

INTERNATIONAL COURT OF JUSTICE

**DISPUTE CONCERNING
CERTAIN ACTIVITIES CARRIED OUT BY NICARAGUA
IN THE BORDER AREA
(COSTA RICA V. NICARAGUA)**

COUNTER - MEMORIAL
OF THE REPUBLIC OF NICARAGUA



**VOLUME II
(ANNEXES FROM 1 TO 26)**

06 August 2012

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Annex 1

Rives Second Report (Transcription)

2 March 1888

Second

If the Treaty of the 15th April, 1858 is valid, what is its true meaning in respect of the various matters submitted for decision?

One question of interpretation is formulated by the Treaty of Arbitration itself, and eleven others are submitted by Nicaragua under the sixth article of the Treaty.

The preliminary question, which is expressly raised by the Treaty of Arbitration, is as follows: "If the Arbitrator's award should determine that the Treaty [of 1858] is valid, the same award should also declare whether Costa Rica has the right of navigation of the River San Juan with vessels of war or of the revenue service."

The answer to this question depends upon a consideration of Article VI of the Treaty of 1858, which reads as follows:

"Article VI. The Republic of Nicaragua shall possess exclusively the dominion and supreme control (tendrá exclusivamente el dominio y sumo imperio) of the waters of the River San Juan from its outlet from the Lake until it empties into the Atlantic; but the Republic of Costa Rica shall have the perpetual right of free navigation (los derechos perpetuos de libre navegación) on the said waters from the river's mouth to three English miles below Castillo Viejo, *for the purposes of commerce*, whether with Nicaragua, or with the interior of Costa Rica by way of the Rivers San Carlos or Sarapiquí or any other route proceeding from the tract on the shores of the San Juan which is hereby declared to belong (que.... se establece corresponder ...) to the last named Republic. The vessels of both countries may indiscriminately approach the shores of the river where the navigation is common; and no charges of any kind of duties shall be collected unless where levied by mutual consent of both Governments."

The foregoing Article it will be observed is silent as to the right of navigation by public vessels. If such a right exists, it must by virtue of a general rule and not affected by the Treaty, or must be implied from the general scope and purpose of the Treaty stipulations.

In considering these aspects of the case, it must be remembered that the boundary line runs along the right bank of the river from its mouth to a point three English miles below the Castillo Viejo and that the river above that point runs wholly within Nicaraguan territory. It should also be noted that the San Juan, -besides the mouth above referred to, - had two other mouths, the Colorado and the Taura both of which run to the sea through Costa Rican territory. The following provisions of the Treaty of 1858 are also important: "Article IV ... Costa Rica shall be bound, as far as the portion of the banks of the San Juan which belongs to her is concerned, as Nicaragua is by treaties, to contribute to its custody in the same way that the two Republics shall contribute to the defence in case of a foreign aggression, and this they shall do with all the efficiency within their reach." "Art. IX... Under no circumstances and even in case the Republics of Costa Rica and Nicaragua should unhappily find themselves in a state of war, shall either of them be allowed to commit any act of hostility against the other ... in the San Juan River."

Upon these facts, it is argued by Costa Rica that the provisions of Art. IX, forbidding acts of hostility on the River, imply a right of using it in peaceful ways; that the stipulations giving Nicaraguan vessels the right to unload on the Costa Rican side presuppose the Right of Costa Rica to watch her shores by a river police; that by analogy with ports of free entry which, it is asserted are always considered to be accessible to foreign men-of-war, a navigable river like the San Juan is to be regarded as open to the men-of-war of friendly nations, that the maxim qui dicit de uno, negat de altero, does not apply here, as the right to navigate with public vessels is not in any respect inconsistent with the right of navigation *for purposes of*

commerce; that by the usage of nations navigation of territorial waters by foreign public vessels can only be forbidden by express stipulation as in the case of the Dardanelles, and that under Art. IV Costa Rica must be permitted to maintain her vessels on the San Juan in order to guard and defend it with all the efficiency within her reach.

Some of these arguments may be dismissed at once.

The prohibition of acts of hostility on the river, cannot be construed as conferring on Costa Rica a right to maintain upon its waters public vessels in time of peace. The implication, instead would seem to be the other way.

The right of Nicaraguan vessels to land freely on the Costa Rican side confers no right on Costa Rica to maintain a river police. She has undoubtedly the right to establish Custom Houses along the River and to maintain a force of revenue officers. But this force need not necessarily patrol the river in boats. This may be a convenient way of preventing smuggling; but it is not so necessary an incident to the rights of Costa Rica to enforce her customs laws as to be inevitably implied ex-necessitate from the provisions of the treaty.

The stipulations of Article IV throw no light on this question. All that Article requires is that Costa Rica should repel foreign aggression on the river with all the efficiency within her reach. If under the terms of the Treaty, Costa Rica is not permitted to maintain vessels of war on the River she cannot be regarded as derelict if she fails to oppose foreign aggression in that quarter by her naval forces. Impossibilities are not required. Costa Rica would only be bound to contribute to the defense of the stream by land, a mode of defense, it may be added which seems better adapted to a River of the size and character of the San Juan.

The matter is less clear when we consider the rights conferred by this treaty in the light of international usage, for the present case appears to be one without exact precedent which must be governed by analogies more or less remote.

It must not be forgotten that the sovereignty of Nicaragua extend over all the waters of the San Juan. In the unusual and forcible language of the Treaty, she possesses exclusively the domain and supreme control of these waters. Costa Rica is bounded not by the thalweg, or the middle of the stream, but by its right bank. Any vessel navigating the river is, therefore, within Nicaraguan territory and on Nicaragua falls exclusively, the duty of policing the stream.

Leaving out of sight for the present the fact that Costa Rica owns one bank of the San Juan and regarding solely as a Nicaraguan river, we may first enquire whether the right of free commercial navigation granted to Costa Rica necessarily involves the right of navigation by her vessels of war.

The writers upon international law leave the matter in some doubt. Hall (International Law, Oxford 1880 § 42) says: "The right of innocent passage does not extend to vessels of war. Its possession by them could not be explained upon the grounds by which commercial passage is justified. The interests of the whole world are concerned in the utmost, -liberty of navigation for the purposes of trade by the vessels of all States. But no general interests are necessarily or commonly involved in the possession by a State of a right to navigate the waters of other States with its ships of war. Such a privilege is to the advantage only of the individual State; it may often be injurious to third States; and it may sometimes be dangerous to the proprietor of the waters used. A state has therefore always the right to refuse access to its territorial waters to the armed vessels of other States, if it wishes to do so."

And see also § 55, in which he states that foreign ships of war enjoy extraterritoriality; and in extreme cases as when the peace of a nation is seriously threatened or its sovereignty is infringed such a ship may be summarily ordered out of the territory.

Bluntschli (Lardy's Trans, § 321) After stating that foreign men-of-war enjoy complete extraterritoriality when entering the waters of a State by its permission, adds: "Il faut toujours 'que le navire de guerre étranger ait reçu l'autorisation de pénétrer dans les eaux dépendant du territoire de l'état."

He considers that the usage in respect of extra-territoriality is based not on courtesy but on the difficulty and danger to the local police of acting with effect towards the crew of a man-of-war; and he states that in case of violations of the laws of the port, the local authorities have ample power to command a foreign man-of-war to quit the harbor.

Calvo, on the other hand, in his Dictionnaire de Droit Internationale (Paris, 1885, tit. Navire) says: "A moins de prohibitions et de règlements ou de Lois formellement contrains, les ports sont considérés comme libres et ouverts pour les navires de guerre et les corsaires des peuples avec lesquels on est en paix." The same view is taken by Sir Frasers Twiss in his on the Rights and Duties of Nations in time of Peace (2nd Ed., 1884, § 165).

Reference may also be made to the case of the Exchange (7 Cranch, 116) in which the Supreme Court of the US had occasion to enquire as to the jurisdiction of the Courts of this country over foreign ships of war. Chief Justice Marshall, delivering the opinion of the court, after stating the rule applicable to the transit of foreign troops by land said: "but the rule which is applicable to armies does not appear to be equally applicable to ships of war entering the ports of a friendly power... A different rule therefore, with respect to this species of military force, has been generally adopted. If for reasons of state, the ports of a nation generally or any particular ports be closed against vessels of war generally, or the vessels of any particular nation, notice is usually given of such determination ... if there be no prohibition the ports of a friendly nation are considered as opened to the public ships of all powers with whom it is at peace... the implied license, therefore, other which such a vessel enters a friendly port, may reasonably be construed, and it seems to the Court ought to be construed, as containing an exemption from the jurisdiction of the sovereign within whose territory she claims the right of hospitality." See also the opinion of Mr. Cushing in 7 Op Atty. Gen. 122.

The case of the Dardanelles is cited by Costa Rica as illustration of the theory that Treaty stipulations alone suffice to exclude foreign ships of war from friendly waters. But Halleck remarks (Backers ed., London., 1878, chap 6 §21) that these straits been within the territorial jurisdiction of Turkey "she has a right to exclude all foreign ships of war from entering or passing either the Dardanelles or the Bosphorus", this right he adds was "recognized", not created by the treaties of 1840, 1841, and 1856.

It will thus be seen that there is at least an apparent contradiction between these authorities. But the conclusion may perhaps be fairly deduced from an examination of all the opinions cited, that although a passive permission or implied license, to visit a friendly port is usually understood to be granted to foreign man-of-war, yet such permission is always to be regarded nearly as an act of comity and hospitality. But his privilege is now so generally accorded that it is hardly to be distinguish from a right. Except in the case of the Dardanelles, it is understood that civilized nations at the present day, impose no restriction upon the friendly visit of foreign men-of-war in time of peace; and this general usage maybe said to constitute an imperfect right to entitle such vessels to claim hospitality.

But it is not important at present to determine precisely the limitations of this privilege.

We are next to enquire whether there is any different rule where the nation owning the visiting vessels also owns territory bordering upon the waters visited.

I find no authority upon this point; but in my judgment this circumstance is not material, for all the reasons which apply to one case apply also to the other. The close proximity of two countries, divided only by a navigable stream may make the frequent passage of public vessels proper, and even necessary; specially where, - as in the present case, - such stream forms a highway between two parts of the dominion of the state that borders on, but does not own such waters. But the same fact of proximity also emphasizes the importance of avoiding difficulties to which the impossibility of control by the local police over foreign national vessels might easily give rise.

It remains to be considered whether vessels of the revenue service stand upon any different footing from vessels of war. It would seem evident, from the reason of the rule, that they do not; and this view is fully sustained by the authorities. In the case of the Parlement Belge (Eng law rep., 5 p.d.197) the English Court of Appeal decided that the test of extraterritoriality was not the fact that a vessel was an armed ship, but the fact that she was the public property of a foreign state, and destined to its public uses. In the United States the same doctrine, in substance, has been applied to light ships, which have been held exempt from ordinary judicial process. See also Calvo, Dictionnaire de tit. Navire, Hall §44; Twiss §165.

The preliminary question of interpretation as to the right of navigation of the San Juan by public vessels of Costa Rica, should, therefore, in my judgment, be answered by saying that the vessels of war and of the revenue service belonging to Costa Rica have the same privilege of navigating the River San Juan as usually accorded in their territorial waters by civilized nations to the public vessels of friendly powers in time of peace, - but no other, or greater privileges.

I shall now take up in order the points submitted for interpretation by the Government of Nicaragua.

1. Punta de Castilla point having been designated as the beginning of the border line on the Atlantic side and finding itself, according to the same Treaty, at the mouth of the San Juan River; now that the mouth of the river has been changed, from where should the boundary start?

The facts in regard to this branch of the inquiry are set forth at length in the reply of Nicaragua.

It appears that long and antecedent to the Treaty of 1858 the River San Juan had established itself in three streams from the delta to the Sea namely the San Juan proper which enters the harbor of Greytown; the Taura, which branches off to the South, six miles above Greytown, entering the sea five miles from Greytown; and the Colorado which also branches to the south, eighteen miles above Greytown and enters the sea about the same distance South to the port.

The Taura is an unimportant stream, the mouth being invariably closed in the dry season. The Colorado, ever since 1860 has been the main stream. In that year, the waters were diverted from the San Juan proper into the Colorado, and now by far the greater part of the waters of the present stream finds its outlet through that river. In the height of the dry season, at least twenty times as much water goes to the Sea by way of the Colorado as by the San Juan proper.

Not less serious changes have taken place in the Harbor of Greytown since the date of the Treaty. This Harbor which lies in a bend of the Coast and looks towards the North owes its origin, as well as its destruction, to the gradual extension from East to West of a tongue or bar of sand. In the course of a century or more this mole has steadily grown outwards across the land in which Greytown stands. At first, its effect was to enclose a sheet of sheltered water with an easy entrance, but as the extending tongue approached

the main land at the western side of the bay the entrance became difficult and finally closed. This occurred about 1862, since which date none but small coasting vessels and small tugs have been able to enter the Harbor. The great diversion of the waters of the San Juan into the Colorado referred to above are said to have accelerated the closing of the Harbor entrance but not to have been the primary cause of it.

In the dry season, at the present time, it is with difficulty that the water of the river can maintain an opening into the sea at Greytown, and the opening is subject to the most capricious changes. Sometimes the entrance closes almost completely in a single day, sometimes the force of the sea will heap up the sand along the tongue, or mole, so that the waters of the river are entirely shut in, and a channel has to be cut across the bar of sand to allow the pent-up waters to force an opening. The river will sometimes force its way to the sea at one place, sometimes at another; and it will change repeatedly in the course of a single month.

In 1858 there was still a good entrance to the Harbor, and one side of this entrance was formed by the extremity of the Punta de Castilla. But even at that time this tongue of land was occasionally broken through by the sea; although so long as there was an open entrance to the Harbor, it was through that channel that the waters of the river flowed into the sea.

Since 1858 that state of things has entirely changed. There is now no such thing as a fixed Harbor entrance or a fixed Harbor mouth. The waters of the river enter the sea at any place where they can easily break through the sand heaped up by the sea; and where there was a single tongue of land, there is now a chain or group of shifting islands.

Two processes are observable in this history of growth and destruction; one the gradual accretion of the land spit known as the Punta de Castilla ad it grew across the mouth of Greytown Harbor from East to West, the other more or less sudden breaking through of this spit by the action of the Sea or by the pressure of the waters of the River, and, as it appears occasionally by the hand of man.

To these facts, the following rules adopted in international law are applicable:

First: when a River, or one of its banks forms boundary between two states, it continues such without regards to changes produced by gradual accretion or gradual erosion. In the event of addition by accretion, these belong to the owner of the bank on which they were formed.

Second: when a River, which serves too mark the boundary between two states, wholly or partially deserts its old channel and forms for itself a new one entirely within the borders of one of the two states, the old Channel remains the boundary.

These principles are stated and amplified in numerous works on both international and municipal law, among which I refer to the following:

Grotiuer, Liv. II, Cap III §§ 16,17;

Nattel, Liv. I, Cap XXII, §§268-270;

Rutherford, Book II, Ch IX, §7;

Steffter, §66;

Phillmore, Vol. I pp 342-345 (3rd ed. 1879).

Calvo, Livre V. §§341-2 and authorities there cited (ed. 1887).

Angell on watercourses §48vo 59ava;

New Orleans v. US. Ten perters 662, 717;

Banks v. The Ogden, 2 wall.57;

Opinion of Atty. General Cushing, 8 Op. 175.

This last authority relates to the shifting bed of the Rio Grande forming part of the boundary between the United States and Mexico, and it is understood that the views there expressed have always commanded the accent of both nations in the numerous discussions that the varying character of the Rio Grande has occasioned.

Applying these principles to the facts on the case in hand, I conclude that whatever has added by accretion to the sand spit known as Punta de Castilla became a part of it and so a part of the territory of Costa Rica. When the water broke through the spit the part there by severed remain Costa Rican territory still. Any growth of or addition to such a severed part, by accretion did not affect the title. And the breaking through or washing away of a portion of such an island or its division into two or more smaller parcels, will still leave what remains a part of Costa Rica.

The boundary line on the Treaty of 1858 must therefore begin at, and include (illegible) Costa Rica, the islands which by a process of accretion and disruption have formed from the sand spit that was originally the extremity of the Punta de Castilla.

2. How shall the center point of the Salinas Bay, which is the other end of the dividing line, be fixed?
3. Whether by that center point we are to understand the center of the figure; and as it is necessary for its determination to fix the limit of bay towards the ocean, what shall that limit be?

These two questions relate to the same subject and must be considered together. The Treaty provides for the western part of the boundary that from a point on the Sapoá River two mouths from its mouth, "an astronomic straight line shall be drawn to the center point (el punto céntrico) of the Salinas Bay in the South Sea where the line marking the boundary between the two contracting republics shall end.

It is admitted by both parties that this Bay is correctly delimited on the US hydrographic office chart entitled Salinas Bay, from a survey of 1885 by the officers of the USS Ranger.

This chart exhibits the Bay as deep somewhat irregular sheet of water about four and a half miles long by nearly three miles wide of a horseshoe shape and looking a little to the north of west.

Nicaragua contends that the center point "is to be formed by treating the mouth of the bay as marked on either side by Punta Mala and Punta Sacate, and that then a point should be fixed on the shore which meandering along the shore line – is equidistance from each of these starting point." Such a construction of the Treaty seems to me to be clearly inadmissible. The center point of the Bay can not, under any ordinary interpretation, mean a point on the shore. The center of the bay must be the center of the geometrical figure formed by the shore of the Bay and a straight line drawn across its mouth. The center of a circle is not in its circumference.

The boundary line it is true, does not run beyond the shores of the bay, for the bay, B.p Art. IV of the Treaty is to be common to both Republics. But this is but an apparent difficulty which can not overcome the plain language of the Treaty, the center point of the Bay is adopted only as fixing the direction of the line. The line ends at the shore and starting from that extremity, the boundary of Nicaragua runs along the waters of the Bay and the pacific Ocean in a northwesterly direction past Punta Mala and Punta Arranca Barga; while the boundary of Costa Rica runs through the southward and westward along the shore, circling round to take in the land above Punta Sacate, and so to the South along the Pacific.

In determining the center of the Bay, it is first necessary to fix its limits towards the Ocean. Upon this point no dictionary or other authority will serve to define a priory what is the mouth of such a bay nor can any rule be laid down. It is a matter which must be decided arbitrarily upon the examination of the natural

features laid down on the Chart. After careful reflection, it seems to me that the Bay to seaward is best defined by a straight line drawn from Punta Arranca Barba to the westernmost part of the land about Punta Sacate. This line will run almost exactly true south.

The problem of finding the center of the irregular figure those form is one that may be worked out by familiar mathematical methods. This has been carefully done with the result of fixing as a center point of the bay a point in latitude in $11^{\circ}03'48''$ north, longitude $85^{\circ}43'34.4''$ west from Greenwich, - taking the latitude and longitude of the summit of Salinas Island to be as fixed by the offices of Rouger Lat. $11^{\circ}03'10''$ M. long 854358 W.

It may be added, for convenience or reference, that this center point lays nearly on a line from the easterly end of Salinas Island to Punta Mala, and about five eights of a nautical mile distant from the former.

4. Nicaragua consented by Article IV, that the Bay of San Juan, which always belonged to her and all of which she exercised exclusive jurisdiction should be common to both Republics and by Article VI she consented also that Costa Rica should have in the waters of the Rivers from its mouth in the Atlantic up to three English miles before reaching Castillo Viejo the perpetual right of free navigation for purposes of commerce. Is Costa Rica bound to concur with Nicaragua in the expense necessary to prevent the Bay from being unobstructed to keep the navigation of the River and port free and unembarrassed, and to improve it for the common benefit? If so-
5. In what proportion must Costa Rica contribute? in case she has to contribute nothing –
6. Can Costa Rica prevent Nicaragua from executing at her own expense the works of improvement? 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?

The representatives of Nicaragua have very earnestly and eloquently pressed upon the consideration of the Arbitrator the supposed injurious effects to the future of both countries of a decision that should exempt Costa Rica from contributing to the cost of improvements of the River and Harbor of San Juan, or should declare that Costa Rica was entitled to an indemnity if her territory was occupied or flooded. But with the consequences of his decision, the arbitrator has nothing to do. He can only construe the agreement which the parties have seen fit to make; he can not frame a new agreement for them.

The Treaty of 1858 is confessedly silent upon the questions now under consideration, ant it is only by implication that Nicaragua deduces answers favorable for herself.

The first question to be considered is whether Costa Rica is bound to contribute to the expenses of improving the navigation of the River or Harbor of San Juan. And this question must be divided, and the facts on regard to the River and the Harbor considered separately. The River lies wholly within the border of Nicaragua, Costa Rica possessing one bank of the portion of his course. Has only what may be described as an easement or servitude in its waters. Under the Treaty, she has the right of navigation for purposes of commerce and, by implication, such other ordinary riparian rights as may be enjoyed without affecting the sovereign rights of Nicaragua. It is therefore perfectly clear that if Nicaragua chooses to improve the River, she cannot compel Costa Rica to contribute to this expense, for the River belongs to Nicaragua subjects to only to such conventional Rights as are secured to Costa Rica by the treaty.

With regard to the Bay, the facts are different. The Bay is “common to both Republics” it is property owned jointly. But, in case one owner cannot ordinarily incur expense upon the common property and charge the

other with the share of that expense. It is one of the necessary incidents and defects of joint ownerships that both parties must concur in dealing with their common property.

It follows that the question marked for must be answered in the negation; and to question number five it must be answered that Costa Rica need bear no share or the expenses referred to, unless an agreement shall be made on the subject.

The next point of enquiry is whether Costa Rica can prevent Nicaragua from executing at her own expense works of improvement. Here again the distinction between the Bay and the River must be born in mind.

So far as the River is concerned, Costa Rica can not interfere with any works of improvement if her territory be not invaded and her rights in the River or in the Colorado and Taura be not impaired. If for example, the works of improvement tended to divert water from the Rio Colorado to the San Juan, Costa Rica might, - if she chose-, interpose a valid objection.

In respect of the Harbor, Costa Rica being one of the joint owners, would have a right to prevent any work been done without her consent.

Nicaragua then enquires whether Costa Rica can demand indemnity for land occupied or flooded in the course of the improvements. To this the answer must be that Costa Rica has the right of repelling any invasion of her territory, She has also the right of demanding indemnity in case that a portion of her soil is occupied without her consent by structures, such as dikes or dams, or is flooded by a rising of the level of the river.

7. If in view of Article V of the Treaty the Branch of the San Juan River known as the Colorado River must be considered as a limit of Nicaragua and Costa Rica from the origin of its mouth on the Atlantic?

The Article of the Treaty refers to as follows:

“Art. V: During the time that Nicaragua may not recover full possession of all her rights in the port of San Juan del Norte, the Punta de Castilla shall be used and possessed entirely by Nicaragua and Costa Rica alike, the whole passage of the Colorado River being designated by as its boundary so long as this community of use and possession lasts. It is further agreed that as long as said port of San Juan may exist classified as free, Costa Rica shall not collect from Nicaragua port dues at Punta de Castilla.”

In order fully to understand the scope of this article, and of the inquiry based upon it, it is necessary to recall the position in which Nicaragua finds herself situated, with respect to San Juan del Norte, at the time of the execution of the Treaty of 1858. The circumstances are matters of common historical knowledge and have formed the subject of voluminous diplomatic correspondence on the part of the United States.

For many years previous to the period now in question, and as far back indeed as the VII century relation of some sort has existed between the British Government and the inhabitants of an extensive and ill defined tract on the Atlantic shores of Central America, known as the Mosquito coast. It would also be unprofitable to examine closely the history and character of these relations, but it may be stated in a general way that they practically ceased for some years after the Treaty of 1783 and 1786 between Great Britain and Spain. About 1840 however Great Britain so fit to advance certain claims, and she accreted the existence of the Mosquito Indians as an independent and sovereign nation under the protection of the British Government. At a later date it was declared that the limits of the Mosquito kingdom extended as far south as the River San Juan; and on the 1st January 1848, H.B.M. ships **Zixen** and **Alarm** in the name of the Mosquito king,

took forceful possession of the town and harbor of San Juan del Norte. Against these acts, the Government of the United States earnestly protested, denying the existence of the Mosquito Indians as an independence nation, and urging Great Britain the restoration of San Juan del Norte to the Nicaraguan authority.

These efforts, were for a long time, unavailing. In 1858 no conclusion had been reached San Juan del Norte, or – as it was then named – Greytown, remained under the nominal sovereignty of the Mosquito king. Its affairs were in fact administered by local governments of the inhabitants, who had adopted a constitution and law of their own as whose de facto rule was respected by the United States and Great Britain, pending a final settlement of the various questions in dispute. The Republic of Nicaragua had possession of no part of this district and exercises no authority within it. But negotiations had then been for a long time progressing which look to a restoration of her authority. In these negotiations the question of constituting the Harbor of Greytown or San Juan del Norte as a free port had always been a great feature.

In 1860 these negotiations were brought to a close by the Zeledon – Wyke Treaty, between Great Britain and Nicaragua, signed at Managua, on the 28th January of that year. By this Treaty, Great Britain was due the protectorate and recognized the sovereignty of Nicaragua over all the Mosquito territory; and it was agreed that a reservation – within which Greytown was not included, - should be set aside for the Mosquito Indians. The important provisions of the Treaty, for present purposes are the following:

“Article VII. The Republic of Nicaragua shall constitute and declare the port of Greytown or San Juan del Norte a free port under the sovereign authority of the Republic. But the Republic, taking into consideration the immunities here to for enjoyed by the inhabitants of Greytown, consents that trial by jury in all cases civil or criminal and perfect freedom of religious belief and worship, public and private, such as has hitherto been enjoyed by them up to the present moment, shall be guaranteed to them for the future.

No duties or charges shall be imposed upon vessels arriving in, or departing from the free port of Greytown, other than such as may be sufficient of the maintenance and safety of the navigation for providing lights and beacons and for the frame the expenses of the police of the port; neither shall any duties or charges be levied in the free port on goods arriving therein, in transit from sea to sea. But nothing contained in this article shall be construed to prevent the Republic of Nicaragua from leaving the usual duties on goods destined for consumption within the territory of the Republic.”

The provisions of the Treaty were dully carried out by the surrender of Greytown to the Nicaraguan authorities and Nicaragua has for about twenty seven years exercised undisputed authority in that place, subject only to such restrictions as were imposed by the stipulations of the Treaty above referred to.

It is now contended b Nicaragua that, in due of the existence of these restrictions, she has not yet recovered “full possessions of all her rights in the port of San Juan del Norte” within the meaning of Article V of the Treaty of Limits of 1858.

These restrictions are of two kinds; the provisions as to trial by jury and religious liberty on the one hand and the provision as to harbor and custom dues in the other.

So far as the guarantee by trial by jury and religious liberty is concerned, I can find no deprivation of the rights of Nicaragua. There is only a grant of certain privileges to individuals which does not in least impair the sovereign rights of the Republic.

The agreement that Greytown shall be a “free port under the sovereign authority of the Republic” is not a deprivation of rights under the Treaty of Limits. Article V of that Treaty is divided in two sentences, the second sentence creates no difficulty of interpretation. That simply provides that so long as San Juan del Norte remains a free port “Costa Rica shall not collect from Nicaragua port dues at Punta de Castilla”.

But Nicaragua contends that a continuous deprivations of her rights is found in those provisions of the Zeledón- Wyke Treaty which forbids the leaving of dues on vessels (as distinguished from goods), except for specified purposes.

This contention proceeds upon the theory that the term “free port” does not involve the idea of a restriction of dues upon vessels, but only of dues upon goods. Such, however, is not the view of all authorities and especially of all Spanish writers. I cite the following definitions from works published shortly before the Treaty of Limits of 1858 and the Zeledón – Wyke Treaty of 1860.

Elementos del Derecho Mercantil Español, by D. Damian de Sobravo y Craibe (Madrid 1846) “the ports are such commercial towns as enjoy the franchise of importing and exporting every kind of merchandise domestic or foreign without other charge there on than the cost of navigation with respect to the vessel itself (gastos de navegación relativos al buque).

Mellado, Enciclopedia Moderna, Madrid 1854. Freeport.– “one in which vessels of all nations of the world may anchor, load and unload, without paying any dues.”

Caballer, Diccionario General de la Lengua Castellana, Madrid 1856). Fee port . - “one in which the ships of any nations whatever may come and go without paying dues.”

Chao, Diccionario Encyclopédico de la Lengua Española, (Madrid 1853-1855): “Free port.- One in which the ships of any nations whatever may come and go without paying dues on themselves or their merchandise”

Domínguez, Diccionario de la Lengua Española (Madrid 1856): “Free port.– One in which the ships of any nations whatever may come and go without paying dues either on the vessels or the cargos or merchandise.”

But even assuming that the words “free port” in the two Treaties refer to were intended to describe a port in which only goods, and only vessels, were free from dues, I am of the opinion that the limitation upon the power of Nicaraguan to impose dues on vessels, is not one on which she can now complain.

When in 1860 the Zeledon-Wyke Treaty was negotiated, Nicaragua might have refused to accept the surrender of Greytown, except unconditionally. If she had so refused, it is possible that the British forces might have still excluded her from Greytown,- but she would then have continued to enjoy the use of Punta de Castilla in common with Costa Rica. Nicaragua instead agreed to receive back Greytown, subject to the limitation that dues on vessels should only be laid for certain purposes. This was the price she voluntarily agreed to pay for the restoration of her possession and her right of sovereignty; and having voluntarily agreed to limit the amount of harbor dues, she cannot now insist that she has not yet recovered full possessions of all her rights in the port.

The agreement as to freedom of goods in transit, is not a deprivation of any rights.

From an attentive consideration of the historical aspects of the questions, as well as of the language of the Treaty, I am convinced that Nicaragua has, within the meaning of Article V of the Treaty of 1858, recover “full possession of all her rights in the port of San Juan del Norte;” and that the Rio Colorado is not to be held as forming any part of the boundary between Costa Rica and Nicaragua.

8. “If Costa Rica, who, according to Article VI of the Treaty has only the right of free navigation for the purposes of commerce in the waters of San Juan River can also navigate with men-of-wars or revenue cutters in the same waters?”

This, in a slightly different form, is identical with the question of interpretation put in the Treaty of Arbitration, and has already been disposed of.

9. “The supreme control (sumo imperio) from the San Juan River from its origin in the Lake and down to its mouth on the Atlantic, belonging to Nicaragua according to the text of the Treaty, can Costa Rica reasonably deny the rights of deviating those waters?”

The form of this question fails to take into account some of the facts which are of importance in arriving at a conclusion with regard to the rights of Nicaragua; for although the San Juan proper is wholly within Nicaraguan territory, and although Nicaragua is vested with the dominion and supreme control over its waters, yet it must be remembered that the Taura and Colorado mouths lie wholly within Costa Rican territory that Costa Rica possesses one bank of the San Juan proper for a large part of his course, and that she has “the perpetual rights of free navigation” of the lower waters of the stream.

The rights of Costa Rica are of two kinds: -

1. Such as accrue to her from her ownership over that part of waters of the San Juan that reach the sea through her territory by way of the Colorado and the Taura.
2. The perpetual right of free navigation of the San Juan proper, as conferred by Article VI of the Treaty of 1858.

With regard to the rights arising of the ownership of the two mouths of the San Juan known as the Colorado and Taura, it seems plain that Nicaragua may not rightfully impair them by any diversion of the waters of the San Juan. As between individual riparian owners, it is believed to be the law of all civilized nations that it is in general illegal to divert a watercourse, for, it is said, every riparian owner is bound, as regard his rights to the waters of his stream, to respect the maxim sic utere tuo ut alienum non laedas. The question is much discussed in Angell on Watercourses §§ 97-108. And as between nations, the rule appears to be the same.

The Government of the United States has on more than one occasion asserted the rights to interfere in preventing the diversion, in other countries, of streams which flowed through or pass its borders. See Wharton's International Law Digest, § 20.

With respect to an impairment of the right of navigation secured by the Treaty of 1858, the case seems to be equally clear. The rule thus laid down by Vattel, Chap 22, §§ 271-273:

“It is not allowable to raise any works on the bank of the river, which have a tendency to turn its course, and to cast it upon the opposite bank, this would be promoting our own advantage at our neighbor's expense... If the river belongs to one nation, and another has an incontestable right to navigate it, the former cannot erect upon it a dam or mill which might render it unfit for navigation. The right which the owner of the river possess on this case is only that of a limited property; and, in the exercise of it, they are bound to respect the rights of others... this right [of navigation] necessarily supposes that the river shall remain free and navigable, and therefore excludes every work that will entirely interrupt its navigation”

These views are not so far, as I am aware, in any respect questioned by other writers on international law, and may be laid down as a general rule that where one State has, by treaty or by international law; a right to the free navigation or other use of the waters of the lower part of the river, such a river cannot be obstructed or its waters diverted by another State, having control of the upper waters of the stream, as to destroy or seriously impair the rights of the former State.

It follows, that Nicaragua has not the right of deviating the waters of the San Juan.

10. “If, considering that the reasons of the stipulations contained in Article VIII of the Treaty have disappeared, does Nicaragua, nevertheless, remain bound not to make any grants for canal purposes across her territory without first asking the opinion of Costa Rica as therein provided? What are, in this respect, the natural rights of Costa Rica alluded to by this stipulation, and in what cases must they be deemed injured?”

It is not clear, from this question, what the Government of Nicaragua means by the phrase considering that the reasons of the stipulation (los motivos de la estipulacion) contained in article VIII of the Treaty “have disappeared”. On turning to the Treaty itself, we find that Article VII provides that nothing contained in the Treaty shall invalidate obligations previously incurred by Nicaragua in regard to canalization or public transit. Article VIII provides that if the contracts of canalization or transit theretofore entered into by Nicaragua should happen to be invalidated, she will not enter into any other arrangement without first hearing the opinion of Costa Rica; “and, if the transaction does not injure the natural rights of Costa Rica, the vote asked for shall be only advisory”.

It will be perceived that no reasons or motions are stated for these stipulations, and everyone may conjecture for himself what they were. I should suppose that sufficient reasons might be found in the strong interest which Costa Rica would necessarily feel if any means of interoceanic transit that lay close to her borders. The representatives of Nicaragua contend that the motives of the stipulation are to be found in the dread of Walker and the filibusters, who have not then been entirely defeated, and who –it is said- might be expected to gain access to Central America under the guise of securing a concession for building a canal. But it is plain that any such surmises, even if the arbitrator thought them probable, could never form the basis for his decision; for they fall far short of the clear proof which alone could justify an application of the maxim, invoked by Nicaragua, cessante ratione, sesat ipsa et lex.

It follows that the provisions of Article VIII must be held to be still in full force.

The second part of the question enquires what are the “natural rights” of Costa Rica, alluded to in this stipulation, and in what cases they must be deemed injured. The words “natural rights” must be considered with reference to the subject matter of the Treaty; and in this light; the answer does not appear difficult. The natural “rights” of Costa Rica are those rights which, in view of the boundary fixed by the Treaty of Limits, she possesses in the soil thereby recognized as belonging exclusively to her, - in the harbor of San Juan del Norte and Salinas of which she is a joint proprietor, - and in that part of the delta of the River San Juan which she owns or of the portion of the River itself in which she has perpetual rights of free navigation and other repairing rights.

It is impossible to foresee all the cases in which these rights would be impaired; but it may be enough to say generally that, within the meaning of the Treaty, an appropriation or flooding of Costa Rican soil, and encroachment on the harbor above mentioned, or an obstruction or deviation of the waters of the San Juan which should destroy or seriously impair the navigation of the waters of that stream from a point three miles below Castillo Viejo, would “injured the natural rights of Costa Rica”.

11. Whether the Treaty of April 15, 1858, gives Costa Rica any right to be a party to the grants of inter oceanic canal which Nicaragua may make, or to share the profits that Nicaragua should reserve for herself as sovereign of the territory, and waters, and in compensation of the valuable favors and privileges she may have conceded?”

The Treaty does not, in terms, give Costa Rica any such rights.

Nicaragua, under Article VIII of the Treaty, is bound to consult Costa Rica before entering into any agreement for the construction of an inter oceanic canal; but is not bound to adopt her views if “the transaction does not injure the natural rights of Costa Rica”. In such cases Costa Rica would be neither in form nor in substance a party to the grants Nicaragua might make, nor entitled to share in the profits reserved in the concessions.

If, on the other hand, the transaction were one which did “injure the natural rights of Costa Rica”, the vote asked for would sense to be only “advisory”. In that event, Costa Rica would have a right of veto, and, her assent being essential to the validity of the agreement, she would in effect become a party to any complete grant for inter-oceanic transit. Costa Rica would be entitled to demand such compensation as might be just, for the concession she was asked to make; but she would not be entitled to share in the profits reserved for Nicaragua.

The question, as profound, is some what ambiguous, but it may be answered thus: the Treaty of April 15, 1858, gives Costa Rica a right to be a party to grants for inter oceanic canals only in cases where the construction of the canal involves appropriation or flooding of Costa Rican territory or encroachment of the harbors of San Juan del Norte or Salinas, or the destruction or serious impairment of the navigation of the River San Juan in any of its branches and at any point more than three miles bellow Castillo Viejo.

Costa Rica has the right to demand such compensation as may be just for the concessions she is asked to make; but is not entitle to share in the profits that Nicaragua may reserve for herself as a compensation for such favors and privileges as she, in her term, may concede.

I have thus considered all the questions submitted to the arbitrator and I respectfully advise that an award be made in accordance with the foregoing views. I submit herewith a form of award which, if my conclusions be approved, maybe executed in triplicate, -one copy to be filed in the Department of State, and the others to be delivered to the representatives of the Governments of Costa Rica and Nicaragua respectively.

G. L. Rives
Department of State
Washington
March 2nd. 1888

Annex 2

Despatch of 26 February 1859 from the United States Consul
in San Juan del Norte

Source: Despatches from United States Consuls in San Juan del Norte
1851-1906 (National Archives Microfilm Publication T-348, roll 3),
General Records of the Department of State, Record Group 59,
National Archives Building, Washington D.C.

Recd 1 Ap Mr Opur
N^o 2

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Commercial Agency U.S.A.
San Juan del Norte,
February 26th 1859.

Hon. Lewis Cass
Secretary of State.
Washington.

Mr:

I enclose copies

of three papers, - No 1 being copies of two laws enacted by the Legislative Council of this town, and Nos. 2 & 3 copies of a letter addressed to me by the agent and part owner of the ship Fortitude wrecked at Cape Gracias a Dios, and my answer.

The harbour of this port has for several months past been filling up and the entrance to it gradually growing narrower and shallower, until none but the lighter draft vessels can enter it. I was told by the Pilot of the port this morning, that yesterday afternoon there was but fifteen feet water at the mouth, where six months ago the soundings showed twenty five feet! The old French Company's buildings at Santa Ana have been carried away.

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old granite
Company's buildings
Carried away.

away, one after another, until only one old shed remains, and even that is in a very precarious condition. A wide opening of several hundred yards has been made by the sea, through the whole length of the Company's dwellings, into the main anchorage of the harbour, through which the men-of-war boats pass and repass at pleasure in and out of the harbour, saving nearly half of the distance between the town and where the ships are anchored. Unless a change soon takes place, I fear this once fine harbour will be ruined.

Visible of
ships in port.

The N. S. ship "St. Louis" came to anchor outside, this morning, and the same town is getting ready for a cruise. H. B. M. S. ship "Cesar" is the only other war vessel now at this port.

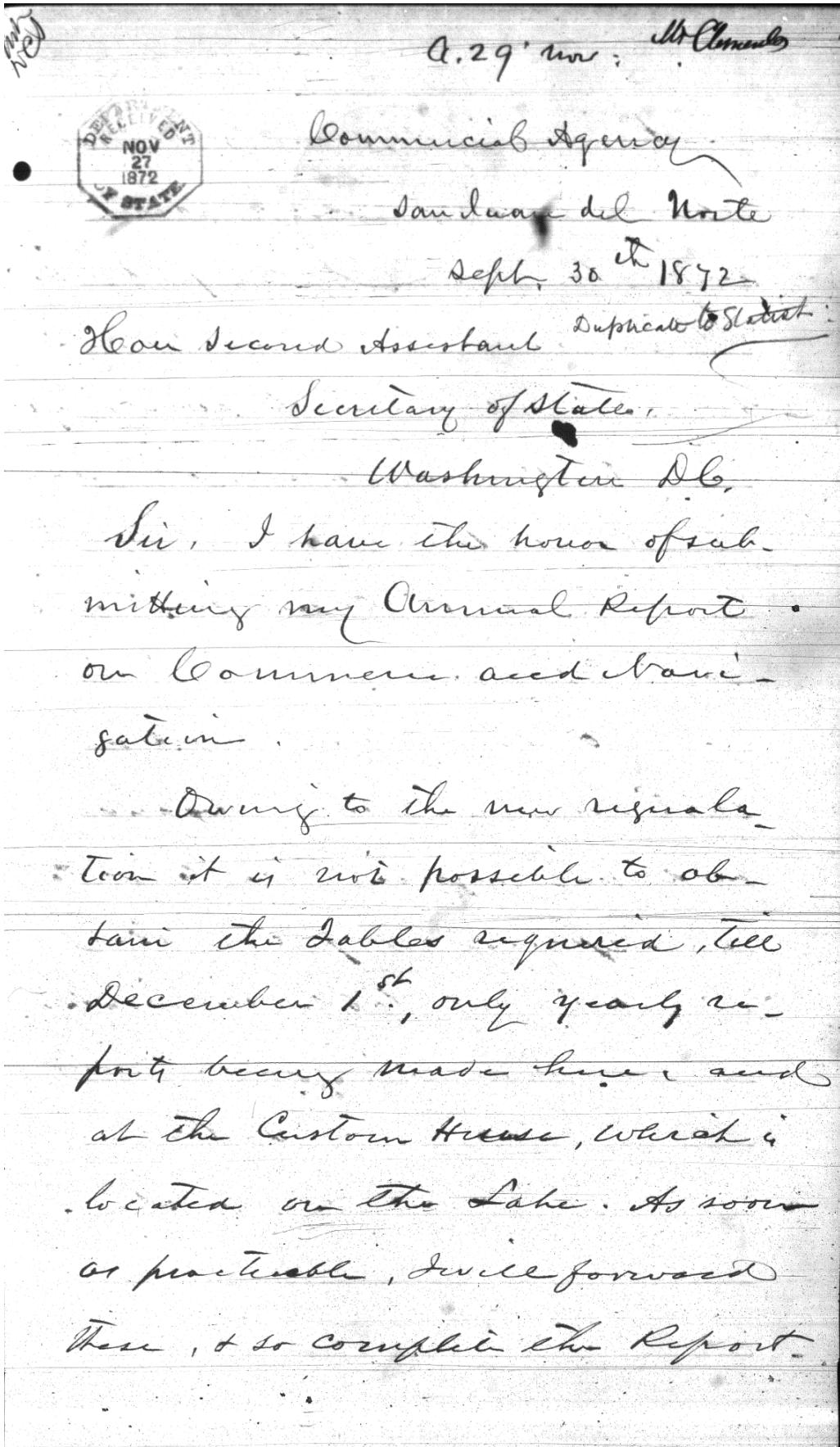
I have the honor to be
Very Respectfully
Your Obedient Servant

S. Guiney Smith
N. S. Com. Adm.

Annex 3

Despatch of 30 September 1872 from the United States Consul
in San Juan del Norte

Source: Despatches from United States Consuls in San Juan del Norte 1851-1906
(National Archives Microfilm Publication T-348, roll 5),
General Records of the Department of State, Record Group 59,
National Archives Building, Washington D.C.



The main difficulty lies in
getting values of cargo, and
any thing short of the published
returns, even if such could
be had, would be worthless.

The Consuls here, all have
to do so, though most of the
shipping is in connexion with
their offices,

I doubt not therefore
the Government will expect,
and will require me to go to
an expense of £50. at least
in getting at tables, indirectly.

I am sir your obt servt

L. P. Oldy

Coml Agent.

1.

Annual Report, on Navigation and
Commerce from the Commercial
Agency of San Juan del Norte,
Nicaragua. For the year ending
20th of September 1872.

I have the honor to submit the
following as tables, showing the
Imports, Exports and Navigation
at this port. Table A, annexed, gives
the Imports. Table B. the Exports.
Table C. the Navigation.

In addition to this tabular state-
ment showing figures, there are some
matters connected with the Commerce
of this Country which may very
properly become a part of the Re-
port, and to such, I beg leave to
direct the attention of the Depart-
ment.

1. Harbor of San Juan del Norte.
At one time this Harbor ranked
high, its depth of water having been

2.

variously sounded by the exploring parties inspecting for an inter-oceanic route, and by the anchors of the ships cast almost anywhere while engaged in trading here. Even frigates entered, and the expanse of water from the town to the inlet was the admiration of all.

At that date the San Juan river debouched here. And being a broad stream, and the sole outlet of the great Lake of the Interior, spread itself over the basin formed by nature for it. The ware-houses being built along the harbor front, could then receive the vessels alongside without expense or trouble.

But some years ago, the San Juan suddenly changed its main channel, pouring nearly its entire volume through a branch called the Colorado, where the channel continues. This change of course left the harbor destitute of water enough to cover the area before occupied, and the soil being alluvion of coarse vegetation commenced in earnest, soon making for the bar itself. Hence at present, rushes and grass extend all in front

of the town leaving wandering chan-^{3.}
nels here and there, which boats naviga-
ting must strictly follow; and making
it may be inferred, miseria in pro-
portion to the space of marsh as opposed
to the ordinary temperature of the Climate.

Here all this will end as one knows.
The inhabitants look on without ability
to remedy it. Dredging would scarcely do,
as the sole cause is lack of water from the
river. The Colorado might be diverted
or stopped up, perhaps, and things be
as formerly, but that lies in Costa Rica
territory and is considered good fortune
to that State, so much as, as not to permit
any intermeddling. The ~~Transit~~ Company
some years ago here, attempted an
alteration but were I believe quickly
stopped. Hence the revival between this
Government and that of Costa Rica of
the old controversy about the boundary
lines. Upon which subject I forwarded
to the Department by last mail, a pam-
phlet from the Government here, and he from
the Capitol at Managua.

The people here speak of but one
remedy for the misfortune, namely, the
frequently contemplated Canal. This
they think would necessarily demand

4.

a harbor, and it kept open. And as ~~nature~~ seems so to have deprived them of a gift once bestowed, they may be allowed to regard with lively interest every such movement for their benefit.

The harbor being thus filled up so as to allow only a few feet depth on the bar, vessels have to anchor outside at sea a mile or two off, and discharge and receive cargoes by lighters.

The principal lighter used at present is a small screw tug, carrying two or three hundred ^{between three and four feet} sacks of Coffee at a load drawing ~~about four feet~~, and running a distance of about twelve miles to reach the ships. During the present year the water on the bar has usually been such as to permit running over it, but this is now changed, compelling the lightering to be done as above stated.

In serving a steamer with two hatchways a load can be carried out and one returned, but with vessels the cargo has I believe, to be unloaded first and afterwards the other put in. In the latter case the process is very tedious, and more trouble results to arrive at

5.

once, quite impossible to attend to them without much consequent delay. This evil however does not occur, only one steamer a month arriving, and two or three vessels besides for the entire year. I do not think the charge for lightering has been raised on account of the more expensive course of work, which of course speaks well for the lighter.

I believe it is conceded that if the harbor gets worse, amounting to a close of it, the first-boating by steamers must end and the primitive canoe become the only transport.

The contract for navigating the lakes and rivers made about two years since between Nicaragua and a Company, runs for twelve years. What effect the filling up of the harbor and the otherwise defective means of running up the river will have on the contract, it is not for me to consider. It is proper I should add, that the contract is one of subsidy also. The State allowing \$6000. for the river boats and one on the Lake of Nicaragua, and \$3000 more for one on lake Managua, or \$9000 per

6.

annum. The mere subsidy is small, and the profits arise from the freights which doubtless pay well.

Should all this change as said, reverting to the native bungs again it will have influence on the shipments of certain products at least, as coffee, which will not bear wetting, which the bungs cannot well prevent, being exposed to the sudden and frequent rains. Freights would not be any higher, yet the damage to them would prevent sending coffee by such routes, if any other could be found, which would be on the Pacific side where the harbors are better and the seasons more uniform.

I may add also, that very possibly the natives who by the introduction of steamers on the river and lake, having lost their somewhat natural right to navigate, would be glad to return therto. But it is likely that if the harbor closed entirely so as to prevent the steamers from running, the trade will immediately divert to the Pacific side and this Coast has become deserted.

11

Corinto.

I will entrench upon the report of the Consul on the Pacific side to the extent of stating a rumor to the effect, that the filling up of this harbor, with some other reasons, has had influence already on the shipping from Corinto. In the days of the Transit Company the route through Nicaragua was quicker by two or three days than that by Panama. But nevertheless, the rumor is that the shipments are taking that route, because of decrease in freights and quicker transit, there being more ~~ship~~ shipping on that side. How all this is, the report from that side will show and probably verify causes.

It makes but little difference with Nicaragua it may be, how her produce is shipped so it goes quickly and cheaply as possible. But, it must be seen that it materially affects the interests of Georgetown, as the loss of its harbor is vital, the population depending entirely on its existence.

III. Productiveness of Chiapas.

Nations dealing with this country ought not to expect too much from her, as by examining her area only so much is found to be valuable. In most states, with us, square miles indicate productiveness. Tennessee for instance, has 50,000 and see her reports! This country is divided between water, swamps and arable.

The Lakes occupy a large share, there being several. Then comes this eastern coast up to the lake, embracing about one third, devoted to almost impenetrable swamps. The producing portion is therefore beyond and round the lake, and only a certain portion of that is valuable, as many mountains exist.

The chief idea is, that Chiapas produces certain things not found generally, giving a kind of lease on the wants of many kinds. The quantity can never amount to much. Dependence is on kind and quality; Coffee, Rubber, Skins, Hides, Indigo &c. as seen in the table. Coffee is select in soil, and requires outlay to raise it. Few from other nations settle here;

and the native is the only labor. 9.

Many dislike planting. Many have not the means. Hence the price of coffee, \$10 per cwt, will not urge its rapid increase; and if true, that those embarking therein on account of a certain bonus offered them by the Government, desire to quit, the present product may be as much as will be seen for a time.

One thing the planter is doing, paying more attention to cleaning coffee. Here lies his chief profit. The bean appears to be excellent in richness of oil, but this is of no avail unless it be properly prepared for market. I am informed that a gentleman from one of the United States has located at Chancagua, and will introduce machinery for cleaning. This will add but little to the cost, as he says it can be done for less than one cent per pound. It would be well if the sugar from such excellent cane were sent to market in its best state; by having more refineries. That arriving here, is very dark and heavy.

What influence the act of Congress taking off the duty on coffee will have in this country, I cannot say.

10.

It may increase the supply to some extent. If it should, the bulk of it will go as now, to Europe, as better prices are paid there and quicker transit given. Of course the reaction benefits the United States, as the consumption in Europe abates so much from the demand, upon other coffee-growing sections.

There are dyewoods here. But the use of cheap chemicals interferes with their shipment, and they rot on the ground. Cochineal has also failed. So has Cotton. And Indigo to some extent, making only three or four products of value, and these only in proportion to the smallness of area; and the many deficiencies in raising, requiring nations to be reasonable in expectation.

IV. Mines.

Nicaragua has no coinage of her own. She has one mine in the Chantales mountains, worked for the government by English operators. The yield is run in the table. Coal has not been discovered. There are other minerals in minor quantities; but will never become of value in commerce.

V.

II.

Climate.

Allusion is made to this heading rather to correct the histories & than, than otherwise. In speaking of Nicaragua these histories divide the seasons into two, the rainy and dry. This is not correct. There is only a portion of the State where this is true. As along the whole Coast from Mexico to the furthest point South, the wet and dry seasons entirely mix, changing by degrees upon advancing into the Interior, there reaching the line of equal division.

Hence, were the soil arable and fertile along the Coast, no cropping could be successfully done. Not is any attempted in Nicaragua on this line, until the Lake country is reached. The Coast is the portion for rain, thunder and lightning in its most awful form; for fevers and rheumatisms, occasioned by miasma and drenchings from the frequent rains.

Hence also, few from other countries settle here. In my count for Georgetown there are about thirty from all countries together, equally divided between English, French, German and American.

Fifty for the Interior would probably

cover the number from the United States, engaged at all work.

All arriving here have to undergo assimilation more or less severe, passing through the first and what else attaches.

Those doing business in the state have usually succeeded, investing in trade mostly. Still, notwithstanding success, very few come, and they with the intention of returning. I have no doubt the Interior of the country is more healthy. Yet, those used to entirely different customs, climate, everything, will hardly venture, and hence with the very few immigrants seen so far, and no reason for expecting a change, - Nicaragua must be left very much to her own resources, for growth and greatness. Doubtless, she, with her sister states have the good wishes of all lovers of liberty, especially of our own, with laws more or less alike, and hopes the same. But her work of progress must necessarily be from herself, fostering the spark of freedom so heroically struck, till it becomes a permanent luminary like our own Union.

VI

Course of Trade.

13.

The all-important query with nations is, the course of trade. Upon this turns their mercantile interests; hence, Consuls are particularly enjoined to report cause and effect. With reference to Spanish America, it seems our esteemed Secretary of State especially requires reasons, for the failure of the United States to get more of the trade. As Agent here, about mid-way on the coast, I will try to answer, and answering for this point, consider it covering the entire ground.

By turning to the tables of commerce annexed, it will be seen Great Britain engrosses nearly all the trade. As all know she depends mainly on commerce for existence. With little territory proper, but a vast population, she must make every edge cut. She therefore puts her people to manufacturing for the world at low prices, and the rest of her capital invested in ships to accommodate still further. Between the two ideas, of making what everybody wants, and carrying the same to them quickly and cheaply, she regulates the course of trade, and is emboldened to declare, as she sometimes does,

that she can and will break ~~14.~~
down all competition!

Now it is very plain, unless other nations
urged by the same necessity and with
like means, imitate, this supremacy
must continue. But what other nation
is so driven? The Dutch to some extent,
and they are engaged in the carrying
trade up to this extent. But how with
the United States? Look at her territory.
At her home-use for Capital. At her
domestic instincts. These states manu-
facture but little, and that at high prices
on account of labor. They are occupied
in developing the resources of the country;
in navigating rivers and lakes; in
building rail-roads, and every where filling
up the land with permanent wealth.

Hence, there has been no rivalry with na-
tions existing on the sea. And we have
grown great without, these, with it.

But while England thus occupying
the field against all others, she really
seems to have expedited the result, by
enlarging upon her idea, of ships for
every port, and making these ships
of the fastest and largest kind.
A trading ship thus becomes a splendid

war= usual at need, equipped at the same time with every comfort for the traveller, rendering her desirable for safety, speed and comfort.

It is these kind of vessels that are engrossing the traffic of the world. Why, what do we see at this fast=failing port? Monthly, at the day and hour, one of these floating palaces, of a sub-sidy-line of seven, drops anchor for the little trade of Nicaragua. Bringing merchandise for cargo, while all nations together, do not send over two or three vessels of small class during the year. Such promptitude, such display of power over Commerce, necessarily tends to fill the people with respect, and therefore nearly everything here seen is British, while they carry nearly everything away.

It is sometimes said that countries in political sympathy should trade together. This might be so while trade was placed on precisely equal footing as to price and quality. In case of friendship we somewhat expect it between man and man. Yet admitting this to be so, the traffic of England with this coast

16.

does not show this equality, for she furnishes such things as are wanted more cheaply than other countries do, and it is said pays better price for produce in return.

Trade always flows in natural channels. It is a truism. Apply the rule. What England cannot make as well and cheaply as others, will be supplied by them. Therefore, by looking at the shipments from the United States and Italy, only certain articles are seen, these being precisely what England cannot or will not make.

Timber, flour, groceries and the like, will therefore come from the States.

Wine from Italy. And all this too, in face of the fact that flour reaches the price here of 24 p.s. in gold, and bacon forty cents per pound. England has not the flour to send nor the meat, but instead, manufactures from a pin and needle almost anything desired.

Although regretting to see our commerce so small in Central and South America, there seems to be no commercial law to prevent it.

17.

It is said that the New Orleans merchants design putting capital in the trade with Mexico, to divert it from its present route.

The design is very worthy, but they must contend against this rivalry of British necessity, and it is hoped they may not despair at not getting entire control.

If they share it all equally, it should satisfy them. Self-sustaining as are the States of the American Union, no failure of this sort can mortify.

Doubtless, in time more American capital will be directed to commerce, which when done, the effect will be seen and in the way demanded by the stern rules of trade.

~~Imports.~~ The regular custom-house of the State is up the river near the Lake. Merchandise for sale here pays a duty to the Governor of the Port. The Intusion duties range at about 25 per cent ad valorem. San Juan port duties were not free, 40 per cent. The free-list I believe, includes flour, bread, corn, rice, beans, barley, oats, onions, turnips, potatoes, green apples, machinery, scientific instruments, printed

18.

books, tar, pitch, oakum, copper-nails, and a few others. And on goods imported in barter for Coffee at 10 per cent, and to the exact extent of such return, no duty is levied. This is done to stimulate the growth of Coffee, and I am told it is doing it. Gun-powder, Manufactured and Leaf Tobacco, are exceptional, the duties being high.

Exports. The Invoice books show the value of articles to average as follows; — Rubber 35 cents, Coffee \$1.0 per cwt., Hides \$2, Deer-skins 27 cents per pound, Cocoa-nuts \$12 per thousand, Indigo \$1. per pound.

Commissions. Merchants charge $2\frac{1}{2}$ per cent with certain items for lightage, handling &c, all moderate enough.

Dennis P. Olds.

Commercial Agent.

Supplement to Annual Report.

Since forwarding my report proper, it is evident that the Harbor of Georgetown, or San Juan del Norte, has virtually closed. There is only one opening called Harbor Head, with three feet of water; ^{the dangerous point where the harbor head is located} how long this opening will continue is uncertain. When it does fill up, the little water coming down this arm of the river, settles in the town, becomes a lagoon, passing off alone by evaporation.

It was hoped by the inhabitants here, that the quantity of rain falling at this season of the year, would force a passage across the bar to the ocean again. But not so. With the strength of the beating surf on the one side, and the weight of water on the other, the desired result has as yet failed to be effected.

From present indications, the miasma which must rise from this stagnated water will cause much death and sickness, and a general moving away.

Vessels now visiting the port ride well out to sea, and anchor roughly there. This is so disliked by Captains as to

present this return; consequently, a new
captain, if not a new vessel has to
be chartered each voyage.

I am informed that the British Royal
Mail Line of steamers will continue
to touch monthly until the end of next
year, provided, any possible means
continue for unloading and loading.
It is possible the Harbor could have
been kept open, had the Government
here spent some time and money in
dredging, but there seems to be not
enough energy in this people to pro-
vide against misfortunes.

MERCHANTS resident in this place wish
much for the Canal, as they have in-
vested somewhat largely here in real
estate. But I am told, that our nine
tenths of the people in Nicaragua are
opposed to any improvement being in-
troduced into the Country, either by
rail-road or Canal, b^d, that "they wish
to be let alone".

Nature having ampley provided for
them, and when they can pluck and
eat, no later than ^{at} ~~any~~ ^{regularly} ~~time~~ for
subsistence, it would be asking too

too much to wake them up, to the habits
connected with internal improvements,
involving customs, morals and every-
thing!

It is true, one can subject easily by using
only the commonest native productions,
repudiating clothing, and what are
usually termed comforts; but, whether
this should be considered existence or not,
is the question.

It is but reasonable to suppose that it would
be the wish of other nations, to see Cen-
tral America rise to a proper level,
and with a more suitable national
code of laws fulfill a higher destiny.
If the prospect of a Canal crossed
the merchants and others of more en-
gineeristic cast, will, they inform me, move
to Simon Bay or elsewhere; leaving
the old Spanish town to gran over
with the quickly spreading forests of
the Coast, its site being known only
by a few remaining fisherman, as at Indian
Riv^r, becoming lost to commercial traffic
forever.

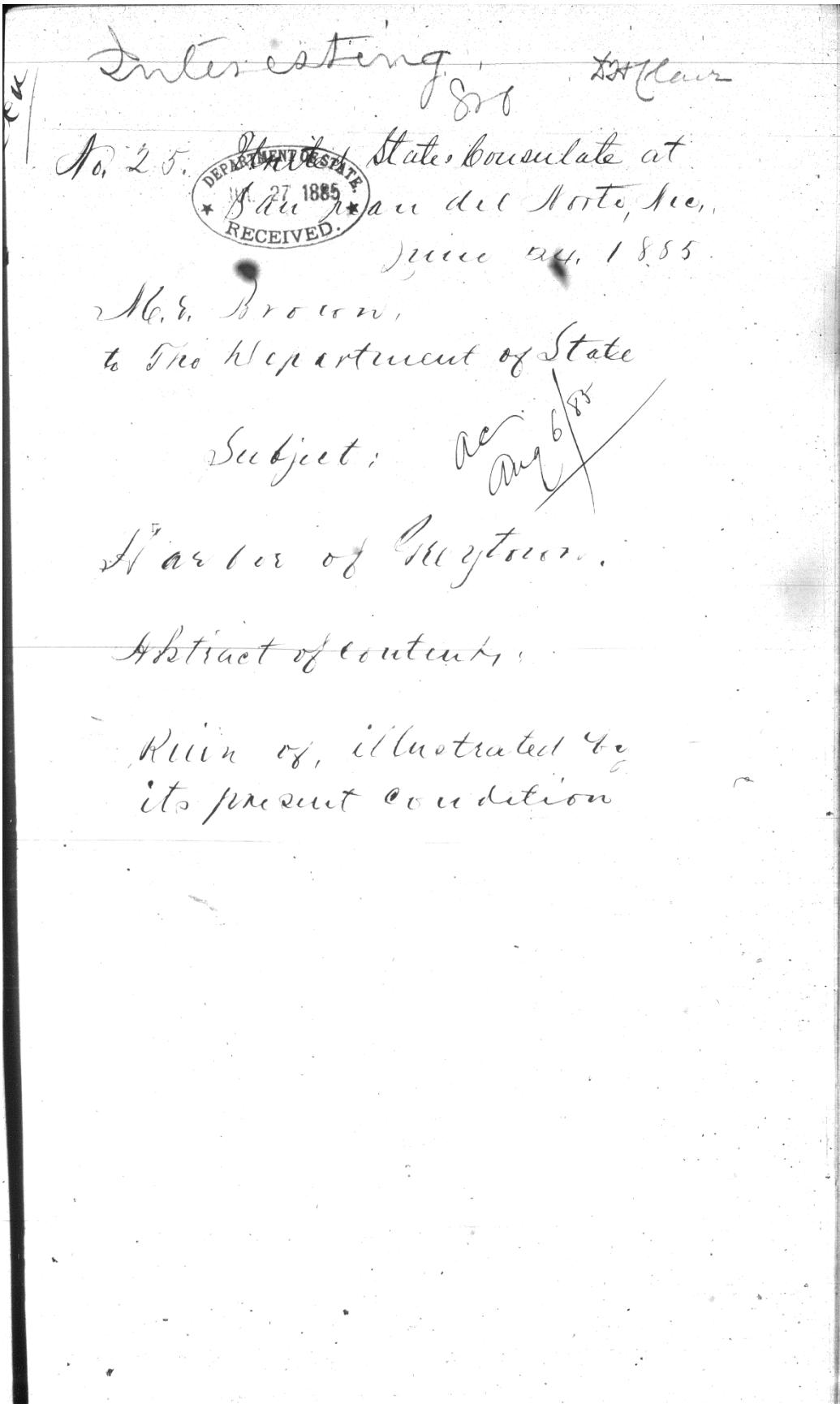
L. P. Olds.

Commercial Agent.

Annex 4

Despatch of 24 June 1885 from the United States Consul
in San Juan del Norte

Source: Despatches from United States Consuls in San Juan del Norte
1851-1906 (National Archives Microfilm Publication T-348, roll 7),
General Records of the Department of State, Record Group 59,
National Archives Building, Washington D.C.



No. 25. United States Consulate at
San Juan del Norte, Nic.

June 5th, 1883

Hon. James H. Porter,
Assistant Secretary of State,
Washington, D. C.

Sir: The arrival off this
port of the S. S. "Pass" on the 12th of
last April afforded a striking illus-
tration of the completely ruined
condition to which the once
magnificent harbor of Grey-
town is reduced.

What in former day
was a spacious haven of
safe anchorage, and of easy
approach is now graphically
described as a mere lagoon
with an uncertain inlet,
and the approach to it is dread-
ed and avoided by all na-
vigators.

As the Report you know,
since 1865 no ordinary sea-
going vessel, have been able

to outer the harbor, its use has been monopolized by light draft coasting vessels and the flat bottomed steam boats of the "Niagara-qua Mail Steam Navigation Company".

American captains are reluctant to deposit "rip, paper," at a port from which they are liable at any moment to be driven by stress of weather.

Much annoyance and delay is experienced in securing the requisite signatures of Master and Mates to landing certificates.

The distance from Niagara to where vessels lay at anchor when discharging cargo, and the foul, or navigation result often in damage to it, and much delay as well.

It has often happened in bad weather that vessels

while discharging their cargo
have been forced to leave the
port with most of the freight
destined for Georgetown on
board sometimes being taken
back to Boston and its com-
pleted delivery have delayed
six months.

Cards arriving off the
port usually anchor out
in the roadstead three or four
miles from the city, out-
side of what since 1865
has been known as the
"outer-bar". This bar has
accumulated since that
date, and extends in front
of the entrance to the harbor
and between it and the sea.

And so uncertain is the
channel into the harbor,
and so rough and danger-
ous is the sea to be crossed
in approaching it that no
doubt very seldom venture

~~to send to sound ashore their
own boats.~~

The mail is usually brought in, and taken out to the Royal Mail S.S. by a canoe manned by natives of the "Mosquito Coast," the most competent men for that dangerous work to be found in the country.

That the ordinary boats now are not equal to the perilous work has been repeatedly demonstrated at a cost of several lives.

When the sea runs high the mail pouches and other movable things are lashed fast to the canoe to guard against loss in the event of the upsetting or swamping of the canoe, a not infrequent occurrence when sufficient skill, such as only those Bluffield's boatmen display is not exercised in

riding the heavy seas that roll
back the outer bar.

The freight and passengers,
are transferred to the city by
iron steam lighters.

This is always a slow, and at
times a hazardous operation
especially in bad weather and
when the discharging vessel is
built of wood.

Often the cargo is damaged
and even lost in the sea while
being scoured by means of
derricks from the deck of the
ship to that of the lighter.

These iron ^{boats} will at times
be dashed against the ship
with a force that only an iron
ship can resist without injury.

Occasionally lives even are
lost in this work either by men
being crushed to death, or knocked
overboard to be comined off by
the strong current and drowned
or to become food for the
sharks,

that infest these waters.

During the greater part of the year the entrance to the harbor, after the outer bar is passed has a width varying from 100 feet to 250 feet, with a depth of water in the channel, leading into the basin of the harbor, of from five to seven feet.

But all this varies with the changes from wet to dry season throughout the twelve months, not only as to the capacity and course of the channel but also as to its location, the sand of the San Juan River accumulated before forming the sea constituting a shifting bar that has been known to change its location a hundred yards within twenty-four hours. Another feature is that at times this may two and even three thousand, through the beach.

In the dry season, particularly during the months of March April and May, the waters of the harbor and of the lower Saugan River, which empties into it or near, are at a low stage, and at such periods the entrance to the harbor may be entirely closed within the space of a single night, thereby shutting in even the light draft coasters outward bound, and compelling the inward bound craft to lay at anchor in the roadstead for weeks, usually, at least until some new diversion of the waves and currents a new channel is opened through the break.

Thus on the 12th, of last April the water in the harbor being low and the channel narrow and shallow, the "Progresista," one of the smallest iron steam lighters in the harbor was sent out to bring from the "Para" the freight consigned to this port

She steamed through the channel about 9 o'clock drawing 93 feet of water, and after going out across the outer bar to where "Pera Cay," and taking aboard her cargo, was returning through the channel she passed out early in the morning, when she went aground on a bar which had formed across it during the day.

This was at 4 o'clock P.M., and despite the efforts of the crew during that day and night the "Progresista" remained on the bar, and by 4 o'clock on the succeeding day she was high and dry, with four feet of sand around her, imbedded in a sandy beach from fifty to two hundred and fifty feet wide extending from either side of her entirely across the entrance to the harbor and

completely separating the waters of the harbor from those of the sea.

So complete was the closing of the harbor that at any time during the ensuing two weeks, one could have walked on board of the "Proresista" from any point in the city without wetting his shoes.

When the "Parrá" left on the 15th. of April the passengers for her were taken across the harbor in canoes, or small boats to the beach thus formed, across which they walked, and from thence were taken in sinus over the outer bar through the sea to the "Parrá".

About three weeks after the lighter grounded, a new channel opened through the beach, but not near enough to be of any aid to her sides. She was finally gotten

off by the aid of a steam tug
after tugs had been made
around her, her cargo
in the meanwhile had been
brought to Lacytown by small
boats.

There are now two open-
ings in the beach but only
one of sufficient capacity
to admit the passage of the
light draft coasting craft.

For awhile there was a depth of
five feet water over the inner bar,
but during the last three days
this has been so reduced that a
schooner drawing only four
feet of water was compelled
to return to her anchorage
in the harbor being unable
to get out.

As we however having
an unusually prolonged
dry season, there is but little
water in the Parana River (lower)
River; there will be no change

for the better until the rainy season sets in, in full force in the "Interior," and brings relief to the navigation of the river.

For the past three months, with the exception of the 20th instant, scarcely anything longer than a canoe has been able to follow the river from Colorado a distance of 20 miles from here, and in consequence of that, we have had no regular mail from the "Interior." Freight has accumulated at various points along the river awaiting the rise in the river which the rainy season will produce.

With these difficulties, our transportation, during delay and additional expense, it is not strange that the business of the port was quite extensive.

has fallen off at equal pace
with the destruction of the
hortor.

Much commerce that
formerly passed through this
port to, or from the "interior",
now goes by way of Pacific
ports because that route is
more expeditious and nearly
as cheap.

And then to further paralyze
business is the disturbed
condition of all of Nicaragua's
and since Bonito's essay to
form the Central American
Union. The working portion
of the nation are hiding from
military duty, and the more
independent classes are
leaving the country for
the same reason. Those
who remain feel discouraged
at the business outlook
and do nothing.
In one whose knowledge

of this port is limited to
the present condition of
the harbor, it is difficult
to recognize in this shal-
low lagoon dotted with
patches of weeds the grand
harbor of former years
carrying from its basin
to the sea thirty feet of
water through an en-
trance one mile and
three quarters wide, with
no dangerous bar menac-
ing its front; or that as
late as the year 1856, those
lay securely at anchor
under its protection seven
teen sloops of war of
Her Britannic Majesty's "fleet"
just from the scene of the
Cinicalta and accompanied
by one war vessel of the Uni-
ted States, the "L'abord, I.
think.

And while the detonating forces of nature have been constantly at work for thirty years destroying the harbor and roads San Juan comparatively nothing has been done by man to repair the damage done or prevent its continuance in the future. During the time that the Mosquito Government controlled this port and coast north of it, something, though in a crude way, was done to keep the harbor and river in a navigable condition. But since it has passed out of the hands of the Mosquitos but little has been done to arrest the destruction of these waterways, or to improve their condition at all.

The Government, or one year

ago purchased at a cost of \$40,000.00. But after using it a little in dredging a part of the river, it has since been unused and allowed to go to ruin in, and with the harbor. The boiler I believe however has for some time been doing duty in the works of the "Niagara Mail Steam Navigation Company."

The Gov't, in some of its reports on the state of Public Works, notes the necessity of the improvement of the San Juan River and the restoration of the port of San Juan del Norte.

The latest information to this subject being the proposal to extend telegraphic communication from the interior to San Carlos, and ultimately to this port.

Still no work is all performed and money (some of it borrowed from the port) expended in other

part of the Republic and ~~not~~ ^{thus} allowed
to destroy.

I am, Sir,

your obedient servant,
Geo. A. Brown
U.S. Consul

Annex 5

Whether Costa Rica is bound to co-operate in the preservation and improvement of the San Juan River and the Bay of San Juan, and in what manner; and whether Nicaragua can undertake any work without considering the injury which may result to Costa Rica. Argument on the Question of the validity of the Treaty of Limits between Costa Rica and Nicaragua and other supplementary points connected with it,

(Washington, Gibson Bros., 1887) pp. 162-168

ARGUMENT

ON THE QUESTION OF THE VALIDITY OF
THE TREATY OF LIMITS BETWEEN
COSTA RICA AND NICARAGUA

AND

OTHER SUPPLEMENTARY POINTS CONNECTED WITH IT,

SUBMITTED TO THE

Arbitration of the President of the United States of America,

FILED ON BEHALF OF THE GOVERNMENT OF COSTA RICA

BY

PEDRO PÉREZ ZELEDÓN,

ITS ENVOY EXTRAORDINARY AND MINISTER PLENIPOTENTIARY
IN THE UNITED STATES.

(TRANSLATED INTO ENGLISH BY J. I. RODRIGUEZ.)

WASHINGTON :
GIBSON BROS., PRINTERS AND BOOKBINDERS.
1887.

CHAPTER III.

WHETHER COSTA RICA IS BOUND TO CO-OPERATE IN THE PRESERVATION AND IMPROVEMENT OF THE SAN JUAN RIVER AND THE BAY OF SAN JUAN, AND IN WHAT MANNER ; AND WHETHER NICARAGUA CAN UNDERTAKE ANY WORK WITHOUT CONSIDERING THE INJURY WHICH MAY RESULT TO COSTA RICA.

A NEW group of questions comes now, consisting of those which in the list of Nicaragua are marked Nos. 4, 5 and 6, and read as follows :

“ 4. Nicaragua consented, by Article IV, that the Bay of San Juan, which always exclusively belonged to her and over which she exercised exclusive jurisdiction, should be common to both Republics ; and by Article VI she consented, also, that Costa Rica should have, in the waters of the river, from its mouth on the Atlantic up to three English miles before reaching Castillo Viejo, the perpetual right of free navigation for purposes of commerce. Is Costa Rica bound to concur with Nicaragua in the expense necessary to prevent the Bay from being obstructed, to keep the navigation of the river and port free and unembarrassed, and to improve it for the common benefit ? If so—

“ 5. In what proportion must Costa Rica contribute ? In case she has to contribute nothing—

“ 6. Can Costa Rica prevent Nicaragua from executing, at her own expense, the works of improvement ? 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 ? ”

Denying the historical truth of the statements made in the preamble of question No. 4, and the first of this group,

and referring to those chapters of the first part of this argument, wherein I showed that Costa Rica had eminent domain and sovereignty on the waters of the San Juan river previous to the treaty of 1858, and taking only into consideration the particular point of the inquiry, I think that it is necessary before all to distinguish carefully what the treaty itself has taken pains to distinguish.

The right of Costa Rica on the Bay of San Juan is a right of sovereignty which she exercises jointly and in common with Nicaragua; and the right of Costa Rica in the San Juan river, from the mouth thereof on the Atlantic, to the point three miles from Castillo Viejo, which has been fixed, is the right of use and navigation. In the former case Costa Rica is joint owner; in the latter, Costa Rica is simply the *cestuy que use*; it being expressly stipulated by Article VI that the Republic of Nicaragua shall have exclusively the eminent domain and sovereignty over the waters of the San Juan river from its rise in the lake to its mouth on the Atlantic.

It is, therefore, plain that the answer to be given to the interrogatories of Nicaragua depends entirely upon the legal status in which Costa Rica finds herself, of joint owner in the one case, and of *cestuy que use* in the other.

It might be remarked with justice that the three questions of this group should be thoroughly eliminated from the present discussion because this refers only to those points of the treaty of 1858 which Nicaragua considers to be doubtful and upon which she desires to secure the authoritative and enlightened decision of the Arbitrator, while the points involved in those questions have nothing to do directly with the treaty of limits, nor are they doubtful, nor can they be considered other than pure effects of casuistry, the solution of which in reality should not be given beforehand.

It is plain, however, and so it is stated in the present answer in order that it may never be said that Costa Rica has evaded to make any reply, that if the sovereign rights which belong to Nicaragua over the San Juan river terminate on

the right bank thereof, which is the Costa Rican, and that if her rights on the river itself are limited to the perpetual use or navigation, and to the other riparian rights acknowledged by law, the duty to keep the navigation of the said river free and unembarrassed, and of contributing to the expenses for that purpose incurred, is not, nor can it be, incumbent upon her.

It seems to be in the natural order of things that the obligation to make repairs and to keep the property in the condition in which it was when the use and possession thereof was granted to another party, and the duty to pay the expenses incurred thereby, should belong to the owner.

The Roman civil law, which in the matter of rivers has been generally adopted by all nations, as remarked by Halléck¹ and declared by Wheaton, who quotes the precedent established by Mr. Jefferson in his Instruction to the United States Minister in Spain, of March 18, 1792, settled this question finally² and explicitly.

The *jus utendi* does not involve the obligation to pay expenses for the preservation of the thing used, nor any other expenses alluded to in questions Nos. 4 and 5.

And the right of free navigation on a river which belongs to another power does not imply either in any way whatever, no matter how remote, the obligation to pay the expenses which the owner of the said river may be pleased to incur for its preservation and improvement.

Easements are rights which men have over things belonging to others; they are burdens weighing upon these things, whether by the will of the parties, or by the force of circumstances, and certainly it would be to disturb the order of law, to demand from the possessor of the easement that he should assist the owner in paying the expenses required in the preservation and improvement of the property.

¹ Chapter VI, § 27.

² Wheaton, by Lawrence. Part II, Chap. IV, § 18.

Nothing would be easier than multiplying quotations from the Pandects, and from the Institutes of Justinian, in support of this doctrine, which is truly universal because of its wisdom and truth; and there is no nation in the civilized world that has not embodied it in its laws.

In Central America, as in England and the United States and everywhere else, the obligations which refer to the ownership are incumbent upon the owner; and the *cestuy que use*, or the possessor of any easement whatsoever, is not called to share those burdens unless by agreement especially entered into by him.

The civil law of Spain, which, until very recently, constituted the fundamental basis of the Nicaraguan law, as well as that of Costa Rica, has expressly declared this principle.

"But the one who has only the right of use over a thing," says King Don Alfonso the Wise, "as was stated in the preceding law, is not bound to do any of the aforesaid things in the property over which he has that use."¹

Those things before said are, as it can be seen by perusing the said law, "to guard, preserve, repair, and improve" the property.

If the interpretation of the legal precept were different, the most lamentable confusion of things fundamentally different by their own nature, as are the rights of ownership and use, would take place. The former represents the plenitude of power, while the latter only represents restrictions or emanations thereof.

In reference to the Bay of San Juan, over which the rights of Costa Rica are sovereign, it seems to be unnecessary to state that the limitation or abridgment of the said rights cannot take place, whether directly or indirectly, except by an act of the will of Costa Rica, and with her consent.

The history of bordering nations, joint sovereigns of streams, straits, and bays, presents numerous cases fixing

¹ Law XXII, Title 31, Partida III.

the rule to be observed when some work is to be done or certain measures to be taken for the preservation or improvement thereof.

What has been done in those cases was always done by the will of interested parties, by means of treaties, and specially having in sight the concrete fact, the project of the work or improvement, its plans, the estimate of its expense, and everything else necessary to give a complete idea of the subject under consideration. It is in this way, and in no other, that both Costa Rica and Nicaragua have to act in regard to the Bay of San Juan ; and Costa Rica has to reserve for itself its freedom of action until seeing practically and concretely what is intended to be done to improve that Bay and prevent it from being obstructed, and before that she cannot bind herself or contract engagements for the future, upon mere general propositions, or academical themes, more properly to be discussed in the law school than in an international arbitration.

If, in the opinion of both Republics, some work is to be done, and the particulars of the work are given in such a way as is proper for all public works, then it is through an agreement or a formal treaty, concluded in accordance with the respective Constitutions of the two countries, that the said work must be undertaken and carried into effect. The mutual interests of the two parties would be sufficient to facilitate the enterprise.

On the other hand, Nicaragua and Costa Rica find themselves in regard to this point exactly in the same position. Both are joint owners of the Bay, and either of them, when considering it necessary for their mutual interests to undertake a work for preservation or improvement, must submit the project to the other.

If the scientific studies required for the work, made by agreement of both parties, lead to a decision in favor of the advisability or necessity of the said work, the latter could be undertaken either at the expense of the two parties, in

equal proportion, if both of them were benefited thereby equally and without delay, or on account of whichever party was in need of it, subject to indemnification by the other party whenever it should be willing to avail itself of the improvement. Such is the doctrine of equity, and the one which universally rules in matters of joint ownership.

Referring now to Interrogatory No. 6, I shall state positively that Costa Rica has the right to prevent Nicaragua from executing, at her own cost, the works to which she alludes, whenever undertaken without consideration of the rights which belong to Costa Rica, whether as *cestuy que use* of the river, or as joint owner of the Bay, or exclusive sovereign of the right bank of the San Juan river, and of the whole of the Colorado river, or of the other lands and waters of her territory.

Costa Rica can, therefore, prevent any place on the river bank which belongs to her from being occupied. And to prevent one thing from being done is something more than asking indemnification for the occupation and for the damages done in consequence thereof, whether through the flooding of the lands, or by destruction of the river front, or for any other reason.

Nicaragua cannot do any work either on the river or bay, whether for the improvement or for the preservation of the same, without first giving notice to Costa Rica and obtaining her consent. And as Costa Rica has the perpetual right of free navigation in the river, everything which may endanger or injure or modify or abridge that right is to be considered as an attack upon her property. *Sic utere tuum ut alienum non ledas* Costa Rica will always say and repeat to her sister and neighbor, Nicaragua. "Do not touch the river which is of common possession, nor the Bay over which the two parties are sovereign, without previous deliberation and agreement upon the full knowledge of the nature of the work to be accomplished."

In regard to the occupation of any part of the Costa Rican

territory, because it may be deemed necessary for the work of improvement, scarcely can it be understood how the idea that such a thing is possible has occurred to any mind. It is true that a sovereign can, by virtue of his eminent domain, appropriate for public use and for reason of public utility, within his own dominions, and subject to indemnify the owners, such property as may be required. But when or where has the doctrine been established that such a power can be exercised extra-territorially?

Who gives authority to a sovereign, no matter how absolute he may be within his own dominions, to appropriate for public use any property situated within the limits of the neighboring sovereign?

The limit of the jurisdiction of Nicaragua is fixed by the line which runs along the right bank of the San Juan river, and from there to the interior of Costa Rica the land is inviolable for Nicaragua.

If, in consequence of some work surreptitiously done on the river or port, without the consent of Costa Rica, it should happen that some lands become inundated, whether absolutely or temporarily, or that the river-bed becomes dry and Costa Rica is deprived of her river front, the right of Costa Rica to demand the restoration of everything to the same condition in which it was before, and, furthermore, the proper indemnification for damages, does not admit of contradiction.

Annex 6

Cleto González Víquez, Temblores, Terremotos, Inundaciones y Erupciones Volcánicas en Costa Rica (1608-1910), Tipografía de Avelino Alsina.

San José, Costa Rica, 1910

DUPLICATE COPY
TEMBOLORES, TERREMOTOS
INUNDACIONES
— Y —
ERUPCIONES VOLCÁNICAS
EN
COSTA RICA

1608-1910

Datos compilados por el
LIC. CLETO GONZÁLEZ VÍQUEZ



SAN JOSÉ DE COSTA RICA
TIPOGRAFÍA DE AVELINO ALSINA
MCMX

1861

Las inundaciones han sido y son frecuentes en la región Atlántica. Sabido es que en esa sección del país, todavía en el período torrencial, los ríos cambian á menudo de curso y que aún después de la conquista se ha modificado sustancialmente la dirección y salida de las aguas. El río Parismina, antes independiente y con boca al mar, es hoy un afluente del Reventazón, el río Pacuare, antes afluente del Reventazón, es hoy río independiente y va al mar directamente, no obstante que en algún punto comunica sus aguas con un brazo del Reventazón; el mismo río Pacuare acaba de dividirse en dos brazos y ha obligado á la Compañía ferrocarrilera á construir un nuevo puente, y el río San Juan se ha echado casi todo por el brazo del Colorado.

No es de sorprender, por lo mismo, que año con año tengamos dificultades por aquel lado.

En cuanto al Pacífico, tenemos también inundaciones, pero no tan frecuentes. El río Tempisque, que riega en su parte baja las inmensas llanuras del Guanacaste, de cuando en cuando, en el brazo principal ó en alguno de sus afluentes, levanta el nivel é invade los terrenos adyacentes.

El río Grande de Térraba, por la misma razón, ha formado diferentes bocas y se riega á veces sobre las tierras bajas. La primera inundación de que tenemos noticia en ese lado fué la que sufrió Gil González Dávila en 1522 á que se refiere minuciosamente en su informe de descubrimiento.— (Fernández, *Historia*, p. 24).

Las inundaciones en el interior han sido muy raras, y más que á exceso

Annex 7

Environmental Impact Study for Improving Navigation
on the San Juan de Nicaragua River (Excerpts)

September 2006

**ENVIRONMENTAL IMPACT STUDY
FOR IMPROVING NAVIGATION ON THE SAN JUAN DE NICARAGUA RIVER**

I. GENERAL ASPECTS

1.1 Introduction

This document analyzes the different stages in the process of executing the project "**IMPROVING NAVIGATION ON THE SAN JUAN DE NICARAGUA RIVER**" (Section of Delta – San Juan de Nicaragua River), in order to comply with the legal requirements demanded by MARENA, and which requests all investment projects to comply with the General Law of the Environment and Natural Resources and its Regulation 45-94, in relation to the Environmental Impact Studies.

The Environmental Impact Study prepared by the multidisciplinary and interdisciplinary team, shows the results and analysis of each environmental component and the actions and operations of the project "**IMPROVING NAVIGATION ON THE SAN JUAN DE NICARAGUA RIVER**" (Delta – San Juan de Nicaragua River). The project's length is 42.0 km, and it is located in the city of San Juan de Nicaragua, inside the San Juan de Nicaragua River Biosphere Reserve. In preparation of the Environmental Impact Study, each stage of the dredging process was assessed, as were the negative and positive effects that these processes could have on the ecology of the San Juan de Nicaragua River and the Biosphere Reserve.

To face the negative environmental situation that the project could create, and to respond to what is stipulated in the terms of reference prepared by MARENA, and what is mandated in Decree 45-94 "Regulation of Permit and Environmental Impact Assessment" for projects that require an Environmental Impact Study, using the cause-effect matrix, and applying the methodology that was revised and corrected by MILAN, presented later in this document, an Environmental Management Plan has been prepared containing four stages: Environmental Supervision and Control, Environmental Education, Environmental Restoration, and Environmental Contingency, which are extremely important methodological instruments used to carry out the actions that allow minimizing, preventing, restoring and offsetting both the negative and positive impacts that are identified.

In 1989, Nicaragua began to experience growth in commercial activity at the national and international levels, which has resulted in the need to improve road, lake and ocean infrastructure, and thus to increase the transport of merchandise for export and import, and to increase the flow of domestic and foreign tourists. This has been having positive repercussions in the social and economic arenas at the local and regional levels.

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In light of the difficulty of navigating the San Juan de Nicaragua River, due to its shallow waters, which is caused by constant obstruction due to erosion in its hydrographic basin, Empresa Portuaria Nacional (EPN), which is the State institution in charge of handling and administering ports whose strategic objectives include improving the country's navigation systems, and to optimize ship traffic capacity, is carrying out the project "**IMPROVING NAVIGATION ON THE SAN JUAN DE NICARAGUA RIVER**" (Section of Delta – San Juan de Nicaragua River) in order to increase transit and transportation activity along this river, and to respond to the development requirements indicated in the CAFTA (United States – Dominican Republic – Central American Free Trade Agreement), and for the country's own development.

The work performed by men on natural lagoons and bays in order to facilitate navigation along certain trajectories directly affects the evolution of natural systems. The projects that include dredging work require a detailed study of all the parameters that directly affect the surrounding system, the metabolism, and nutritional relationships of the lotic system, to thus determine the damage that imposition of such artificial events in the ecosystem will cause. In order to face these problems, the final document of the Environmental Impact Study presents an environmental management plan that is compatible for use as a methodological instrument, and to place it into operation and ensure that the impacts are minimal, and the measures of mitigation and restoration guarantee the sustainability of the physical and biological resources of the project area.

* * *

**ENVIRONMENTAL IMPACT STUDY
FOR IMPROVING NAVIGATION ON THE SAN JUAN DE NICARAGUA RIVER**

* * *

II. DESCRIPTION OF THE PROJECT AND ITS ALTERNATIVES

2.1 General description of the project

The project consists of dredging critical points along 42.0 kilometers of the riverbed of the San Juan de Nicaragua River that make navigation difficult for ships transporting freight and passengers, and that impedes the flow of tourist movement. This dredging activity will be performed by extracting material that basically consists of sand, creating a channel that is 2.0 meters deep, 30 meters wide at the upper section, and 20 meters wide at the lower section. The debris that is removed will be deposited at sites that have already been selected. It will be shaped and flattened to a height of no more than one meter. These sites will be restored and replanted with species native to the humid tropics of Nicaragua.

The San Juan de Nicaragua River sandbar will also have to be broken up in order to allow the dredging equipment to enter from the sea.

Keeping the sandbar open requires studies using data that has been collected for four or more years; however, it was not feasible to carry out these studies during this study. Consequently, the data obtained is based on existing behavior and information on the Caribbean Coast of Nicaragua, and not to the project site specifically.

2.1.1 Location

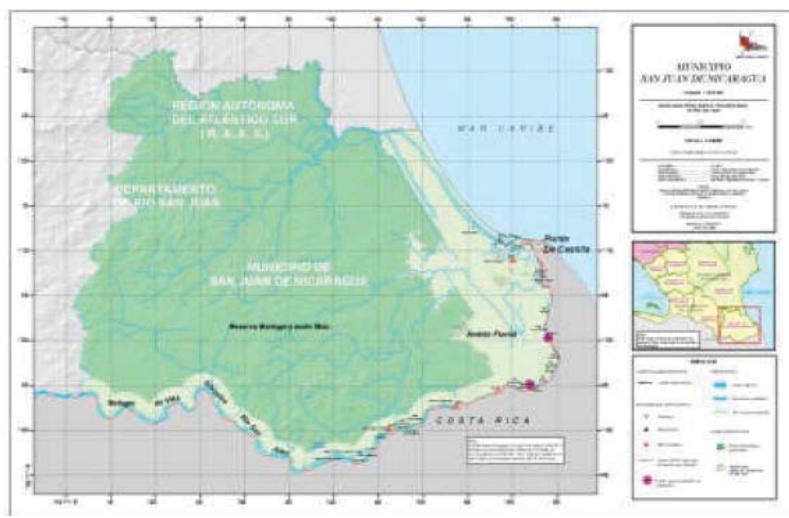
The project is located in the Department of Río San Juan in the Municipality of San Juan de Nicaragua, inside the San Juan de Nicaragua River Biosphere Reserve, in the section of the river that goes from the Delta – San Juan de Nicaragua, whose length is 42.0 kilometers.

The coordinates of San Juan de Nicaragua are 10° 55' north latitude, and 85° 42' west longitude. It is situated in the extreme southeast of national territory, and is bordered on the north by the municipality of Bluefields (RAAS), to the east by the Caribbean Sea, to the south by the Republic of Costa Rica, and to the west by the municipality of El Castillo. It is located 190 kilometers south of the capital of the department, the city of San Carlos, and 490 kilometers from the city of Managua.

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Figure 2.1 shows the general location of the project.

**Figure No. 2.1
Map of the Municipality of San Juan de Nicaragua**
Source: INETER 2004



2.1.2 Location

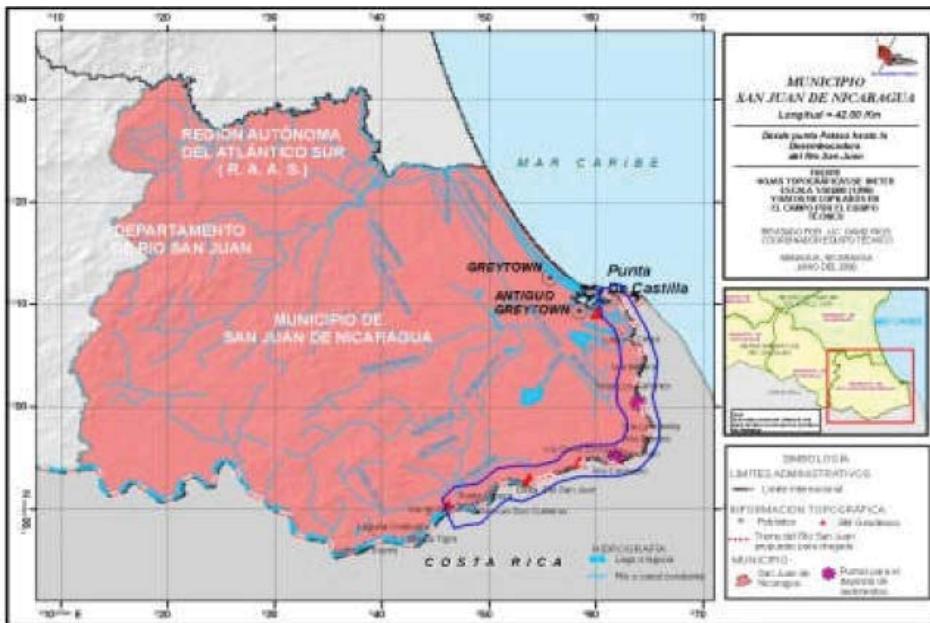
The project is located in the municipality of San Juan de Nicaragua, on the San Juan de Nicaragua River. It is 42.0 kilometers long, with the following coordinates:

Start of section (Punta Petaca)		End of section (San Juan de Nicaragua)	
North	East	North	East
1189750	191350	201064	1211721

The territorial area where the dredging project will be carried out for “**IMPROVING NAVIGATION ON THE SAN JUAN DE NICARAGUA RIVER**” (Delta – San Juan de Nicaragua) comprises a surface area of 533.0 km² and an average elevation of 50 meters above sea level. Thirty-four percent of the area is lower than 5.0 meters above sea level, where the lagoons of Silico, Los Encuentros, La Barda, etc. are located.

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**Figure No. 2.2
Map of the Project Area**



2.1.3 Justification for the Project

The only way to transport merchandise from the interior of the country to the municipality of San Juan de Nicaragua is by the San Juan de Nicaragua River; that is, a significant portion of the nation's commercial activity is carried out on this body of water. A large percentage of the products from San Carlos and other bordering communities are destined for Costa Rica and other countries throughout the world, principally the affluence of domestic and foreign tourists. [sic]

It is of vital importance for Nicaragua to improve conditions for navigating the Delta – San Juan de Nicaragua section of the river. To do this, the riverbed must be deepened to a depth of 2.0 meters and widened to 30 meters, thus eliminating the current impediments and delays, and thus facilitating permanent and safe navigation of ships for public and private transport that travel the section from San Carlos to San Juan de Nicaragua.

The dredging will only affect the bottom of the river at a width of 30 meters. This will increase the depth and flow, which will not affect the hydro-biological connectivity,

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rather it will facilitate the movement of euryhaline species toward the river, where they will remain for long periods of time, or just to fulfill a part of their life cycle.

The San Juan River presents navigation problems, with some sections identified by the municipal authorities as being more problematic in the summer due to the loss of water flow, which makes boats run aground. Sometimes boats will remain for hours or days before reaching their final destination.



To be able to finish their trajectory, villagers must push boats off the existing sandbars.

2.1.4 Objectives

Project Objectives

(a) General objective

To perform maintenance dredging on the navigation route to a depth of 2.00 meters from the lowest level of the river, to be able to navigate between the Delta and the outlet of the San Juan River into the Caribbean Sea in order to build a navigation route that is safe throughout the year.

(b) Specific objectives

- ❖ To afford safe and continuous navigation to passenger ships and freighters.
- ❖ To maintain and increase safety levels in navigation for the boats that travel the San Juan River.
- ❖ To encourage commerce between San Carlos and San Juan de Nicaragua.

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Objectives of the Environmental Impact Study

(a) General objective

- To design an Environmental Management Plan from the Environmental Impact Study of the dredging project to improve the navigation system between the bay of San Juan de Nicaragua and the Delta.

(b) Specific objectives

- To determine the abiotic and biotic characteristics of the area of study.
- To learn about the physical characteristics, hydrological, hydrogeological and hydrochemical conditions, and degree of contamination of the area of study, as well as the variations that will occur to these characteristics and conditions with the implementation of the project to dredge 42 kilometers of the river.
- To identify and predict the environmental effects caused by the construction and operation of the project.
- To evaluate the project's different activities in order to minimize environmental repercussions (positive and negative).
- To propose viable alternatives for control and mitigation in accordance with the negative effects identified due to these impacts on human beings, flora and fauna, the soil, air, water and climate.
- To prevent any environmental condition that could possibly damage the project and the communities surrounding the area of the project's influence.

To prepare an Environmental Management Plan for the problems identified in the construction and start-up of operations of the dredging project.

2.1.5 Presentation of the surface plan of the work

The following page shows a plan of the work. Annex 4 shows all of the plans.

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2.2 Description and Technical Characteristics of Dredging Activities to Deepen the Riverbed

2.2.1 Technical description of the dredging and deepening work

Configuration of the river

1. Petaca – Delta Section

This sector begins eight kilometers upriver of the Delta at Punta Petaca, where the width of the river is 510 meters, with maximum depths of 4.47 meters, and an average depth of 2.50 meters. At this point the river has two well-defined channels: one large channel located on the banks or on the Costa Rican border, with a surface width of 200 meters at the wider sections, and up to 150 meters at the narrower parts. Depths are up to 4.47 meters during the rainy season and 2.50 meters during the dry season, and there is a small channel on the Nicaraguan border that is 60 meters wide, and 2.90 meters deep during the rainy season, and up to 0.90 meters during the dry season. Between the two channels there is a pronounced sandbar that is 150 meters wide, whose highest point becomes an outcropping during the dry season or when the river's water levels drop, which is dangerous for navigation, causing ships to run aground and become shipwrecked, damaging ships or their motors.

At the start of the section are several locations with rocks, and four kilometers from Petaca there are more rocks that project above the surface of the water in the dry season, which is dangerous for navigation. These sites must be marked so that the ship's pilot can locate them properly, avoiding possible collisions and negative consequences.

On the rest of the bed of the investigated section, fine to gross sand particles were extracted in swaths of two to three meters deep, with diameters of the sand varying between 0.35 mm to 0.95 mm.

Current measurements showed an average speed of 1.07 meters per second, at a flow of 1,372 cubic meters per second.

A preliminary analysis suggests to us that channeling the flow should start at least two kilometers upriver of the Delta, using a larger section of the channel than what is proposed for the other sections, at least double the size of the other sections, keeping the elevation of the riverbed at 2.0 meters, all of which ensures that we will have sufficient flow in the dry season, which is critical for navigation. This of course does not substantially harm the flow of the Colorado River, since we will only take 5% of the total flow, ensuring permanent navigation on the San Juan River.

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2. Delta – San Juanillo Section

This section begins at the Delta and ends at the outlet of the San Juanillo River. It is 22 kilometers long, with its width varying between 95 and 100 meters, with average speeds of 0.68 up to 0.87 meters per second, and flows obtained at that time went from 107 up to 138 cubic meters per second.

The samples obtained and processed in the laboratory were gross to fine sand, with diameters varying between 0.58 mm to 0.90 mm, with specific gravity of 2.53.

At the start of the section at the Delta there was a 500-meter long layer of coffee-colored, highly malleable clay (CL). That layer, located precisely at the start of the widening of the San Juan River, faces the location where the Colorado River begins, it forms a top layer that is 1.20 meters to 2.0 meters high in relation to the depth of the river, in front of the Delta, serving as a retaining wall, which, during dry periods, prevents the passage of higher flows toward the rest of the river, deviating the major flow toward the Colorado River, causing scarce flow in the navigation channel during the summer.

The depths of the river in this section at the bed are 1.55 up to 100 meters before the outlet of the San Juanillo River, 2.21 into El Zapotal, and 1.43 into Los Reyes, and 2.91 into the Delta at the entry of the section, resulting in a sinuous configuration with peaks or cresting elevations in the Delta and El Zapotal, and depressions or valleys at Los Reyes, resulting in an average slope of 6.18×10^{-3} .

This section has problems with the river flooding its banks. This is a more serious problem on the Costa Rican side because the peasants who inhabit the area deforest the area around the river, leaving the riverbanks without protection. The soil formation is mud and sand, and the rains and the current facilitate flooding, as the banks are not protected by grass. This, in addition to the transport of sediment from the river, low speeds and the inverted slope up to a certain section, give rise to the formation of islands that block the channel, thus completely losing this section of the river. The largest number of islands of various sizes appears in this section.

During probes of this section, the remains of organic material were found, including trees 0.6 meters in diameter buried under the riverbed up to a depth of 3.00 meters. In three of the 118 probes, samples of organic material were recovered (buried trees), under the bed of the river. These trees or trunks that come downstream during periods when the river is very high go downstream, bumping against the islands, which retain them, serving as energy dissipaters, retaining some sediment, which, upon accumulation during the year increases the size of the islands, or causes new, small islands to be created.

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Here the geometric section of the channel is trapezoidal, with its base width being less than 20 meters, and 30 meters on its upper base, with a depth of 2.0 meters during the dry season.

In parallel with the channel, the natural channel that is currently in use continues generally with the proposal that if there is stable alignment of the channel, it will only be necessary to expand it. The other alternative is to locate the channel at the center of the river, but the sandbanks and the islands that are generally located in the center will produce large volumes of material to dredge.

This section is defined as the most critical due to the large volumes of sedimentation located on the sandbanks, islands, etc., therefore the dumpsites have been located more regularly to facilitate the immediate deposit of the extracted sediment.

3. San Juanillo – San Juan River Mouth

This section presents fewer navigation problems as it maintains navigable depths during the summer of up to 1.5 to 2.0 meters. The section begins precisely at the outlet of the San Juanillo River into the San Juan River, and ends at the outlet of the San Juan River into the Caribbean Sea. It is six kilometers long, it is quite flat and low, and it is exactly in this sector where there are three closed curves due to the very slight slope, joining with one of its curves and forming a small island. The average speed that was determined at the outlet of the river was 0.56 meters per second.

The width of the river varies from 80 meters at its narrowest sections, up to 182 meters at the outlet, with depths of 2.42 up to 4.0 meters. The capacity close to the mouth was a flow of 170 cubic meters per second.

The predominant vegetation along the riverbanks includes jupati palms, natural hay, arrowgrass, wild lettuce and mangroves in the estuaries facing the sea.

The result of the geotechnical probes in the section is the following:

Fine- to large-sized grains of sand (SM), with average diameters of 0.45 to 0.68 mm, poorly graduated with specific gravity of 2.45, changing at the mouth or outlet to the Caribbean Sea to clean, fine sand grains, with diameters from 0.31 to 0.58 mm, with specific gravity of 2.64.

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A thin layer of clay (CL) was also found that is light coffee-colored, has little plasticity, and mud and sand (OL), average compaction from 2.0 to 2.50 meters below the level of the riverbed.

The entire section is influenced by ocean tides, meaning that there is sea penetration during high tide, and ebbing during low tide, causing flows of different densities.

The geometric section of the channel in this section is the same as in the prior section, that is, 30 meters wide at the upper base, by 20 meters wide at the lower base, and 2.0 meters deep.

The geometric section of the access channel from the sea toward the mouth of the San Juan River is 60 meters wide at its upper base, by 40 meters at its lower base, and it is 6.0 meters deep for approximately 600 meters. It is aligned with the current inlet, reinforced with the dredged material from the dikes that are easily breached during storms.

The volumes of material to be dredged in this section are not very high, which is why the changes in the section will be minimal.

4. Inlet – San Juan de Nicaragua Wharf Section

The section begins at the inlet of the San Juan River and goes to the municipal dock of San Juan de Nicaragua. It is 5.0 meters long, and the channel runs almost parallel to the coast of the Caribbean Sea. Along this section, the San Juan River, the Indio River and the lagoon or bay of San Juan join together in this section.

The material found in the riverbed is fine sand with mud (SP), with an average diameter of 0.50 mm, with 2.54 specific gravity.

This section of the channel also experiences influence from ocean tides, especially in the Indio River channel.

Between the outlet of the Indio River and the outlet of the San Juan River there is a coast or beach along the sea whose morphology is very dynamic, meaning that it is constantly changing in accordance with climate and wind conditions, especially when combined with the Sicigias Tides in August, and in October with its strong and intense rains. The height of the waves increases, and this plus the erosion caused by the river currents, breaks the closed dunes or dikes that were formed previously during the dry period, and they close off again during the next dry season. These changes are cyclical.

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The volumes of material to dredge in this section will also be minimal, because the channel has a certain degree of stability in its configuration, with the exception of some specific areas, for example, where the San Juan River meets the Indio River and the Bay of San Juan. In addition, there is the sea current that enters through the two inlets, causing those currents to smash against each other, and there are banks of sediment that are constantly moving according to the forces resulting from the river flows and sea currents.

Width of the Channel

The minimum width of a straight channel initially depends on the size of the ships and their ability to maneuver, in addition to the wind and current conditions that affect the channel. The width of the channel is divided into three zones or lines for one or two lanes of shipping traffic.

- Keel Line
- Line of Maneuverability
- Keel line between ships
- Side line at the foot of the slope

The width of a restricted channel must consider the bottom of the dredging level, and the sum of the three zones or spacing lines. The width of the line of maneuverability generally varies from 1.6 to 2.0 times the beam of the typical boat or ship that navigates the channel.

In conclusion, we can say that for the channel to be dredged, the width will follow the dimensions listed below, using the El Azul y Blanco as the typical vessel, and for two-way shipping traffic, the ship Diamante No. 7.

Keel: 0.60 m (from the dredged riverbed to the boat's keel)
 Maneuverability distance: $3.20 \text{ m} \times 2.0 \text{ times} = 6.40 \text{ meters}$ (B.T. beam x factor)
 Distance to the foot of the slope: $3.20 \text{ m} \times 1.5 \text{ times} = 4.8 \text{ meters}$ (B.T. beam x factor)
 Free distance between ships: $3.20 \text{ m} + 1.6 \text{ m} = 4.8 \text{ meters}$ (beam + manev. distance)

Determining channel design

In order to determine the volume to dredge in the different sections, it is necessary to determine the section of the channel to be dredged. The minimum depth that the channel requires has been determined, which is 2.0 meters, using the ship Azul y Blanco, with draft of 0.80 meters fully loaded, but considering use in the near future of a ship with a draft of 1.80 meters. Now it is necessary to determine the cross section of the channel, that is, to define the width at the bottom, and the slopes on the sides, which would finally give us the expected channel for navigation of the river.

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Channel dimensions:

Depth: **2.0 meters**
Includes dredged: **0.20 meters**
Width at the bottom: **20.0 meters**

Depth of the river

Over the course of the 42 kilometers with critical depths, an estimate of the volume of material that must be dredged has been established. The distances that cover the different sections with their average depths are presented on the following table.

SECTION NAME	DISTANCE	MINIMUM DEPTH	MAXIMUM DEPTH
PETACA – DELTA	8.5 KILOMETERS	1.50 M	2.00 M
DELTA – SAN JUANILLIO	2.2 KILOMETERS	0.30 M	0.30 M
SAN JUANILLO – INLET	7.5 KILOMETERS	1.50 M	1.50 M
INLET – SAN JUAN DE NIC. DOCK	4.0 KILOMETERS	1.00 M	1.50 M

TABLE 4.1 Average Depths in the Sections in the Area of Study

Identification of zones to be dredged and equipment to be used

The dredging work on the San Juan River in the section comprising 42.0 kilometers from the San Juan River Delta to its outlet into the Caribbean Sea is described below.

Dredged Channel with Access to the Caribbean Sea – San Juan River Inlet

One of the considerations analyzed by the consultant, which was proposed to maintain a continuous current from the San Juan River to the Caribbean Sea, is the need to increase the depths at the outlet. To do this, it will be necessary to deepen and build a channel that, in addition to allowing the dredger access from the sea to the San Juan River, also prevents sediment (sand) from being transported from the sea to the estuary where the San Juan River empties.

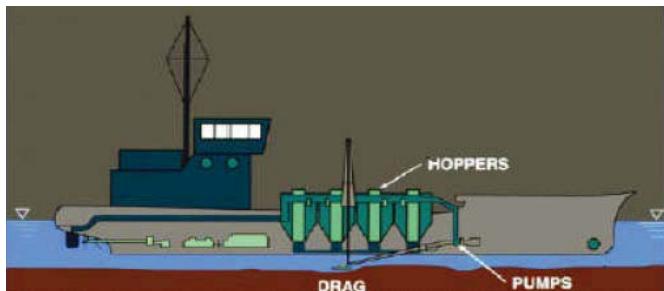
The characteristics of the proposed channel are as follows:

Channel length: **2,000 meters**
 Channel width: **40 meters**
 Depth: **NMM – 6.00 m**
 Lateral slopes: **1:10**

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The width was established based on the type of dredger that has to be used to dredge that channel, considering a minimum width of 40 meters, and considering the depth required so that a tugboat can begin the cut and suction dredger up to the river mouth. The lateral slopes were considered based on the slope of the sand.

The intent of the dredging is to prevent the flow from the San Juan River from losing speed when it reaches the estuary, which causes the formation of sandbanks upriver, and makes navigation difficult. The material to be dredged would be deposited on the coast, forming a dike or a dune that decreases the energy of the waves, and decreases the volumes of sand that enter through the sandbar, thus preventing the reduction in depth.

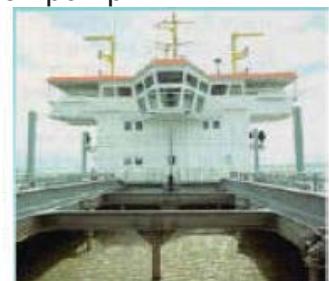


Suction Hopper Dredger Under Way

The equipment proposed to dredge the access channel, which would enter from the sea where the average depth is 6.00 meters and motor up to the sandbar of the San Juan River, is a self-propelled hopper dredger, as shown in the above figure. This is the same as a boat that uses one or two arms with pipes that suck sediment from the bottom of the river and deposit it in a hopper located in the center of the vessel. Once this compartment is full, it may be unloaded through the bottom of the hopper through sluices that open and allow the material to slide out. Some are designed to unload the material through a pipe using the same centrifugal suction pump.



Suction dredger under way, designed to unload through pipes.

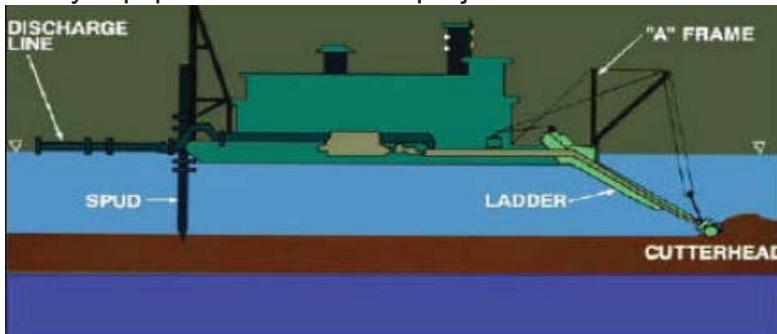


Hopper on a suction dredger.

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Dredging from the Delta Channel up to the Inlet of the San Juan River (42 Km)

Conveying a cutting and suction dredger to perform dredging work from the channel in the proposed section is only strategically and economically possible through the Caribbean Sea. This type of equipment, due to its capacity and size, is not available in Nicaragua, therefore a dredging company with the capacity and experience to perform the work would have to be contracted. Therefore, the cutting and suction dredger projected to perform this type of project will have to be transported from a foreign country, or the possibility that the equipment is available in the region [sic]. This type of equipment cannot navigate by itself; it must be transported using larger-sized ships or vessels with sufficient capacity to convey the dredger, pipes, and other auxiliary equipment used in the project.



A dredger of the type indicated.

Description of a cutting and suction dredger, with its main parts. The principal vestibule, where the motors and pump are located, the ladder for the cutter, the anchor stanchions, and the exit for the discharge pipes.

2.2.2 Processes, machinery and equipment

In order to choose the capacity of the dredger, the capacity of the cutter and the suction pump must be considered, as well as the diameter of the suction pipes and the diameter of the discharge pipe. The following table shows different types of dredgers with the aforementioned requirements for cutting and suction dredgers. This section briefly describes some types of dredgers that may be used to carry out the project.

TYPE OF DREDGER	Pump Capacity Kw (hp)	Diameter of Suction and Discharge Pipes (m)	Cutter Capacity Kw (hp)	Dredging Depth (m)
IHC Beaver 300	175 (238)	0.26 / 0.26	30 (40)	6
IHC Beaver 600	390 (530)	0.40 / 0.40	52 (70)	8
IHC Beaver 1200	610 (830)	0.45 / 0.45	110 (150)	10
IHC Beaver 1600	835 (1140)	0.55 / 0.50	170 (230)	14 (16)

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TYPE OF DREDGER	Pump Capacity Kw (hp)	Diameter of Suction and Discharge Pipes (m)	Cutter Capacity Kw (hp)	Dredging Depth (m)
IHC Beaver 2400	1275 (1735)	0.60 / 0.55	294 (400)	14 (16)
IHC Beaver 3800	1846 (2510)	0.70 / 0.65	552 (750)	16 (18) (20)
IHC Beaver 4600 MP	2x1275 (2x1735)	0.75 / 0.70	552 (750)	16 (18) (20)
IHC Beaver 8000 MP	2x1680 (2x2285) 1x919 (1x1250)*	0.80 / 0.75	883 (1200)	22

Pump table for submersible dredger MP = mono-pontoon version (one float or hull) (16) (18) (20) optional dredging depths

The equipment will generally excavate a channel 42 kilometers long, with the following characteristics:

Length of channel for river navigation:	42 kilometers
Width of the bottom of the channel:	20 meters
Dredging depth:	Dry season – 2.0 m
Lateral bottom slopes:	2:2.5 minimum
Characteristics of the material to dredge:	Thick sand with gravel up to fine sand with low % of mud and clay

2.2.3 Fuel Supply

The company responsible for the dredging work will have the sole option of getting fuel supplies at the Bluff, a place located to the north of the outlet of the San Juan River, with the entry to Bluefields Bay in the Autonomous Southern Atlantic Region of Nicaragua (Región Autónoma Atlántico Sur de Nicaragua – RAAS). There is a fuel terminal operated by the oil company PETRONIC on Bluff Island. This company is the only one in the Caribbean region of Nicaragua that supplies diesel and gasoline.

The consultant is aware that the company PETRONIC has a barge with a shallow draft driven by a tugboat named the Atlantic Queen, with capacity for 13,000 gallons. This vessel supplies fuel to different sites on the Atlantic coast, including Corn Island. Therefore, the contractor that performs the dredging work may be able to establish fuel supply with PETRONIC.

Another possibility is for the fuel to be supplied to Bluff Island by PETRONIC, and then transferred using the contractor's own equipment. Note that PETRONIC has storage tanks installed in San Juan de Nicaragua with capacity for 16,000 gallons, which would have to be reactivated to provide service.

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The dredger's fuel consumption will particularly depend on the equipment that the contractor provides to perform the work. It must be noted that the dredgers have their own compartments for fuel storage, and the availability of diesel on board the vessel will depend on the capacity of the tanks and draft limitations.

2.2.4 Waste management:

The environmental policy of the project is the commitment to preserve the surroundings and the environment, and its main objectives are to prevent contamination, minimizing possible impacts to the sea and the coastline where the dredging work is located. Control of the supply processes, changes in oils and lubricants, waste from materials used in maintaining the equipment, must be performed where the ships are moored and operating.

Having a procedural manual as a simple and precise guide to good practices to prevent marine contamination and to actively collaborate in caring for the environment must be a task of the entities and institutions involved in these types of operations.

Waste:

All ships must have a sheet with instructions on what to do with waste, and they must carry three plastic bags where they will put their waste:

1. Blue bag: general trash, food waste, packaging, paper, cardboard...
2. Red bag: hazardous waste, paint cans, varnish, lacquer, solvents...
3. Green bag: paintbrushes, masks, burlap, sandpaper, rags...

Once the bags are full, it is the responsibility of the cleaning crew to dispose of them.



[Picture title illegible]

Control of contamination and emergencies

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It is fundamental part of the contract for the dredging work that a contamination control and emergency plan be created to prevent and control accidents with the substances, fuels and structures that are used in the machinery and equipment during dredging. The plan must also include areas intended for use by different types of equipment and machinery, the storage and fuel supply area, and the appropriate signage for each case, as well as the action procedure during a contingency. The contamination control and emergency plan must be provided as an annex to the service provision contract by the contractors who perform the work.

- ✿ The project area, and specifically the area used for handling fuel and flammable substances, must comply with the safety measures and emergency equipment required by specific contingency plans authorized by the existing prevention system.
- ✿ Paints or solvents must be handled as stipulated in the repair plan to prevent them from falling into the water.
- ✿ MARENA and other institutions involved must specify the characteristics, systems and procedures to prevent leaks and spills.
- ✿ Gasoline tanks must have controlled pressure caps to minimize evaporation.
- ✿ Design a specific emergency and environmental contingency plan for the project in particular, considering the ecological area to be affected.
- ✿ Any oil-derived product that falls into the water must be recovered in accordance with the procedures stipulated in the emergency plan.
- ✿ The characteristics of emergency systems and procedures in the event of flows and leaks of dangerous substances must be included. These systems may be, for example, floating contention barriers and absorbent materials.
- ✿ Local authorities must project measures to prevent the dispersion of contaminants, whether using natural means (ocean currents, natural flows, etc.) or artificial means.
- ✿ There must be temporary storage with safety measures, and leak and spill prevention measures for hazardous materials such as solvents, paints, oils, varnishes, etc., as mentioned in the General Law of Toxic Waste and NOM-52-SEMARNAT-1993.

Solid waste management

The dredging work and machinery maintenance activities create solid waste that must be disposed of in the containers assigned for it, and these must be prevented from being thrown into the sea.

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Those deposits would be emptied periodically, and organic trash would be transported to the dumpsite authorized by the municipality.

- ✿ During the project there must be enough trash storage to keep the site in a healthy state, and there must be a monitoring and transfer plan for the containers.
- ✿ The facilities must have a location defined and indicated with signage for the systems and equipment for handling solid waste to minimize the impact.
- ✿ In no case may the waste be thrown into bodies of water or in the proximity of aquatic ecosystems, nor may it come into contact with the soil.

Conserving natural resources

The project area is a globally recognized biosphere reserve, and it is absolutely necessary for visitors and the local authorities to preserve the natural conditions by conducting operations properly. Tourists visit these sites for the beauty of their landscapes and their pristine natural condition, therefore these are people who are very sensitive to conserving natural resources. The dredging project and the facilities involved must contemplate the protection of natural resources from the adverse impacts that could occur due to establishing infrastructure and the use of ships inside the operational areas.

- ✿ Design an operating program that foresees and avoids conflicts with wildlife, both land and aquatic.
- ✿ During the dredging, prevent impacts to submerged aquatic vegetation as much as possible. Place the equipment so that it is not necessary to disturb areas of aquatic vegetation once the dredging is under way.
- ✿ Conserve and restore the natural resources in those areas that are not used in the project, within the limits of the project.
- ✿ Promote conservation of sandy beach areas in the coastal zone to absorb the energy of the waves produced by the wind or by the passage of ships, minimizing the effects that may occur due to erosion.

2.2.5 Handling dredged material

The dumpsites were chosen considering every environmental factor in the surrounding area, mainly the soil, vegetation, the subsurface slope, and the precipitation system. Based on these criteria, 24 sites were investigated, of which 21 were selected as presenting a high degree of deterioration due to deforestation and the use of destructive agriculture. These adverse conditions will allow the impact of depositing dredged materials that are a product of the project's activities to be

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minimal. Further, the restoration tasks contemplated in the project's environmental management plan will improve the environmental conditions and will enrich the landscape by inserting fruit-bearing forest species existing in the area of the project, which will serve as food and refuge for wildlife.

Physical characterization was determined using manual probing at each site, at a depth of 0.00 – 1.00 meters, performing a total of 21 open-sky manual probes, obtaining 42 samples of materials with clay with medium to high malleability. The equipment used consisted of shovels, hammers and bars for probing, and GPS for positioning. The probe was placed at the center of the selected site in the majority of cases, and two samples per probe were taken. Sample analysis showed the capacity to support the selected sites to be used to deposit the debris.



This photo shows the predominant characteristics of the Los Reyes dumpsite.

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LOCATION OF THE SITES EVALUATED FOR DISCARDING MATERIAL

No.	NAMES OF DEPOSIT SITES	UTM COORDINATES		AREA (MZ)	VOLUME m³
		NORTH	EAST		
0	Public Property*	1 211 244	202 220	00	
1	Public Property	1 209 201	206 250	2.25	60,704
2	Public Property	1 207 483	207 205	00	98,273
3	Public Property	1 207 078	207 805	2.08	14,579
4	Juan Popa	1 206 540	207 309	15.73	110,532
5	Public Property	1 205 357	207 314	5.61	39,404
6	Private Property (Chepe)	1 204 349	208 162	1.19	16,744
7	Daniel Reyes	1 203 662	208 278	13.39	188,184
8	Noel Castillano	1 202 463	207 727	2.13	29,958
9	Calixto	1 200 692	207 477	14.65	102,941
10	José Gómez	1 199 981	207 762	4.73	66,436
11	José Gómez	1 198 453	208 250	27.41	192,571
12	Alejandro Reyes Aragón	1 197 832	208 809	19.22	135,019
13	Socorro López S.	1 196 615	208 869	9.01	63,283
14	Dáario Sánchez (El Jobo)	1 194 306	205 891	2.40	33,700
14A	Public Property	1 193 874	205 266	2.12	21,226
14B	Public Property	1 194 151	204 172	2.12	21,226
15	Ricardo Salinas	1 194 453	203 651	1.86	26,090
16	Silvio Reyes	1 193 900	202 322	25.16	363,801
17	Rubén Reyes	1 193 247	200 549	13.73	
18	Felipe Espinoza	1 193 136	199 890	5.34	75,074
19	Gregorio Chamorro	1 192 607	198 443	0.52	7,334
20	San Juan River Delta	1 192 386	197 532	1.19	2,050
21	Public Property	1 192 429	197 088	1.30	---
22	Public Property	1 192 535	196 203	0.39	5,544
23	Public Property	1 191 939	194 134	1.20	16,874
24	Public Property	1 189 857	189 947	6.65	46,742

* The deposit identified with the number zero is an alternate site if required.

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2.2.6 Sandbar to protect the banks of the San Juan River

During the field studies performed, some locations on the banks of the river were seen to continuously flow over the banks, possibly due to the type of soil, the current, the waves produced by outboard motors with capacity higher than 40 HP, the trees and trunks that the current conveys, etc. This also causes sedimentation, in addition to the sedimentation carried by the river, forming numerous islands and sandbanks in this sector. It is necessary to protect those sites against erosion, otherwise, with the new channel design, the situation may worsen.

In order to protect sites that are generally located in narrow areas where large islands are forming that reduce the space of the channel, slightly increasing current speed, such as Isla Salomón, Taura, etc., we are recommending the construction of a protective barrier on the banks of the river.

The protective barrier on the banks of the San Juan River consists of the following:

Construction of a structure or physical wall that does not allow erosion along the riverbanks, meaning that it must be impermeable, continuously retaining erosion or flooding that occurs during times when the river rises. It must be firm and solid, easily and quickly built, it must be built prior to or in parallel with the dredging process so that the dredged material can be used to fill the empty sections of the barrier.

2.2.6 Barrier construction process

First, galvanized metal pipes are driven into the ground, sheet no. 20, 4 inches in diameter, with embedded length of 2.5 meters and 2.0 meters of free space, which coincides with or exceeds the height of the edge, and these pipes will be spaced every 1.20 meters, reinforced with another pipe as a bracket at a 30° angle every 5 pipes, that is, every 6.0 meters. Then tension cables 3/8" in diameter will be put into position, joining the upper part of those pipes at the middle and lower sections of the pipes, passing inside a metal band ½" in diameter, welded onto the pipe. Then the same metal cable is placed diagonally across the spaces between the pipes, from the upper part of the pipe to the lower part of the pipe on the riverbed, with proper tension, and it is secured and aligned with the pipes.

Once the securing structure is ready, an 8-foot cyclone-type metal screen is put into place with proper tension, and it is tied with metal wire no. 16 to the metal cable, resulting in a firm, rigid and very resistant structure.

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Next, Geotextil or unwoven screen no. 200 is placed in lengths according to the site to be protected. The Geotextil is put into place, vertically supported on the screen, placing a rod vertically over a metallic rod that is $\frac{1}{4}$ " in diameter in order to affix the Geotextil to the screen, and on the lower part of the Geotextil, an edge of it is folded into the riverbed 3.0 meters wide, affixing it to the riverbed with metallic posts that are $\frac{1}{4}$ " in diameter by 30 centimeters long, and sacks full of sand are immediately put into position, putting pressure on the Geotextil to affix it to the riverbed and preventing it from raising up and floating while it is filled with dredged material or sand.

Once all elements of the protective barrier are in place, anchors are placed every five pipes on the barrier, 10 meters away from the barrier, to prevent its collapse due to the effects of forces resulting from movement.

These protective barriers for the riverbanks must also be built:

1. When inhabitants of the area pull up and cut the grass on the river's edge, leaving the natural soil without protection, and when strong and continuous rain falls, which is normal in the area, the surface soil erodes, opening small fissures that later connect with each other, and in combination with the river's currents downstream, collapse the wall of the edge until it falls into the river.
2. To protect the material at the dump site once it is placed at the site so that it does not leak and return to the river, it is necessary to build a protective curtain or barrier that is sufficiently firm to prevent possible collapse of the material.
3. This protective barrier is also built in construction of the island closures, seeking a gentle angle to prevent frontal shock of the current against the barrier, thus preventing its destruction in a short period of time. Once that protective barrier is built, it is filled with material obtained from dredging along the island.
4. Installation of a protective barrier in sections where the dumpsite is located closed to the river.

In option 2, the dumpsites that will have heights of dredged material higher than or equal to 2.0 meters must be protected. In this case, this means dumpsites 3, 6, 7, 8, 10, 14, 15, 18, 19, 21, 21, 22 and 23, for a total of 2,834.0 linear meters to protect.

A construction plan and design of this protective barrier is presented on an attached page for the banks of the San Juan River, with its details, dimensions, etc.

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III. DESCRIPTION AND ENVIRONMENTAL CHARACTERIZATION OF THE AREA OF INFLUENCE (See Maps in Annex 1)

3.1 Limits of the area of influence

In the territorial area where the dredging project will be undertaken for “**IMPROVING NAVIGATION ON THE SAN JUAN DE NICARAGUA RIVER**” (Delta – San Juan de Nicaragua), there are several protected areas in the southeast of Nicaragua that, due to their importance, were declared to be Biosphere Reserves by the government in 1999. This initiative was recognized internationally in 2003, when it was included in the World Network of Biosphere Reserves under the name the San Juan River Biosphere Reserve.

The territory that will experience the direct and indirect impacts of the project’s actions and their alternatives, is called the project’s Area of Influence. The definition of its limits is only determined in the final stages of the environmental impact studies. Every impact, depending on the modifying environmental factor, has repercussions in a certain geographic area, or in a human community, which determines its area of impact. The total limits of the project’s area of influence will be the group of all environmental factors that are positively or negatively affected by the different activities of the project, and the areas of incidence of all the impacts.

The areas directly and indirectly affected by the impacts that will undergo more intense transformations must also be determined. Those limits may only be definitively established when the analysis of all significant impacts of the project are established. In practice, for the purpose of execution of subsequent tasks, initially the contours of the area of influence are determined, based on the knowledge of the professionals in the different disciplines who comprise the team, including the necessary adjustments to the extent to which the environmental impact study is developed.

In any event, no set formula can be given to define such an area of influence. For countries such as Nicaragua, where information is not widely available nor are there resources for studies, the recommendation is to start with identification of critical problems in the project-surroundings relationship, discarding non-relevant factors and focusing on the truly significant problems. (Milán 2004)

For the case of the project “**IMPROVING NAVIGATION ON THE SAN JUAN DE NICARAGUA RIVER**” (Delta – San Juan de Nicaragua), the area of influence is defined as the zone where dredging activities and movement of machinery directly affect the surroundings (amount of debris, deposit sites, dredging depth, and alteration of the ecological niche on the riverbed), and further, those areas that, due to their proximity, are affected or that benefit.

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The area that will be directly impacted is defined by the depth of the river and the amount of debris to remove, and the sites where this debris will be deposited, whose limits are established in the design presented by the Empresa Nacional de Puertos (EPN). The total length is 42.0 km, and the width at the different points of the river. [sic]

We define the area to be indirectly affected as an extension of the right-of-way to 100 meters to each side of the river from the center, resulting in an approximate total of 320 hectares along the entire trajectory as the area that may be indirectly affected positively or negatively. The area in which negative impacts will affect the environment directly is at the 22 sites where debris will be dumped, which together add up to a total area of approximately 142 hectares (174 property divisions). In this area, herbaceous vegetation will be eliminated, however, the few existing trees will not be cut down. The dredged material consists basically of sand that will be formed and spread out, forming an embankment that is one meter high. A restoration plan will be executed immediately in order to plant vegetable material consisting of trees and shrubs that are native to the humid tropics in this area, with the objective of enriching the landscape and restoring and forming a zone for the feeding, movement and protection of wildlife.

Environmental Description

The project is located inside the Wildlife Refuge of Río San Juan de Nicaragua, which forms part of one of the two most extensive and best-preserved biological centers of the Mesoamerican Biological Corridor, and it forms one of the most important wetlands in Central America, as it is the end section of the most extensive watershed in Central America, as the hydrographic basin of the San Juan de Nicaragua River is located on a river plain – low marine area, with average elevations of 20 meters above sea level, and slopes of less than 0.5%, with a landscape morphology of deltas, low river dikes, marshes and sandbars, moderately well to poorly drained, which, combined with the high precipitation in the zone, keeps the ground saturated with water.

The tropical rainforest that comprises the plant mass in the wild area of the San Juan de Nicaragua River is the雨iest zone in the country, with precipitation of up to 6,000 mm in the southeastern corner. Due to this high level of precipitation, the zone's relative humidity is greater than 90%, and the temperature varies between 24°C and 30°C. The biophysical conditions of the area shelter an enormous variety of flora and fauna in the complex and diverse land, marsh and coastal marine ecosystems, with high and diverse values of natural and cultural biodiversity that are of national and international importance.

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On June 4, 1994, Decree 28-94 was published: Declaration of the Southeastern Region of Nicaragua Territory of Sustainable Development. The objective of the declaration is to encourage ***“the rational use of natural resources, to conserve the environment, biodiversity and development, based on the capacity of land use, and in particular, ecotourism.”***

* * *

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Water Quality

Ionic Content – Background

Procuenca¹ determined that the water quality in the San Juan River is generally calcium bicarbonate.

The hydrochemistry of the San Juan River has been defined by Fuentes S., who indicates that the predominant type of the water up to the Machado River is calcium-sodium bicarbonate, or calcium-magnesium bicarbonate, in accordance with the water from the rivers that feed the San Juan River.

The anomaly is found at the site called Salida del Río San Juan, at the confluence of the San Juan River and the Colorado River, which empties toward Costa Rica. In this section from the Machado River to the exit of the San Juan River, two major rivers empty from Costa Rica, the San Carlos and the El Sarapiquí, which occupy a major portion of the area that drains to the San Juan River, which is also an area where agricultural activities are intensively performed.

The sulfates come from fertilizers and soil correctors, which are not used in moderation, thus they easily get into the water.

The results of the physical-chemical analyses performed for this study, and those performed for the Procuenca Project at the entry of the San Juan River and the Delta, are shown in Table No. 7.

Physical-Chemical Field Parameters

High levels of turbidity were reported in July from the Santa Cruz River, and high values of suspended solids were reported in Nicaragua, with values of 38.4 UNT and 73 mg/l. In 2003 in the area of the Delta, turbidity values of 149 UNT were reported, and 218 mg/l was reported for suspended solids. The influence of the San Carlos and Sarapiquí Rivers from Costa Rica are clearly seen here.

The alkalinity values from the Machado River very close to Sarapiquí and in the Delta are low, therefore there is a risk of acidification.

During the field stage, measurements were taken of physical-chemical parameters in the field with the following results.

¹ Creation of a Strategic Action Program for Integrated Management of Water Resources and Sustainable Development of the San Juan River Basin and its Coastal Zone (PROCUENCA SAN JUAN) 2004.

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Table No. 6. Physical-Chemical Field Parameters

LOCATION	EAST	NORTH	PH	CE (μS)	REDOX	T ($^{\circ}\text{ C}$)
Sarapiquí River before [illegible]	178849	1186546	4.42	116	281	27
Sarapiquí River Outlet	178919	1185546	4.74	96	238	25
Punta Petaca	191350	1189750	6.90	104	281	26
Before Boca Colorado Outlet	196679	1192111	6.93	106	230	26
After Boca Colorado Outlet	198655	1192369	6.84	107	226	27
El Jobo	205870	1194145	5.60	106	210	27
El Zapotal	207840	1199396	5.62	113	91	27
Before San Juanillo Outlet	207000	1205550	7.01	114	109	27
After San Juanillo Outlet	207000	1206000	6.31	91	197	28

The pH is the measurement of activity of the hydrogen ion in a solution, and it determines acidity or alkalinity. Aqueous solutions with a pH lower than 7 are acidic, and those with values higher than 7 are basic. A low pH indicates a tendency toward acidity, and a high pH indicates a tendency toward alkalinity. Specifically in the area of outlet of the Sarapiquí a low pH is reported, which is acidic due to the contaminants that are brought from this river. Further, the influence of the San Carlos River is clearly seen in the pH measured before the outlet of the Sarapiquí River.

The low pH reported at El Jobo and Zapotal may follow the type of soil found in the zone, as intense agricultural activity is not reported. Therefore, the acidity in this section may be associated with the high presence of organic matter and the natural chemical content of the soil.

Electrical conductivity is related to the solids dissolved in the water and mineralization. This is a parameter that varies quite a bit according to what is dumped in the river, as well as to the sedimentation that solids undergo over time. In general, no anomalies of electrical conductivity in the field were reported.

The Redox potential determines the reactions of oxidation – reduction. The area shows conditions of oxidation, therefore the availability of oxygen in the water is not considered to be limiting. Fuentes S. Indicates availability of dissolved oxygen of 95% at the San Juan River outlet (Delta), which means that this is not a limiting factor for the development of aquatic life in the area.

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Results of Laboratory Analyses

Physical-Chemical Laboratory Parameters

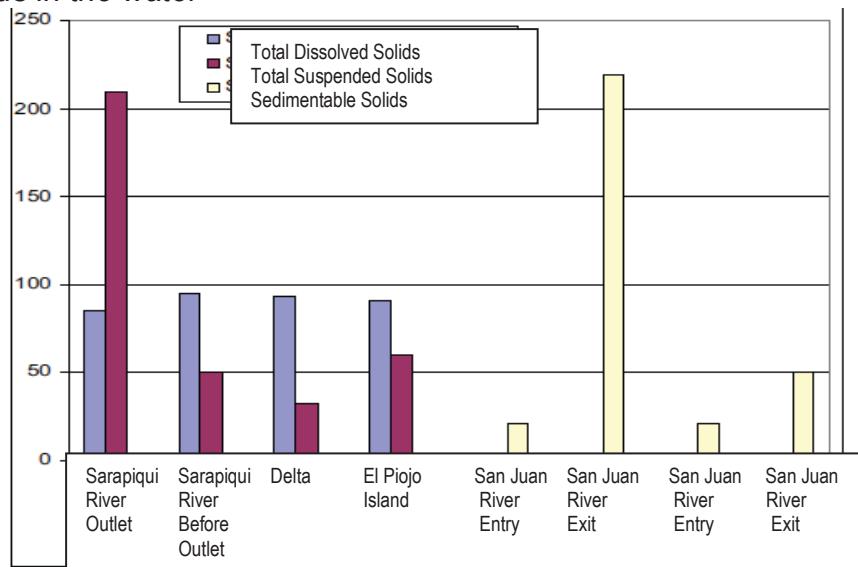
The results of the physical-chemical laboratory parameters are summarized in Table No. 7.

Table No. 7. Physical-Chemical Laboratory Parameters

**Results of Physical-Chemical Parameters Measured in the Laboratory
Dredged from San Juan de Nicaragua**

Site	Date	E	N	Turbidity (UNT)	pH	CE ($\mu\text{S}/\text{cm}$)	STD (mg/l)	STS (mg/l)	SS (mg/l)	Color (mg/l)
Sarapiquí River – Outlet	6/2/2006	178849	1186546	198.00	6.2	109.6	84.58	209.0	1.2	10.0
Sarapiquí River – Before Outlet	6/2/2006	178919	1185546	33.60	6.8	132.1	94.64	50.0	0.5	12.5
Delta	6/1/2006	197481	1191931	44.80	6.8	123.6	92.97	32.0	0.1	12.5
El Piojo Island	6/1/2006	198881	1192496	46.20	6.8	122.9	90.99	60.0	0.5	12.5
Entry of San Juan River	4/24/2003			18.40	9.38	79.6			20.8	75.0
Exit of San Juan River	4/24/2003			149.00	8.05	202			218.9	5.0
Entry of San Juan River	6/27/2003			18.40	7.07	79.6			20.8	75.0
Exit of San Juan River	6/28/2003			6.40	7.02	122.5			50.6	20.0

- Solids in the water



*Graph No. 6. Concentration of solids. mg *l⁻¹*

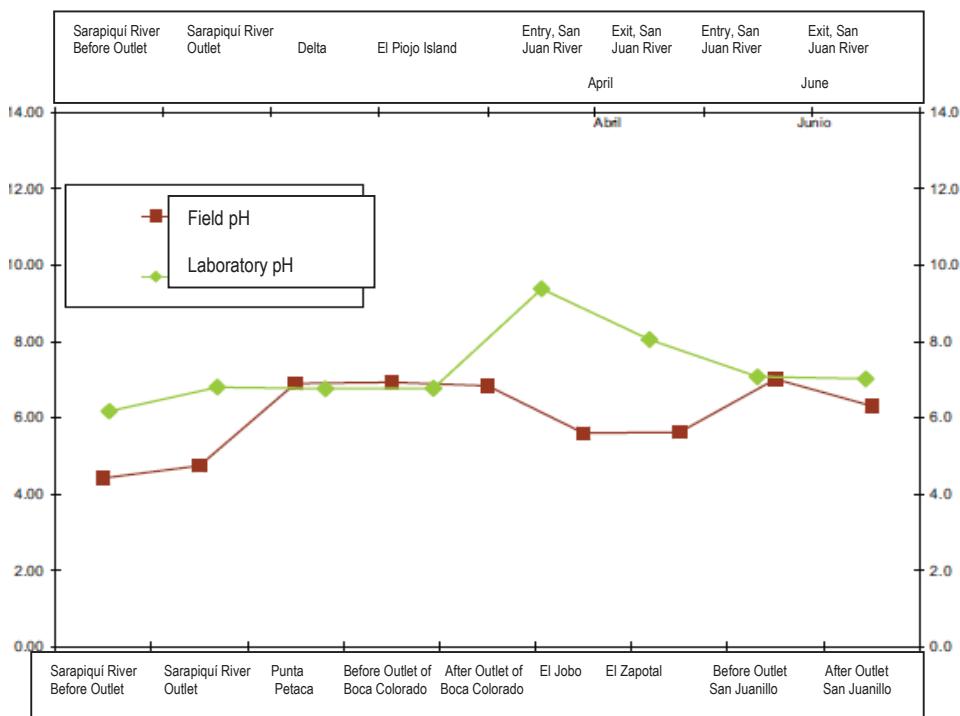
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Graph No. 6, Dissolved, Suspended and Sedimentable Solids, shows that for both seasons, the data measured by Procuenca at the entry and exit of the San Juan River (Delta) shows an increase in sedimentable solids. The largest amount was measured in April, which is considered to be the dry season. This was due to the increase in concentration of solids in relation to the decrease in the volume of water from precipitation.

The information from the samples for this study show that the largest amount of total dissolved solids was measured close to the outlet of the Sarapiquí River, clearly indicating the significance of the amount of this section of the river toward the area of study to the west.

Turbidity, associated with dissolved solids, is shown to be high in the area of Sarapiquí and the exit to the San Juan River. However, a drastic decrease in the rainy season is noted. Deforestation and intensive agriculture become a source of sediment which, when deposited in the rivers and lakes, destroys the habitat of numerous species.²

- *pH of the water*



Graph No. 7. Comparison of water pH from the field and from the laboratory. Study Zone.

² <http://www.monografias.com/trabajos29/organismos-cuenca.shtml#analisis>

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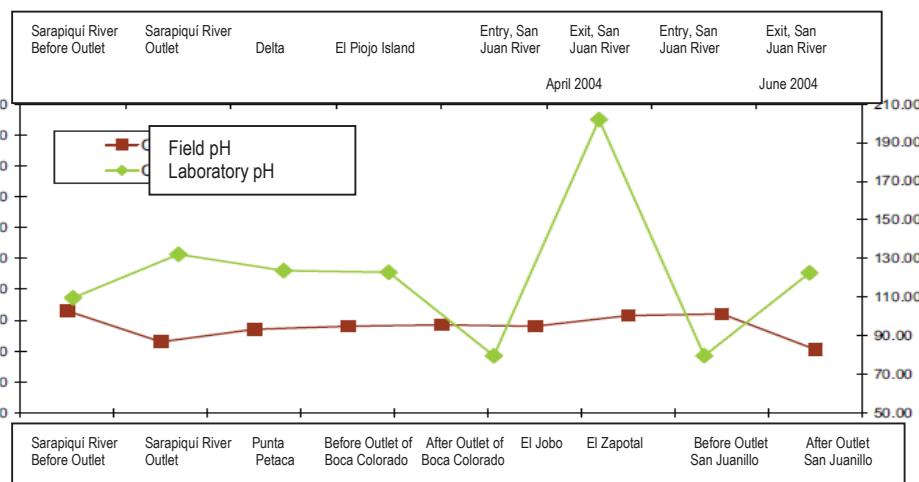
The behavior of the field pH has already been explained. For El Piojo Island, it is assumed that the pH is equal to the pH that was measured around the mouth of the Colorado River. It can be seen that the field data remains equal to the laboratory measurements.

No measurements were taken at the entry of the San Juan River for this study. Fuentes S. believes that the high pH is due to wastewater from the city of San Carlos, which decreased at the measurement in June due to dilution.

The different pH found between the laboratory and field data for the area of the Sarapiquí follows the same reactions over time from sampling and analysis of the sample. This causes the concentration of hydrogen ions to decrease, increasing the pH of the water.

When there are fewer hydrogen ions available, a buffer effect is created, which causes the pH to remain at more or less the same concentration. This may explain why the pH around El Piojo Island has not undergone any change.

- *Conductivity of the water*



Graph No. 8. Conductivity of the water µS-cm

The conductivity measured in the field experienced some variations, because when solids turn to sediment, conductivity tends to decrease. The entry and exit data of the San Juan River are measurements from 2004, when the concentration of solids at the river's exit caused a significant increase in electrical conductivity.

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Ions

The results of the ions that were analyzed are shown in Table No. 9.

Table No. 9. Concentration of ions in the area to be dredged

**Results from Physical-Chemical Analysis – Environmental Impact Study
Dredged from San Juan de Nicaragua**

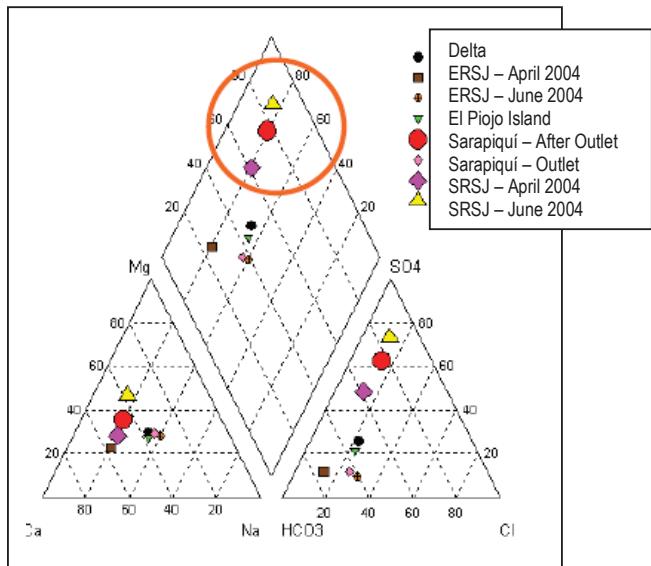
Site	Date	UTM Z17 Coordinates		Ca ²⁺	Mg ²⁺	Na ⁺	K ⁺	Cl ⁻	NO ₃	NO ₂	SO ₄	HCO ₃	DT	Acl T	Si	Fe	F
		E	N	Mg* l ⁻¹													
Sarapiquí River Before Outlet	6/2/2006	178849	1186546	9.22	4.37	4.46	1.59	4.98	1.15	0.00	29.19	13.42	41.00	11.00	22.70	11.86	0.32
Sarapiquí River Outlet	6/2/2006	178919	1185546	9.22	4.86	11.52	2.53	11.58	2.11	0.02	7.27	50.04	43.00	41.00	20.75	2.27	0.20
Delta	6/1/2006	197481	1191931	9.22	4.62	9.73	2.33	9.49	1.64	0.03	15.08	38.44	42.00	31.50	21.78	2.96	0.18
El Piojo Island	6/1/2006	198881	1192496	9.22	4.13	9.92	2.33	9.69	1.68	0.02	12.35	40.88	42.00	33.50	21.43	3.03	0.14
San Juan River Entry	4/28/2003			14.9	8.07	21.68	4.87	20.98	0.03		9.04	74.32		86.1			0.29
San Juan River Entry	6/27/2003			8.02	1.94	3.28	1.41	3.34	0.51		4.04	32.16		27.43			0.07
San Juan River Exit	4/24/2003			12.9	9.75	6.17	2.5	7.57	0.03		58.51	14.1		11.55			0.37
San Juan River Exit	6/27/2003			10.4	3.48	4.78	1.51	4.79	1.79		24.05	24.16		19.8			0.16

It can be seen that in the area of the outlet of the Sarapiquí River, sulfates always appear in relatively high concentrations compared with other ions. Again, it can be seen that the concentration for the month of June is lower during the two times that samples were taken. The values found in the 2004 dry season are close to the Canadian environmental standard for freshwater aquatic life, which is considered to be an allowable value of 72 mg*l⁻¹.

- *Hydrochemical Type*

The hydrochemical type has been determined using the specialized AQUACHEM program, with the result that the majority of the samples are calcium bicarbonate. This anomaly occurs in the area of the outlet of the Sarapiquí River, which also impacts the area of the exit of the San Juan River. Piper Graph No. 9.

Graph No. 9. Hydrochemical type of samples.



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Table No. 10 shows a comparison of CAPRE Standards – Water Quality Standards for Human Consumption and Canadian Standards for the same purpose. The Canadian Standards were taken from the AquaChem Program used to prepare the Piper Graph, which represents the type of water found in the area of study, compared with the water that arrives from Lake Cocibolca.

Table No. 10. Physical-Chemical Laboratory Parameters

Location	Element	Unit	Measure- ment	Recommended		Allowable Limit	
				Canadian Standard	CAPRE	Canadian Standard	CAPRE
Delta	Fe	mg * l ⁻¹	2.96	<0.05	0.1	<0.02	0.3
Entry San Juan River April 2004	PH	pH unit	9.38	6.5 – 8.5	6.5 – 8.5	<9.5	--
	Na	mg * l ⁻¹	21.86	<20	25	<200	175
El Piojo Island	Fe	mg * l ⁻¹	3.03	<0.05	0.1	<0.2	0.3
Sarapiquí River After Outlet	PH	pH unit	6.2	6.8 – 8.5	6.5 – 8.5	<9.5	--
	Fe	mg * l ⁻¹	11.86	<0.05	0.1	<0.2	0.3
	SO ₄	mg * l ⁻¹	29.19	<25	25	<250	250
Sarapiquí River Outlet	Fe	mg * l ⁻¹	2.27	<0.5	0.1	<0.2	0.3
Exit San Juan River April 2004	SO ₄	mg * l ⁻¹	58.51	<25	25	<250	250

It can be seen that Fe is one of the elements found in greater concentrations in the area of study. This is understandable due to the volcanic nature of the zone. Iron gives a disagreeable taste and odor to drinking water.

Heavy Metals

Heavy metals are present in the zone, as throughout the entire domestic territory due to the nature of the geological formations, which have undergone hydrothermal alteration in some cases.

At all points sampled for the Procuenca Study, the presence of heavy metals in the water was found, and in some cases there were high values.

At the Boca de Sábalos River, the concentration of aluminum was 10.95 mg/l, it was 13.851 mg/l in the Santa Cruz River, and 7.905 mg/l at the Delta.

Two water samples were analyzed at the Delta and El Piojo Island to determine the concentration of arsenic. Arsenic was not found, thus the concentrations are below the equipment's detection limits.

A lead analysis was performed at the same sites, resulting in a concentration of 10.652 µg * g⁻¹ for the Delta and 8.995 µg * g⁻¹ for El Piojo Island, located before and after the outlet of the Colorado River, respectively.

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These concentrations are associated with the volcanic rock that dominates the entire San Juan River area. Canadian Environmental Quality Standards for Sediment presented values of $91300 \mu\text{g} * \text{Kg}^{-1}$, which would be $91.3 \mu\text{g} * \text{g}^{-1}$, as a level likely to have adverse effects on the aquatic biome.

Planktonic and benthonic organisms

The species found in the San Juan River Study (PROCUEENCA 2004), indicate that there is an average to moderate degree of contamination, as macro-tolerant and colonizing invertebrates were found, such as the *Chironomidae* family.

At the points before and after the outlet of the Colorado River in the direction of San Juan de Nicaragua, water samples were analyzed for planktonic and benthonic organisms. The results are summarized in Table Numbers 11 and 12.

Table No. 11. Planktonic Organisms in the Zone

San Juan Delta	
Taxonomy Classification	Ind. m³
Phylum Arthropod	
Crustacean Class	
Copepod Sub-Class	
Cyclopod Order	
<i>Mesocyclops edax</i>	242
Total	242
EI Piojo Island	
Taxonomy Classification	Ind. m³
Phylum Rotifera	
<i>Epiphantes macrorus</i>	30
Phylum Arthropod	
Crustacean Class	
Branchypod Sub-Class	
Cladocera Order	
<i>Ceriodaphnia cornuta</i>	30
<i>Iliocryptus agilis</i>	30
Copepod Class	
Cyclopod Order	
<i>Mesocyclops edax</i>	176
Calanoid Order	
<i>Arctodiaptomus dorsalis</i>	383
Juvenile and larval states	
Cyclopoid copepodites	147
Calanoid copepodites	89
Nauplios (copepods)	58
Total	943

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Table No. 12. Benthonic Organisms in the Zone

San Juan Delta	
Taxonomy Classification	Ind. m²
Phylum Nematode	
Genus n.i	109
Phylum Annelid	
Naididae Family	
<i>Pristina sp</i>	22
Phylum Arthropod	
Chironomidae Family	
<i>Coeleotannypus sp</i>	44
Total	175
El Piojo Island	
Taxonomy Classification	Ind. m²
Phylum Annelid	
Naididae Family	
<i>Limnodrilus sp</i>	338
Phylum Arthropod	
Chironomidae Family	
<i>Procladius sp</i>	22
<i>Chironomus sp</i>	33
Total	393

A low density of organisms was noted both in the water and in the sediment, with the predominance of species that are tolerant and adapted to adverse conditions. It must be considered that the locations where the samples were taken is located at the outlet of the San Juan River where the majority of contaminants have been carried, as well as gross sediment, which translates into the presence of tolerant species.

The pH measured in the field was quite low, therefore a high density of species is not expected. The high concentration of sulfates found in the surrounding area also has an impact.

3.2.3 Hydrological Description

The San Juan River Basin has a drainage area of 29824 km². Lake Apanás is located in that area, whose waters empty from the Tuma River Basin into the Viejo River, which flows to Lake Managua (endorheic), and finally Lake Nicaragua, which empties into the San Juan River.

The name of the San Juan River is taken from the outlet of Lake Nicaragua. This river runs from west to east for approximately 205 km until it empties into the Caribbean Sea at two points: Laguna de San Juan de Nicaragua in Nicaragua, and the Colorado River in Costa Rica, which are separated from each other by 20 km.

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The principal flows from the San Juan River (Figure No. 8) come from the drainage area in Costa Rica, through the Frío, San Carlos and Sarapiquí Rivers. They run along the border with Nicaragua, and finally empty directly into Lake Nicaragua.

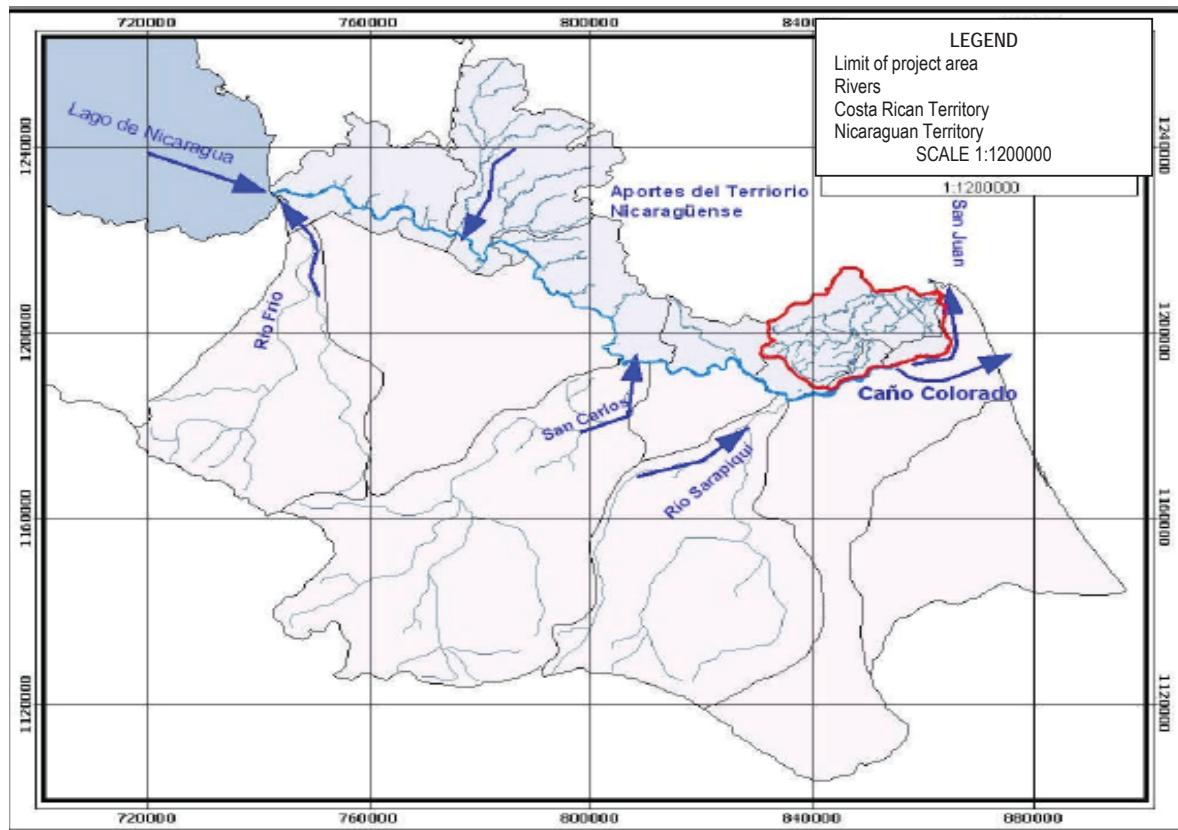
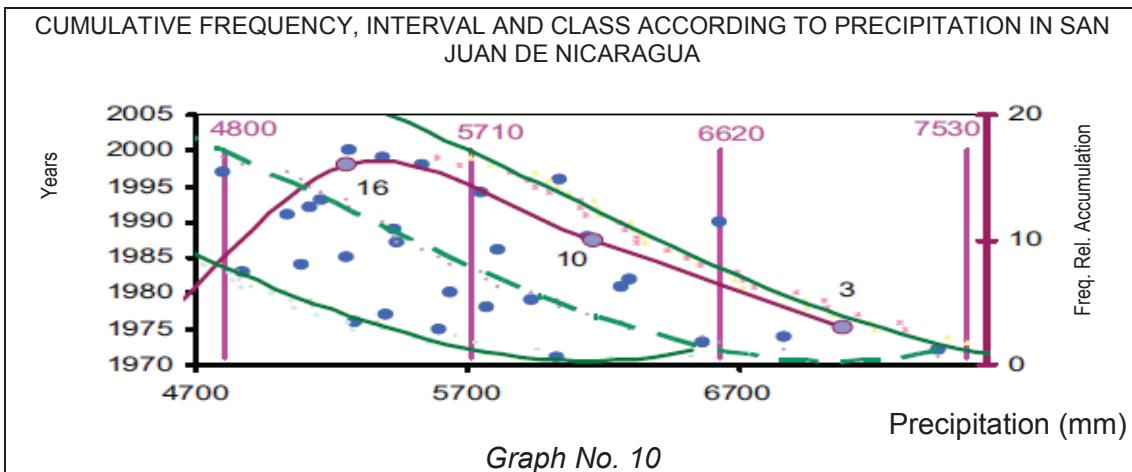


Figure No. 8

The upper section of the San Juan River, from the outlet of Lake Nicaragua until it reaches the mouth of the Boca de San Carlos River, is narrow, deep, without islands, and with some rapids. In contrast, the lower section is wide, shallow, and with many small islands, creating a delta close to its outlet.

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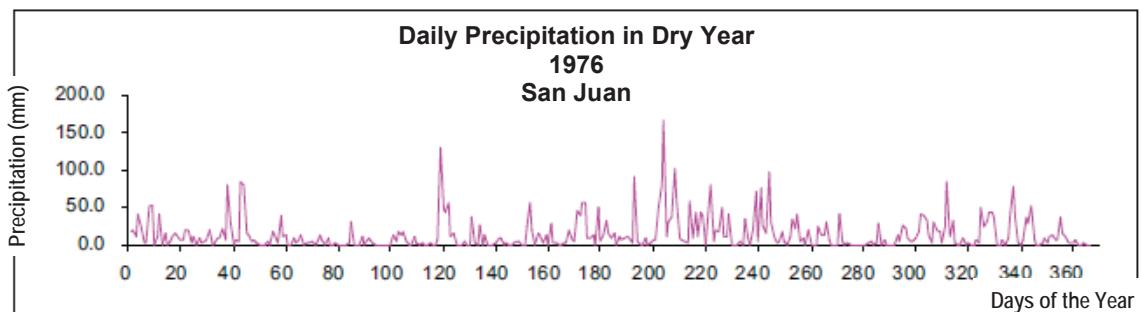


The record of annual average precipitation for San Juan de Nicaragua (Table A8, attached), shows an average of 5597 mm. The main parameters for these descriptive statistics are shown in Graph No. 10.

According to the relative accumulated frequency (green), there are 16 information points that oscillate according to the class type (magenta), from 4800 mm up to 5710 mm. Average precipitation of 5597 mm is found in this range, located precisely in the first class type. In the next grouping, according to the graph, are 10 information points within the class type, which oscillate from 5710 mm up to 6620 mm. The sum of this information (26) shows spatial uniformity from the precipitation in the study area. This uniformity is shown in its distribution in the "xy" plane within the standard deviation.

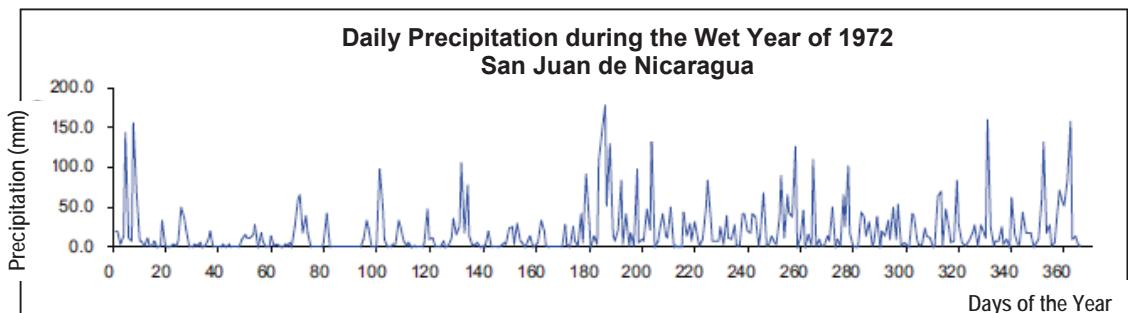
The uniformity can be seen in the behavior of the meteorological station of San Juan de Nicaragua, from which the driest year was taken, which is 1976, Graph No. 11, Annex Table A9. It can be seen from all months of the year that San Juan de Nicaragua receives from the direction of the Caribbean Sea. This process is explained in the chapter on meteorology.

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Graph No. 11

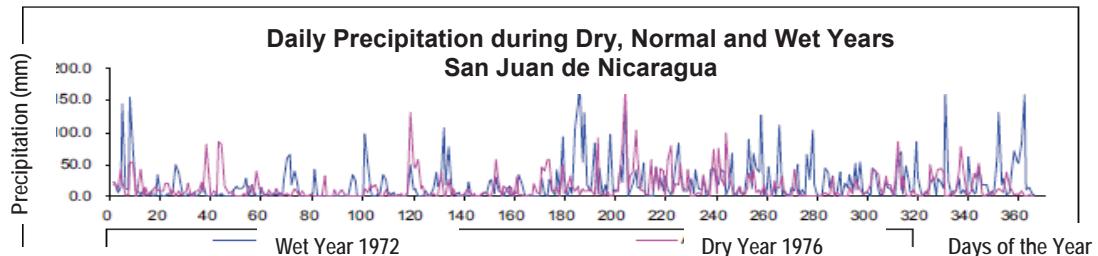
The “wettest” year was also put into graph form, which was the year 1972, Graph No. 12, Annex Table A10. This also shows that during all months of the year, San Juan de Nicaragua receives rain from the Caribbean Sea.



Graph No. 12

The two graphs show similar precipitation tendencies. This can be seen much better if the two graphs are transposed on top of each other – Graph No. 13. From days 220 to 240 precipitation is uniform, and it is of more or less the same magnitude, both in the wet and in the dry year. The same observation can be made for days 280 to 320.

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Graph No. 13

It can be added that there is a 50% probability that rain amounts of 41 mm can fall in a dry year, and 50.4 mm in a wet year. Likewise, it can be said that there is a 75% chance of 18.2 mm of rain accumulating in a 24-hour period in a dry year, and 26.8 mm in a wet year.

Because it rains 268 days of the year in San Juan de Nicaragua, the land has a propensity to flood intermittently. This explains why the static depth levels do not exceed 1.7 meters deep, up to 100 meters along the riverbank. Photo No. 5 Level of Flooding, shows the flood level at El Jobo. These levels are the common extremes, and reach a stratum of 15 cm. Photo No. 6, Drainage Pipe, shows the drainage work that the municipal authorities had to perform, as well as the construction of footpaths and pedestrian overpasses in San Juan de Nicaragua.



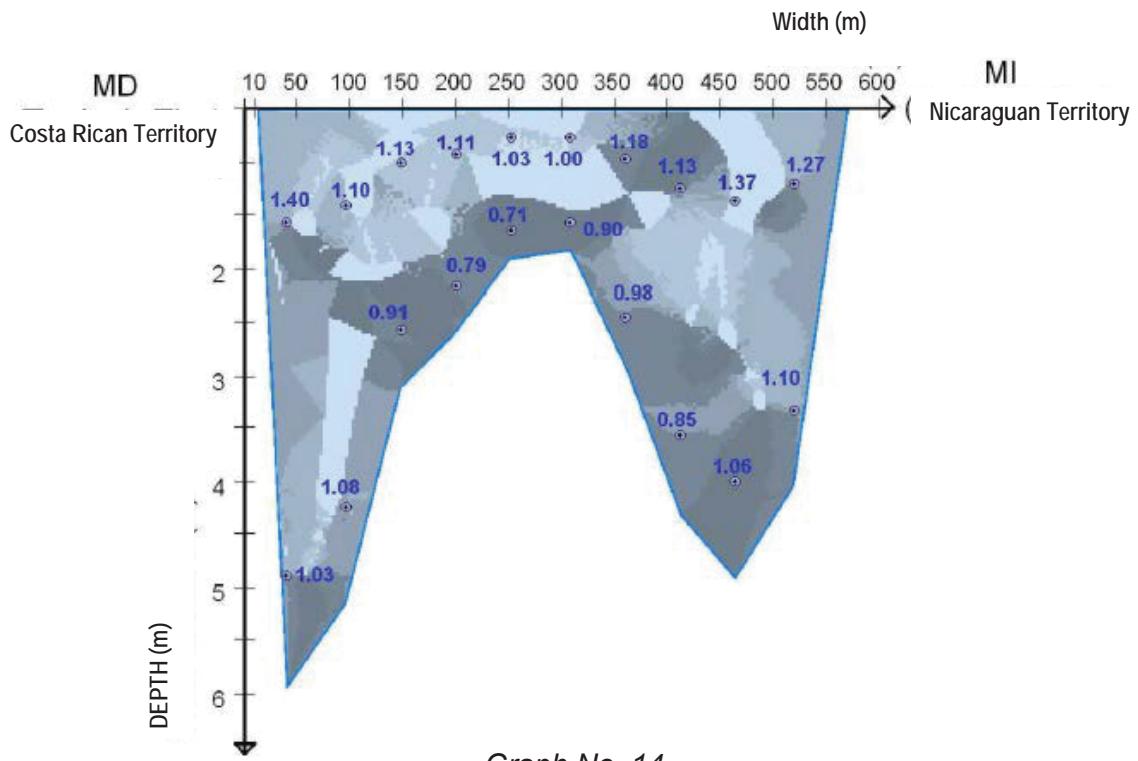
Photo No. 5. Flood Level.



Photo No. 6. Drainage Pipe.

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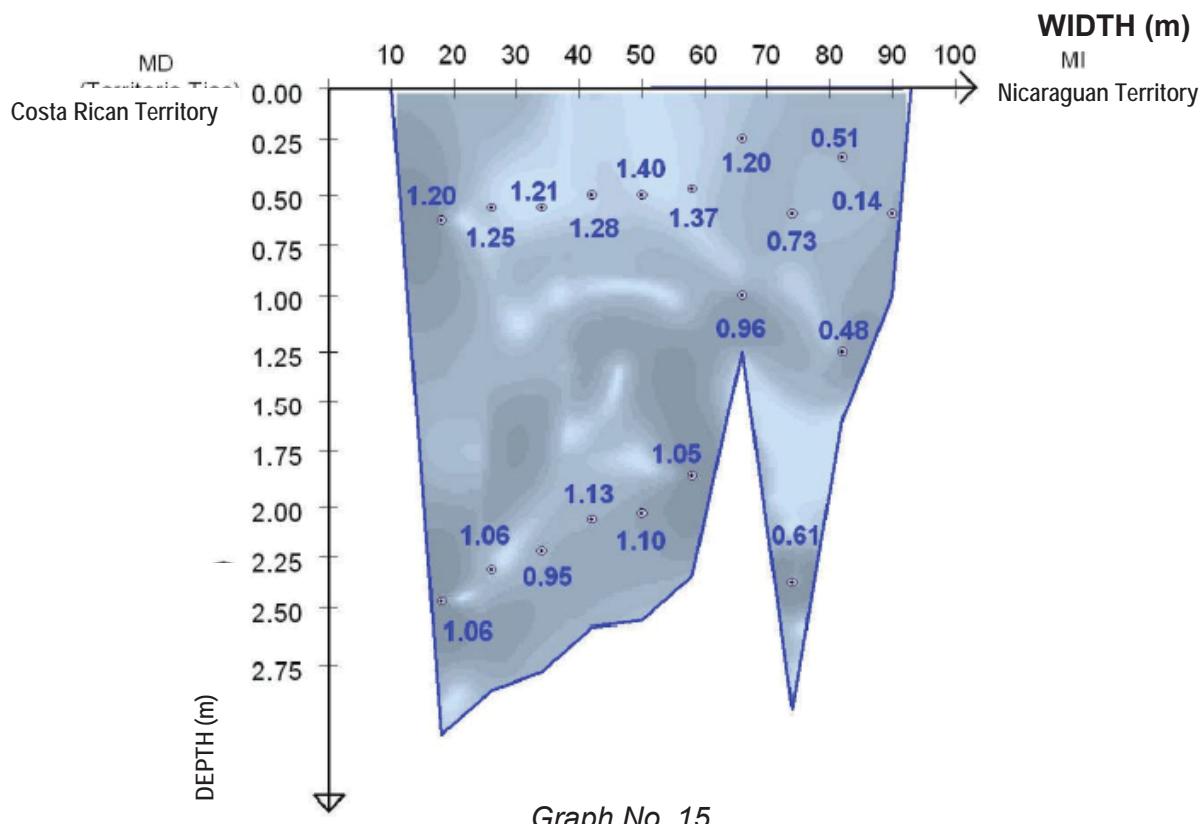
For the purposes of this study, measurements were taken in August 2006, two of which were before Caño Colorado, and the other two were after that point. Graph No. 14 shows the measurement located upriver of Caño Colorado.



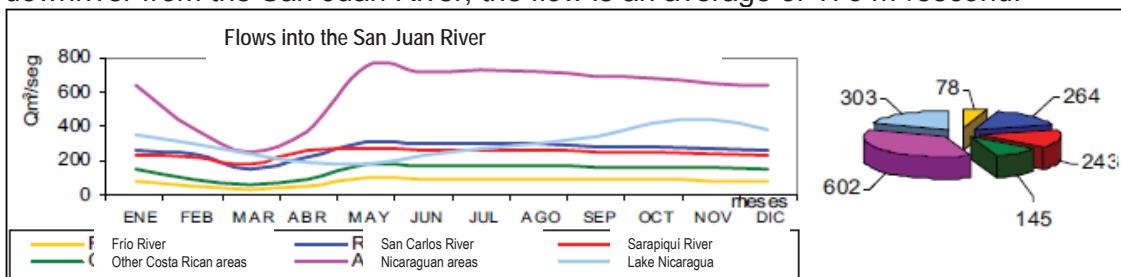
The results are the following: an area of 1624 m^2 , average speed of 1.01 m/second , and a flow of $1636 \text{ m}^3/\text{second}$, with an average depth of 2.89 meters. This measurement shows that the tendency toward consistent speeds is on the border of Costa Rican territory, which probably occurs because the section narrows from 150 and 200 meters, and mainly because the depth is greater toward that bank by 1.06 meters.

Graph No. 15 shows the measurement located downriver of Caño Colorado on the San Juan River. The results for this measurement were the following: an area of 182 m^2 , average speed of 0.982 m/second , and flow of $178 \text{ m}^3/\text{second}$, with an average depth of 2.19 meters. The trend of the speeds is on the right bank (Costa Rican territory). Both results show that the circulating volume is 11% on the San Juan River, and 89% on the Caño Colorado.

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The foregoing shows that due to its geographical location, San Juan de Nicaragua is one of the main receiving hydrological units in the southeastern region and the country. It has been estimated that flows toward the San Juan River, between the Sarapiquí River and Caño Colorado, are 303 m³/second. With water from Lake Nicaragua at 264 m³/second, from the San Carlos River at 243 m³/second, and the Sarapiquí River, the flow increases up to 1636 m³/second, due to the amounts from the drainage area from both Nicaragua and Costa Rica. After Caño Colorado downriver from the San Juan River, the flow is an average of 176 m³/second.



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Characterization of the Section to be Dredged

The San Juan River presents navigation problems (photo no. 7), with some sections identified by the municipal authorities as being more problematic in the summer due to the loss of water flow, which makes boats run aground. Sometimes boats remain for hours or days before reaching their final destination. It was also mentioned that it is not rare for this also to happen in the winter as well.



Photo No. 7. To be able to finish their trajectory, villagers must push boats off the existing sandbars.

One of the main activities performed for the future dredging was to install geodesic boundary markers that will initially serve to develop the bathymetry of the section to be dredged. This activity was developed by the Nicaraguan Institute of Territorial Studies (INETER).

The markers or boundaries are located in:

- 1.1 Petaca
- 1.2 Delta
- 1.3 Los Reyes
- 1.4 El Jobo
- 1.5 El Zapotal

Mr. Juan José Zambrana – Vice Mayor, was also a guide for INETER personnel in establishing boundaries for the geodesic bathymetry markers and subsequent dredging.

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The boundary markers are 15 x 15 (cm²), by 10 cm high, with the name of their location. Photo No. 8, "Boundary marker in Petaca."

The section proposed to be dredged by the project differs from that proposed by the municipal authorities. The mayor's office proposes sections that conflict, both in summer and in winter. Figure No. 9, Section to be Dredged Proposed by the Project, and Figure No. 10, Section to be Dredged Proposed by the Mayor's Office.



Photo No. 8. Boundary Marker in Petaca.

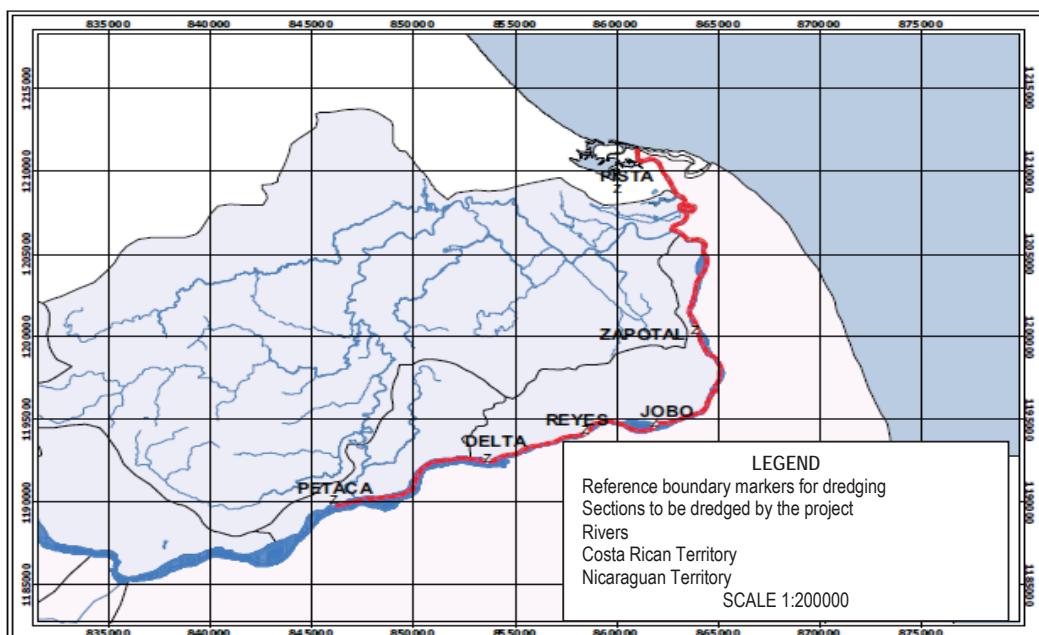


Figure No. 9. Section to be dredged, proposed by the project

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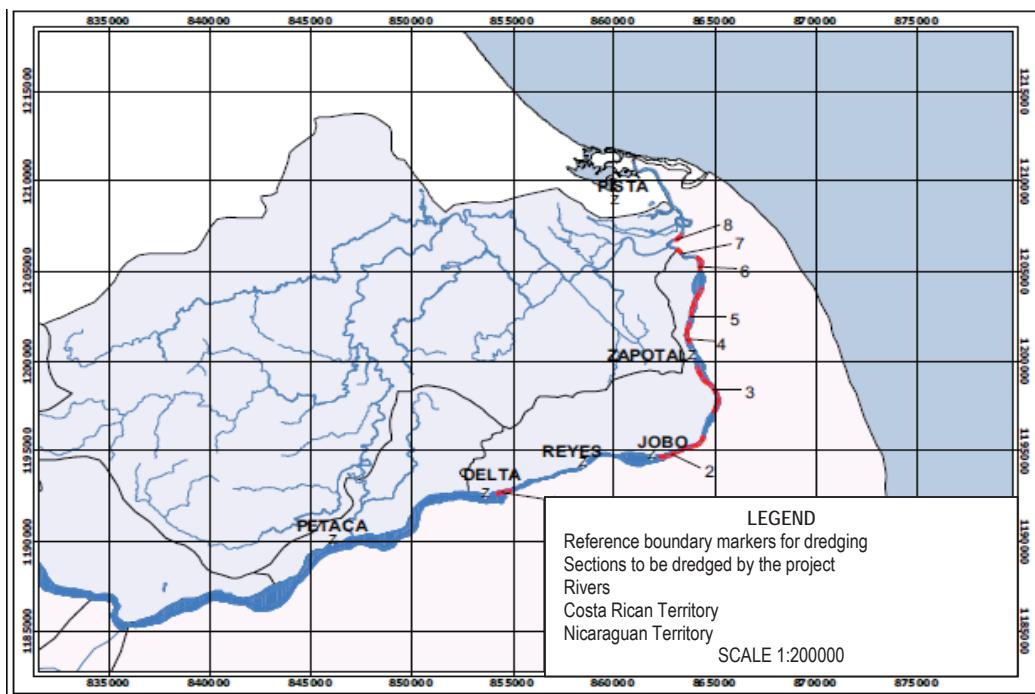


Figure No. 10. Section to be dredged, proposed by the mayor's office

The municipal government has indicated eight critical sections of the river. With sandbanks, these sections add up to an approximate length of 11 km. Figure No. 10. However, the section proposed by the project is 41.6 km. Figure No. 9. The theoretical volume to be dredged is shown in Table No. 13.

Table No. 13. Calculation of the Volume to be Dredged

VOLUME TO BE DREDGED IN THE SECTION OF THE SAN JUAN RIVER IN WHICH THE MUNICIPALITY IS INTERESTED (m ³)									
No.	LENGTH (km)	Depth = 1.0 m			Depth = 1.5 m			Depth = 2.0 m	
		b = 6.0	b = 10	b = 80	b = 6.0	b = 10	b = 80	b = 6.0	b = 10
1	0.7	4200	7000	56000	6300	10500	84000	8400	14000
2	2.6	15600	26000	208000	23400	39000	312000	31200	52000
3	3.0	18000	30000	240000	27000	45000	360000	36000	60000
4	1.2	7200	12000	96000	10800	18000	144000	14400	24000
5	1.8	10800	18000	144000	16200	27000	216000	21600	36000
6	0.8	4800	8000	64000	7200	12000	96000	9600	16000
7	0.3	1800	3000	24000	2700	4500	36000	3600	6000
8	0.5	3000	5000	40000	4500	7500	60000	6000	10000
TOTAL		65400	1090000	872000	98100	1635000	1308000	130800	218000
									1744000

Table No. 13 shows that it is necessary to dredge 2.0 meters deep by 80 meters wide to obtain an approximate volume of 2,000,000 m³. The initial dredging depth must be

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one meter (1.0 meter), because in summer the water level may reach 0.60 m in depth in the sections in which the municipal authorities are interested. However, the section proposed by the project is 41.6 km, requiring 25 x 2 meters, as the section for dredging to attain the 2,000,000 m³.

Both the bathymetry and the dredging that are performed over the 41.6 km must prioritize the critical sections suggested by the municipal authorities (see Photo No. 4).

Sedimentation

The problem of sedimentation to date has caused losses of domestic territory, in addition to the loss in river flow.



Photo No. 9



Photo No. 10



Photo No. 11



Photo No. 12

3.1 Photos 9-12 show collapses along the riverbanks.

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3.2 The soil from the riverbanks collapses due to the lack of natural structures to sustain them. The roots of trees or shrubs perform this “binding” function, or physical resistance to erosion of the slope and to the effect of gravity on the exposed slope.

3.3 This sediment is generally deposited on the islands, as shown in Photo No. 13, where it can be seen on the right bank (Costa Rican territory) that there is sedimentation close to contact with the edge of the neighboring border.



Photo No. 13

If the previous scenario is added to the fact that the river carries and deposits branches, tree trunks and sediment in the area, in summer it is common for undergrowth to grow between the contact points of the islands and firm ground. Deforestation by the inhabitants for firewood decreases the “riverbank level” in contact with neighboring territory. This is how some islands have been lost, which have been annexed to Costa Rican territory.

Problems with penetration of the sea into the navigation route.

During high tide and in seasons when the river is high, ships for public transport and for freight, etc., must have an alternate route due to the risk that occurs because of the San Juan – Indio entering at this point. The inhabitants travel by a route that is currently covered by undergrowth, which they request be reactivated.



Photo No. 14 shows penetration of the sea, and Photo No. 15 shows the alternate route mentioned by the authorities.

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The amount of sediment in the Sarapiquí River always exceeds that in the San Carlos river by an amount that depends on the precipitation in the respective basins, which varies by approximately two to six times more than that in the San Carlos River. This situation denotes that more sediment is carried in the Sarapiquí River. The concentration of total suspended solids in the Sarapiquí River is also greater, which is indicative of increased erosion in the river basin.

In both riverbeds there is a tendency to carry larger amounts of suspended solids during the rainy season, but alarming values were not seen during the period of study.

The maximum amount of sediments carried from the Sarapiquí River is around 10 kg/s, and the minimum is 1.2 kg/s. For the San Carlos River, the amount carried oscillated between 0.4 kg/s and 14 kg/s.

During the dry season, transport of sediment from these rivers is low, but in relation to the flow, the amount of sediment is relatively high. The Sarapiquí River carries 2.8 kg of suspended sediment per second, which is deposited in areas where the current speed is low. In the rainy period a significant amount of sediment is carried, and in turn there is a considerable increase in flow (2-3 times), which increases the load proportionally.

The Costa Rican Electricity Institute (Instituto Costarricense de Electricidad – ICE) report for the Sarapiquí from September 1970 to July 1990, indicated an average flow of 116 cubic meters per second, and an average discharge of sediment of 215,060 tons per year.

Distribution of sand, lime and clay in suspended solids in the San Carlos and Sarapiquí Rivers.

Clay	% Sand	% Lime	% Clay
Sarapiquí	21.6	16.4	62
San Carlos	17.31	9.7	63

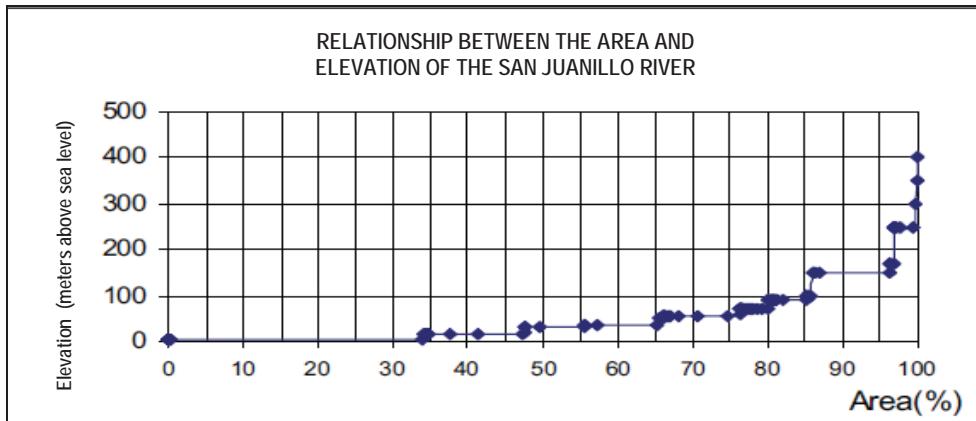
Relationship of the project area and the section to be dredged

The surface area of the study is 533 km², with an average elevation of 50 meters above sea level. Thirty-four percent of the area is below 5 meters above sea level. The Silico, Los Encuentros, and La Barda Lagoons, etc. are located in these areas.

Graph No. 15 shows that 50% of the area is below 30 meters above sea level, and 75% are below 55 meters above sea level.

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Fifty percent of the length of the San Juanillo River is below 5 meters above sea level, with a slope of 0.0002 in that section, which means surface retention of water, relative humidity, the wetlands of the lagoons, and consequently, intermittent flooding.



Graph No. 15

According to the municipal authorities, after the San Juanillo River (Aguas Zarcas) empties, the navigation route to the urban sector of San Juan de Nicaragua does not present any problems since the river is sufficiently deep for ships to travel along it. Figure No. 10 – Section of Dredging Proposed by the Mayor's Office. According to Figure No. 11, this is because the drainage area leads to the San Juanillo River, which is in contrast to the rest of the section to be dredged, which receives discharge from the San Juan River. This area (82.2%), whose flow is important for navigating levels, is downriver of the section to be dredged.

The rest of the project area (94.9 km^2), which is located in direct relationship with the section to be dredged from Petaca up to the outlet of the San Juanillo River, for water supply purposes, has an average width of 3 km, and an estimated length of 32.2 km.

From the Delta, the width of the San Juan River is reduced due to the exit of part of its flow to the Colorado River, therefore the most critical section to dredge remains with the area of direct supply of water, with an average width of 2.7 km and estimated length of 19.3 km.

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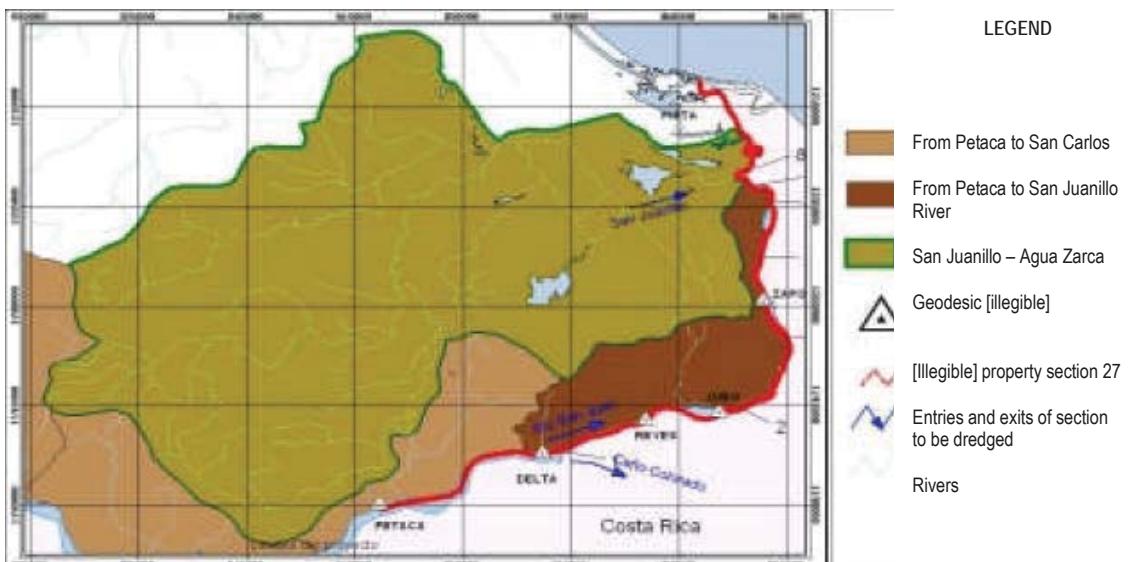


Figure No. 11

The entire strip of drainage area that is directly related to the section to be dredged does not represent a sufficient contribution of flows to resolve the navigation problem in the section analyzed. The analyzed section is the terminal phase of the passage of flows through the San Juan River Basin, its final outlet to the Caribbean Sea (through Caño Colorado in Costa Rican territory – 70%, and the San Juan River in Nicaraguan territory – 30%).

Due to the foregoing it is necessary to analyze and control erosion and carrying of sediment along the section to be dredged from the Delta (2.5 km upriver) toward the outlet of Lake Nicaragua, and from the Delta (0.5 km downriver) toward the outlet of the San Juan River.

Both for communication through navigation, as well as for aquatic life, dredging of the proposed section is of utmost importance. Further, it is important to indicate that the process of sedimentation results in territorial losses and ecological deterioration, with the inherent consequences.

The section to dredge presents the consequence of the lack of Integrated Management of the Basin at the national level as well as in Costa Rican territory. This section receives all the sediment that is brought from Lake Cocibolca, as well as what arrives from Costa Rica from Lake Cocibolca and directly to the San Juan River.

Risk and Vulnerability

According to the zone's characteristics, two classes of risk to the area's inhabitants have been identified:

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Collapse of the Riverbanks:

Along the entire trajectory of the section to be dredged, the riverbanks along the entire river, on both the Nicaraguan and Costa Rican sides, constantly collapse due to the passage of currents related to heavy rain. The strong effect of the elements on the rock in the surrounding area has also had an impact.

The majority of houses in the zone are located just 20 meters from the banks of the river, thus they are highly vulnerable to riverbank collapses.

The reason for these collapses is due to the lithological composition of the banks, as well as to the heavy effect of the elements on the rocks. In addition, deforestation of the area has limited the growth of trees with deep roots, which help to contain the soil along riverbanks.



Photo No. 16



Photo No. 17

Flooding

With the conditions that more than 50% of the area experiences, with slopes of less than 30%, soil that is predominantly oxisol and inceptisol in origin (clay, photo no. 2), and precipitation an average of 22 days per month, the likelihood of intermittent flooding corresponds to the days that it rains and to the humidity that precedes the rain, which in this case is helped by the abundant plant coverage that is a product of the protection of the Biosphere Reserve of Southeastern Nicaragua.

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Due to these characteristics, the average depth of the water in the excavated wells is less than 1.7 meters. Once the ground is saturated, circulation through pores in the subsoil is detained, and the water begins to flood the zone. The intermittent floods may reach 5 to 10 cm along the banks of the river, extending 100 meters inland (Photo No. 5).



Photo No. 19. El Jobo Flood Plain.

Conclusions

- The dredging zone is impacted by all activities in the San Juan de Nicaragua River Basin, from the Cocibolca River Basin. However, its area of impact extends from the San Juan Delta to the outlet of the San Juanillo River to approximately 12 km from San Juan de Nicaragua.
- The geological surroundings are determined only with difficulty due to the abundant forest coverage in the area. Regional studies have shown, however, that the area is dominated by volcanic rock of basaltic andesite. In the lower areas a sedimentation plain has developed from the materials that are brought from higher areas and from the Caribbean Sea.

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- The predominant type of soil is Oxisol, which develops from the intense effect of the elements on the soil caused by the climactic conditions of the area, followed by inceptisols in the lower areas.
- Use of soil from the area is due to the fact that this is part of the Biosphere Reserve of the Southeast of Nicaragua. However, it is possible to distinguish some areas that have been affected, especially along the banks of the San Juan River.
- The water quality is affected by agricultural and cattle-raising activities in the area, which cause the sulfur content in the river to increase, resulting in water with sulfate content and low pH in the area of the outlet of the Sarapiquí River.
- Concentration of solids carried by the San Juan River varies in accordance with precipitation in the zone, and the ratio of concentration in the flow of solids increases in the dry season.
- The low density of planktonic and benthonic organisms back the claim of poor water quality in the San Juan River.
- There is a risk of the riverbanks collapsing, and there is a vulnerable population settled there.
- Due to its geographical location, San Juan de Nicaragua is one of the largest hydrological units in the southeastern region and in the country. It has been estimated that the flows to the San Juan River between the Sarapiquí River and Caño Colorado are 303 m³/second. Water from Lake Nicaragua of 264 m³/second, flows from the San Carlos River of 243 m³/second, and from the Sarapiquí River increase the flow to up to 1180 m³/sec, due to the water from the drainage area both from Nicaragua and from other parts of Costa Rica. It is estimated that after Caño Colorado, the flow of the San Juan River is 150 m³/sec on average during the summer.
- The municipal authorities indicate that there are eight critical sections on the river with considerably wide sandbanks. Those sections add up to a length of approximately 11 km. In exchange, the section proposed by the project is 41.6 km.
- Both the municipal authorities as well as those living on the banks of the San Juan River urgently require the dredging work to be done, both for navigation as well as to be able to use the dredged material, which they intend to use to protect themselves from flooding and from riverbank collapses. The dumpsites of Los Reyes, El Jobo and El Zapotal are low areas that are vulnerable to flooding. The local authority in particular is interested in the material so that it

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can be used as a source of material for the future construction of a landing strip. In addition, there are dumpsites between San Juanillo and San Juan de Nicaragua in order to raise the level of the ground and prevent flooding, as well as to reinforce the entry area to the sea.

- During high tide and during periods when the river is full, public transport and freight shipments require an alternate route due to the risk presented by entry at San Juan – Indio. Inhabitants travel by a route that needs to be reactivated.
- The strip directly related to the section to be dredged does not have sufficient water flow to resolve the problem of navigation in the analyzed section. The analyzed section is terminal phase of the water from the San Juan River Basin, its final outlet into the Caribbean Sea, through the Caño Colorado (70%) and the San Juan River (30%).

Recommendations

- Establish binational actions to restore the water quality in the San Juan River (integrated management of hydrographic basins).
- Analyze and control the erosion and sedimentation that occurs in the section to be dredged from the Delta (2.5 km upriver) to the outlet of Lake Nicaragua and the Delta (0.5 km downriver), until the outlet of the San Juan River.
- Dredging is extremely important, both in order to use this section of the river as a means of communication, as well as for aquatic life. The process of sedimentation results in territorial losses, ecological deterioration and the subsequent loss of wildlife.
- The consequences that are shown in the section to be dredged are the effect of the lack of integrated management of hydrographic basins, as well as the lack of binational relationships in this regard.
- In order to characterize the dynamics of this section it is absolutely necessary to take measurements in the area of the Delta 2.5 km upriver and 0.5 km downriver, as well as to conduct a bathymetry study of the proposed areas.

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Biotic Environment (Flora, aquatic and land fauna)

3.3.1. Flora

Methodology

In conducting the study of flora and fauna in the project's area of influence, a methodology was followed taking into account that the proposed territory is located in a homogeneous geographic region. In addition, its territorial system includes a series of very complex areas that integrally interact with one another. Thus, any action, decision or impact on one of them affects the system as a whole. Based on these criteria, the following parameters were considered: First, the project's area of influence was defined. Secondly, the cartographic material and basic information on the study area was prepared and the corresponding maps were developed: Base Map. Soil Map. Use Current Map. Potential Use Map. Vegetation Map. Hydrographic Map. Gradient Map. (See maps in Annex 1)

The research team's on-site visit went from the Delta to the mouth of the river in San Juan, Nicaragua. Previously obtained information establishes that the most important forest masses in this Refuge are of two types. One is the low open woodland to the North of the San Juan human settlement, whose configuration is a relatively flat, flood prone territory. The second type of forest is much higher, and actually a continuation of a similar forest from the neighboring Biological Reserve of the north. Its height reaches 30 meters, structured in three or four altitude strata, with 80% coverage. 145 arboreal species of trees have been counted there (Information from the refuge management plan).

The team, in order to determine and confirm the information on the forest in the project's area of influence conducted a direct observation of arboreal, shrub and herbaceous species, and also designed five 20 X 20 m. grids to determine the existing population, become aware of the different species, their state and their predominance. The grids were established at different points and their point of reference was the following: Coordinates 17p0206266 UTM1206136; Coordinates 17p0206334 UTM1209534; Coordinates 17p0207773 UTM 1202770; Coordinates 17p0204150 UTM 1209365; Coordinates 17p0202877 UTM1204768. This means that the species existing in an area measuring 2000 m² were counted, and their height, diameter and predominance were calculated.

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Table No. 3.1 Plant species found in the zone of influence of the project entitled
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(Delta – San Juan of Nicaragua).

COMMON NAME	SCIENTIFIC NAME	FAMILY
Mahogany	<i>Swietenia macrophylla</i>	Meliaceae
Trumpet tree	<i>Cecropia peltata</i>	CECROPIACEAE
Spanish elm	<i>Cordia alliodora</i>	BORAGINACEAE
Spanish Cedar	<i>Cedrela odorata</i>	Meliaceae
Sprague	<i>Vochysia hondurensis</i>	vochysiaceae
Almendro	<i>Dipteryx oleifera</i>	fabaceae
Sotacaballo	<i>Zygia longifolia</i>	Fabaceae
Spanish plum	<i>Spondias Mombin</i>	Anacardiaceae
Bonewood	<i>Macrohasseltia macroterantha</i>	flacourtiaceae
Cativo	<i>Prioria copaifera</i>	caesalpiniaceae
Red ucuuba	<i>Virola sebifera</i>	myristicaceae
Oil Tree	<i>Pentaclethra macroloba</i>	mimosaceae
Panama Rubber Tree	<i>Castilla elastica</i>	MORACEA
Santa Maria	<i>Calophyllum brasiliense</i>	Clusiaceae
Pochote	<i>Bombacopsis quinata</i>	Bombacaceae
Roble coral	<i>Guettarda combssi</i>	Rubiaceae
Guiana-chestnut	<i>Pachira aquatica Aubl</i>	Bombacaceae
Encenillo	<i>Miconia tomentosa</i>	Melastomataceae
Corkwood	<i>Pterocarpus officinalis</i>	Fabaceae
Bitterwood	<i>Quassia amara</i>	Simaroubaceae
Pink trumpet tree	<i>Tabebuia rosea</i>	Bignoniaceae
Laurel	<i>Cordia alliodora</i>	Boraginaceae
White Leadtree	<i>Leucaena leucocephala</i>	Mimosaceae
Copal	<i>Tetragastris panamensis</i>	Burseraceae
Prickly holly	<i>Zanthoxylum panamense</i>	Rutaceae
Guava	<i>Psidium guajava</i>	Myrtaceae
Titor tree	<i>Sacoglottis trichogyna</i>	Humiriaceae
Malagueto	<i>Xylopia frutescens</i>	Annonaceae
Sapodilla	<i>Manilkara chicle</i>	Sapotaceae
Muskwood	<i>Guarea grandifolia</i>	Meliaceae
Coco plum	<i>Chrysobalanus icaco</i>	Chrysobalanaceae
Marmelada	<i>Alibertia edulis</i>	Rubiaceae
Coconut palm	<i>Coco nucifera</i>	Arecaceae
Coralillo	<i>Inga vera spuria</i>	Leguminosae

We were able to observe that in the zone of the refuge area there are certain areas that have been intervened upon by anthropogenic action, principally in the mid basin

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of the San Juan River of Nicaragua. Most of the refuge's territory is in an excellent state of conservation, especially on the Nicaraguan side. Of importance is the wetland Vegetation found in poorly drained areas along the San Juan River of Nicaragua, lakes and streams.

The predominant vegetation on both sides and on certain parts of the riverbank are palms, principally pinecone palm (*Raphia taedigera*). This ecosystem in the reserve is very commonly found in large patches of flood prone lands and freshwater rivers with a very slow current.

There are also certain associations tied to the coastline: small clusters of mangroves, while along sandy beaches coco plums and seagrapes are common.

Agricultural Soils

The production of basic foods by people on both sides of the river is a hard-felt need. Unfortunately, the environmental conditions, extreme humidity and soil conditions are not apt for agriculture or livestock raising.

The space designated for the production of basic grains in the Management Plan is very small. Thus, inappropriate use of that space would lead to a very rapid deterioration on account of the excess rainfall, compromising its sustainable use, with the resulting loss of such local production. Probably, this situation would drive the local population to try and use other spaces that have not been principally authorized for the production of basic grains.

Mangroves

The small areas of mangrove trees observed during the site visit are highly deteriorated. Preservation of this ecosystem is basic within the reproductive chain of fish that share freshwater, estuary and brackish ecosystems (Robleto, 1996a)

The eastern sector of the Bay of San Juan has been gradually narrowing as a consequence of sedimentation and water currents from the Caribbean. Said natural behavior is upsetting the balance of this ecosystem and its vegetation component. This plant variety (Mangrove tree), characterized by its complexity, establishes itself in the Refuge's floodplain. Meanwhile, the floodplain itself is spreading due to the influence of the high tides of the Caribbean, which enter beyond the estuary of the San (Juan) of Nicaragua, the mouth of Spanish Creek, and Haulover. That makes the estuary waters brackish, creating conditions for the presence of mangrove trees (*Rhizophora mangle*), which have the ability to absorb the impact of the waves along the shore.

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The small clusters of mangrove trees within the Refuge are in urgent need of greater attention for their preservation, both on the part of the local authorities and that of the inhabitants. This calls for joint implementation of a restoration program that will allow for the recovery of this natural resource through reforestation, in order to increase the population of mangrove trees in the areas where they already exist.

A conservation alternative for the Forest resource The wooded area of the refuge is in very good condition. It is well known that certain natural resources generate a series of positive externalities to everyone's benefit. One very important factor is the role played by forest masses in fixing atmospheric carbon.

Carbon sink. A beneficial product of conserving and protecting the vegetation layer is that it can provide an economic alternative for the communities of the refuge. Presently, no one is benefiting from the natural activity of the forest in fixing carbon. That situation is a typical case where positive actions are generated for others, but are not currently generating any benefit to the country or the local community. One solution would be to try and internalize the benefit that the forest provides by fixing carbon in its areas. This is a natural service that has a cost and that has to be offered to the world. In this way, the world would pay the administrators of tropical forests for the value of the services being provided on account of holding a quantity of carbon. Were it not for that, the carbon released would exacerbate and increase global warming of the atmosphere.

The best use of these soils in the refuge is strictly to conserve and protect them, given the climate conditions in the zone. If their use were to change, that is, if these spaces were slashed or burned in order to devote them to agricultural activity and/or livestock raising, the possibility would be lost of capturing the environmental and economic benefits of forest services.

In the course of identifying the plant species existing in the area of influence where the dredging will take place for the project entitled "**IMPROVEMENT OF NAVIGATION IN THE SAN JUAN RIVER OF NICARAGUA**" (Delta - San Juan of Nicaragua) an inventory of existing species was conducted. The inhabitants of the zone were also interviewed regarding the species' common names in order to later look up the respective Scientific Name at the offices of the National Herbarium of Nicaragua.

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These plants are located on the riverbanks of bodies of water



These species develop in the undergrowth.



These are epiphyte plants. Araceae.



Aquatic vegetation of great importance for life



Measurement transect

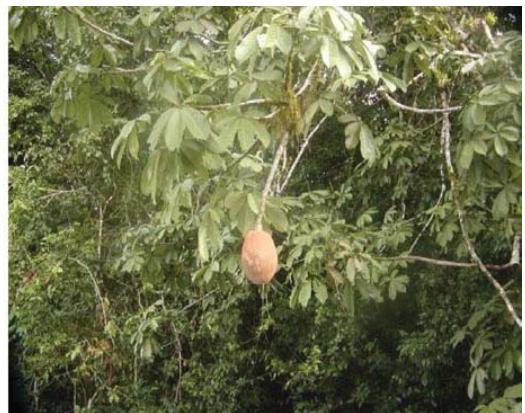


Determining tree diameters

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Palms, pinecone palm (*Raphia taedigera*) predominant in this sector.



Guiana chestnut (*Pachira aquatica Aubl*)
This tree is typical of the ecosystem



Exuberant epiphytes within the forest



Burning and destruction of pinecone palms



Captaceae with fruits



Vegetation on the riverbank

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Tree where Orioles make their nests



Plant association



Heterogeneous vegetation



Aquatic vegetation



The abundant humidity and organic material generate the production of fungi



Estuary in San Juan of Nicaragua

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3.3.2. Fauna

The Wildlife Refuge of the San Juan River of Nicaragua forms a part of one of the two most extensive and best conserved biological nuclei of the Mesoamerican Biological Corridor. It also comprises one of the most important Central American wetlands, since it is the final stage of Central America's largest basin, in a low-lying fluvial-marine plain, with average elevations of 20 meters above sea level and gradients of less than 0.5%. The basin's landscape has a morphology of deltas, low river dikes, wetlands and sandbars, moderately well to poorly drained, which, combined with the high precipitation of the zone, keeps the soil permanently saturated with water.

The lacustrine complex is comprised by several small lakes interconnected to a multitude of small ponds by means of a complex system of rivers that empty downstream into the freshwater populations and their biological cycle. All these bodies of water empty their content very slowly into the San Juan River of Nicaragua, which in turn empties into the Atlantic Ocean.

Species Diversity

The zone of the Wildlife Refuge of the San Juan River of Nicaragua contains a highly extensive diversity of species. In this area 303 bird species (24 migratory), 30 mammal species, 20 reptile species, 10 amphibian species and 274 insect species have been registered. Also known are 7 species of marine crustaceans and 2 freshwater crustacean species, 13 saltwater fish species and 10 freshwater fish species.

Nonetheless, the San Juan River Wildlife Refuge has already provided us with important discoveries, despite what little material has been collected in such a reduced time period. This leaves us no choice but to imagine the immense deposit of biodiversity yet to be discovered once systematic inventories are conducted and the scientific activity intensifies.

The method used to determine the fauna was that of a comparison of lists of species in already existing reports. Use was also made of direct observation and consultation with the inhabitants during the field reconnaissance period throughout the span.

The Biosphere Refuge of the San Juan River of Nicaragua is composed of two types of forests. The low open woodland is located to the North of the San Juan human settlement. It is a relatively flat, flood prone territory, crossed from Northwest to Southeast by the course of the Indio River, parallel to the El Pescador and Casa Alta streams. Given its environmental characteristics, this type of forest is home to several animal species such as the great curassow (*Crax rubra*), and the crested guan (*Penelope purpurascens*). At night it is common to hear tinamous

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of at least three species *Tinamus major*, *Cripturellus boucardi* and *C. cinnamomeus*. Of particular value for tourism are the two species of parrots present in the area, *Ara macao* and *Ara ambiguus*, both of which are endangered species.

It is important to note that already known species exist in the study area. The value of some of them should be stressed given their economic and ecological significance, as well as their beauty:

Heraldic Value.

In a natural space such as this Wildlife Refuge, each species has a specific function, which means that all of them are important. But here one particularly valuable species exists, which, given its uniqueness, could in-and-of itself represent the importance of the entire Wildlife Refuge: the West Indian manatee (*Trichechus manatus*). This harmless, little known mammal can have a length of more than 3 meters and weigh more than half a ton. Its females nurse their young almost in the same way as humans do. European sailors in the past believed that they saw the legendary mermaids in these aquatic mammals. For that reason, zoologists included this species in the Sirenia taxonomic order.

This family consists of only three species worldwide, all of which are threatened with extinction (Jiménez, 2000). The species we found in the Refuge is only found in the waters of the Caribbean and is very rare. It is therefore very much on the radar of international organizations interested in conservation. This Refuge probably has one of the largest populations of Manatee in Nicaragua, principally in still waters, where there is abundant herbaceous vegetation on which it feeds (Jiménez and Altrichter, 1998).



West Indian manatee (*Trichechus manatus*)

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**Below are some species of birds and mammals
found in this type of ecosystem**



Piranga rubra



Mandacus candei



Jacana spinosa



Catharus ustulatus

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Butorides virescens



Nighthawk (*Chordeiles acutipennis*)



Eggs of the Nighthawk discovered



Amazona albifrons



Bubulcus



Kingfisher

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The second type of forest is much higher. These forests house a great number and variety of land fauna, judging from the abundance of tracks we found in these places (mountain boar, peccaries, tapir, jaguar, raccoon). These wildlife populations are indispensable for the survival of the jaguar and other species of mammals.



Jaguar (*Pantera onca*)



Jaguarundi (*Herpailurus*)



Armadillo



deer



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Raccoon



Weasel



Baird's Tapir (*Tapirus bairdii*)



Bat

In these forests it is possible to observe some very interesting phenomena, such as the association between certain plants and animals. Such is the case between fig trees and/or stranglers, each of which has its own species of pollinating wasp, which, in turn, depends on the ripening of the pollinated fruits to complete its biological cycle. Other cases are hummingbirds, which, given the form of their beaks, feed off the flowers of the Parrot's Plant and Heliconia and at the same time fertilize flowers.

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**This type of heliconia is where
hummingbirds feed**

3.3.3. Species on the Verge of Extinction

In the San Juan River wildlife refuge there is a presence of species that are extinct elsewhere. Such a situation justifies the protection of many wildlife refuges in the world. An international convention ratified by Nicaragua in 1977 (*La Gaceta, Official Gazette # 183*) obligates us to pay attention to the species identified on the CITES list (List of the Convention on International Trade in Endangered Species of Wild Fauna and Flora), to control their international trade. In this Wildlife Refuge 46 of these species are found in relative abundance, which grants additional value to the intelligent management of natural resources in this part of the country.

The tables inserted below provide a list of certain specimens of wildlife fauna in the zone, with the objective of encouraging the authorities and the population in general to protect and conserve them.

3.3.4. Mammals

Table No. 3.2. Most common land and aquatic mammals inhabiting the area of influence of the project for the “**IMPROVEMENT OF NAVIGATION IN THE SAN JUAN RIVER OF NICARAGUA**” (Delta - San Juan of Nicaragua)

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Common Name	Scientific name	Family
Paca	<u>Agouti paca</u>	AGOUTIDAE
Two-toed Sloth	<u>Choloepus hoffmanni</u>	BRADYPODIDAE
Three-toed Sloth	<u>Bradypus variegatus</u>	BRADYPODIDAE
Mantled Howler monkey	<u>Alouatta palliata</u>	CEBIDAE
Black-handed Spider Monkey	<u>Ateles geoffroyi</u>	CEBIDAE
White-faced Capuchin	<u>Cebus capucinus</u>	CEBIDAE
White-tailed Deer	<u>Odocoileus virginianus</u>	CERVIDAE
Red Brocket Deer	<u>Mazama americana</u>	CERVIDAE
Central American Agouti	<u>Dasyprocta punctata</u>	DASYPROCTIDAE
Fruit-eating bat	<u>Artibeus jamaicensis</u>	PHYLLOSTOMIDAE
Great Fruit-eating bat	<u>Artibeus lituratus</u>	PHYLLOSTOMIDAE
Tent-roosting Bat	<u>Artibeus watsoni</u>	PHYLLOSTOMIDAE
Short-tailed Fruit Bat	<u>Carollia perspicillata</u>	PHYLLOSTOMIDAE
Tent Making Bat	<u>Uroderma bilobatum</u>	Phyllostomidae
Gray Four-eyed Opossum	<u>Philander opossum</u>	DIDELPHIDAE
Common Opossum	<u>Didelphis marsupialis</u>	DIDELPHIDAE
Cougar	<u>Felis concolor</u>	FELIDAE
Jaguar	<u>Panthera onca</u>	FELIDAE
Long-tailed Weasel	<u>Mustela frenata</u>	MUSTELIDAE
Tayra	<u>Eira barbara</u>	MUSTELIDAE
Cottontail Rabbit	<u>Sylvilagus floridanus</u>	Leporidae
Northern Tamandua	<u>Tamandua mexicana</u>	MYRMECOPHAGIDAE
Dwarf Squirrel	<u>Microsciurus alfari</u>	SCIURIDAE
Variegated Squirrel	<u>Sciurus variegatoides</u>	SCIURIDAE
Baird's Tapir	<u>Tapirus bairdii</u>	TAPIRIDAE
White-lipped Peccary	<u>Tayassu pecari</u>	TAYASSUIDAE
Collared Peccary	<u>Tayassu tajacu</u>	TAYASSUIDAE
West Indian Manatee	<u>Trichechus manatus</u>	TRICHECHIDAE
Eastern Spotted Skunk	<u>Spilogale putorius</u>	Mustelidae

3.3.5. Birds and Reptiles.

The great curassow (*Crax rubra*), and the crested guan (*Penelope purpurascens*). Less visible but very audible at night time are tinamous of at least three species *Tinamus major*, *Cripturellus boucardi* and *C. cinnamomeus*. Of particular value for tourism are the two species of parrots present in the area, *Ara macao* and *Ara ambiguus*, both of which are endangered species. The presence of the latter of these species provided the incentive for the Costa Rican government to protect a forest adjacent to the San Juan River of Nicaragua with the principal aim of conserving said species in Costa Rica and study its behavior. Thanks to that effort, its migratory pattern between the forests of that country and ours are now known.

Table No. 3.3. Most common birds inhabiting the area of influence of the project for the **IMPROVEMENT OF NAVIGATION IN THE SAN JUAN RIVER OF NICARAGUA**" (Delta - San Juan of Nicaragua)

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Common Name	Scientific Name	Family
<i>Great-tailed Grackle</i>	<i>Quiscalus mexicanus</i>	Icterinae
<i>Ruddy Ground Dove</i>	<i>Columbina talpacoti</i>	Columbidae
<i>Clay-colored Thrush</i>	<i>Turdus grayi</i>	Turdidae
<i>White-winged Dove</i>	<i>Zenaida asiatica</i>	Columbidae
<i>Short-billed Pigeon</i>	<i>Columba nigrorostris</i>	Columbidae
<i>Red-billed Pigeon</i>	<i>Columba flavirostris</i>	Columbidae
<i>Inca Dove</i>	<i>Columbina inca</i>	Columbidae
<i>Cattle Egret</i>	<i>Bubulcus ibis</i>	Ardeidae
<i>White-throated Magpie-Jay</i>	<i>Calocitta formosa</i>	Corvidae
<i>Rufous-naped Wren</i>	<i>Campylorhynchus rufinucha</i>	Troglodytidae
<i>Blue-grey Tanager</i>	<i>Thraupis episcopus</i>	Thraupidae
<i>Dusky-capped Flycatcher</i>	<i>Myiarchus tuberculifer</i>	Tyrannidae
<i>Pauraque</i>	<i>Nyctidromus albicollis</i>	Caprimulgidae
<i>Great Kiskadee</i>	<i>Pitangus sulphuratus</i>	Tyrannidae
<i>Groove-billed Ani</i>	<i>Crotophaga sulcirostris</i>	Cuculidae
<i>Ocellated Quail</i>	<i>Cyrtonyx ocellatus</i>	Phasianidae
<i>Stripe-tailed Hummingbird</i>	<i>Eupherusa eximia</i>	Trochilidae
<i>Hoffmann's Woodpecker</i>	<i>Melanerpes hoffmannii</i>	Picidae
<i>Barn Swallow</i>	<i>Hirundo rustica</i>	Hirundinidae
<i>Cliff Swallow</i>	<i>Hirundo pyrrhonota</i>	Hirundinidae
<i>Yellow-throated Vireo</i>	<i>Vireo flavifrons</i>	Vireonidae
<i>Black-and-White Warbler</i>	<i>Mniotilla varia</i>	Parulidae
<i>Tennessee Warbler</i>	<i>Vermivora peregrina</i>	Parulidae
<i>Yellow Warbler</i>	<i>Dendroica petechia</i>	Parulidae
<i>Turkey Vulture</i>	<i>Cathartes aura</i>	Catartidae
<i>Black Vulture</i>	<i>Coragyps atratus</i>	Catartidae
<i>Thick-billed Seed-finches</i>	<i>Oryzoborus funereus</i>	Emberizidae

Table No. 3.4. Most common reptiles and amphibians inhabiting the area of influence of the project for the **IMPROVEMENT OF NAVIGATION IN SAN JUAN RIVER OF NICARAGUA**" (Delta – San Juan of Nicaragua)

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Common Name	Scientific Name	Family
Amphibians		
Cane Toad	<i>Bufo marinus</i>	Bufonidae
Gulf Coast Toad	<i>Bufo valliceps</i>	Bufonidae
Yellow-headed Gecko	<i>Gonatodes albogularis</i>	Gekkonidae
Common House Gecko	<i>Hemidactylus frenatus</i>	Gekkonidae
Green Iguana	<i>Iguana iguana</i>	Iguanidae
Black Iguana	<i>Ctenosaura similis</i>	Iguanidae
Lemur Anole	<i>Norops lemurinus</i>	Iguanidae
Slender Anole	<i>Norops limifrons</i>	Iguanidae
Central American Ameiva	<i>Ameiva festiva</i>	Teiidae
Black-bellied Racerunner	<i>Aspidoscelis deppii</i>	Teiidae
Squamata / Snakes		
Boa constrictor	<i>Boa constrictor</i>	Boidae
Brown Vine Snake	<i>Oxybelis aeneus</i>	Colubridae
Green Ratsnake	<i>Senticolis triaspis</i>	Colubridae
Central American Coral Snake	<i>Micrurus nigrocinctus</i>	Elapidae



Bothrops atrox



Basilisk



Iguana



Red frog

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3.3.6. Threatened and Endangered Species

In the zone of the project for the “**IMPROVEMENT OF NAVIGATION IN THE SAN JUAN RIVER OF NICARAGUA**” (Delta – San Juan of Nicaragua), the area of influence has species of flora and fauna listed as endangered and threatened species by the Ministry of the Environment and Natural Resources and by the National Secretariat of CITES – Nicaragua.

FLORA:		
Mahogany	<i>Swietenia macrophyllum</i>	CITES Appendix I
BIRDS:		
Clay Colored Robin	<i>Turdus grayi</i>	Nicaragua Version
Double-Striped Stone-Curlew	<i>Burinus bistriatus</i>	CITES Appendix III
REPTILES:		
Boa constrictor	<i>Boa constrictor</i>	CITES Appendix II
Green Iguana	<i>Iguana iguana</i>	CITES Appendix II
Green Iguana	<i>Iguana iguana</i>	CITES Nicaragua Version II
Black Iguana	<i>Ctenosaura similis</i>	Nicaragua Version

3.4. Fishing Biology

3.4.1. Introduction.

In recent years, a marked decrease of fishing resources in bodies of water has been seen. The cause may be in large part the strong pressure put on all freshwater species, but more particularly on migratory euryhaline species. This activity makes it difficult for these fish to finish their route to complete the reproductive cycle that will take them back to the estuary systems to spawn. The lack of applicability of strict bans and the use of illegal fishing equipment, such as gill nets that have a mesh size with an opening of less than three inches, in extremely sensitive areas (river mouths) is affecting the fishing ecological base of the entire region, but especially the fishing areas downstream of the Delta.

Small-scale fishing in the San Juan River relies largely on migratory species such as the sea bass, gaspar and river shrimp. All of these have a specific commercial value that helps to temporarily increase the purchasing power of the fishermen each year. However, every year these species encounter more problems for making their journey to the San Juan River through the Colorado River in Costa Rica.

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The fragility of these resources occurs under two circumstances. The first is spatial in nature. It consists of the areas where the fish swim, which make it possible, with very little fishing effort, to catch the entire population swimming in a specific area by installing trammel nets at the mouths of the tributary rivers, waterways and creeks. The second circumstance is biological-temporal in nature and is related to the seasonal movement of these populations in order to complete their reproductive cycle. Consequently, the viability of these populations depends on a sufficient number of fish being able to spawn in the appropriate lake shores, banks or estuaries.³

3.4.2. The species of fish in the river.

There are several studies that specify the variety of species present in the San Juan River basin. The most recent studies include the information provided in the Procuencia-San Juan Transboundary Environmental Diagnosis (2004), in which, at the end of the research, a total of 21 families, 38 genera and 45 species were registered, with the following families being the most representative:

Cichlidae (Guapotes and mojarras)
 Poeciliidae (Pepescas)
 Characidae (Machacas)
 Eleotridae (Guavinas and dormilons)
 Pimelodidae (Barbudos and chulins).

In the 1982 publication, Dr. Jaime Villa, in his work “Peces Nicaragüenses de agua dulce” [“Nicaraguan Freshwater Fish”], reported a quantity of 35 families, 78 genera and more than 100 species, with the condition that here populations were included from all of the country’s bodies of water. The families cited here include:

- a. Anguillidae (Eel)
- b. Ariidae (Catfish)
- c. Bothidae (Flatfish)
- d. Carangidae (Saurel)
- e. Engraulidae (Anchovy)
- f. Gerreidae (Sea mojarra)
- g. Lutjanidae (Red snapper)
- h. Megalopidae (Shad)
- i. Mugilidae (Striped mullet)
- j. Pomadasysidae (Grunt)

³ ¹ There is no updated information available on the biology and life cycles of the majority of the species that inhabit and swim upstream in the San Juan River, which complicates the establishment of specific standards for the sustainable use of these species. (Procuencia-San Juan, 2004)

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- k. Soleidae (Flatfish)
- l. Syngnathidae (Pencil fish)
- m. Carcharhinidae (Shark)
- n. Pristidae (Sawfish).

In 1967, Ignacio Astorqui, S. J., published his studies on “Fish from Nicaragua’s Big Lake Basin” in the magazine Conservadora, in which he identified 16 families and 45 different species.

The end of this study presents a taxonomically updated list of the species of fish that have been reported for the big lake basin, which makes them potential inhabitants of the entire course of the San Juan River.

3.4.3. Biology of the most notable species that inhabit the San Juan River.

This ichthyofauna includes carnivorous, herbivorous and omnivorous fish. Many of the characids, pimelodids, poeciliids and the young from all the groups feed on aquatic or terrestrial insects (according to their habitat). The characid Bramocharax, the poeciliid Belonesox and the guapotes Parachromis are piscivorous. The groups of fish that swim upstream from the sea, such as centropomus (sea bass), Lutjanus (red snapper), Pomadasys (grunts) and eleotrids (guavinas), eat fish and crustaceans. The Roeboides species feed on the scales of other fish and on aquatic insects. Many cichlids are omnivorous. They eat insects, seeds and organic waste. Several species of Poeciliids, a characid (Carlana) and a cichlid (Herotilapia) feed mainly on seaweed. The machaca (Brycon) eats fruit in rivers, but when it is living in lakes, it changes its habits to being carnivorous.

3.4.3.1. Reproduction.

Many species have reproductive forms developed and the combination of the habitat, specific physiology and reproductive behavior represents key factors in determining their reproductive strategy. These strategies may require a large number of eggs or a small number of eggs but with a great opportunity for survival. The fish ensure the survival of a portion of the eggs either by defending them, covering them or directly protecting the young.

The location and season of the year are factors of great importance in the spawning of many species because good environmental conditions such as temperature, water salinity and lighting cause the gametes to mature. In some species, reproductive speed may be influenced

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by photoperiodicity and warm water temperature. Spawning may also be suddenly accelerated by excessive availability of natural food.

For most fish there is a defined reproduction season and, according to this, they can be classified as warm-water fish that spawn in the summer or dry season and cold-water fish that spawn during the autumn and in the winter. Those that tolerate intermediate temperatures tend to spawn during the spring. Many of our tropical species spawn throughout the year.

The fish use a large variety of reproductive strategies, from scattering eggs at random to viviparity. Characids mate and deposit eggs on the bottom or among the vegetation with no care provided by the parents. Other fish such as cichlids lay adhesive eggs on rocks or submerged logs and one or both parents protect the eggs and then the young. Poeciliids are viviparous and the young are born ready to defend themselves. It is known that species of poeciliids and cichlids reproduce throughout almost the entire year. Other cichlids and some characids may prefer the summer or winter for their reproduction and spawn either during high-water periods or during the dry season.

In general, fish possess almost all the reproductive mechanisms or variables that are present in the animal kingdom, and in some cases they exhibit specializations that facilitate the acceleration of this action under adverse conditions in which they feel they are in danger from being pursued or from environmental conditions. There are oviparous, ovoviviparous and viviparous fish.

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Photo 1. Cichlidae Family.



Photo 2. Lepisosteidae Family.



Photo 3. Clupeidae Family.



Photo 4. Characidae Family.

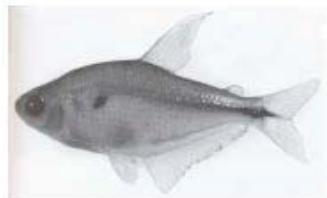


Photo 5. Ariidae Family.



Photo 6. Pimelodidae Family.



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Photo 7. Rivulidae Family.



Photo 8. Poeciliidae Family.



Photo 9. Atherinidae Family.



Photo 10. Synbranchidae Family.



Photo 11. Centropomidae Family.

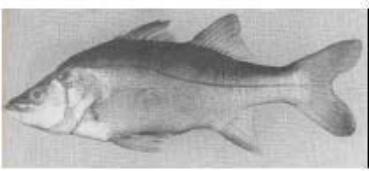


Photo 12. Carangidae Family.

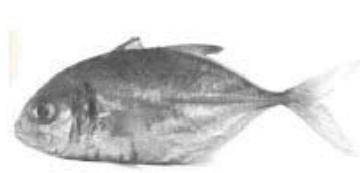


Photo 13. Gerreidae Family.

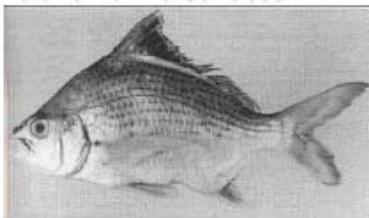


Photo 14. Haemulidae Family.

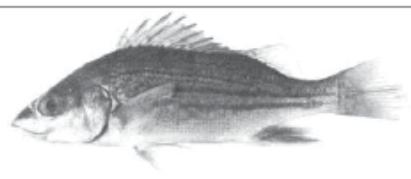


Photo 15. Mugilidae Family.



Photo 16. Gobiidae Family.



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Photo 17. Eleotridae Family.

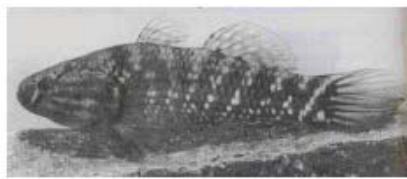


Photo 18. Paralichthyidae Family.



3.4.3.2. Food production.

The greatest productivity of the San Juan River system is restored in the final kilometers of its route, from Boca de San Juanillo to Bahía de San Juan de Nicaragua, with its waterways and small lagoons. Here at the mouth is where the greatest potential for food production is concentrated, given that the estuary is the system where the physical and biotic components are balanced and thus there is a high intensity of biological productivity. The sedimentary system of canals, waterways and lagoons represents places where the production processes are superior. Here the nutritional elements are regenerated and placed into circulation again. The plankton and nekton are synergized in transforming and transporting nutritional elements and energy. At all points of the river where sand is being deposited on the bottom, the primary productivity of production of benthic seaweed that grows not just from macrophytes and sessile animals, but also on certain types of bottoms such as clay and mud, is being lost. In many places this mud seaweed represents up to a third of the primary production that supports other life forms from the base of the food pyramid.

During the performance of this study, almost no young of the species that were caught were seen, even though the habitats of the young include marshes, a lagoon-estuarine environment, mangrove swamps and mouths of streams. The ecological definition of the environment always determines the clear establishment of each of these habitats, and in many cases, well-defined separations are created between the young, the adults and even the areas of availability of ichthyoplankton. Through mere observation, this biological separation may suggest the existence of a strong relationship between the fish and specific characteristics of each habitat, in

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high-diversity estuarine tropical communities. This means that the fish cannot be located in a specific trophic level. Therefore, it can be determined that in the near future, priority must be given to studies of the dynamics of the fish communities in the San Juan River area. This includes taxonomic identifications in the first stages of development of the fish, including larvae and eggs, because it is a well-known problem that in tropical areas where a high number of species coexist, there is little possibility of accurately establishing a specific category for the different ichthyoplankton eggs, especially when there are biotic interactions among highly diverse populations.

The area of the mouth that forms the estuary should be treated with particular care given that it is ecologically responsible for regeneration of the local biota because it has periodic contributions of aufwuchs, marine nekton (especially water fleas and copepods) and dwarf plankton (algae and protozoa to a large extent). These elements are those that restore the primary mangrove swamp environment, which can be called a breeding ground or "nursery" for a large number of organisms that contribute to restoration of the food networks.

The care of these places translates into a potentiality of fish resources, so they should be watched from an in-depth ecological perspective, especially the care of the marsh, lagoon and estuary habitat. Port and canal construction activities must be performed with the greatest care for protection of these ecosystems. It is likewise essential for there to be urgent control over the dumping of chemical waste, oil and fishing waste (viscera) in the entire river region. The population should be made aware that the long-term cumulative effects of contaminants alter the environmental behavior and the dynamics of the ecosystem.

At the points before and after the mouth of the Colorado River, in the direction of San Juan de Nicaragua, water samples were analyzed for planktonic and benthonic organisms. The results obtained can be seen in tables 11 and 12 of the Hydrology chapter, but here some results from the microorganism indexes should be noted: Copepods 240 ind/m³, Rotifers 30 ind/m³, Nematodes 100 ind/m³, Annelids 340 ind/m³.

A low density of organisms was seen both in the water and in the sediment, with predominance of species that are tolerant and adapted to any environment. It should be taken into consideration that the places where the samples were taken are located at the mouth of the San Juan River, toward which the majority of the contaminating substances have been dragged, along with coarse sediment, which translates into the presence of highly tolerant species. The low density of planktonic and benthonic organisms shows that the water of the San Juan River is very poor in quality and content of productive microorganisms.

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The diet of a large part of the freshwater fish that live in the San Juan River consists of microorganisms suspended in water, seaweed, diatoms, plankton and detritus, such as:

Cichlids: Some of these also feed on seaweed and detritus.

Clupeids: These feed on plankton.

Pimelod[di]jids: Detritus.

Poeciliids: Microorganisms suspended in water.

Atherinids: Seaweed and diatoms.

Gobioids: Seaweed and invertebrates.

Eleotrids: Mud, detritus and plankton.

The plankton communities near the coasts and particularly at the mouth of the rivers are subject to many variables and circumstances, as noted previously. This is important because the number of trophic levels required for the organic material to reach the fish decreases as the size of the plant cells corresponding to the start of the food chain increases.

In one community, nanoplankton are prey of microzooplankton, which include protozoa and small crustacean larvae, which, in turn, constitute food for carnivorous zooplankton (it was believed that many of its species were herbivorous). Secondary carnivores feed on zooplankton, so that the organisms corresponding to the three trophic levels that follow the three primary levels are made up of animals 1 to 2 centimeters long, so there are at least one or two additional trophic levels before they reach the level of fish like the gaspar, sea bass and shad, in this chain passing through most of the species in the river, which are very small in size and serve as food for the base of the food chain. This can be seen in the following diagram from Figure 1.

In the rivers, plankton originate in ponds, lagoons or broad shores where the river runs slowly. They multiply until becoming an integral part of the community. In places where the water is deeper, there is production of phytoplankton, which generally form colonies several millimeters in diameter and are vulnerable to direct ingestion by fish of the Atherinid and Poeciliid types, although many of the fish that may be found in these places belong to the sardines group, many of which are herbivorous.

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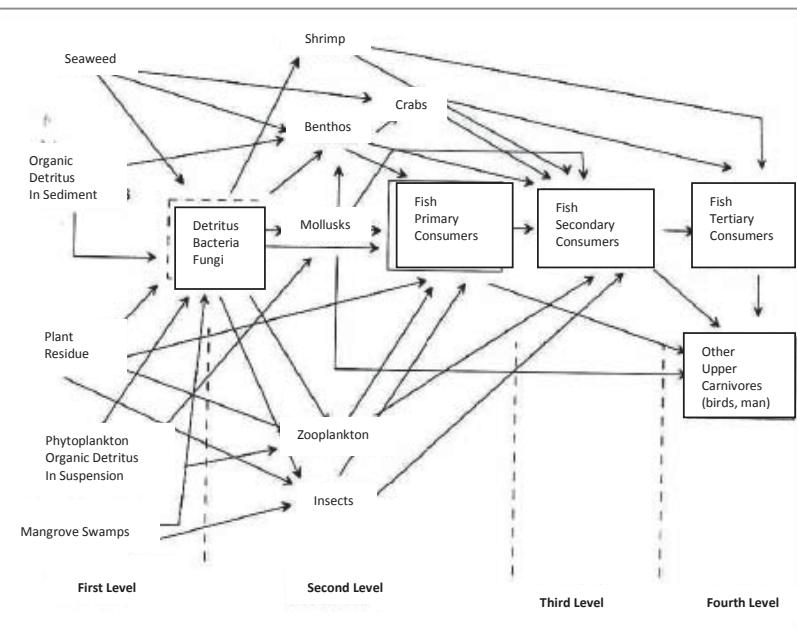


Figure 1. Graphic representation of the trophic level structures in ecosystems similar to those existing in the San Juan River. (De Pérez 1999)

With the exception of cichlids, all the fish from the cited families are small in size and serve as a food base for larger fish and for migratory euryhaline fish. Restoration and preservation of the water quality in the river's entire course is essential for maintaining the primary productivity on which many lower species that are near the food base depend. That is why it is important to legislate to regulate the sediment loads that enter both from the big lake's waters and from the tributaries along the Costa Rican border.

Similarly, to represent the relationship between the species we could use a dendrogram, which is a type of graphic representation of data in the form of a tree that organizes the items into subcategories, which are divided into others until reaching the desired level of detail, in this case the chain of who eats whom. This type of representation makes it possible to see the group relationships between the individuals and even between groups of these. Unfortunately, the amount of specific information on the species being studied is not sufficient to prepare the

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diagram, given that the presence of several of the species was not confirmed for the purpose of establishing the Jaccard similarity coefficients, which are calculated from the simple variables of presence or absence of species at points of study. It would be recommendable in the future for this to be part of a study of the species so as to contribute to the knowledge of their distribution and the degree of grouping among them.

3.4.4. The River Environment.

The San Juan River, seen as a means of life support for the ichthyofauna, is fragile, because it is the environment in which the indigenous fauna of the region lives, moves and develops, and fish species with high commercial and cultural value and even extremely important mammals like the manatee grow and reproduce in it. The San Juan is currently receiving a high load of sediment and foreign elements that change its basic composition (at least at its mouth or entrance), which in one way or another affects the presence and distribution of specific groups of fish that, in some cases, do not tolerate contamination of the water.

As an ecosystem, the San Juan River is subjected to the pressure of large discharges of sediment, waste and also discharges of agrichemicals from, mostly, its Southern bank, principally from the Sarapiquí river, which moves a greater load of suspended solids to the San Juan as the rainy season progresses. In the dry season, the contribution from the Costa Rican rivers is around 2.8 kilograms of suspended sediment per second, which is deposited in the areas of low current speed. In the rainy season, this load increases 2 to 3 times. It has been estimated that the contributions to the San Juan River, between the Sarapiquí River and Caño Colorado, are 303 m³/second contributed by Lake Nicaragua, 264 m³/second contributed by the San Carlos River and 243 m³/second contributed by the Sarapiquí River, with the flow increasing up to 1180 m³/second because of the contributions from the drainage area both from Nicaraguan territory and from the remaining Costa Rican territory. It is estimated that after Caño Colorado, an average of 150 m³/second circulates in the San Juan River in the summer season.⁴

From the above it is inferred that the San Juan River is gradually losing its water purity, its bottom productive capacity and, therefore, the variety of organisms that sustain the food chains and aquatic, euryhaline and marine species. In the long term, they will no longer be able to migrate through its waters to reach Lake Cocibolca and the economy and nutrition of different population groups who survive from fishing will be affected. The sedimentation processes not only entail losses of territory but also inherently involve ecological deterioration and the inevitable decrease of the associated wildlife.

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According to the fishes' tolerance to different water environments, fish that are strictly freshwater or strictly marine fish can be known as stenohaline. The euryhaline species are those that come from the sea and occasionally visit freshwater environments, sometimes to stay for long periods or only to carry out or conclude part of their life cycle. The San Juan River has both types of populations. During the intervention stage, euryhaline species were only caught at station one (rucos) and six (palometas). This is indicative of a marked division of ecotones, in which there is a division of food-chain phenomena, which determines a different trophic structure between one ecotone that we could define from the Delta upstream of the San Juan and the second from the Delta downstream.

In the first, soft bottoms predominate with tributary rivers that have fair water quality and a moderate sediment load. In addition, the human activity from centers such as Boca de Sábalos and El Castillo contribute elements that, in one way or another, feed the system and provide material for the disintegrators or saprovores that decompose the trophic base. This attracts a large variety of young fish, crabs, young shrimp, sardines and pepescas, which are the food source of carnivores such as sea bass, shad, grunts and guapotes.

In the second ecotone, downstream of the Delta, the trophic situation changes. Here we find muddy water because of the extremely high amount of dissolved sediment, elevated quantities of plant material, shallow depth of the river (some sectors have 30 centimeters or less), slow current and vegetation that is unvarying and not very diverse on the banks. We could identify the most significant factor that affects the fish population as the type of bottom. It is made up almost exclusively of fine sand, gravel and, in some sectors, rocks and flat stones. This is a limiting factor for primary production, which is reflected in the almost total absence of lower species (sardines and pepescas), with the banks being the only source of earthy material. These banks are generally occupied, in small "caves," by guapotes, the predominant carnivores in this ecotone up to the San Juanillo area, where the gaspar (Photo 8) is the higher species.

Many of the primary consumers from the rivers feed on detritus and depend largely on the organic materials that are dragged by the water or fall into it from the land vegetation on the bank. In addition, sometimes the plankton and detritus that come into the river from calmer waters, such as flooded plains and the lagoons that flow into the San Juanillo, are important elements from the standpoint of their variety and quantity, which raises the site value due to primary availability and their position as restorers of trophic systems when natural phenomena or violent human interventions occur that alter the system's balance, such as, for example, potential dredging. This leads us to take into consideration that the strong and mild currents determine the distribution of organic and inorganic solid particles, and of the salts and microorganisms that support the food chains.

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The total absence of marine fish considered to be euryhaline between the Delta and the San Juan de Nicaragua bay is real and also evident, and it is not until this latter place where we once again find species such as the palometa *Eugerres brasiliensis* (Photo 25) and the grunt *Pomadasys crocro* (Photo 27), which confirms a total distancing of these species in the study area.

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3.4.6. Observations on the San Juan River System.

The presence of marine fish considered to be diadromous was only seen at two points, at station one located upstream of the Delta and at station six, in the San Juan de Nicaragua bay. At fishing points 2, 3, 4 and 5, nothing was caught with nets, but it was observed that the locals with their hooks catch guapotes, guavinas, machacas and barbudos, which are freshwater species that have seasonal populations and are not migratory.

No migratory species such as sea bass and shad were caught or seen. It is assumed that this is due to the San Juan's scant connection with the sea and the species that swim up the Colorado through the delta to the San Juan River do so by following its route upstream and not down, where it would have been more feasible to find them. The fishermen who live near the bar of the Colorado River have to look for the waterways and branches of the Colorado to be able to catch

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fish for their livelihood, because when the rains start, the abundance of fish decreases due to the elevated amount of dirt dragged by the currents.

Shallow waters, elevated turbidity, substratum formed by sand, the absence of muddy bottoms and currents with abundant plant waste are all adverse factors for carrying out successful fishing. The majority of the section being studied is shallow. Depths from 30 centimeters to a meter and a half were found, and at certain points sandbanks were seen in the center of the water or on the sides of the river, with some banks being larger than others. The strongest current that was seen is located two kilometers upstream from the border point of the delta and turns toward this outlet forcefully, in the direction of Costa Rican territory. This is the type of current that species from the sea swim up, but the height of the bodies of these fish causes them to follow channels with depths greater than 30 centimeters, which is currently not possible in many sections downstream of the San Juan River, a condition that becomes more critical during the summer months, when the flow and level of the water decreases drastically, which also results in a greater decrease in the variety of fish available.

The preservation of mangrove swamp ecosystems is basic in the reproductive chain of fish and crustaceans that share freshwater, estuarine and salty ecosystems. The strangulation in the eastern sector of the San Juan bay, as a result of the sedimentation and water currents from the Caribbean, is not allowing this ecosystem to be maintained.

In the long term, the dredging activity would be a positive factor for the repopulation of fish in the section between the Delta and the San Juan de Nicaragua bay, by making its waters passable again and restoring the trophic chains and competition between freshwater fish and the predators that enter from the sea.

Critical Areas.

The current condition of the natural resources in the Río San Juan Wildlife Refuge reduces the critical areas to the areas where there is greater pressure from human activities or a direct impact on the resources from these activities. The following areas can be classified as critical:

- The beaches in the marine-coastal area, where all the nesting of birds, reptiles and diversity of flora could be altered from the extraordinary volume of all types of solid waste that the tides deposit on this sand.
- The mouth of the San Juan. If the strangulation between the river and the sea is completed, the mangrove swamp and, with it, all the species of fish that

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need the salt water from the estuary, including the young shrimp and lobster, would also be wiped out.

- Boca de San Juanillo. This place has particular importance because it is the outlet of the Ebo and Silico lagoons, which, because of the characteristics of their calm, crystal clear water and abundant aquatic and land vegetation, could be considered as primary repopulators of phytoplankton, zooplankton and a large number of invertebrates.
- The San Juan River. Excessive pressure from fishing at certain points threatens the survival of species and restricts commercial use of migratory fish to the upper course of the river. Sedimentation makes navigation of the river increasingly difficult from the Delta downstream and at some intermediate points such as Boca de San Carlos.

CONCLUSIONS

1. There is a marked difference between the fish populations that move between the Delta, El Castillo and the town of San Carlos and the population that is found between the delta and the town of San Juan de Nicaragua. The latter is dominated by lower carnivores of the cichlid family and in areas very defined by gaspars. This evidences the establishment of different trophic structures that have adapted to the changing seasonal phenomena that are present throughout the year in the lower part of the San Juan River.
 2. The fish populations upstream of the Delta are more numerous in variety of species and in quantity, which determines a greater biomass and greater food availability for the upper or euryhaline fish, which are used by the local residents. These conditions are determined by the availability of primary production, which may be affected in the lower part due to the quantity of sediment and the agrichemical load carried by the water.
 3. The availability of fish downstream of the delta is almost exclusively restricted to the cichlid family (mojarras and guapotes), which makes it hard for local residents to catch considerable quantities of fish because these are also subject to passive fishing methods (hooks and laying nets).
 4. The majority of the section being studied is shallow. Depths from 30 centimeters to a meter and a half were found, and at certain points sandbanks were seen in the center of the water or on the sides of the river, with some banks being larger than others. The strongest current that was seen is located two kilometers upstream from the border point of the delta and turns toward this outlet forcefully, in the direction of Costa Rican territory. This is the type of current that species
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from the sea swim up, but the height of the bodies of these fish causes them to follow channels with depths greater than 30 centimeters, which is currently not possible in many sections downstream of the San Juan River, a condition that becomes more critical during the summer months, when the flow and level of the water decreases drastically, which also results in a greater decrease in the variety of fish available.

5. Because of the size of the fish sample obtained, it is difficult to reach precise and correct conclusions about the reproductive state of the cichlid populations. Here only their condition of being partial spawners throughout the year can be stated, and we agree with Procuencia-San Juan in stating the need to update and deepen knowledge of the biology of the fish in this region, given that catches of some species could have been owing to factors pertaining to food, reproduction or temporary gathering.

6. To date there are no estimates of fishing production from San Juan de Nicaragua, but during the visit to the site it was evident that the production obtained from sea fishing is sent entirely to Costa Rica. This is facilitated by the number of collection centers and numerous points for unloading private boats. Only during the Holy Week time do the locals receive orders from Nicaraguans for the fishing and gaspar drying season.

7. The dredging of the planned section of the river would cause a trophic imbalance in the current food chain of fish, but the restoration of these (plural) is unquestionable when the bottom soil quality, the volume of circulating water and the strength of the river's downward current are changed. We must add to this the future contribution that sea water will make in the bay area. This will generate restoration of the mangrove swamp micro-ecosystems, which are the fundamental base of the estuaries and deltas. A regeneration of the local biota would be expected because of having strong contributions of aufwuchs, marine nekton (water fleas and copepods) and dwarf plankton (algae and protozoa) to restore the primary mangrove swamp environment, which can be called a breeding ground or "nursery" for a large number of organisms that will contribute to restoration of the food networks in the mouth of the San Juan River.

RECOMMENDATIONS

1. Not to dump material from the dredging on the bank and in the surrounding areas between the outlet of Caño Sucio and Boca de San Juanillo, because it is believed that this could alter the water circulation due to the slight slope present in this drainage area of the Ebo, La Barca and Sílico lagoons. Additionally, the quality of the water that empties into the river must be preserved because of its importance from the standpoint of primary production.

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2. The area at the mouth of the San Juan River as well as Boca de San Juanillo must be treated with special care. The care of these places translates into a potentiality of fish resources, so they should be watched from an in-depth ecological perspective, especially the care of the marsh and lagoon habitats. Port and canal construction activities must be performed in accordance with the scientific guidelines provided by the specialists on the matter, with the greatest care for protection of these ecosystems. It is likewise essential for there to be urgent control over the dumping of chemical waste, oil and fishing waste (viscera) in the entire river region. Work should be done on and focus given to an environmental education module for creating awareness that the long-term cumulative effects of contaminants alter the environmental behavior and the dynamics of the ecosystem, which in the long run directly affects the livelihood of the populations that also make use of fishing.
3. It will be advisable to monitor the behavior of the fish populations during the dredging phase so as to document and diagnose the responses to alteration of their environment and the possible consequences (unforeseen) of displacement of cichlids from that system. Here it should be taken into consideration that river organisms have a lower tolerance and are more sensitive to oxygen reductions, a condition that will very likely occur when the present bottoms are removed.
4. It is also recommended that monitoring be performed to record data from the subsequent repopulation of lower species such as poeciliids, characids and gobioids, which will be the point of reference for restoration of upper fish populations. This is also recommended when the euryhaline species take this route up again for their migration to the big lake.
5. Priority must be given to studies of the dynamics of the fish communities in the San Juan River area. This includes taxonomic identifications in the first stages of development of the fish, including the larva and egg stages, so as to be able to formulate the characterization of the biological stratification of the fish populations.
6. The area of the mouth that forms the estuary with the sea should be treated with particular care given that it is ecologically responsible for regeneration of the local biota and a large number of organisms that contribute to restoration of the food networks.
7. The amount of specific information on the species being studied is not sufficient to prepare a relationship dendrogram, given that the presence of several of the species was not confirmed at the different sampling points. It would be recommendable in the future for this to be part of a study of the species so as to contribute to the knowledge of their distribution and the degree of grouping among them.

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8. The pertinent institutions must make an effort to integrate the specific contributions from San Juan de Nicaragua into the economic map of the region, at the same time encouraging the integration thereof into the trade of goods with the interior of the country.

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IV. IDENTIFICATION, EVALUATION AND ANALYSIS OF ENVIRONMENTAL EFFECTS

For the environmental effects that will be produced by the project's activities, it is important for two factors to be taken into account, first because of their great importance from the ecological point of view at a national as well as international level since this is a protected area. The legal framework that develops constitutional precepts and directly controls the handling of the protected area of the Refugio de Vida Silvestre [Wildlife Refuge] of the San Juan River, is contained in the General Environment and Natural Resources Law, the Regulation for Protected Areas, the Decree that creates Protected Areas in the South East of Nicaragua and declares the area to be the Biosphere Reserve.

And in the second place, the low impact in relation to human activities that are currently being developed have a direct bearing on the general state of conservation of the same. Nevertheless, some features derived from the socioeconomic and environmental situation would, in the not too distant future, possibly develop into serious problems if adequate measures are not taken and specific actions not implemented.

Taking the concept of the foregoing as a starting point, the General Environment and Natural Resources Law and Statute 45-94 sets forth that protected areas must fulfill the following objectives:

- Preserving natural ecosystems that are representative of the diverse biogeographical and ecological regions of the country;
- Protecting natural landscapes and the settings of archeological and artistic historic monuments;
- Promoting recreational and touristic activities that are in coexistence with nature;
- Protecting hydrographic river basins, hydrologic cycles, aquifers, evidence of biotic communities, genetic resources and wild genetic diversity of flora and fauna; favoring the development of technology that is appropriate for the improvement and rational and sustainable use of natural ecosystems;
- Favoring environmental education, scientific research and the study of ecosystems (Law No. 217 / 96, Art. 18).

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4.1 Identification of Environmental Effects

In order to identify potential environmental impacts generated by the dredging project in the San Juan River in Nicaragua, the multidisciplinary team traveled across the section to be dredged and the area of influence of the project, and to landfill sites where debris from dredging was deposited. The methodologies in each discipline were taken into consideration to identify the environmental impacts that may be generated in the execution and setting in operation of the dredging process and traffic. The excellent state of conservation of natural resources in the Refugio reduces the critical areas to zones where there is greater pressure from human activities or a greater direct or indirect impact caused by the project. Therefore, we may identify some factors that will be considered to be affected to a greater or lesser degree:

Environmental Impacts on Abiotic Factors

- Increase of contaminant gases.
- Spillage of hydrocarbons and other materials that affect the environment.
- Increase in Noise.

Environmental Impacts on the Landscape

- Impacts on the landscape upon elimination of vegetation by the removal of the debris from dredging.
- Impact on fauna by immigration to other areas in view of the loss of its ecological niche and elimination of vegetation.

Environmental Impacts on Water Quality

- Decrease in dissolved oxygen.
- Decrease in water transparency.
- Alteration of water color.
- Increase in turbidity by sediment in suspension.
- Changes in pH readings.
- Changes in water hardness.
- Variation in the electrical conductivity of water.
- Variation in DBO [Biochemical Oxygen Demand].
- Eutrophication of water.
- Changes in thermal stratification of the water column.

Environmental Impact on Fauna

- Negative effect on benthic communities.
- Negative effect on Fish habitat.
- Negative effect on mammal populations.

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- Negative effect on bird populations.

Environmental Impacts on Vegetation

- Negative effect on wetlands.
- Endangered species.
- Negative effect on the latí foliated forests.

Environmental Impacts on Ecological Processes

- Changes in the diversity of species.
- Changes in the abundance of populations.
- Negative effect on the wildlife refuge area.
- Negative effect on the food chain.

Impacts on the Socio-Economic Sector

- Negative effect on the population's health.
- Changes in the Local Economy.
- Changes in the Regional Economy.
- Increase in Employment.
- Increase in the Flow of Transport.
- Changes in Tourism.
- Changes in Quality of Life.

4.2. Evaluation and Analysis of Impacts

4.2.1. Methodology

Overview

For the development of environmental impact studies, there does not yet exist a specific methodology nor a well defined standard, since the factors to be evaluated will depend directly on the type of project to which it is going to be applied, on environmental factors at the project site, the intensity and extent of the possible impacts produced and the depth of the type of Environmental Impact Statement (**EIS**) that is going to be developed.

Instrument Used

To identify the impacts produced by the project, a cause-effect impact matrix was used. This matrix is characterized as a double-entry table, the columns of which will feature the influential actions arranged in rows - the environmental factors likely to receive said impacts. In order to attain a clearer understanding of the activities of the project, we have divided it into phases.

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The purpose of the cause–effect matrix is to facilitate the identification of the impacts on the environment, to which a system of symbols and colors will be used; such as are indicated in drawing No. 4.1

Drawing No. 4.1. Symbols used for identification and definition

SYMBOLS	IMPACT
Blue	Positive
Red	Negative
G	Large
M	Medium
P	Small
T	Permanent
t	Temporary

Example: **tM** (Negative Impact, temporary, medium);

tM (Positive Impact, temporary, medium).

The distinctive feature of this holistic focus is that it tries to recognize that a single action of the project may produce a series of impacts of a dialectic nature. Thus, this method provides a guide for the identification of the second and third level effects.

Importance Matrix

The importance matrix that was previously used belonged to Vicente Conesa 1995, modified by **Milán 1998**. This matrix involves the completion of a qualitative assessment of the impacts identified. Each check box in the matrix or type factor will give an idea of the effect of each action on an environmental factor. The matrix's check boxes will be populated with the assessment corresponding to ten attributes as follows:

Color: Represents the beneficial or detrimental nature of the impact..

SIGNIFICANCE	COLOR
Beneficial impact	Blue
Detrimental Impact	Red

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Intensity (I): In this sense refers to the action's incidence level on the environmental factor. A value of 1 expresses a low negative effect and a value of 12 expresses a total negative effect and the values included between these reflect intermediate situations.

Intensity (I)	Value
Destruction	
Low	1
Medium	2
High	4
Very High	8
Total	12

Extension (E): Refers to the impact's theoretical area of influence on the project's background. If the action produces a very localized effect, the impact will be considered to have a precise effect. If the effect is produced within the project's framework, the impact will be total, and for intermediate situations partial and extensive impact will be used. If it is a very significant impact, a critical value is added (+4).

Extension (E)	Value
Precise	1
Partial	2
Extensive	4
Total	8
Critical	(+4)

Point in Time (M): Is the identification period of the impact and describes the time that passes between the appearance of the action (t_0) and the beginning of the effect (t_1) on the factor considered.

POINT IN TIME (M)	Value
Long period (> 4 years)	1
Medium period (1-3 years)	2
Immediate (< 1 year)	4

Persistence (P): Refers to the time the effect will remain in place starting from its appearance.

Persistence (P)	Value
Permanence of the Effect	
Fleeting (< 1 Year)	1
Temporary (1 – 4 Years)	2
Permanent (> 10 Years)	4

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Reversibility (R): Indicates the possibility of reconstruction of the negatively affected factor as a result of the action completed, i.e., the possibility of returning to the initial conditions prior to the action, by natural means.

Reversibility	Value
Reconstruction	
Short period	1
Medium period	2
Irrecoverable	4

Accumulation (A): Refers to the progressive growth of an impact

Accumulation	Value
Simple without synergism	1
Synergistic	2
Cumulative	4

Probability (PB): Indicates the certainty of appearance; gives maximum value to environmental impacts recognized as resulting from an action.

Probability	Value
Probable	1
Doubtful	2
Certain	4

Effect (EF): Refers to the cause of the effect, whether direct or indirect, for this purpose the impacts will be identified by means of a network system.

Effect	Value
Indirect (secondary)	1
Direct	4

Frequency (PR): The regularity of appearance of the impact is indicated, as the impact becomes more continuous, the maximum value is given to it.

Period of Time	Value
Irregular and discontinuous	1
Periodic	2
Continuous	4

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Social Perception (SP): The population's vision regarding determined environmental impact is incorporated.

Perception	Value
Minimum (25%)	1
Medium (50%)	2
High (75%)	4
Maximum (100%)	8
Total (>100%)	(+4)

Corrective Measures (MC): Indicates the possibility and the time of introduction of actions and measures to prevent, mitigate and correct the impacts.

Corrective Measures	Value
In the project phase	P
In the construction stage	O
In the functioning phase	F
No possibility exists	N

Importance of impact: The importance of the effect of an action on an environmental factor should not be confused with the importance of the affected environmental factor.

$$\text{Importance I} = (3I + 2E + M + P + R + A + PB + EF + PR + PS)$$

After calculating the importance of the impacts, an importance matrix is established, in which actions are substituted for results in values obtained from the prior matrix and based on the cause-effect. This matrix is called importance matrix.

Subsequently, statistics were used to complete the process of distinction with the purpose of finding a greater level of precision on establishing the importance of the impacts, for which we base our arguments in the following criteria:

Average values were determined for both positive and negative values, and for the typical deviation, considering those impacts whose importance values may have been inferior to the median value minus typical deviation, as irrelevant

$$V_{ir} = V_i < V_m - \delta$$

Cause – Effect Matrix

Next, damages are produced on the environment. Some generated impacts exist. The cause - effect matrix drawing No. 4.2 is present where activities that are identified for the setting in place of the project (complete work) and as a result of this, impacts are produced. The said impacts cannot be identified by means of rehabilitation activities.

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Importance Matrix

The importance matrix can be found in box No. 4.2 and, in accordance with the values of the importance matrix, low intensity impacts were sought for those positive and negative impacts.

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Cause – Effect Matrix

ENVIRONMENTAL CHARACTERISTICS AFFECTED BY THE PROJECT		PROJECT ACTIVITIES								
		DREDGING STATE			OPERATIONS STAGE					
LANDSCAPE	HYDRIC RESOURCE	CUTTING AND SUCTION OF MATERIALS	TRANSFER OF DREDGED MATERIAL	REMOVAL OF DREDGED MATERIAL	STORAGE AND SUPPLY OF HYDROCARBONS	NAVIGATION WITH PASSENGERS	TRANSPORT OF MERCHANTISE	FLOW OF TOURISTS	ARTISAN FISHING	ENVIRONMENTAL MANAGEMENT PROGRAM
		Air Quality (gas)	BT							PP
		Air Quality Noise	GT							PT
		Landscape		GT						Gr
		Dissolved Oxygen	PT	GT	MP	PT	BP		MT	PD
		Water Transparency	GT	GT	MT	MT	BP		PT	GR
		Color	MP	GT	MT	MT	PT		PT	PD
		pH	BT	GT	GT	BT	BT		BT	PP
		Hardness	PT	PT	PT	PT	PT		PT	PT
		Electrical Conductivity	PT		PP	PP	PP		PP	PP
HYDRIC RESOURCE	FLORA	DBO	PT	PT	PT	PT	PT		PT	PT
		Eutrophication	PP	PP					PT	PT
		Thermal Stratification	PB	PB					PP	PP
		Contamination by Hydrocarbons	GT		GP	MP	MB	MP	MP	GT
		Volume Changes	GP	GP						MP
		Wetlands Vegetation		GT						GP
		Endangered Species		MT						GP
		Benthic Communities	PT						MT	PT
		Fish Habitat	PT	GT					GT	MT
		Fish Populations	PT	GT		PP	PP		MP	MT
ECOSYSTEMS	FAUNA	Aquatic Mammals		GT		PP	PP		MT	MT
		Birds		GT	GP	MT	MT		MT	MT
		Reptiles		PT					PT	PT
		Wetlands		GT	GT	MB	MT		PT	GT

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ENVIRONMENTAL CHARACTERISTICS NEGATIVELY AFFECTED BY THE PROJECT		PROJECT ACTIVITIES								
		DREDGING STAGE				OPERATIONS STAGE				
SOCIAL AND ECONOMIC PROGRESS	Seabords	CUTTING AND SUCTION OF MATERIALS	TRANSFER OF DREDGED MATERIAL	REMOVAL OF DREDGED MATERIAL	STORAGE AND SUPPLY OF HYDROCARBONS	NAVIGATION WITH PASSENGERS	TRANSPORT OF MERCHANDISE	FLOW OF TOURISTS	ARTISANAL FISHING	ENVIRONMENTAL MANAGEMENT PROGRAM
	Aquatic Food Chain	PT		GP	GP	MP	MP			GT
	Migratory Routes	GT		GT	GT	GT	MT	MT		GT
	Diversity of Species			GP	GP	MT	MT			GT
	Protected Areas	GT	GT	GP	GT	MP	MP			GT
	Health		GT	GT	GT					GP
	Local Economy		PP	PP	PP	GP	GP	GP	GP	GP
	Regional Economy		PT	PP	PP	GP	GP	GP	GP	GP
	Employment	PT	PT	PT	PT	GP	GP	GP	GP	GP
	Transport			PT	PT	GP	GP	GP	GP	GP
	Tourism		PT	PT	PT	GP	GP	GP	GP	GP
	Quality of Life	GP		PT	PT	GP	GP	GP	GP	GP
	Public Investment			MT	GP	GP	GP	GP	GP	GP

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IMPORTANCE MATRIX

CUTTING AND SUCTION OF MATERIALS

		ENVIRONMENTAL CHARACTERISTICS		IMPACT																			
ECOSYSTEMS	FAUNA	HYDRIC RESOURCE	LANDSCAPE	INTENSITY		POINT IN TIME		PERSISTENCE		REVERSIBILITY		ACCUMULATION		PROBABILITY		EFFECT		TIME PERIOD		SOCIAL PERCEPTION		IMPORTANCE	
				ENVIRONMENTAL FACTORS	CHARACTERISTICS	EXTENSION	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	PERIOD	
ECOSYSTEMS	FAUNA	HYDRIC RESOURCE	LANDSCAPE	Air Quality (Gases)	1	1	4	2	1	1	1	4	4	4	4	4	4	4	2	27			
				Air Quality (Noise)	1	1	4	2	1	1	1	4	4	4	4	4	4	2	27				
				Landscape																			
				Dissolved Oxygen	1	1	4	1	1	1	1	4	4	4	1	1	1	1	22				
				Water Transparency	1	1	4	1	1	1	1	4	4	4	1	1	1	1	22				
				Color	1	1	4	1	1	1	1	4	4	4	1	1	1	1	22				
				pH	1	1	4	1	1	1	1	4	4	4	1	1	1	1	22				
				Hardness	1	1	4	1	1	1	1	4	4	4	1	1	1	1	22				
				Electrical Conductivity	1	1	4	1	1	1	1	4	4	4	1	1	1	1	22				
				DBO	1	1	4	1	1	1	1	4	4	4	1	1	1	1	22				
FAUNA	WETLANDS	WETLANDS	WETLANDS	Eutrophication	1	1	4	1	1	1	1	4	4	4	1	1	1	1	22				
				Thermal Stratification	1	1	4	1	1	1	1	4	4	4	1	1	1	1	22				
				Contamination By Hydrocarbons	8	4	4	2	2	2	2	2	4	4	4	1	2	51					
				Volume Changes	4	2	4	4	2	1	2	2	4	4	4	1	1	1	38				
				Wetlands Vegetation																			
				Endangered Species																			
				Benthic Communities																			
				Fish Habitat	1	2	4	4	2	2	2	4	4	4	2	1	1	30					
				Fish Populations	1	2	4	4	2	2	2	4	4	4	2	1	1	30					
				Aquatic Mammals	1	2	4	4	2	2	2	4	4	4	2	1	1	30					
ECOSYSTEMS	FLORA	WETLANDS	WETLANDS	Birds																			
				Reptiles																			
				Wetlands																			

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CUTTING AND SUCTION OF MATERIALS

		ENVIRONMENTAL CHARACTERISTICS										
		INTENSITY	EXTENSION	POINT IN TIME	PERSISTENCE	REVERSIBILITY	ACCUMULATION	PROBABILITY	EFFECT	TIME PERIOD	SOCIAL PERCEPTION	IMPORTANCE
SOCIAL AND ECONOMIES ECOLOGICAL PROCESSES	Seabords	1	2	4	4	2	2	4	4	2	1	30
	Aquatic Food Chain											
	Migratory Routes											
	Diversity of Species											
	Protected Areas											
	Health	8	1	4	2	2	4	4	4	1	1	48
	Local Economy											
	Regional Economy											
	Employment											
	Transport											
	Tourism											
	Quality of Life											
	Public Investment	8	4	2	2	2	4	4	4	2	4	56

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DEPOSITION OF DREDGED MATERIAL

		ENVIRONMENTAL CHARACTERISTICS										
		INTENSITY	EXTENSION	POINT IN TIME	PERSISTENCE	REVERSIBILITY	ACCUMULATION	PROBABILITY	EFFECT	TIME PERIOD	SOCIAL PERCEPTION	IMPORTANCE
LANDSCAPE ENVIRONMENTAL FEATURES	Air Quality (Gases)											
	Air Quality - Noise											
	Landscape	8	2	2	4	2	4	4	4	4	4	
	Dissolved Oxygen	1	1	4	1	1	1	4	4	1	1	
	Water Transparency	1	1	4	1	1	1	4	4	1	1	
	Color	1	1	4	1	1	1	4	4	1	1	
	pH	1	1	4	1	1	1	4	4	1	1	
	Hardness	1	1	4	1	1	1	4	4	1	1	
	Electrical Conductivity	1	1	4	1	1	1	4	4	1	1	
	DBO	1	1	4	1	1	1	4	4	1	1	
	Eutrophication	1	1	4	1	1	1	4	4	1	1	
	Thermal Stratification	1	1	4	1	1	1	4	4	1	1	
	Contamination by Hydrocarbons											
	Changes in Volumes	8	4	2	4	2	4	4	4	4	4	
	Vegetation in Wetlands	8	4	2	4	2	4	4	4	4	4	
	Endangered Species	2	2	2	4	2	4	4	4	4	4	
HYDRIC RESOURCE	Benthic Communities	1	2	4	2	2	1	2	4	2	1	
	Fish Habitat	2	2	2	4	2	4	4	4	4	4	
	Fish Populations	2	2	2	4	2	4	4	4	4	4	
	Aquatic Mammals											
	Birds	2	2	2	4	2	4	4	4	4	2	
	Reptiles	1	1	1	4	2	4	4	4	4	1	
	Wetlands	8	4	2	4	2	4	4	4	4	60	
FLORA												
FAUNA												

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ENVIRONMENTAL CHARACTERISTICS		INTENSITY	EXTENSION	POINT IN TIME	PERSISTENCE	REVERSIBILITY	ACCUMULATION	PROBABILITY	EFFECT	PERIOD IN TIME	SOCIAL PERCEPTION	IMPORTANCE
ECOLOGICAL PROCESSES	Seabords	8	4	2	4	2	4	4	4	4	4	60
	Coral Reefs	8	4	2	4	2	4	4	4	4	4	60
	Marine Ecosystems	8	4	2	4	2	4	4	4	4	4	60
	Aquatic Food Chain	8	4	2	4	2	4	4	4	4	4	60
	Migratory Routes	8	4	2	4	2	4	4	4	4	4	60
	Diversity of Species	8	4	2	4	2	4	4	4	4	4	60
	Protected Areas	8	4	2	4	2	4	4	4	4	4	60
	Health	8	2	4	4	4	4	4	4	1	4	57
	Local Economy	1	1	4	1	2	4	4	4	1	4	29
	Regional Economy	1	1	4	1	2	4	4	4	1	4	29
	Employment	1	1	4	1	2	4	4	4	1	4	29
	Transport											
	Tourism											
	Quality of Life	1	1	2	1	1	2	4	4	4	4	27
	Public Investment											

ENVIRONMENTAL IMPACT STUDY FOR IMPROVEMENT OF NAVIGATION IN THE SAN JUAN RIVER IN NICARAGUA

ENVIRONMENTAL MANAGEMENT PROGRAM

**ENVIRONMENTAL IMPACT STUDY
FOR IMPROVEMENT OF NAVIGATION IN THE SAN JUAN RIVER IN NICARAGUA**

ENVIRONMENTAL MANAGEMENT PROGRAM											
ENVIRONMENTAL CHARACTERISTICS		INTENSITY	EXTENSION	POINT IN TIME	PERSISTENCE	REVERSIBILITY	ACCUMULATION	PROBABILITY	PERIOD OF TIME	SOCIAL PERCEPTION	
ECOLOGICAL PROCESSES	Coral Reefs	8	4	4	4	4	4	4	4	2	62
	Marine Ecosystems	8	4	4	4	4	4	4	4	2	62
	Aquatic Food Chain	8	4	4	4	4	4	4	4	2	62
	Migratory Routes	8	4	4	4	4	4	4	4	2	62
	Diversity of Species	8	4	4	4	4	4	4	4	2	62
	Protected Areas	8	4	4	4	4	4	4	4	2	62
	Health	8	4	4	4	4	4	4	4	2	62
	Local Economy	12	8	4	4	2	4	4	4	4	82
	Regional Economy	8	8	4	4	2	4	4	4	4	70
	Employment	12	12	4	4	2	4	4	4	4	90
	Transport	8	8	4	4	2	4	4	4	4	70
	Tourism	12	8	4	4	2	4	4	4	4	82
	Quality of Life	12	12	4	4	2	4	4	4	4	90
	Public Investment	12	12	4	4	2	4	4	4	4	90

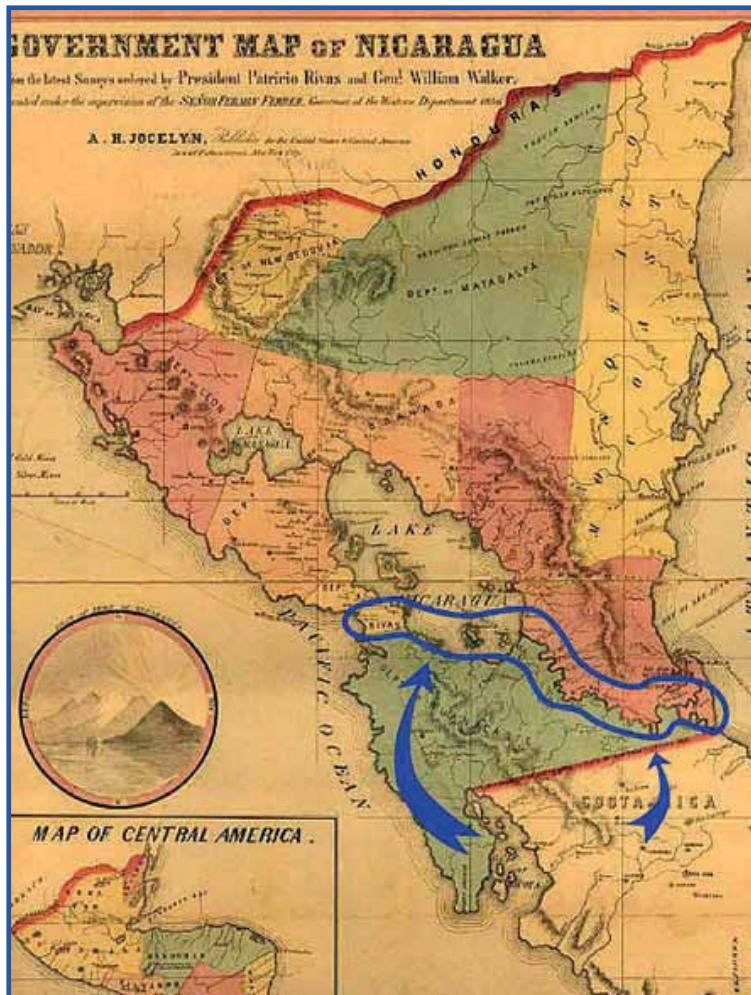
THE TRUTHS THAT COSTA RICA HIDES

**COSTA RICA PRESENTS
ITSELF AS A COUNTRY
THAT PROMOTES PEACE
AND DEMOCRACY**

**HISTORY SHOWS
THE CONTRARY**

FALSE!

NICARAGUAN TERRITORY OCCUPIED BY THE ARMY
OF COSTA RICA EVEN AFTER THE NATIONAL WAR ENDED
BY MAY, 1857



After the National War against Walker ended in May of 1857, Nicaragua was severely devastated. Costa Rica supported Nicaragua with its army, but that support was charged in the letter of a treaty drafted by Costa Rica in July of 1857 — the Juarez Cañas Treaty—that Nicaragua did not ratify because it was so harmful. Juan Rafael Mora, then President of Costa Rica, not satisfied with the concession already made by Nicaragua to yield Guanacaste and Nicoya, maintained the military occupation in the San Juan River and Lake of Nicaragua and pressured Nicaragua to surrender the Fort of San Carlos, demanding to put it under the dominion of her armed forces.

SAN JUAN DE NICARAGUA RIVER

After the independence of Nicaragua and other Central American countries from Spain in 1821, the most coveted territory in the region was the Great Lake of Nicaragua, by far the largest freshwater body in the Caribbean area that had its outlet to the sea through the San Juan River. The Lake of Nicaragua and the San Juan River were considered the most promising place for the construction of a transoceanic canal.

This apparent gift of nature and its potential as a route for a transoceanic canal has been the cause of the main international problems that Nicaragua has faced. Mr. George Weitzel, Minister of the United States in Nicaragua in 1913, considered that "in all the disputes of Nicaragua... the true cause of the problem was the desire to control the route of the inter-oceanic canal." (Mentioned in NM par. 1.2.26)

(Circa 1821) The possibilities of this natural water course spurred enormous interest in Costa Rica, the closest neighbor to the Great Lake and River of Nicaragua. Immediately after independence, Costa Rica took advantage of a civil war in Nicaragua for the purpose of annexing an important part of the Nicaraguan territory commonly known as the Nicoya Party.

The annexation of this territory, clearly lacking any defined limits, gave way to the possibility that the borders of Costa Rica could extend to the shores of the coveted Lake of Nicaragua. In addition to the annexation of this territory, Costa Rica claimed co-ownership over the San Juan River. This placed Costa Rica in a strong position to claim rights over any route of the canal through this water system.

Costa Rica based its annexation of the department or party of Nicoya on a referendum held in that territory once it was under its control.



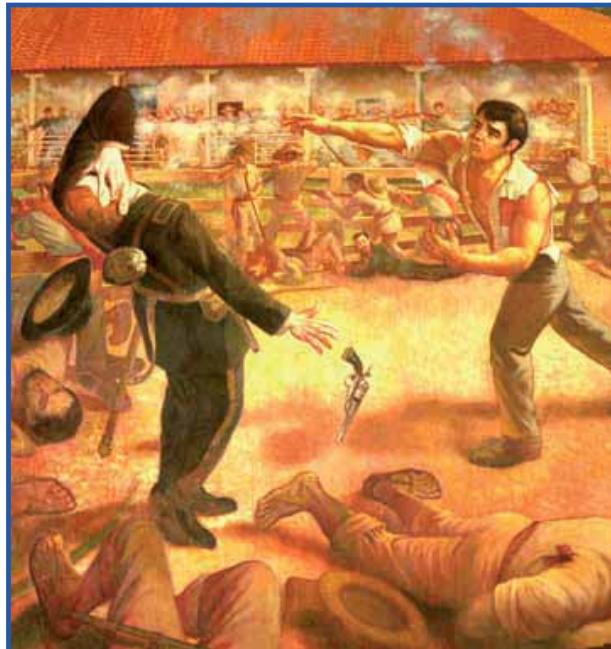
THE TRUTHS THAT COSTA RICA HIDES

Nicaragua of course opposed the annexation of its territory and demanded the application of the principle of *uti possidetis iuris* as the only valid means to determine the scope of its territorial rights. The principle of *uti possidetis* was precisely conceived to avoid uncertainties in the limits of the new independent states and it was and is the principle accepted in all the former Spanish colonies.

The problem caused by this annexation continued as an issue of constant discussion between both countries during the next 30 years.

In 1856, Nicaragua was invaded and taken over by the forces directed by an ad-

venturous military from the United States, filibuster William Walker, who was working in concert with some southern states of the United States that were seeking to incorporate new territories to the American Union to reinforce their positions on questions such as slavery. Walker quickly self-proclaimed himself President of Nicaragua and changed the legal system, decreeing, among other things, the reestablishment of slavery that had been abolished in Nicaragua.



The invasion of the forces of Walker caused the reaction of all the countries of Central America against this foreign usurper who put in danger the sovereignty and peace of the entire region. The war was bloody and destructive. Whole cities like Granada, the most important urban commercial zone of Nicara-

guá, were devastated and set on fire by Walker.

To give an idea of the dimension of this conflict little remembered outside the Central American area, it is important to indicate that more people died during this war than in the very well-known war that occurred three decades later between Spain and the United States in 1898, which culminated with the overtaking of Cuba, Puerto Rico and other territories by the United States. (Bermann, Karl: Within the framework of the Great Stick: Nicaragua and the United States since 1848 (South End Press, Boston, 1986, p. 72-76).

SAN JUAN DE NICARAGUA RIVER

This war left Nicaragua completely on its knees. Costa Rica, whose army, aside from the army of Nicaragua, had been the most important element in the defeat of Walker, maintained military control over the San Juan River and parts of the Great Lake after the war. The years following the war were full of threats and negotiations for the purpose of reaching an agreement by way of which Nicaragua accepted the annexation by Costa Rica of the Nicoya region, as well as other rights demanded by Costa Rica over the San Juan River.



threatened by Costa Rica. This led Nicaragua to challenge the validity of the Treaty of 1858.

That was the situation when Nicaragua signed for the first time a government to government agreement with the United States on December 1, 1884, for the construction of a canal through Nicaragua. This agreement was not ratified by the U.S. Senate by a few votes due to the explicit obligation assumed by the United States to defend the Nicaraguan territory from all external aggressions.

The possibility that the negotiations with the United States would be resumed and that Nicaragua could reach an agreement on the construction of a canal without the participation of Costa Rica led that country to revive the dispute over the scope of its navigation rights in the San Juan River. Accordingly, Costa Rica announced in 1885 that it would send a military ship to patrol the San Juan River.

It was only after a declaration of war and the mediation of other Central American States that a final agreement was crystallized with the signing of the Cañas Jerez Treaty of Limits of April 15, 1858, which constitutes the spinal cord of the territorial rights of both States. (Circa 1885) During the next 30 years, there was deep resentment and rejection toward the Treaty of 1858 in Nicaragua, which was seen as an instrument that Nicaragua signed while it was occupied and

THE TRUTHS THAT COSTA RICA HIDES

In order to avoid an escalation of the dispute, it was decided through the Arbitration Convention of December 24, 1886 to refer the dispute to arbitration. The arbitrator was President Grover Cleveland, who gave his award on March 22, 1888. After determining that the Treaty of 1858 was valid, the arbitrator settled other issues raised by Nicaragua that will be explained in the next section.

For more than a hundred years after the Cleveland Award, Costa Rica made no military claims over the San Juan River. At the end of 1980, there were talks again about reviving the old dream of the Nicaragua canal and improving navigation in the San Juan River, which triggered the reaction of Costa Rica just like it had reacted a hundred years back. Costa Rica demanded the right to navigate and patrol the San Juan River with its armed security forces. History was repeating itself.

Costa Rica filed a complaint against Nicaragua before the International Court of Justice, demanding full rights to navigate the river with armed personnel and questioning the right of Nicaragua to regulate the use of the San Juan River, including navigation. The Court reaffirmed the rights of Nicaragua in all these questions and, specifically, reaffirmed the rights of Nicaragua in regulating navigation in the river and maintaining the navigability of the river, as well as the right to dredge it.

And now that some modest cleaning activities have been carried out in the river, including some waterways that were obstructed, Costa Rica has gone to international political bodies like the OAS seeking support for its claims against the rights of Nicaragua and has even dared to mention the possibility of invoking military treaties like the Inter-American Treaty of Reciprocal Assistance (commonly known as the Rio Treaty or by the Spanish-language acronym TIAR).

The current situation is about a new avatar of the traditional strategy of Costa Rica to try to undermine the sovereignty of Nicaragua over the San Juan de Nicaragua River whenever Nicaragua tries to recover the waters of the river to its original state of navigability.

Based on the above historical reference, the SILENT STRATEGY PROMOTED has been proven:

SAN JUAN DE NICARAGUA RIVER

LA ESTRATEGIA SILENCIOSA QUE HAN VENIDO IMPULSANDO

1. The annexationist attempts of Cardenas (1992, 1997 and 2002)
2. The separatist intention of Jomusa (1996).
3. The creation of the Special Economic Zone (Huetar Norte, 2000).
4. The depredation of the flora and fauna along 39 kilometers.
5. The contamination of the San Juan River with toxic pollutants along 29 kilometers.
6. The dredging of 12 kilometers of the Colorado River, affecting the San Juan River and violating the Reform Law on the Border Administration Regime.



THE TRUTHS THAT COSTA RICA HIDES

COSTA RICA "HAS NOT CEASED" IN ITS ATTEMPTS

Despite the treaties, awards and ICJ Judgment that clearly establish the territorial sovereign rights of Nicaragua, Costa Rica always tries to affect the full exercise of the sovereignty rights of the State of Nicaragua by creating a manipulated, prefabricated and evilly disposed border situation to create confusion and to keep "its strategy alive".

Nicaragua's large water resources —The Great Lake of Nicaragua and the San Juan River— are the ultimate goal of the expansionist strategy of Costa Rica.

The maps presented by Costa Rica do not truthfully and reasonably depict the limits of our south border.

Truth and reason are found in the Cañas Jerez Treaty, the Cleveland and Alexander Awards and the ICJ Judgment of July 13, 2009.



SAN JUAN DE NICARAGUA RIVER

THE CONFLICT GENERATED BY COSTA RICA'S LONG-STANDING

On page five of Costa Rica's Official Gazette No. 211 of Tuesday, November 7, 1995, the justification and decree of the Legislative Assembly (File No. 12387) consider among other aspects the following:

"...As regards the north border with Nicaragua, there is no joint border development agreement, only agreements on the protection of forest areas and migration control. In a recent boundary marking operation agreed by the Geographic Institute, based on the Alexander acts and the recognition of the Ministry of Foreign Affairs, a factual situation arose according to which for many years properties that have been registered in the Costa Rican Public Registry now appear in Nicaraguan territory. These lands could be lost."

The neighbors of this zone have alleged before the United Nations that they do not belong to Costa Rica or to Nicaragua. and they have identified themselves as the Independent Republic of "Airrecú".

 <p>San José, Costa Rica Lunes 15 de marzo, 1999 Carlos Hernández Corresponsal de <i>La Nación</i></p> <p>Límites confusos</p> <p>Este nuevo lío fronterizo revive las dificultades entre ticos y nicas originadas, en opinión de los afectados, en un trazado poco claro de los límites que dividen a las dos naciones.</p> <p>En marzo de 1994, como consecuencia de una nueva demarcación entre los mojones 12 y 13 llevada a cabo por el Instituto Nicaragüense de Estudios Territoriales y su similar de Costa Rica, nuestro país perdió 213 kilómetros cuadrados de territorio pues fincas que siempre pertenecieron a agricultores de Jomusa, México, San Antonio, San Isidro y Las Delicias de Upala, quedaron en el lado nicaragüense.</p>	 <p>San José, Costa Rica, Jueves 20 de enero, 2000 Carlos Hernández, Corresponsal de <i>La Nación</i></p> <p>Persiste confusión</p> <p>Vecinos y regidores de Upala afirmaron que la redemarcación de la frontera llevada a cabo en 1994 por el Instituto Geográfico de Costa Rica y su similar de Nicaragua, el Instituto Nacional de Estudios Territoriales (<i>Ineter</i>), aumentó la confusión que históricamente ha existido en torno al trazado de la línea divisoria.</p> <p>"Seguimos creyendo que esa acción solo benefició a Nicaragua, que se ganó 213 km cuadrados de territorio que siempre pertenecieron a agricultores nuestros, establecidos en pequeñas comunidades como Jomusa, Méjico, San Antonio y San Isidro de Upala", manifestó Efraín López Cerna, representante de Jomusa ante la Municipalidad upaleña.</p> <p>Elena Leda Araya, funcionaria del Departamento de Topografía del Instituto Geográfico de Costa Rica, aseveró ayer que desde el año pasado está paralizada la colocación de más mojones para demarcar mejor la frontera, la cual se debe realizar juntamente con el <i>Ineter</i>.</p>
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THE TRUTHS THAT COSTA RICA HIDES

THESE WERE THE HISTORICAL COLONIAL LIMITS OF NICARAGUA

Costa Rica has been claiming rights over Nicaragua's strategic resources in the south border for more than 150 years.

Since 1824, Nicaragua lost 13,000 square kilometers of its territory —Guanacaste and Nicoya.

After the National War ended in 1856, when its troops still occupied the south part of Lake Nicaragua and the San Juan River, Costa Rica tried to take over the south shore of Lake Nicaragua and the entire San Juan River through a treaty.

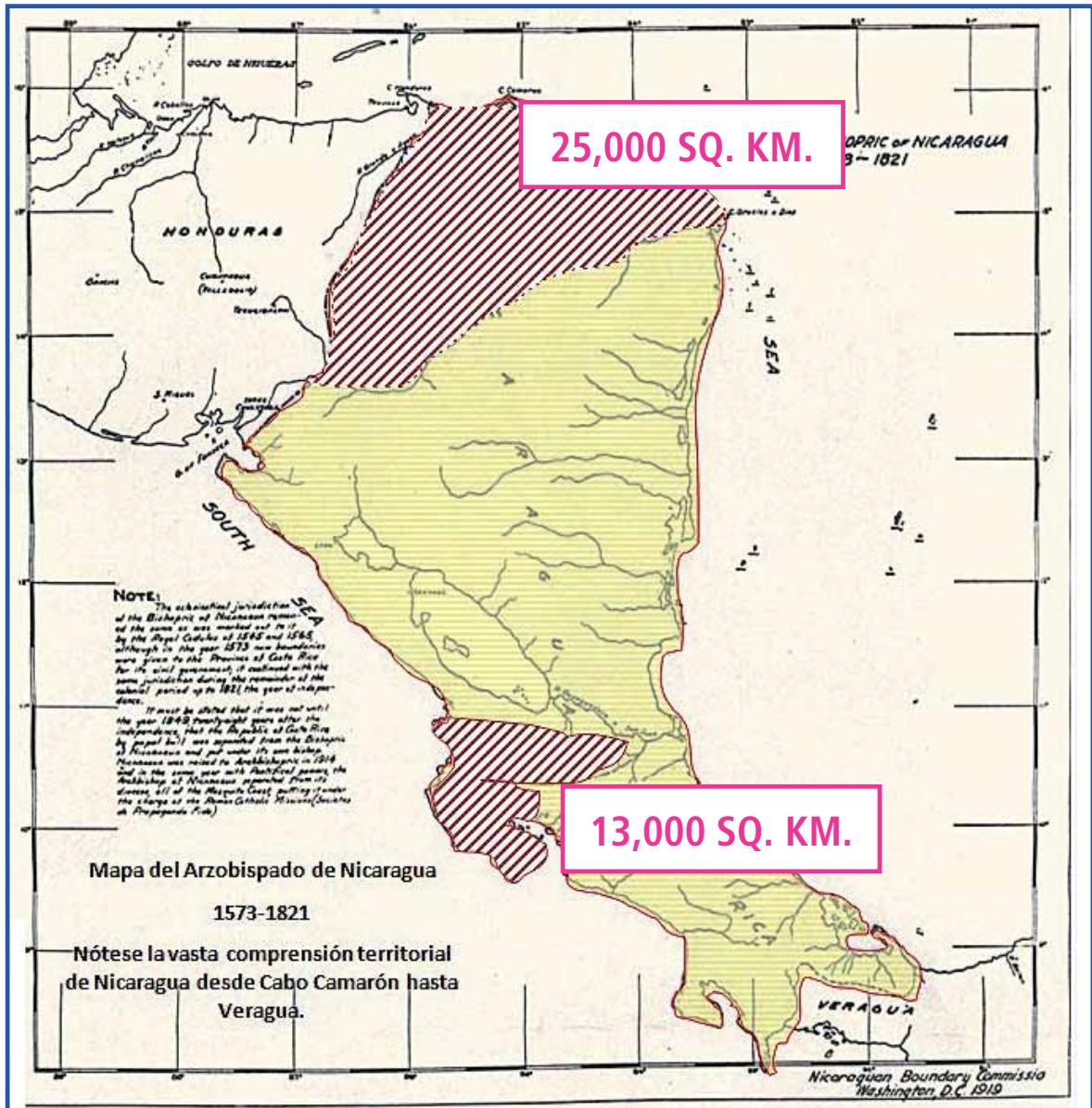
The Constitution of Costa Rica of 1825 had limits that were far away from the current limits.



THESE TERRITORIAL CLAIMS NEVER DISAPPEARED,
THEY WERE ALWAYS ALIVE

SAN JUAN DE NICARAGUA RIVER

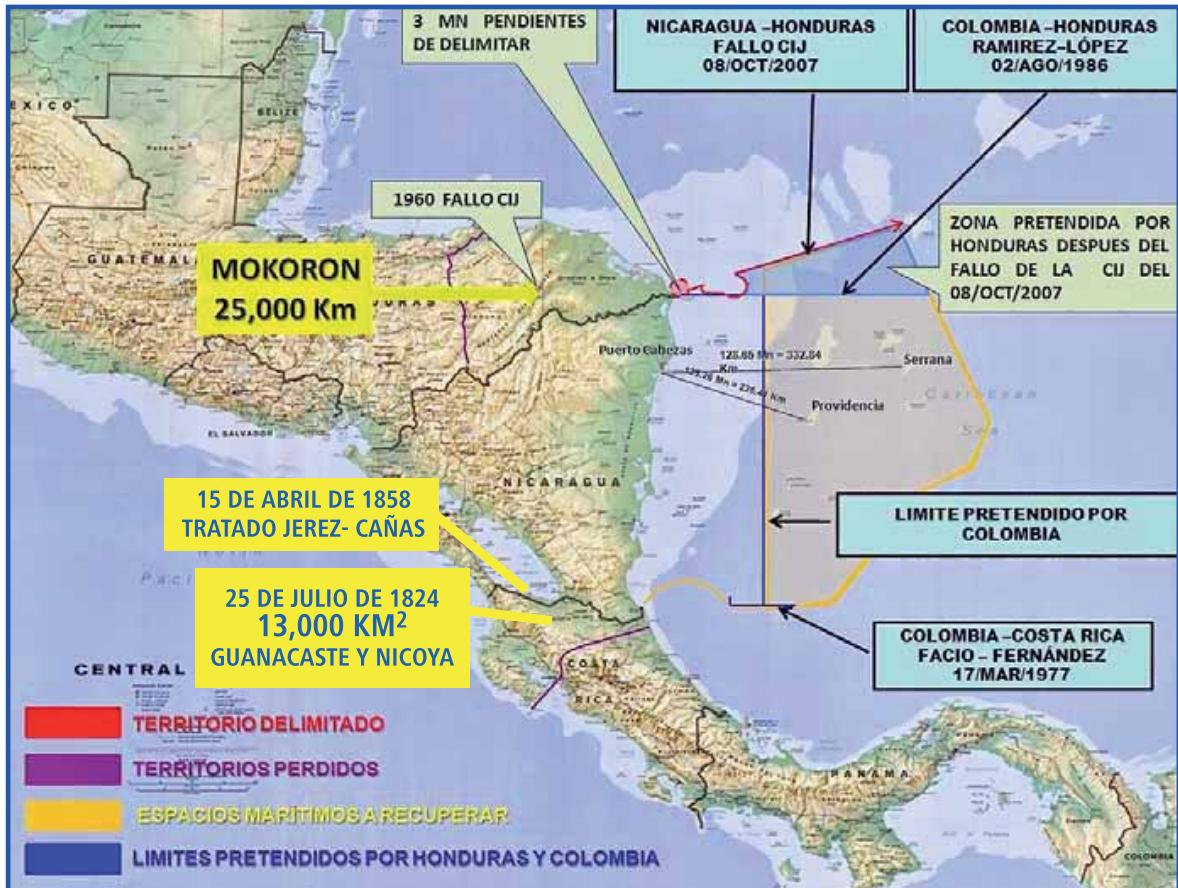
THESE ARE THE TERRITORIES THAT HAVE BEEN SEVERED FROM NICARAGUA:



NICARAGUA RATIFIES THAT IT WILL NOT ALLOW ITS TERRITORY TO BE INJURED AND SEVERED AGAIN.

THE TRUTHS THAT COSTA RICA HIDES

WE HAVE BEEN VICTIMS, OTHERS ARE THE USURPERS.



- NICARAGUA HAS ALWAYS PRIVILEGED THE PEACEFUL SOLUTION OF DISPUTES.
- WE HAVE ALWAYS TAKEN OUR DISPUTES TO THE INTERNATIONAL COURT OF JUSTICE, WHICH HAS GIVEN US THE REASON.
- NICARAGUA WILL NEVER ALLOW ANOTHER INCH OF ITS TERRITORY TO BE SEVERED BY TAKING THE LAW INTO ONE'S OWN HANDS AND VICIOUS PROCESSES.

SAN JUAN DE NICARAGUA RIVER

COSTA RICA ARGUED THAT THE OAS WAS THE COMPETENT ORGANIZATION TO HEAR THESE **FALSE!** FACTS



On November 16, 2010, OAS Secretary General Jose Miguel Insulza said that the best way to resolve this issue "would be simply that each one stays in its observation posts and that this issue be taken to the International Court of Justice or wherever they want."

We are striving to create the conditions for that".

Fuente: EFE

Costa Rica affirmed that the OAS was competent to hear the dispute with Nicaragua. That is false and Costa Rica demonstrated that this is false when it filed a complaint against Nicaragua before the International Court of Justice on November 18, 2010, for the same facts that it claimed would be resolved by the OAS.

Nicaragua, on the other hand, from the first moment maintained that it was a territorial dispute and that the body to resolve those disputes was the International Court of Justice, the world's maximum judicial authority. So Costa Rica gave the reason to Nicaragua.

THE TRUTHS THAT COSTA RICA HIDES

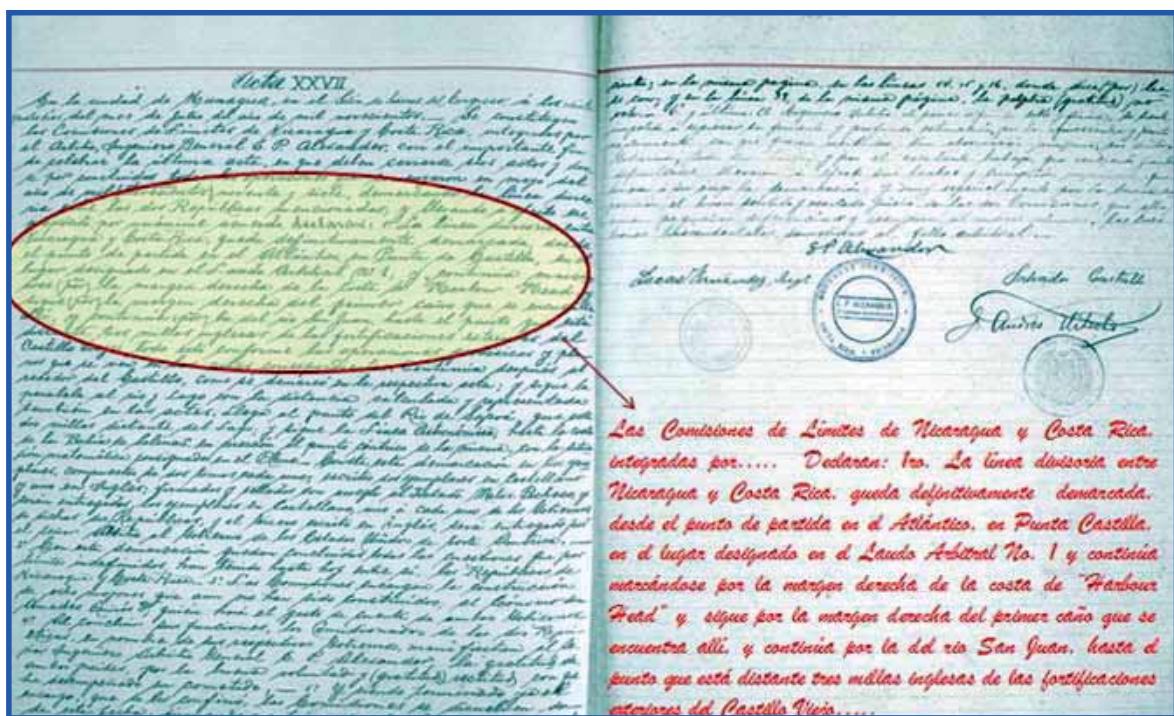
CURRENT BORDER BETWEEN NICARAGUA AND COSTA RICA

An important part of the border between Nicaragua and Costa Rica is defined by the course of the San Juan River. This means that it is not a static border, but subject to the changes undergone by the course of the river. These changes refer solely to natural changes and not to those caused by the industry or artifice of Costa Rica. The history of the border and its changes are shown below.

APPLICABLE TREATY AND AWARDS

The Jerez Cañas Treaty signed on April 15, 1858, provides in Article II that the border between Nicaragua and Costa Rica "begins in the North Sea, at the extreme end of Punta de Castilla, at the mouth of the San Juan de Nicaragua River, and continues on the right bank of that river to a point three English miles from the Castillo Viejo..."

President Cleveland's Award dated March 22, 1888, confirmed the terms of the Treaty of 1858 and the issues that were still under discussion regarding the exact location of the starting point of the border. The outline and demarcation of the border in all its extension were resolved by the awards of General Edward Porter Alexander as engineer-umpire.



SAN JUAN DE NICARAGUA RIVER

WHAT THE ALEXANDER AWARD SAYS

General Alexander's first award, dated September 30, 1897, indicated the starting point of the demarcation, identifying what seemed to him the extremity of Punta de Castilla:

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

This Award was limited to indicating that on reaching the waters of Harbor Head, the boundary line would turn to the left, or southeastward, and would follow the water's edge around the harbor until it reached the river proper by the first channel met and would then continue following the course of the river upstream.

The Commissions of Limits of Nicaragua and Costa Rica accepted the Award and incorporated the provisions in Minutes XXVII.



THE TRUTHS THAT COSTA RICA HIDES

Costa Rica was not happy with this decision and asked the Arbitrator to measure the line that continued from the starting point and to make a drawing of that line. The Nicaraguan Commission expressed the view that the measurement and mapping work on that portion of the line was pointless and worthless because, according to the Award by General E. P. Alexander, the left bank of the Harbor and of the river formed the boundary and that therefore the dividing line was subject to change and not permanent. Therefore, the map and any data obtained shall never correspond to the actual dividing line.

General Alexander recognized the validity of Nicaragua's arguments considering that any line fixed at that moment "will necessarily be affected in the future by all these gradual or sudden changes". Nevertheless, he considered that the Treaty of 1858 authorized that measurement and acquiesced to the same with the aforesaid warnings.

This point was clearer in the third award, in which the arbitrator clarified that the water level of the river that should have been used to determine the position of the right bank was the water level in their ordinary state and not in moments of great swelling or special drought. Alexander said:

"I therefore rule that the exact dividing line between the jurisdictions of the two countries is the right bank of the river, with the water at ordinary stage and navigable by ships and general-purpose boats. Fluctuations in the water level will not alter the position of the boundary line, but changes in the banks or channels of the river will alter it, as may be determined by the rules of international law applicable on a case-by-case basis."

BORDER SUBJECT TO VARIATIONS

We are before a part of the border that is changing by nature since the river undergoes variations, and the limits have not been measured or reviewed in more than 100 years. The maps in this case are not definitive because they do not reflect the changes in the course of the river and much less have they been done on the basis of field work for over a century.

For that reason, both the official maps of Nicaragua and Costa Rica clearly express that the data on which they are based "has not been verified in the field".

SAN JUAN DE NICARAGUA RIVER

The same arbiter, General Alexander, had anticipated the occurrence of these changes mainly in the lower part of the river. In the second award, he points out:

"...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.

The zone disputed by Costa Rica is indeed located in the mouth of the river in that swampy zone that unites the river with Harbor Head and it is precisely the zone now in dispute.

Apart from the changes and variations in the river and delta, it should be taken into account that in the last decades the largest portion of the waters of the San Juan River has been diverted toward the branch called Colorado that is located in Costa Rican territory. In the last 30 kilometers of a river that begins in the greatest lake of Latin America, at par with the Titicaca Lake, 90 percent of the volume disappears through the territory of Costa Rica. The river that until the nineteenth century the English and other Europeans, as well as the North Americans, wanted to use for the transoceanic canal now empties almost completely in its final part into Costa Rica. In addition, the mouth of the river is no longer a "flat and sandy delta", but a swamp.

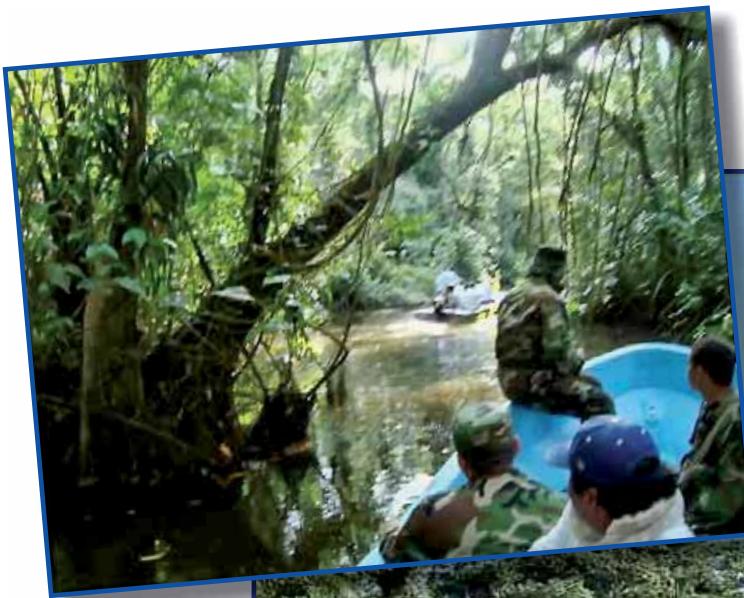
San Juan river
exit at the
Caribbean Sea



THE TRUTHS THAT COSTA RICA HIDES



ENTRANCE TO THE SAN JUAN RIVER. NICARAGUAN TERRITORY (SEPTEMBER 8, 2010)



ENTRANCE
TO HARBOR
HEAD LAGOON,
NICARAGUAN
TERRITORY,
SEPTEMBER 8,
2010

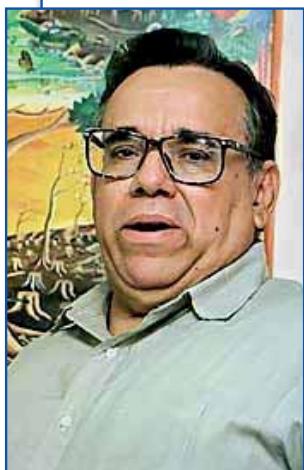


SAN JUAN DE NICARAGUA RIVER

THE OPINION OF EXPERTS IN THIS FIELD

Doctor Jaime Incer Barquero

Nicaraguan scientist,
November 12, 2010



“... the transformations in the delta of the San Juan River do not have to be an excuse for Costa Rica to modify and ignore the boundary lines drawn up in the Cañas-Jerez Treaty, the Cleveland and Alexander Awards, and ICJ Judgment.”

“Costa Rica cannot benefit from these changes caused the diversion of the waters and the sedimentation caused from its territory in the last decades”.

Doctor Francisco Aguirre S.

President of the Foreign Affairs Commission of the National Assembly, November 12, 2010.

“We are in Nicaraguan territory, according to the Cañas-Jerez Treaty, the Cleveland Award, the five Alexander Awards and the Judgment of the International Court of Justice in 2009.”



DOCTOR MAURICIO HERDOCIA

International Law Analyst,
November 6, 2010:



“The position I maintain is that the limits between Costa Rica and Nicaragua have been established, and I believe stability is important in all this. All this problem is precisely because the first and second award of Arbitrator Alexander have not been adequately read.”

THE TRUTHS THAT COSTA RICA HIDES

LO QUE OPINAN, CONOCEDORES DEL TEMA

Doctor Norman Caldera

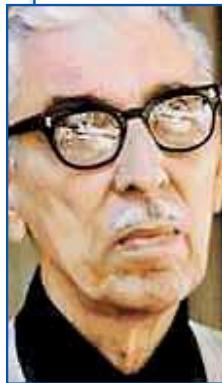
ex-Chancellor of the Republic of Nicaragua,
November 14, 2010:



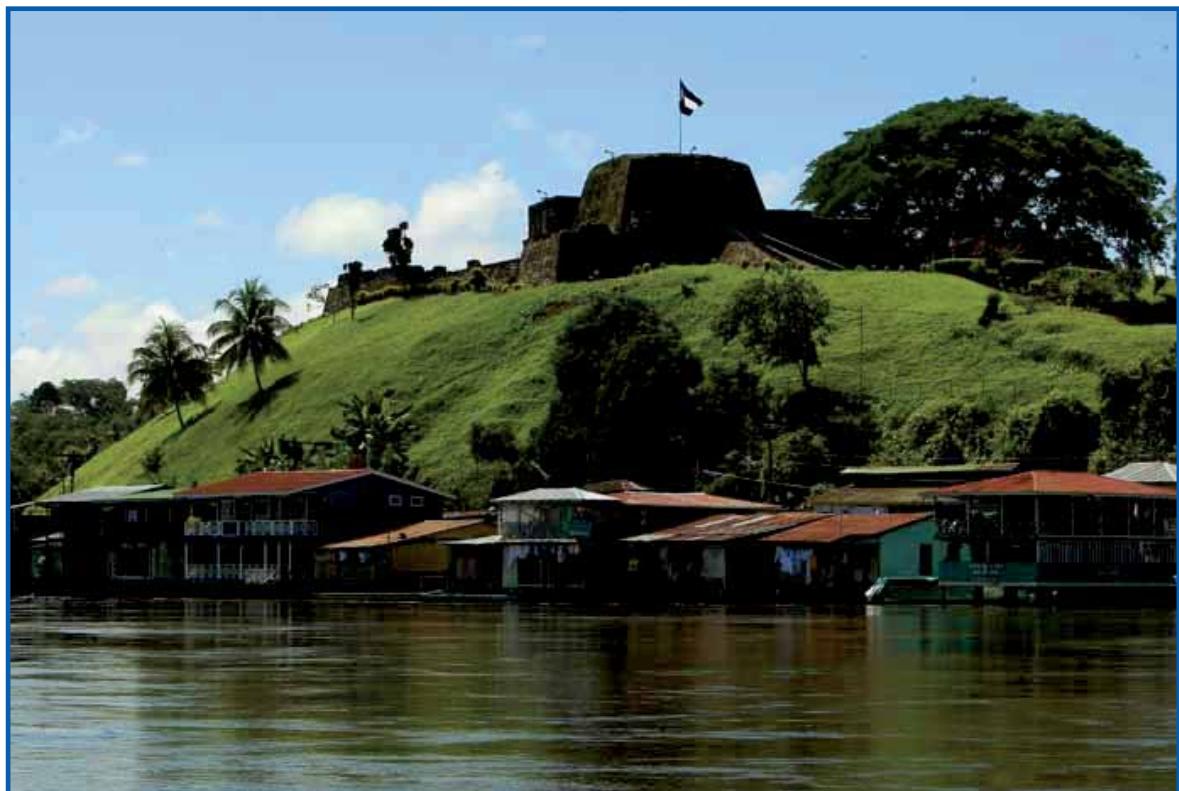
"Nicaragua should not withdraw military forces from our territory. To accept that they withdraw from Nicaragua is outrageous. If they are in Nicaragua, they are in Nicaragua."

Pablo Antonio Cuadra (deceased)

December 15, 1973



"Costa Rica was and still is implacable in this small imperialism of its border demands. In border disputes, there are no sister nations."



SAN JUAN DE NICARAGUA RIVER

THE PROBLEM IS NOT NEW

This is not a new subject or a subject that Nicaragua is wielding until now. In the allegations made by Nicaragua before the International Court of Justice, this fact was especially mentioned and an express reservation was made of the rights of Nicaragua to take this matter to the Court.

On page 251, paragraph three of the Counter-Memorial dated May 29, 2007, Nicaragua stated as follows:

“Nicaragua expressly reserves the right to file a complaint against Costa Rica for ecological damages to the waters of the San Juan River, as well as the diversion of its traditional water current towards agriculture, industry and other purposes in the territory of Costa Rica, and towards the waters of the Colorado River.”

This reserve was reaffirmed by Nicaragua in page 327 of the Rejoinder presented before the Court on July 15, 2008.

Nicaragua also reserved the right on the limits in the mouth of the San Juan River. That point was not under discussion before the Court and for that reason Nicaragua simply clarified that it reserved its rights in all matters related to the attribution of territory between both countries in the general zone of the mouth of the river. This appears on page 9 of the Counter-Memorial, which textually reads:

Harbor
Head
Lagoon

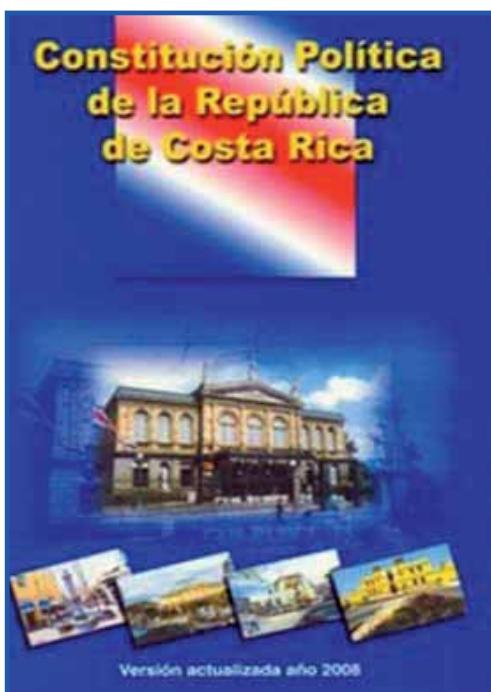


“Map 5 of the Memorial of Costa Rica does not reflect the correct attribution of the territory of Nicaragua and Costa Rica in the general area of the mouth of the San Juan River. Nicaragua therefore reserves its rights on these subjects.”

THE TRUTHS THAT COSTA RICA HIDES

THE LIMITS ARE TOTALLY DEFINED

The limits between Nicaragua and Costa Rica are defined in the Jerez-Cañas Treaty of April 15, 1858, ratified by the Award of the President of the United States Grover Cleveland on March 22, 1888, and demarcated in the five Alexander awards (1897 - 1900).



The Jerez-Cañas Treaty clearly provides in Article 6 that "the Republic of Nicaragua shall have exclusively the dominion and sovereign jurisdiction over the waters of the San Juan River, from its outlet from the lake to its mouth in the Atlantic.

According to the Jerez-Cañas Treaty and the Judgment of the International Court of Justice of July 13, 2009, Nicaragua has the exclusive dominion and sovereign jurisdiction over the waters of the San Juan River.

The Political Constitution of the Republic of Costa Rica of November 7, 1949 and its subsequent reforms confirms in Article 5 that the limits between Nicaragua and Costa Rica are defined in the Jerez-Cañas Treaty of April 15, 1858, ratified by the Award of the President of the United States, Grover Cleveland, on March 22, 1888, which reads as follows:

"Article 5. The national territory is comprised between the Caribbean Sea, the Pacific Ocean and the Republics of Nicaragua and Panama.

The limits of the Republic are those determined in the Cañas-Jerez Treaty of April 15, 1858, ratified by the Cleveland Award on March 22, 1888, with respect to Nicaragua, and the Echandi Montero Fernández Jaén Treaty of March 1, 1941 as regards Panama".

The judgment of the International Court of Justice of July 13, 2009 is categorical: Nicaragua maintains the exclusive dominion and sovereign jurisdiction over the San Juan River in its entire course. Paragraph 87 of the judgment of the Court is forceful in concluding that "Nicaragua has the power to regulate the exercise of Costa Rica of the right of free navigation derived from the Treaty of 1858."

SAN JUAN DE NICARAGUA RIVER

COSTA RICA'S RIGHTS:

- a. The right to navigate in the San Juan River for trade purposes.
- b. The right to navigate for commercial purposes including the transportation of passengers.
- c. The right to navigate for commercial purposes including the transportation of tourists.
- d. People traveling on board Costa Rican boats are not required to obtain Nicaraguan visas.
- e. People traveling on board Costa Rican boats are not required to buy Nicaraguan tourism cards.
- f. The inhabitants on the Costa Rican bank have the right to navigate between the riparian communities, having as the sole purpose the essential necessities of daily life that require expeditious transport.
- g. Fishing activities for subsistence by the inhabitants of the Costa Rican must be respected by Nicaragua as a common law right.

NICARAGUA'S RIGHTS:

- a. To prohibit navigation of Costa Rican boats performing police functions.
- b. To prohibit navigation for exchange of personnel in the border police stations and resupply of official equipment, including regular weapons and ammunition.

In the part where Costa Rica has a limited right of navigation, the International Court of Justice reaffirmed that Nicaragua has the right to regulate, among other things:

- a. To demand Costa Rican boats and passengers make a stopover in the first and last Nicaraguan post.
- b. To demand people traveling in the river carry a passport or identity card.
- c. To demand departure dispatch certificates from Costa Rican boats, but not to require the payment of a fee for such certificate.
- d. To impose a schedule for navigation by boats.
- e. To demand Costa Rican boats to be equipped with masts or posts to display the flag of Nicaragua.

THE TRUTHS THAT COSTA RICA HIDES

THE TRUTH THAT COSTA RICA HID ON THE MAPS THAT IT DISCLOSED

The maps do not substitute the provisions of the Cañas-Jerez Treaty, the Cleveland and Alexander Awards, and the ratifications of the International Court of Justice on July 13, 2009.

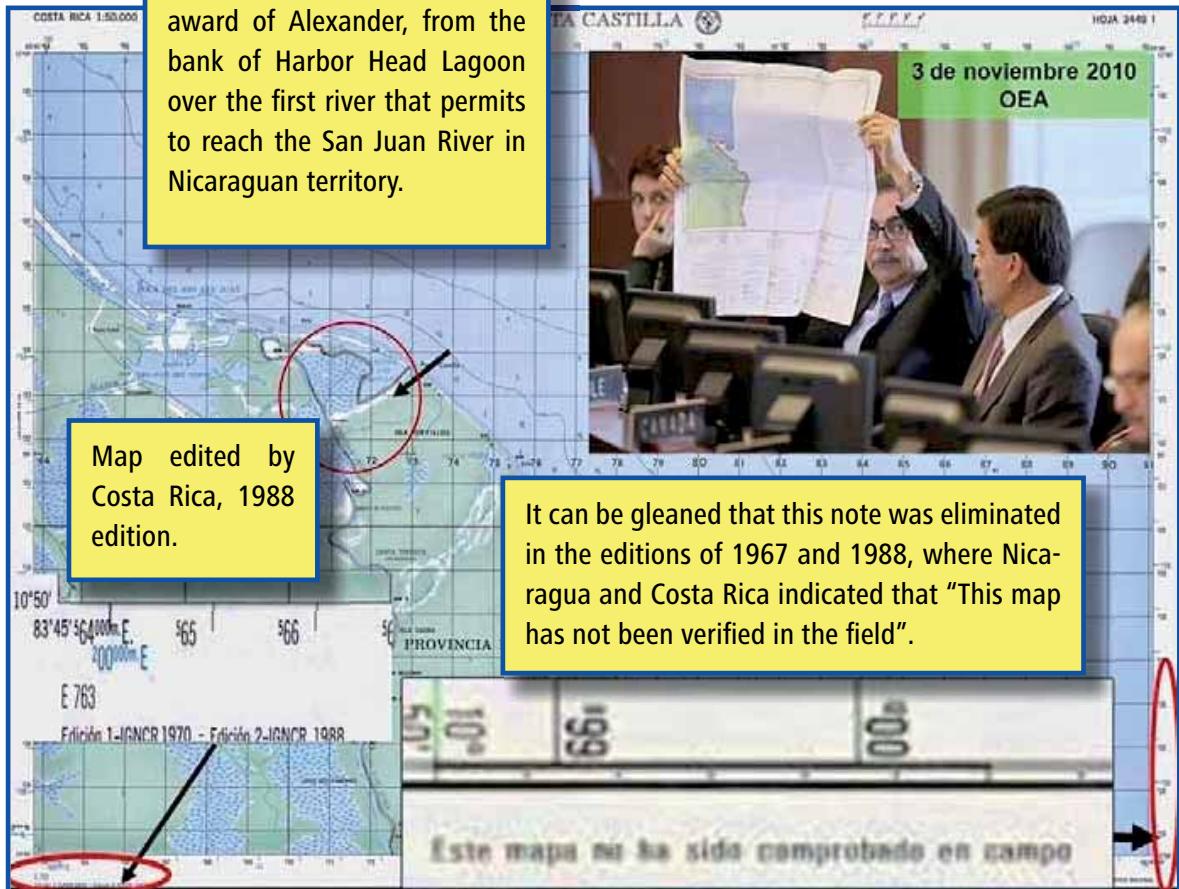
The maps, not verified in the field, are not the reason or the truth of the limits of our border. Costa Rica ignores the content of its Constitution in relation to limits.



IN RELATION TO THE MAP PRESENTED BY COSTA RICA, IT IS WORTH TO MENTION THAT THE PUBLICATION OF 1967 AND 1988 INDICATES THAT ITS CONTENTS HAVE NOT BEEN VERIFIED IN THE FIELD.

SAN JUAN DE NICARAGUA RIVER

It should be noted that under the assumption of "low vegetation", there is an attempt to ignore the provisions of the first award of Alexander, from the bank of Harbor Head Lagoon over the first river that permits to reach the San Juan River in Nicaraguan territory.



THE TRUTHS THAT COSTA RICA HIDES

COSTA RICA SAYS IT IS RESPECTFUL OF TREATIES AND AWARDS ON THE LIMITS WITH NICARAGUA. WHY HAS IT REFUSED TO MARK THE BOUNDARY?

AÑO DE INSTALACION	TOTAL INSTA- LADOS	DISTRIBUCIÓN DE MOJONES AUXILIARES ENTRE HITOS PRINCIPALES																	
		TRAMOS ENTRE HITOS PRINCIPALES																	
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al
1994	17	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TOTALES	17																		

AÑO DE INSTALACION	TOTAL INSTA- LADOS	DISTRIBUCIÓN DE MOJONES AUXILIARES ENTRE HITOS PRINCIPALES																	
		TRAMOS ENTRE HITOS PRINCIPALES																	
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al
1996	10	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1998	16																4	4	2
2000	13																8	4	4
2001	30	1	2	6	6												4	11	
2002	10																		
2003	25	1	3	2	1	4	1	4	2							1	2	3	1
2004	15																9	6	
TOTALES	119	1	3	9	8	1	11	5	6	10	2	0	10	12	11	11	9	8	2



Hitos De - A	Distancia en kilómetros	Hitos De - A	Distancia en kilómetros
1- 2	138.0 *	11-12	2.0
2- 3	2.7	12-13	29.6
3- 4	2.6	13-14	37.1
4- 5	3.1	14-15	15.8
5- 6	3.4	15-16	7.3
6- 7	5.9	16-17	11.5
7- 8	9.3	17-18	6.3
8- 9	2.3	18-19	5.5
9- 10	3.7	19-20	17.9
10-11	7.6		
Continúa....		Total	311.6 kilómetros

* A lo largo de la margen derecha del río.

DECLARACIÓN BINACIONAL NICARAGUA – COSTA RICA

Signed at San Jose, Costa Rica, on October 3, 2008, by Nicaragua's Deputy Minister Valdrack Jaentschke of Nicaragua and Costa Rica's Deputy Minister Edgard Ugalde.

As the first actions derived from the letter of intent, both institutes agree to exchange, within the fourth quarter of 2008, all information required that allows to initiate the homologation processes of the geodesic coordinates of the landmarks of the terrestrial borders between both countries, with a view to the ratification of the marker densification process jointly carried out to date, as well as the beginning of coordinated preparatory activities conducive to the creation of compatible basic cartographies in the border zone of both countries", which process did not continue as Costa Rica has refused to sign the minutes on the marking of boundaries with any reasonable justification.

SAN JUAN DE NICARAGUA RIVER

**COSTA RICA SELLS
ITSELF AS A COUNTRY
THAT PROMOTES
HUMAN RIGHTS FALSE!**

As regards Nicaraguans in Costa Rica, thousands are contributing to harvest coffee, bananas and citrus fruits. Thousands of Nicaraguans are working in construction and provide domestic services, all with dedication and honesty.

Instead of recognizing the effort of the Nicaraguan labor, there are xenophobic manifestations that denigrate the human condition of our fellow citizens.



Nicaraguenses en Costa Rica.

THE TRUTHS THAT COSTA RICA HIDES

It suffices to remember Natividad Canda Mairena, who was torn to pieces by dogs that caused his death under the observation and presence of Costa Rican citizens and authorities that did not prevent this inhuman fact.

In Costa Rica, Nicaraguans are treated like inferior human beings. They are marginalized and not recognized as persons who deserve to be respected. Nicaraguan women are denigrated. Costa Ricans constantly refer to our fellow citizens in the mass media with offensive words, fostering offenses, insults and scorn.

Systematic campaigns are aimed against Nicaraguans as the cause of all their problems. Nicaraguan children are discriminated. Only children born to Nicaraguan and Costa Rican parents are seen like people.

Nicaragua hopes that this situation will improve and that labor and living conditions of Nicaraguans in Costa Rica will be more human.

Course of the
San Juan de
Nicaragua River



SAN JUAN DE NICARAGUA RIVER

WITH ALL THESE TRUTHS, NICARAGUA PROVES TO THE NATIONAL AND INTERNATIONAL COMMUNITY THAT:



President of the
República,
Commander
Daniel Ortega S.

The Judgment of the International Court of Justice of July 13, 2009, is of inevitable compliance and cannot be modified since the first effect of res judicata is that the court that delivers a judgment detaches itself from the case and cannot modify or alter any of its parts, from which the concept of immutability of res judicata is derived.

Based on the principle of international reciprocity, Nicaragua insists on the right that our country has to request free navigation in the waters of the Colorado River while the San Juan River is being dredged. This dredging is based on the Ruling of the International Court of Justice of July 13, 2009, as well as the Cleveland and Alexander Awards, which determine that Nicaragua has exclusive jurisdiction and sovereignty over the river basin and grant ample rights to Nicaragua to carry out

THE TRUTHS THAT COSTA RICA HIDES

cleaning and other works to improve the flow and navigation of the river; and eventually, to compensate Costa Rica for any damages caused as a result of the dredging.

Since the year 2007, Nicaragua has shown an interest in using the waters of the Colorado River, a branch or tributary of the San Juan River, which is fed 90% by the latter. On the other hand, it is before this International Court of Justice where the claim regarding the damages caused to Nicaragua by Costa Rica from an ecological viewpoint will be addressed.

The National Army and Police will stay in the national territory as they have been so far. They will continue to fight drug trafficking and organized crime.

It is within the frame of the Bi-national Commission that policies to prevent and fight drug trafficking and organized crime should be discussed, as well the marking of boundaries in accordance with the Cleveland and Alexander Awards.

Words of the President of the Republic, Commander Daniel Ortega, on the occasion of the second working session with the Council of the Powers of the State in the defense of Nicaraguan peace and sovereignty.

"Can Costa Rica prevent Nicaragua from executing, at her own expense, works of improvement?"

"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..." (Cleveland Award, question 6)

SAN JUAN DE NICARAGUA RIVER

"Can Costa Rica prevent Nicaragua from executing, at its own expense, improvement works?"

"The Republic of Costa Rica cannot prevent the Republic of Nicaragua from executing, at its own expense and within its own territory, such improvement works..."

Laudo Cleveland
Question No. 6

