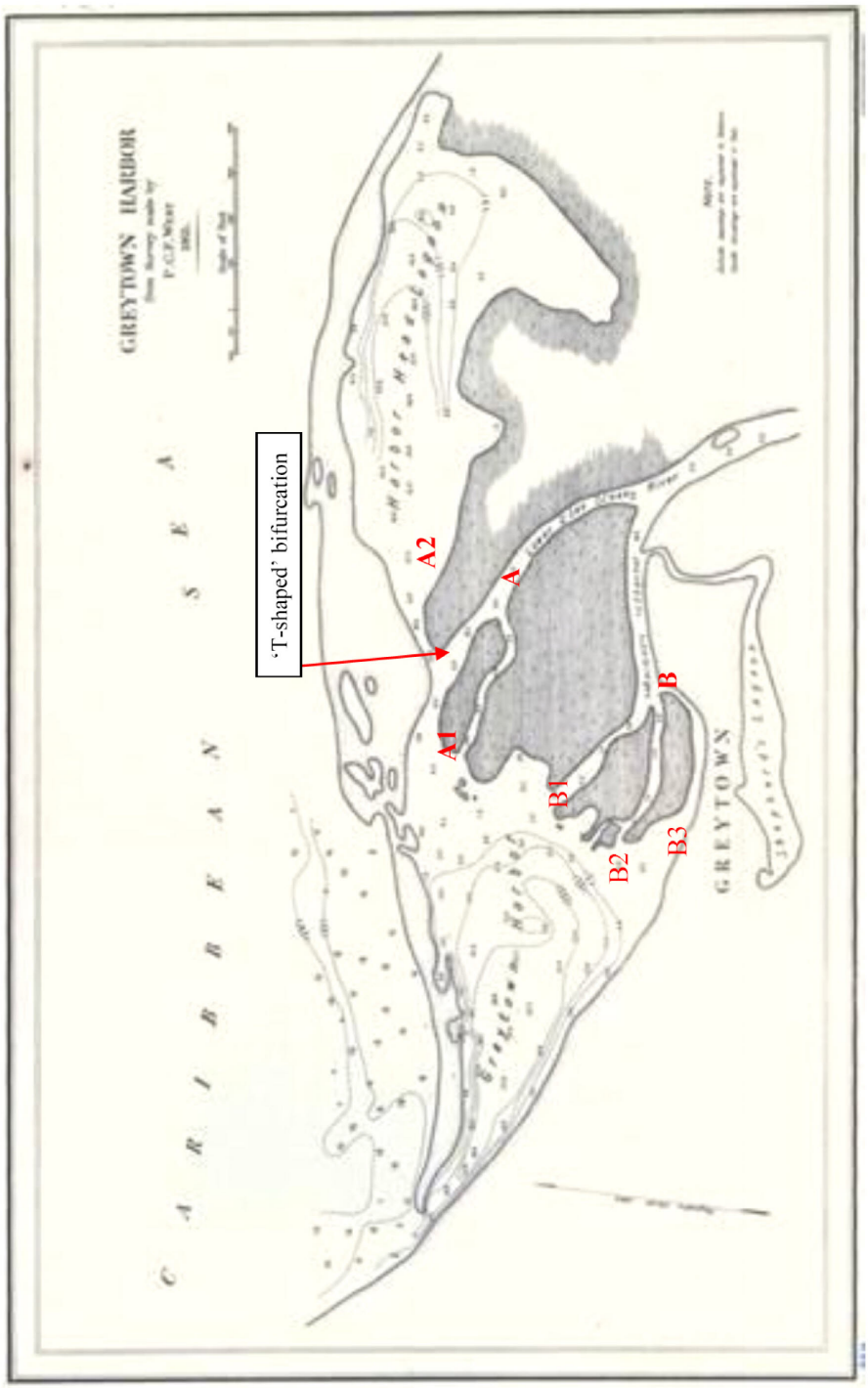


Figure Note: See text for explanation of labels.

Figure I.6. Map of 1865 – P C F West (annotated from Aguirre Sacasa (2002)).

1890

Notable changes in the map based on surveys by A W J Maxwell (1888) that was updated by H Elmer (1890) (Figure I.7) are:

- continued northward and westward growth of the micro-delta and complex of depositional islands into Greytown Harbor;
- closure of the western end of the bay by attachment of the spit to the mainland;
- engineering works to open a navigation channel linking Greytown Harbor to the Caribbean Sea; and
- breaching of the spit separating the Harbor Head Lagoon from the Caribbean Sea.

The western branch of the Río San Juan (labelled B in Figure I.7) continues to advance westward of the delta in the southern part of Greytown Harbor, though the main channel crossing the delta in a north-westerly direction (labelled A in Figure I.7) remains the wider of the two.

The main channel still forms the T-shaped bifurcation where it approaches the southern flank of the Isla de Castilla that was first identified in the map of 1865 (see Figure I.6). The western distributary (labelled A1 in Figure I.6) is extending the delta into the northern part of Greytown Harbor, while the wider, eastern distributary (labelled A2 in Figure I.6) debouches to the Caribbean Sea via the north-western part of the Harbor Head Lagoon.

The land to the west and south of the Harbor Head Lagoon is shown as being marshy and thickly vegetated, while that to the east is shown as being less marshy and tree-covered. However, no channels are indicated as linking the Río San Juan to the southern part of the Harbor Head Lagoon.

1897

The importance of the map reproduced in Figure I.8 is that it was produced by Alexander and used in his First Award of 1897.

Points to note are that, following the shoreline of the Harbor Head Lagoon southwards from Punta Castilla, the first channel of the Río San Juan that is encountered is the eastern distributary of the two formed at the 'T-shaped' bifurcation just south of the Isla de Castilla (labelled A2 in Figure I.8). This channel is known to have existed since 1865 and to have been the wider of the two branches of the main channel of the Río San Juan since 1890. In Alexander's map, the eastern distributary (A2) has widened, while both the western distributaries (labelled A1 and B in Figure I.8) have diminished, suggesting that the A2 channel is carrying most of the discharge of the Río San Juan. The wide breach mapped in the Isla de Castilla spit in the north-western part of the Harbor Head Lagoon is consistent with the bulk of the discharge of the Río San Juan debouching to the Caribbean Sea in this location.

This map shows that there was no channel linking the Río San Juan to the southern part of the Harbor Head Lagoon in 1897.

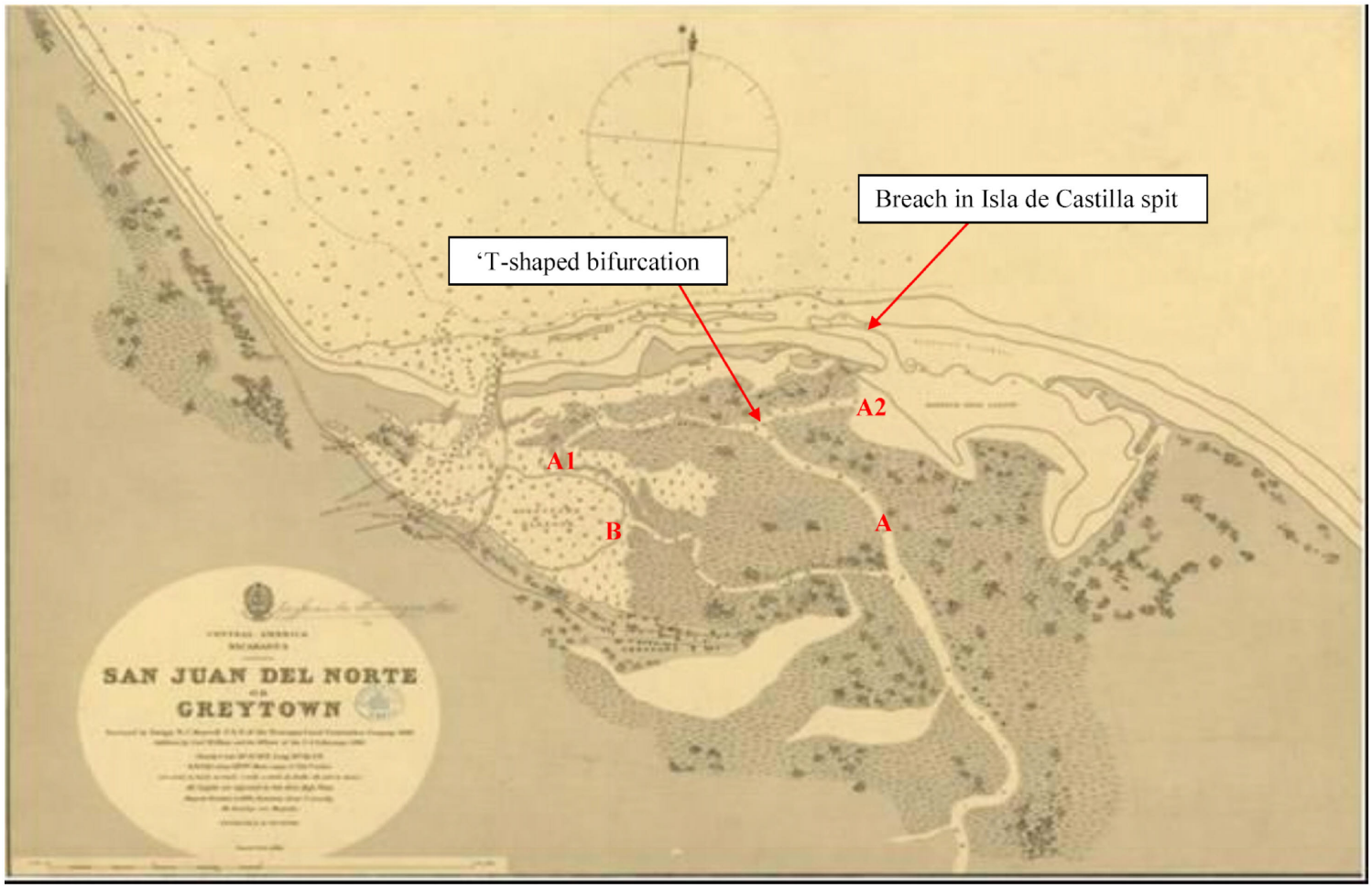


Figure Note: See text for explanations of labels.

Figure I.7. Map of 1890 (updated by H Elmer) – San Juan del Norte or Greytown by A W J Maxwell (1888) (annotated from the UK Hydrographic Office).

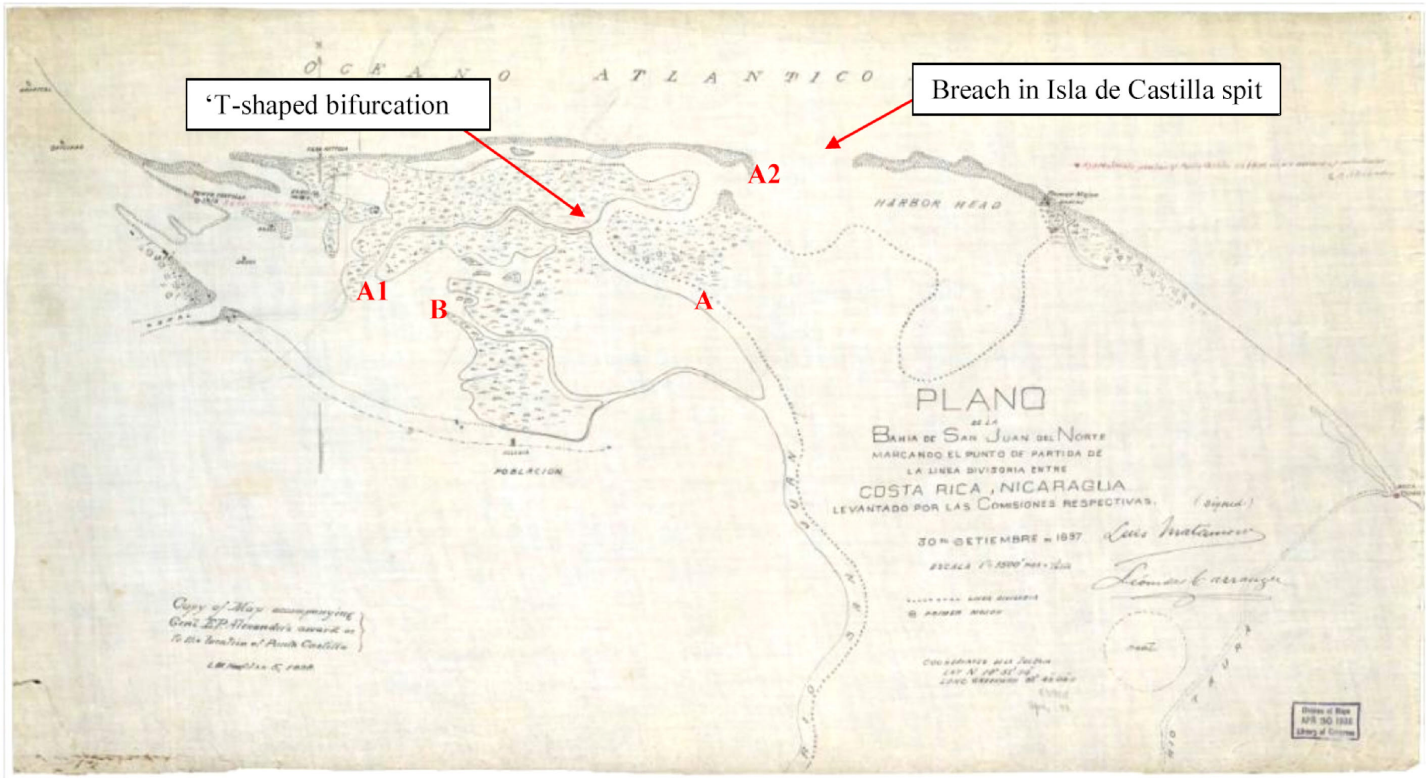


Figure Note: See text for explanations of labels.

Figure I.8. Annotated map of 1897 by Alexander.

1899

In the Nicaragua Canal Commission map of 1899, deposition driven by the western distributary at the 'T-shaped' bifurcation in the main channel of the Río San Juan (labelled A1 in Figure I.9) has extended the delta further into the northern part of Greytown Harbor though the engineering structures designed to provide navigation access to the Caribbean Sea that were evident in the map of 1890 are still in place and are maintaining an artificial breach in the Isla de Castilla spit. It is, though, notable that on this map the name used to describe the western part of the Bay of San Juan del Norte has been changed from 'Greytown Harbor' to 'Greytown Lagoon – suggesting that the function of that water body as an anchorage for ocean-going vessels has been compromised.

The main channel of the Río San Juan (labelled A in Figure I.9) curves to the east as it approaches the 'T-shaped' bifurcation at the southern flank of the Isla de Castilla, continuing through the eastern distributary (labelled A2 in Figure I.9) to enter the Caribbean Sea via wide, natural breaches in the spit located in the north-western part of the Harbor Head Lagoon. The western distributaries (labelled A1 and B in Figure I.9) have changed little since 1879.

Marine erosion processes (driven by wave action and long-shore currents) have reduced the breadth of the Isla de Castilla, widening the breach in the spit that had separated the Lagoon from the open sea since the early 19th century.

The configuration and position of the shoreline of the southern part of the Harbor Head Lagoon are again unchanged and the map of 1899 shows no distributary channel or channels linking the Río San Juan to the southern part of the Harbor Head Lagoon.

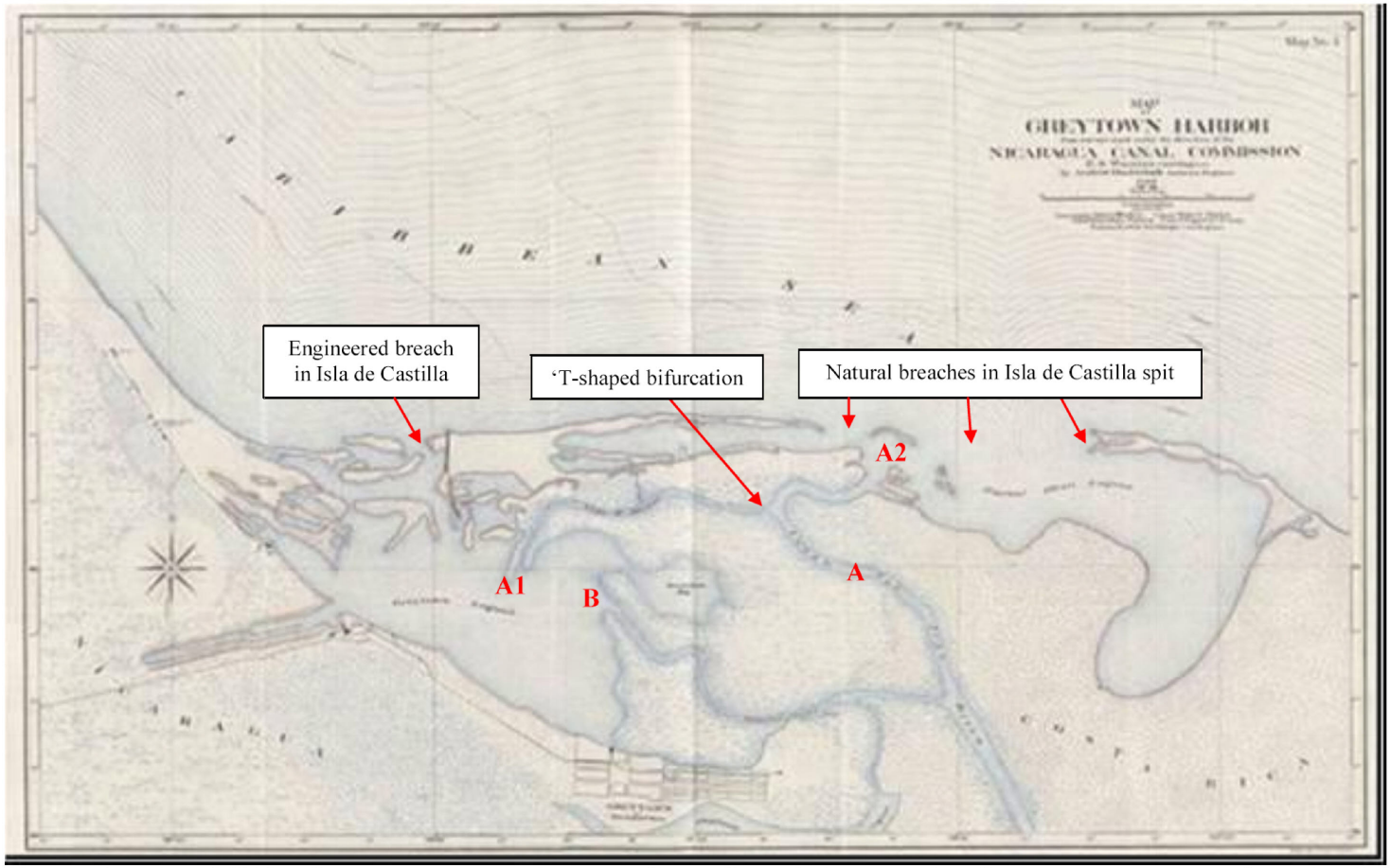


Figure I.9. Map of 1899 – Greytown Harbor Nicaragua Canal Commission Map 4 (E S Wheeler) (annotated from Aguirre Sacasa (2002)).

1961

The image of 1961 shows that the breadth of the Isla de Castilla and width of the spit more generally have been further reduced by coastal erosion (Figure I.10). The western 'steamer channel' branch has declined and flow in the Río San Juan is almost entirely concentrated in the long-lived, main channel that still divides at the T-shaped bifurcation into distributaries draining west to Greytown Harbor and east to the Caribbean Sea. However, coastal erosion has destroyed all but a tiny fragment of the Isla de Castilla, and all that separates the T-shaped bifurcation in the river from the Caribbean Sea is a narrow strip of the remaining spit.

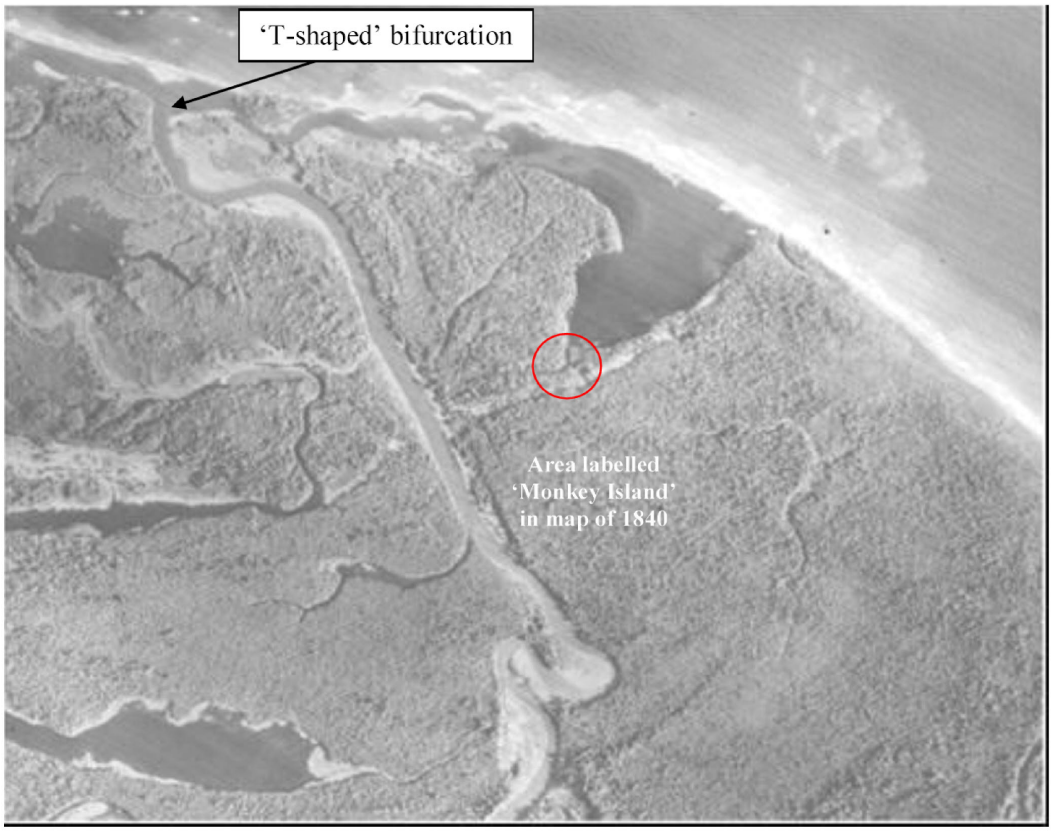


Figure Note: Red circle highlights the narrow inlet that was identified in the maps of 1834 and 1840 as being an unsedimented pocket in between the late-18th century micro-delta and the ancient shoreline of the Bay of San Juan del Norte.

Figure I.10. Annotated remotely-sensed image from 1961.

The most notable feature of the planform of the Río San Juan is its straight alignment apart from a pair of gently curving bends close to the coast and another pair of more tortuous meanders further upstream, in the southern part of the image.

The former courses of distributaries crossing the alluvial delta that were abandoned during the 19th century can be traced in the thickly-wooded land to the east of the Río San Juan, and the red circle highlights the narrow inlet that was demonstrated to be a pocket between the micro-delta

and the much older shoreline of the Bay of San Juan del Norte in the maps of 1834 and 1840. The close correspondence between the contemporary shoreline of the Harbor Head Lagoon and that in the 18th century maps is both remarkable and proof that sediment-laden water from the Río San Juan has not drained into the Harbor Head Lagoon in any quantity, as this would certainly have altered the shoreline through accretion.

Another historical feature that can be identified in the vegetation pattern is the course of the right-bank tributary channel mapped in 1840 as defining the northern and western margins of 'Monkey Island'. It is notable that trace of this channel visible in the vegetation pattern is consistent with the map of 1840 in showing that it comes nowhere near to intersecting the shoreline of the Harbor Head Lagoon or linking to the narrow inlet at the southern tip of the Lagoon (see Figure I.4).

Hence, there is also no evidence in the vegetation pattern in the 1961 satellite image of any contemporary or historical distributary channel linking the Río San Juan to the Harbor Head Lagoon.

1981

There is no evidence in this image for the existence of any channel linking the river to the Harbor Head Lagoon.

Flow in the Río San Juan remains concentrated in the single, main channel, but the eastern distributary at the T-shaped bifurcation located just south of the spit has been abandoned and the river debouches to the Caribbean Sea via Greytown Lagoon (Figure I.11). The morphology of the river has changed little. For example, while the two bends near the river mouth have grown slightly, the pair of tortuous meanders visible in the southern part of the image have hardly changed at all.

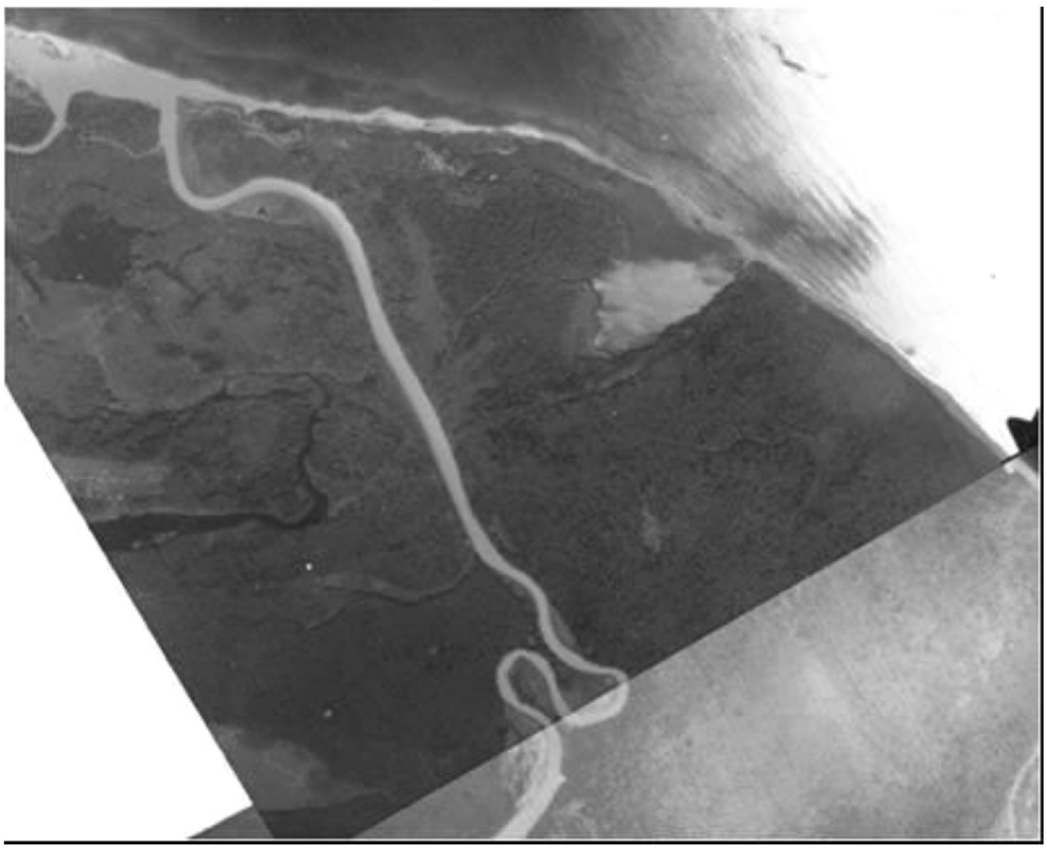


Figure I.11. Remotely-sensed image from 1981.

2003

Comparison of the images for 1981 and 2003 (Figure I.12), as well as images taken in 1986 and 1997 that are not reproduced here, indicates that the morphologies of the Río San Juan (including its meander bends) and the Harbor Head Lagoon remained stable during the last two decades of the 20th century and the first 3 years of the 21st century.

This was not true of the coastline, however, where continued marine erosion meant that by 2003 the Río San Juan debouched into the Caribbean Sea and the Greytown Lagoon, the former eastern distributary having disappeared due to the retreat of the coastline.

As in all previously described maps and images, there is no evidence of a distributary channel linking the Río San Juan to the Harbor Head Lagoon in the images for 1986, 1997, and 2003, although the traces of long abandoned branches can still be discerned, the narrow inlet at the southern tip of the Harbor Head Lagoon is still present and small channels draining runoff (generated in the surrounding wetland) by local rainfall can be identified.



Figure I.12. Remotely-sensed image from 2003.

4 May 2008

Morphological changes evident in the 2008 image (Figure I.13) include continued, incremental growth of the bends close to the mouth of the Río San Juan and, more notably, natural cut-off of the second of the pair of tortuous meander bends located further upstream, in the southern part of the image. This natural cut-off is discussed further in Part II of this Report, in the context of the artificial cut-off constructed by Nicaragua in 2010-11.

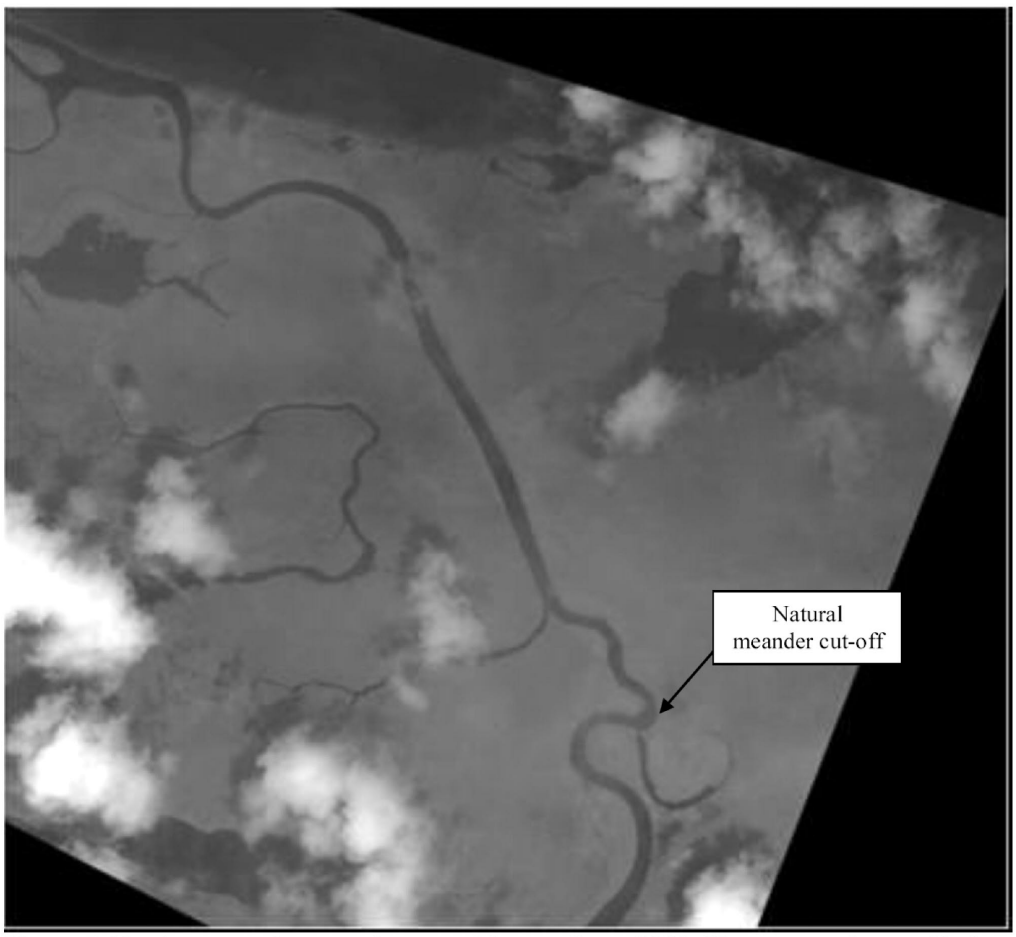


Figure I.13. Annotated remotely-sensed image from 2008. Note natural cut-off of meander bend.

15 October 2009

No marked morphological changes since May 2008 are evident in this image (Figure I.14). Three inlets flooded by backwater effects from the Harbor Head Lagoon can be identified. These probably convey surface runoff (generated by local rainfall in the surrounding wetlands) to the lagoon during the rainy season, but none of them is linked to the Río San Juan.

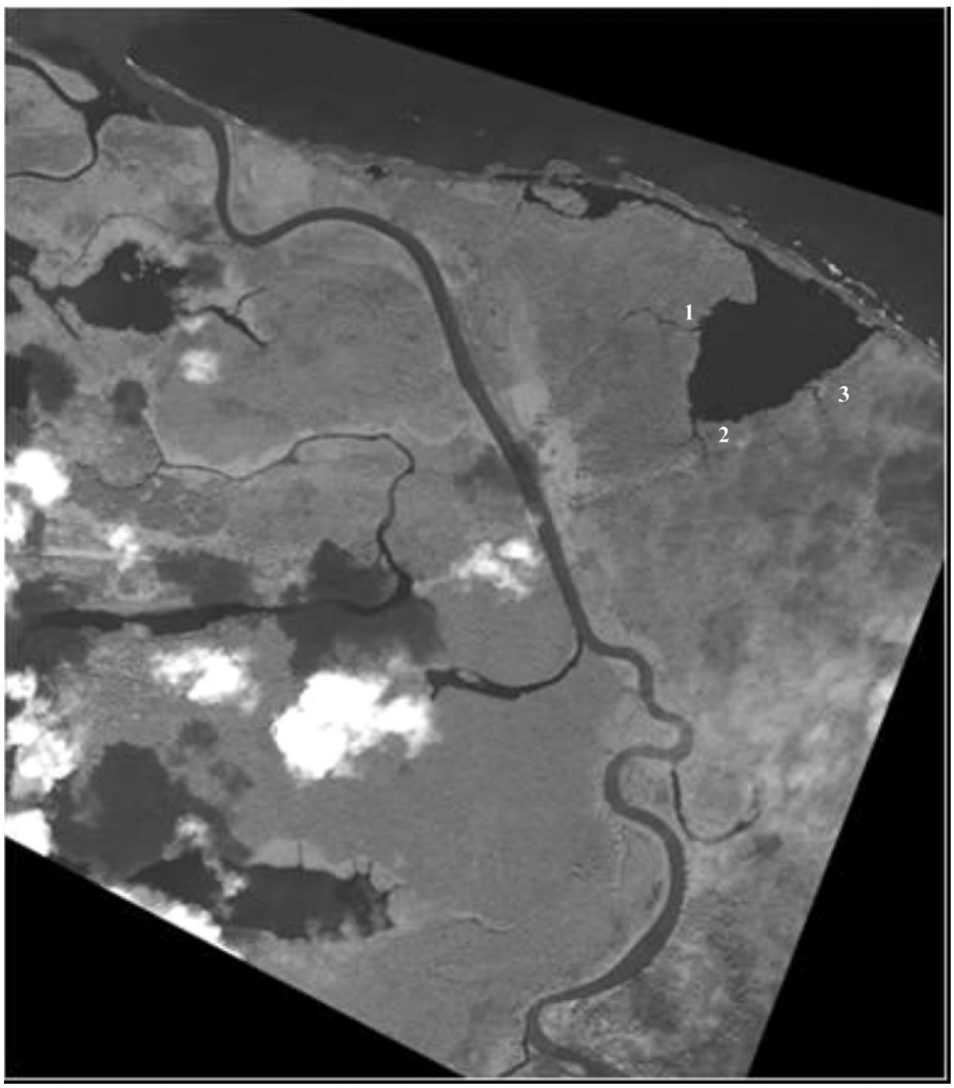


Figure Note: The numbers identify three inlets flooded by backwater effects from the Harbor Head Lagoon.

Figure I.14. Annotated remotely-sensed image on 15 October 2009.

21 January 2010

No morphological changes to the Río San Juan and the Harbor Head Lagoon can be discerned in this image (Figure I.15). There is no channel linking the Río San Juan to the Harbor Head Lagoon and the forest between the river and the Harbor Head Lagoon is undisturbed.



Figure I.15. No morphological changes observed in this image taken on 21 January 2010.

8 August 2010

No morphological changes to the Río San Juan and Harbor Head Lagoon are evident in this image but vegetation appears to have been disturbed in patches distributed over an area of the right-bank floodplain of the Río San Juan, with some patches being cleared of trees (Figure I.16).



Figure Note: Red outline indicates area of recent vegetation disturbance on right-bank floodplain of the Río San Juan.

Figure I.16. No morphological changes observed in this image taken on 8 August 2010.

19 November 2010

In the image reproduced in Figure I.17, not only have further, additional areas been cleared of trees (red outlines), but new channels also appear (brown lines) and what appears to be a dredger can be seen in the Río San Juan (yellow dot).

Two new channels, beginning at different locations along the right bank of the Río San Juan, confluence orthogonally at the site known as Aragon. The mouth of the primary channel – which is generally referred to as the 'Caño' or sometimes the 'Harbor Head Caño' or even the 'Caño Pastora', is in the right bank of the Río San Juan about half a kilometre upstream. The mouth of the secondary channel is also in the right bank of the Río San Juan, but it is further north – almost due west of Aragon.

At Aragon, the primary channel turns to the right and approaches the Harbor Head Lagoon through a wide corridor that has been cleared of trees. The channel then runs through uncleared forest until it reaches the Harbor Head Lagoon at the head of the narrow inlet identified in the historical maps and earlier satellite images. A large patch of forest has been cleared on the left bank of the inlet at the edge of the Harbor Head Lagoon. No natural process could have resulted in these changes and the only possible explanation for the destruction of the vegetation and appearance of the 'Caño' and secondary channels between 8 August and 19 November 2010 is that the trees were cut down and the channels dug artificially.

Further upstream, on the left bank of the Río San Juan, a corridor has been cleared of vegetation across the neck of a meander bend and what appears to be a dredger is visible in a new channel that extends upstream part way along that corridor, from its downstream end. The only logical explanation for this is that the dredger is cutting a pilot channel across the neck of the bend in order to artificially cut-off the meander.



Figure Notes: Red outlines indicate areas cleared of vegetation since 8 August 2010. Brown lines indicate newly-dug channels. Yellow dot indicates location of what appears to be a dredger and a pilot meander cut-off channel that is under construction.

Figure I.17. Changes observed in image taken on 19 November 2010.

14 December 2010

The major change visible in this image (Figure I.18) is that the 'Caño' is now seen to be conveying river water from the Río San Juan to the Harbor Head Lagoon (brown line). Brown, river water can be identified in the channel of the 'Caño' and a plume of sediment-laden water can be seen to extend along the western edge of the Harbor Head Lagoon, which indicates that sediment-laden water from the river is flowing into the lagoon. Based on the historical analysis reported above, this is the first time that the Río San Juan has been linked by a channel to the southern part of the Lagoon since the late-18th century. The only feasible explanation for channelised flow from the river to the lagoon is construction of the 'Caño' that began sometime between 8 August and 19 November 2010, and was completed prior to 14 December 2010.



Figure Notes: Brown line indicates line of recently completed, artificially-dug channel of the 'Caño' linking Río San Juan to the Harbor Head Lagoon. Red circle indicates location of what appears to be a dredger in the artificial meander cut-off channel that is under construction.

Figure I.18. Changes observed in image taken on 14 December 2010. A plume of sediment-laden river water flows from the end of the 'Caño' along the west edge of the Harbor Head Lagoon.

What appears to be a dredger is still visible in the meander cut-off channel at the bend about 400 m upstream of the mouth of the 'Caño', though little progress seems to have been made in extending the artificial cut-off channel upstream, across the neck of the meander.

24 January 2011

In Figure I.19, the flow of sediment-laden water along the channel linking the Río San Juan to the Harbor Head Lagoon can be seen to have receded. The channel appears to have widened and shoaled due to bank erosion or manual digging, coupled with the deposition of sediment carried into the channel from the Río San Juan.



Figure Notes: Red rectangle indicates location of dredger and extended meander cut-off channel, now nearing completion. Yellow rectangle highlights a corridor that appears to have been cleared of vegetation along a tributary probably draining from Laguna la Barca at the inside of a long radius meander bend in the Río San Juan.

Figure I.19. Changes observed in image taken on 24 January 2011. Flow in the dug channel linking the Río San Juan to the Harbor Head Lagoon has receded. The 'Caño' appears to have widened and shoaled compared to its condition on 19 November 2010 (see Figure I.17).

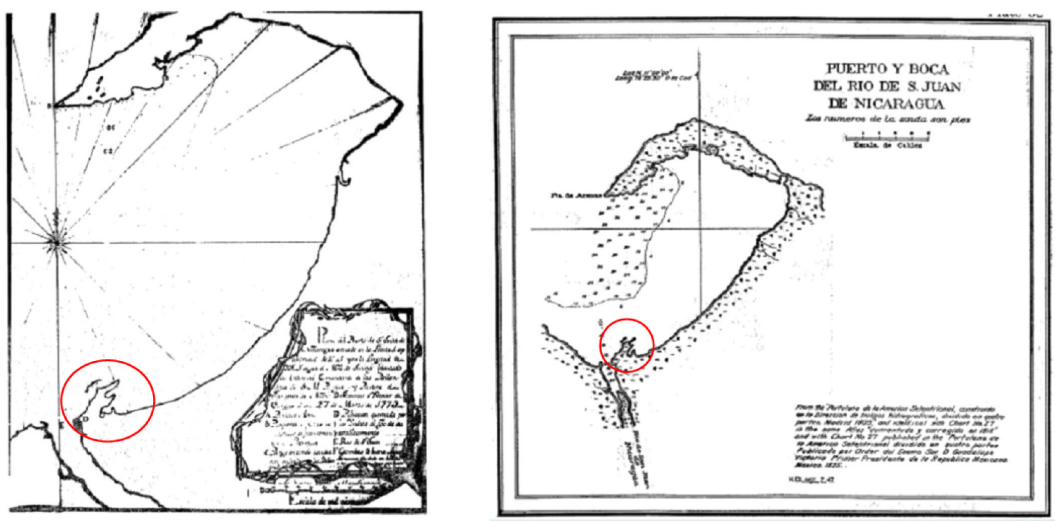
Further dredging of the cut-off channel (outlined in red in Figure I.19) has resulted in marked extension of the artificial channel, which is now close to cutting off the meander bend.

Inspection of the southern part of the image reveals what appears to be a new strip of disturbed or cleared vegetation on the left floodplain of the Río San Juan. This follows the course of a

small tributary stream that probably drains to the Río San Juan from the Laguna la Barca. The cleared strip is located at the inner margin of a long radius meander bend in the Río San Juan. Given the clearance of vegetation observed between August and November 2010 at the next bend but one downstream (outlined in red in Figures I.17 and I.19), vegetation clearance would be consistent with site preparation for construction of a second meander cut-off channel.

Further investigation of the inlet identified at the southern tip of the Harbor Head Lagoon

During the historical analysis, the importance of the origin of the narrow inlet at the southern tip of the Harbor Head Lagoon became increasingly apparent to the author. Consequently, a search was performed for additional information to substantiate this and two further maps were located in a publication by Alejandro Bolaños Geyer (Bolaños Geyer, 2000) (Figure I.20).



(a) annotated map of 1779 (b) annotated map of 1825

Figure I.20. Additional historical maps that confirm the origin of the narrow inlet at the southern tip of the Harbor Head Lagoon as being a pocket of open water between the micro-delta of the Río San Juan and the ancient coastline of the Bay of San Juan del Norte.

The significance of these additional maps is that they both show how early growth of the micro-delta of the Río San Juan at the point where it entered the Bay of San Juan del Norte left an unsedimented pocket of open water between the alluvial delta (which initially grew to the northwest and away from the coastline) and the much older coastline to the east. Thus, the inlet that is evident in all subsequent maps and satellite images is a remnant of the Bay of San Juan del Norte. It is not and never has been a distributary of the Río San Juan.

The inlet is, however, easily mistaken for a channel. There are several reasons for this including:

- it is long and narrow, which gives it the appearance of a channel;
- during the wet season it will be inundated by the high water table in the surrounding wetland;
- it will provide a natural pathway for surface runoff (generated by local rainfall) to drain to the Harbor Head Lagoon; and
- it will remain flooded even during the dry season due to backwater effects in the lagoon.

These attributes may explain why Nicaraguan witnesses have mistaken the inlet for a distributary channel and written affidavits to the effect that they have used the inlet to navigate into the wetland from the Harbor Head Lagoon using small boats (Republic of Nicaragua, 2011). This is understandable – the author only identified the actual morphogenetic origin of the inlet following a detailed historical investigation and on the basis of careful geomorphological interpretation of the landforms in and around the Río San Juan and the Bay of San Juan del Norte.

I.3 Summary and conclusions based on the historical investigation

I.3.1 Summary

The chronological account of morphological changes in the lower course of the Río San Juan and the Laguna San Juan del Norte since the late-18th century presented in Section I.2 is well-supported by reliable evidence from a series of historical maps and satellite images whose provenance has long been proven.

Consequently, it provides a sound basis from which to: (1) establish the sequence of events responsible for the genesis and subsequent evolution of the Harbor Head Lagoon, and (2) determine whether the 'Caño' linking the Río San Juan to the Harbor Head Lagoon is an established, natural waterway or has recently been constructed.

I.3.2 Conclusions

The conclusions relevant to the Terms of Reference for this Report that emerge from the historical investigation of maps and remotely-sensed images may be summarised as follows:

1. The Harbor Head Lagoon evolved into a discrete water body during the early-19th century when the much larger Bay of San Juan del Norte was bisected along an axis from southeast to northwest by distal extension of the micro-delta of the Río San Juan.
2. The area of the Harbor Head Lagoon has diminished progressively since its formation due to alluvial siltation advancing from the west in the northern part of the lagoon, coupled with southward retreat of the spit/barrier beach that separates the lagoon from the Caribbean Sea.
3. The landward shorelines of the Harbor Head Lagoon have changed very little since the mid-19th century.
4. The history of siltation in the Harbor Head Lagoon is inconsistent with the entry of sediment-laden water draining through a channel linking the Río San Juan to the southern tip of the Harbor Head Lagoon at any time since the late-18th century. It must be understood that the

Harbor Head Lagoon has persisted for more than 200 years and exists in its present form not because the Río San Juan has historically drained into it along the path of the 'Caño', but precisely because the Río San Juan has ***not*** done so. This conclusion is further supported by geomorphic interpretation of the morphological evolutions of Greytown Harbor/Lagoon, and the north-western part of the Harbor Head Lagoon.

Specifically, the record of extensive advance of the river delta and reductions in depth and open-water area in Greytown Harbor/Lagoon is entirely consistent with the points of entry and directional trends of the western distributary channels of the Río San Juan (labelled A1 and B on the historical maps), which have emptied into that water body during the last 150 years. It demonstrates that the high trap efficacy of coastal lagoons with respect to sediment supplied from the Río San Juan rapidly leads to lagoons that receive sediment-laden water from the Río San Juan rapidly being silted. Similarly, the micro-delta of the eastern distributary of the Río San Juan that drained into the north-west corner of the Harbor Head Lagoon between about 1850 and 1980 (labelled A2 in the historical maps) rapidly filled-in the north-western corner of the Harbor Head Lagoon.

It follows that, if a distributary of the Río San Juan *had* drained into the southern tip of the Harbor Head Lagoon it would have silted some or all of the southern part of the lagoon. The record of the morphological evolution of the Harbor Head Lagoon provided by available maps and remotely-sensed images established unequivocally that the shape of this lagoon has changed in a way entirely consistent with alluvial siltation in the north-western corner and an almost complete lack of alluvial siltation in the southern part of the water body.

It must, therefore, be concluded that, prior to construction of the 'Caño' in November 2010, no distributary of the Río San Juan had ever drained into the southern tip of the Harbor Head Lagoon since that lagoon was created by division of the Bay of San Juan del Norte into two discrete water bodies sometime between 1825 and 1832.

5. Other than the eastern distributary draining into the far north-west corner of the Harbor Head Lagoon between 1850 and 1980, the only other channels identified as draining into the Harbor Head Lagoon prior to November 2010 are small wetland watercourses carrying runoff generated by local rainfall. This includes the narrow inlet at the southern tip of the Harbor Head Lagoon, which is a remnant of the former Bay of San Juan del Norte rather than a fluvially-formed channel. This, and the other minor watercourses that now drain to the southern part of the Harbor Head Lagoon, are not and never have been distributaries of the Río San Juan.
6. Remotely-sensed images taken between 1961 and January 2011 provide no evidence that the barrier beach separating the Harbor Head Lagoon from the Caribbean Sea has been breached during the last 50 years. Had a substantial volume of water discharged from the Río San Juan into any part of the Harbor Head Lagoon (as it did in the case of the north-west part of the lagoon during the late-19th century), this would have led to breaching of the barrier beach. The fact that the barrier beach appears to have remained intact is further evidence that no channel linking the Río San Juan to the Harbor Head Lagoon has existed within the last 50 years.
7. Morphological interpretation of the available historical maps and remotely-sensed images strongly suggests that the 'Caño' is an artificial channel dug from scratch and that its construction did not involve either cleaning or restoring a former course of the Río San Juan.
8. Examination of remotely-sensed images narrows down the period when the channel of the 'Caño' was constructed to between 8 August and 19 November 2010. It is not possible,

based on interpretation of the remotely-sensed images alone, to say anything more specific about the clearance of trees and other vegetation that created the corridor within which the 'Caño' is located, its method of construction, the volume of sediment dug out and how it was disposed of, or the environmental impacts of the 'Caño' on the Río San Juan, Harbor Head Lagoon and Isla Portillos wetlands. These issues are, therefore, addressed further in Sections I.4 and I.5 of this Report, based on evidence gathered from contemporary aerial and ground-based surveys.

9. The Río San Juan carries a heavy sediment load, giving it a distinctively brown colour that contrasts with the blue water of the Harbor Head Lagoon. Consequently, linking the Río San Juan with the Harbor Head Lagoon would inevitably change the water colour of the Lagoon. In the remotely-sensed images for January, August, and November 2010 and January 2011 (Figures I.15, I.16, I.17, and I.19, respectively), the water in the lagoon is entirely blue, while that in the river displays its distinctive brown colour. In contrast, in the image for 14 December 2010 (Figure I.18), a plume of brown water can be identified in the otherwise blue lagoon water. This plume emanates from the mouth of the 'Caño' and diffuses along the north-west shoreline of the lagoon.

   This is strong evidence that the only period during which brown (sediment-laden) water from the Río San Juan has drained through a channel carrying brown river water into the blue water of the Harbor Head Lagoon was immediately following construction of the 'Caño', that is, during late-November and December 2010. That the image for 24 January 2011 (Figure I.19) shows no evidence of brown water entering the lagoon, suggests that the 'Caño' had become ineffective in linking the river to the lagoon by that date.

10. Inspection of the remotely-sensed images for 19 November 2010 (Figure I.17) to 24 January 2011 (Figure I.19) reveals that tree clearance and dredging has also been undertaken on the left bank and left floodplain of the Lower Río San Juan, with the aim of creating at least one and possibly two meander bend cut-offs.

I.4 Contemporary investigation into the construction of the 'Caño'

This account of the construction of the 'Harbor Head Caño' builds on and complements the historical investigation reported in Section I.2 and summarised in Section I.3. In doing so, it draws on evidence gained from:

- quantitative analysis of remotely-sensed images;
- aerial reconnaissance; and
- fieldwork (ground-based observations, photography, data collection) coupled with subsequent scientific analyses (e.g., dendrochronology) performed by Costa Rican investigators and representatives of the Ramsar Convention, between October 2010 and July 2011.

The evidence provided by these sources supplies the basis for establishing the:

- key dates and the chronology of construction of the 'Caño';
- areal extent, numbers, species, and ages of trees cut down in clearing the wider corridor around the 'Caño';

- quantity of soil that was dug out and dumped in the wetland in creating the channel of the 'Caño'; and
- post-construction evolution of the 'Caño', in terms of silting, changing width, vegetation recovery, and the capacity of the channel to convey water and sediment from the Río San Juan to the Harbor Head Lagoon.

The evidence also provides the information necessary to assess the current and potential, future impacts of the 'Caño' on the Río San Juan, the Harbor Head Lagoon and the surrounding wetlands in the Isla Portillos. These issues are addressed in Sections I.5 and I.6.

I.4.1 Quantitative analysis of satellite images from August, November, and December 2010

A quantitative analysis of available remotely-sensed images was performed by the United Nations Institute for Training and Research/UNITAR's Operational Satellite Applications Programme (UNITAR/UNOSAT), in response to a request from the Government of Costa Rica. The outcomes are fully described in their report, issued on 4 January 2011 (UNITAR/UNOSAT, 2011a). The salient points are summarised here to allow this Report to stand alone.

Figures I.16, I.17, and I.18 reproduce remotely-sensed images taken on 8 August, 19 November, and 14 December 2010, respectively. In Section I.2, these images were assessed qualitatively in chronicling the morphological history of the Lower Río San Juan, Harbor Head Lagoon, and 'Caño'.

Figure I.21 illustrates the changes observed between the images, superimposed on the image for 14 December 2010. The annotations in Figure I.21, as well as the interpretation provided in the body of the UNITAR/UNOSAT (2011a) report, are entirely consistent with the qualitative account developed independently by the author, in Section I.2 of this Report. For example, with respect to the 'Caño', the UNITAR/UNOSAT (2011a) report states that,

"*Based on an analysis of satellite imagery recorded on 8 August, 19 November and 14 December 2010, there is strong evidence to suggest that a new river channel leading from the San Juan River to the Los Portillos* (i.e., Harbor Head) *lagoon was constructed between August and November 2010.*"

and with regard to whether a channel linking the Río San Juan to the Harbor Head Lagoon existed prior to 2010,

"*As of 8 August 2010 there were no signatures within the satellite imagery indicating the existence of an ephemeral stream to explain the appearance of this channel. There are also no apparent characteristic patterns of vegetation to suggest the presence of stream delineation as expected with an ephemeral stream activity resulting from seasonal floods.*"

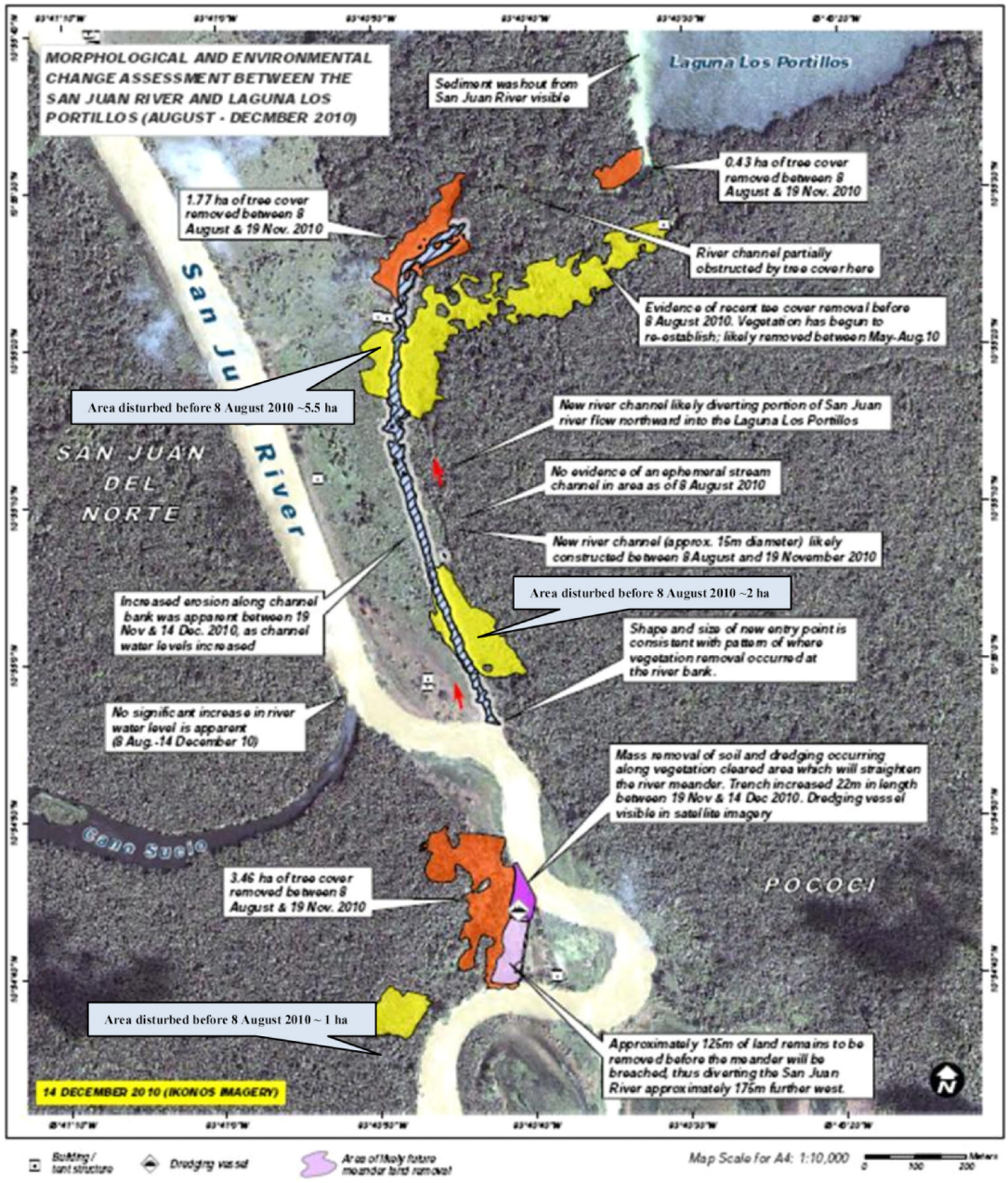


Figure Notes: The white call-out boxes show the UNITAR/UNOSAT (2011a) information and the pale-blue call-out boxes show the supplemental quantitative information added by the author.

Figure I.21. Annotated satellite image for 14 December 2010.

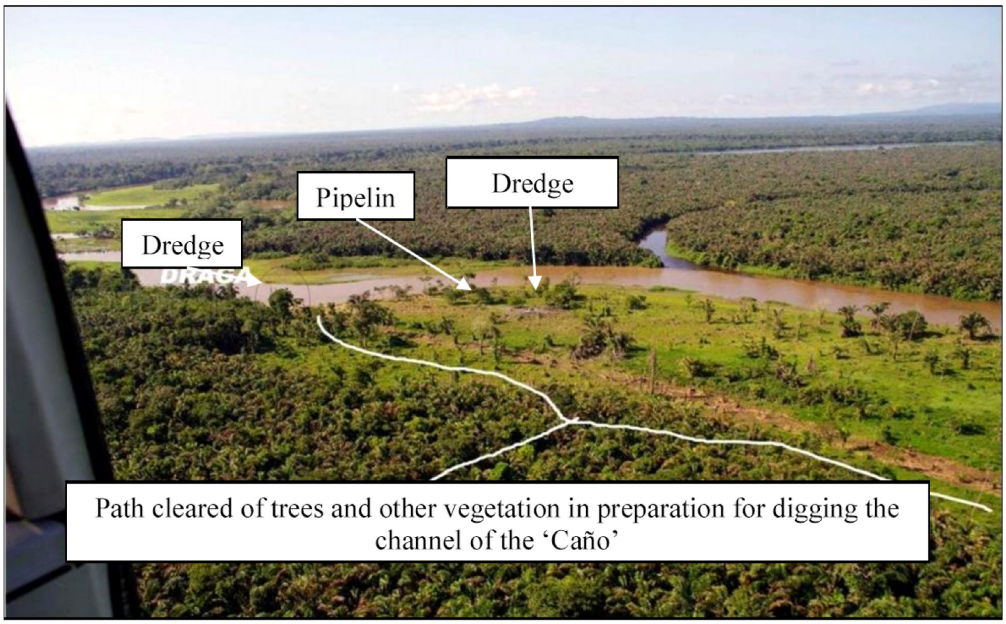
The results shown in Figure I.21 indicate that:

- Some vegetation was disturbed prior to 8 August 2010 in three patches. Based on interpretation of the satellite image in Figure I.21, the author estimated the areas of the three respective patches to be nearly 5.5 ha, just over 2 ha, and nearly 1 ha (Figure I.21). It is not known when disturbance of the vegetation took place. UNITAR/UNOSAT (2011a) suggested that vegetation clearance probably occurred between May and August 2010, but this cannot be verified.
- Further vegetation was removed between 8 August and 19 November 2010 in three other patches. Based on satellite-image interpretation, UNITAR/UNOSAT (2011a) estimated the areas of these three respective patches to be 0.43 ha, 1.77 ha, and 3.46 ha (Figure I.21). It should be noted that these initial estimates of the areas cleared (based on satellite interpretation) were later refined through ground truthing, during fieldwork on 25 October 2010 and 5 April 2011. Hence, the areas reported above by the UNITAR/UNOSAT (2011a) do not coincide with (and are superseded by) those later measured on the ground. Hence the area of the patch cleared close to the Harbor Head Lagoon is now estimated to be 0.48 ha (rather than 0.43 ha as shown in Figure I.21), while the patch to the west is believed to have an area of 2 ha rather than the 1.77 ha as indicated in Figure I.21.
- UNITAR/UNOSAT (2011a) report that the width of the 'Caño' measured in the image of 19 November 2010 was about 10 m. Increased discharge, coupled with erosion of the unvegetated banks of this new channel during the flood that peaked on 5 December, resulted in this width increasing to an average of 15 m in the image of 14 December 2010.

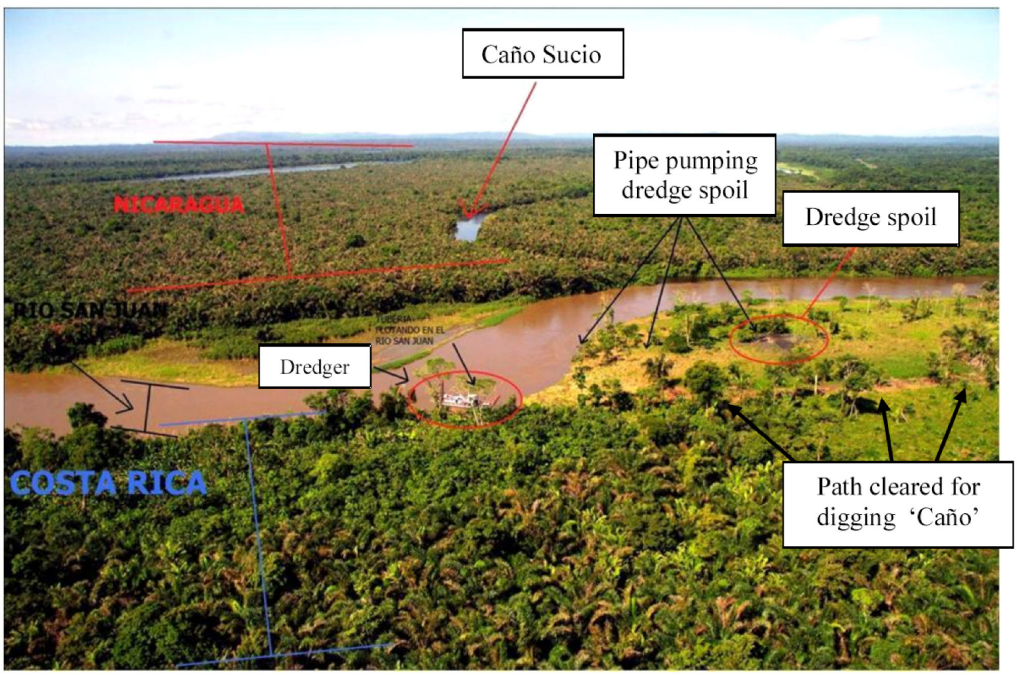
I.4.2 Aerial reconnaissance 20 October 2010

In October 2010, officials from the Ministry of Public Security and the Tortuguero Conservation Area, noticed unauthorised activities causing environmental damage in the area of Portillos Island immediately southwest of the Harbor Head Lagoon. Under the National System of Conservation Areas (SINAC), the affected area is located in the Tortuguero Conservation Area (ACTo) and within the wildlife-protected area Corredor Fronterizo Norte (Northern Border Corridor) National Wildlife Refuge.

Photographs taken during an aerial reconnaissance of the area on 20 October 2010 (Figures I.22(a) and (b)) show that a dredger positioned close to the right bank of the Río San Juan, immediately downstream of what is now the mouth of the 'Caño', was removing sediment from the river and pumping it through a pipeline that terminated on the right floodplain of the river. The dredge spoil can be seen gushing from the end of the pipe. The dredge spoil is adding to the area and elevation of an oval-shaped, raised area of deposited sediment that has blanketed the wetland vegetation. A brown-coloured strip of damaged vegetation, including multiple cut and felled trees, marks the path cleared so that the 'Caño' could subsequently be dug through what is clearly intact and previously-unchannelled floodplain.



(a) southwest view



(b) west view

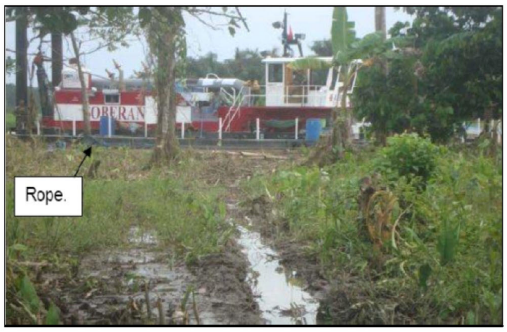
Figure I.22. Aerial views across the Río San Juan with dredger, pipeline, and dredge spoil gushing onto the right-bank floodplain annotated. Vegetation has been destroyed and trees cut to create a path for the 'Caño'. Photographs taken on 20 October 2010.

I.4.3 Fieldwork and aerial reconnaissance on 22 October 2010

On the afternoon of 22 October 2010, the Control and Surveillance Officer for the RNVSBC (Barra del Colorado National Wildlife Refuge) visited the Isla Portillos west of the Harbor Head Lagoon, together with the Deputy Prosecutor for the Second District Court of the Atlantic Area, a Court Officer, and representatives of the Costa Rican Ministries of Security and of Foreign Affairs. A full report of observations made during fieldwork and a brief helicopter over-flight may be found in Montero-Navarro (2010). The main points are summarised here in order to allow this Report to stand alone:

- Two Nicaraguan vessels were in the Río San Juan at this location. The first was the dredger "Soberanía" with at least five Nicaraguan soldiers and approximately six civilians on board, which was moored against the right (Costa Rican) bank. A second, smaller, vessel was observed adjacent to the left bank with four Nicaraguan soldiers on board.
- A row of floats used to suspend the dredger's spoil pipes was observed to extend along the right margin of the Río San Juan for a distance of about 80 m.
- A depression or track left by the dredger's spoil pipes (Figure I.23(a)) and a patch of bare, sandy sediment deposits with an area estimated to be around 2,400 m^2 (Figure I.23(b)) were found on the right (Costa Rican) floodplain of the Río San Juan. The nature of the sediment patch was observed to be uncharacteristic of the area's wetlands. It appeared to be composed of dredge spoil, consisting of sediment removed from the Río San Juan and dumped on the floodplain.
- Near the area of deposited sediment, a mature tree *Spondias Mombin* with a height of 14 m and a trunk diameter of 52 cm had been cut down.
- At a location with the global positioning system (GPS) coordinates N10.92377° W083.68121°, approximately 1 km northeast of the dredger and spoil patch, approximately 5 ha of forest had been cleared of trees. A large number of trees and pieces of cut wood were left on the ground (Figure I.23(c)).

Inspection by the author of other photographs taken from the air on 22 October 2010 (Figure I.24), that were not referenced by Montero-Navarro (2010), better illustrate the spatial relationship between the dredger, depression left by the spoil pipeline linking the dredger to the spoil dump, and the extent of the area of floodplain wetland buried by dredge spoil. The corridor along the right-bank floodplain that has been prepared for digging of the 'Caño' is also clearly visible. This corridor runs through intact floodplain, providing further evidence that no distributary channel existed here prior to digging of the 'Caño' by Nicaragua, which cannot have commenced prior to 22 October 2010.



(a) dredger and track left by spoil pipe on right bank of Río San Juan



(b) part of the ~2,400 m^2 area of dredge spoil on right-bank floodplain of Río San Juan





(c) cut trees in a 5-ha area cleared of forest and undergrowth at coordinates N10.92377° W083.68121°

Figure I.23. Observations made during fieldwork. All photographs taken on 22 October 2010 and reproduced from Montero-Navarro (2010).



Figure Notes: This photograph shows the dredger (red circle), the depression left by the spoil pipeline linking the dredger to the spoil dump (blue line), and the area of floodplain wetland buried by dredge spoil (blue circle). The corridor cleared in preparation for digging of the 'Caño' is also visible (brown line).

Figure I.24. Photograph of changes due to dredging (dredger, spoil pipeline depression, dredge spoil on floodplain, and corridor) taken on 22 October 2010. The corridor does not follow any existing watercourse. This photograph provides further evidence to refute the proposition that creation of the 'Caño' involved cleaning the course of a pre-existing, natural channel that had become choked.

I.4.4 Fieldwork on 25 October 2010 and subsequent scientific analysis

Officers of the Ministry for Public Security and the Tortuguero Conservation Area visited the affected area on 25 October 2010, to observe and collect data pertaining to the environmental damage caused by dredging, dumping of dredge spoil, and forest clearance by Nicaragua in the area between the Río San Juan and the Harbor Head Lagoon.

Fieldwork involved:

- identifying the activities causing the damage,
- documenting the nature of the damage,
- discussing the purpose of the activities with the Nicaraguan Army personnel present,
- measuring the extent of the area affected by tree felling and clearance of undergrowth, and
- taking a census of the trees cut down in an area of forest that had been cleared.

A detailed account of the data collected and scientific analysis performed using it may be found in Araya-Montero (2010). However, to allow this document to stand alone, a summary is included in this Report. In the field, the actions causing the environmental damage were identified as being threefold:

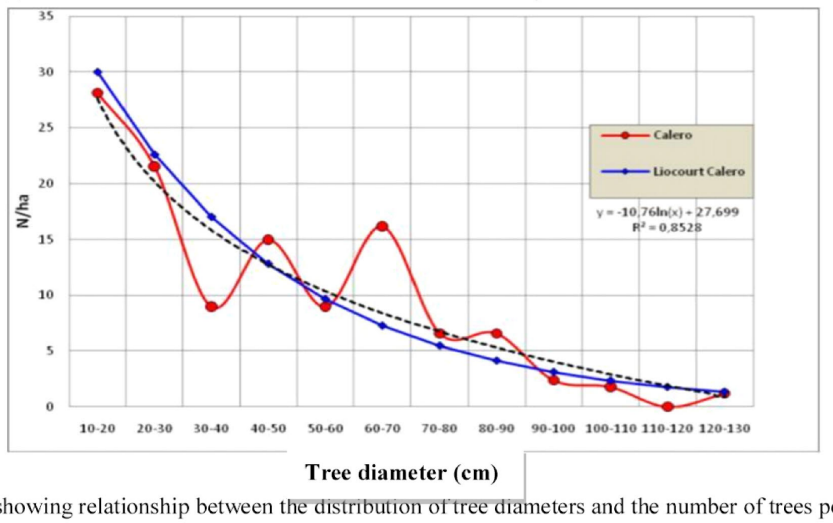
1. on-going operations by the dredger bearing the name "Soberanía,"
2. clearance of understorey vegetation and cutting down of trees in areas close to the Harbor Head Lagoon, and
3. establishment of a track linking the Río San Juan, just upstream of the dredge spoil disposal site, to the area where the forest had been cleared.

The field team measured the area that had been entirely cleared of trees and also observed that vegetation (undergrowth and some further trees) had also been removed in an area of slightly over 4 ha surrounding that area entirely cleared of trees. A census of the trees that had been felled was performed, based on examination of cut trunks and tree stumps in the affected area (Figure I.25(a)). In the field it was estimated that 197 trees had been felled. Subsequently, further investigations revealed that in fact the cleared area was somewhat larger than at first estimated and that at least 292 trees had been cut down (Aguilar-González and Moulaert-Quirós, 2011). Fourteen species of tree were identified, with the dominant species (in terms of number of trees per hectare) being *P. officinalis*, followed by *R. taedigera* and *P. aquatic*. The trunk diameters of these trees ranged between 0.5 and 1.3 m. Scientific analysis of the data was then performed to estimate, using the 'times of passage' methodology, the minimum age of the forest and establish whether it was primary or secondary forest.

The times of passage methodology accounts for the fact that in a mature forest, 1 to 5% of the canopy is opened annually by natural processes. This results in a characteristic distribution between the sizes and densities of trees such that as the diameter increases, the number of trees per unit area of forest floor decreases (Valerio and Salas, 1998). While every forest has its own characteristic relationship, the theoretical form of the distribution of the number of trees per diameter class in forests with trees of various ages is described by De Liocourt's Law (Fredericksen *et al*., 2001), which is shown by the blue curve in Figure I.25(b).



(a) size of trees cut down to clear the forest and make way for construction of the 'Caño



(b) graph showing relationship between the distribution of tree diameters and the number of trees per hectare

Figure Notes: Blue line indicates theoretically-expected distribution for primary forest. Red dots indicate distribution observed in area cleared around the corridor of the 'Caño'. Black-dashed line and equation indicate least squares regression line fitted to observed data, which has a coefficient of determination (R^2) = 0.85 that is statistically significant (source: Araya-Montero (2010)). Close correspondence between theoretical (blue) and observed (black dashed) curves supports the conclusion that the affected area was primary forest.

Figure I.25. Photograph taken on 25 October 2010 and data related to cut trees.

The fact that the diameter of a tree increases with its age can be used to estimate its age based on statistical correlation between age and growth rate developed from long-term monitoring of permanent sampling plots or by means of forest inventories (Dance and Malleux, 1976).

Based on the data collected at permanent sampling plots in northern Costa Rica, the average rate of diameter increase is around 5 mm/year. While there is considerable scatter in the data,

statistical analysis of the dispersion of the data indicates that there is a 95% probability that the average rate of growth of trees growing in and around the clear-cut area will be between 4 and 6 mm/year.

Using these growth rates, best-estimate, maximum and minimum ages for the felled trees were obtained by dividing the average diameter for each species by the average, lower- and upper-bound estimates of the rates of average annual growth given in the previous paragraph. The results are listed in Table I.2.

Table I.2. Average, minimum, and maximum average ages of trees in different diameter classes observed in the area cleared of trees.

Average Diameter Class (cm)	Approximate Age (years)		
	Minimum	Average	Maximum
15	24.8	29.7	37.2
25	41.3	49.5	62.0
35	57.8	69.3	86.7
45	74.3	89.2	111.5
55	90.8	109.0	136.3
65	107.3	128.8	161.1
75	123.8	148.6	185.9
85	140.3	168.4	210.7
95	156.8	188.2	235.4
105	173.3	208.0	260.2
115	189.8	227.8	285.0
125	206.3	247.6	309.8

The range of ages of trees, dominant species, species diversity, diameters, and density (basal area of trees per hectare) found in the affected area are all characteristic of primary forest in the coastal area of the Isla Calero, Costa Rica.

While the age distribution of the trees cannot be used to establish a precise date for the initiation of the forest, the presence of trees with ages of 200 to 300 years (best-estimate 248 years) indicates that the forest in the area affected was at least 200 years old. Statistically, the probability of the forest being less than 200 years old is less than 2.5%. Statistics also suggest that the most likely age of the forest is around 250 years, which indicates that trees have been growing there since around 1760.

This finding is entirely consistent with the sequence of historical maps in Section I.2, which suggested that the land area immediately southwest of the Harbor Head Lagoon was created by development of the micro-delta of the Río San Juan sometime prior to 1797 (Figures I.1 and I.20) and remained undisturbed until 2010.

Taken together with observations made on 20 and 22 October 2010 and the results of subsequent investigations and analysis using the appropriate scientific methods, the evidence provided by fieldwork performed on 25 October 2010 shows that:

- The actions leading to environmental damage in the area between the Río San Juan and the Harbor Head Lagoon were undertaken by Nicaragua.

- Work to clear a path for construction of the channel of the 'Caño' was performed prior to 20 October 2010.
- The dredger "Soberanía" dredged sediment from the Río San Juan and pumped it onto the right-bank floodplain of the river in mid-October 2010 to create a raised area of dredge spoil.
- Digging of the channel of the 'Caño' did not commence until after 25 October 2010.
- Cutting trees between the Río San Juan and the Harbor Head Lagoon as part of work to construct the 'Caño' involved cutting down hundreds of trees in an area of primary forest that had been growing, undisturbed, for at least 200 years and which probably came into being sometime around the middle of the 18th century.

I.4.5 Aerial reconnaissance 1 November 2010

A photograph taken on 1 November 2010 (Figure I.26) illustrates that on that date the corridor for the 'Caño' was being widened progressively by clearing vegetation and removing trees.



Figure I.26. On 1 November 2010, the corridor cleared for channel of the 'Caño' has been widened, though the widened reach does not extend the full length of the corridor in the downstream direction.

I.4.6 Aerial reconnaissance 11 November 2010

Photographs taken during an over-flight on 11 November 2010 (Figures I.27 and I.28), show:

- the initial channel of the 'Caño' dug into the corridor that was cleared of vegetation in late October,
- a second channel orthogonal to the 'Caño' in the area of Aragon that links it to the Río San Juan to the west (see Figure I.17),

- an encampment on the area of raised ground where dredge spoil was pumped and deposited onto the floodplain in late-October 2010, and
- the mouth of the 'Caño', which was dug by hand sometime in October 2010.

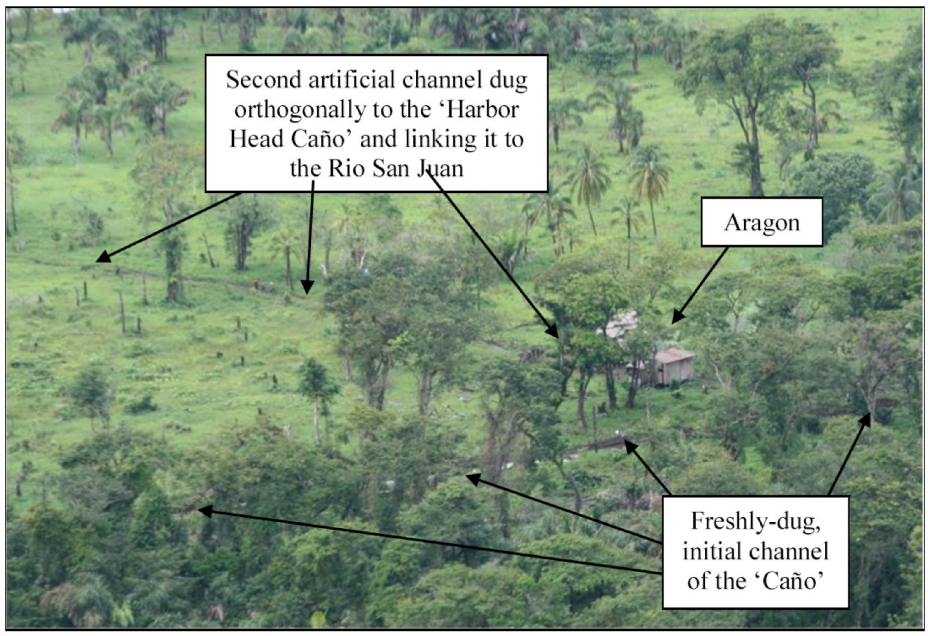


Figure I.27. By 11 November 2010, the initial channel of the 'Caño' has been dug out. The second channel dug orthogonally between the Río San Juan and the 'Caño' at Aragon that was identified in the satellite image for 19 November 2010 (see Figure I.17) can also be seen in this photograph.

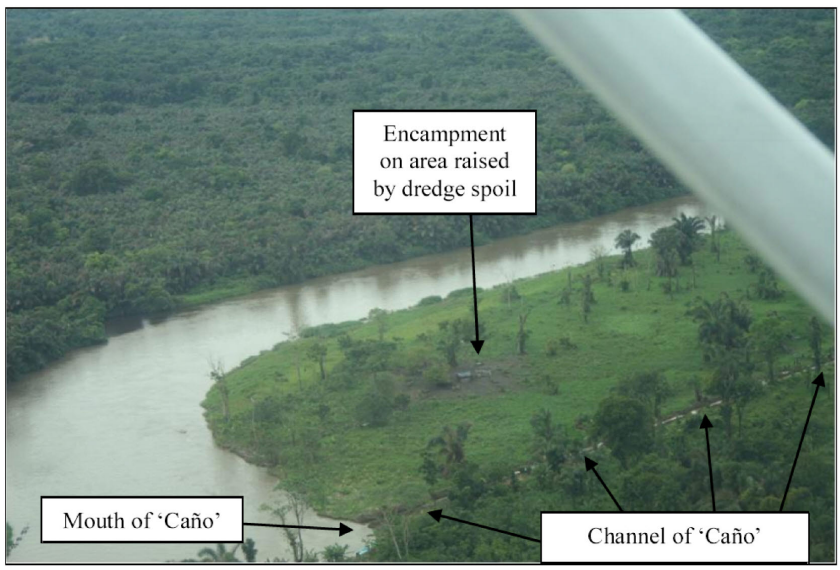


Figure I.28. Photograph taken on 11 November 2010 showing an encampment established on raised ground created by dredge spoil and the newly-dug channel of the 'Caño', extending north from the mouth cut by hand in the right bank of the Río San Juan during late-October 2010.

I.4.7 Aerial reconnaissance 14 November 2010

Photographs taken on 14 November 2010 (Figure I.29) show that sediment-laden river water from the Río San Juan had started to flow into and along the newly-cut channel of the 'Caño' by that date and that the area raised using dredge spoil was occupied by an expanded, tented encampment.



(a) sediment-laden water flowing into the mouth of the 'Caño'



(b) upstream reach of the 'Caño' with encampment in background



(c) close-up view of flow in the freshly-cut channel



(d) wider view of flow in freshly-cut channel

Figure I.29. Photographs of the 'Caño' taken on 14 November 2010, with Río San Juan in the background.

I.4.8 Aerial reconnaissance December 2010

The photograph taken during an over-flight on 5 December 2010 is important, as this date coincided with the peak of a flood event in the Río San Juan. It can be seen in Figure I.30 that the width of the stream of sediment-laden water flowing into and along the 'Caño' has increased markedly compared to the situation on 14 November 2010. Also, the utility of pumping dredge spoil onto the floodplain to create an area of raised ground is now apparent; the encampment has become an artificial island in the otherwise water-logged floodplain.



Figure I.30. Photograph of sediment-laden flood flow taken on 5 December 2010. Note high water level in Río San Juan, increased width of flow in the 'Caño', and water-logged area around encampment on artificially-raised ground created in late-October by dumping of dredge spoil.

I.4.9 Aerial reconnaissance 29 January 2011

A photograph taken on 29 January 2011 (Figure I.31) shows that the water level in the Río San Juan had fallen from its December peak, leading to flow receding into the inner channel of the 'Caño'. The effects of the flood flow and spilling of water into the 'Caño' can be seen to include widening of both inner channel and shallower, outer channel through bank retreat and the washing away of vegetation by fluvial processes of erosion, sediment transport, and siltation. The tented encampment on the area of ground raised by dumping of dredge spoil appears to have been abandoned.



Figure I.31. Photograph taken on 29 January 2011. Discharge in the Río San Juan has decreased and flow in the 'Caño' has receded into the narrow, inner channel. Widening of both the outer and inner channels due to erosion and destruction of vegetation during the flood event of December 2010 can be identified. The encampment on the raised area of dredge spoil appears to have been abandoned.

I.4.10 Aerial reconnaissance 15 March 2011

In two photographs taken on 15 March 2011 (Figure I.32), it is clear that discharge in the 'Caño' has further decreased, allowing the outer channel to dry out. The brown colour of the water in the inner channel indicates that the remaining discharge is silt-laden and it is likely that this silt is settling out on the bed along the course of the 'Caño' due to the quiescent nature of the flow. Close examination of the mouth of the 'Caño' in the right bank of the Río San Juan reveals that sand has accumulated in the funnel-shaped embayment leading to the channel, and that this is isolating the 'Caño' from flow in the river.



(a) low discharge of silt-laden water in the inner channel and drying out of outer channel – note that area of dredge spoil remains abandoned but has not recovered or revegetated

(b) upper reach of 'Caño' showing that flow is blocked from entering the 'Caño' by sand (grey sediment) deposited in its funnel-shaped mouth though silty (brown) water is still present in the channel proper

Figure I.32. Views upstream along the 'Caño' on 15 March 2011.

I.4.11 Field survey 5 April 2011

A technical team of scientists from the Costa Rican Environmental Commission accompanied by staff from the Ramsar Commission undertook fieldwork on 5 April 2011. One of the aims was to collect the data necessary to allow them to calculate the approximate volume of sediment that had been dug out in constructing 'Caño'. A detailed account of this investigation and the way in which the soil volumes were calculated may be found in Jimenez (2011). A summary is provided here to allow this Report to stand alone.

To estimate the volume of soil dug out in constructing the channel of the 'Caño', the length of the 'Caño' was divided into three reaches (A, B, and C in Figure I.33). In the lowest reach of the 'Caño' digging was unnecessary as its channel links to the narrow inlet of the Harbor Head Lagoon that was identified in the maps and satellite images presented in Section I.2 of this Report. The cross-sectional dimensions of the channel in Reaches A through C were measured on site on 5 April 2011 (Figure I.34), producing the results listed in Table I.3.

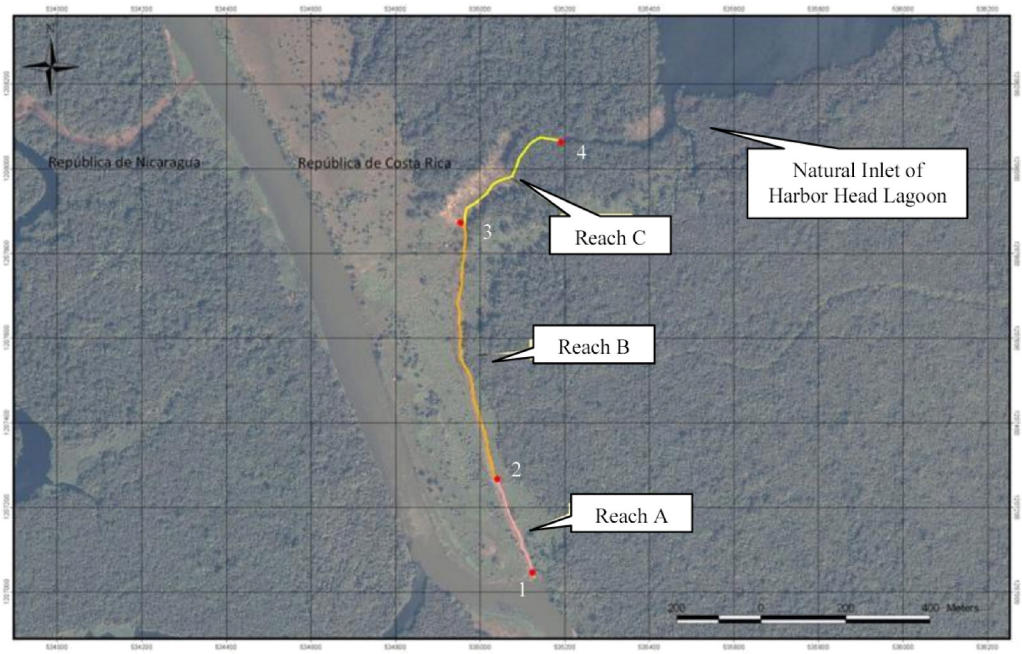


Figure Note: Numbers denote four points where cross-sectional surveys were made.

Figure I.33. Survey reaches established on 5 April 2011 that were used to calculate volume of soil dug out in constructing the channel of the 'Caño'.



Figure I.34. Field survey of 'Caño' dimensions in progress at Point 2. Note heavily-silted condition of channel and its recolonisation by vegetation. Photograph taken on 5 April 2011.

Table I.3. Points of measurement and channel dimensions recorded on 5 April 2011.

Point	GPS Coordenadas Universales	GPS Coordenadas CRTM05	Channel Depth (m)	Water Depth (m)	Channel Width (m)
1	N 10.91577 W 83.67867	N 1207046 W 535124	1.25	0.6	5.30
2	N 10.91776 W 83.67942	N 1207267 W 535041	0.6	0.2	4.20
3	N 10.93324 W 83.68021	N 1207873 W 534955	1.5	1	5.20
4	N 10.92495 W 83.67805	N 1208062 W 535191	1.5	1	5.20

The lengths of the reaches of channel between the four points where cross-sectional surveys were made were estimated to be:

Reach A (Point 1 to Point 2)	249 m
Reach B (Point 2 to Point 3)	628 m
Reach C (Point 3 to Inlet of the Harbor Head Lagoon)	331 m
Total length	1,208 m

The volumes of soil removed to create each reach and the 'Harbor Head Caño' as a whole are listed in Table I.4.

Table I.4. Channel volumes calculated using measurements made on 5 April 2011.

Reach	Channel Volume (m^3)
A	1,648
B	1,582
C	2,585
'Caño'	**5,815**

The field team also observed that the sediment dug out to create the 'Caño' had been dumped on the wetland along the course of the constructed channel. The dumped sediment created bunds on one or both sides of the channel along the entire length of the 'Caño' that were estimated to be 2.5- to 5-m wide, and which varied in thickness between 0.5 and 1.5 m (Figure I.35).

As a result, the topography of the land surface was artificially altered, while the wetland vegetation was buried and the soil beneath the bunds compressed by the weight of the dumped sediment. These outcomes will permanently affect surface and sub-surface hydrology, aquifer recharge, water quality, and habitat in the wetland unless the area is restored.



Figure I.35. Berms created by dumping of soil dug out to create the 'Caño'. Photograph taken on 5 April 2011.

The team noted that, although it is impossible to restore the wetland to a pre-disturbance condition, the medium- and long-term impacts of construction of the 'Harbor Head Caño' could still be reduced if the soil that was dug out and dumped to create the channel and berms was returned to the channel.

During the survey, the stumps of several Yolillo (*Raphia taedigera*) and Sangrillo (*Pterocarpus officinalis*) trees cut down within the channel of the 'Caño' were observed (Figure I.36).



(a) Yolillo (*Raphia taedigera*) (b) Sangrillo (*Pterocarpus officinalis*)

Figure I.36. Stumps of trees in the channel of the 'Caño'. Photographs taken on 5 April 2011.

It is unlikely that either of these species took root in the bed of a pre-existing stream because the buoyancy of their seeds greatly decreases the chances of successful sub-aqueous rooting, especially in flowing water.

It was also decided to map the locations of twenty-one of the Sangrillo (*Pterocarpus officinalis*) trees that had been cut down within the course of the channel and use established scientific

practice to estimate their ages (Figure I.37). Analysis was not extended to the Yolillo (*Raphia taedigera*) due to lack of rigorous scientific references concerning the growth rate of this species. A full account of the analysis is available in a report by Araya-Montero (2011), but the main findings are summarised here for completeness.

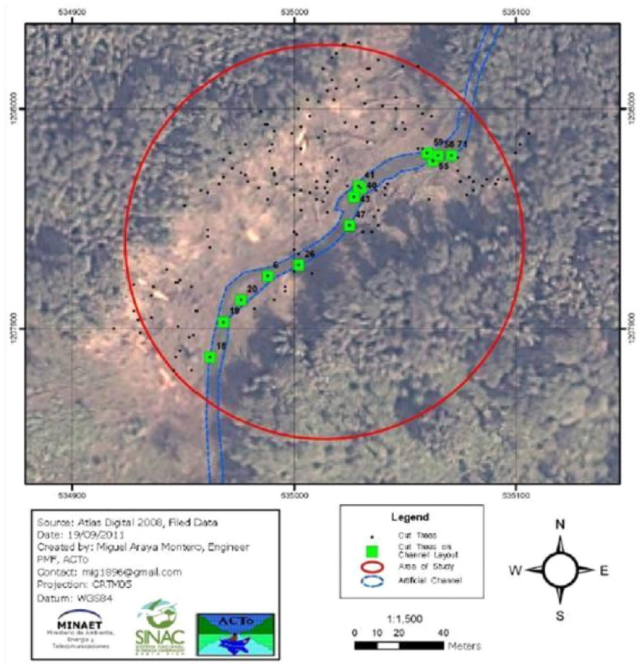


Figure I.37. Map documenting the locations of some of the stumps of Sangrillo (*Pterocarpus officinalis*) trees observed on 5 April 2011 within of the channel of the 'Caño'.

Growth rates for Sangrillo (*Pterocarpus officinalis*) have been established through long-term plot studies in the north Caribbean region of Costa Rica (Aguilar *et al*., 2008). These rates were used to establish, with a 95% level of confidence, the minimum, best-estimate, and maximum ages of a tree based on its diameter (Table I.5). Best-estimates of the ages of the twenty-one Sangrillo (*Pterocarpus officinalis*) located within the channel were estimated to range from a minimum of over 40 years to a maximum probably exceeding 200 years and, possibly, greater than 250 years (Table I.5).

Table I.5. Ages of Sangrillo (*Pterocarpus officinalis*) trees as a function of their diameter (Araya-Montero, 2011).

Diameter Class (cm)	Number Observed in Channel	Age of Tree (years)		
		Minimum	Best-estimate	Maximum
10 – 20	11	35.7	42.4	52.2
20 – 30	2	59.4	70.6	87.0
30 – 40	0	83.2	98.9	121.8
40 – 50	1	107.0	127.1	156.6
50 – 60	0	130.7	155.4	191.4
60 – 70	4	154.5	183.6	226.3
70 – 80	2	178.3	211.9	261.1
80 – 90	0	202.0	240.1	295.9
90 – 100	1	225.8	268.4	330.7

In summary, the results of the field investigation conducted on 5 April 2011 establish that:

- In excess of 5,500 m^3 of wetland soil was dug out in constructing the channel of the 'Caño'.
- Tree stumps identified as being of the species *Pterocarpus officinalis* and *Raphia taedigera* were cut down to make way for the channel of the 'Caño'. It is very unlikely that either species took root in the bed of a pre-existing stream at this location due to the buoyancy of their seeds. Their presence in the 'Caño' make it unlikely that the work performed in November 2010 involved cleaning an existing, flowing distributary linking the Río San Juan River to the Harbor Head Lagoon. The presence of these trees is, however, consistent with the work performed in November 2010 involving construction of a new channel through a forested wetland floodplain.
- The trunks of twenty-one trees of the species *Pterocarpus officinalis* cut down within the course of the channel dug between the two field trips made to inventory trees (25 October 2010 and 5 April 2011) included two trees, one with a diameter between 70 and 80 cm and one with a diameter between 90 and 100 cm. Scientific analysis of the growth rate of this species in northwest Costa Rica indicates that trees had been growing at those locations for at least 175 years and probably more than 200 years.
- Taking these findings, together with the fact that no channel was evident in the area cleared of trees when it was surveyed on 25 October 2010, establishes that the channel of the 'Caño' was excavated in November 2010 through removal of floodplain soil in an area of primary forest that had been undisturbed for over 200 years.
- This proves that constructing the channel of the 'Caño' definitely could not have involved cleaning a pre-existing, natural distributary of the Río San Juan.

I.4.12 Interpretation of satellite image from 7 June 2011

Further analysis of available remotely-sensed images was performed by UNITAR/UNOSAT based on comparison of satellite images taken on 22 February and 7 June 2011. The outcomes are fully described in their report, issued on 12 September 2011 (UNITAR/UNOSAT, 2011b). The salient points are given here to allow this Report to stand alone.

Figure I.38 is reproduced from UNITAR/UNOSAT (2011b). In the accompanying commentary, it is stated that the 'Caño' was likely constructed between 8 August and 19 November 2010, and had attained a width in excess of 14 m on 22 February 2011. However, by 30 April 2011 this width had decreased to only 3 to 4 m, which concurs with the field measurements made on 5 April 2011 (Table I.3). This is still the width in the image of 7 June 2011. The reduction in width may be attributed to decreased discharge coupled with rapid accumulation of sediment and organic debris in the channel, and regrowth of vegetation on the banks, bars, and berms.

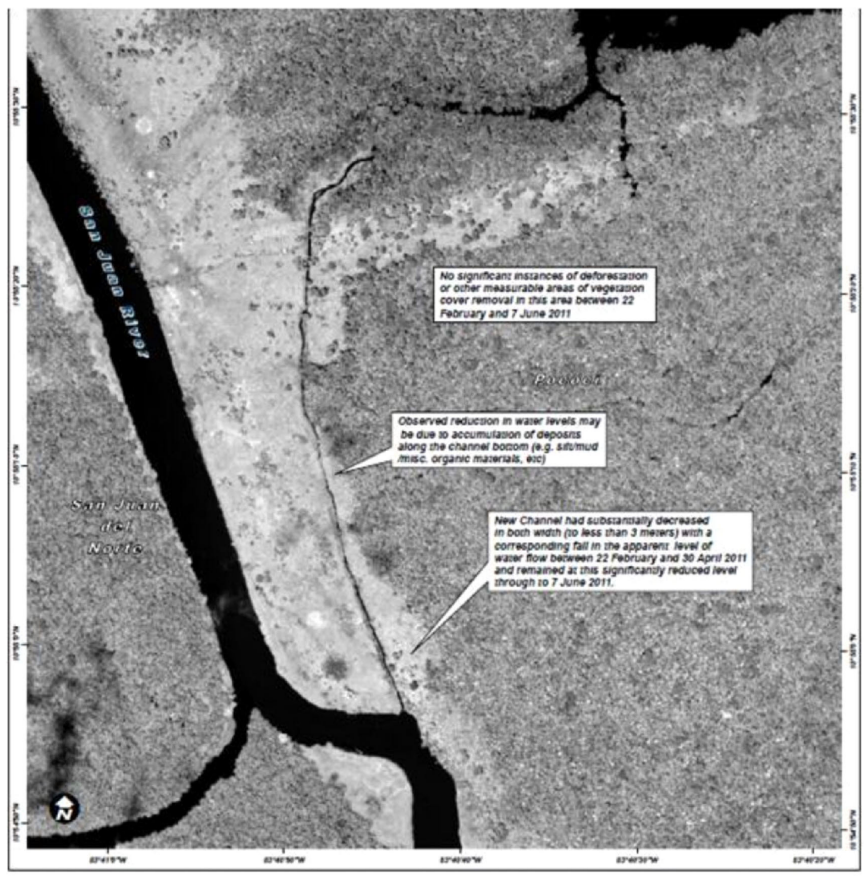


Figure I.38. Annotated satellite image taken on 7 June 2011 (UNITAR/UNOSAT, 2011b).

I.4.13 Aerial reconnaissance 15 June 2011

An oblique aerial photograph taken on 15 June 2011 (Figure I.39) shows that, while a little open water remains in the inner channel of the 'Caño', the width of both that channel and the outer channel have both further diminished due to siltation and, particularly, vegetation regrowth. Vegetation has also begun to colonise the raised area of dredge spoil, though it is restricted to small patches at this time.



Figure I.39. Photograph taken on 15 June 2011 showing reduced flow and channel widths in the 'Caño', vegetation recolonising the outer channel and berms, and patches of vegetation growing on the area raised by the pumping of dredge spoil.

I.4.14 Author's over-flight 7 July 2011

The author personally inspected and photographed the Lower Río San Juan, Harbor Head Lagoon, and 'Caño' from a helicopter over-flight of Costa Rican territory on 7 July 2011 (Figure I.40).

The mouth of the 'Caño' was observed to be open, though little flow appeared to be entering it from the Río San Juan (Figure I.40(a)). The patches of vegetation recolonising the area raised by pumping dredge spoil that were noted on 15 June 2011 had further expanded (Figure I.40(b)).

It was quite difficult to see the channel in the upper course of the 'Caño' due to the small amount of water in it, siltation and, particularly, recovery of the vegetation on the banks, bars, and berms (Figures I.40(c) and (d)). The same was true of the secondary channel constructed orthogonally between the Río San Juan and the 'Caño' at Aragon (Figure 40(e)).

The channel was more clearly defined and silted in the lower-middle course of the 'Caño', around Aragon (Figure I.40(f)). Where the lower course of the 'Caño' entered the narrow inlet in the Harbor Head Lagoon, the channel was inundated by the backwater effect of the Harbor Head Lagoon. Though flow in the inlet and 'Caño' was imperceptible, it seems likely that water was moving from the Harbor Head Lagoon into the wetland rather than from the Río San Juan to the Harbor Head Lagoon (Figure I.40(g)). Vegetation was observed to be recolonising the area of primary forest to the north of the inlet that was cleared between August and October 2010 (Figure I.40(h)). However, while the shrubs and understorey appeared to be recovering from disturbance, the mature trees felled during clearance are irreplaceable.



(a) Río San Juan and mouth of the 'Caño'



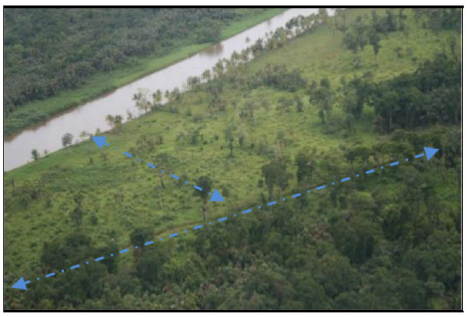
(b) area of pumped dredge spoil



(c) upper course of the 'Caño'



(d) upper-middle course of the 'Caño'



(e) secondary channel orthogonal to lower-middle course 'Caño' at Aragon



(f) lower-middle course 'Caño' at Aragon (compare to Figure I.26)



(g) inlet in Harbor Head Lagoon at lower end of 'Caño'



(h) close-up of inlet and revegetation of area cleared in late-2010

Figure Notes: Blue arrows indicate 'Caño' and secondary channels, red circles highlight features mentioned in text.

Figure I.40. Photographs of observed changes by the author taken on 7 July 2011.

I.5 Summary and conclusions based on the contemporary investigation

I.5.1 Overview

The evidence assembled and reviewed in Section I.4 provides a semi-continuous record of activities related to construction of the 'Caño' that took place in and around the Lower Río San Juan and the Harbor Head Lagoon between late-2010 and mid-2011. Evidence comes from quantitative analysis of satellite images, aerial and ground inspection and photography, scientific data collection in the field, and corroborative statements by those performing the fieldwork based on their first-hand observations. Interpretation of this evidence by the author provides a sound basis on which to draw firm conclusions concerning:

- key dates and the chronology of construction of the 'Caño';
- the areal extent, numbers, species, and ages of trees cut down in clearing a corridor to make way for the 'Caño';
- the quantity of soil dug out and dumped in the wetland to create the channel of the 'Caño'; and,
- post-construction evolution of the 'Caño', in terms of its capacity to convey water and sediment, siltation, width change, and vegetation recovery.

I.5.2 Key dates and chronology of construction of the 'Caño'

1. **Prior to 8 August 2010:** preparations for construction of the 'Caño' may have been initiated through the clearance of trees and undergrowth in at least two patches of the primary forest between the Río San Juan and the Harbor Head Lagoon, although the dates and details are unknown.
2. **8 August to 25 October 2010:** preparatory work for digging the channel of the 'Caño' involved clearing patches of primary forest, digging an artificial mouth for the 'Caño' in the right bank of the Río San Juan and pumping dredge spoil onto the right-bank floodplain to create an area of raised ground suitable for a military encampment. Clearing a path for the 'Caño' involved cutting down trees that were found, from scientific analysis of their diameters, to have been at least 200 and probably 250 years old, in an area of primary forest that inspection of historical maps demonstrates to have been created by growth of the micro-delta of the Río San Juan, probably between about 1760 and 1780.
3. **1 November 2010:** digging of the channel of the 'Caño' commences. A second, smaller channel running orthogonally from the Río San Juan to the 'Caño' at Aragon is also dug out. Recent and contemporary satellite images, aerial photographs, and ground observations demonstrate that no natural watercourses existed in the locations of these two channels prior to 1 November 2010. In addition, the historical investigation reported in Section I.2 and summarised in Section I.3 demonstrates conclusively that no natural watercourse has linked the Río San Juan to the southern part of the Harbor Head Lagoon since the creation of the Harbor Head Lagoon when the larger Laguna San Juan del Norte was bisected along an axis from southeast to northwest by distal extension of the delta of the Río San Juan between 1780 and 1850.
4. **11 to 19 November 2010:** digging of the channels of the 'Caño' and the second smaller channel at Aragon completed and water is flowing between the Río San Juan and the Harbor

Head Lagoon. The 'Caño' and second channel can easily be identified in the satellite image taken on 19 November 2010. The width of the 'Caño' on that date is about 10 m. Satellite images, aerial photographs, ground photographs, and narrative descriptions of the planform and morphology of the channel of the 'Caño' make it clear that its channel in no way resembles any of the natural distributary channels of the Río San Juan. In fact, it has the features of an artificially-excavated ditch.

5. **December 2010:** The 'Caño' diverts considerable flow of sediment-laden water from the Río San Juan during the flood that peaked on 5 December 2010. The military encampment on the raised area of dredge spoil became an island. The width of the channel increases to its peak of around 15 m. The Harbor Head Lagoon changes colour from blue to brown due to the influx of sediment from the Río San Juan and erosion of the 'Caño'.
6. **January 2011:** the encampment was abandoned and construction/maintenance activities on the 'Caño' had ceased by late-January 2011, after which time the condition of the channel seems to have started to deteriorate with its width, depth, and discharge capacity all diminishing.
7. ***Conclusions 1 to 6 demonstrate that the 'Caño' and the smaller secondary channel connecting it orthogonally to the Río San Juan near Aragon are both recently dug, artificial ditches, that digging them did not involve cleaning or restoring a former channel of the Río San Juan and that, being unnatural, they began deteriorating through siltation and vegetation regrowth as soon as they had been created.***

I.5.3 Areal extent and numbers of trees cut down in clearing the wider corridor around the 'Caño'

8. Evidence provided by quantitative analysis of satellite images, coupled with fieldwork and scientific analysis of tree data, establishes that between 8 August and 25 October 2010 at least 292 trees of fourteen different species and with diameters ranging from 5 to 130 cm were cut down as part of clearing over 2 ha of primary forest in preparation for digging of the 'Caño'.
9. The frequency distribution of the diameters of trees cut down to make way for the 'Caño' is consistent with this being mature, primary forest. Primary forest is irreplaceable and the environmental functions it performs and ecological services it provides cannot be replaced by planting replacement trees in mitigation.
10. ***Conclusions 8 and 9 demonstrate that clearing the path for the 'Caño' involved destroying hundreds of trees, including some over 200 and perhaps 250 years old, that are irreplaceable and were providing outstanding habitat and valuable ecological services in an area of primary wetland forest.***

I.5.4 Quantity of soil dug out and dumped in creating the channel of the 'Caño'

11. Volumetric calculations based on measurements of the cross-sectional area and length of the Harbor Head Caño' made on 5 April 2011 establish that digging it involved excavating in excess of 5,500 m^3 of soil from the floodplain and dumping on the surrounding wetland.
12. In fact, this is likely to be an under-estimate because by April 2011 the width and depth of the 'Caño' had already been reduced from their December maxima through siltation and the accumulation of organic debris. Had the dimensions been measured on 19 November 2010,

when the width estimated from a satellite image was 10 m, it is likely that the volume calculated would be nearly double that estimated in April 2011 and could have exceeded 10,000 m^3. A proportion of this sediment must have been washed into the Harbor Head Lagoon, where excessive sediment loads would have damaged the aquatic and benthic environments.

13. ***Conclusions 11 and 12 demonstrate that the volume of soil dug out and/or eroded from the intact floodplain and either dumped in the primary wetland forest or washed into the Harbor Head Lagoon was at least 5,500 m^3 and more likely exceeded 10,000 m^3. Disturbance on this scale would certainly disrupt sub-surface, terrestrial and aquatic processes, habitats, and species.***

I.5.5 Post-construction evolution of the channel of the 'Caño'

14. At the time that construction was completed in November 2010, the width of the 'Caño' was around 10 m. During December 2010, water entering the 'Caño' during a flood peak in the Río San Juan eroded the banks of the cut channel, widening it to around 15 m. Had this trend continued then the 'Caño' would likely have captured an increasing, and non-negligible, proportion of the discharge of the Río San Juan, diverting it into the Harbor Head Lagoon. This would have led to marked and adverse environmental impacts in the Río San Juan, Harbor Head Lagoon, and surrounding wetland.
15. The dimensions and hydraulic performance of the 'Caño' continued to deteriorate throughout the Spring of 2011 and, by 5 April 2011, its width was measured on the ground to have shrunk to 5.5 m or less.
16. This trend continued during the summer, with the width estimated to have decreased to 3 to 4 m based on the satellite image of 7 June 2011.
17. During the aerial inspection performed by the author on 7 July 2011, a low water level, siltation, and vegetation regrowth had resulted in the channel shrinking to the point that it was difficult to pick out the 'Caño' at all along substantial reaches in its upper and middle courses.
18. ***Taken together, Conclusions 14 to 17 demonstrate that the artificial form and location of the 'Caño' make it unsustainable as a distributary channel of the Río San Juan. Provided that no further meander cut-offs, dredging, or digging is performed, the channel of the 'Caño' is likely to naturally revert to floodplain through siltation and vegetation regrowth, though the range and value of habitats destroyed during its construction will not recover in the foreseeable future. Conversely, if further work aimed at perpetuating the artificial link between the Río San Juan and the Harbor Head Lagoon created in November 2010, this is likely to involve further and repeated capital works followed by maintenance digging and dredging to enlarge and keep the channel open, with adverse impacts on natural morphologies; hydrologic processes; wildlife habitats; and species in the river, lagoon, and surrounding wetland.***

I.6 Impact of the 'Caño' on Río San Juan and potential for further impacts if it is enlarged

It is well-established in the academic and professional literatures on river science and engineering that artificial diversion of water and sediment from a river directly impacts, to a greater or lesser degree, its hydrology, hydraulics, water quality and sediment dynamics. These direct impacts, in turn, trigger complex responses involving: fluvial, chemical and biological processes, channel morphology, the range and quality of habitats that the river provides, the ecosystem, and biodiversity that it supports (Richter *et al.*, 1996, 1997; Poff *et al.*, 1997; Thorne *et al.*, 1997; Callow and Petts, 1994; Fisher and Ramsbottom, 2001; Sear *et al.*, 2010). It is important to recognise that the value of the river to humankind depends on the ecological services it supplies (Costanza and Daly, 1992; Costanza *et al.*, 1997), and this value may be reduced when a river is disturbed by artificial diversion of water from it. Hence, it should be expected *a priori* that diverting some portion of the flow and sediment load from the Río San Juan into the 'Harbor Head Caño' could have multiple impacts on the river, biota that inhabit it, and the ecological services it supplies.

Assessment of the impact of the 'Caño' on the river is based on assembly and inspection of the sequence of all available satellite images (including, but not limited to, those presented in Section I.2), aerial photographs, ground-based photographs and textual accounts (including, but not limited to, those presented in Section I.4) of the lower course of the Río San Juan and the area around the 'Caño' prior to January 2010 (i.e., pre-disturbance condition) and up to June 2011 (i.e., recent, post-disturbance condition), and the author's first-hand observations made during an over-flight on 7 July 2011.

Examination of the sequence of satellite images between 1961 and January 2010 indicates that the channel of the Río San Juan in the reach between the meander about 400 m upstream of the location of the mouth of the 'Caño' (that was cut-off artificially in late-January or February 2011 – see Section I.9) and the micro-delta in the lagoon of San Juan del Norte was in a state of dynamic equilibrium during the 50 years prior to its disturbance by the dredger "Soberanía," starting in October 2010. This conclusion is based on the facts that the width, planform pattern and location of the channel did not change appreciably during that period.

Aerial and ground-based photographs taken in October 2010, together with supporting, textual accounts, establish that the Río San Juan was directly disturbed in at least two places by:

- dredging and pumping by the "Soberanía" of approximately 1,700 m^3 of sediment from the bed of the river that was deposited onto the right-bank floodplain to create an area of about 0.24 ha of artificially-raised ground subsequently used as a military encampment during construction of the 'Caño' between October 2010 and January 2011; and
- dredging to create the artificial mouth of the 'Caño' in the right bank during October 2010.

Mechanical disturbance resulting directly from these activities was, however, small in scale; and observations in June and July 2011 suggest that natural sediment dynamics and siltation, coupled with recovery and regrowth of riparian vegetation, meant that the impacts were of local extent and time-limited duration.

The indirect impacts on the Río San Juan resulting from the river's morphological and environmental responses to diversion of some of its flow and sediment load into the 'Caño' are more difficult to assess because there is the potential for positive feedback loops operating in the fluvial system to magnify them locally, promulgate them both upstream and downstream, and perpetuate them through time. The existence of these complex process-response mechanisms in the fluvial system means that the potential exists for impacts that initially appear minor to trigger non-linear process-responses that amplify rather than dampen their effects on channel forms, habitats, and ecosystem (Sear *et al.*, 2010).

These complexities make it necessary to assess the indirect impacts of the 'Caño' not only in the short-term (i.e., during and immediately following its construction), but also in the subsequent months and the longer-term future. In the latter context, assessment of the potential for future impacts and responses must include consideration of the possibility of further actions by Nicaragua to re-excavate or enlarge the 'Caño'.

Diversion of water and sediment into the 'Caño' began during November 2010, peaking in December 2010 in conjunction with bank erosion that widened the channel of the 'Caño' from around 10 m to as much as 30 m. During this period, both the discharge and sediment load of the Río San Juan were high due to the flood event that crested on 5 December 2010. Consequently, although the 'Caño' diverted a considerable volume of sediment-laden water from the river and conveyed it to the Harbor Head Lagoon during this period, this represented only a fraction of the river's discharge and sediment load at that time.

Between January and June 2011, discharge in the Río San Juan receded and spilling of water into the 'Caño' was also increasingly restricted by the accumulation of sand in its funnel-shaped mouth (Figure I.41). Also, the capacity of the 'Caño' to convey water and sediment to the Harbor Head Lagoon had decreased due to progressive siltation of the channel and regrowth of vegetation along its banks. In fact, at the time of the author's over-flight on 7 July 2011, the channel width had decreased to less than 5 m and, in places, less than 3 m. While there was standing water in the 'Caño', there was no perceptible flow from the river to the lagoon at that time.



Figure I.41. Sand bar partly blocking the mouth of the 'Caño'. Photograph taken on 5 April 2011.

Based on these observations, it is likely that the proportion of the discharge and sediment load diverted into the 'Caño' remained very small throughout the period between its construction in November 2010 and its closure due to siltation during mid-summer 2011. Hence, it may be concluded that the short-term impacts of the 'Caño' on the hydrology, hydraulics, water quality, and sediment dynamics of the Río San Juan were small or negligible.

The short-term behaviour of the 'Caño' indicates that the concentration of sediment in the flow it receives from the Río San Juan is sufficiently high to overwhelm the channel's capacity to convey all of the sediment it receives from the river to the Harbor Head Lagoon. Lack of sufficient capacity to transport the sediment received from the Río San Juan was compounded in December 2010 by the supply of additional sediment through erosion of the steep, unvegetated banks of the freshly-cut channel. Although the banks appear to have stabilised due to vegetation regrowth during summer 2011, the characteristically high-sediment concentrations in the Río San Juan mean that it is unlikely that the 'Caño' will develop the sediment-transport capacity necessary for its channel to become sustainable. It is actually much more likely that the channel will silt progressively, eventually developing the form of a vegetated swale in the floodplain that frequently features standing water but which conveys discharge to the Harbor Head Lagoon only during rare, extreme floods. In this case, the artificial connection between the Río San Juan and the Lagoon that was created in November 2010 will be short-lived and the longer-term impacts of the 'Caño' on the Río San Juan will, like the short-term impacts, be small or negligible.

An important proviso to this prediction is that the wetland and floodplain disturbed by construction of the 'Caño' are allowed to recover naturally. The prediction that future impacts

are likely to be negligible would no longer be valid in the event that further actions were to be taken to re-excavate or enlarge the channel linking the Río San Juan to the Harbor Head Lagoon that was created in November 2010. In this context, it should be noted that the corridor cleared through the forest to make way for the 'Caño' has been made sufficiently wide to accommodate most if not all of the discharge of the Río San Juan. This reduces the flow and erosion resistances of the forest and wetland, increasing the possibility of further diversion of flow through the channel triggering an avulsion of the Río San Juan that would divert the river along the course of the 'Caño' and into the Harbor Head Lagoon.

This would be highly damaging to the river and its environment and there are compelling reasons why any plan to re-excavate or enlarge the 'Caño' should be resisted. To explain why, it is necessary to start by considering how distributary fluvial systems behave naturally.

Alluvial, deltaic rivers are potentially unstable because, if the cross section of the smaller of the two distributary channels downstream of a bifurcation enlarges so that it attracts more of the discharge, flow in the larger distributary must, according to the law of conservation of mass, diminish. What happens next depends not only on the proportion of water diverted into the enlarging channel, but also the proportion of the sediment load.

If the enlarging distributary cannot carry the sediment supplied from the trunk stream (plus the additional sediment derived from its eroding bed and/or banks); it will silt, flow will be impeded, its growth will cease, and the main channel will persist. However, if the enlarging distributary can carry the sediment load supplied to it (plus the additional load derived from channel scour) then it will continue growing. Simultaneously, the diminished flow in the larger distributary can no longer convey the sediment load it is supplied with, and so it silts. Under these circumstances, there exists a *tipping point* at which the smaller, enlarging distributary gains ascendancy, capturing more and more of the flow until it eventually becomes the dominant course of the river.

Although the channel of the 'Caño' that was dug in early-November 2010 grew initially, it was unable to carry the sediment load supplied by the Río San Juan (plus that derived from channel scour) and so, inevitably, it silted. However, had its approach and entrance conditions been more favourable and its conveyance capacity greater, it is conceivable that the tipping point might have been reached, with the 'Caño' capturing more and more of the discharge of the Río San Juan and growing at the expense of the natural river channel.

In this context, the breadth of the corridor cleared of trees to make way for the 'Caño' could have been pivotal, as it would have provided the space necessary for the channel to widen, unfettered by the very high flow and erosion resistances provided by intact, primary forest.

Had the tipping point been reached, the short-term impacts on the current channel of the Río San Juan would have been serious and, in the longer-term, decline of the historically-stable course in favour of a new course along the alignment of the 'Caño' would have had catastrophic impacts on the ecosystem the river currently supports both in its channel and the Greytown Lagoon.

The fact that the tipping point was not reached in December 2010 does not preclude the possibility of it doing so, should renewed attempts be made to re-open an artificial link between

the Río San Juan and the Harbor Head Lagoon that existed between November 2010 and summer 2011. Indeed, completion of the cut-off channel at the meander bend about 400 m upstream in late-January 2011 has already the axis and orientation of flow approaching the mouth of the 'Caño' in ways that would favour flow entering a re-excavated channel. A subsequent attempt to re-open it might involve:

1. cutting an additional meander in the Río San Juan upstream (where vegetation clearance has already occurred and a pilot channel exists) to further increase velocities and better align flow in the river with the orientation of the 'Caño';
2. dredging a deeper, more bell-shaped mouth to improve entrance conditions and reduce local energy losses and sand accumulation;
3. widening and deepening the channel of the 'Caño' to increase its initial capacity to convey water and sediment to the Harbor Head Lagoon; and
4. performing frequent maintenance (dredging, de-silting, and vegetation removal) as necessary to keep the 'Caño' open and prevent flow switching back to the natural course of the river into the Greytown Lagoon.

In the short-term, such works would seriously disturb wildlife and cause further direct damage to the Río San Juan in the vicinity of the cut meanders and in the area around the mouth of the 'Caño'. In the longer-term, the scale and intensity of the initial works, coupled with the chronic and cumulative impacts of the repeated maintenance that would be essential to maintaining the channel, would likely lead to serious and probably irreversible morphological and environmental degradation in the channel and micro-delta of the Río San Juan; the area of the Greytown Lagoon currently fed by water and sediment flows in the Río San Juan; and the coastal zone that presently receives freshwater, silt, and nutrients supplied by the river on its natural alignment.

I.7 Short-term impacts of the 'Caño' on the Harbor Head Lagoon and Isla Portillos wetland, plus potential for medium- and long-term impacts if it is enlarged

In addition to the observations recounted in Section I.4 and summarised in Section I.5, additional assessment of the direct impacts of the 'Caño' on the Harbor Head Lagoon and surrounding wetland system were assessed as part of a Ramsar Mission undertaken in response to a request made by Costa Rica under Article 3.2 of the Ramsar Treaty. The mission took place between 27 November and 1 December 2010. The initial, preliminary report prepared by the team that conducted Ramsar Advisory Mission (RAM) No. 69 was issued on 17 December 2010 (Ramsar Convention on Wetlands, 2010).

Ramsar scientists also participated in a field visit on 5 April 2011. At the time of writing (October 2011) the final report based on the November and April missions has yet to be issued, but the author was given sight of an advanced draft (Araya-Montero *et al.*, 2011). Relevant here are the environmental impacts observed and/or inferred by the Ramsar teams to have been caused by the 'Caño' in a 225-ha area of the Isla Portillos bordered by the Río San Juan, Caribbean Sea, and Harbor Head Lagoon.

Elements of the physical and hydrological systems reported to have been impacted by the 'Caño' include:

- surface water hydrology;
- surface water drainage network;
- exchange between surface and sub-surface water;
- exchange between surface water, hyporheic zone and wetland aquifer;
- sediments and water quality;
- soils; and
- river, deltaic, and coastal geomorphic systems.

It was further noted that the 'Caño' had altered hydrological and environmental conditions through:

- increasing freshwater flow into the Harbor Head Lagoon, altering its water quality and salinity;
- increasing sediment discharge into the Harbor Head Lagoon, altering its turbidity, water quality, nutrient balance, and benthic environment;
- decreasing residence times for nutrients and organic materials in the Harbor Head Lagoon, impacting its trophic state;
- increasing freshwater flow to the Isla Portillos wetland, altering water balance, water quality, and salinity; and
- causing river water from the Río San Juan to enter the aquifer of Isla Portillos wetland, altering groundwater hydrology, water quality, and trophic state.

Direct and indirect impacts on flora were observed or inferred in terms of:

- loss of primary forest due to felling of patches of mature trees with ages of at least 200 and possibly in excess of 250 years, to create the pathway for the 'Caño';
- loss of vegetation cover over wider areas due to the clearing of the understorey in the wetland and primary forest;
- reductions in the abundance and distribution of aquatic vegetation species in the Harbor Head Lagoon and the Isla Portillos wetland;
- reductions in the abundance and distribution of terrestrial vegetation species in the wetland; and
- reductions in the rate of growth of vegetation species in the wetland.

In terms of fauna, changes mentioned include:

- changes in abundance and distribution of aquatic faunal species (especially fish) in the Harbor Head Lagoon and surrounding wetland;
- loss of aquatic habitat for fauna due to transformation of areas of standing water to a flowing condition;
- changes in the trophic chain likely to reduce reproductive success of aquatic species in the Harbor Head Lagoon and surrounding wetland;

- loss of habitat for migrant and resident birds in the wetland of the Isla Portillos and the Harbor Head Lagoon;
- fragmentation of habitats and blocking of biological corridors in the wetland; and
- changes in distribution and abundance of terrestrial faunal species.

The Ramsar reports include evaluations of the short-term (0 to 6 months), medium-medium (1 year), and long-term (5 to 10 years) outcomes likely to result from these changes in the Direct Impact Area (DIA), based on consideration of the hydraulic connection provided by the 'Caño' between the Río San Juan to the Harbor Head Lagoon. However, the Ramsar Mission felt that they did not have sufficient information to include the effects of the 'Caño' in modifying the wider patterns of superficial and sub-surface flows in the wetland hydrological system. Hence, their predicted outcomes are more likely to under-estimate rather than over-estimate the full impacts of the 'Caño'.

In this Report, the author has built on the preliminary and draft reports prepared following the Ramsar Missions, drawing on the wider range of evidence provided in Sections I.2 and I.4 to assess the short-term impacts and consequences, and, in assessing the medium- and long-term outcomes of its physical and environmental impacts, taking into consideration the possibility that the 'Caño' might be re-excavated or enlarged (Table I.6).

The short-term impacts of the 'Caño' have already been felt in the Harbor Head Lagoon and surrounding wetlands. However, the performance of the 'Caño' to date suggests that, provided it is not re-excavated or enlarged:

- short-term impacts and their longer-term environmental consequences should be restricted to the 'Caño' itself, the Harbor Head Lagoon and adjacent areas of primary forest cleared of trees and vegetation as part of its construction; and
- wider impacts and environmental consequences in areas of the Harbor Head Lagoon and Isla Portillos wetland that were not directly affected by the 'Caño' between its construction in November 2010 and its decline in the first half of 2011 should be time-limited.

However, if the areas of wetland and floodplain disturbed by construction of the 'Caño' are not allowed or assisted to recover as necessary, and were further actions taken to re-excavate or enlarge the 'Caño', then the environmental consequences would be likely to lead to a collapse in the wetland and lagoonal ecosystems that would probably prove, in the long-term, to be irreversible. To illustrate this point, the medium- and long-term consequences listed in Table I.6 are, therefore, based on this 'worst-case' scenario.

In judging the scale of the environmental consequences of the 'Caño', the Fundación Neotrópica have attempted to assess, with the best technical international information currently available, to establish the value of ecological goods and services provided by natural capital in the Isla Portillos (listed in Table I.7) based on the potential costs of the impacts reported in the preliminary report issued by Ramsar following its mission in November 2010 (Ramsar Convention on Wetlands, 2010).

Table I.6. Environmental outcomes in the Harbor Head Lagoon (HHL) and Isla Portillos wetland due to the Harbor Head 'Caño' (adapted from Aguilar-Gonzalez and Moulaert-Quirós (2011)).

Short Term (0 to 6 months)	Medium Term* (1 year)	Long Term* (5 to 10 years)
1. Disturbance to fauna and flora during operations related to construction of the 'Caño'. 2. Loss of habitat due to clearing of vegetation and felling of trees to create corridor through primary wetland forest. 3. Changes to topography, drainage patterns, and habitat in wetland due to dumping of dredge spoil and soil dug out to create the channel. 4. Changes in water quality and salinity due to increased freshwater flow from Río San Juan to HHL and insular wetland. 5. Introduction of river sediments, nutrients and pollutants into HHL and wetland. 6. Changes in rates and spatial distributions of hydrologic, geomorphic, geochemical, biochemical, and biological processes. 7. Mortality or morbidity in species unable to adapt to disturbance and rapid environmental changes. 8. Reduced resilience in river, lagoonal, and wetland ecosystems, increasing vulnerability of species, including some listed as endangered. 9. Adverse impacts on species in the affected areas and proportional reduction in provision of environmental services.	1. Progressive changes in hydrology, morphology, environment, and habitat of HHL due to cumulative effects of the 'Caño'. 2. Increased mortality or morbidity in aquatic species unable to adapt to changes in environment and habitat provided by HHL. 3. Cumulative changes in the hydrology, environment, and habitat of the insular wetland due to extension of the area influenced by the river. 4. Increases in frequency and amplitude of water-level fluctuations in the wetland and HHL correlated with the seasonal and event-driven hydrographs of the Río San Juan. 5. Increased water stresses in wetland leading to mortality or morbidity in tree and understory species unable to adapt quickly to environmental change, generating extensive areas of dead/sick vegetation. 6. Progressive reductions in area and increases in fragmentation of habitat available for terrestrial flora and fauna. 7. Cumulative decrease in resilience of ecosystem and vulnerability of species including some listed as endangered. 8. Further decline in biodiversity and environmental services provided by HHL and wetland.	1. Erosive processes driven by diverted river water enlarge 'Caño', leading to its progressive growth at the expense of natural channel of the Río San Juan. 2. Breaching of barrier beach separating HHL from Caribbean Sea due to the increased influx of river water, leading to changes in hydrology, salinity, geomorphology, environment, and habitat of HHL that will be radical and probably irreversible. 3. Eradication of previous ecosystem in HHL (adapted to a closed lagoon) and evolution of new and different ecosystem adapted to seasonal or permanent breaching of the barrier beach. 4. Reduction of wetland area due to erosion by enlarging the 'Caño' and erosion of shoreline around HHL. 5. Siltation in landward part of HHL due to growth of a micro-delta built by sediment delivered by the 'Caño'. 6. Progressive changes in wetland aquifer due to cumulative effects of altered recharge regime that may be irreversible. 7. Collapse of wetland ecosystem due to rapid and extreme hydrologic, hydraulic, geomorphic, and environmental changes, involving loss of protected species and valuable environmental services.

*assuming that the 'Caño' is maintained and enlarged artificially and/or due to erosion by flow diverted from the Río San Juan

Table I.7. Land uses and environmental services provided by the Isla Portillos based on the benefit transfer methodology of the ECOTICOS Project in the Terraba-Sierpe Wetland Reserve (source: Aguilar-González and Moulaert-Quirós (2011)).

Land Use	Environmental Service
Mangrove	Food production Recreation Habitat/Refuge Raw materials Disturbance regulation Waste treatment Total ecosystem
Tropical Forests	Erosion control Nutrient cycling Genetic resources Food production Water regulation Water supply Recreation Raw materials Soil formation Waste treatment Disturbance regulation Climate regulation
Wetland	Water regulation Water supply Aesthetic and recreational Refugium and nursery Climate regulation Waste treatment Total ecosystem
Beach	Disturbance regulation Recreation
Pastures	Aesthetic and recreational Soil formation Biological control Food production Pollination

In making their assessment, the Fundación Neotrópica also used information provided in the report of the UNITAR/UNOSAT (2011a). The results of their Ecological Economic Valuation were included in a draft report issued on 15 June 2011 by Aguilar-González and Moulaert-Quirós (2011). The limited data available to support application of the method to the DIA meant that uncertainty in the results was high and to represent this, lower- and upper-bound estimates for the value of ecological services were calculated rather than a single, best-estimate.

According to their calculations, the Fundación Neotrópica estimate the annual value of ecological services provided by the DIA is likely to exceed $0.6 million. For comparison, a study performed independently by Allan Astorga Gättgens and reported in a newspaper article (Astorga, 2011a) produced a lower-bound estimate of $1.2 million for the annual value of ecological services provided by the DIA.

The higher values in Astorga's analysis stem from inclusion of ecological services provided in sensitive beach and coastal areas outside the DIA. The justification for their inclusion is that the effects of, for example, breaching the barrier beach that separates the Harbor Head Lagoon from the Caribbean Sea could trigger changes in coastal currents and sediment dynamics, with environmental consequences felt as far away as Uvita Island and Cahuita National Park in south eastern Costa Rica that would affect important species such as sea turtles.

It is clear from the evidence provided in Sections I.2 and I.4 (for example, the destruction of trees with ages in excess of 200 years in multiple patches of primary wetland forest) and the assessment set out in this section, that construction of the 'Caño' has already led to adverse environmental impacts and ecological consequences, that have resulted in a loss of environmental capital and a reduction in the ecological services provided by the Isla Portillos and Harbor Head Lagoon. In this context, a second document issued by the Fundación Neotrópica on 7 October 2011 sought to estimate the costs of those damages based on the numbers and ages of trees that were cut down in October 2010 (Aguilar-González and Moulaert-Quirós, 2011).

Based on recognised methods of evaluating humid tropical forests published by Obando-Vargas *et al.* (2009) and Mena (2008) and conservative assumptions concerning the value of ecological services provided by the trees themselves, Aguilar-González and Moulaert-Quirós (2011) report that the Total Value Estimate (TVE) of costs resulting from clearing primary forest to make way for the 'Caño' in October 2010 is likely to have exceeded $1.5 million. This does not reflect solely the commercial value of the trees as lumber, but includes their value as natural capital and the value of the ecosystem services they were providing prior to their destruction.

The performance of the 'Caño' to date suggests that its channel silting, its capacities to convey water and sediment are declining and vegetation along its banks is recovering. While the mature trees cut down during its construction are irreplaceable and substantial environmental costs have already been incurred, the on-going, adverse impacts of the 'Caño' on the Harbor Head Lagoon and wetland are likely to diminish with time.

This point lends further support to the conclusion that the 'Caño' is an artificial channel that has no natural precedent or function. It also suggests that, although the adverse impacts of the 'Caño' on ecological services provided by the Isla Portillos and Harbor Head Lagoon are likely to persist for some time, they are likely to diminish as the 'Caño' silts and re-vegetates. Future impacts could, however, be reduced if the soil dug out and piled on the wetland to create the channel were returned to the channel to fill it in.

However, a cautionary note must be added to this conclusion. Further actions that attempt to improve the approach and entrance conditions of the 'Caño', re-excavate or enlarge its channel, or divert a significant proportion of the flow from the Río San Juan into the Harbor Head Lagoon by any other means, would have devastating consequences, not only in the lagoon and

surrounding wetland, but potentially over a much wider area influenced by currents in the Caribbean Sea.

Under these circumstances, a significant proportion the valuations provided by the Fundación Neotrópica and Astorga would be lost due to reductions in the capacity of the area to generate these services. This suggests that losses due to reductions in natural capital and ecological services could be measured in millions of dollars. If the capacity of the area was entirely compromised (an unlikely, but perhaps not impossible scenario), losses of natural capital and reductions in the supply of ecosystems services might be measured in tens of millions of dollars.

Two final points emerge from this assessment of the wider impacts of the 'Caño'. First, this assessment adds a note of urgency to the case for restorative actions to reverse as many of the deleterious outcomes of the creation of an artificial link between the Río San Juan and the Harbor Head Lagoon as possible. Second, it emphasises the necessity of avoiding any repetition or escalation of the actions that caused the environmental and ecological losses incurred in 2010.

I.8 Origin and construction of meander cut-offs in the Lower Río San Juan

In late-2010, at the same time that the 'Harbor Head Caño' was being constructed in the right-bank floodplain of the Río San Juan, activities also began in the left-bank floodplain of the Lower Río San Juan. The locations of these actions were mapped using radar satellite images by Astrium (2011) (Figure I.42).

The first (main) site is at the inside of a meander located approximately 400 m upstream (south) of the mouth of the 'Caño', where work began in October 2010 (Figures I.42(a), (c), and (e)). There is some evidence of activity at a second site on the inside of a meander bend further upstream, where a strip of vegetation may have been cleared in January 2011 (Figures I.42(b), (d), and (f)).

The first bend impacted by actions in 2010 came into being between 2003 and 2008 following a natural cut-off that occurred between the two, tortuous meander bends that are easily identifiable in the satellite image taken in 1961 (see Figure I.10). The width of the neck of land between these bends had been reduced by bank erosion in 1981 (see Figure I.11) and only a narrow strip of land remained to separate the bends in 2003 (see Figure I.12). The river probably broke through the neck of the meanders soon after 2003 and by 2008 the channel had settled into its new planform pattern. Subsequent changes to the bend are chronicled in Figure I.43.

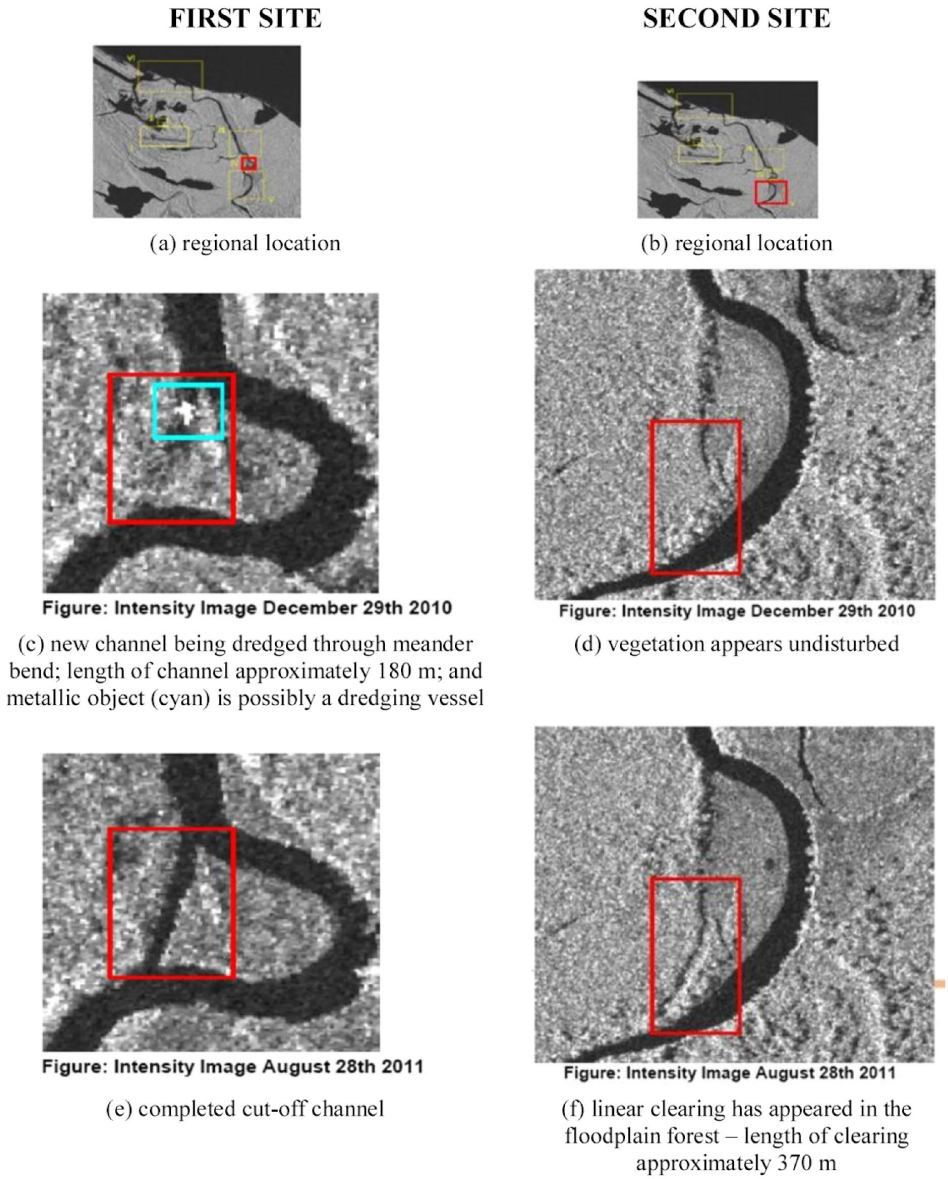


Figure I.42. Radar satellite images of the first and second sites (source: Astrium (2011)).

The planform geometry and position of the bend were stable between 2008 and January 2010; and in the image taken on 22 January 2010 (Figure I.43), the entire point bar at the inner bank is densely vegetated. What appears to be disturbance to the vegetation at the landward edge of the point bar in the image taken on 8 August 2010 might be just that, or could be the result of freshly-deposited sediment that has accreted on the point-bar surface. However, in the satellite image of 19 November 2010 (Figure I.43), a corridor has been completely cleared of vegetation right across the neck of the meander bend and a dredger can be seen in a channel it has cut

approximately 20 m into that corridor, starting from its downstream end. This is definitely the result of human action rather than river processes.

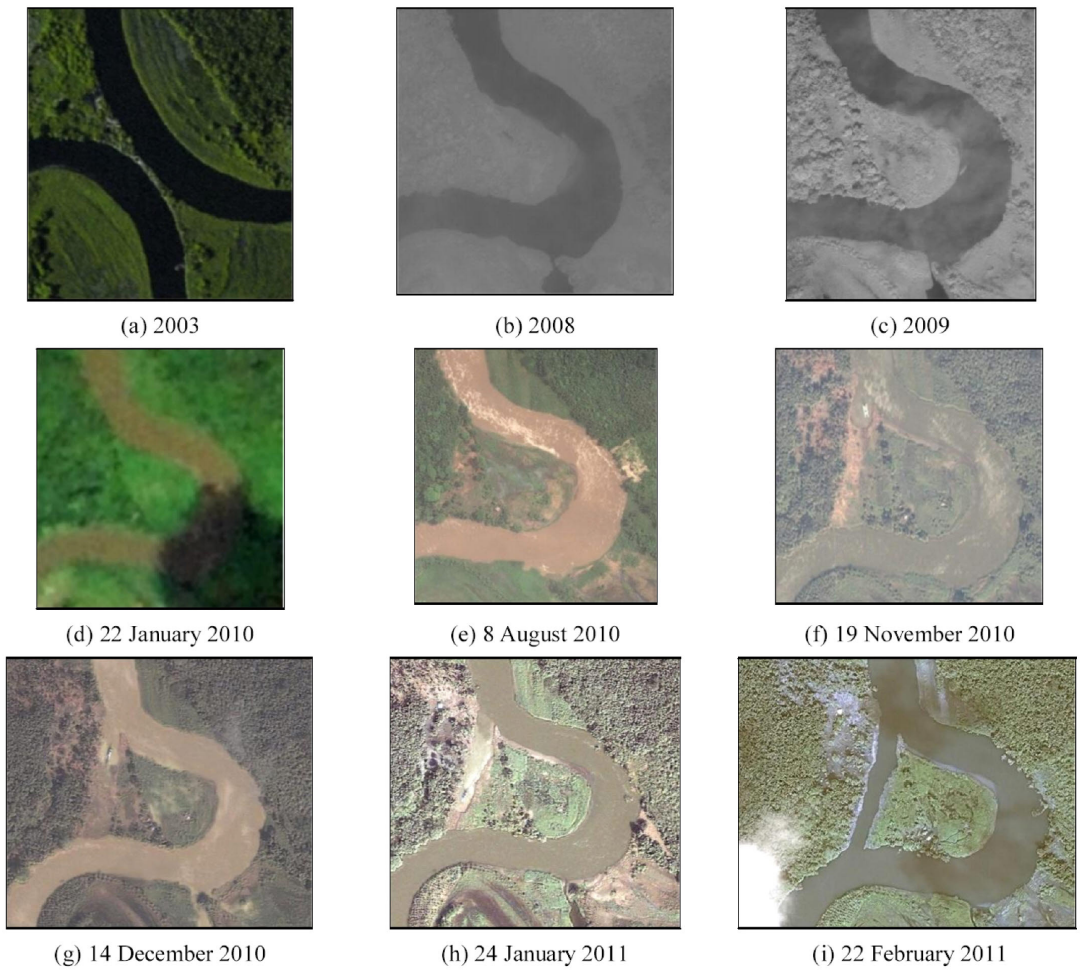


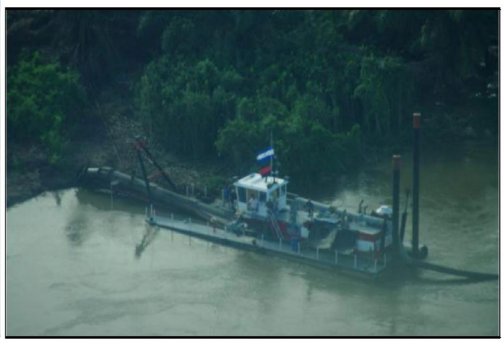
Figure I.43. Satellite-image sequence chronicling the history of the meander bend in the Río San Juan about 400 m upstream of the mouth of the 'Harbor Head Caño' from its inception between 2003 and 2008 to its artificial cut-off between October 2010 and February 2011.

In the image of 14 December 2010, the dredger has advanced about 70 m into the cleared corridor. On 24 January 2011 the dredger and the cut-off channel have both advanced southwards, almost cutting through the neck of the meander. Dredging of the channel was completed early in 2011, as the artificial channel extends all the way through the neck of the meander in the image taken on 22 February 2011 (Figure I.43).

The record provided by the satellite images in Figure I.43 can be fleshed out using oblique aerial photographs taken during over-flights by Costa Rican technical specialists and the author (Figure I.44). Commentary on these photographs may be found in the figure caption.



(a) 1 November 2010: view west showing corridor cleared of vegetation, dredger, and second vessel moored at left bank



(b) close-up of dredger in previous photograph



(c) 8 November 2010: view south (upstream) showing cleared vegetation and dredger at work



(d) 5 December 2010: flood peak has inundated partially-constructed cut-off channel



(e) 29 January 2011: dredger close to completing cut-off channel



(f) 7 July 2011: completed cut-off channel being used for navigation

Figure I.44. Oblique aerial photographs establishing sequence of events in construction of the meander cut-off channel in 2010 and 2011.

The record established by the photographs in Figures I.43 and I.44 conclusively demonstrates that the meander bend approximately 400 m upstream of the mouth of the 'Caño' was artificially cut-off by clearance of vegetation (which included felling a large number of trees), followed by dredging of a channel across the neck of the bend by a dredger between October 2010 and

February 2011. Inspection from the air by the author on 7 July 2011 confirmed that the river was flowing through both the natural and cut-off channels at that time.

The account of actions at the first meander bend presented above is consistent with an independent analysis reported by the UNITAR/UNOSAT (2011b), who also studied actions at the second meander highlighted in Figure I.42.

Figure I.45 presents a sequence of satellite images of the second meander bend between 2009 and 2011. The planform geometry and position of the Río San Juan are stable, but some changes can be detected along the course of the stream draining to the river along the landward edge of the point bar (which probably originates from Laguna la Barca in Nicaragua) and in a strip of the vegetation to the south of this stream.

Specifically, it appears that vegetation may have been cleared along the course of the tributary stream between 2 and 24 January 2011, while additional areas cleared of vegetation can be identified in the image taken on 22 February 2011. However, no further changes are apparent in the image of 7 June 2011 (Figure I.45).

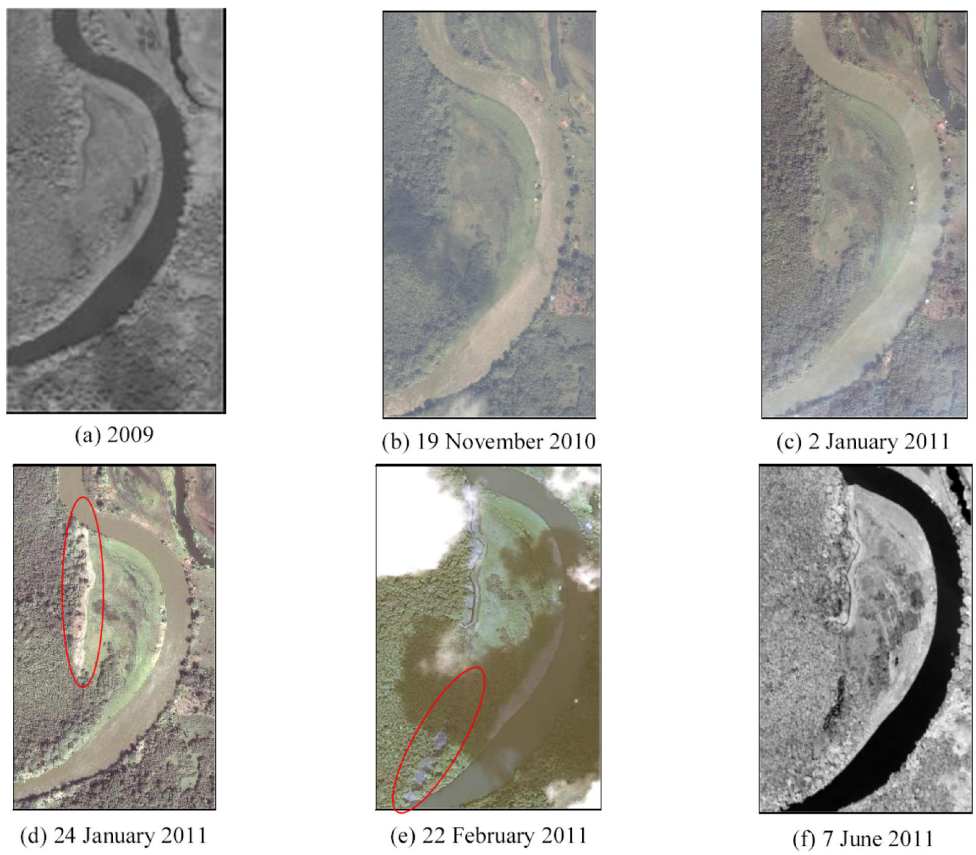


Figure I.45. Satellite-image sequence illustrating apparent clearance of a strip of vegetation at the second meander bend in the Río San Juan between about 24 January and 22 February 2011.

Based on their interpretation of changes between February and June 2011, the UNITAR/UNOSAT (2011b) concluded,

"the small creek likely originating from Laguna la Barca in Nicaragua has remained stable but slightly diminished in water flow, while the area of significant tree cover removal identified between 24 January and 22 February 2011, has also remained unchanged with no indication of further changes, suggesting that the possible plan for a second meander cut along the San Juan in this area had been suspended between 22 February and 7 June 2011."

The record provided by the satellite images in Figure I.45 can be fleshed out using oblique aerial photographs taken during over-flights by Costa Rican technical specialists and the author in 2010 and 2011 (Figures I.46 to I.48).

A view west across the meander bend during the peak of the flood on 5 December 2010 (Figure I.46) shows that, up to that time, there had been no disturbance to vegetation along the tributary or in the primary forest to the south.



Figure I.46. View west across bend on 5 December 2010. Note that the tributary draining from Laguna la Barca is obscured by vegetation and the primary forest to the south (left in the photograph) is undisturbed.

In contrast, the stream draining Laguna la Barca is clearly exposed in a photograph taken by the author on 7 July 2011 (Figure I.47), suggesting that shrubs and trees along its course had been cleared (red circle) sometime between December 2010 and July 2011. This is consistent with the results of satellite-image analyses performed independently by Astrium (2011) and the UNITAR/UNOSAT (2011b).



Figure I.47. View north on 7 July 2011. The tributary draining from the Laguna la Barca is clearly visible and a strip of disturbed vegetation is evident along its course.

The corridor cleared of shrubs and trees along the tributary draining from the Laguna la Barca can also be seen in a close-up taken on 10 August 2011 (Figure I.48). Grassy vegetation has recolonised the cleared area during summer 2011, but the corridor and its edge can still be identified.

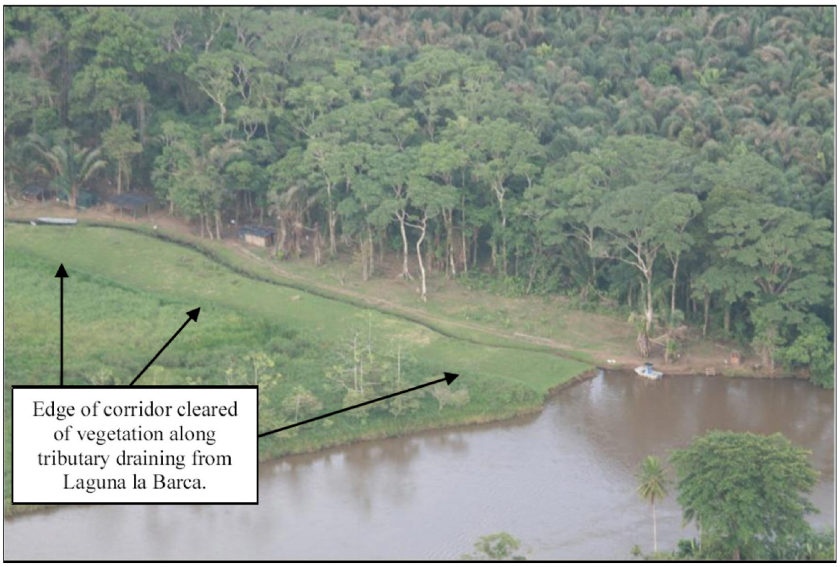


Figure I.48. Close-up of tributary to Río San Juan draining from Laguna la Barca showing corridor cleared of shrubs and trees along the channel. Photograph taken on 10 August 2011.

I.9 Impact of cut-off on the Río San Juan plus potential for further impacts on the Harbor Head Lagoon and surrounding wetland if further cut-offs are constructed

Artificial cut-offs have historically been constructed in meandering rivers by engineers attempting to improve the performance of the channel with respect to navigation and flood control. For example, between 1932 and 1942 the U. S. Army Corps of Engineers (USACE) constructed fourteen cut-offs in the Lower Mississippi River (Winkley, 1977). These cut-offs shortened the course of the river (reducing energy losses) and increased its slope (increasing the rate of conversion of potential to kinetic energy). The initial outcomes were for the increased flow velocities to lower water-surface elevations during floods and for the removal of tight bends to make navigation easier, and the cut-offs were hailed as almost magical solutions to flood and navigation problems during the 1950s and early-1960s.

However, within a few decades the high velocities in the cut-off channels had destabilised the channel through localised bed scour and accelerated bank erosion. Increased bed-material loads (generated by local bed scour) deposited shoals and bars that caused the channel to braid, while bank erosion quickly restored much of the sinuosity removed by the cut-offs. During the late-1960s and 70s, these morphological responses wiped out the initial advantages provided by the cut-offs. The statutory navigation channel could not be maintained, a huge dredging programme was required to keep the navigation channel open, and in some locations flood elevations returned to pre-cut-off levels (Winkley, 1977).

The eventual outcome was that the USACE re-aligned some of the straightened reaches back into sinuous courses (Winkley, 1994), lined the banks of the Lower Mississippi with concrete revetments to prevent further recovery of its naturally meandering planform, and installed hundreds of kilometres of low stone dikes to maintain the navigation channel at huge cost to the economy and the environment. Lessons have been learned and the USACE have never again attempted to improve navigation or flood control by cutting off meander bends.

This experience has relevance to the Río San Juan because the Mississippi is, like the San Juan, a lowland, sand-bed river with a heavy sediment load, erodible banks, and a predominantly meandering planform.

Environmentally, it might be argued that, as cut-offs occur naturally, the imposition of an artificial cut-off falls within the gamut of what happens to meandering rivers anyway. In fact, the impacts, responses, and environmental consequences of an artificial cut-off may be quite different to those associated with a natural cut-off. This is the case because cut-offs that occur as part of planform evolution and change in a naturally evolving river take place within the context of events in a series of meander bends, each of which is linked geomorphologically to the bends upstream and downstream. In this respect, the occurrence of a cut-off is part of an evolutionary cycle that is spatially-organised and non-random.

Biota characteristic of meandering rivers are well-adapted to coping with this type of fluvial behaviour. In contrast, the occurrence of an artificial cut-off is not appropriately synchronised with the natural sequence of bend initiation, growth, and cut-off in a reach. Consequently, its effect is to perturb the meandering pattern, triggering process-response mechanisms and

morphological changes that are rapid and unprecedented. Unsurprisingly, biota are unaccustomed to these changes and the more vulnerable species may fail to adapt quickly enough to survive.

While these general facts apply to all alluvial streams, every river has its own fluvial characteristics and its morphological response to the perturbation caused by one or more artificial cut-offs will be unique and, therefore, to an extent unpredictable. What is known is that cutting off a meander alters the spatial and temporal distributions of velocity and stream power, with consequences that may include:

- acceleration of velocities in the cut-off channel and deceleration in the meander loop, leading to silting of the bend that concentrates flow in the cut-off channel;
- alterations to the balance between scour and deposition of bed sediments, leading to channel degradation upstream of the cut-off, elevated sediment loads, and aggradation downstream;
- increased bank erosion, especially where flow impinges against the bank due to channel realignment downstream of the cut-off, leading to further increases in sediment loads and destruction of riparian corridor and parts of the floodplain;
- generation of complex currents that can be difficult to navigate and may be dangerous to river traffic;
- requirement for frequent, heavy dredging to maintain navigability; and
- requirement for bank protection along some or all of the river to hold the new alignment and prevent recovery of its natural sinuosity.

Given the nature of these morphological responses, as well as the engineering and maintenance actions that may be taken to combat or mitigate them, deleterious impacts on the aquatic, benthic, riparian, and floodplain habitats the river provides are unavoidable. Typical impacts due to an artificial meander cut-off are likely to include:

- destruction of some floodplain and benthic habitats and spawning areas due to bed scour;
- smothering of other floodplain and benthic habitats and spawning areas due to sediment deposition;
- increased turbidity during low discharges that reduces light penetration and affects water quality;
- changes to the nutrient balance and capacity of the river to recycle carbon;
- destruction of riparian and floodplain habitats by bank erosion or installation of revetments;
- loss of off-stream habitats due to sedimentation in marginal deadwaters and secondary channels; and
- hydrologic changes in surface, hyporheic, sub-surface, and groundwater systems.

The direct consequences for the river's ecosystem include:

- disturbance to fauna and flora during operations related to construction of the cut-off;
- loss of habitat due to clearing of vegetation and felling of trees to create a corridor through the floodplain and primary wetland forest;
- changes to topography, flow patterns and habitat in the river due to pumping of sediment dredged to create the cut-off channel;

- elevated concentrations of sediments and nutrients;
- changes in rates and spatial distributions of hydrologic, hydraulic, geomorphic, geochemical, biochemical, and biological processes;
- mortality or morbidity in species unable to adapt to disturbance and rapid environmental change;
- reduced resilience in river, riparian, and linked-wetland ecosystems, increasing vulnerability of species, including some listed as endangered; and
- adverse impacts on species in the affected areas and proportional reduction in provision of environmental services.

Aerial and ground-based photographs taken between October 2010 and July 2011, together with supporting, textual accounts, establish that the Río San Juan was directly disturbed at the first bend by:

- dredging and pumping by a Nicaraguan vessel of sediment from the point-bar area of the bend that was cut off between November 2010 and February 2011; and
- opening of an artificial cut-off channel in late-January or February 2011.

Mechanical and sediment-related disturbance to the river during construction must be considered in the context of the flood event of December 2010, during which discharges and sediment loads were naturally high, which would reduce the relative impacts of the work on the river's ecosystem.

The indirect impacts on the cut-off resulting from the river's morphological and environmental responses to the artificial channel are more difficult to assess because there is the potential for positive feedback loops operating in the fluvial system to magnify them locally, promulgate them both upstream and downstream, and amplify them through time. The existence of these complex process-response mechanisms in the fluvial system means that the potential exists for impacts that initially appear minor to trigger non-linear responses that amplify rather than dampen their effects on channel forms, habitats, and ecosystem (Sear *et al.*, 2010).

These complexities make it is necessary to assess the indirect impacts of the cut-off not only in the short-term (i.e., during its construction), but also in the subsequent months and the longer-term future. In the latter context, assessment of the potential for future impacts and responses must include consideration of the possibility of further actions to cut-off a second bend.

Given the low-gradient, limited stream power and erosion-resistant bank materials of the Río San Juan, the channel should be quite resilient to perturbation. Hence, extreme fluvial and morphological responses would not be expected due to cutting off a single bend, especially one that was not particularly old or tortuous. Inspection of Figures I.43 and I.44 shows that the cut-off channel is noticeably smaller than the natural channel and, unless additional sediment is dredged from the artificial channel (to enlarge it) and pumped to the natural channel (to block it), it is likely that the flow will favour the much larger and more naturally-aligned pathway around the bend. In this case, the cut-off channel is likely to silt and close. In this eventuality, the indirect impacts of the cut-off channel should be spatially-restricted and time-limited.

However, this prognosis would change if attempts are made to cut-off a second bend. Figure I.49 shows the bend cut-off in late-January or February 2011 in relation to the bend where vegetation was cleared during the same period, possibly in preparation for dredging or digging a pilot cut-off channel. There are strong reasons why this would be highly undesirable.



Figure Note: Arrows indicate preferred flow path if a cut-off channel were to be constructed along the line of the strip cleared of vegetation at the second bend.

Figure I.49. View south showing bend cut-off between 24 January and 22 February 2011 in relation to the second bend where vegetation was cleared during the same period.

The effect of the second cut-off would be to re-align the flow approaching the bend that has been cut-off, to favour it entering the cut-off channel rather than following the natural curve of the meandering channel. Under these circumstances, it is likely that the cut-off channel would grow to capture most or all of the flow in the Río San Juan, while the natural bend would silt and be abandoned. In this case, the medium- and long-term impacts of the two cut-offs acting together would no longer be spatially-restricted or time-limited. By shortening and re-aligning the channel they would have the potential to destabilise the river, triggering the morphological responses and ecological consequences in the bullet points listed above.

However, it is the possibility of two cut-offs interacting with the 'Caño' that causes the most serious risk to the river and its ecosystem.

Figure I.50 shows the bend where vegetation was cleared in late-January or February 2011 in relation to the bend cut-off during the same period and the mouth of the 'Caño'.



Figure Notes: Arrows indicate preferred flow path if a cut-off channel were to be constructed along the line of the strip cleared of vegetation at the second bend. The effect would be to align the flow in the Río San Juan with the mouth and heading of the 'Caño'.

Figure I.50. View north showing bend where vegetation was cleared in late-January or February 2011 in relation to the bend cut-off during the same period and the mouth of the 'Caño'.

Figure I.50 illustrates how a second cut-off would not only straighten flow through the former meander bends, but would also align it almost perfectly with the mouth and heading of the 'Caño'. As noted above, bed and bank scour are likely where the flow impinges against a channel bank downstream of a meander cut-off. Hence, the re-aligned flow could erode and open-up the mouth of the 'Caño', while its momentum would drive more of the discharge through the enlarged mouth and along the artificial channel, especially during flood events.

In this scenario, not only would the impacts of the cut-offs on river processes, morphology, habitats, and ecosystems be realised, but so would the impacts of diverting a substantial proportion of the river's discharge into the 'Caño' and thence to the Harbor Head Lagoon.

In the 'worst-case' scenario, the diverted water might scour the 'Caño' sufficiently for the balance of flow at the bifurcation to reach the tipping point, triggering an avulsion of the greater part of the flow to a new course emptying to the Caribbean Sea via a semi-permanent breach in the barrier beach at the Harbor Head Lagoon.

The rapid and unprecedented changes to hydrologic, hydraulic, sedimentary, nutrient, water quality, and salinity conditions resulting from such a radical shift in the flow would certainly cause serious and irreversible morphological and environmental degradation; not only in the

channel and micro-delta of Río San Juan, the area of the Greytown Lagoon currently fed by water and sediment flows in the Río San Juan, and the coastal zone that presently receives freshwater, silt, and nutrients supplied by the river on its natural alignment; but also the Harbor Head Lagoon, wetland of the Isla Portillos, and the coastal zone, including the possibility that adverse environmental impacts might extend as far south as Uvita Island and Cahuita National Park in south-eastern Costa Rica, should the predictions by Astorga (2011a) prove to be accurate.

PART II. THE DREDGING PROGRAMME IN THE RÍO SAN JUAN

II.1 Study approach

The form and dynamics of a river system are governed primarily by geology and hydrology, and how these independent controls influence and interact with erosion and sediment dynamics in the river basin (Callow and Petts, 1994). In addition, in most rivers, human impacts related to changes in land use, water resource development, and river engineering also influence channel forms and dynamics (Sear *et al.*, 2010). Hence, in assessing the impacts of Nicaragua's dredging programme on the Río San Juan, it is necessary to consider the specific, anthropogenic actions involved, their direct impacts on river form and process, and responses in the fluvial, environmental, and ecological systems within the contexts of the geology, hydrology, sediment dynamics, ecosystems, and historical development of the river basin.

The geology of Central America and the Caribbean Basin (including the catchment of the Río San Juan) is complex but well-understood and this knowledge provides a sound base from which to explain the existence and geomorphic functioning of the Delta and Isla Calero. The hydrology of the basin has also been studied extensively, though there are few long-term records of river discharge based on measurements at established hydrometric stations. The situation with respect to sediment records is not nearly as good. While the general distributions of sediment-producing areas and sediment fluxes through the drainage network are known, little quantitative data exist to define sediment concentrations and annual loads.

The availability of a series of multiple historical maps dating back as far as the late-18th century, coupled with a sequence of cloud-free, remotely-sensed images beginning in 1952 and extending up to the end of 2010, make it possible to reconstruct the planform history of the Delta of the Río San Juan with a high degree of confidence. All these maps and images have been in the public domain for decades or more and their provenance and originality is well-established. However, to date, the long and semi-continuous record they provide has not been used systematically to chronicle the morphological history of the Delta.

In addition to the historical maps and remotely-sensed images, the author was supplied with numerical data, photographs, and textual evidence pertaining to recent activities at the Delta and in the 31.5-km reach of the Río San Juan between the Delta and the coast. These materials are derived from aerial reconnaissance, scientific studies, and field inspections undertaken by Costa Rican investigators between November 2010 and mid-October 2011 (Table II.1). Additionally, the author took part in a helicopter over-flight, boat tour, and field inspection of the Delta, Río San Juan, and Río Colorado (all from Costa Rican territory) to view the current morphology of the rivers and wetlands, and observe first-hand dredging operations, on 7 July 2011.

Table II.1. Sources of data and information used in preparing Part II of this Report.

Source		Document	Evidence
Fundación Neotrópica	Aguilar-González and Moulaert-Quirós (2011)	• A Preliminary Ecological-Economic Estimation of the Environmental Service Loss Due to the Current Ecological Conflict in the Isla Portillos Region in the Caribe Noreste Wetland in Northeastern Costa Rica.	Estimate of value of ecological services provided by natural capital in Isla Calero. TVE for damage caused by cutting trees in Isla Portillos.
Astrium	Astrium (2011)	• TerraSAR-X Amplitude Change Analysis Border Area San Juan River – Nicaragua / Costa Rica 2010-12-29 – 2011-08-28.	Analysis of changes RadarSat imagery of the Río San Juan in 2010 and 2011.
ICE	Aviles (2010)	• Estudio de Comportamiento de Caudales en la Bifurcación Río San Juan – Río Colorado	Results of modelling of the division of flow at the Delta using Hydraulic Engineering Center River Analysis System (HEC-RAS).
	ICE (2011a)	• Streamflow Balance – San Juan River. Costa Rican Institute of Electricity – UEN Proyectos y Servicios Asociados (PySA), October 2011, 2 p.	Compilation of available discharge records from hydrometric stations on the Río San Juan and its tributaries.
	Gomez (2004)	• Informe Sobre la Distribucion Especial de la Erosion Potencial y la Produccion de Sedimentos en la Cuenca Definida para el P.H. Penas Blancas.	Data on soil loss and sediment yields in the Penas Blancas sub-catchment of the Río San Juan Basin.
	ICE (2011b)	• Applying the Einstein bed-load function to the 1973-1976 daily streamflow record from La Trinidad station to estimate the annual sand load in Río San Juan. Área de Ingeniería Hidráulica, C. S. Diseño, San José, Costa Rica.	Estimated annual sand loads at the Delta.
Costa Rican Environmental Commission	Jimenez (2011)	• Para Determinar el Volumen de Sedimentos en el Canal Artificial.	Calculation of volume of soil removed in digging the channel of the 'Caño'.
UNITAR/UNOSAT	UNITAR/UNOSAT (2011a)	• Morphological and Environmental Change Assessment: San Juan River Area (including Isla Portillos and Isla Calero), Costa Rica. Report to Government of Costa Rica UTC – Version 2.0.	Satellite-image processing and interpretation concerning changes in the Isla Portillos and Isla Calero.

Source		Document	Evidence
	UNITAR/UNOSAT (2011b)	• Morphological and Environmental Change Assessment: San Juan River Area, Costa Rica. Report to Government of Costa Rica UTC – Version 4.0.	
Dr. Allan Astorga	Astorga (2011b)	• Geology, Sedimentology and Tectonics within the Surroundings of the San Juan River and Calero Island.	Regional geology, historical development of the lower Río San Juan and sediment dynamics in the Río San Juan Basin.
Organisation of American States	Barrantes and Romero (1997)	• Manejo Ambiental y Desarrollo Sostenible de la Cuenca del Río San Juan: Estudio de Diagnostico de la Cuenca del Río San Juan y Lineamientos del Plan de Accion.	Broad range of information on the physical, social, and environmental geographies of the Río San Juan Basin in Nicaragua and Costa Rica.
Government of Nicaragua	Lacayo *et al.* (2006)	• Gran Canal Interoceanico por Nicaragua Perfil del Proyecto.	Information on hydrology and sediment dynamics of the Río San Juan Basin.
	Republic of Nicaragua (2011)	• Documents submitted to the International Court of Justice	Information on dredging programme.
C. van Rhee and H. J. de Vriend	van Rhee and de Vriend (2011)	• Morphological stability of the San Juan River delta Nicaragua/Costa Rica	Expert analysis of dredging programme.
Ramsar Convention on Wetlands	Ramsar Convention on Wetlands (1996)	• Notificacion: Inclusion del "Humedal Caribe Noreste" (HCN) en la Lista de Humedales de Importancia Internacional de la Convención de Ramsar.	Background information on HCN.
	Araya-Montero *et al.* (2011)	• Evaluación y Valoración de la Situación Ambiental en el Humedal Caribe Noreste en el Marco de la Providencia de la Corte Internacional de Justicia Informe Técnico. Draft Report (as of September 2011).	Information on environmental impacts of actions in the HCN Ramsar site.

The account and conclusions reported here are based on the author's independent inspection and interpretation of reports on the geology, hydrology, and sediment dynamics of the Río San Juan and Río Colorado and a chronologically-arranged sequence of maps and satellite images of the Delta, coupled with consideration and analysis of the photographs, textual accounts, and data based on the aerial and field investigations. All available maps and remotely-sensed images were examined (maps used are listed in Table II.2), although for illustrative purposes only a selection are reproduced here and described in detail in the text.

Table II.2. List of maps examined in the study of the Delta.

Date	Description	Source*	Image in this Report
1780	Río San Juan de Nicaragua – Delta by John Campbell	Bolaños Geyer (1999, pp. 37)	Figure II.12(a)
1847	Río San Juan – Delta by Von Bulow	Bolaños Geyer (2000, pp. 27)	
1848	A sketch of St. John River – Bulow	Aguirre Sacasa (2002, N118, CD filename: nic_reg_021)	Figure II.12(b)
1849	Map of the River of San Juan de Nicaragua – E G Squier	Aguirre Sacasa (2002, N1, CD filename: MA001014)	
1887	Spezialkarte des Nicaragua Kanales – A G Menocal	Aguirre Sacasa (2002, N122, CD filename: spezialkarte)	
1888-90	San Juan de Nicaragua or Greytown by Maxwell and Elmer	Bolaños Geyer (2000, pp. 118)	
1895	San Juan and Colorado Rivers, 1865 P C F West	Aguirre Sacasa (2002, N111, Plate XXI, CD filename: nic_reg_16)	Figure II.12(c)
1897-99	Canal de Nicaragua by Wheeler para la Nicaragua Canal Commission, Map No. 3, Canal Interoceanico-LBC	Aguirre Sacasa (2002, N126, CD filename: nic_sub_082a)	
1897-99	Greytown Harbor, Map 3, Sheet 6	Aguirre Sacasa (2002, N23, CD filename: nic_sub_088)	

*Aguirre Sacasa, Francisco Xavier (2002). Un Atlas Histórico de Nicaragua;
Bolaños Geyer, Alejandro (1999). Campana Rota, Camalotes, Tumbas y Olvido; and
Bolaños Geyer, Alejandro (2000). Sepultado en el Olvido.

II.2 Geology, hydrology, and sediment dynamics in the Río San Juan Basin

II.2.1 Geological and neotectonic control of the Río San Juan, including the Delta

The way that geology influences long-term channel dynamics in the Río San Juan and Río Colorado and controls the position and morphology of the Delta, can only be explained by reference to structure and tectonics of the Caribbean region. The account presented here is based on original and background research performed by Dr. Allan Astorga and is presented in detail in a report to the Costa Rican Government (Astorga, 2011b).

In the geological-tectonic map of the Caribbean region published by Case and Holcombe (1980), the Hess Escarpment Fault is an important geological feature within the Caribbean Plate (Figure II.1). The fault intersects the coast of Central America close to the Delta of the Río San Juan and Río Colorado.

At the coast, the Hess fault merges with the Santa Elena Fault to form a major tectonic limit between two contrasting types of the Earth's crust (Figure II.2). North of the Hess-Santa Elena Fault System lies the Chortis Block, which is continental and transitional crust, while south of it is the Caribbean Plateau, which is thickened, oceanic crust (Figure II.3).

The Hess fault is believed to have been geologically active for 90 million years, exhibiting a sinistral (left-sided), transform movement, due to east-northeasterly migration of the Caribbean Plateau relative to the Chortis Block. Tectonic activity along the Hess Fault is on-going and is represented in the neotectonic map of the Caribbean Region (Figure II.4).

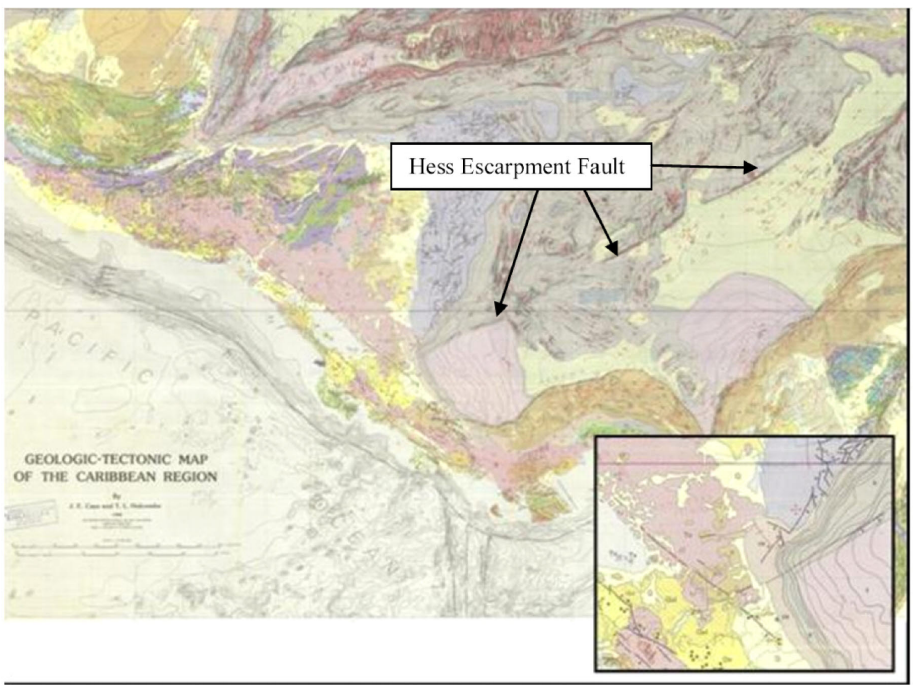


Figure Note: The insert box shows that the Hess Fault intersects the coast of Costa Rica close to the Delta of the Río San Juan.

Figure II.1. Annotated geological-tectonic map of the Caribbean. The Hess Escarpment Fault is an important geological borderline within the Caribbean Tectonic Plate.

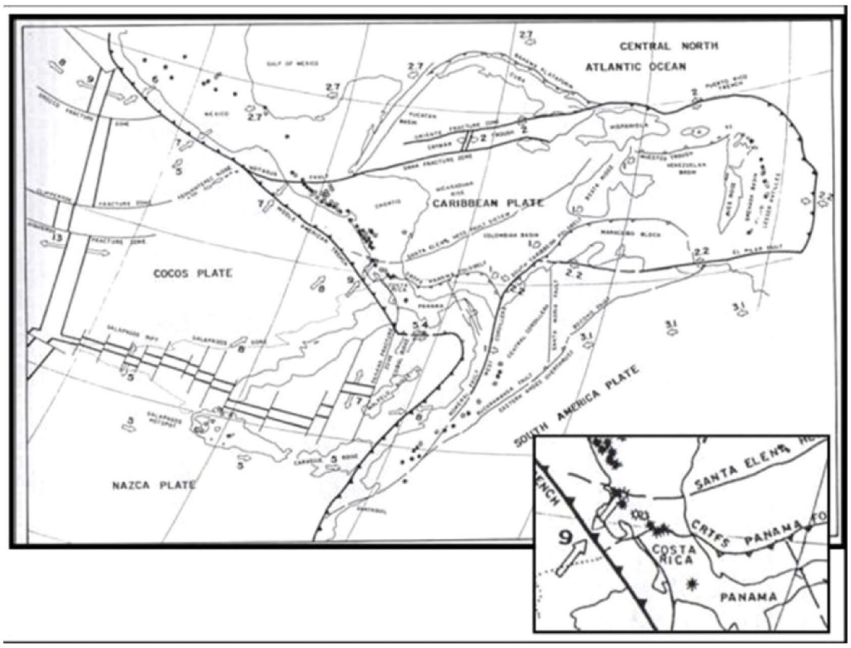


Figure Note: The insert box shows that the Hess-Santa Elena Fault in Costa Rica is close to the Delta of the Río San Juan.

Figure II.2. Tectonic map of Central America and the Caribbean (Astorga, 1997).

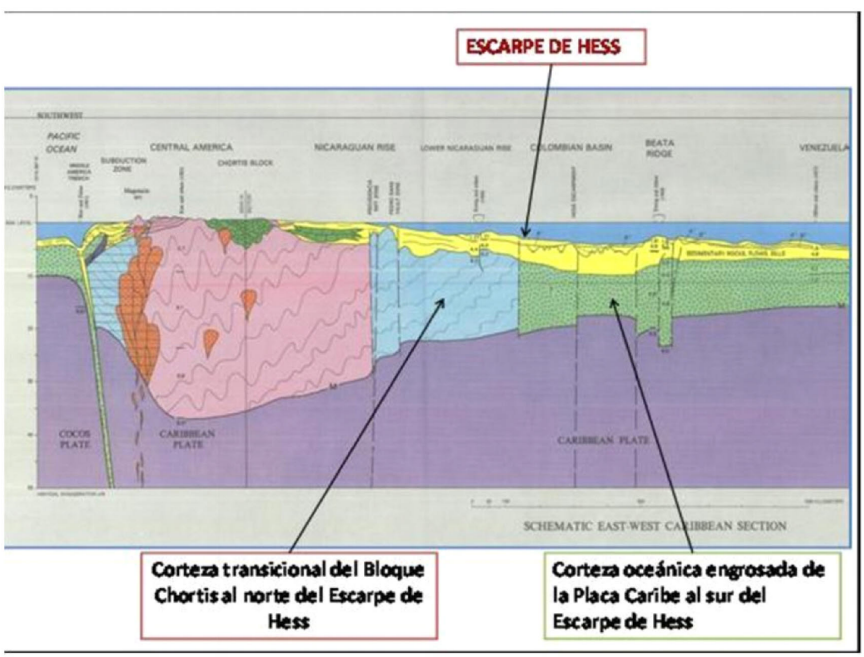


Figure II.3. Geological-tectonic section through the Caribbean from north to south. Note different types of crust north and south of the Hess Escarpment Fault (Case and MacDonald, 1990).

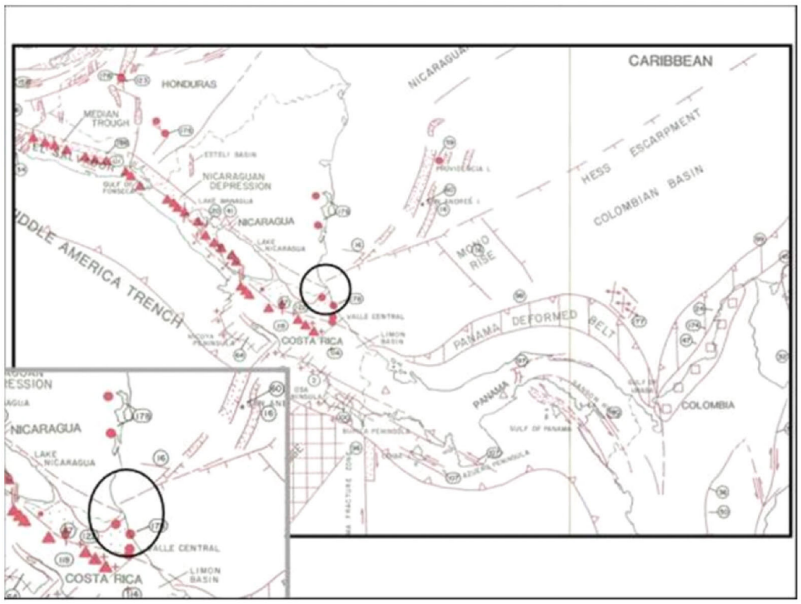


Figure Note: Inset box and circle highlight recent seismic activity in the Delta and Isla Calero due to movement along the Hess Escarpment Fault.

Figure II.4. Section of the neotectonic map of the Caribbean Region (Mann et al., 1987).

The relief of the area around the Delta can be represented using a Digital Elevation Model (DEM) based on available topographic maps (Figure II.5).

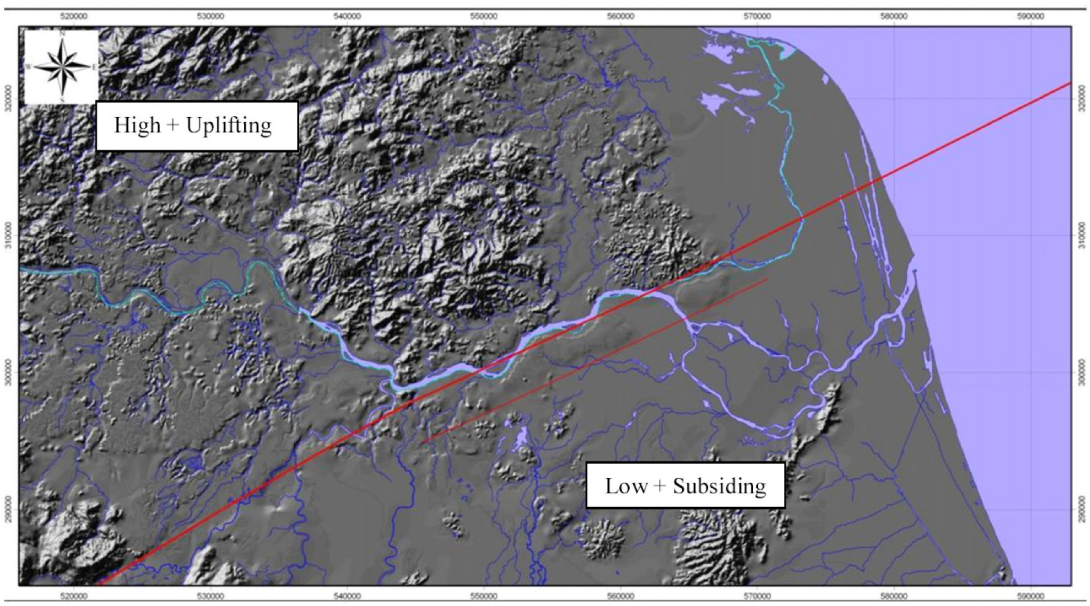


Figure II.5. Annotated DEM for the border area of Costa Rica and Nicaragua based on available topographic maps at 1:50,000 scale.

The strong and eminent structural lineament (red line in Figure II.5) is interpreted as the Santa Elena continuation of the Hess Fault and submarine escarpment in the Caribbean Sea. The higher and irregular relief of the Chortis Block to the north contrasts clearly with the low, plain relief of the Caribbean Plateau to the south. Neotectonically, the land of the Chortis Block north of the fault line is characterised by uplift, while the low plain to the south is subsiding. Over geological time, the effect on terrain is marked. For example, land around the fault zone in the Isla Calero is as much as 22 m higher than land in the subsiding plain to the south. Where the southwest trending course of the Río San Juan encounters the Hess-Santa Elena Fault it turns northeast to follow the line of the fault, until the river bifurcates at the Delta.

It is not a coincidence that the Delta, where the San Juan River bifurcates into the larger, Río Colorado to the south and smaller Río San Juan to the north, is located precisely on the line of the Hess-Santa Elena Fault. In fact, the geology and, particularly, the tectonic history of the area explain both the existence and recent (last ~200 years) hydrologic and geomorphic evolution of the Delta.

In Figure II.6, it can be seen that the river approaches the Delta from the southwest along the northern edge of the Hess-Santa Elena Fault zone, being confined on both sides by high ground. At the Delta, the Río San Juan continues to follow the trend of the fault, but the larger part of the flow spills to the southeast (into the wide, low and subsiding plain on the Caribbean Plateau) through a gap in the higher ground within the fault zone, forming the Río Colorado.

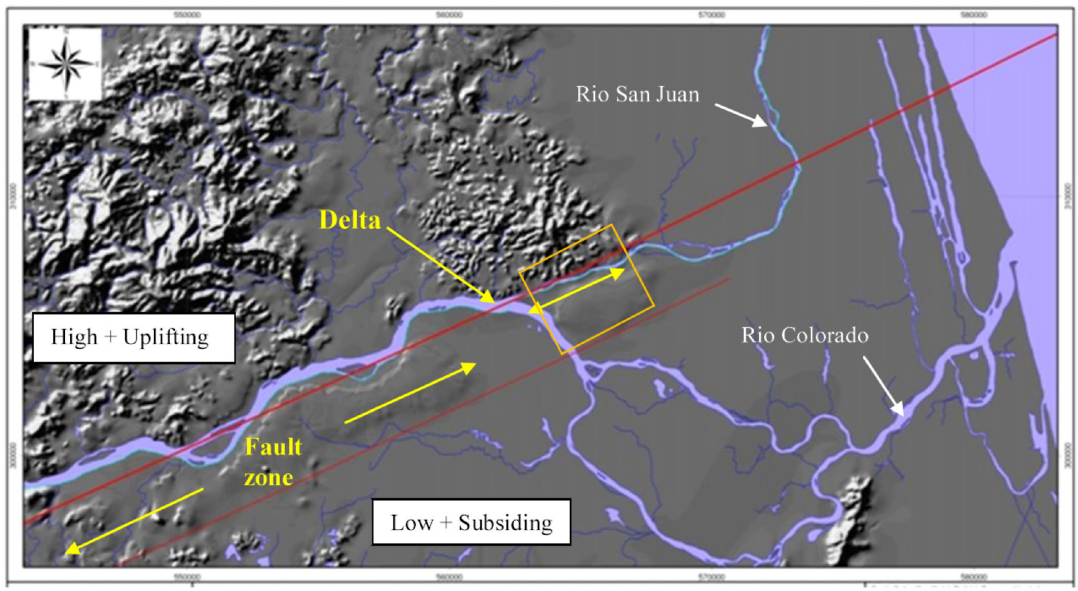


Figure Notes: Red lines delineate fault zone. Orange square indicates a 'choke' on planform shifting and development of an anabranching pattern in the reach immediately downstream of the Delta, where the Río San Juan is confined by higher ground on both sides. In contrast, the Río Colorado can be seen to be free to migrate and divide unfettered across its broad, alluvial plain.

Figure II.6. Detail of the annotated DEM of the area around the Delta.

The residual flow in the Río San Juan is confined in a narrow trough between the high and rising Chortis Block and raised ground along the fault zone. The Río San Juan then turns north where geological control ends at the former location of the ancient coastline (which was inland of the contemporary coastline), due to the effects of local neotectonics, coastal accretion and deflection by long-shore currents in the Caribbean Sea.

Hence, the regional geology dictates that the division of discharge at the Delta is bound to be unequal, with the great majority of the water flowing to the Río Colorado and a much lesser proportion flowing to the Río San Juan. This current division of flows is the outcome of control of the river by geological structures that are both huge and ancient. It follows that the unequal division of the flow at the Delta is entirely explicable as being a natural phenomenon.

The account also leads to the conclusion that the Río San Juan is, over geological timescales, likely to be a declining river. This is the case for four reasons:

1. Downstream of the Delta, the Río San Juan flows to the north – against the prevailing, neotectonic trends, which are for land to the north to continue rising, while that to the south continues to subside. Through time, the effect is to reduce the gradient of the Río San Juan and, hence, its capacity to transport sediment to the coast, leading to its channel tending to silt and lose conveyance capacity.
2. Conversely, downstream of the Delta the Río Colorado flows to the south – with the prevailing, neotectonic trends. Through time, the effect is to increase the river's gradient and, hence, its capacity to transport sediment to the coast, allowing the channel to grow and gain conveyance capacity.
3. Immediately downstream of the Delta, the course of the Río San Juan is confined by high ground on both sides (Figure II.6). Hence, it is unable to shift laterally or avulse onto a new course in response to deposition of relatively coarse sediments that it can no longer carry to the coast due to the effects of neotectonic uplift. When sediment accumulates in this reach, it must instead aggrade – further reducing the channel's future capacity to convey water and sediment.
4. Conversely, the Río Colorado flows across a broad alluvial plain (Figure II.6), providing ample room for lateral shifting, the development and abandonment of anabranches and diffusion of sediments over the floodplain. Consequently, sediment can accumulate without reducing the river's future capacity to convey water and sediment.

River changes driven by neotectonics are often thought of as being so slow as to be imperceptible on a human timescale. In fact, subsidence may be episodic as well as gradual. For example, the earthquake of 1872 is a notable example of a seismic event associated with long-term tectonic control of the Delta (Allan Astorga, personal communication, 2011).

Similarly, a low-gradient, deltaic river system carrying a heavy load of sediment is highly susceptible to even subtle changes in gradient and we should not be surprised if changes in the balance of discharges in the Río San Juan and Río Colorado are detectable over decades or centuries. This is not only to be expected, it is also natural. What would not be expected is that trends of change would be monotonic; deltaic rivers are complex fluvial systems that respond to changes in their flow and sediment regimes through adjustments that are highly non-linear.

Hence, we should expect that a considerable degree of natural variability in the division of flows at the Delta should be superimposed on any long-term, geologically-driven trend.

Based on this account of how regional geology controls the morphology and functioning of the Delta, it must be concluded that:

- as geological controls and neotectonics naturally oppose growth of the Río San Juan branch at the Delta (in fact, they promote its long-term decline), dredging the Río San Juan downstream of the Delta cannot be considered as any form of 'restoration' to a more natural condition; and
- it follows that, dredging intended to attract flow away from the Río Colorado and into the Río San Juan represents an attempt to artificially alter the natural condition and fight the long-term, geological trend at the Delta.

II.2.2 Hydrology of the Río San Juan

The hydrology of the Río San Juan has been assessed by ICE (2011a) on the basis of analysis of records available from a network of hydrometric stations along the trunk stream and on its tributaries (Tables II.3 to II. 5, and Figure II.7).

Table II.3. Hydrometric stations, data, and periods of record along the Río San Juan.

Code	Station Name	Basin Area (km^2)	Discharge (m^3/s)	Period of Record
690101	San Carlos	30,306 (INETER, 2002)	297 (INETER, 2002)	1965-86 (INETER, 2002)
690102	El Castillo	32,819 (INETER, 2006)	422 (INETER, 2001)	1971-81 and 1997-98 (INETER, 2001)
690103	La Trinidad	38,730 (ICE, 1973)	1,123 (ICE, 2011c)	1973-76 (ICE, 1973)
691104	Delta Colorado	–	1,026 (ICE, 2011d)	2010-11 (ICE, 2011d)

Data sources: Instituto Costarricense de Electricidad (ICE) and Instituto Nicaragüense de Estudios Territoriales (INETER)

Table II.4. Discharges from Costa Rican catchments draining to the Río San Juan.

Catchment	Area (km^2)	Mean Annual Discharge ($m^3\ s^{-1}$)	(%)
Río Frío	1,556	112	14
Río Pocosol and others (Medio Queso, etc.)	1,256	58	7
Río Infiernito	561	36	5
Río San Carlos*	2,735	209	27
Río Cureña	328	25	3
Río Sarapiquí**	2,762	343	44
Total	**9,198**	**783**	**100**

*The area and discharge of the San Carlos catchment exclude the sub-catchment of Lake Arenal.

**The area and discharge of the Sarapiquí catchment were corrected in order to take into account the change in the course of the Río Sucio, which currently drains to this catchment.

Table II.5. Discharges from Costa Rican and Nicaraguan catchments draining to Río San Juan.

Catchment	Mean Annual Discharge ($m^3 s^{-1}$)	%	% (Excluding Lake Nicaragua)
Lake Nicaragua	185*	16	–
Costa Rican catchments	783	70	83
Nicaraguan catchments	155**	14	17
Total	**1123**	**100**	**100**

* This value was estimated as the difference between the discharge of the Río San Juan at San Carlos station (INETER, 2002) and the input from Río Frío catchment (ICE, 2010).

**This value was estimated as the difference between the discharge of the Río San Juan at La Trinidad station (ICE, 2011c) and the sum of inputs from Lake Nicaragua and all Costa Rican catchments.

According to this assessment (if the input from Lake Nicaragua is excluded), approximately 83% of the discharge of the Río San Juan is derived from sub-catchments in Costa Rica, while the Nicarguan sub-basins downstream of Lake Nicaragua together contribute only about 17% of the flow.

This is the case because the sub-basins to the north of the trunk stream (in Nicaraguan territory) are relatively small (the largest being Río Sábalos), have relatively low headwaters and feature gentle slopes (Figure II.8). The tributaries that drain from the south (in Costa Rican territory) have larger, steeper sub-basins that originate at elevations as high as 3,000 m above sea level. Notable examples include the San Carlos and Sarapiquí, which together contribute over 70% of the runoff input to the Río San Juan by sub-catchments in Costa Rica (Table II.4).

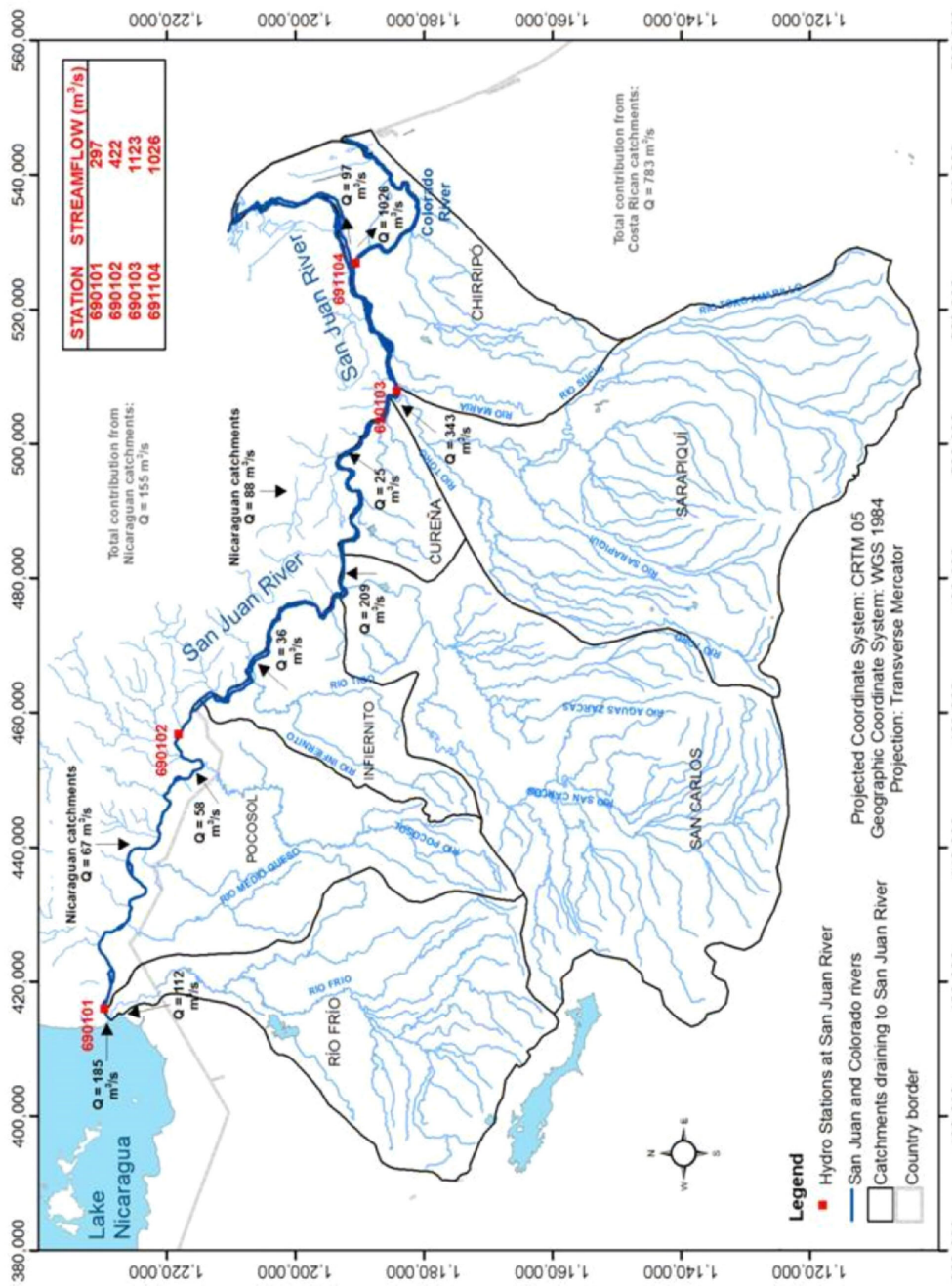


Figure II.7. Hydrometric stations on the Río San Juan and discharges input from Costa Rican catchments (from ICE (2011a)).

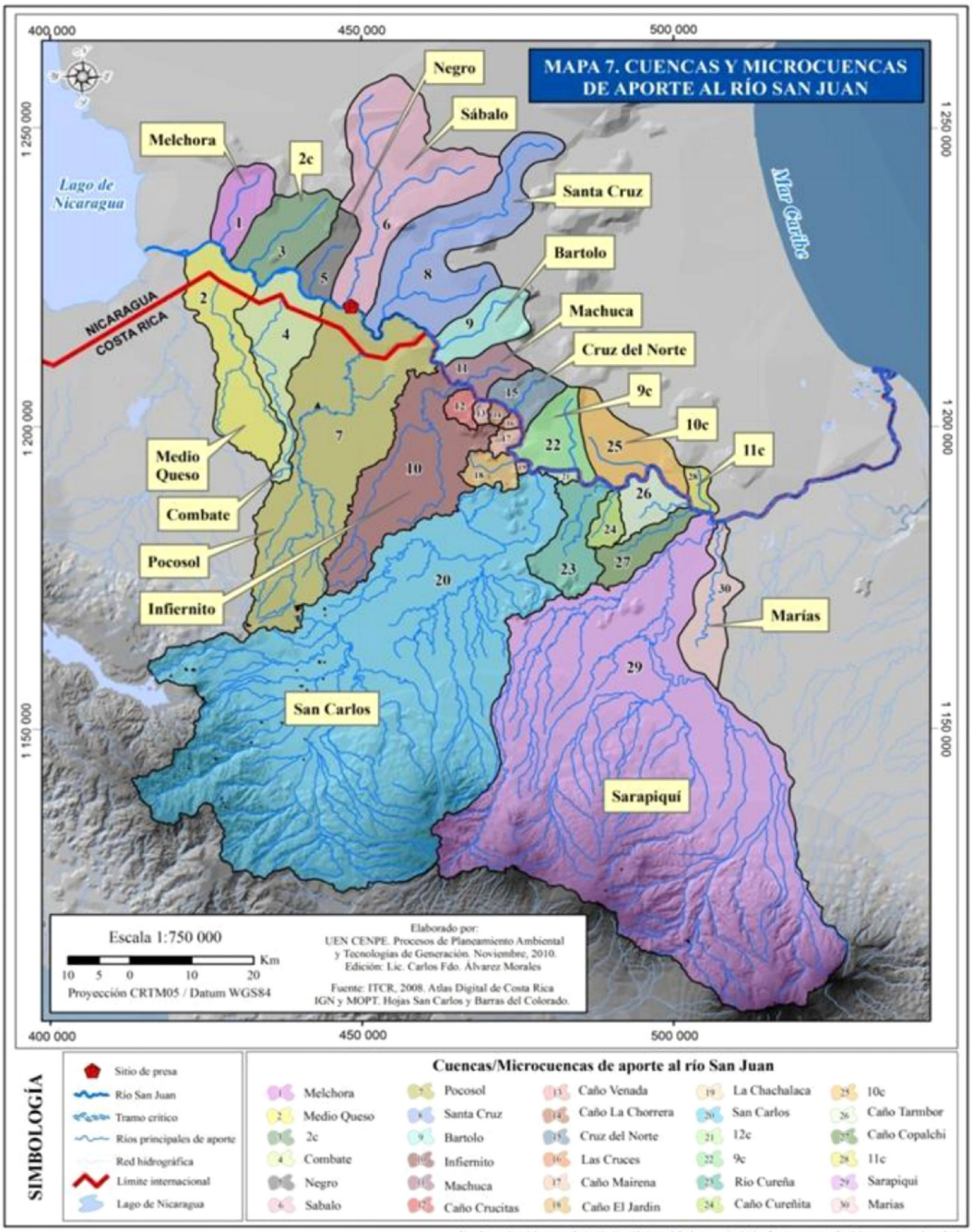


Figure II.8. Sub-catchments of the Río San Juan downstream of Lake Nicaragua (map supplied by ICE, Costa Rica).

The great majority of flow to the Río San Juan originates from the Costa Rican sub-basins not only because of these sub-basins are larger (8,590 km^2 in Costa Rica compared to only 2,347 km^2 in Nicaragua), but also because the Costa Rican catchments receive more rainfall (ranging from 2,000 to over 7,000 mm annually) (Figure II.9) and convert a high proportion of it to runoff (Figure II.10) due to their high relief and steep terrain.

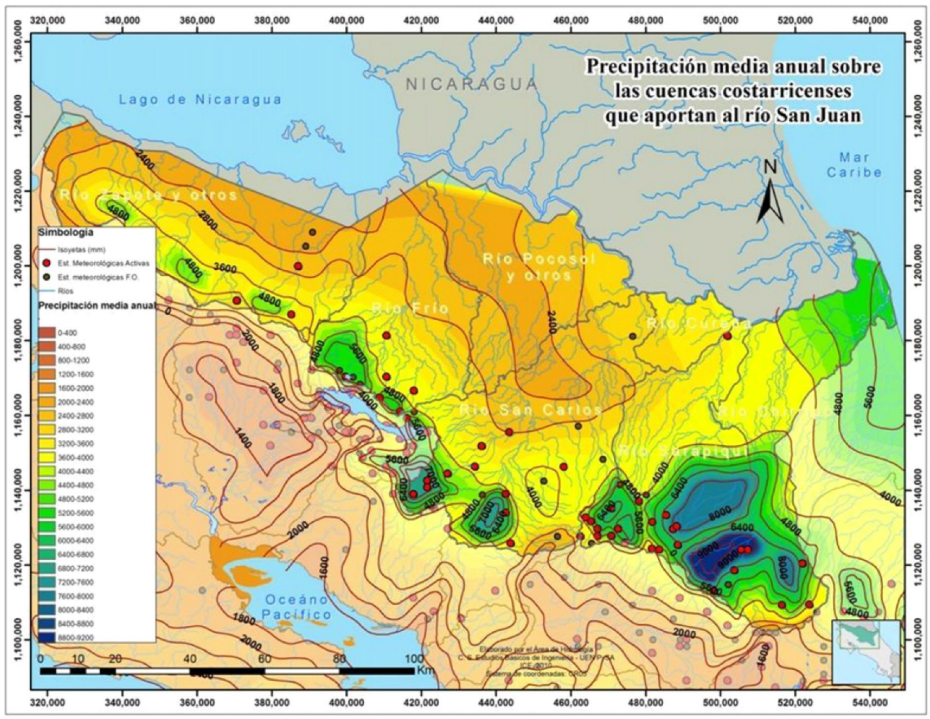


Figure II.9. Annual average rainfall in sub-catchments within Costa Rica (supplied by ICE).

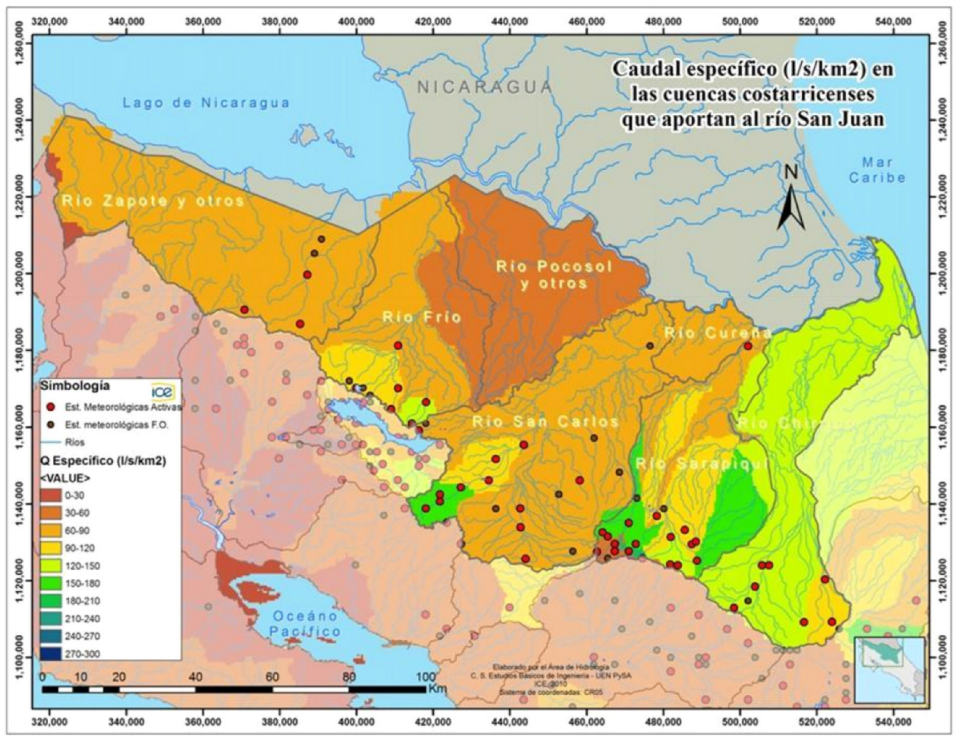


Figure II.10. Runoff in sub-catchments within Costa Rica (map supplied by ICE, Costa Rica).

In addition to supplying runoff to the surface water drainage network, rainfall and geology also drive a complex sub-surface hydrological system of surficial, shallow, and deep aquifers. Deep aquifers are recharged from the Central Mountains of Costa Rica under great pressure via permeable rock strata. Surficial and shallow aquifers receive their recharge directly from local rainfall, rivers, and lagoons. It is impossible to overstate the importance of links and interactions between surface and sub-surface hydrodynamics to the water resources and ecosystems of the Río San Juan Basin, especially near the Caribbean coast where freshwater recharge maintains the halocline and balance between fresh and saltwater environments. For example, the Delta of the Río San Juan – Río Colorado receives in the order of 24 km³ of runoff annually and this maintains the hydrodynamic balance in the Refugio de Vida Silvestre Corredor Fronterizo and the Refugio de Vida Silvestre Barra del Colorado in Costa Rica. It also represents around 20% of the total renewable water resource available to Costa Rica.

II.2.3 Sediment dynamics in the Río San Juan

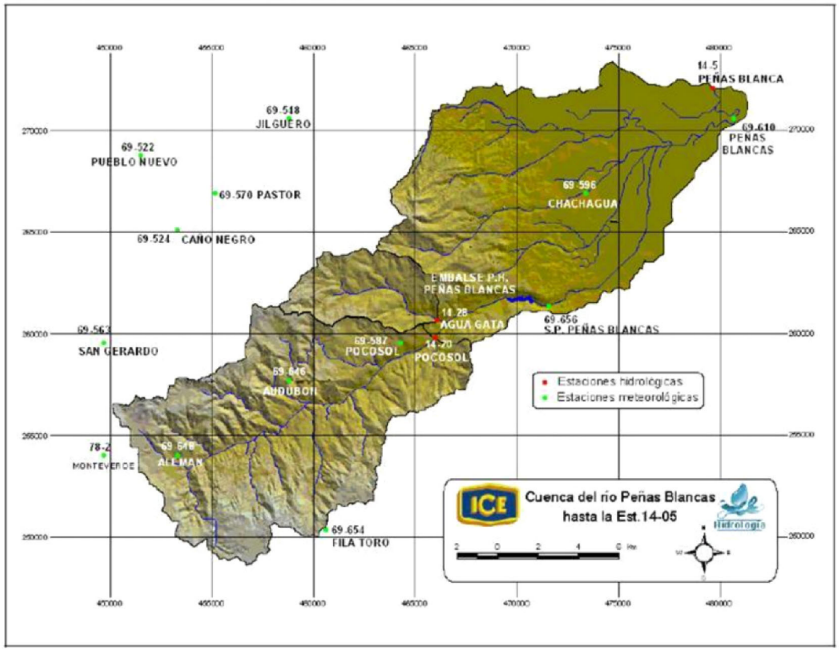
As the tributaries draining to the Río San Juan from the southern (Costa Rican) side supply about 83% of the water supplied by the catchment downstream of Lake Nicaragua, it would be expected that they would also supply most of the sediment and, in fact, they do. This is especially the case because the steep, unstable slopes and fragility of the soils (mainly volcanic) in the headwaters of tributaries draining the Central Mountains to the south of the Río San Juan,

coupled with the intense and prolonged rain events produce large sediment yields. In this context, Barrantes and Romero (1997) note that the rivers draining to the Río San Juan from the Central Mountain range of Costa Rica carry heavy sediment loads supplied from this volcanically-active region throughout the Quaternary – a period in excess of 2.5 million years.

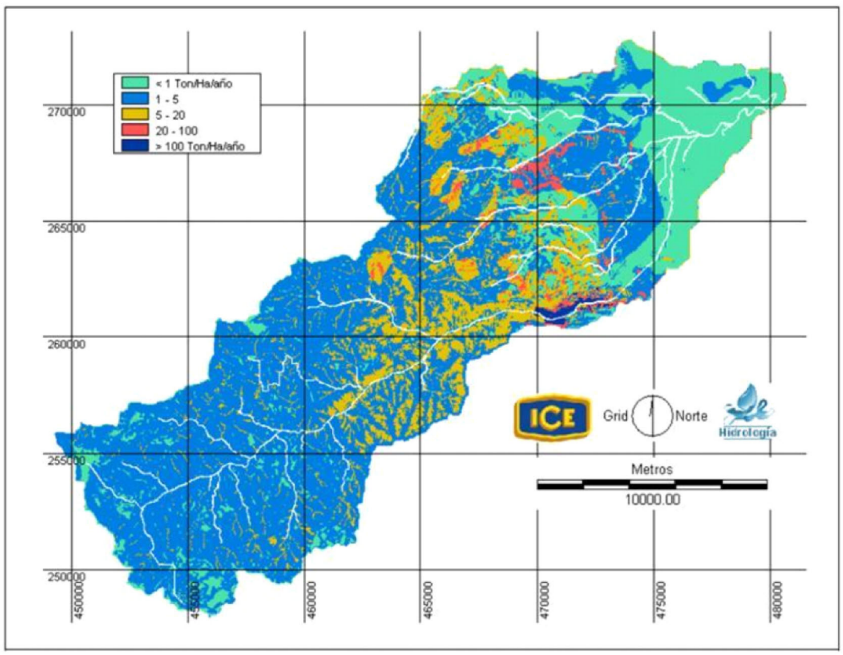
During about the last 200 years, parts of the catchment of the Río San Juan have been cleared to allow development for arable agriculture, livestock ranching, and other primary industries (Barrantes and Romero, 1997; Lacayo *et al.*, 2006). Deforestation is believed to have led to elevated soil erosion and increases in sediment yield in areas of both Nicaragua and Costa Rica directly affected, though it is by no means certain that the effects on sediment loads would be detectable as far downstream in the drainage network as the Delta. For example, Lacayo *et al.* (2006) noted that the data needed to substantiate the effect of deforestation on sediment loads does not exist and that more investigation will be needed to understand and better explain the impacts on the river basins and lands subject to flooding. Specifically, they pointed out that additional studies will be necessary to describe (1) the extent of deforestation and (2) the impacts of deforestation on the characteristics of the river basins, run-off, and volume of sediments carried throughout the year.

Organisation of American States (1997) point out that, in any case, most of the sediments carried by the Río San Juan originate landslides in the upper and middle parts of sub-basins, where the slopes are steep, soils are naturally erodible, and the rainfall is heaviest. Available data support this conclusion with, for example, the highest yield of sediment in the Río San Juan catchment found downstream of the upper/middle reaches of the San Carlos sub-basin, which has a yield of 817 tonnes/km^2/year at the Colorado Terrón monitoring station. Yields measured in the Sarapiquí at the Port Viejo and Veracruz stations are much lower (but still significant), averaging 216 tonnes/km^2/year.

Gomez (2004) further demonstrates the importance of slope instability in upland areas of sub-basins, noting that only 1% of the area of the Peñas Blancas sub-basin suffers severe or very severe sheet erosion, with yields greater than 100 tonnes/km^2/year (Figure II.11), leading to the conclusion that 60% of the sediment measured at the Pocosol station is probably derived from natural events such as landslides in steep, headwater areas, that are triggered by extreme events such as earthquakes and the exceptional intensities of rainfall associated with, for example, hurricanes.



(a) topography



(b) potential for sheet erosion calculated using the Universal Soil Loss Equation

Figure II.11. Peñas Blancas sub-catchment of the Río San Juan (Gomez, 2004).

The high-sediment yields in the sub-catchments described above in turn produce high-sediment loads in the rivers draining those sub-catchments (Table II.6), which are input to the main stream of the Río San Juan.

Table II.6. Suspended-sediment concentrations measured in tributaries to Río San Juan.

Station Code	Station Name	Sub-catchment	Drainage Area (km^2)	Number of Samples	Estimation Reliability	Sediment Yield ($tonnes/year^{-1}$)
12-03	Puerto Viejo	Sarapiquí	821	264	Regular	165,000
12-04	Veracruz	Sarapiquí	191	280	Low	112,000
14-02	Jabillos	San Carlos	552	338	Regular	247,000
14-04	Terrón Colorado	San Carlos	2,040	53	Good	300,000
14-05	Peñas Blancas	San Carlos	293	308	Regular	160,000
16-02	Guatuso	Frío	253	361	Regular	62,000

These data are important because they prove the point that most of the sediment load is derived from erosion in the steep, wet but relatively natural upper and middle parts of the sub-basins, rather than the lower parts – where development for agriculture, ranching, or plantation cropping is more extensive. For example, in the San Carlos the load measured at Jabillos (drainage area 552 km^2) is 82% of that measured close to the basin outlet at Terrón Colorado, where the drainage area is over three times larger (2,040 km^2). Similarly, at Veracruz on the Río Sarapiquí, the upper 191 km^2 of the basin generate an annual load that makes up 70% of that measured downstream at Puerto Viejo, where the drainage area is over four times larger.

Both theoretical considerations and available data demonstrate that, in comparison to natural drivers of erosion such as high relief, steep slopes, erodible volcanic soils, and extreme events (earthquakes, volcanic eruptions, hurricanes, and other intense rainfall events), anthropogenic influences are likely to be relatively minor. This explains, for example, why the percentage of the measured and calculated sediment yields supplied by sheet erosion in arable or over-grazed fields lower down in the sub-catchments is small and much more of the load is derived from the upper and middle reaches of sub-basins draining the Central Mountains of Costa Rica.

II.3 Environment and Ecology of the Río San Juan and Humedal Caribe Noreste

II.3.1 The Humedal Caribe Noreste Ramsar site

This section provides the environmental and ecological contexts for the author's assessment of the likely impacts of Nicaragua's dredging programme on the Río San Juan and linked system of distributaries, swamps, flooded forests, lakes, and coastal lagoons that make up the surrounding wetlands. It is based on reading and assessing the reliability and relevance of information in published papers and reports including, particularly, documents pertaining to the actions taken by Nicaragua produced by and building on the Ramsar Missions that visited Costa Rica in November 2010 and April 2011 (Ramsar Convention on Wetlands, 2010).

The Delta, Isla Portillos, Isla Calero, Río San Juan, and Río Colorado that bound it all lie within the HCN Ramsar site, which was designated as a *Wetland of International Importance* on 20 March 1996. It is an area of great importance environmentally and ecologically including, for example, being a stopover site for migratory birds and a home to many species that are either vulnerable or under threat of extinction. Due to the wide range of habitats it provides, the area is a highly-valued reservoir of genetic and biodiversity. However, the area also supports a rural population and some of the land use has long been used for agricultural, livestock, tourism, and fishing (Ramsar Convention on Wetlands, 1996).

II.3.2 Environment

The area is a mosaic of channels and shallow water bodies (lagoons), grass marshes, and wooded swamps fed by the Río San Juan. At the coast, a geomorphologically-active system of sand bars, spits, and barrier beaches separates the freshwater and brackish wetlands from the Caribbean Sea except where it is breached by rivers; principally, the Río San Juan and the Río Colorado. The main supply of freshwater comes from the basin and sub-basins of the Río San Juan, which is distributed unequally at the Delta with most of the discharge flowing south in the Río Colorado and a much smaller proportion flowing north in the Río San Juan, due to regional geological and neotectonic controls on the morphology of the rivers and the Delta. These rivers are linked to a groundwater system that maintains the high phreatic surface in the superficial aquifer. Tides in the Caribbean Sea influence water levels in the estuaries and coastal lagoons, especially during periods of low river flow, controlling the position and gradient of the halocline and generating a supply of salt water to water bodies close to the coast.

When evaluating the environmental functioning of the Isla Calero, it is important to understand that the aquatic system provides two sources of food through nutrient and carbon cycling. The first is *autochthonous*; that is, derived from the primary production of aquatic vegetation present in bodies of water. The second is *allochthonous*; that is, stemming from incorporation of organic matter supplied from terrestrial vegetation. This illustrates one of several functional links between the aquatic and terrestrial environments that are real, complex, and vital to the sustainability of ecosystems and natural resources in the Isla Calero.

Indeed, it is the high degree of environmental heterogeneity and inter-linkage that allows the area to provide a rich range of valuable aquatic, riparian, seasonally-flooded, and terrestrial habitats. It is no exaggeration to say these properties underpin the wealth of flora and fauna found in the Isla Calero.

II.3.3 Ecology

Birds

The bird population includes a number of threatened species including the Harpy Eagle (*Harpya harpyja*), Crested Eagle (*Morphnus guianensis*), and Great Curassow (*Crax rubra*), which are all considered at risk of extinction. Other species at risk or endangered include the Black Rail (*Laterallus jamaicensis*) which inhabits salt and freshwater marshes; and the Buffon's or Great Green Macaw (*Altar ambiguus*), Spot-fronted Swift (*Cypseloides cherriei*), and Keel-billed Motmot (*Electron carinatum*) all of which live in primary or mature secondary wet woodlands.

These species are considered under threat of extinction, due to the loss of habitat due to deforestation. Birds that migrate altitudinally between the mountains and the HCN include the Bare-necked Umbrellabird (*Cephalopterus glabricollis*), which is endemic to Costa Rica and Panama, and the Three-wattled Bellbird (*Tricarunculata procnias*) both of which are considered rare due to loss and fragmentation of habitat. The Tawny-chested or Salvin's Flycatcher (*Aphanotriccus capitalis*) inhabits forest edges and natural clearings and it is regarded as a declining, vulnerable species due to its small range and intolerance of forest fragmentation.

Aquatic species

The Río San Juan supports eight families, twenty-five genera, and fifty-four species of freshwater fish; and at least eighty-four species of marine fish. The diversity of fish (eighty species) is also great in the lagoons linked directly or indirectly to the river thanks to the huge variety of aquatic vegetation, submerged trees, silt, debris, etc. found in these water bodies. The significance of habitat diversity in the river and lagoons can be illustrated by comparison to the near shore, coastal zone, which is characterized by a uniform shoreline and a sandy sea bed and which supports only forty-four species of fish.

These aquatic habitats also support migratory fish such as the Atlantic Tarpon (*Megalops atlanticus*), Fat Snook (*Centropomus parallelus*), and Bull Shark (*Carcharhinus leucas*), and are breeding sites for twenty-six fish species, including the Burro Grunt (*Pomadasys spp.*). The coastal spits and beaches provide food and breeding sites for the Green (*Chelonia mydas*) and Leatherback (*Dermochelys coriacea*) Turtles. Aquatic habitats also shelter one of the two populations of Tropical Gar (*Atractosteus tropicus*) in Costa Rica, as well as a population of West Indian Manatee (*Trichechus manatus*), which has been declared under threat of extinction.

The sensitivity of manatee to environmental change stems from their low rate of reproduction and dependence on access to a wide variety of submerged, floating, and emergent plants for food. To thrive, manatees must be able to move freely between rivers, estuaries, and coastal areas to take advantage of the salty, brackish, and freshwater environments they provide. This makes them vulnerable to habitat destruction due to dredging and disturbance or injury by fast motorboat traffic.

It should be remembered that the aquatic ecosystem also provides a fishery that is important to the indigenous people both nutritionally and as a way of raising income from tourists attracted to the area by fishing.

Plants

Levels of biological diversity are also high in terrestrial flora and fauna, with typical habitat and floral assemblages that include:

- coastal or beach vegetation, where Coconut Trees (*Cocos nucifera*) are very common;
- Tall hill forests;
- wooded swamps or flooded forests, with species of trees such as the Captive Wood (*Prioria copaifera*), Kapok Tree (*Ceiba pentandra*), Gavilan (*Pentaclethra macroloba*), Andiroba (*Carapa guianensis*), and Guiana Chestnut (*Pachira aquatica*);

- Yolillales, woodlands formed and dominated by the Yolillo Palm *(Raphia taedigera)*;
- grass marshes, where the Paspalum Grass (*Paspalum sp.*) is very common; and
- floating herbaceous plant communities, where the Common Water Hyacinth (*Eichhornia crassipes*) is widespread.

Flora includes 779 species, the most abundant trees being the Gavilan (*Pentaclethra macroloba*), Golden Fruit (*Virola koschnyi*), Andiroba (*Carapa guianensis*), Captive Wood (*Prioria copaifera*), and Guiana Chestnut (*Pachira aquatica*). Thirty-six of these plants are endemic to Costa Rica (Table II.7), though none of these are listed as endangered or under threat of extinction.

Table II.7. Species of endemic flora present in the HCN.

Family	Species	Family	Species
Acanthaceae	*Aphelandra storkii*	Fabaceae/Caes.	*Macroiobium herrerae*
Amaranthaceae	*Alternanthera costaricensis*	Fabaceae/Mim.	*Zygia confusa*
Annonaceae	*Guatteria aeruginosa*	Gesneriaceae	*Besleria columneoides*
	Unonopsis stevensii		*Drymonia submarginalis*
Araceae	*Anthurium austin-smithii*	Marantaceae	*Calathea hammelii*
	Anthurium subsignatum	Marcgraviaceae	*Marcgravia pittieri*
	Dieffenbachia concinna	Melastomataceae	*Clidemia pubescens*
	Monstera costaricensis	Myrtaceae	*Eugenia siggersii*
	Philodendron aromaticum	Orchidaceae	*Scaphyglottis limonensis*
Boraginaceae	*Bourreria costaricensis*	Passifloraceae	*Passiflora lancearia*
Bromeliaceae	*Aechimea mariae-reginae*	Piperaceae	*Peperomia vueltasana*
Cactaceae	*Hylocereus stenopterus*		*Piper pseudobumbratum*
Chrysobalanaceae	*Licania belloi*	Rubiaceae	*Coussarea talamancana*
	Licania stevensii		*Manettia longipedicellata*
Connaraceae	*Connarus costaricensis*		*Psychotria laselvensis*
	Rourea suerrensis		*Randia grayumii*
Cyperaceae	*Cyperus costaricensis*		*Rudgea monofructus*
Dichapetalaceae	*Dichapetalum moralesii*	Solanaceae	*Solanum mirabile*

It is crucial to conserve these forest and wetland plant communities because they provide the resources that enable fauna to survive. Conversely, fauna play crucial roles in the environmental dynamics of forests and wetlands that make these environments sustainable. For example, animals that feed on nectar, fruit, and seeds contribute to the processes of pollination and seed dispersal. It should be noted that forest fauna are also vital to the regeneration of plants and animals that are exploited commercially.

Herpetofauna

There are probably over 150 species of amphibians and reptiles living in the HCN, many of which have some form of conservation status (Table II.8). A considerable proportion of them are endemic, which is why their conservation is so important.

Table II.8. Herpetofauna believed to occupy the HCN that are reported to have some level of conservation status (source: Ramsar Convention on Wetlands (2010)).

	Species	Status according to IUCN*	Status according to MINAE*
AMPHIBIANS			
Caecilians	*Gymnopis multiplicata*		Reduced population
Salamanders	*Bolitoglossa colonnea*		Reduced population
	Oedipina cyclocauda		Reduced population
	Oedipina gracilis	Endangered	
Frogs and Toads	*Bufo melanochlorus*		Reduced population
	Dendrobates auratus		Reduced population
	Dendrobates pumillo		Reduced population
	Phyllobates lugubris		Reduced population
	Agalychnis calcarifer		Reduced population
	Agalychnis saltator	Near threatened	Reduced population
	Smilisca puma	Vulnerable	
	Eleutherodactylus mimus		Reduced population
	Eleutherodactylus noblei		Reduced population
	Eleutherodactylus ranoides	Critically endangered	
	Eleutherodactylus altae	Vulnerable	Reduced population
	Rana warszewitschii	Near threatened	
REPTILES			
Lizards	*Iguana iguana*		
	Thecadactylus rapicauda		Reduced population
	Dactyloa frenata		Reduced population
	Norops lemurinus		Reduced population
	Norops carpenteri		Reduced population
	Norops pentaprion		Reduced population
	Polychrus gutturosus		Reduced population
Snakes	*Boa constrictor*		Under threat of extinction
	Corallus annulatus		Reduced population
	Ungaliophis panamensis		Reduced population
	Clelia clelia		Reduced population
	Micrurus nigrocinctus		
Turtles	*Kinosternon angustipons*	Vulnerable	Reduced population
	Chelydra serpentina		Reduced population
	Dermochelys coriacea	Critically endangered	Under threat of extinction
	Caretta caretta	Endangered	Under threat of extinction
	Chelonia mydas	Endangered	Under threat of extinction
	Eretmochelys imbricata	Critically endangered	Under threat of extinction
	Chrysemys ornata	Near threatened	
	Rhinoclemmys annulata	Near threatened	
	Rhinoclemmys funerea	Near threatened	
Crocodiles	*Caiman crocodilos*		Reduced population
	Crocodylus acutus	Vulnerable	Under threat of extinction

*International Union for Conservation of Nature (IUCN) and Ministerio del Ambiente y Energia (MINAE)

II.3.4 Ecosytem services

Ecosystem services are the benefits people and society obtain from the natural capital of an area. These include the provisioning, regulatory, and cultural services that directly affect people, in addition to the services required to sustain ecological processes (support). The HCN provides a range of valuable ecosystem services that includes:

- flood alleviation;
- drought mitigation;
- groundwater recharge;
- retention and recycling of sediments and nutrients;
- water purification;
- biodiversity reservoirs;
- aquatic and wetland products; and
- recreation and tourism (especially ecotourism).

Although these services are provided naturally, they have value and their loss would invoke costs on communities directly affected and society more widely. These values, as well as the costs to society of losing the ecological services that produce them, can be assessed using Environmental Economic Evaluation and the costs resulting from their loss can be assessed through TVE.

II.4 Historical and recent evolution of the Delta

II.4.1 Morphological evolution

Stability is the most remarkable feature of the morphological evolution of the Delta evident in the sequence of historical maps and remotely-sensed images in Figure II.9.

As bifurcations in alluvial rivers are conditionally unstable and seldom persist at the same location for more than a few years or decades, the findings that:

- the basic form of the bifurcation is clearly recognisable in all the maps and images, and
- the geometry of the bifurcation has remained, essentially, unchanged for at least 230 years;

may appear, initially, surprising. However, when the fact that the position and geometry of the bifurcation are actually controlled by regional geology and tectonics (as explained in detail in Section II.2) is taken into account, the stability of the feature over a timescale of a couple of centuries is precisely what would be expected.

While the position and geometry of the Delta has remained stable since the late-18th century, changes are apparent in the channel of the Río San Juan downstream of the bifurcation. In the map of 1780 (Figure II.12(a)), the Río Colorado and Río San Juan upstream of the Delta are depicted as having braided planforms, with flow dividing and rejoining around multiple bars and islands, while the Río San Juan downstream of the Delta (labelled as the Nicaragua River) is shown as having a single, sinuous planform. The presence of bars and islands is evidence that a stream is heavily laden with relatively coarse sediment that moves along or near the bed. Conversely, the sediment load is lighter in streams with single-thread, sinuous, or meandering channels. Hence, it might be inferred that in the late-18th century, the Río San Juan downstream of the Delta was, for whatever reason, receiving water that was, proportionately, less heavily laden with relatively coarse sediment than that in either the river upstream or the Río Colorado downstream. It would be possible to explain why this might have been the case

morphogenetically, but to do so would be highly speculative given the lack of any information on discharges, sediment concentrations, or sediment calibres in the Río San Juan at that time.

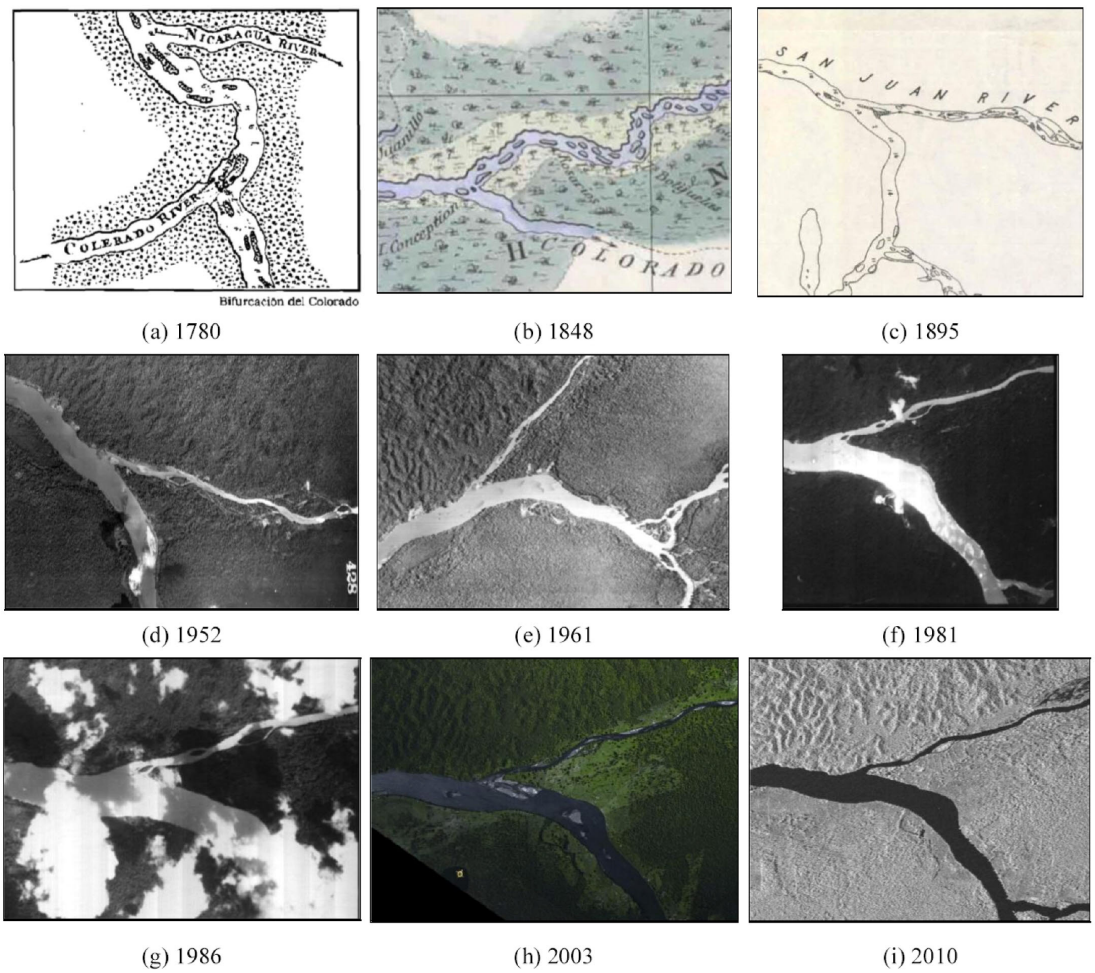


Figure II.12. Historical maps and satellite images of the Delta of the Río San Juan.

What can be said with confidence is that by 1848 the situation had reversed, with the Río San Juan clearly represented as being braided, while the Río Colorado is shown as having a single-thread, sinuous planform (Figure II.12(b)). It may be inferred that the proportion of the coarse fraction of the sediment load in the Río San Juan approaching the Delta that was supplied to the Río San Juan had increased, while that supplied to the Río Colorado had decreased. The effect was to over-load the Río San Juan with coarse bed and near-bed load, building bars that deflected the flow against the banks to drive bank retreat and channel widening that created the width and additional sediment needed to spawn more bars and islands.

In interpreting the increasing width of the Río San Juan downstream of the Delta at this time, it is important to bear in mind that widening due to planform metamorphosis from a single-threaded to a braided configuration does not indicate an increase in water discharge. Rather, it suggests an

increase in the supply of coarse sediment or a decrease in the volumetric flow rate of water. Hence, the map of 1848 suggests that more sediment and proportionately less water were entering the Río San Juan at the Delta during the first half of the 19th century, while more water but proportionately less sediment were flowing to the Río Colorado.

Braiding in the Río San Juan downstream of the Delta persisted at least until the end of the 19th century, though in the map of 1895 (Figure II.12(c)) the number of bars seems to have decreased through their amalgamation into larger units that are longer and narrower. As a result, the widening trend evident between 1780 and 1848 has ceased. This would suggest that the imbalance between the divisions of water and sediment at the Delta were stabilising in the second half of the 19th century.

Allowing for the effects of differences in stage between images (which means that bars evident in images taken at low flow disappear in images taken during the flood season), changes in the planform patterns and dimensions of the Río San Juan upstream of the Delta or the Río Colorado during the 20th century have been minimal. It flows that the Río San Juan upstream and the Río Colorado have been able to convey the load of sediment supplied from upstream without progressive aggradation or degradation. Conversely, this has not been the case in the Río San Juan downstream of the Delta. The sequence of satellite images taken between 1952 and 2010 (Figures II.12 (d) through (i)) indicates a progressive reduction in width through conversion of mid-channel bars to point bars and closure of side channels separating islands from the floodplain. A reduction in channel width driven by this pattern of planform evolution is consistent with either a long-term accretionary trend or a progressive reduction in discharge.

II.4.2 Hydrological records

While the data are sparse, a record of discharge measurements in the Río San Juan and Río Colorado upstream and downstream of the Delta stretching back to the mid-19th century has been tabulated in Table II.9.

This record demonstrates that the great majority of the water flowing to the Delta has followed the southern (Río Colorado) branch during all of the 161 years for which discharge measurements are available. The length of this record is significant because the earliest discharge measurements recorded pre-date signing of the 1858 Treaty of Limits between Costa Rica and Nicaragua. This finding is entirely consistent with the morphological stability of the bifurcation that stems from its geologic control.

That said, uncertainties in the data are high due to the limited accuracy of methods available to gauge discharges in the 19th century. The fluctuations apparent in the divisions of flow in Table II.9 are, to an unknown extent, the result of errors in the measurements or differences in the way that discharge estimates were made and season that they were made in.

Modern stream gauging techniques using, for example, Acoustic Doppler Current Profilers, are more reliable and records for the Río San Juan at La Trinidad and the Río Colorado at Delta Colorado (see Table II.3) indicate that 91% of the annual average discharge at the Delta flows to the Río Colorado, with about 9% continuing along the Río San Juan. A document submitted to the International Court of Justice by the Republic of Nicaragua (2010, Quintero Annex 3) report

discharges of 1,487 m^3/s in the Río Colorado and 178 m^3/s in the Río San Juan downstream of the Delta, representing 89% and 11% of the approach flow, respectively.

Table II.9. Division of flow at the Delta during the second half of the 19th century.

Author	Year	Discharge (m^3/s) (Values in parentheses indicate % of flow in Río San Juan upstream of Delta)		
		Río San Juan		Río Colorado
		Upstream of Delta	Downstream of Delta	
Orville W. Childs (1852, pp. 83)	20 August 1850	1,539.87	348.98 (23%)	1,190.89 (77%)
Ephraim George Squier (1860)	1850s	–	– (<33%)	– (>66%)
George Ripley and Charles Dana (1861, pp. 333-341)	1850s	–	– smaller	– larger
Alejandro Bolaños Geyer (1999, pp. 55-56)	1857-60	–	– (10%)	– (90%)
A.M. Brandreth (1880, pp. 123)	1872-73	1,571.58	52.39 (3.33%)	1,519.15 (96.67%)
Lull (Nicaragua Canal Commission, publication date unspecified)	16-20 May 1873	16,770	607 (3.6)	16,190 (96.4)
The Royal Geographical Society (1897, pp. 68)	1897	883.33	88.33 (10%)	795 (90%)
John Grimes Walker *et al.* (1899, pp. 60)	1897-99	–	– (20%)	– (80%)

What can be concluded from this review of historic and current discharge in the Río San Juan and Río Colorado is that the data available indicate that the division flow at the Delta has been at or around its present ratio (whereby of the order of 10% goes to the Río San Juan and around 90% goes to the Río Colorado) at least since the mid-19th century.

II.4.3 Sediment dynamics

It was established in Section II.2 that most of the water and sediment delivered to the Delta is derived from runoff and upland erosion in Costa Rican sub-catchments that drain to the Río San Juan. Indeed, it is probable that approximately 60% of the sediment load carried to the Delta by the Río San Juan comes from just two tributaries: (1) the San Carlos and (2) Sarapiquí. These rivers deposit most of the coarse sediment load (cobbles and gravels) they carry in their lower courses and the sediment supplied to the Río San Juan is composed of sand, silt, and clay. Analyses of channel changes during the 20th century indicate that the cross-sectional area of the Río San Juan increases with distance downstream of the confluences of both the San Carlos and Sarapiquí. This indicates that the river has sufficient transport capacity to carry the sediment load contributed by the San Carlos and Sarapiquí downstream to the Delta without a substantial portion of it being deposited along the way.

However, the trend of downstream growth in the channel of the Río San Juan reverses in the final 31.5 km of its course to the Caribbean coast, beginning at the Delta. In this reach, the historical record presented in Section I.2 suggests that sediment has accumulated in the channel. Notwithstanding the fact that most of the sediment that accumulates in the Río San Juan

downstream of the Delta is probably supplied by the San Carlos and Sarapiquí, it is difficult to argue that siltation is *directly* related to the high-sediment concentrations in these tributaries. If those high concentrations were in themselves responsible for silting the Río San Juan, why should this process not occur until the tens of kilometres downstream of the tributary junctions?

The explanation for sedimentation in the final 31.5 km of the Río San Juan actually stems from the change in the form of the river that occurs at the Delta. Upstream of this point, the river follows a single-thread, meandering course through the structural valley between the high ground of the Chortis Block to the east and north and the raised ground of the Hess-Santa Elena Fault zone. At the Delta, the form of the river changes to that of a deltaic system with most of the discharge (~90%) flowing south through the Río Colorado, while the residual (~10%) remains in the Río San Juan (see Table II.9). As explained earlier, this occurs as a result of geological control and neotectonic influence on the river. Consequently, the Delta marks the proximal head of an alluvial fan that constitutes the entire Isla Calero, and which naturally features a complex depositional system of fluvial channels, lagoons, swamps, marshes, and frequently inundated floodplains, all classified as wetlands and, as noted above, of high environmental, ecological, and resource value.

As indicated in Table II.9, most of the water flowing to the Delta passes through the southern (Río Colorado) branch and, as the great majority of the sediment load is carried in suspension, so does most of the sediment. The Río Colorado is able to accommodate this load because it flows across a wide alluvial delta within which it is free to adjust its network of natural channels through lateral migration, planform change, avulsion, and the opening and closing of distributaries, and also because it can disperse suspended sediment throughout extensive floodplains and wetlands that can trap and absorb huge quantities of sediment. This is a natural consequence of the Río Colorado's location to the south of the Hess-Santa Elena Fault, in an area characterized by low relief and subsidence.

The situation in the Río San Juan branch of the deltaic is quite different. Although this river receives less of the sediment delivered to the Delta than the Río Colorado does, it is unable to accommodate even this load. This is because, in the reach downstream of the Delta, constraints are imposed first by the narrow width of the corridor between high ground to the north and south of the river (which prevents the Río San Juan from distributing its sediment load through a multi-channel, anabranched pattern) and, further downstream, by the diminishing gradient associated with the river's physiographic location and heading, which robs the river of its capacity to convey sediment to the coast. Instead of being dispersed, the sediment is instead deposited in and along the (mainly meandering) channel in the form of shoals, islands, point bars, and natural levees. This too is entirely natural and results from the location of the Río San Juan branch north of the Hess-Santa Elena Fault, in an area characterized by relatively high relief and an uplifting tendency.

It follows from this assessment that sediment accumulation in the Río San Juan downstream of the Delta is not caused by excessive concentrations of sediment in the San Carlos and Sarapiquí (or indeed any of the Costa Rican tributaries), but is the consequence of natural geological controls and neotectonic influences. The scale and power of the natural phenomena responsible for conditioning fluvial processes and controlling morphological evolution in the Río San Juan and Río Colorado are such that attempting to reverse their effects is likely to be futile. The

geology and neotectonics of the region will continue affecting this deltaic system for centuries, with or without the dredging.

Viewed in this light, dredging the Río San Juan downstream of the Delta can only ever provide short-term, temporary relief from navigation problems because it works *against* the natural tendency for sedimentation in this reach. Insights gained through logical consideration of the geology, hydrology, sediment dynamics, geomorphology, and environment of the Río San Juan and the Delta reveal that maintaining navigation in the Río San Juan for vessels with drafts greater than, say about 1 m, will require not a single, capital operation but repeated dredging and the removal of hundreds of thousands of cubic metres of sediment year after year.

II.5 Dredging programme and relationship between annual sediment load in Río San Juan and dredged quantity

II.5.1 Nicaragua's account of the dredging programme

According to documents submitted to the International Court of Justice (Republic of Nicaragua. 2011) the dredging project undertaken by Nicaragua includes:

- creating and maintaining a navigation channel, "*along a section of 41,963.57 linear meters that extends from the site known as Punta Chingo Petaca to the mouth of the San Juan River*" (Annex 7) with dimensions of, "*20 meters wide on the bottom, 30 meters wide on the surface, and 2 meters deep*" (Annex 11). This would give the navigation channel a cross-sectional area of ~50 m^2. Given the length stated above, the volume of the navigation channel would be ~2.1 million m^3. The volume of material to be dredged would be somewhat less than this and the figure stated for the volume of spoil to be disposed of by dumping it in the wetland (~1.6 million m^3) sounds about right (Republic of Nicaragua (2011), Annex 7).

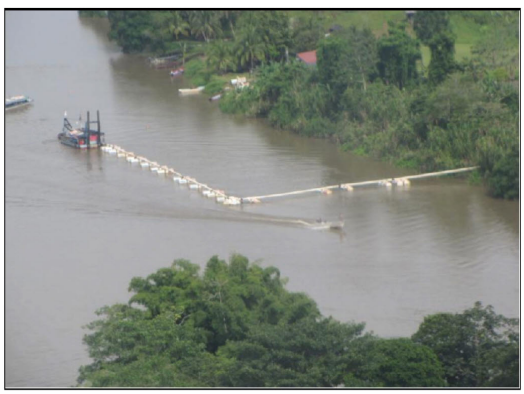
With respect to disposal of dredge spoil, MARENA state in Annex 7 that 130.8 ha of floodplain at 23 sites distributed along the length of the northern (left, Nicaraguan) bank of the Río San Juan will be buried by up to 1.1 m of sediment removed from the river bed. It is stated that disposal sites will be located in areas that are, "*affected by human activities (agriculture and livestock systems), low-density and dispersed humanized areas with a small amount of vegetation*" (Republic of Nicaragua (2011), Annex 7).

The documents to the International Court of Justice also include as an Expert Report by Delft University (Document 18; van Rhee and de Vriend (2011)). The experts from Delft University applied Chezy's Equation (see Sellin (1969)) in conjunction with an estimate of Manning's 1890 roughness coefficient (see Chow (1964)) to predict that Nicaragua's dredging programme would result in the discharge of the Río San Juan by approximately 20 m^3/s at low flow, rising to about 50 m^3/s during an average flow. Chezy's equation applies to uniform, steady flow. The American Society of Civil Engineers (ASCE) recommends that the Darcy-Weisbach friction factor should be used in preference to Manning's roughness coefficient (see ASCE (1963)).

The decision to use Chezy's Equation, in preference to one of the more sophisticated hydrodynamic models developed during the 20th and 21st centuries that are capable of dealing with the non-uniform, unsteady flow conditions characteristic of the Delta, is not explained. Also, the calculations assume that Nicaragua's dredging programme is actually limited to creating a navigation channel 2-m deep and with a width of 30 at the upper section and 20 m at the lower section. Finally, the Expert Report takes no account of morphological responses (bank instability, sedimentation, and planform change) that may be triggered by the dredging programme and which are likely to mean that further dredging and channel engineering works will probably be required to maintain navigation and increased discharges in the Río San Juan.

II.5.2 Evidence from over-flights

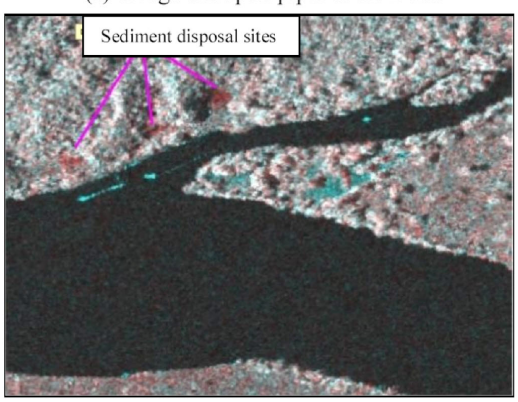
The photographs in Figures II.13(a), (b), (d), (e), and (f) were taken by the author during an over-flight of the Río San Juan between the Delta and the coast on 7 July 2011. Other photographs are as dated in the captions.



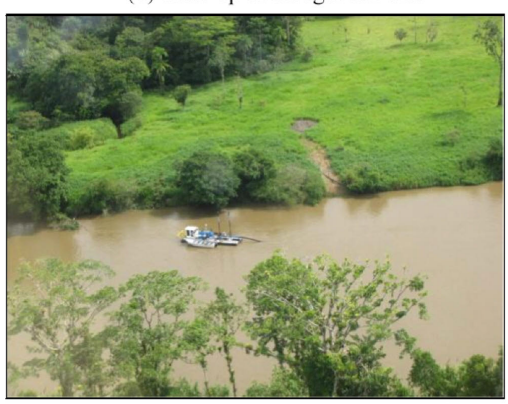
(a) dredge and spoil pipes at the Delta



(b) close-up of dredger at Delta



(c) satellite image of Delta (September 2011) with three dredge disposal areas highlighted



(d) second dredger, spoil pipe, and disposal site in Río San Juan downstream of Delta



(e) third dredger next to right (Costa Rican) bank of Río San Juan downstream of Delta (note dredge disposal site on left bank opposite)



(f) dredge spoil on left floodplain of Río San Juan downstream of Delta





(g) dredge disposal site on left bank of Río San Juan downstream of Delta (3 September 2011)

Figure II.13. Direct impacts of Nicaragua's dredging programme on the Río San Juan.

Points to note in Figure II.13 include:

- Photographs (a) and (b) confirm that the dredging programme is underway and that the dredger at the Delta is Nicaraguan.
- Photograph (c) proves that three spoil disposal sites are located close together at the Delta, rather than being widely dispersed, as specified by MARENA (Republic of Nicaragua (2011), Annex 7).
- Photograph (d) confirms that a second dredger was operating in the Río San Juan on 7 July 2011. This one does appear to be disposing of dredge spoil on agricultural land.
- Photograph (e) shows a third dredger in the Río San Juan on 7 July 2011. A spoil disposal site located on the left (Nicaraguan) bank does appear to be in an area of pasture. However, the dredger is right next to the right (Costa Rican) bank. This bank and Costa Rican territory are at risk of damage and/or erosion due to vessel movements and mechanical contact with the bank. Also the bank could certainly be destabilised if the dredger removes sediment from close to the bank or disturbs sensitive bank vegetation.
- Photograph (f) shows an area of dredge spoil on the left (Nicaraguan) side of the river at the inside of a meander where a corridor of vegetation was cleared in January-February 2011 (see Figure I.45). This patch of dredge spoil appears similar to the area of raised ground

created in October 2010 on Costa Rican territory, near the construction site for the 'Caño' (see Figures I.22, I.23, and I.24). This was used between October and December 2010 as the site for an encampment occupied by Nicaraguan military during construction of the 'Caño' (see Figure I.28).

- The dredge spoil disposal site in two photographs (g) appears to be located in an otherwise undisturbed area of forest. This suggests that the plan to locate disposal sites in areas that are, "*affected by human activities (agriculture and livestock systems), low-density and dispersed humanized areas with a small amount of vegetation*" (Republic of Nicaragua (2011), Annex 7) has *not* been followed in practice.

II.5.3 Relationship between annual sediment load in Río San Juan and dredged quantity

Investigations conducted in the Río Colorado immediately downstream of the Delta have included repeated, areas of bed materials. These have established that the bed is almost entirely composed of sand (Figure II.14).

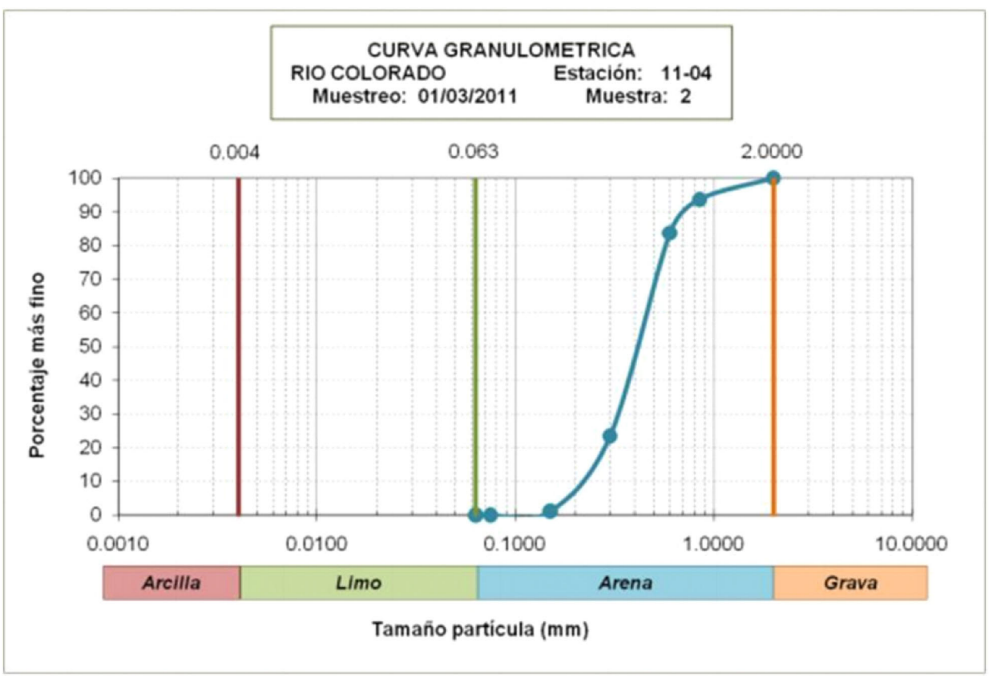


Figure II.14. Typical example of the bed-material size distribution in the Río Colorado immediately downstream of the Delta.

The frequency distribution in Figure II.14 suggests that little or no silt or gravel is present in the bed material of the channels around the Delta and indicate that the bed is formed exclusively in sand. The frequency distribution of median bed-material sizes in Table II.10 yields a median bed-material size (D_{50}) of about 0.45 mm.

Table II.10. Frequency distribution of median grain sizes (D_{50}) sampled in the Río Colorado.

Class (mm)	Frequency
0.1	1
0.24	1
0.38	10
0.52	10
0.66	3
greater	6

It may be concluded from these findings that sediment dredged from the bed of the Río San Juan is predominantly sand sized.

The size distribution of the suspended load carried by the river is considerably finer than that found in the bed, but varies seasonally (Figures II.15 and II.16).

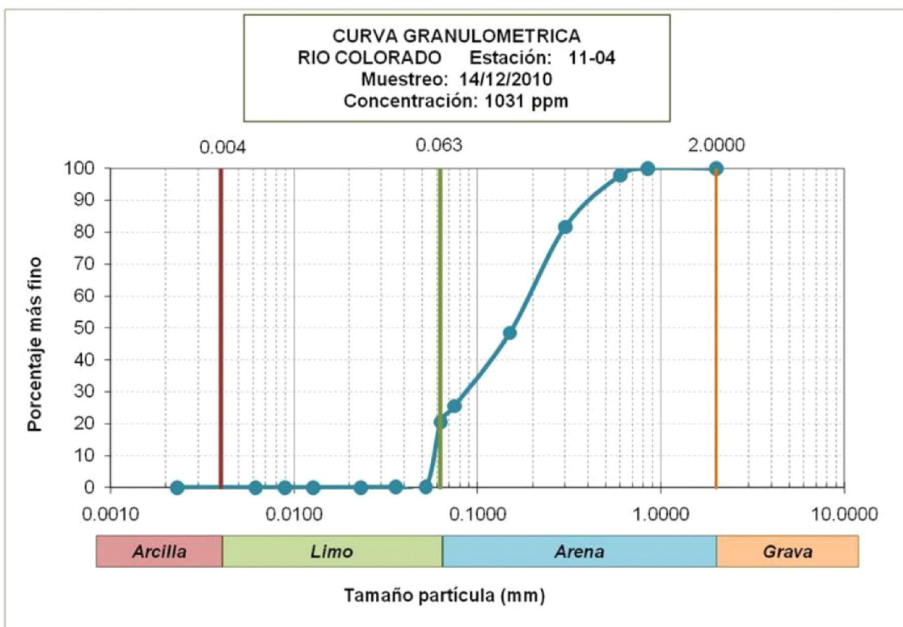


Figure II.15. Suspended sediment size distribution in the Río Colorado at the Delta (December 2010).

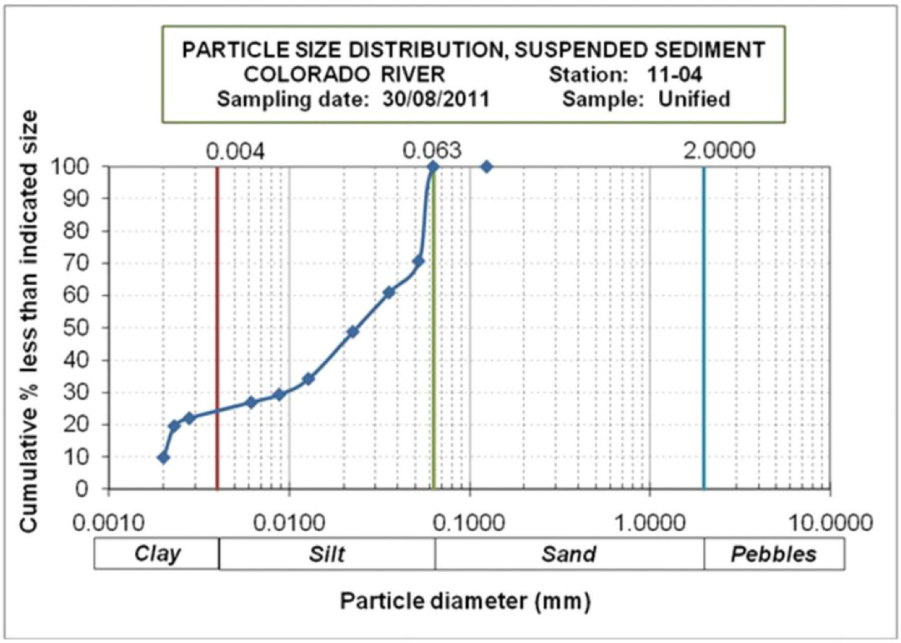


Figure II.16. Suspended sediment size distribution in the Río Colorado at the Delta (August 2011).

These measurements indicate that while 80% of the suspended load was sand in the Río Colorado during December 2010, in August 2011 only silt was being carried in suspension.

It may be concluded from these results that it is the sand fraction of the sediment load that is relevant to the dredging programme because this constitutes that part of the total load that is sourced from the bed on the rising stage of a flood and deposited there when transport decreases during recession of the hydrograph.

Analysis of bed-material and sediment-load characteristics at the Delta provide the basis for estimating the annual sand loads carried by the Río San Juan using Einstein's method, which is a complex but respected technique for calculating sediment loads in alluvial rivers. This method is based on a sound theory and uses a combined mechanistic-probabilistic approach, which deals explicitly with the transport of sediments with mixed grain sizes (Einstein, 1950). The calculations were performed by the ICE using data from the La Trinidad hydrometric station (ICE, 2011b) and the results are summarised in Figure II.17, which shows how transport rates (tonnes per day) increase as a function of streamflow (m^3/s) for a range of sand sizes between 0.063 and >1 mm.

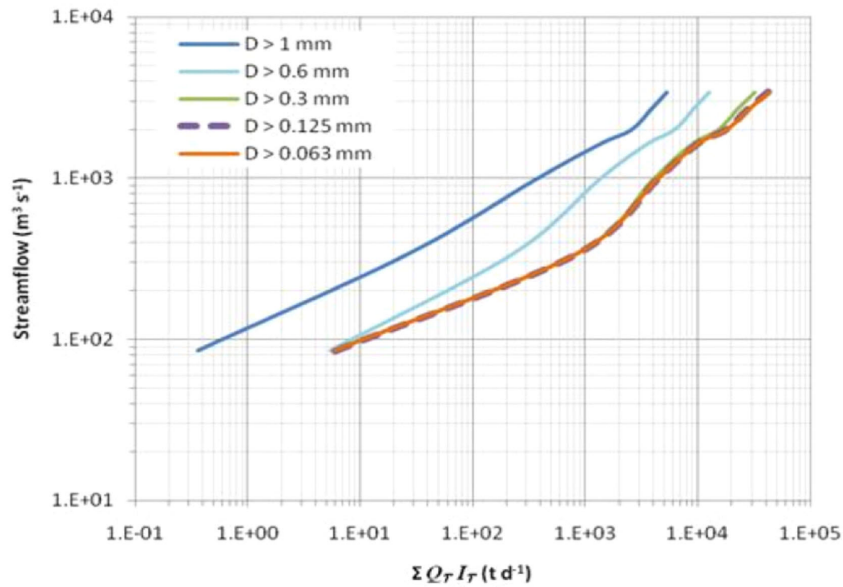


Figure II.17. Sediment rating curves for different sand sizes derived from application of Einstein's equation using daily discharge records for the period 1973-76 at the La Trinidad hydrometric station on the Río San Juan, just downstream of the confluence of the Río Sarapiquí, and sediment size data compiled from twenty-nine separate bed-material samples.

Based on the rating curves in Figure II.17, the best-estimate of the annual sand load entering the Río San Juan at the Delta is 260,000 tonnes/year. Assuming a bulk density of 1,650 kg/m^3, this equates to 150,000 m^3/year. Recognising that sediment-transport calculations are subject to considerable uncertainty, reasonable lower- and upper-bound estimates would be 140,000 and 160,000 m^3/year, respectively.

The main assumptions underpinning these estimates are that:

- Bed-material properties in the Río San Juan upstream of the Delta (at station 69-01-03, La Trinidad) are not significantly different to those in the Río Colorado immediately downstream of the Delta (at station 69-11-04, Delta Colorado).
- The cross section of the Río San Juan at station 69-01-03, La Trinidad, can be approximated as being rectangular in shape.
- The Río San Juan downstream of the Delta carries 9% of the discharge and bed-material load in the Río San Juan upstream the Delta (in line with the records in Table II.10 of this Report).

In Section II.5.2, it was established that achieving Nicaragua's aim of dredging a navigation channel with dimensions of "*20 meters wide on the bottom, 30 meters wide on the surface, and 2 meters deep*" (Republic of Nicaragua (2011), Annex 11), would in the first instance require removing ~1.6 million m^3 of sediment from the bed of the river. This equates to between ten and eleven-and-a-half times the average annual sand load, with a best-estimate of 10.4 times.

While the calculations performed by the ICE are subject to uncertainty, they are nevertheless indicative of the degree to which the dredging programme will perturb sediment transport in the Río San Juan and sediment dynamics in the river's fluvial system. Disruption to sediment dynamics on this scale is almost certainly sufficient to trigger non-linear, dynamic, process-response mechanisms, leading to complex morphological responses with environmental impacts and ecological responses that are significant at both the local- and system-scales.

II.6 Impact of dredging on Río San Juan and Río Colorado plus potential for further impacts if dredging continues

II.6.1 Short-term impacts

Hydraulics

The aims of dredging a river to improve navigation are to substantively increase the minimum depth in the navigation channel during low flow to a value greater than the draft of the largest vessel seeking passage and remove all sediment shoals and bars that could present a danger to shipping. It follows that dredging directly and significantly increases the reach-averaged hydraulic depth of the river channel and reduces the degree of local, morphological variability. A common side effect may be to over-steepen the stream's banks sufficiently to trigger mass instability and retreat that leads to significant channel-widening that further enlarges the channel.

In the case of a distributary river, enlarging the cross section increases the capacity of the channel to convey discharge and so it would be expected that the proportion of the approaching discharge should flow to the dredged branch at a bifurcation following enlargement. At the Delta, this short-term impact of dredging was predicted by Delft University to be 20 to 50 m^3/s based on Chezy and Manning's equations for steady, uniform flow in a single channel. However, application of a hydraulic model, such as the USACE's HEC-RAS would be expected to produce a more accurate prediction.

A HEC-RAS model was built for the Río San Juan and Río Colorado at the Delta and used to make preliminary predictions of the possible impact of dredging the Río San Juan below the Delta on the division of flow at the Delta (Aviles, 2010).

The input data to run the model came from channel surveys, bed-material sampling, suspended-load measurement, and stream gauging of the Río Colorado performed in November 2009, when the discharge was 1,509 the m^3/s and the sediment concentration was 166 parts per million, values which are representative of high-flow conditions in the river. The model distributes water between the branches at the bifurcation hydrodynamically, according to the geometries and hydraulic characteristics of the approach channel and the two branches downstream and based on the assumption that flow through the bifurcation varies gradually.

The model was run for existing, baseline conditions at the bifurcation (Table II.11) and three scenarios representing the effects of enlarging the channel of the Río San Juan downstream of

the Delta through dredging by 1, 2, or 3 m (Table II.12). The results obtained using HEC-RAS are summarised in Table II.13.

Table II.11. Baseline data for the current condition of rivers at the Delta.

River	Depth (m)	Width (m)	Discharge (m^3/s)	Discharge (%)
Río San Juan (upstream)	6.29	480	1,796.4	100%
Río Colorado	6.29	457.5	1509	84%
Río San Juan (downstream)	4.75	90	287.4	16%

Table II.12. Dimensions of the Río San Juan downstream of the Delta for three dredging scenarios.

Dredging Scenario	Depth (m)	Width (m)
1	5.75	120
2	6.75	150
3	7.75	180

Table II.13. Indicative results of HEC-RAS modelling for the dredging scenarios in Table II.12.

River	Scenario 1		Scenario 2		Scenario 3	
	Q (m^3/s)	Q (%)	Q (m^3/s)	Q (%)	Q (m^3/s)	Q (%)
Río San Juan (upstream)	1,796.4	100%	1,796.4	100%	1,796.4	100%
Río Colorado	1,428.14	80%	1,356.28	75%	1,293.41	70%
Río San Juan (downstream)	368.26	20%	440.12	25%	502.99	30%

The results summarised in Table II.13 are no more than preliminary estimates due to the broad assumptions necessary to build and run the model. They indicate only the initial impacts of dredging on the division of flows at the Delta because the effects of scour, sediment transport and, most importantly, deposition are not accounted for in the model. Also it must be borne in mind that the results apply only to a high flow of around 1,500 m^3/s – the division of flow would be different for other discharges at other times of the year.

The results obtained from hydrodynamic modelling contrast to those based on a uniform flow assumption by van Rhee and de Vriend (2011). Specifically, dredging the San Juan downstream of the Delta by 1 m is predicted to initially increase the percentage of flow entering that branch from the baseline used in this model value (16%) to about 20% of the discharge in the Río San Juan upstream of the Delta. Dredging by 2 m is predicted to initially increase flow in the Río San Juan to approximately 25% of that upstream, while lowering the bed by 3 m is predicted to increase this figure to around 30%.

Environment and Ecology

Dredging also has direct, short-term impacts on river environments and ecosystems through disturbing aquatic flora and fauna, destroying benthic communities and, potentially, increasing

turbidity and reducing water quality, with impacts that will be felt throughout the trophic network.

Even when dredging operations in the channel have ceased, its effects continue due to artificial disturbance of river hydrology, hydraulics, sediment dynamics, coupled with short and longer-term, morphological responses driven by perturbation of the fluvial system. The feedback loops involved in dynamic process-response are sufficiently complex to preclude detailed prediction of the sequence of morphological adjustments triggered by disturbance due to dredging (Sear *et al.* 2010) and the timescale for morphological responses is indeterminate because it is dictated by the future flow events that are not uncertain, but unknowable. The environmental impacts and ecological consequences of these morphological responses are impossible to predict in detail, but are both unavoidable and deleterious. Generally, they scale on the severity and extent to which the fluvial system is perturbed, ranging from reach-scale damage associated with limited dredging at a single site, to system-wide collapse stemming from multi-site or repeated dredging operations. In the case of the Río San Juan, removing 10 year's worth of the sand load supplied at the Delta represents a serious perturbation, likely to lead to significant environmental impacts and adverse ecological consequences.

Sediment dynamics and morphology

When dredging occurs at a channel bifurcation in an alluvial stream, another dimension is added to the potential for impacts and damages. This is the case because, as explained in Part I of this Report, bifurcations in alluvial streams are conditionally unstable. This follows because the impacts of increasing the cross-sectional dimensions, conveyance capacity, and discharge in one branch downstream of a bifurcation must reduce the discharge in the other branch. Hence, the morphological responses and ecological consequences experienced in the dredged branch are likely to be mirrored in the undredged branch. There is also the possibility that, if disturbed sufficiently, a tipping point might be reached where enlargement of the dredged branch and resultant diminution of the undredged branch becomes self-reinforcing so that the dredged branch captures an increasing proportion of the discharge.

In assessing the actual and potential impacts of Nicaragua's dredging programme on the Río San Juan and Río Colorado, available satellite images, aerial photographs, and documents were examined; and the author also viewed and photographed the rivers and on-going dredging operations personally, during a field visit and over-flight on 7 July 2011 (Figure II.18).



(a) author at Delta



(b) retreating right (Costa Rican) bank at Delta



(c) view upstream to Delta



(d) fallen tree (right bank) and eroding bank at outer bend



(e) river cliff at left bank settlement



(f) meandering reach



(g) divided reach



(h) local bank erosion at d/s end of divided reach



(i) sinuous reach



(j) view downstream to coast

Figure II.18. Photographs of the Río San Juan downstream of the Delta taken by the author on 7 July 2011.

Mechanical disruption and sediment-related disturbance to the river during dredging is inevitable in the vicinity of the operations and, based on first-hand observation on 7 July 2011, at last three dredgers are engaged in the programme, each working at different locations along the Río San Juan (see Figure II.12). This appears to include dredging close to both the left and right banks. It is, therefore, likely that direct, short-term, site-scale, and reach-scale impacts include:

- damage or destruction of bedforms and benthic ecological communities;
- disturbance to aquatic ecosystems;
- artificial changes to flow depths and velocities;
- over-steepening of banks due to bed lowering; and
- mechanical damage to banks and riparian areas by:
  - vessel manoeuvring and mooring,
  - installation and removal of spoil pipes, and
  - burial of floodplain soils and plants at spoil disposal sites.

Evidence of all these impacts may be seen in Figure II.19. Impacts on turbidity and water quality seem unlikely due to the naturally-high concentrations of suspended sediment in the river, which would reduce the downstream impacts of the work on the river ecosystem.

However, mapping of dredge spoil sites reveals that dredging has been performed in reaches scattered throughout most of the length of the Río San Juan downstream of the Delta (Figure II.19). In this case, the short-term, cumulative effects of the direct impacts experienced around each of the individual sites may be sufficient to produce significant morphological responses with serious ecological consequences that extend beyond the site to at least the reach-scale.

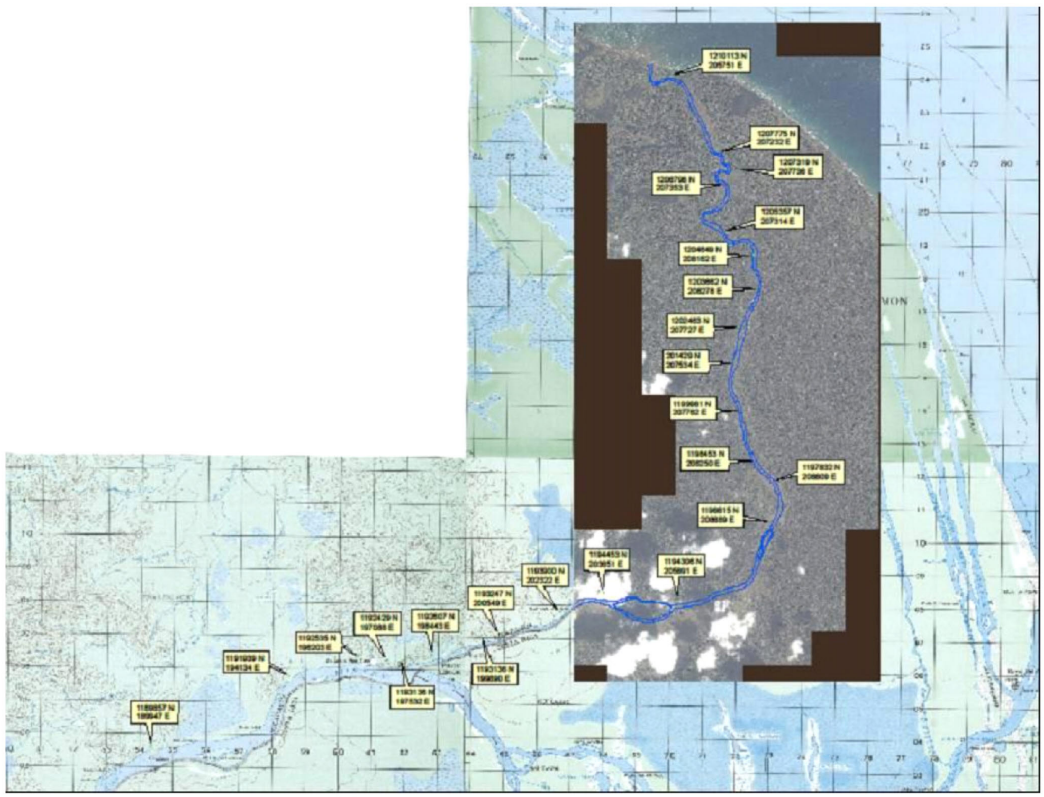


Figure II.19. Mapped dredge spoil sites along the Río San Juan downstream of the Delta.

The indirect impacts of dredging resulting from the river's morphological and environmental responses are more difficult to assess because there is the potential for positive feedback loops operating in the fluvial system to magnify them locally, promulgate them both upstream and downstream, and perpetuate them through time. The existence of these complex process-response mechanisms in the fluvial system means that the potential exists for impacts that initially appear minor to trigger non-linear responses that amplify rather than dampen their effects on channel forms, habitats, and ecosystems not only in the Río San Juan, but also in the Río Colorado.

These complexities make it necessary to assess the indirect impacts of the dredging programme not only in the short-term (i.e., during operations), but also in subsequent months and years. In the latter context, assessment of the potential for future impacts and responses must include consideration of the possibility of further actions by Nicaragua to repeat, intensify, or extend dredging. One other issue that must be considered is the possibility of the impacts of diverting water into the 'Caño' and cutting off one or possibly two meander bends (assessed in Part I of this Report) catalysing responses to the dredging programme to synergise morphological responses and move the Delta closer to its geomorphic tipping point – an unlikely but perhaps not impossible scenario.

II.6.2 Long-term impacts

The low-gradient, limited stream power, and erosion-resistant bank materials of the Río San Juan should limit its capacity to scour sediment from its bed and banks, making erosion-led instability due to perturbation of the fluvial system unlikely. Hence, sustained fluvial and morphological responses initiated through fluvial scour of the bed or bank, or widespread erosion of the banks would not be expected in response to the cumulative effects of site or reach-scale dredging alone.

Figure II.18 showed ground-based and oblique, aerial photographs of the Río San Juan downstream of the Delta taken by the author on 7 July 2011. Localised bank erosion was evident on the right (Costa Rican) bank immediately downstream of the Delta and in other places, particularly at the outside of bends, in divided reaches and associated with riverside settlements. However, at that time there was no evidence of widespread bank erosion triggered by systemic response to the cumulative effects of the dredging programme.

The low-gradient, limited stream power, erosion-resistant bank materials and heavy supply of sediment make it more likely that the Río San Juan will respond to disturbance caused by the cumulative effects of dredging through changes led by accelerated sedimentation. This is the case because while enlarging the cross section may increase the percentage of flow approaching the Delta that flows to the San Juan, it also lowers the bed elevation and allows more of the bed and near-bed load to enter the channel. Also, increasing the cross-sectional area tends to reduce the velocity and, as the sediment-transport capacity of the flow is proportional to the velocity raised to the sixth power, a reduction in velocity results in a disproportionate decrease in sediment-transport capacity. In essence, process-response results in the accelerated siltation in the navigation channel and, potentially, at other locations too.

If the Río San Juan responds to the dredging programme in this way, the bed is likely to aggrade, locally attempting to return the river to its morphological status quo and, in doing so, negating the benefit of the dredging to navigation. That is not to say that morphological response would be simple. In fact it would be complex and non-linear.

However, this prognosis would change if the cumulative effects of diverting the river to the Harbor Head Lagoon via the 'Caño', straightening and re-aligning the river's course by cutting off two bends, and dredging to enlarge its channel and remove shoals were to interact synergistically.

In this unlikely but perhaps not impossible scenario, the increased energy slope (due to shortening the length of the river by cutting off meanders and re-routing the river to the Harbor Head Lagoon), coupled with reduction in energy losses (due to cutting off bends and removing shoals), could produce an increase in sediment-transport capacity sufficient to trigger bed degradation that would migrate upstream as a knickpoint in the river's longitudinal profile. Bed lowering would over-steepen the banks and allow erosion to undermine the roots of trees growing on the bank top, negating their effectiveness in reinforcing the bank, and making it likely that they would destabilise the bank through wind throw and surcharging. As a result, a wave of instability involving bed scour, knickpoint migration and bank retreat would migrate upstream through the reach, generating secondary waves of instability in its wake – a phenomenon termed 'complex response' (Schumm, 1977). The morphological outcome would

probably still be for the channel to eventually recover to its pre-disturbance condition, but the environmental impacts and ecological consequences of the morphological adjustments involved in its doing so would be serious, long-lived, and possibly irreversible.

However, in a less likely but not impossible, 'worst-case' scenario, it could be envisaged that complex responses in the fluvial system to cumulative and synergistic interactions resulting from Nicaragua's actions in simultaneously diverting the river, cutting meanders, and dredging the bed could lead to the balance of flows at the Delta reaching a geomorphic tipping point, such that the Río San Juan captured an increasing proportion of the flow that naturally flows to the Río Colorado. A feature observed during field inspection on 7 July 2011 illustrates how this might happen. In the field, an area was identified where flood water flowing across the narrow isthmus between the Río Colorado and Río San Juan a few hundred metres downstream of the Delta had scoured a channel in the floodplain (Figure II.20).

In this scenario, increased spilling of overbank flow to the San Juan during floods would scour several such channels, which would enlarge and combine to open up one or more additional mouths and pathways through which water could leave the Río Colorado and follow the Río San Juan. This would allow the Río San Juan to capture more of the flow at the Delta, especially during high discharges, leading to progressive growth of the Río San Juan and decline in the Río Colorado.



Figure II.20. Overbank scour generated by water spilling from the Río Colorado to the Río San Juan immediately downstream of the Delta during the flood of December 2010. Photograph taken by author on 7 July 2011.

In this scenario, substantive reductions in the discharge of the Río Colorado would lead inevitably to adverse and probably irreversible environmental impacts and ecological consequences throughout that river, including the distributary channels and lagoons that it feeds, the wetlands in the Isla Calero, and the coastal zone that receives its freshwater and sediment.

II.7 Impact of dredging on wetlands plus potential for further impacts if dredging continues

II.7.1 Area at risk

In Part I of this Report, the DIA identified by the Ramsar Mission in late-2010 was adopted as the area over which the impacts of constructing the 'Caño' and cutting one or possibly two meanders in the Lower Río San Juan were considered. This covered the northern part of the Isla Portillos (Figure II.21). The Ramsar report (Ramsar Convention on Wetlands, 2010) also identified a much larger Indirect Influence Area (IIA), but in Part I (of this report) it was concluded that the impacts of constructing the 'Caño' and cutting the meanders would be unlikely, alone, to produce detectable impacts in the IIA. This is not the case for Nicaragua's dredging programme.

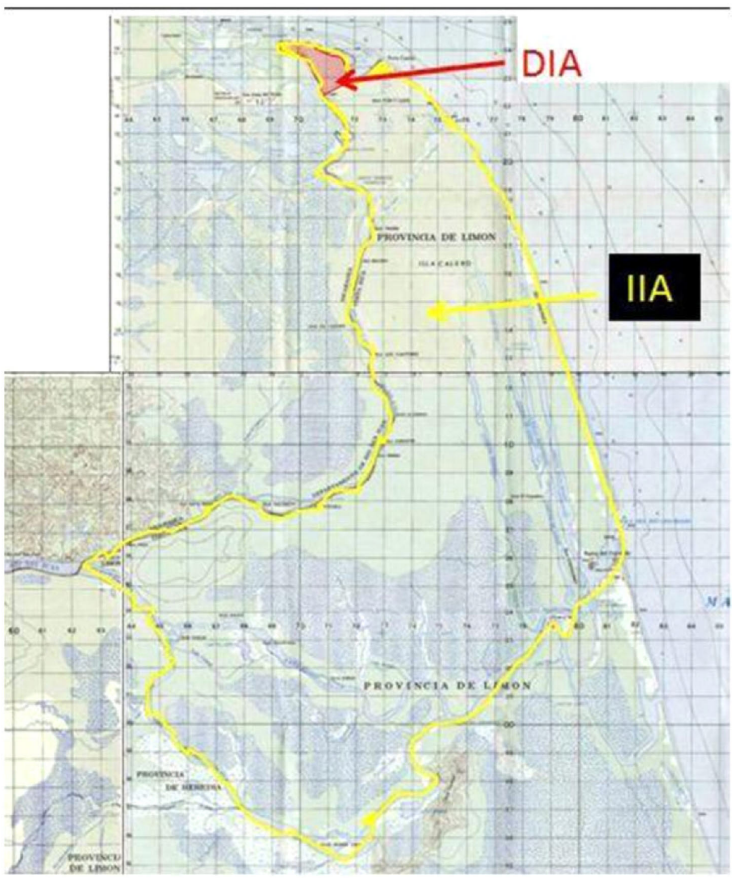


Figure II.21. Map illustrating the DIA and IIA delineated by the Ramsar Mission in their report of December 2010 (Ramsar Convention on Wetlands, 2010).

Dredging would impact the wetlands and coastal zone in the DIA and the rest of the Isla Portillos, the wetlands along the course of the Río San Juan and, possibly, the Río Colorado. Under a 'worst-case' scenario, the possibility exists that the whole of the IIA could also be affected. If dredging, further work to enlarge the 'Caño' and cutting of the second meander were all to proceed in a coordinated, concerted action, this possibility becomes a probability.

The IIA covers the entire Isla Calero, being bounded by the Río San Juan, Río Colorado, and coastline between the mouths of these rivers (Figure II.21). Thus, the DIA and IIA together encompass 21,725 ha of Ramsar-registered wetland that is home to one-third of the endangered species of fauna listed in Costa Rica (Ramsar Convention on Wetlands, 2010).

II.7.2 Environmental impacts

Approach

The preliminary report issued by the team involved in the Ramsar Mission conducted in November 2010 (Ramsar Convention on Wetlands, 2010) includes an authoritative description of

changes in the physical and ecological characteristics of the wetlands affected by the actions of Nicaragua in constructing the 'Caño' and cutting off a meander in the Lower Río San Juan, based on relevant technical documents, photographs, and satellite images. The author has taken the content of the Ramsar Mission's preliminary report as the baseline for assessing the impacts of Nicaragua's dredging programme in the Isla Portillos and Isla Calero (i.e., the DIA and IIA). In doing so, inferences have also been drawn from all the other documents and sources cited earlier in this Report, as well as the author's first-hand observations and interpretations, made during the field visit, boat trip, and over-flight on 7 July 2011.

River flow regimes

One of the effects of the dredging programme is to divert more of the flow approaching the Delta into the Río San Juan. This is bound to alter the flow regimes of the Río San Juan and Río Colorado to some degree, though the difficulties of accurately predicting the combined impacts of dredging the Río San Juan, straightening it, and diverting it to the Harbor Head Lagoon via the 'Caño' mean that changes could range from just 20 to 50 m^3/s (according to van Rhee and de Vries (2011)) to more than 4% (Aviles, 2010) or, if a tipping point in the balance of flows between the Río San Juan and Río Colorado is reached, much more than this. Even subtle changes to the flow regimes of either river would impact in-stream and estuarine environments and ecosystems, as well as those in the riparian corridor, linked lagoons and wetlands. These latter areas would be especially vulnerable to changes in the frequencies and durations of extreme high and low flows.

Hyporheic exchange and aquifer recharge

The aim of dredging is to lower the bed of the channel and so improve navigability. An unintended, but unavoidable, consequence of lowering the bed is to alter the relationship between the surface and sub-surface components of the hydrological system. This is important as it results in changes to patterns and rates of hyporheic exchange and recharge of the surficial and shallow aquifers, which are located in and directly beneath the wetland.

While the impacts and outcomes of these changes will be varied and location-specific, generally the effect will be to disturb hydrological processes in a band extending into the wetland on both banks of the Río San Juan along most of its length downstream of the Delta, as well as in linked water bodies including lagoons and seasonal lakes, with concomitant changes in the wetland's environment and ecosystems. Should enlargement of the Río San Juan lead to substantial reductions to flows in the Río Colorado, this would impact hyporesis and aquifer recharge over a much larger area, including the margins of the main stream, its distributaries, linked lagoons, and swamps.

Groundwater hydrology

The changes in the surficial and shallow hydrological systems outlined above have the potential to disturb the local and regional water balances, with consequential changes in groundwater elevations, groundwater quality and, near the coast, the position of the halocline.

Sediment and nutrients

The hydraulic and hydrologic impacts outlined above would certainly affect sediment dynamics and the capacity of surficial water bodies and wetlands to retain sediments and cycle nutrients in areas affected. As sediment and nutrient processes respond to disturbance in ways that are complex and non-linear, marked adjustments in the dimensions and morphologies of distributary and floodplain channels should be expected, with commensurate changes in their capacity to convey flood flows and sediment loads.

Soils

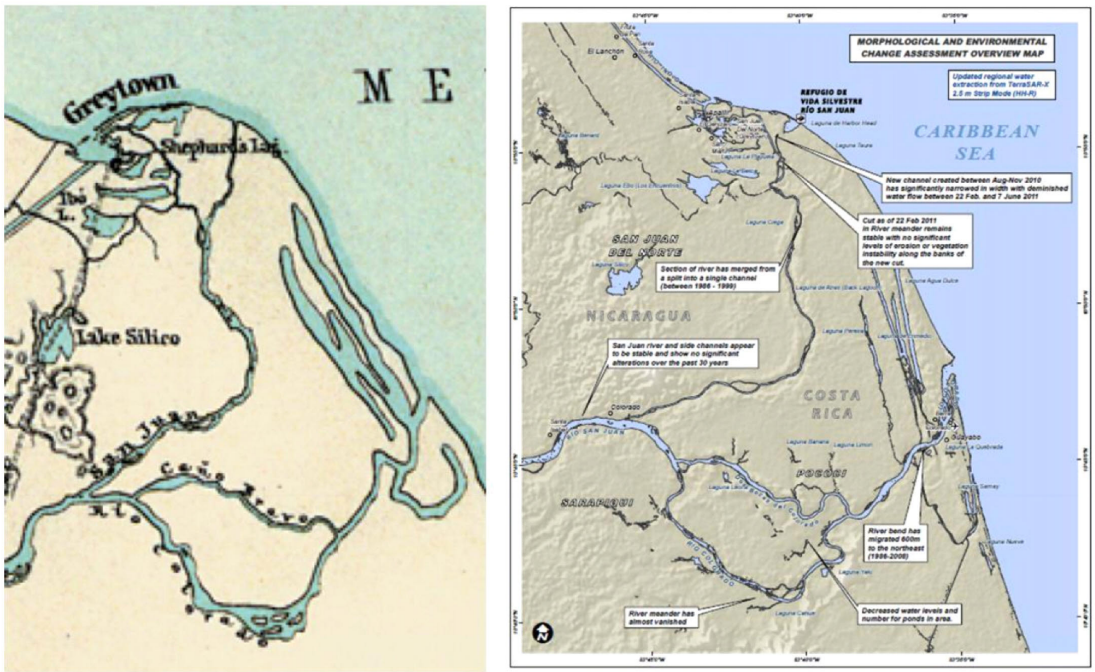
Changes in soil properties should be expected due to the hydrological, sediment, and nutrient impacts outlined above, especially in respect to increases in the frequency and duration of flooding that increase the extent of terrestrial areas subject to permanent inundation or long-term water-logging and/or elevated rates of sediment deposition. These outcomes would lead to consequential changes in soil moisture, chemistry, and biology in affected areas. Conversely, soils in areas subject to reduced frequencies and durations of inundation and sedimentation would be expected to experience changes in the geochemical properties due to reductions in soil moisture leading to, for example, increased weathering and oxidation.

Surface drainage network and geomorphology

The drainage network in the Isla Portillos and Isla Calero is dynamic and heterogeneous. It features distributary channels with micro-deltas, estuaries, lagoons, seasonal lakes and ponds, ancient and modern alluvial plains, and extensive wetlands. Yet, at the regional scale, the drainage network appears to have been stable for at least a century and probably much longer (Figure II.22). This is the case because the main elements of the drainage network are geologically controlled and have been adjusting to the regional structure and tectonics since the beginning of the Quaternary over 2 million years ago, driven by abundant runoff, naturally-high catchment sediment yields, and sediment dynamics in the Río San Juan.

Despite its apparent stability, it is possible that the regional drainage network could respond dynamically to the dredging programme through substantial morphological changes. While such changes would be short-lived when measured on a geological timescale, they could persist sufficiently long to radically alter the landscape and environment of the DIA and IIA.

For example, altering the balance of sediments diverted to the Río San Juan and Río Colorado branches at the Delta, would represent a step-change in the sediment regimes of the rivers, leading to dynamic process-responses and changes to channel cross sections, planform patterns, rates of bankline migration shifting that would be complex and widespread within the drainage network.



(a) 1887 (b) 2010

Figure II.22. Comparison between drainage networks mapped in 1887 and depicted in a contemporary DEM of the Isla Calero and Isla Portillo (DEM reproduced from the UNITAR/UNOSAT (2011b)).

Coastal geomorphology

The dredging programme will alter the delivery of sediments from the Río San Juan to the coast and could potentially impact delivery in the Río Colorado as well. Morphological changes to sand spits, barrier beaches, coastal lagoons, beaches, and the near-shore zone in the Bay of San Juan del Norte will result, with consequential changes to long-shore currents and sediment dynamics. This could also occur at Barra del Colorado. However, more detailed and intensive studies would be required to assess the types, extents, and morphological outcomes of such changes.

II.7.3 Environmental and ecological consequences

Water quality and haloclines in near-coast lagoon and estuarine systems

In areas where the supply of freshwater to near-coast wetlands and linked aquatic systems changes substantially, ecological outcomes result from alterations to hydrodynamics, sediment dynamics, thermal mixing/stratification, water quality, nutrient balances, and saltiness. Ecosystems adapted to pre-disturbance conditions may collapse, reducing the system's overall production and biodiversity, and threatening species, including some that are listed as endangered.

Trophic states in near-coast lagoon and estuarine systems

Trophic states in the aquatic and wetland systems are controlled by residence times for water, sediments, vegetable organic matter and other nutrients supplied by the drainage network. In the coastal zone, sea water is also input from the Caribbean Sea and a halocline within lagoons may contribute to the process known as "internal recharge," which generates an additional nutrient supply from lagoon sediments. Reduction in the supply and residence times of river water could result in eutrophication characterised by increased abundance of aquatic vegetation, elevated Biological Oxygen Demand (BOD) and reductions in water quality, and the capability of the system to support fish and herpetofauna. Conversely, increasing the flow of river water (and reducing its residence time) would cause a rapid reduction in the trophic state by leaching nutrients, loss of the internal recharge and input of higher sediment loads. Likely outcomes include significant reductions in aquatic plant communities, the abundance of phytoplankton, with a consequential effects on trophic webs.

Wetland water quality

The wetlands of the Isla Portillos and Isla Calero receive water from local rainfall, the channel network and groundwater, and it is the balance between these sources that controls the quality of soil moisture as well as water quality in the surficial, shallow, and deep aquifers. Rain and groundwater supplies have very low levels of total suspended solids that contrast with the high concentrations of sediments and nutrients in river water. However, interaction between rain water and the tree line enriches this water with the humic compounds. Changing the balance between supplies of river, rain, and groundwater in wetlands would alter surface, soil, and interstitial water qualities, including turbidity and the ratios of organic to inorganic compounds, with consequential outcomes for wetland ecosystems and biodiversity.

Water balance in the superficial aquifer

Water quality in the superficial aquifer is controlled by rainfall infiltration, influxes from groundwater, and seepage of river water during periodic inundation during flood events. Changing the frequency and duration of flooding would change the timing and quantity of river water inputs, altering the geochemistry of water in the aquifer with consequential impacts on those parts of the ecosystems dependent on it.

Trophic states in the wetlands

The trophic state of the wetlands of the Isla Portillos and Isla Calero, where grass marshes and/or wooded swamps predominate, is fundamentally controlled by maintenance of a stable water-table elevation, which depends on the water balance in the superficial aquifer. This, in turn, is controlled by variability due to changes in the balance between precipitation and evapotranspiration and periodic influxes of river water during flood events. If the supply of water received from the channel network changes, this alters the water balance, changing water levels and inducing water stresses through either increases or decreases in water-table elevation and variability. In either case the trophic state of the wetland will be reduced.

Wetland/riparian vegetation and soils covered in dredge spoil

Disposing of dredge spoil has adverse impacts on the wetland and riparian plant communities and soils that are actually buried at sites where spoil is dumped and these are likely to be irreversible. With the exception of the raised area used as a military encampment near the 'Caño' (see Part I of this Report for details), dredge spoil disposed of to date appears to have been placed on the left-bank floodplain of the Río San Juan, in Nicaraguan territory. However, implications for the environment and ecology of the right bank of the Río San Juan may emerge as the volume of spoil dumped and the number and size of sites increases. This is the case because the hydrologies of the river, surficial, shallow and groundwater systems are intimately linked. Local risks to the right-bank (i.e., Costa Rican territory) wetland stem from changes to the topography of the left bank and floodplain (for example, ground elevations in spoil areas will be raised by up to 1.1 m, disrupting flow paths during flood events), and soil compaction that changes soil moisture retention characteristics and hydrodynamics in the surficial and shallow aquifers. These impacts would be exacerbated if dredging destabilises the banks of the Río San Juan.

Abundance and distribution of aquatic species in lagoons and wetlands

As described above, changes in hydrodynamics, thermodynamics, geochemistry, water quality, and nutrient balances, lead to alterations to the trophic states, which determine the distribution and abundance of aquatic species in lagoons and other surficial water bodies within the wetland. Initially, the abundance and diversity of aquatic species will diminish, and communities may collapse completely in lagoons that are either severely affected or changed from closed to open systems by breaching of barrier beaches currently separating them from the Caribbean Sea.

Terrestrial vegetation species

Dredging will affect the spatial distribution, abundance, diversity, morbidity, and mortality of terrestrial species of flora (including trees) in the DIA and IIA due to changes in water stresses related to increases or decreases in the supply of river water, and consequential impacts including increased water logging or drying out of the soils, and changes to environments and ecosystems in affected areas.

Wetland vegetation species

Dredging will affect the spatial distribution, abundance, diversity, morbidity, and mortality of wetland species of flora (including trees) in the Isla Portillos and Isla Caleros through the effects of changes in the water balance, water-table elevation, seasonal flooding, water quality, sedimentation, and trophic states on plants growing in aquatic, swamp, and peatland environments. Location-specific outcomes will range from reductions in biodiversity through to elimination of species unable to adapt to change quickly enough and, in extreme cases, ecosystem collapse.

Aquatic fauna

The lagoons and estuaries of the Isla Portillos and Isla Calero are naturally able to support a very wide diversity of fish and herpetofauna due to their environmental and structural heterogeneities. However, the hydrodynamic, thermodynamic, geochemical, sedimentary and trophic attributes of the various water bodies connected with the drainage network will be altered by dredging, with some lentic systems becoming more lotic and some lotic systems becoming more lentic. Lagoons linked to the Río San Juan may receive additional river water, promoting increased mixing that disrupts or destroys vertical stratification to homogenize the water column, while in the Río Colorado losses of flow to the enlarged channel of the San Juan (if significant) could reduce the benefits currently gained from inputs of, for example, allochthonous organic materials and nutrients. These impacts would pose significant risks to multiple species, some of which are listed as endangered.

Loss of aquatic habitat due to transformation from lentic to lotic conditions

Dredging will transform conditions in any lagoons and wetland systems that receive sufficient additional runoff to convert them from a lentic condition (featuring vertical and lateral heterogeneity) to a lotic-type system, where the main environmental gradient is longitudinal. Such a change in the aquatic environment would lead to transformation from an environment with numerous, diverse habitats (structural heterogeneity) to one featuring a single, more extensive habitat dominated by runoff from the enlarged Río San Juan. Loss of habitat diversity would almost inevitably lead to a reduction in biodiversity.

Composition and reproductive success of lagoon and wetland species

Changing water and nutrient residence times, through increases or decreases in the inflows of river water, would cause a reduction in the trophic state in the short-term by the leaching of nutrients, loss of the internal recharge, and inflow of water with a high-sediment content. This process will reduce the recharge capacity and main energy source of the aquatic ecosystems (aquatic plants). In lagoons and wetland systems that receive significant quantities of additional river water, the metabolism would become more heterotrophic, that is, driven by the use and recycling of organic matter input by the river. Conversely, any lagoons and wetland systems where inputs of river water were significantly reduced would become less heterotrophic and more reliant on primary production within the water body (*autochthonous processes*). Such changes in the sources of carbon and nutrients that supply the trophic web will, in turn, alter the composition of species and affect their reproductive success.

Migratory and resident birds

In addition to posing problems for ichthyofauna, dredging of the Río San Juan and (were to occur) diversion of significantly greater runoff from the basin upstream that converted some of the linked lagoons and wetlands from lentic to lotic systems would lead to a reduction in food availability and habitat diversity for both migratory and resident bird populations.

Terrestrial fauna

If dredging of the Río San Juan results in significant changes to the frequencies and durations with which terrestrial and seasonally-flooded areas in the wetland system are inundated, consequent changes to terrestrial flora (both trees and understorey vegetation) would alter the types, spatial distributions, and diversity of terrestrial habitats and the food and shelter available to terrestrial fauna. The outcomes would be location-specific, ranging from reductions in biodiversity through to elimination of fauna unable to adapt quickly enough to change (perhaps including listed species) to, in extreme cases, collapse of the terrestrial ecosystem.

Fragmentation of natural biological corridors

If dredging, straightening and diversion of the Río San Juan leads to significantly-increased frequencies and durations of flooding in terrestrial areas coupled with overbank scour and destabilisation of banklines along the main stream and distributary channels in the drainage network, this could cut existing, natural corridors for passage and migration of terrestrial species and create new barriers for terrestrial fauna with restricted mobility.

II.7.4 Environmental valuation

The previous sections highlight both the ecological significance of the Isla Portillos and Isla Calero and the vulnerability of their ecosystems to disruption and degradation that would result from coordinated dredging, straightening and diversion of the Río San Juan. In addition to their national and international importance as part of the HCN Ramsar site, and the ecosystems linked to the Río San Juan and Río Colorado also have value due to the ecological services provided by their natural capital (Table II.14).

Table II.14. Ecosystem services provided by wetlands as defined the by Millennium Ecosystem Evaluation from 2005 (source: adapted from Ramsar Convention on Wetlands (2010)).

Supply of Services	Regulation of Services	Cultural Services
Products Obtained from the Ecosystems	Benefits Obtained from Ecosystem Regulation Processes	Non Material Benefits Received from Ecosystems
• Food • Potable water • Fuel • Vegetable fiber • Biochemicals • Genetic resources	• Climate regulation • Disease control • Water regulation • Water purification • Pollination	• Spiritual and religious • Recreational and touristic • Aesthetic • Inspirational • Educational • Sense of identity • Cultural capital
Support Services		
Services necessary for the production of all the other services of the ecosystem		
Soil formation	Nutrient Cycling	Primary Productivity

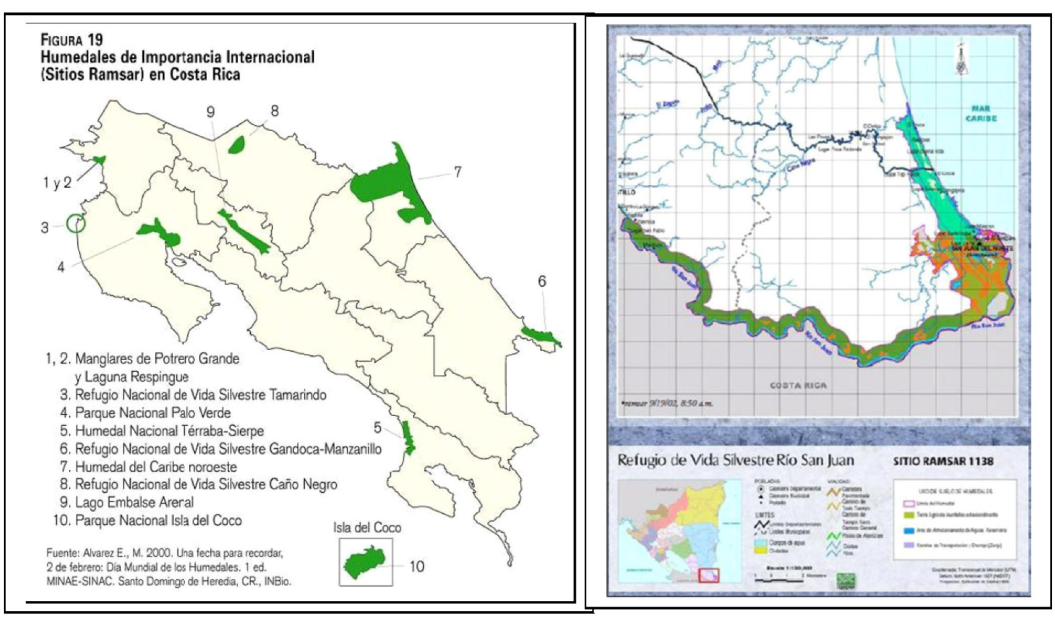
Specific services provided in the HCN include:

- flood control;
- surface water and aquifer recharge;
- sediment and nutrient retention;
- water purification;
- biodiversity; and
- wetland products including sport and subsistence fisheries, hunting and forest products, recreation, and tourism.

With respect to biodiversity, the HCN has the highest terrestrial floral and faunal biodiversity in the Costa Rican Caribbean because it provides particularly valuable habitats such as:

- beaches,
- terrestrial forests,
- flooded forests,
- Rafia (*Raphia taedigera*) areas,
- herbaceous swamps, and
- floating herbaceous communities.

The importance of protecting these and other habitats and the ecosystems they support has long been recognised through the award of conservation designations to areas along both banks of the Río San Juan in Costa Rica and Nicaragua (Figure II.23).



(a) Costa Rica (b) Nicaragua

Figure II.23. Protected areas. Note the Humedal del Caribe Noreste and the Refugio de Vida Silvestre Río San Juan along the right and left banks of the Río San Juan, respectively.

Aguilar-González and Moulaert-Quirós (2011) undertook an Ecological Economic Valuation to establish the value of ecological goods and services provided by natural capital in the IIA identified by the Ramsar Mission. The limited data available to support application of the method to the IIA meant that uncertainty in the results was high and to represent this, lower- and upper-bound estimates for the value of ecological services were calculated rather than a single, best-estimate.

According to their calculations, Aguilar-González and Moulaert-Quirós (2011) estimate the annual value of natural capital and ecological services provided annually by the IIA are likely to exceed $33 million. For comparison, a study performed independently by Astorga (2011a) produced an estimate of the order of $60 million for the annual value of ecological services in the IIA.

The higher values in Astorga's analysis stem from inclusion of ecological services provided in sensitive beach and coastal areas outside the IIA. The justification for their inclusion is that the effects of, for example, breaching the barrier beach that separates the Harbor Head Lagoon from the Caribbean Sea, and changing the locations and rates of outflow of freshwater and sediments to the coastal zone could trigger changes in coastal currents and sediment fluxes, with environmental consequences felt as far away as Uvita Island and Cahuita National Park in south-eastern Costa Rica that would affect important species such as sea turtles.

It is clear from the evidence provided in Part I (of this Report) that dredging, straightening, and attempting to link the Río San Juan to the Harbor Head Lagoon via the 'Caño' has already led to adverse environmental impacts and loss of environmental capital in the Isla Portillos and Harbor Head Lagoon. For example, the clearance of primary forest to make way for the 'Caño' alone is reported by Aguilar-González and Moulaert-Quirós (2011) to have led to the loss of trees with a Total Value Estimation (TVE) estimated to exceed $1.5 million. This does not reflect only the commercial value of the trees as lumber, but includes their value as natural capital and the value of the ecosystem they supported and the ecosystem services they were providing prior to their destruction.

Although substantial, these sums would be eclipsed by far greater environmental costs if the dredging programme were to be continued and intensified, especially if accompanied by renewed attempts to link the Río San Juan to the Harbor Head Lagoon by, for example, improving the approach and entrance conditions to the 'Caño', re-excavating or enlarging its channel, or diverting a significant proportion of the flow from the Río San Juan into the Harbor Head Lagoon by some other means. This is the case because continuing to dredge the Río San Juan would not only add to and amplify environmental damage already suffered in the DIA, but also, potentially, extend the affected area to the Isla Calero and possibly even the much wider area influenced by currents and near-shore sediment dynamics in the Caribbean Sea.

Under a 'worst-case' scenario, where dredging, straightening and diverting the river interact synergistically to take the divisions of flow at the Delta and the 'Caño' to their geomorphic tipping points, a significant proportion of the future valuations of the IIA provided by Aguilar-González and Moulaert-Quirós (2011) and Astorga (2011a) could be lost due to loss of natural capital and reduction in the capacity of the Isla Calero to generate ecological services. Under

this unlikely, but perhaps not impossible scenario, losses of natural capital and ecological services could be measured in tens of millions of dollars.

In conclusion, the evidence assimilated and considered in Part II of this Report suggests that the morphological, environmental, and ecological risks associated with continuing the dredging programme are serious. It also emphasises the necessity of avoiding any actions that might increase the probability that the cumulative effects of dredging, straightening and diverting the Río San Juan might destabilise the natural division of flows at the Delta, due to the potentially dire environmental and ecological consequences for the Isla Calero.

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PART IV. OVERALL CONCLUSIONS

With respect to the issues and questions in the Terms of Reference for this Report, the following conclusions reflect the honest beliefs of the author:

The 'Caño'

1. Identify whether the canal known as the 'Caño' that extends from the Río San Juan to the Harbor Head Lagoon is an established waterway or is recently constructed.

   The channel of the 'Caño' that extends for about 1,208 m from the right bank of the Río San Juan to the head of the inlet at the southern tip of the Harbor Head Lagoon is recently constructed. The final 336 m of the 'Caño' makes use of a natural inlet that is probably a remnant of the Bay of San Juan del Norte.

   To the extent that the 'Caño' is recently constructed, please provide an estimate of when it was constructed and explain the means by which it is possible to establish this fact.

   Preparatory work to clear a path for the 'Caño' began in earnest in October 2010 and the channel itself was excavated by removal and dumping of around 5,800 m^3 of soil between 1 and 19 November 2010. It is possible to establish this because a large body of evidence has been assembled and assessed in this Report including satellite imagery, oblique aerial photographs, documented field investigations performed by technical specialists from SINAC and Ramsar, and scientific analyses using well-established methods and techniques.

2. Identify changes to the morphology of the Río San Juan which have resulted from the presence of the 'Caño'.

   To date, the impacts of the 'Caño' on the morphology of the Río San Juan have been limited to the creation of its funnel-shaped mouth in the right bank. This is the case because, even at its peak in December 2010, the 'Caño' diverted no more than a few percent of the river's discharge and, by July 2011, flow entering the 'Caño' had receded due to siltation in the channel and, especially, its mouth. It may, therefore, be concluded that the magnitude and duration of flow diversion into the 'Caño' were too small to drive more widespread morphological changes in the Río San Juan.

3. Identify potential effects to the surrounding wetland as a result of further dredging of the 'Caño'.

   Construction and operation of the 'Caño' has adversely impacted the Harbor Head Lagoon and surrounding wetlands. Within the Harbor Head Lagoon, inflows of sediment-laden river water during December 2010 altered the turbidity, nutrient balance, water quality, benthic conditions, and salinity. In the wetland, disturbance during construction was accompanied by habitat loss that included the destruction of at least 292 mature trees, some with ages in excess of 200 years, and changes to the topography, surficial hydrology, and the shallow aquifer beneath the wetland resulting from digging of the channel. The Total Value Estimate

(TVE) for loss of natural capital and ecological services resulting from destruction of the trees is estimated to have exceeded $1.5 million. Further digging or dredging of the 'Caño' would increase the discharge of river water diverted into the Harbor Head Lagoon, leading to breaching of the barrier beach that separates the lagoon from the Caribbean Sea. Resultant changes in the surficial and sub-surface hydrology, salinity, and trophic state of the lagoon and surrounding wetland might lead to irreversible collapse of the ecosystem in the northern Isla Portillos. The annual value of the ecological services provided by natural capital in the northern Isla Portillos has been estimated to exceed $0.6 million and, under this 'worst-case' scenario, a large proportion of these services would be lost.

Nicaragua's Dredging Programme

4. Identify and outline the effect of dredging on river morphology.

   Dredging increases the depth of a river and reduces the degree of local, morphological variability by removing shoals. Both these changes tend to reduce energy losses and may increase the mean velocity. In the case of a distributary river, dredging would be expected to increase the proportion of the approaching discharge that flows to the dredged branch at a bifurcation. A common side effect of dredging is to over-steepen the river banks, leading to bank retreat and channel widening that further enlarges the cross section. Dredging may also trigger dynamic process-response mechanisms in the fluvial system, producing complex morphological adjustments which are impossible to predict in detail, but which can amplify rather than dampen the destabilising effects of dredging on river morphology.

5. Identify and analyse the effect of Nicaragua's dredging programme on the following:

   a. Sedimentation in the Río San Juan;

      The volume of bed material removed in the dredging programme is estimated by Nicaragua to be 1.6 m^3, which equates to about ten times the annual sand load supplied to the Río San Juan downstream of the Delta. Given the low gradient of the river, the most likely short-term effect on sedimentation in the Río San Juan will be for more of the sand load (which moves as bedload and in suspension near the near the bed) to be deposited within a relatively short distance downstream of the Delta. This would reduce the depth in the navigation channel, necessitating further dredging to maintain navigability during low flows. The finer, silt load (which is mixed throughout the water column as suspended wash load) will continue to be carried downstream through the fluvial system. Through time, the cumulative effects of repeated dredging to maintain navigability may produce further impacts on sedimentation that extend beyond the vicinity of the Delta to at least the reach-scale.

   b. Morphology of the Río San Juan; and

      Morphological changes to the river in the vicinity of dredged sites are inevitable and these sites are distributed throughout the Lower Río San Juan. On 7 July 2011, dredgers were observed at three different locations and were positioned close to both the left and right banks. It is, therefore, likely that direct, morphological effects include:

- *widespread damage or destruction of bedforms and bars,*
- *artificial changes to flow depths and channel roughness throughout the reach,*
- *bank over-steepening where dredging is performed close to the bank, and*
- *mechanical damage to banks and riparian areas by vessel manoeuvring and mooring.*

The cumulative effects of dredging at multiple sites distributed throughout the river may be sufficient to produce significant morphological responses at the reach-scale. Dynamic morphological responses to the dredging programme are more difficult to predict because feedback loops operating in the fluvial system may diffuse or magnify them through time and space, which could necessitate further dredging to maintain or enlarge the navigation channel. Also, there exists the possibility that diverting water into the 'Caño' and cutting off one or possibly two meander bends could interact synergistically, moving the Delta closer to its geomorphic tipping point and leading to significant increase in the discharges of water and sediment carried by the Lower Río San Juan – an unlikely but perhaps not impossible scenario.

c. Flows and morphology of the Colorado River.

To date, there is no evidence that the dredging programme has significantly affected flows in the Río Colorado. The stated intention of the dredging programme is to create a navigation channel 20-m wide on the bottom, 30-m wide on the surface, and 2-m deep. Hydraulic modelling suggests that lowering the bed by 1 m might result in a decrease in discharge in the Río Colorado of around 4%, rising to 9% if the bed were lowered by 2 m. The Río Colorado feeds a complex network of distributary channels with micro-deltas, estuaries, lagoons, seasonal lakes and ponds, ancient and modern alluvial plains, and extensive wetlands. These morphological features will be affected by the dredging programme if it significantly alters the balance of water and sediment diversion at the Delta. In such a scenario, dynamic process-responses in the fluvial system of the Río Colorado would drive changes to sedimentation, channel cross sections, planform patterns, and rates of bankline migration that would be complex, widespread, and difficult or impossible to reverse.

6. Identify and describe any resulting or expected changes to the morphology of the Río San Juan resulting from the cutting of meanders.

Cutting off meanders is known to perturb the fluvial system and may generate medium- to long-term morphological instability, including degradation upstream and aggradation downstream, and bank erosion where re-aligned flow impinge against the banklines. The low-gradient and erosion-resistant banks of the Río San Juan reduce the river's sensitivity to perturbation and this should limit the impacts of the single cut-off constructed to date. However, if a second cut-off were to be constructed, this would align flow in the Río San Juan with the mouth and heading of the 'Caño' increasing the percentage of flow diverted to the Harbor Head Lagoon. Though unlikely, the risk is that synergistic interaction between the meander cut-offs, the dredging programme, and the 'Caño' could lead to a 'worst-case' scenario in which a substantial change in the balance of flows at the Delta results in system-

wide morphological impacts throughout the drainage networks of the Río San Juan and the Río Colorado.

General

7. Identify any other environmental impacts that have, will or might result from either the presence of the 'Caño' or the dredging of the Río San Juan.

Construction and operation of the 'Caño' had impacts in the Harbor Head Lagoon and wetlands in the Isla Portillos that were immediate and adverse. Within the Harbor Head Lagoon, impacts include inflows of sediment-laden river water during December 2010 that altered turbidity, nutrient balance, water quality, benthic conditions and salinity. If river water continues to flow through the 'Caño', resultant changes in habitats and the trophic chain will likely impact aquatic flora, aquatic fauna, and resident and migratory birds, leading to reductions in reproductive success and biodiversity, and increases in vulnerability, morbidity, and mortality. In the Isla Portillos wetland, construction of the 'Caño' led to disturbance and habitat loss, including the destruction of at least 292 mature trees, some with ages in excess of 200 years, and changes to the topography, surficial hydrology, and shallow aquifer beneath the wetland resulting from digging of the channel. The TVE for loss of natural capital and ecological services related to destruction of the trees is estimated to exceed $1.5 million. Re-excavating or enlarging the Caño' might lead to breaching of the barrier beach that currently separates the Harbor Head Lagoon from the Caribbean Sea, triggering changes in the surficial and sub-surface hydrology, salinity and trophic state of the lagoon and surrounding wetland, and collapse of the ecosystem in the northern Isla Portillos that could be irreversible.

Naturally-high sediment and nutrient concentrations in the Río San Juan, together with the mobility of the sand bed, are likely to have limited impacts of increased turbidity, reduced water quality and disturbance to the benthos that are customarily associated with dredging. Even so, mechanical and sediment-related disturbance to the environment and ecosystem at each dredging site are inevitable and the extent of the dredging programme is sufficient that cumulative effects and morphological responses may yet produce environmental impacts that extend beyond the site to at least the reach-scale. The evidence assembled and assessed in this Report suggests that the morphological, environmental, and ecological risks associated with continuing the dredging programme are serious. It also emphasises the necessity of avoiding any future actions that might increase the probability that further dredging, straightening, and diversion of the Río San Juan might interact synergistically to destabilise the natural division of flows at the Delta, due to the potentially dire environmental and ecological consequences for the Isla Calero should this occur.

CERTIFICATION

I have the honour to certify that the documents annexed to this Memorial are true copies and conform to the original documents and that the translations into English made by Costa Rica are accurate translations.

Ambassador Edgar Ugalde Alvarez

Agent of Costa Rica

5 December 2011

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