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)

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LIST OF ANNEXES
VOLUME II

Annex 1

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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 posses 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 ponts sont considérés comme libres et ouverts pour les navres de guerre et les corsaires des peuples avec lesquels on est eu 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 vessels enters a friendly port, may reasonably be construed, and it seems to the Court aught 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. Cuching 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 straights 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 time as much waters 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 braking 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 states 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;
Rutherforth, 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 braking 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°03'48" north, longitude 85°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°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, Cost 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 Cost 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 Sates.

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 where 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 believe 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 Enciclopédico 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 form 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 form 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 lied 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 posseses 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 [illegible] 184

No. 2

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

Hon. Lewis Cass
Secretary of State,
Washington.

Sir:-

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 adressed to me by the agent and part Owner of the Ship Fortitude wrecked at Cape Gracias á Dios, and my answer.

The harbour at 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 shewed twenty five feet! The Old Transit Companys buildings at Punta Arenas, have been carried

away

185

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's boats pass and repass at pleasure in and out of the harbour, saving nearly half of the distance between the town and where the Ship's are anchored. Unless a change soon takes place, I fear this once fine harbour will be ruined.

Old Transit Company's buildings carried away.

The U. S. Ship "St. Louis" Came to anchor outside, this Morning, and the Jamestown is getting ready for a cruise. H. B. M's Ship "Cezar" is the only other war vessel now at this port.

Vessels of war in port.

I have the honor to be
Very Respectfully
Your Obt. Servant

L. Squire Cottrell
U. S. Coml. Agt

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.

A. 29 nov. Mr Clements

Commercial Agency
San Juan del Norte
Sept. 30th 1872

Hon Second Assistant Duplicate to Statist.
Secretary of State,
Washington D.C.

Sir, I have the honor of submitting my Annual Report on Commerce and Navigation.

Owing to the new regulation it is not possible to obtain the Tables required, till December 1st, only yearly reports being made here, and at the Custom House, which is located on the Lake. As soon as practicable, I will forward these, & so complete the Report.

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

The Consuls, him, all have to do so, though most of the shipping is in communication with their Offices.

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

I am Sir your obt Servt

L. P. Olds

Consul Agent.

Annual Report, on Navigation and Commerce from the Commercial Agency of San Juan del Norte, Nicaragua. For the year ending 30th 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 statement showing figures, there are some matters connected with the Commerce of this Country which may very properly become a part of the Report, and to such, I beg leave to direct the attention of the Department.

1. Harbor of San Juan del Norte.

At one time this Harbor ranked high, its depth of water having been

variously sounded by the exploring parties inspecting for an inter-oceanic route, and by the anchors of the ships cast almost any where 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 course 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 navi=
gating must strictly follow, and making
it may be inferred, miasma in pro=
portion to the space of marsh as opposed
to the ordinary temperature of this Climate

Where all this will end no 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 so, 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 pamp
hlet from the Governor 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 necessarially deman

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 kindly 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 sacks of Coffee at a load drawing ~~about four feet~~ between three and 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 hatch=ways 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 were several vessels to arrive at

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 lighterage 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 river-boating by steamers must end and the primitive canoe become the only transport.

The contract for navigating the lakes and river 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

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 hungs again it will have influence on the shipment of certain products at least, as Coffee, which will not bear wetting, which the hungs 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 route, 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 rivers and lake, having lost their somewhat natural right to navigate, would be glad to return thereto. But it is likely that if the harbor closes entirely so as to prevent the steamers from running, the trade will immediately divert to the Pacific side and this Coast have become deserted.

7.

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 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 effects the interests of Greytown, as the loss of its harbor is vital, the population depending entirely on its existence.

III. Productiveness of Nicaragua.

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 Nicaragua produces certain things not found generally, giving a kind of lease on the wants of mankind. 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.

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 Managua, 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 on this country, I cannot say.

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 Chontales mountains, worked for the government by English operatives. The yield is sure in the table. Coal has never been discovered. There are other minerals in minor quantities; but will never became of value in Commerce.

V. Climate.

Allusion is made to this heading rather to correct the histories extant, 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. Nor is any attempted in Nicaragua on this line, until the Lake country is reached. The Coast is the portion for rains, thunder and lightning in its most awful form; for fever and rheumatisms, occasioned by miasma and drenchings from the frequent rains.

Hence also, few from other Countries settle here. In my count for Greytown 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. 12.

All arriving here have to undergo acclimation more or less severe, passing through the fever 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 favor more or less alike, and hopes the same. But her work of progress must necessarially 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 etent,
and they are engaged in the carrying
trade up to this etent. 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 occupies
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 kinds.
A trading ship thus becomes a splendid

war-vessel 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 trafic of the world. Why, what do we see at this fast-sailing port? Monthly, at the day and hour, one of these floating palaces, of a subsidy-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 where 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 trafic of England with this Coast

does not show this equality, for the
furnishes such things as are wanted
more cheaply than other countries do,
and it is said pays better prices 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.
Lumber, 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 ₤.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 direct 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 repine 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 Intision duties range at about 25 per cent advalorem. San Juan port duties where not free, 10 per cent. The free-list I believe, includes flour, bread, corn, rice, beans, barley, oats, onions, turnips, potatoes, green apples, machinery, scientific instruments, printed

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 $10 per cwt, Hides $2, Deer-skins 27 cents per pound, Cocoa-nuts $2 per thousand, Indigo $1. per pound.

Commissions. Merchants charge 2½ per cent with certain items for lighterage, handling &c, all moderate enough.

Lewis P. Olds.
Commercial Agent.

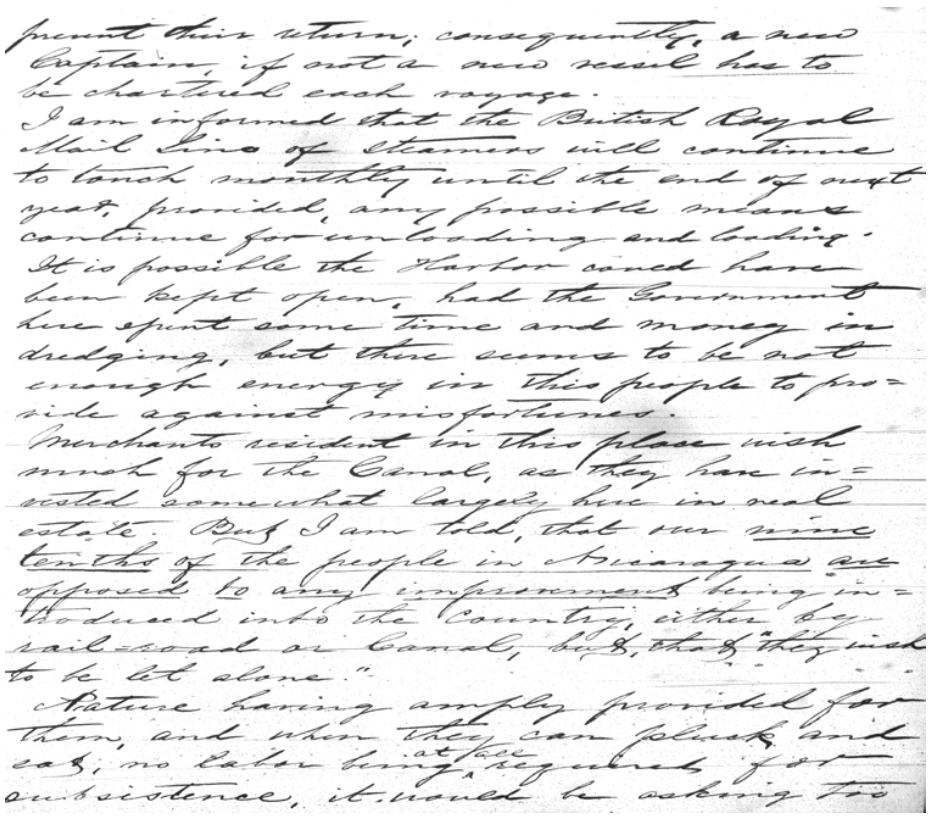
Supplement to Annual Report.

Since forwarding my report proper, it is evident that the Harbor of Greytown, or San Juan del Norte, has virtually closed. There is only one opening called Harbor Head, with three feet of water; the danger point when the Kansas took so many 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



prevent their 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
have 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, but, that they wish
to be let alone."
Nature having amply provided for
them, and when they can pluck and
eat; no labor being required, for
subsistence, it would be asking too

too much to make them up, to the activity
connected with internal improvements,
involving customs, morals and every=
thing."
It is true, one can subsist 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 cause
the Merchants and others of more ener=
getic cast, will, they inform me, move
to Limon Bay or elsewhere. Leaving
the old Spanish town to grow over
with the quickly spreading forests of
the Coast, its site being known only
by a few remaining fishermen, as at Indian
River, becoming lost to Commercial busyness
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

Interesting. D.H. Clark

820

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

June 24. 1885

M. E. Brown,
to The Department of State

Subject: ac Aug 6/85

Harbor of Greytown.

Abstract of contents:

Ruin of, illustrated by its present condition

No. 25. United States Consulate at
San Juan del Norte, Nic.
June 20, 1883

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

Sir: The arrival of the
port of the S.S. "Para" 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 days
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 nav-
igators.

As the Department knows,
since 1865 no ordinary sea
going vessel, save [illegible]

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

American captains are reluctant to deposit "ship's papers" 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 procuring the requisite signatures of Master and Mate to landing certificates.

The distance from Greytown to which vessels lay at anchor when discharging cargo, and the peril of navigation exist often in danger to it, and much dislocation as well.

It has often happened in bad weather that vessels

while discharging their cargo have been forced to leave the port with half the freight destined for Greytown on board sometimes being taken back to Aden and its completed delivery have delayed six months.

Vessels arriving off the port usually anchor out in the roadstead three or four miles from the city, outside 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 dangerous is the sea to be crossed in approaching it that vessels very seldom venture

~~to land~~ to land about 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 this country.

That the ordinary boats' crew are not equal to this 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 these Bluefields boatmen display is not exercised in

riding the heavy seas that roll
over 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 swung 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 carried off & be
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 six 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 sands of the San Juan River deposited by it from 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 there may be two and even three channels 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 San Juan River, which empties into the ocean, 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 by some new diversion of the bars and sands a new channel is opened through the beach.

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 32 feet of water, and after going out across the outer bar to where "Pará" lay, and taking aboard her cargo was returning through the channel she passed out during the morning, when she went aground on a bar which had formed across it during the day.

This was at 1 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 "Progresista" from any point in the city without wetting his shoes.

When the "Para" 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 there were taken in canoes over the outer bar through the sea to the "Para".

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

She was finally gotten

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

There are now two openings 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 two feet of water was compelled to return to her anchorage in the harbor being unable to get out.

As we have been having an unusually prolonged dry season, there is but little water in the San Juan (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 first three months, (with the exception of the Colorado) scarcely anything longer than a canoe has been able to pass the river from Colorado a distance of 20 miles from here, and in consequence of that, the town 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 in transportation adding daily and additional expense it is not strange that the business of the port were quite extensive

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

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 since Barrios' 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."

"Some one whose knowledge

of this port is limited to the present condition of the harbor, it is difficult to recognize in this shallow 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 entrance one mile and three quarters wide, with no dangerous bar menacing its front; or that as late as the year 1856 there lay securely at anchor under its protection seventeen sloops of war of "Her Britanic Majesty's" fleet just from the seine of the Crimean[?] accompanied by one war vessel of the United States, the "Cäborn," I think.

And while the detonating forces of nature have been constantly at work for thirty years destroying the harbor and river 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 water-ways, or to improve their condition at all.

The Government of the pres-

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 un-
used and allowed to go to
ruin in, and with the har-
bor. The boiler & delicate how-
ever has for some time been
doing duty in the works of the
"Nicaragua Mail Steam Navigation
Company."

The Govt. in some of its reports
on the state of Public Works notes
the necessity of the improve-
ment of the San Juan River and
the restoration of the port of San
Juan del Norte.

The latest reference to this sub-
ject 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 this port) expended in other

part of the Republic and this port allowed
to decay.

I am, Sir,

your obedient servant,

Wm. 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 Halleck[1] 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 finally[2] 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.

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[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 establised 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

TEMBLORES, 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

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.

In light of the difficulty of navigating the San Juan de Nicaragua River, due to its shallow waters, which is the 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.

* * *

* * *

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.

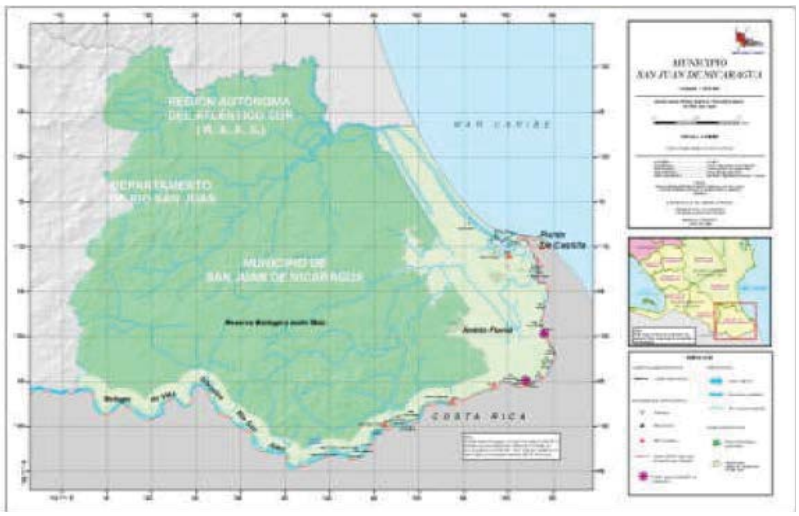
2.1.1 Location

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.

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



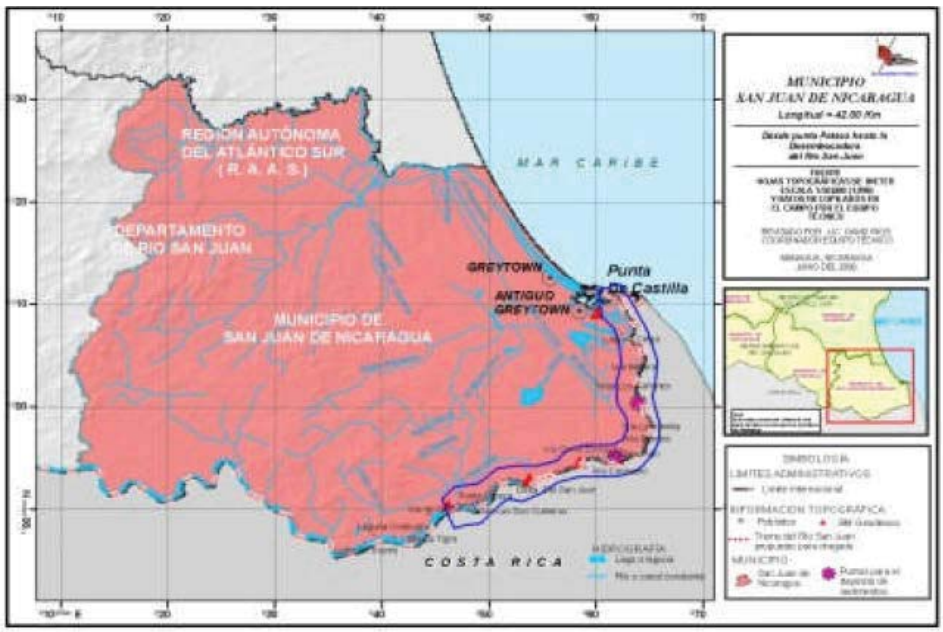
2.1.2 Location

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 km^2 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.

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,

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.

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.

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.

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.

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.

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.

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 m x 2.0 times = 6.40 meters (B.T. beam x factor)
Distance to the foot of the slope: 3.20 m x 1.5 times = 4.8 meters (B.T. beam x factor)
Free distance between ships: 3.20 m + 1.6 m = 4.8 meters (beam + maneuv. 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.

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

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

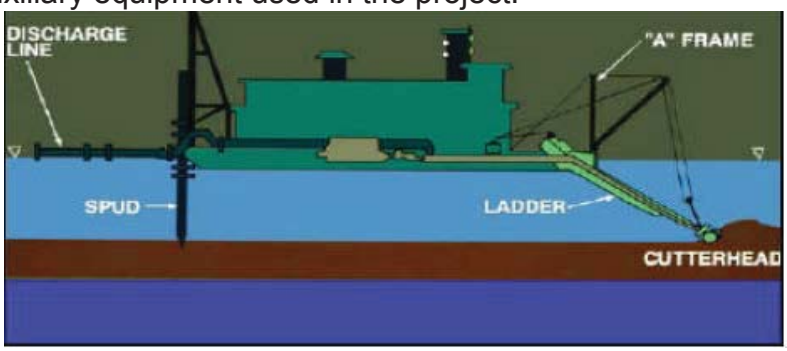
The equipment proposed to dredge the access channel, which would enter from the sea where the average depth is 6.00 meters and motor up to the sandbar of the San Juan River, is a self-propelled hopper dredger, as shown in the above figure. This is the same as a boat that uses one or two arms with pipes 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.

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)

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)*	0380 / 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.

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

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.

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

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.

LOCATION OF THE SITES EVALUATED FOR DISCARDING MATERIAL

No.	NAMES OF DEPOSIT SITES	UTM COORDINATES NORTH	UTM COORDINATES EAST	AREA (MZ)	VOLUME m^3
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	Dário 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.

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.

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 ¼" 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 ¼" 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.

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.

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 rainiest 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.

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."***

* * *

Water Quality

Ionic Content – Background

Procuenca[1] 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.

Table No. 6. Physical-Chemical Field Parameters

LOCATION	EAST	NORTH	PH	CE (µS)	REDOX	T (°__ 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.

Results of Laboratory Analyses

Physical-Chemical Laboratory Parameters

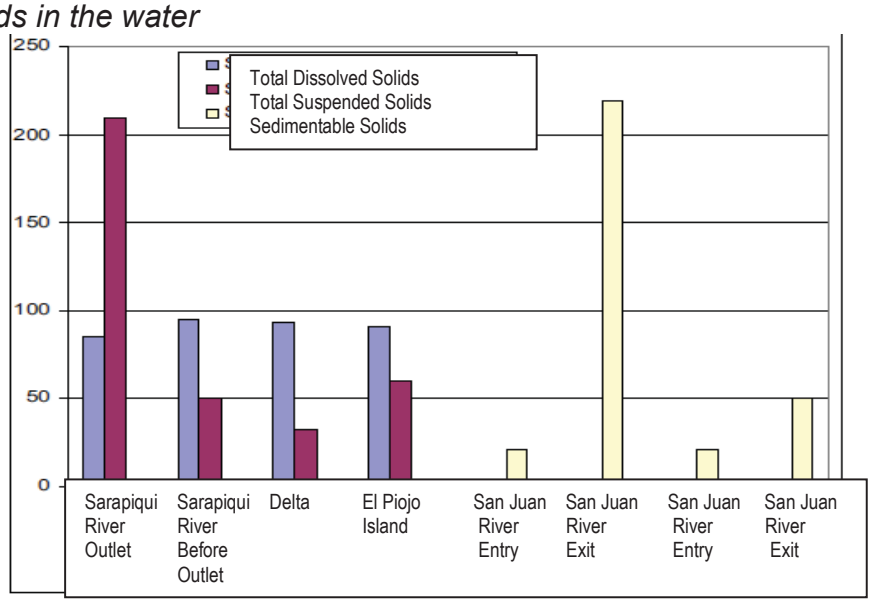
The results of the physical-chemical laboratory parameters are summarized in Table No. 7.

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 (µS/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



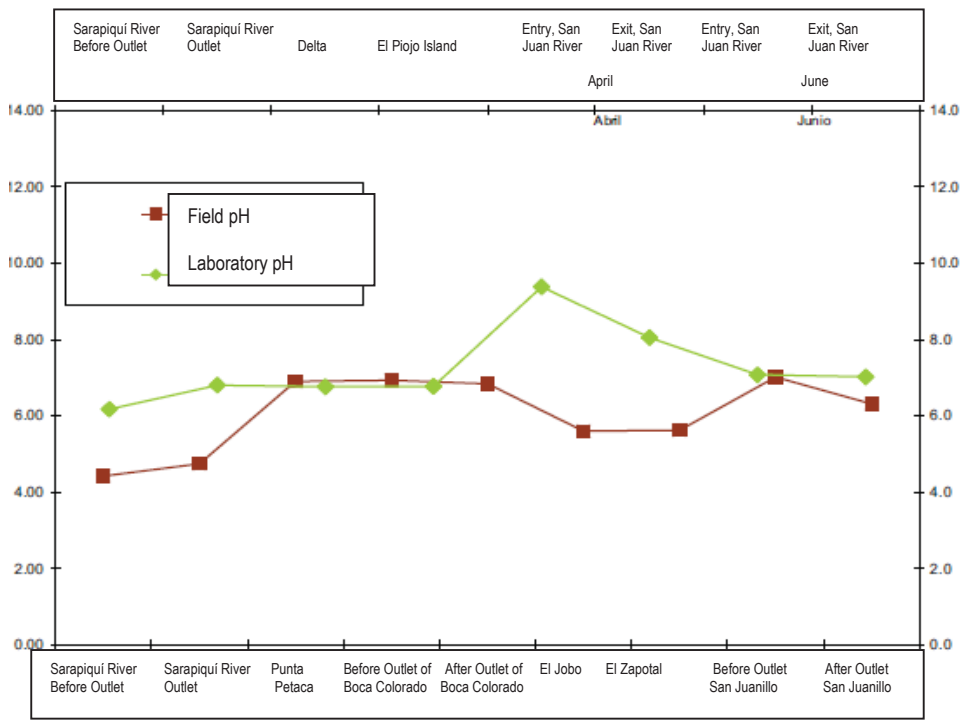
*Graph No. 6. Concentration of solids. mg *l^{-1}*

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

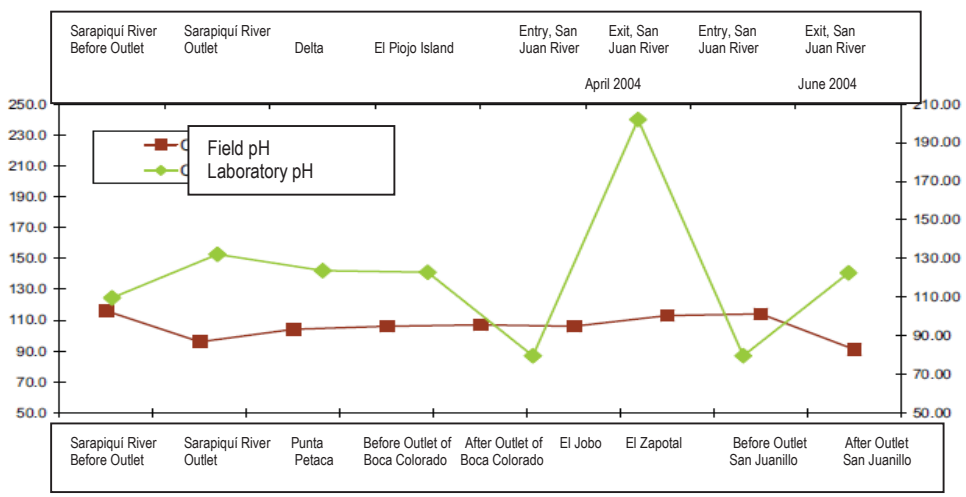
The behavior of the field pH has already been explained. For El Piojo Island, it is assumed that the pH is equal to the pH that was measured around the mouth of the Colorado River. It can be seen that the field data remains equal to the laboratory measurements.

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.

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.

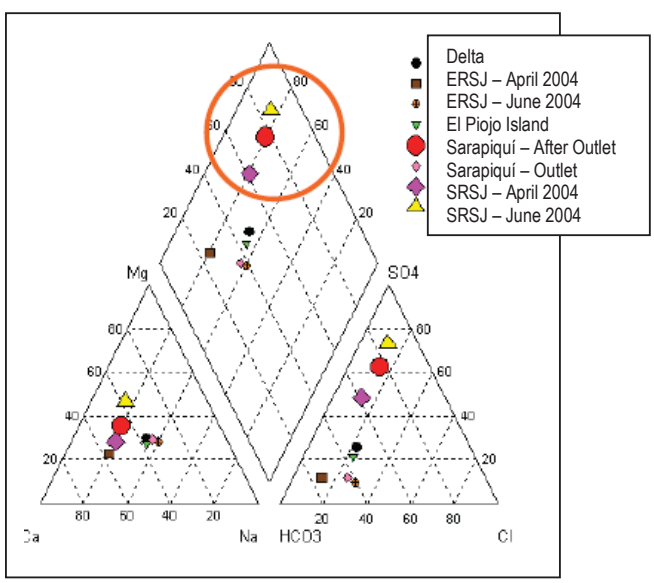


Table No. 10 shows a comparison of CAPRE Standards – Water Quality Standards for Human Consumption and Canadian Standards for the same purpose. The Canadian Standards were taken from the AquaChem Program used to prepare the Piper Graph, which represents the type of water found in the area of study, compared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

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 µg * Kg^{-1}, which would be 91.3 µg * 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 (PROCUENCA 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. m^3**
Phyllum Arthropod	
Crustacean Class	
Copepod Sub-Class	
Cyclopod Order	
Mesocyclops edax	242
Total	**242**
El Piojo Island	
Taxonomy Classification	**Ind. m^3**
Phyllum Rotifera	
Epiphanes macrorus	30
Phyllum Arthropod	
Crustacean Class	
Branchypod Sub-Class	
Cladocera Order	
Ceriodaphnia cornuta	30
Iliocryptus agilis	30
Copepod Class	
Cyclopod Order	
Mesocyclops edax	176
Calanoid Order	
Arctodiaptomus dorsalis	383
Juvenile and larval states	
Cyclopoid copepodites	147
Calanoid copepodites	89
Nauplios (copepods)	58
Total	943

Table No. 12. Benthonic Organisms in the Zone

San Juan Delta	
Taxonomy Classification	**Ind. m^2**
Phyllum Nematode Genus n.i	109
Phyllum Annelid Naididae Family *Pristina sp*	22
Phyllum Arthropod Chironomidae Family *Coeleotannypus sp*	44
Total	**175**
El Piojo Island	
Taxonomy Classification	**Ind. m^2**
Phyllum Annelid Naididae Family *Limnodrilus sp*	338
Phyllum Arthropod Chironomidae Family *Proclaius sp* *Chironomus sp*	22 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 km^2. 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.

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.

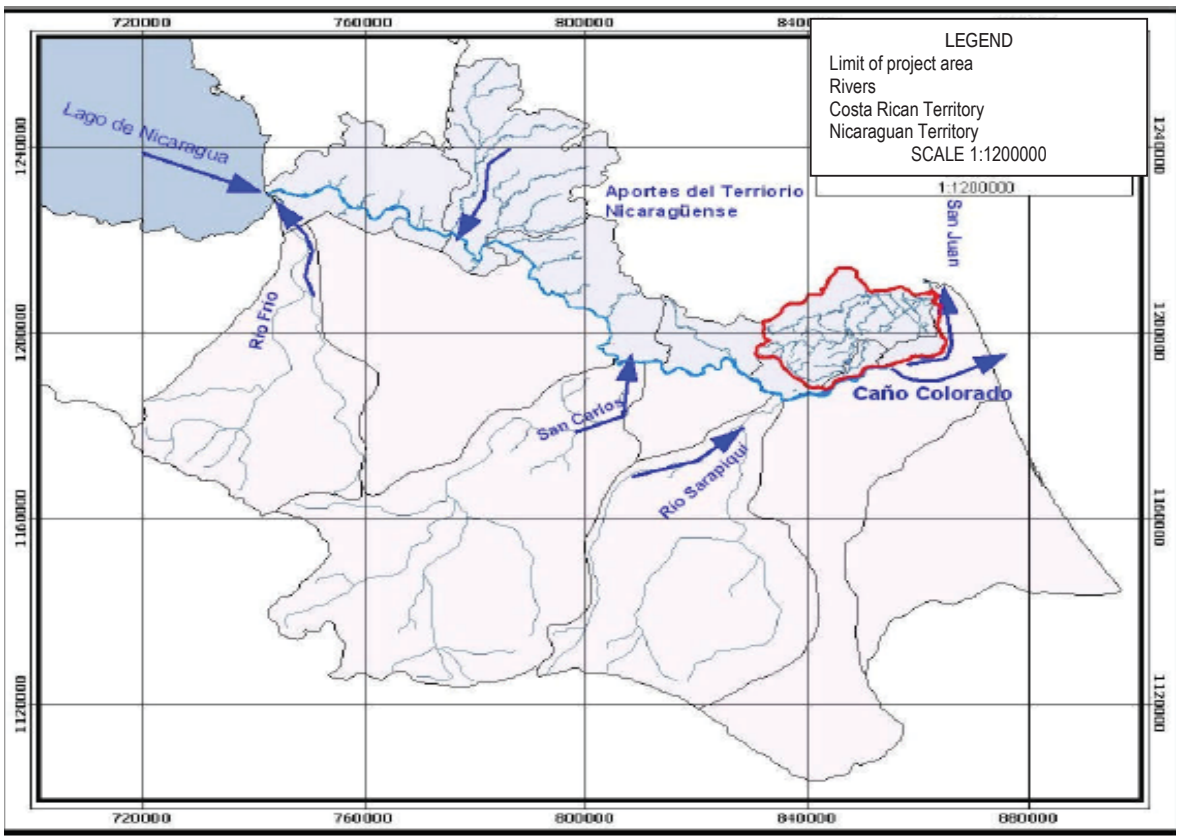
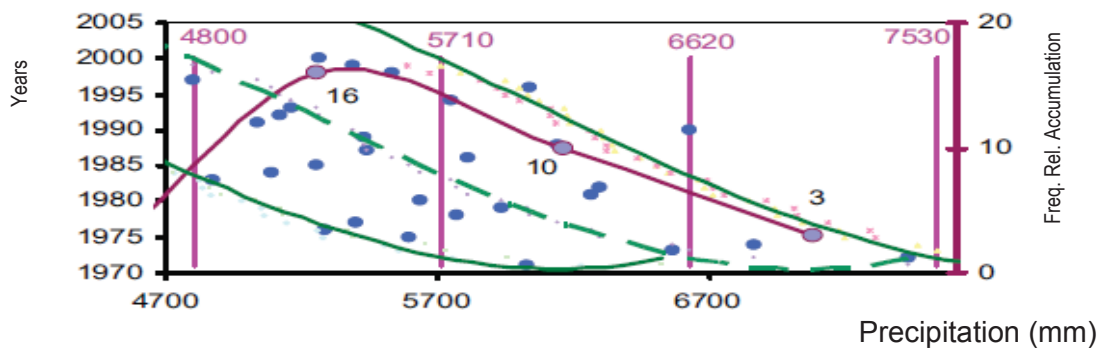


Figure No. 8

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.

CUMULATIVE FREQUENCY, INTERVAL AND CLASS ACCORDING TO PRECIPITATION IN SAN JUAN DE NICARAGUA

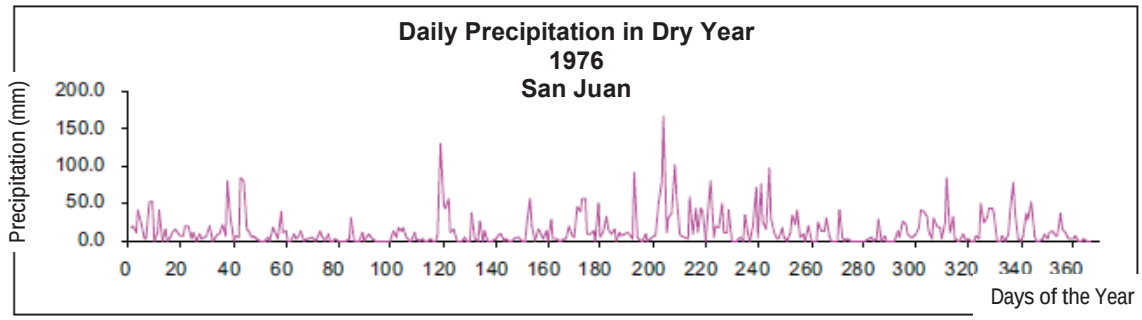


Graph No. 10

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.

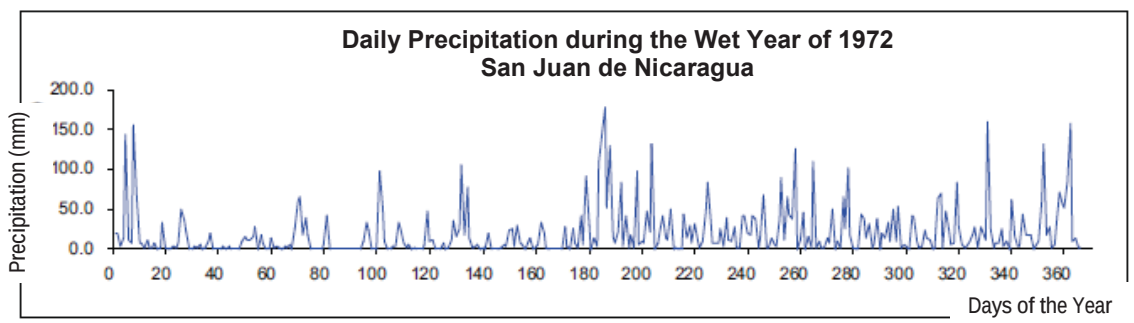
According to the relative accumulated frequency (green), there are 16 information points that oscillate according to the class type (magenta), from 4800 mm up to 5710 mm. Average precipitation of 5597 mm is found in this range, located precisely in the first class type. In the next grouping, according 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.



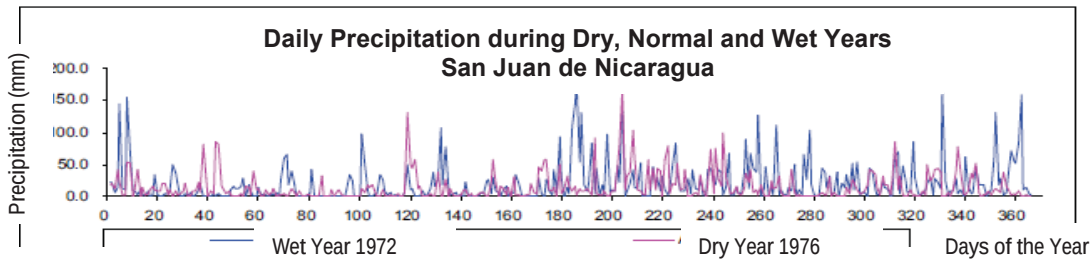
Graph No. 11

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.



Graph No. 13

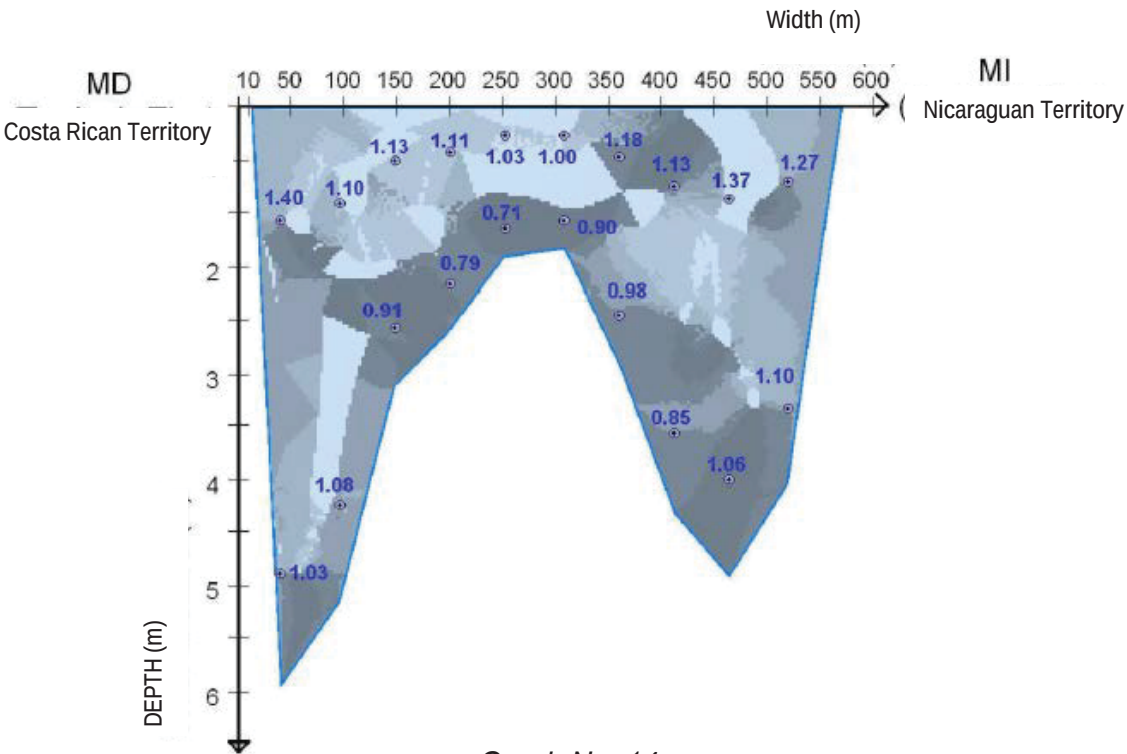
It can be added that there is a 50% probability that rain amounts of 41 mm can fall in a dry year, and 50.4 mm in a wet year. Likewise, it can be said that there is a 75% chance of 18.2 mm of rain accumulating in a 24-hour period in a dry year, and 26.8 mm in a wet year.

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.

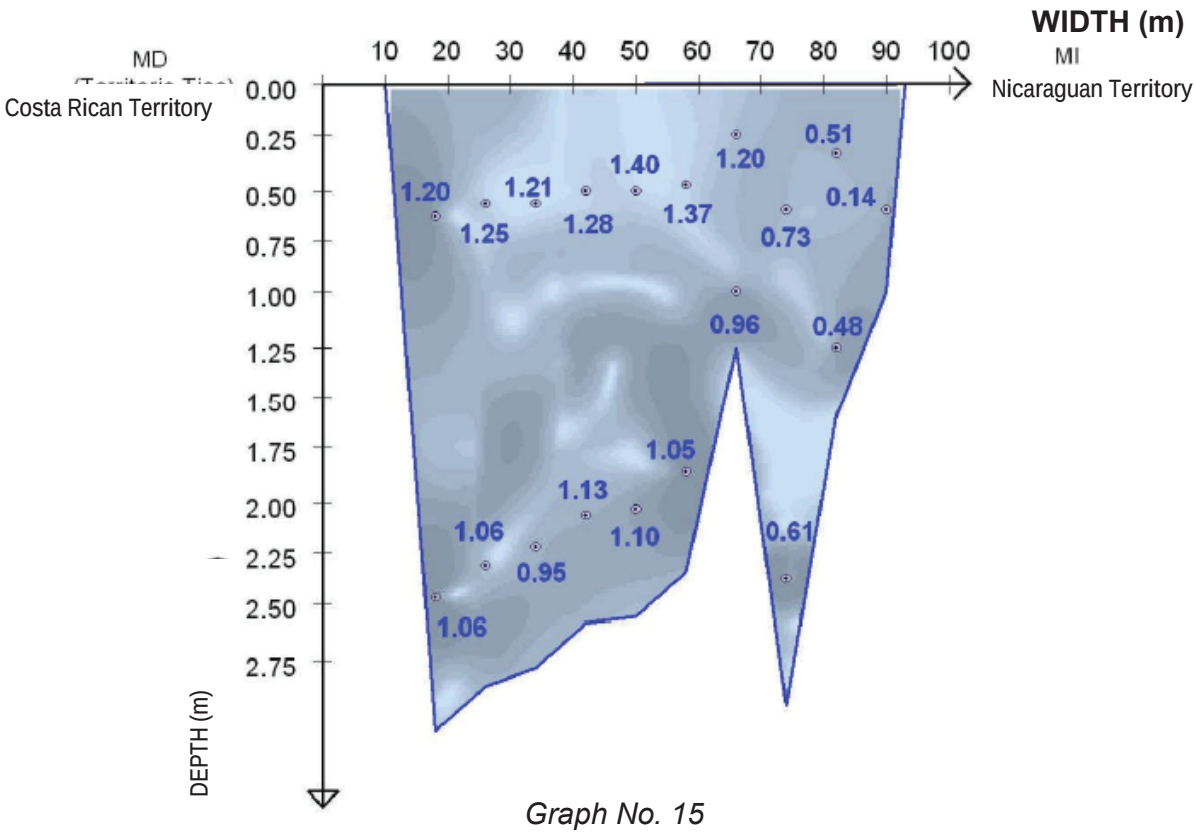
For the purposes of this study, measurements were taken in August 2006, two of which were before Caño Colorado, and the other two were after that point. Graph No. 14 shows the measurement located upriver of Caño Colorado.



Graph No. 14

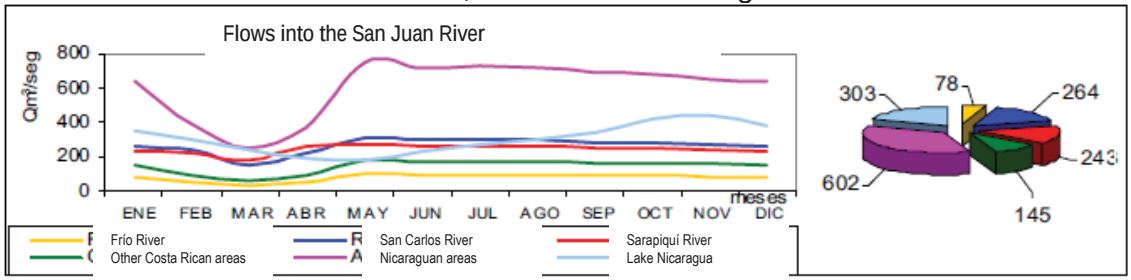
The results are the following: an area of 1624 m^2, average speed of 1.01 m/second, and a flow of 1636 m^3/second, with an average depth of 2.89 meters. This measurement shows that the tendency toward consistent speeds is on the border of Costa Rican territory, which probably occurs because the section 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 m^3/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.



Graph No. 15

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 m^3/second. With water from Lake Nicaragua at 264 m^3/second, from the San Carlos River at 243 m^3/second, and the Sarapiquí River, the flow increases up to 1636 m^3/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 m^3/second.



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.

The boundary markers are 15 x 15 (cm^2), by 10 cm high, with the name of their location. Photo No. 8, "Boundary marker in Petaca."

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.

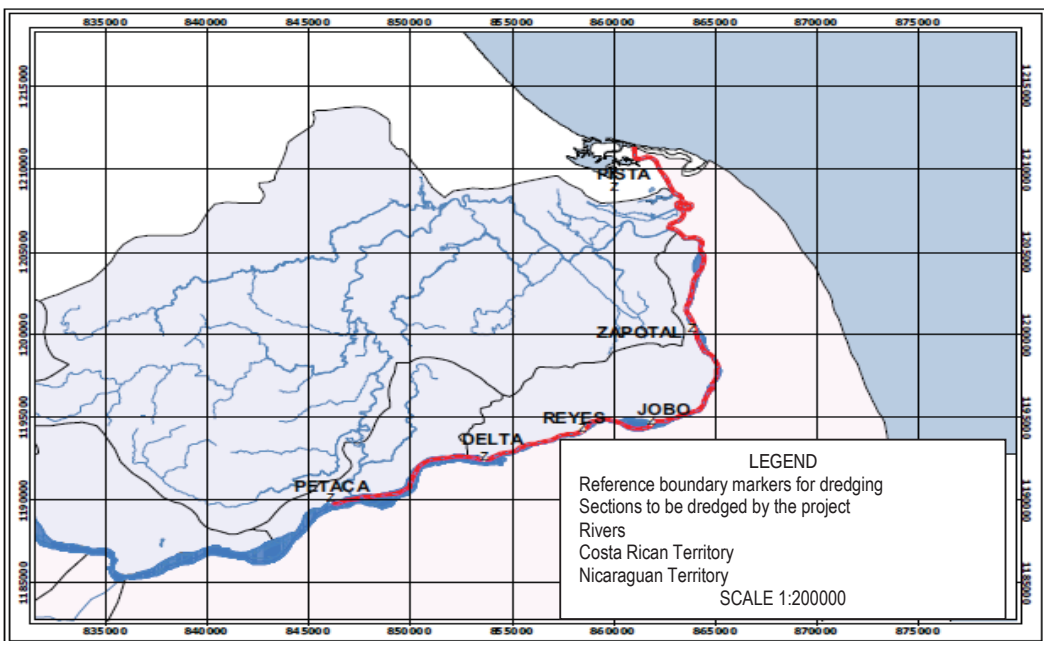


Figure No. 9. Section to be dredged, proposed by the project

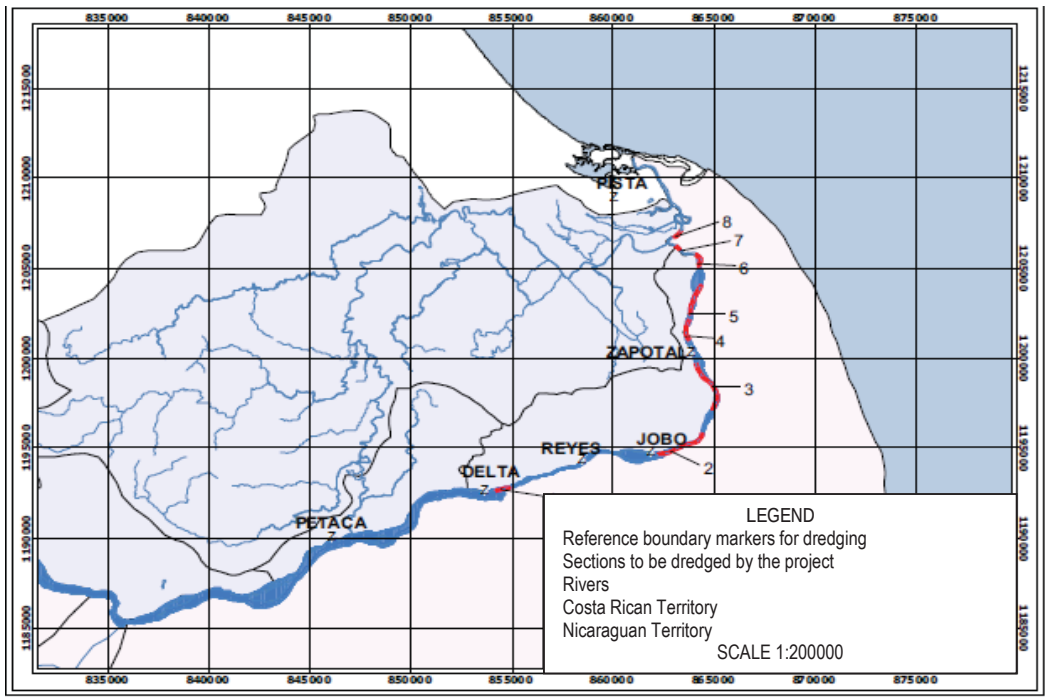


Figure No. 10. Section to be dredged, proposed by the mayor's office

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	b = 80
1	0.7	4200	7000	56000	6300	10500	84000	8400	14000	112000
2	2.6	15600	26000	208000	23400	39000	312000	31200	52000	416000
3	3.0	18000	30000	240000	27000	45000	360000	36000	60000	480000
4	1.2	7200	12000	96000	10800	18000	144000	14400	24000	192000
5	1.8	10800	18000	144000	16200	27000	216000	21600	36000	288000
6	0.8	4800	8000	64000	7200	12000	96000	9600	16000	128000
7	0.3	1800	3000	24000	2700	4500	36000	3600	6000	48000
8	0.5	3000	5000	40000	4500	7500	60000	6000	10000	80000
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 m^3. The initial dredging depth must be

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 m^3.

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.

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.

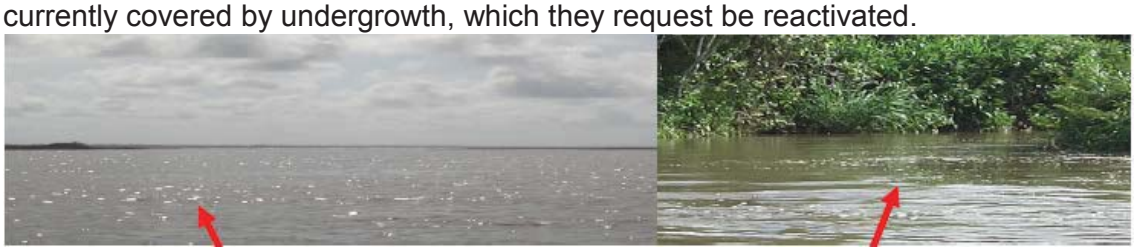


Photo No. 14 shows penetration of the sea, and Photo No. 15 shows the alternate route mentioned by the authorities.

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.

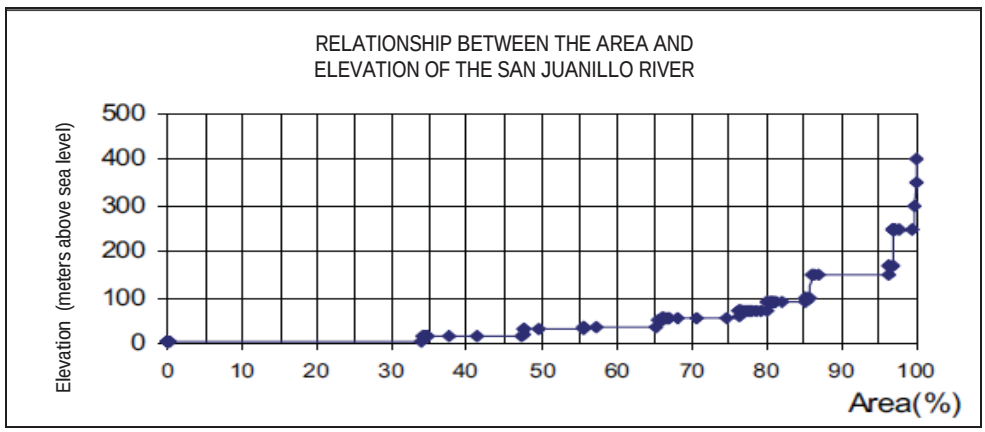
Clay	% Sand	% Lime	% Clay
Sarapiquí	21.6	16.4	62
San Carlos	17.31	9.7	63

Relationship of the project area and the section to be dredged

The surface area of the study is 533 km^2, 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.

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.

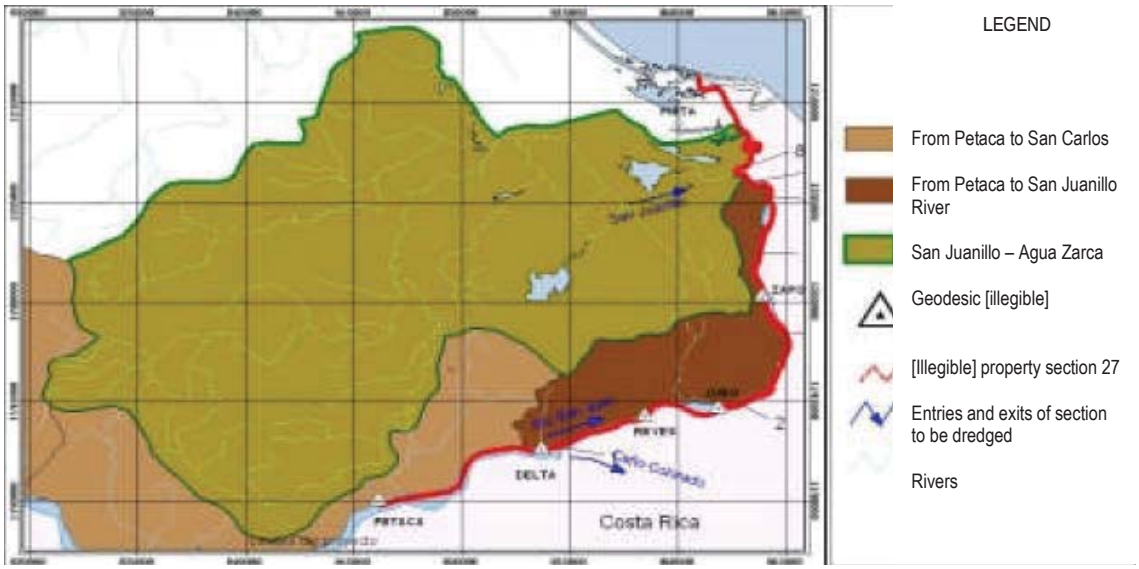


Figure No. 11

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:

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.

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.

- 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 m^3/second. Water from Lake Nicaragua of 264 m^3/second, flows from the San Carlos River of 243 m^3/second, and from the Sarapiquí River increase the flow to up to 1180 m^3/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 m^3/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

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.

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 m^2 were counted, and their height, diameter and predominance were calculated.

Table No. 3.1 Plant species found in the zone of influence of the project entitled **IMPROVEMENT OF NAVIGATION ON SAN JUAN RIVER OF NICARAGUA"** (Delta – San Juan of Nicaragua).

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

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

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.

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.

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

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

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

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

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 ambigua*, 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*)

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

Piranga rubra

Mandacus candei

Jacana spinosa

Catharus ustulatus

Butorides virescens

Nighthawk (Chordeiles acutipennis)

Eggs of the Nighthawk discovered

Amazona albifrons

Bubulcus

Kingfisher

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)

Juguarundi herpailurus

Armadillo

deer

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.

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)

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

3.3.5. Birds and Reptiles.

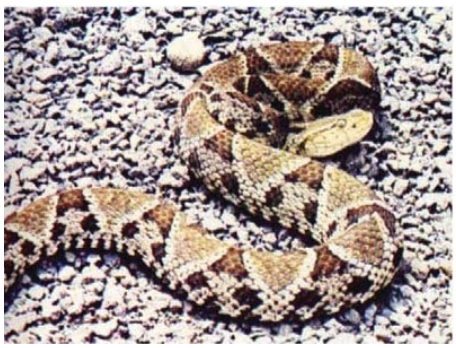
The great curassow (*Crax rubra*), and the crested guan (*Penelope purpurascens*). Less visible but very audible at night time are tinamous of at least three species *Tinamus major*, *Cripturellus boucardi* and *C. cinnamomeus*. Of particular value for tourism are the two species of parrots present in the area, *Ara macao* and *Ara ambigua*, 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)

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

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



Bothrops atrox

Basilisk

Iguana

Red frog

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	*Swietenia macrophylum*	CITES Appendix I
BIRDS:		
Clay Colored Robin	*Turdus grayi*	Nicaragua Version
Double-Striped Stone-Curlew	*Burinus bistriatus*	CITES Appendix III
REPTILES:		
Boa constrictor	*Boa constrictor*	CITES Appendix II
Green Iguana	*Iguana iguana*	CITES Appendix II
Green Iguana	*Iguana iguana*	CITES Nicaragua Version II
Black Iguana	*Ctenosaura similis*	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.

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 Procuenca-San Juan Transboundary Environmental Diagnosis (2004), in which, at the end of the research, a total of 21 families, 38 genuses 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)
Pimelo[d]idae (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 genuses 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. Pomadasyidae (Grunt)

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[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. (Procuenca-San Juan, 2004)

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), Pomadasydos (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

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.

* * *

* * *

Photo 1. Cichlidae Family.

Photo 2. Lepisosteidae Family.

Photo 3. Clupeidae Family.

Photo 4. Characidae Family.

Photo 5. Ariidae Family.

Photo 6. Pimelodidae Family.

Photo 7. Rivulidae Family.

Photo 8. Poeciliidae Family.

Photo 9. Atherinidae Family.

Photo 10. Synbranchidae Family.

Photo 11. Centropomidae Family.

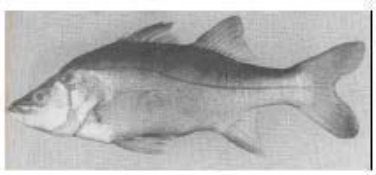

Photo 12. Carangidae Family.

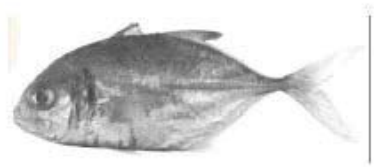

Photo 13. Gerreidae Family.

Photo 14. Haemulidae Family.

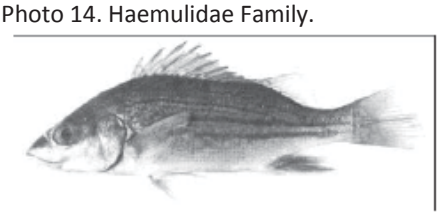

Photo 15. Mugilidae Family.

Photo 16. Gobiidae Family.

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Photo 17. Eleotridae Family.

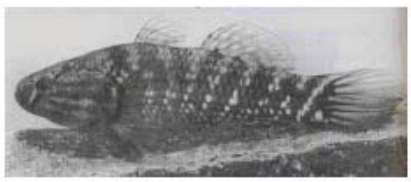
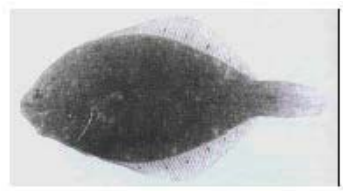


Photo 18. Paralichthydae Family.



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

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.

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.
Pimelo[d]ids: 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.

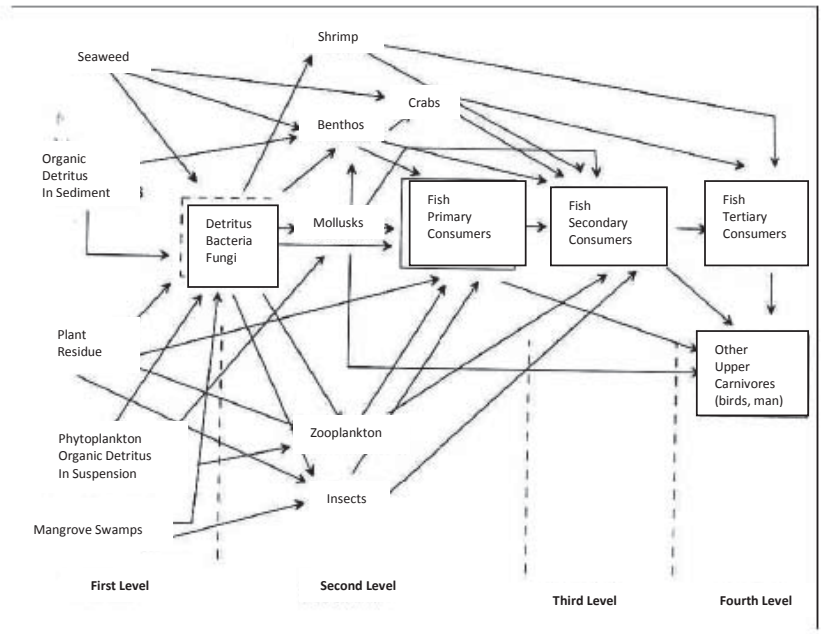


Figure 1. Graphic representation of the trophic level structures in ecosystems similar to those existing in the San Juan River. (De Pérez 1999)

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

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.

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.

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 brasilianus (Photo 25) and the grunt Pomadasys crocro (Photo 27), which confirms a total distancing of these species in the study area.

* * *

* * *

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

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

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

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 Procuenca-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.

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.

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.

* * *

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).

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.

- 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.

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**

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

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

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.

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.

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

Cause – Effect Matrix

ENVIRONMENTAL CHARACTERISTICS AFFECTED BY THE PROJECT		PROJECT ACTIVITIES								
		DREDGING STATE				OPERATIONS STAGE				
		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	ARTISAN FISHING	ENVIRONMENTAL MANAGEMENT PROGRAM
ENVIRONMENTAL FACTORS	Air Quality (gas)	BT								PP
	Air Quality Noise	GT								PT
LANDSCAPE	Landscape			GT						Gr
HYDRIC RESOURCE	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
	DBO	PT		PT	PT	PT	PT		PT	PT
	Eutrophication	PP		PP						
	Thermal Stratification	PB		PB						
	Contamination by Hydrocarbons	GT			GP	MP	MB	MP	MP	GT
FLORA	Volume Changes	GP		GP						MP
	Wetlands Vegetation			GT						GP
	Endangered Species			MT						GP
FAUNA	Benthic Communities	PT							MT	PT
	Fish Habitat	PT		GT					GT	MT
	Fish Populations	PT		GT					MP	MT
	Aquatic Mammals				GT	PP	PP		MT	MT
	Birds			GT	GP	MT	MT			PT
	Reptiles			PT						PT
ECOSYSTEMS	Wetlands			GT	GT	MB	MT			GT

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

ENVIRONMENTAL CHARACTERISTICS NEGATIVELY AFFECTED BY THE PROJECT		PROJECT ACTIVITIES								
		DREDGING STAGE				OPERATIONS STAGE				
		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
ECOLOGICAL PROGRESS	Seaboards	PT		GP	GP	MP	MP			GT
	Aquatic Food Chain	PT		GT	GT	MT	MT			GT
	Migratory Routes	GT		GT	GT	GT	MT			GT
	Diversity of Species			GP	GP	MT	MT			GT
	Protected Areas			GP	GT	MP	MP			GT
SOCIAL AND ECONOMIES	Health	GT	GT	GT	GT					GP
	Local Economy			PP	PP	GP	GP	GP	GP	GP
	Regional Economy			PT	PP	GP	GP	GP	GP	GP
	Employment		PT	PT	PT	GP	GP	GP	GP	GP
	Transport				PT	GP	GP	GP	GP	GP
	Tourism					GP		GP	GP	GP
	Quality of Life		PT	PT	PT	GP	GP	GP	GP	GP
	Public Investment	GP			MT	GP	GP	GP	GP	GP

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

IMPORTANCE MATRIX

CUTTING AND SUCTION OF MATERIALS

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

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

CUTTING AND SUCTION OF MATERIALS

	ENVIRONMENTAL CHARACTERISTICS	INTENSITY	EXTENSION	POINT IN TIME	PERSISTENCE	REVERSIBILITY	ACCUMULATION	PROBABILITY	EFFECT	TIME PERIOD	SOCIAL PERCEPTION	IMPORTANCE
ECOLOGICAL PROCESSES	Seaboards	1	2	4	4	2	2	4	4	2	1	30
	Aquatic Food Chain											
	Migratory Routes											
	Diversity of Species											
	Protected Areas											
SOCIAL AND ECONOMIES	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

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

DEPOSITION OF DREDGED MATERIAL

	ENVIRONMENTAL CHARACTERISTICS	INTENSITY	EXTENSION	POINT IN TIME	PERSISTENCE	REVERSIBILITY	ACCUMULATION	PROBABILITY	EFFECT	TIME PERIOD	SOCIAL PERCEPTION	IMPORTANCE
ENVIRONMENTAL FEATURES	Air Quality (Gases)											
	Air Quality - Noise											
LANDSCAPE	Landscape	8	2	2	4	2	4	4	4	4	4	56
HYDRIC RESOURCE	Dissolved Oxygen	1	1	4	1	1	1	4	4	1	1	22
	Water Transparency	1	1	4	1	1	1	4	4	1	1	22
	Color	1	1	4	1	1	1	4	4	1	1	22
	Ph	1	1	4	1	1	1	4	4	1	1	22
	Hardness	1	1	4	1	1	1	4	4	1	1	22
	Electrical Conductivity	1	1	4	1	1	1	4	4	1	1	22
	DBO	1	1	4	1	1	1	4	4	1	1	22
	Eutrophication	1	1	4	1	1	1	4	4	1	1	22
	Thermal Stratification Contamination by Hydrocarbons	1	1	4	1	1	1	4	4	1	1	22
FLORA	Changes in Volumes	8	4	2	4	2	4	4	4	4	4	60
	Vegetation in Wetlands	8	4	2	4	2	4	4	4	4	4	60
FAUNA	Endangered Species	2	2	2	4	2	4	4	4	4	4	38
	Benthic Communities	1	2	4	2	2	1	2	4	2	1	25
	Fish Habitat	2	2	2	4	2	4	4	4	4	4	38
	Fish Populations	2	2	2	4	2	4	4	4	4	4	38
	Aquatic Mammals											
	Birds	2	2	2	4	2	4	4	4	4	2	36
	Reptiles	1	1	1	4	2	4	4	4	4	1	29
	Wetlands	8	4	2	4	2	4	4	4	4	4	60

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

REMOVAL OF DREDGED MATERIAL

	ENVIRONMENTAL CHARACTERISTICS	INTENSITY	EXTENSION	POINT IN TIME	PERSISTENCE	REVERSIBILITY	ACCUMULATION	PROBABILITY	EFFECT	PERIOD IN TIME	SOCIAL PERCEPTION	IMPORTANCE
ECOLOGICAL PROCESSES	Seaboards	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
SOCIAL AND ECONOMIES	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 CHARACTERISTICS	INTENSITY	EXTENSION	POINT IN TIME	PERSISTENCE	REVERSIBILITY	ACCUMULATION	PROBABILITY	EFFECT	PERIOD OF TIME	SOCIAL PERCEPTION	IMPORTANCE
ENVIRONMENTAL FEATURES	Air Quality (gases)	1	1	4	4	2	4	4	4	4	4	35
	Air Quality - Noise	1	1	4	4	2	4	4	4	4	4	35
LANDSCAPE	Landscape	12	12	4	4	2	4	4	4	4	4	90
HYDRIC REOURCE	Dissolved Oxygen	1	1	4	4	2	2	4	4	4	4	33
	Water Transparency	1	1	4	4	2	2	4	4	4	4	33
	Color	1	1	4	4	2	2	4	4	4	4	33
	Ph	1	1	4	4	2	2	4	4	4	4	33
	Hardness	1	1	4	4	2	2	4	4	4	4	33
	Electrical Conductivity	1	1	4	4	2	2	4	4	4	4	33
	DBO	1	1	4	4	2	2	4	4	4	4	33
	Eutrophication											
	Thermal Stratification											
	Contamination by Hydrocarbons	8	4	4	4	4	4	4	4	4	2	62
FLORA	Volume Changes	2	4	4	4	4	4	4	4	4	2	44
	Wetlands Vegetation	8	4	4	4	4	4	4	4	4	2	62
	Endangered Species	8	4	4	4	4	4	4	4	4	2	62
FAUNA	Benthic Communities	2	1	4	4	2	2	4	4	4	1	33
	Fish Habitat	2	1	4	4	2	2	4	4	4	1	33
	Fish Populations	2	1	4	4	2	2	4	4	4	1	33
	Aquatic Mammals	2	1	4	4	2	2	4	4	4	1	33
	Birds	1	1	4	4	2	2	4	4	4	1	30
	Reptiles	1	1	4	4	2	2	4	4	4	1	30
ECOSYSTEMS	Wetlands	8	4	4	4	4	4	4	4	4	2	62
	Seaboards	8	4	4	4	4	4	4	4	4	2	62

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	EFFECT	PERIOD OF TIME	SOCIAL PERCEPTION	IMPORTANCE
ECOLOGICAL PROCESSES	Coral Reefs	8	4	4	4	4	4	4	4	4	2	62
	Marine Ecosystems	8	4	4	4	4	4	4	4	4	2	62
	Aquatic Food Chain	8	4	4	4	4	4	4	4	4	2	62
	Migratory Routes	8	4	4	4	4	4	4	4	4	2	62
	Diversity of Species	8	4	4	4	4	4	4	4	4	2	62
	Protected Areas	8	4	4	4	4	4	4	4	4	2	62
SOCIAL AND ECONOMIES	Health	8	4	4	4	4	4	4	4	4	2	62
	Local Economy	12	8	4	4	2	4	4	4	4	4	82
	Regional Economy	8	8	4	4	2	4	4	4	4	4	70
	Employment	12	12	4	4	2	4	4	4	4	4	90
	Transport	8	8	4	4	2	4	4	4	4	4	70
	Tourism	12	8	4	4	2	4	4	4	4	4	82
	Quality of Life	12	12	4	4	2	4	4	4	4	4	90
	Public Investment	12	12	4	4	2	4	4	4	4	4	90

4.2.2. Identification and Description of Environmental Impacts

4.2.2.1. Environmental Impacts on Abiotic Factors

Potential Increase of Contaminant Gases

The main contaminants that would present due to the execution of the project and the increase in navigation are: CO (carbon monoxide), Ozone (O), Nitric Oxide (NO), Sulfur Dioxide (SO_2). These gaseous contaminants succeed in dissipating into the River's environment: first because the dredge and machinery that will complete the dredging work from the river bed is temporary and second because the aquatic ships that go by are shallow draft-keeled ships and, as a result, the presence of their gases in the air is very limited time wise.

Sulfur Dioxide (SO_2): negatively affects certain groups of the population that are sensitive to these contaminants and who suffer from asthma, and it also affects children, the aged, and cardiac patients or those who have respiratory illnesses. The concentration permitted according to National Ambient Air Quality Standards (NAAQS) is 0.03ppm. However, the daily exposure limit (8 hours) is between 2 ppm and 5 ppm (15 minutes).

Carbon Monoxide (CO): CO causes harm when it bands with hemoglobin in the blood and forms carboxyhemoglobin. CO joins with the blood more rapidly than oxygen and causes poisoning. The permitted concentration is 9 ppm in an average of 8 hours. The maximum permitted is 400 ppm in 15 minutes.

Pm10: Soot, particles, ashes pulled by combustion gases or material particles. These particles cause various health and environmental impacts.

Negative health effects have been associated with various chronic illnesses including:

a) A s t h m a
b) Negative Effect on the Respiratory System (Coughing)
c) Chronic Bronchitis
d) Decrease in Lung Function
e) Premature Death

The concentration allowed is 50 g/m^3 annually and the maximum allowed is 150 g/m^3 in 24 hours.

Lead (Pb): Lead testing was carried out, resulting in a

concentration of 10.652 µg * g^{-1} for the Delta y 8.995 µg * g^{-1}, for the El Piojo Island, situated before and after the estuary of the Colorado River respectively.

These concentrations are associated with volcanic rocks dominating the entire San Juan River area in Nicaragua. Canadian Environmental Quality Guidelines for sediments present a value of 91300 µg * Kg^{-1}, that would be 91.3 µg * g^{-1}, as a probable level that may cause adverse effects to aquatic plant life in the region.

Lead is present in some types of hydrocarbons. Lead accumulates in the blood, bones, muscles and fat. The negative health effects are varied, among which the following are most prevalent:

a) Negative effect on the brain and central nervous system
b) Negative effect on the heart and blood
c) Negative effect on land and aquatic animals and on plants

Air quality is determined by measuring the levels by emission of contaminants in the atmosphere between zero and two meters in height on the surface.

The concentration permitted is 150 µg/m^3 in 8 hours and the maximum is 450 µg/m^3 in 15 minutes.

This environmental impact presents the following characteristics:

It is of low intensity; considered to be precise because it originates in the combustion site of the hydrocarbons; the permanence of the gases in the atmosphere is fleeting; it is reversible because of conditions in the area where it is located at sea level. This Impact seems to be immediate because it is inevitable. This impact is directed at protecting the health of the workers.

Environmental Measure

Prevention upon contact with these contaminants is the principal environmental measure, reason for which workers must be provided with protective work instruments.

- **Potential Increase in Noise**

The noise generated by the various dredging activities produces a direct impact. The typical activities of the dredging project and the setting into operation of the section will generate an increase in the noise, the activities being as follows:

a) Cutting and Suction of Materials.
b) Transfer of dredged material.
c) Supply of hydrocarbons and components.
d) Maintenance and repair of machinery.
e) Transfer of Dredge.
f) Moving of machinery to the removal site.

The most critical activities related to noise are those that are carried out on the dredge, with suctioning of material and the transfer of the materials being the principle sources of emission, with sound levels decreasing as distance from the source is achieved.

According to measurements of noise in similar dredging projects, levels attained on dredges in dB (decibels) fluctuate between **81 and 116 dBA**.

This environmental impact presents the following characteristics:

Noise is not cumulative, it presents itself uniquely in the sites that generate it; aquatic fauna will be negatively affected for a very limited period of time, due to the fact that its permanence at that point in time is fleeting; it is considered of low importance and precise, reversible. This impact appears in an immediate and inevitable manner. The environmental measure to be applied is a preventative one.

Environmental Measure

The people who work near the motors in the dredging and transportation embarkations must use protective earphones in order to avoid auditory lesions.

4.2.2.2. Environmental Impacts on the Scenic Element

- Characterization of the deposit sites

DEPOSIT SITE Nº 4
Coordinates: 207,335 and 1,206,800.
Water Table is at 0.20 meters.
Coordinates of the riverbank: 207,370 and 1,206,801
Height of the shore: 1.10 meters.

Remarks:

This deposit site is 25% clean, only covered with grass, *gamalote*, and 75% of the area is covered with brush such as bramble and *zacate gamalote*. On the site there are areas covered with water, and mud with a maximum depth of 0.30 mts. This site is considered viable for the deposit siteing of the materials because it is very wide and there is no effect on noble wood trees, the test was performed 50 meters from the riverbank.

DEPOSIT SITE Nº 5
Coordinates: 207,297 and 1,205,292.
Water Table is at 0.50 meters.
Coordinates of the riverbank: 207,319 and 1,205,330

Remarks:

In this deposit site the first twenty meters of the riverbank contains some trees, but after that belt the vegetation is brush, yolillo palms, and royal palm on the part of the land plant material can be seen such as rotten trees, leaves, and waste. This site is considered viable for the deposit siteing of the materials because it was determined that there are almost no noble wood trees. We recommend that when cleaning the area the trees that are in the belt or shore within twenty meters from the river not be touched.

Name of the owner of the area: CALIXTO

DEPOSIT SITE Nº 6
Coordinates: 208,119 and 1,204,480.
Water Table is at 0.90 meters. Height of the riverbank is 1.10 meters
Coordinates of the riverbank: 208,157 and 1,204,469

Remarks:

This area is clean, toward the back it is covered by wild plants such as yolillo palms and there are some low-quality shrubs, the state of the soil is moist because of the winter season. The test was performed 50 meters from the riverbank.

Name of the owner of the area: CANDIDO ROCHA LÓPEZ

DEPOSIT SITE Nº 7
Coordinates: 207,921 and 1,204017
Water Table is at 0.80 meters. Height of the riverbank is 1.00 meter
Coordinates of the riverbank: 207,917 and 1,204,015

Remarks:

This deposit site is clean, covered with brush. This area is at the end of Isla Taura.

Name of the owner of the area: DANIEL REYES GONZALES

DEPOSIT SITE Nº 8
Coordinates: 207,690 and 1,202,512
Water Table is at 0.80 meters. Height of the shore is 1.30 meter
Coordinates of the riverbank: 207,728 and 1,202,461

Remarks:

This area is clean [as] it seems to be waste ground, there is only *zacate* and some trees that are rotting. The area or site is considered viable for the deposit siteing of the materials because the soil is stable and there is only winter moisture. The test was performed 50 meters from the riverbank.

DEPOSIT SITE Nº 9
Coordinates: 207,388 and 1,201,104
Water Table is at 0.75 meters and height of the riverbank is 1.00 meter
Coordinates of the riverbank: 207,435 and 1,201,082

Remarks:

This area is covered with brush such as bramble and small bushes, the area is very clean. The test was performed 50 meters from the riverbank, that area is considered suitable for the deposit siteing of materials.

Name of the Owner of the Site: CALIXTO.

DEPOSIT SITE Nº 10
Coordinates: 207,830 and 1,199,568
Water Table: No water was found and height of the riverbank is 1.30 meters.
Coordinates of the riverbank: 207,872 and 1,199,581

Remarks:

This area is clean, there are no trees just natural *zacate.* The site was observed to be stable and is found near a block that they play baseball [sic]. The test hole was deepened to 1.00 meter and no water table was found. There is no effect on trees and the soil is stable.

Name of the Owner of the Site: JOSE GOMEZ

DEPOSIT SITE Nº 11
Coordinates: 208,530 and 1,198,140
Water Table: Not found and drilling went down to 1.00 meter.|
Coordinates of the riverbank: 0208566 and 1198164

Remarks:

This area is semi-clean, with few trees and there are trees that at an unspecified time were moved and now are in the process of rotting. There are some small areas that have water an average of 0.50 meters deep. No water table was found in the area where the test drilling was performed and drilling went down to 1.00 meter. The area is considered viable

for the deposit siteing of materials because there is no effect on trees and the soil is stable.

Name of the Owner of the Site: ALEJANDRO REYES

DEPOSIT SITE Nº 12
Coordinates: 208,653 and 1,196,601
Water Table: Not found and drilling went down to 1.00 meter.
Coordinates of the riverbank: 208,691 and 1,196,570
Height of the shore is 1.70 meters.

Remarks:

The soil is stable in this area, the height of the riverbank is 1.60 meters and the test hole was drilled 50 meters from the riverbank. The site is considered viable for the deposit siteing of materials because there is no effect on the flora.

Name of the Owner of the Site: SOCORRO LOPEZ

DEPOSIT SITE Nº 13
Coordinates: 205,974 and 1,194,360
Water Table: 1.20 meter.
Coordinates of the riverbank: 205,997 and 1,194,322
Height of the shore is 1.80 meter.

Remarks:

The soil in this area is dirty or dense with growth with very high *zacate* and with some downed trees that are rotting. No ponds are seen on the site just winter moisture and the soil is stable. The site is considered viable for deposit siteing because no trees are affected; the test hole was drilled 50 meters from the riverbank.

Name of the Owner of the Site: RODOLFO LEIVA

DEPOSIT SITE Nº 14
Coordinates: 203,642 and 1,194,480
Water Table: 0.90 meter.
Coordinates of the riverbank: 203,655 and 1,194,439
Height of the shore is 1.80 meters.

Remarks:

The soil on this deposit site was found to be semi-dense with growth, there are some trees but not many, the site is very good as a deposit site because no trees are affected, the test hole was drilled 50 meters from the riverbank.

Name of the Owner of the Site: RICARDO SALINAS MENDOZA

DEPOSIT SITE Nº 15
Coordinates: 202,287 and 1,193,890
Water Table: Not found and drilling went down to 1.00 meter.
Coordinates of the riverbank: 202,317 and 1,193,858
Height of the shore is 1.20 meters.

Remarks:

In this area the soil is clean, there are almost no trees just some grass or *zacate* for livestock and the test hole was drilled 50 meters from the riverbank. The site is considered excellent for deposit siteing because there is no effect on the flora.

Name of the Owner of the Site: SILVIO REYES

DEPOSIT SITE Nº 16
Coordinates: 200,825 and 1,193,380
Water Table: Not found and drilling went down to 1.00 meter.
Coordinates of the riverbank: 200,824 and 1,193,321
Height of the shore is 1.50 meters.

Remarks:

In this area the soil is clean, there are almost no trees just some grass or *zacate* for livestock and some downed trees that are rotting and the test hole was drilled 50 meters from the riverbank. The site is considered very good for deposit siteing because there is no effect on the flora.

Name of the Owner of the Site: RUBEN REYES

DEPOSIT SITE Nº 17
Coordinates: 199,939 and 1,193,148
Water Table: 1.00 meter.
Coordinates of the riverbank: 199,946 and 1,193,095
Height of the shore is 1.20 meters.

Remarks:

In this area the soil is clean and there is only *zacate* for livestock. The site is considered suitable for deposit siteing because there is no effect on the flora. The test hole was drilled 50 meters from the riverbank.

Name of the Owner of the Site: FELIPE ESPINOZA

DEPOSIT SITE Nº 18
Coordinates: 198,088 and 1,192,574
Water Table: 0.70 meter.
Coordinates of the riverbank: 198,082 and 1,192,539
Height of the shore is 1.20 meters.

Remarks:

This area has brush or dense growth of *zacate* and some grass 1.80 meters high. The site is considered very good for deposit siteing because there is no effect on the flora.

Name of the Owner of the Site: GREGORIO CHAMORRO.

DEPOSIT SITE Nº 19
Coordinates: 1,97567 and 1,192,399
Water Table: None
Coordinates of the riverbank: 197,581: 1,192,353
Height of the shore is 1.50 meters.

Remarks:

This area was 40% clean and 60% with brush. The site is considered very good for deposit siteing because there is no effect on the flora. The test was performed 50 meters from the riverbank.

Name of the Owner of the Site: DELTA MIGRACION MARENA

DEPOSIT SITE Nº 20
Coordinates: 197,136 and 1,192,453
Water Table: 0.93 meters.
Coordinates of the riverbank: 197,123 and 1,192,407
Height of the shore is 1.00 meter.

Remarks:

This area has stubble with a lot of brush and some trees. The site is considered very good for deposit siteing because there is no effect on the flora. The test was performed 50 meters from the riverbank.

Name of the Owner of the Site: PUBLIC PROPERTY.

DEPOSIT SITE Nº 21
Coordinates: 196,116 and 1,192,575
Water Table: None
Coordinates of the riverbank: 196,108 and 1,192,533
Height of the shore is 1.00 meter.

Remarks:

This area has *zacate* very mottled. The site is very good for the deposit siteing of the materials. The test hole was drilled 50 meters from the riverbank.

Name of the Owner of the Site: PUBLIC PROPERTY.

DEPOSIT SITE Nº 22
Coordinates: 194,120 and 1,191,953
Water Table: 0.70 meters.
Coordinates of the riverbank: 194,120 : 1,191,953
Height of the shore is 1.00 meter.

Remarks:

This area is very protected with *zacate gamalote* and very dense with growth. The test was performed 27 meters of the riverbank.

Name of the Owner of the Site: PUBLIC PROPERTY.

DEPOSIT SITE Nº 23
Coordinates: 190,543 and 1,190,095
Water Table: None
Coordinates of the riverbank: 190,544 : 1,190,046
Height of the shore is 2.50 meters.

Remarks:

This area has bamboo and some trees such as trumpet-wood and other bushes. The site is considered very good for deposit siteing, no mud was seen. The test hole was drilled 50 meters from the riverbank.

Name of the Owner of the Site: PUBLIC PROPERTY.

DEPOSIT SITE Nº 24
Coordinates: 189,925 and 1,189,898
Water Table: None
Coordinates of the riverbank: 189,952 and 1,189,851
Height of the shore is 1.00 meter.

Remarks:

In this area there are only very dense brush, there are no noble wood trees just bushes and brush. The site is considered viable for deposit siteing because there is no effect on the flora. The test was performed 50 meters from the riverbank.

Name of the Owner of the Site: PUBLIC PROPERTY
Chingo Petaca area.

Regarding the poles that were erected in the riverbed, they were installed 500 meters away from each other, and in almost all of them were inserted to a depth of 3.00 meters down from the riverbed.

The material that predominates is fine to coarse sand with some gravel, solid pebble-size grains, and silt, in some places where the polls were inserted, medium to high plasticity clay was found at depths of 2.70 meters and more, and the clay material was considered somewhat sticky because of its wetness and plasticity.

It was observed at some points in the San Juan River that pieces of wood were sticking out above the surface, and some were located within the sandy material or in the riverbed.

Some points were also detected where small and large stone enclosures existed, and these points were located with coordinates.

The sandy materials are considered to be moderately loose and some sand samples were considered to be a semi-soft to semi-hard because it included some coarse and silty particles and the sand was more accommodating.

It should also be considered that when the river has strong currents it drags stones from one area to other points, small to medium stones, stones with solid, round characteristics. It was noted that some locations in the area had been cleared or cut along the banks of the river, leading to erosion by the semi-strong currents, and the vegetative material or natural soil (clay) is considered to be part of the sediments carried by the river and at the times when the river flow decreases the sediments accumulate in the areas where there are no currents or in the areas of calm water.

There are areas needing reforestation because although there appears to be somewhat thick flora, in reality a closer look reveals that there are only a few trees which are considered to have hardwood and the better part is comprised of weeds or soft wood trees, which grow fast but reach a certain height and lay down or break. These areas should be forested with hardwood and that guardians remain in the area to ensure that the trees grow clean and healthy.

* * *

Impacts on the landscape, fauna and soil (deposit sites)

The landscape and soil will be affected because of the elimination of the existing herbaceous vegetation existing in some of the locations selected as deposit sites for the dredged material.

In the same way, the fauna that lives on this vegetation will be affected temporarily by the elimination of their source of nourishment, reproduction, and shelter.

This environmental impact presents the following characteristics:

It is considered of high intensity, compensable, produces a targeted effect, with temporary permanence, of immediate manifestation, and the restoration will bring benefits to the environment.

Environmental Measure

The deposition of materials produced by the dredging of the river will be located in pre-selected confined sites near the dredging area. The thickness of the debris should range between 1-2 meters (according to the table presented below), in order to create a flat structure, this arrangement and vegetation will improve the landscape and bring food and shelter for the wildlife of the area, and as such the impacts caused by the dredging will be minimal and with the restoration program will improve the equilibrium of the affected ecosystem. Taking into account the climatic conditions in the project area, which tropical and humid with high precipitation, natural and artificial regeneration will recuperate quickly with the fauna and the wind as carriers of seeds, and to prevent the return of the soils to damage the riverbed.

With the implementation of the vegetation restoration program in the deposit areas with tree and shrub species native to the moist tropics that characterize this project area, in a short time (9 months) the conditions in these areas will be observed to have improved, in light of the combination of the colors of the vegetation and the different species used, which will give the right texture to the landscape.

Relevant safety measures must be taken regarding the populations living around the deposit sites at the time of the deposit of the debris. A very detailed work plan must be prepared regarding the deposit sites in order to warn people enough in advance and to establish which measures should be taken.

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

Below a table is presented with the deposit sites, their areas, the estimated volume to be deposited in each one of them and the maximum height permitted.

Stretch/Site	Site Number	Estimated Volume to be to be Deposited	Avg. Height for Deposit	Area for Deposits	Length of Site for Deposits	Capacity Volume
TRAMO/BOTADERO	**BOTADERO NUMERO**	**VOLUMEN ESTIMADO A DEPOSITAR M^3**	**ALTURA PROMEDIO PARA DEPOSITO (M)**	**ÁREA PARA DEPOSITO**	**LONGITUD DE BOTADERO PARA DEPOSITO (M)**	**CAPACIDAD DE VOLUMEN. (M3).**
PETAKA - DELTA		24,500.76				
Petaka, AREA PUBLICA.	**# 24**		**1.00**	**46,742.00**	**292.00**	**46,742.00**
Delta 3, AREA PUBLICA	**# 23**	**14,028.23**	**2.00**	**8,437.00**	**88.00**	**16,874.00**
Delta 2, AREA PUBLICA	**# 22**	**6,459.40**	**2.00**	**2,772.00**	**70.00**	**5,544.00**
Delta 1, AREA PUBLICA	**# 21**	**2,435.85**	**2.00**	**1,583.30**	**125.00**	**3166.00**
Delta (EJERCITO)	**# 20**	**1,577.28**	**2.00**	**1,025.23**	**125.00**	**2,050.00**
SUB-TOTAL:						74,376.00
DELTA - SAN JUANILLO		812,810.75		422,661.59		
GREGORIO CHAMORRO	**# 19**	**36,559.50**	**2.00**	**13,667.00**	**80.00**	**7,334.00**
FELIPE ESPINOZA	**# 18**	**60,085.95**	**2.00**	**37,537.98**	**326.00**	**75,074.00**
RUBEN REYES	**# 17**	**26,063.03**	**1.00**	**363,801.00**	2,415.00	363,801.00
SILVIO REYES	**# 16**	**73,687.69**	**1.00**			
RICARDO SALINAS	**# 15**	**56,139.01**	**2.00**	**13,045.00**	**226.00**	**26,090.00**
EL JOBO, DARIO SANCHEZ	**# 14**	**87,547.91**	**2. 00**	**16,850.00**	**247.00**	**33,700.00**
SOCORRO LOPEZ	**# 13**	**141,480.72**	**1.00**	**63,283.00**	**509.00**	**63,283.00**
ALEJANDRO REYES	**# 12**	**47,693.17**	**1.00**	**135,019**	**648.00**	135,019.00
EL ZAPOTAL 2	**# 11**	**32,585.94**	**1.00**	**192,571.00**	**1,653.20**	192,571.00
EL ZAPOTAL, JOSE GOMEZ	**# 10**	**62,557.36**	**2.00**	**33,218.27**	**300.00**	**66,436.00**
CALIXTO	**# 9**	**57,167.77**	**1.00**	**102,941.00**	**738.00**	102,941.00
NOEL CASTILLANO	**# 8**	**41,022.46**	**2.00**	**14,979.00**	**243.00**	**29,958.00**
DANIEL REYES	**# 7**	**51,462.30**	**2.00**	**94,092.00**	**534.71**	188,184.00
CHEPE HUEVO	**# 6**	**38,757.94**	**2.00**	**8,372.00**	**139.00**	**16,744.98**
SUB-TOTAL:						1,301135.98
SAN JUANILLO - BOCANA		19,919.23		11,868.14		
COME MONO	**# 5**	**3,314.11**	**1.00**	**39,404.00**	**512.00**	**39404.04.00**
JUAN POPA	**# 4**	**4,318.59**	**1.00**	**110,532.00**	**847.00**	**110,532.00**
ISLA	**# 3**	**1,944.73**	**2.00**	**14,579.00**	**331.02**	**14,579.00**
	# 2	**2,039.01**	**2.00**	**12,766.00**	**309.86**	**12,766.00**

TRAMO/BOTADERO	BOTADERO NUMERO	VOLUMEN ESTIMADO A DEPOSITAR M^3	ALTURA PROMEDIO PARA DEPOSITO (M)	ÁREA PARA DEPOSITO	LONGITUD DE BOTADERO PARA DEPOSITO (M)	CAPACIDAD DE VOLUMEN. (M3).
	# 1	8,302.80	1..00	79,022.00	716.58	79,022.00
SUB-TOTAL :						256,303.00
BOCANA - SAN JUAN DE NIC.		114,336.72		37,159.43		
	SIN UBICAR	114,336.72	4.00	37,159.43	350.00	
TOTAL VOLUMEN		971,567.46		487,614.65		1780,452.70

- **Changes in Surface Drainage**

The widening of the navigation channel may require a greater flow of water in areas adjacent to the channel, increasing the speed of superficial flow at times of greater precipitation.

This environmental impact presents the following characteristics:

It is of low importance, not significant, of short duration, direct, appears immediately, and is inevitable.

Environmental Measure

The proposed environmental measure is compensatory in nature; it becomes necessary to increase superficial flow retention by implementing a revegetation program in the disposal sites using species that are typical of the humid tropical ecosystem.

4.2.2.3. Description of the Impacts on the Water Quality Factor

Physico-chemical Parameters

- **Dissolved Solids, Conductivity, Temperature, Transparency, Turbidity, pH**

The conductivity of the water is related to the total dissolved solids in the water, the concentration of solids varies according to the time of year, it is assumed that with the first heavy rains (June) the majority of dissolved, suspended, and sedimentable solids run into the water. No significant difference was found between the contents of solids in the waters of the San Juan River before the stretch to be dredged nor in that stretch. It is therefore considered that the contribution of dissolved solids towards the stretch does not represent a negative impact of the dredging activities.

The consequence will be the removal of sediments from the bottom of the riverbed being dredged, however the particle size data generated in the project do not present a high presence of fine materials that may be suspended in the water during the activity. Only in the stretch near Punta Petaca was a clay-loam material found, which could increase the amount of suspended solids in the water during the dredging. However, the suspension of the finer material will be beneficial for the settlement of benthic communities, once they settle within the dredged section of the River.

The time for recovering the physico-chemical parameters of the water will depend on the dredging time. Transparency, color and turbidity depend on the quantity of solids suspended in the water, which are considered insignificant because of the size of the grains (sand).

Heavier sediments such as gravel and sand settle quickly, but the fine sediments such as clay and silt stay in suspension. These fine sediments are transported by currents and waves covering large areas, some studies have reported sediment plumes of up to 5 square kilometers (Mortion, 1977), generating turbidity and resulting reduction in the penetration of the light necessary for the processes of photosynthesis and changes in radiant heat. Turbidity is the most important physical change generated on water quality (Goodwin and Micaelis, 1984).

Benthic and planktonic organisms will be affected by this removal, the first by being on the riverbed and later by increasing turbidity, however there was little density of these species of organisms in the San Juan River and in the section to be dredged, first because bottom sediments are not a suitable substrate for the settlement of species, and secondly because the nutrient supply is low, as greater input of nutrient loading to the San Juan River was transported by the tributaries of Boca de Sábalos, Santa Cruz, and Melchora. This input of nutrients will be beneficial for the section to be dredged because the low diversity of species is attributed to a lack of food for the primary and secondary organisms of the food chain.

Increased turbidity in the water is fleeing, and it is defined by the time of the dredging and the velocity of the current. Once the depth of the river is increased, the speeds at the bottom of the column are smaller because of reduced wind influence. Therefore, the fine particles will settle to the bottom and begin the colonization by benthic organisms and the consequent effect on the food chain.

Fuente S. reports an oxygen saturation percentage of 90% in the delta of San Juan, therefore, the entry of water with high concentrations of DO to the dredging area will benefit the development of organisms.

This environmental impact presents the following characteristics:

These impacts are of low intensity, are located along the project because its permanence in time is fleeting, is recoverable in the short term, its impact is inevitable and positive for benthic and planktonic organisms because of the deposition of increased nutrients and silty materials.

Ionic Content

The ionic content in the San Juan River is within the range permissible for human consumption, however there are times when sulfates exceed these limits. The concentration of sulfates will depend on the time of the dredging, as they present higher levels primarily during the onset of the rainy season; however, although they are on the standard, they are still within the allowed maximum, because of which it is assumed that the impact to water quality in terms of ionic content is not significant. On the other hand, the iron content found along the San Juan and in the section to be dredged exceeds water quality standards, indicating that the contribution of this cation from the San Juan River will not adversely affect the section to be dredged.

This environmental impact presents the following characteristics:

It is considered of low intensity, is located along the channel, has fleeting permanence, indirect effect, and is inevitable.

Contaminants

The presence of heavy metals in sediments was evaluated as one of the potential risks for water contamination in the section to be dredged as well as the groundwater of the deposit sites.

Heavy metals were found to be below the Canadian limit and the CAPRE limit for water quality, therefore it represents a low effect on the water quality of the river, and the contribution of heavy metals is a problem of the volcanic lands of the whole territory.

The contribution of pesticides toward the dredging area from the main current of the San Juan River will be increased if the dredging is done at the time of heavy rain (June) from the basin, where it has the largest concentration

of pesticides; after these rains the concentrations of pesticides in the water of the River decrease.

Change in pH

The water's pH is affected because this physical parameter is a function of the dissolved CO_2 and is intimately linked to photosynthesis and respiration. Both parameters will be affected by dredging activity (by particles in suspension), for which a light negative effect can be expected on the dredging site (Channel) and toward those sites that are going to be influenced by the River's current.

This environmental impact presents the following characteristics:

It is of low magnitude, short duration and is reversible and inevitable.

Changes in Water Hardness

Changes in water hardness are due to the release of some compounds that are found in the sediments that will be released by the cutting-suction action, as well as by the effects of the removal of the dredged material.

This environmental impact presents the following characteristics

The potential impact is of low importance, in view of the fact that the dredging activity is not constant; its duration is short; its effect will be possible according to the time of sedimentation; it is a mitigable impact on removal sites.

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4.2.2.3. Description of the Impacts on the Water Quality Factor

During the dredging, it will be possible for changes to be produced in the nutrients and rate of water renewal in the area of the dredging, habitat destruction due to the removal of soil, increased turbidity (more sediment in suspension), changes in temperature, which can be intolerable for many species that live in the area.

Similarly, the suspension of bottom sediments during and after the dredging produces an enrichment of the nutrients present in the water column, which can lead to the presence of more species and hence a greater demand for oxygen.

This environmental impact presents the following characteristics:

It is considered high intensity over the course of the river, by extension the impact is total, immediate, fleeting, short-term, reversible, and with direct effect. Once recuperated, it will bring positive effects for the recovery of the primary productivity of benthic algae and other organisms that serve as nutrients in the food chain. Similarly, it will facilitate the communication of species that combine their life cycle between the sea and the river.

Mitigation measures for fish

Special care should be taken in the areas near the mouth of the San Juan River, which forms the estuary with the sea, as it is responsible for the regeneration of the local biota and a large number of organisms that are part of the food chain.

Do not use areas near the mouth of the San Juan and San Juanillo for the depositing of materials.

Maintain strict control in the management of fuel to avoid spills.

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V. Risk and Vulnerability

According to the zone's characteristics, two types of risks have been identified to which the population of the area is subject:

Along the entire trajectory of the section to be dredged, it was seen that the entire riverbank of the river, on both the Nicaraguan and Costa Rican sides, constantly collapses due to the passage of currents related to heavy rain. The strong effect of the elements on the surrounding rock 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.

Collapse of the riverbanks:

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.

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 the porous 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.

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VI. ENVIRONMENTAL MANAGEMENT PROGRAM

6.1 General Outlines.

The Environmental Management Plan for aquatic communication channels are fundamental for the socioeconomic development of the towns that are close to this hydric body. Internal as well as external commerce depends on these channels.

The management of this sector with sustainability criteria involves a series of features that are necessary to implement such things as: System's capability, productivity, stability, conservation of soil and water resources, economic viability, social acceptability, diversification and reduction of risks, continuity and social stability.

The Present Environmental Management Plan has been prepared to strengthen development plans and economic development strategies that are being promoted in all sectors of the department; in this manner they are incorporated into the environmental dimension in the development process for the handling, protection and benefit of natural resources.

In the case of the present plan, the environmental feature has been incorporated into the dredging project for the "**IMPROVEMENT TO NAVIGATION IN THE SAN JUAN RIVER IN NICARAGUA**" (San Juan Delta in Nicaragua) in order to establish adequate conditions of depth of the San Juan River in Nicaragua for greater volume that may facilitate the optimal operation of aquatic ships that travel along this stretch and be able to prevent anticipated environmental impacts. On the other hand, considering that the project is sub aquatic, i.e. in the river bed, the anticipated environmental impacts will be minimal. As a matter of fact, the mitigation and restoration works will improve environmental conditions on both sides of the river bank.

6.2 Objectives

General Objectives

Helping to prevent, minimize and compensate for the environmental effects caused by dredging for the "**IMPROVEMENT TO NAVIGATION IN THE SAN JUAN RIVER OF NICARAGUA**" (Delta to San Juan de Nicaragua).

Specific Objectives

Evaluating the various project activities in order to minimize (negative) environmental repercussions.

Proposing viable alternatives in accordance with the negative effects identified in order to prevent, control or mitigate these impacts directed at human beings, on flora and fauna, on the soil, the air, water and climate, and on the project itself.

Foreseeing any possible environmental activity that may harm the project and effects of the project on the environment.

Succeeding in maintaining the physical integrity of the workers as well as of the citizens who live in the area that is directly affected, as a result of the occurrence of unforeseen phenomena in the design and construction of the work.

To fulfill the objectives of the present plan it is necessary to develop four programs that complement each other:

Environmental Supervision and Control Program

Contingency Program

Environmental Education Program

Restoration Program

Objectives

General Objective

Identifying the appropriate environmental activities in order to attain the goals of the project in harmony with the environment.

Specific Objectives

Foreseeing any environmental damage resulting from the activities of the dredging project.

Identifying those responsible for follow-up of the various programs contained in the Environmental Management plan.

Maintaining the Physical Integrity of the project workers and of the citizens who live in the project's area of influence and who make use of the navigation channel.

Developing a contingency program in the face of unforeseen eventualities.

Designing an environmental supervision and monitoring program in order to ensure the adequate application of environmental measures proposed in order to prevent damage to the environment as a result of the project's activities.

6.3 Environmental Supervision and Monitoring Program

This program seeks to establish indicators to guarantee the development of the project without causing damage to the environment and its users. Moreover, it identifies the person responsible for directing the activity and the person responsible for environmental supervision.

Moreover, it also seeks the following:

1. To verify environmental impacts that are difficult to predict in a first round. (**Residual impacts**).

2. It seeks to detect changes that are not taken into account in the present environmental study.

The follow-up of the incidences will permit an "**ex-post**" evaluation, once a reasonable period of time has passed, to see in what way forecasts are fulfilled and if it is necessary to adopt new corrective measures.

The matrix found on the following page describes the environmental supervision and control plan necessary for the dredging project.

The contractor company performing the project and the owner of the same must notify the competent authority (**MARENA**) [Ministry of the Environment and Natural Resources of Nicaragua] of the Name of the environmental supervisor, in order for the same to be included in project's journal.

PROJECT ACTIVITY	SUPERVISION AND CONTROL ACTIVITY	INDICATORS	RESPONSIBLE PARTY	ENVIRONMENTAL SUPERVISOR
CUTTING-SUCTION OF MATERIALS	Evaluating Physical, Chemical parameters (Dissolved oxygen, turbidity, color, pH, Electrical conductivity, Nitrate, Nitrite, Phosphorous, DBO [Biochemical Oxygen Demand]).	Samples of water for Physical-Chemical analysis – Must make 2 each day. Physical – Chemical samples are made at the site by portable field instruments, except BOD samples must be made in a satisfactory laboratory, every 1,000 meters	**CONTRACTOR**	
	Evaluating the quality of the sediments to be dredged in reference to its granulometry.	Evaluations must be performed with the appropriate instruments on the same dredging ship.	**CONTRACTOR**	
	Evaluating compliance with Occupational Hygiene, Health and Security Standards.	Workers must be provided with protective gear in accordance with MITRAB [Ministry of Work] regulations.	**CONTRACTOR**	
TRANSFER OF DREDGED MATERIAL	Placing visible, luminous signs to prevent accidents,	The signs must be placed 50 meters apart on the tubing; luminosity must be yellow in color and revolving.	**CONTRACTOR**	
REMOVAL OF DREDGED MATERIAL	Evaluating Physical – Chemical parameters (Dissolved oxygen, turbidity, color, pH, Electrical conductivity, Nitrate, Nitrite, Phosphorous, BOD).	Two daily water samples for Physical – Chemical analysis must be made. Physical – Chemical samples are completed at the site by portable field instruments, except the BOD samples must be completed in a satisfactory laboratory, every 1000 meters.	**CONTRACTOR**	
	Evaluating sediment to be dredged and its granulometry.	Evaluations must be completed with appropriate equipment in the same dredging ship.	**CONTRACTOR**	
	Determining and evaluating the direction of the superficial flow.	In order to avoid erosion and sedimentation of dredged material, the site must not be under the influence of currents of water.	**CONTRACTOR**	
REMOVAL OF DREDGED MATERIAL	Evaluate compliance with occupational hygiene, health and security regulations	Workers must be provided with protective gear in accordance with existing MITRAB Regulations.	**CONTRACTOR**	

PROJECT ACTIVITY	SUPERVISION AND CONTROL ACTIVITY	INDICATORS	RESPONSIBLE PARTY	ENVIRONMENTAL SUPERVISOR
STORAGE AND SUPPLY OF HYDROCARBONS	Evaluating the operations for maintenance of ship's motors.	Lubricant wastes must be gathered in metal barrels. Wastes must be transported outside of the project area in order to be eliminated.	**CONTRACTOR**	
	Evaluating fuel supply operations.	Fuel spillage on the cover and on the river's water must not be allowed.	**CONTRACTOR**	
	Evaluating storage of hydrocarbons.	Storage must be in double-walled barrels. The barrels must be secured with chains to fasten them and for the prevention of accidents.	**CONTRACTOR**	
ENVIRONMENTAL MANAGEMENT PROGRAM	Constructing filling with debris materials to be used.	The position of the filling must be located close to the dredging site and parallel to the river's current at a distance of 50 meters from the bank.	**CONTRACTOR**	
	Evaluating signaling implements to avoid accidents.	Visible signs consisting of pennants must be located in the work areas on both sides of the river, at the beginning, middle and end. In order to avoid dangers of navigation during the night hours, luminous signs must be erected.	**CONTRACTOR**	
	Evaluating plant material that is going to be used.	Perfectly healthy forest seedlings to be used in the revegetation program must be 0.50 meters high or more.	**CONTRACTOR**	
	Evaluating sowing of vegetative material.	The seedlings must be sown 3.0 meters apart among low seedlings, in a staggered manner. Controlling the extent to which the plants take root, 15 days after initial sowing, replacing the material that may not have taken root.	**CONTRACTOR**	

CONTROL ACTIVITIES	FREQUENCY OF PERFORMANCE	PERSON IN CHARGE
Measurement of water's Physical – Chemical parameters in the cutting-suction site.	Daily samples while dredging lasts.	CONTRACTOR
Measurement of BOD in the Cutting-Suction site.	Every 500 meters, on a daily basis, while dredging lasts.	CONTRACTOR
Measurement of Physical – Chemical parameters at the site where the dredged material is to be deposited.	2 samples a day while dredging lasts.	CONTRACTOR
Measurement of the soil's behavior at the site where the dredged material is to be deposited.	At each deposit site, 24 hours after.	CONTRACTOR
Measurement of the embankment conformed to the dredged material	During the deposit process	CONTRACTOR
Measurement of debris' granulometry.	Before starting deposit operations for the dredged material.	CONTRACTOR
Confirmation that tasks of depositing of dredged material comply with environmental management plan specifications.	Before starting deposit operations for the dredged material, vegetation to be eliminated is evaluated.	CONTRACTOR
Confirmation that seedlings comply with size specifications provided in the revegetation program.	Before starting to sow seedlings.	CONTRACTOR
Confirmation that specifications for the sowing of seedlings are being complied with.	At the time of sowing of seeds.	CONTRACTOR
Evaluating the status of seedlings taking root.	60 days after sowing.	CONTRACTOR

6.5 Landscape Restoration Program

Overview

The restoration program will consist of the performance of a series of environmental works such as: the set up of the dredged material at the 22 dump sites, extending them to a height of one meter and applying a 10-centimeter thick fertile soil layer.

Planting of trees and shrub species on both banks of the river, forming a vegetable network to anchor the soil and prevent erosion, improve the landscape, and at the same time enrich the vegetable component so that it can serve as a refuge and food source for the fauna and, in this manner, ensuring that the works do not greatly affect the natural environment, the sanctuary areas and the project itself. Some of the areas of the Refugio are severely degraded by human activities and incipient agricultural activities.

Autochthonous vegetation will be used for landscape design and ornamentation to ensure that the plants take root and grow, in order to fulfill the proposed objective of restoration of the areas affected by the environmental impact of the project. This restoration plan is considered within the general plan for the section (Delta – San Juan de Nicaragua).

The restoration area has been ascertained by taking the indirect area of influence, which is 100 meters on either side of the river, as a parameter. That is to say, 200 meters by 42 kilometers in deforested areas, which gives us approximately 320 hectares. The seedlings will be planted at a distance of 3 by 3 meters, i.e. 1,100 seedlings per hectare for a total of 352,000 tree and bush seedlings of forest fruit species that will feed the wildlife fauna of mammals, birds and insects with vegetable nectar, pollen and fruit. Planting the following species is recommended:

Mahogany *(Swietenia macrophylla)*, Guarumo *(Cecropia peltata)*, Laurel *(Cordia alliodora)*, Cedar *(Cedrela odorata)*, Palo de Agua *(Vochysia hondurensis)*, Almond *(Pipterix deifera)*, Sotacaballo *(Zygia longifolia),* Jocote jobo *(Spondias Bombin)*, Areno *(Macrohasseltia macroterantha),* Cativo *(Pria copaifera),* Sebobanak *(Virola sebifera)*, Gavilan *(Pentalethra macroloba),* Santa María *(Calophyllum brasiliense),* Pochote *(Pachir acuática Aubul)*, Guayabo de Charco *(Guettarda combassi)*, Capirote *(Miconia tomentosa),* Hombre Grande *(Quassia amara),* Kerosen *(Tetragastris panamensis),* Sangregado *(Pterocarpus officinalis),* Lagarto *(Zanthxylum panamense),* Guava *(Psydium guajava*), Manga Larga *(Xylopia frutescens)*, Medlar *(Manilkara chicle),* Pronto Aliviio *(Guarea grandifolia)*, Icaco *(Chrysibakanus icaco)*, *Cuajiniquil (Inga vera spuria)*, Jicarillo *(Alibertia edulis),* Coconut *(Coco nucifera)* Capirotes *(Miconias Sp)*.

Planting of mangrove

Planting is done manually during the rainy season, following a triangular planting method with an average separation of 2.5 m x 2.5 m, resulting in 1,600 seedlings per hectare. According to Lewis and Streever (2000), a mortality rate of 50% is to be expected, with replanting later to achieve a closed forest. The typical density of a mature mangrove forest is 1,000 trees per hectare (1 tree per 10 m^2). The size of the seedlings is important as the seedlings are frequently drowned under water.

The density of the seedling planting can be increased. However, this will depend on the availability of vegetable material.

STAGE	ACTIVITIES	RESPONSIBLE PARTY	SUPERVISOR
COLLECTION OF VEGETABLE MATERIAL	Controlling the quality of the vegetable material so that it is sufficiently mature to perform direct planting or seed box planting.	**CONTRACTOR**	
	Controlling that the size of the vegetable material is in accordance with the technical specifications of the restoration program.		
INITIAL PLANTING	Evaluating and controlling the direct planting distances in Rhizophora mangrove.	**CONTRACTOR**	
	Checking and controlling the planting distances for the species that need pre-germination such as white mangrove.		
	Controlling the transportation of the vegetable material to the final planting site.		
	Evaluating and controlling the type of planting used.		
CULTURE CARE	Evaluating and controlling the level to which the vegetable material has taken root, 2 months after the initial planting.	**CONTRACTOR**	
	Controlling infestation by colonizing weeds.		
REPLANTING	Controlling the activities to be performed during replanting.	**CONTRACTOR**	

Annex 8

Project Design Study (Excerpts)
September 2006

II. DETERMINATION OF THE DESIGN VESSEL

2.1 SELECTION OF THE TYPICAL VESSEL USED FOR THE DESIGN

The fundamental basis for the design of the navigation channel is the determination of the design vessel.

According to the records of the General Aquatic Transport Department (the DGTA of the MTI), which is the navigation regulatory authority in Nicaragua, the characteristics of the vessels that navigate the San Juan River are shown in the following chart. The typical boat suggested by the EPN under the terms of reference in this study are included:

The table shows the navigation routes of vessels and the names of the vessels. Length: distance between the longitudinal ends of the vessel. Beam: this is the width measured at its greatest distance between the edges. Height: the height of the bow from its lower edge to its upper edge. Draught: measurement in length of the hull of the vessel that stays below the surface of the water.

ROUTE: SAN CARLOS – SÁBALOS – EL CASTILLO					
VESSEL	**LENGTH**	**BEAM**	**HEIGHT**	**DRAUGHT**	**METHOD OF PROPULSION**
Transporte 2001	20.00	1.98	0.60	0.53	OUTBOARD ENGINE
Nautic Número Uno	17.35	1.85	0.69	0.41	OUTBOARD ENGINE
Delicias No. 4	15.40	1.56	0.65	0.43	OUTBOARD ENGINE
Expreso de Río San Juan No. 2	16.02	1.66	0.80	0.53	OUTBOARD ENGINE
Diamante No. 8	20.58	2.72	1.04	0.68	STATIONARY
Gorrión I	19.90	2.60	0.93	0.61	STATIONARY
River Boy	20.62	2.81	1.16	0.76	STATIONARY
Diamante No. 6	17.61	2.02	0.80	0.53	OUTBOARD ENGINE
Las Delicias No. 5	17.53	2.03	0.74	0.48	OUTBOARD ENGINE
ROUTE: SAN CARLOS – SAN JUAN DE NICARAGUA					
Azul y Blanco	20.20	3.20	1.25	0.80	STATIONARY
Macguiver No. 2	19.50	2.00	0.90	0.59	OUTBOARD ENGINE
El Macgyver No. 3	17.50	1.90	0.63	0.41	OUTBOARD ENGINE
Diamante No. 7	19.79	2.04	0.90	0.59	STATIONARY
ROUTE: SANTA FE – LAS TABLILLAS					
El Alacrán I	8.22	0.97	0.39	0.25	OUTBOARD ENGINE
Halcón	10.90	1.02	0.44	0.29	OUTBOARD ENGINE
El Bic	10.03	1.00	0.46	0.30	OUTBOARD ENGINE
Tucán III	8.47	1.00	0.46	0.30	OUTBOARD ENGINE
TYPICAL VESSEL USED BY THE NATIONAL PORT AUTHORITY (EPN)					
EPN BOAT	25.00	8.00	2.20	1.85	STATIONARY

Data supplied by the DGTA – MTI. TABLE 2.1 Record of Ships in the Route under Study.

As can be seen the largest vessel is the one proposed by EPN, with a draught of 1.85 meters. However, this vessel may not routinely cover the San Carlos – San Juan de Nicaragua route, but it is expected in the

near future to enter the San Juan de Nicaragua area. Nevertheless, the vessel *Azul y Blanco*, with a draught of 0.80 meters, covers this route, this vessel being the one with the greatest draught.

Due to the difficulties of access and the nonexistence of a safe channel entering the bar of the Indio River or the San Juan River, navigation by tourism vessels in transit from Costa Rica and/or Bluefields has heretofore been impossible.

Therefore, an analysis that includes the two draughts in the depth of the channel to be designed, could give us an idea of the increases in the volume of material to be dredged and therefore the economic cost. When listing the dimensions of the boat proposed by EPN, it doubles the dimensions of the vessel *Azul y Blanco*. For the future development of the area the execution of a cost/benefit analysis is deemed necessary. But for this, it would be necessary to consider the improvement of navigation along the entire length of the San Juan River, i.e. from San Carlos to San Juan de Nicaragua.

Under the first scenario we believe that a draught of 0.80 meters is justifiable for the current time, but with a view toward the future we propose a draught of 1.85 meters. However, a request has been made to consider the actual likelihood that an EPN vessel would enter the area. Therefore, the draught of such vessel should prevail, and it should be used to design the channel.

Variation in the Levels of the River in the Dry Season.[1]

According to the pluvial precipitation trends in the area, the months of February, March, and April show the least amount of rainfall, which means that during these months the levels of the San Juan de Nicaragua River fall considerably. The greater difficulty in navigation in the summer is due to this. There are sections identified by the municipal authorities (deputy mayor) as the most problematic ones, due to the fact that the loss of flow volume in the river causes the vessels to "run aground." Sometimes, boats take hours or days to reach their final destination. Likewise, it is known that this situation also occurs in the winter, but with shorter delays.

According to the information from the owners of the vessels that travel on the river, they state that in the summer period the river's flow volume decreases drastically, reaching in the sandbar areas widths of from 10 to 20 m, and depths of up to 60 cms. In the Delta the river moves more than 100 m at both banks.

In the section of the river between the Delta and the San Juanillo River, the navigation conditions are much riskier in the summer period. People must alight the vessel to lessen the weight and also push to go through areas with low depths.

Conclusion: The depth required to navigate during the period of the least amount of rainfall when the waters of the San Juan River descend 1.00 meter on average, requires a depth of 0.80 meters with a keel clearance of 0.20 meters below the hulls of the vessels and a depth of the sedimentation or material in the

[1] Annex No. 9 contains the Hydrogeological Report for the project, as reference for weather conditions.

process of settling of 0.60 meters. Which requires dredging at a depth of the Dry Season Level – approximately 1.60 meters.

3.3 GAUGING IN THE PROJECT AREA[2]

3.3.1 MEASUREMENTS OF CURRENTS IN THE SAN JUAN DE NICARAGUA RIVER

Measurements of currents were taken along the 42-kilometer distance of the San Juan River of Nicaragua under study, at points previously defined as the most significant ones for the study.

Gauging was performed at:

1. Punta Petaca
2. The Delta
3. 500 meters downstream from the Delta
4. El Jobo
5. El Zapotal
6. 200 meters within the bifurcation of the San Juanillo creek
7. 200 meters before the mouth of the San Juan River
8. 300 meters before the mouth of the Indio River.

Transversal sections were taken at those sites, and the speeds were measured. This provided the data to calculate the flow volume that was traveling in the channel at the time.

To determine the behavior, characteristics, and volumes of water that move in the river, seven measurements were taken, at sites previously defined as important for ascertaining unknown characteristics. The method used for taking the measurements was the Gurley meter, consisting in lowering a meter tied to a metal cable, wound on a winch, which also has an electrical cable inside of it that supplies electricity. The meter is lowered to depths of 0.2 h and 0.8 h, with "h" being the water line, the operator obtains the number of turns or revolutions of the meter's propeller in a period of 40 seconds, then applies the meter's equation, containing correction factors, thus obtaining the speed of the current at that site at that time and for that flow volume.

1. Measurement taken at Punta Petaca.

   According to the data attached to the report, the following data were obtained:
   Average speed 1.073 m/second
   Area 1,279.04 m^2

   Resulting in a flow volume of 1,372.39 m^3/second

2. Measurement taken at the Delta

[2] Annex 9 presents the Hydrogeological Report that contains all of the hydrotechnical reference information for the study.

The following data were obtained:

Average speed 1.046 m/second
Area 1,632.01 m^2

Resulting in a flow volume of 1,707.74 m^3/ second

As can be seen, the two flow volumes differ by 335.35 m^3/second, despite the fact that there is a distance of 8 kilometers between the two sites, and the bifurcation has not yet occurred; however, the flow volumes are not necessarily going to be equal, because it depends on the weather conditions, etc., unless they are performed simultaneously.

What the measurement in the Delta shows us is the volume of the body of water or the flow volume that the current section of the San Juan River can contain without problems, as well as that there is an amount or volume of water circulating that we could use to increase the flows in the channel bed of the San Juan River downstream from the Delta.

3. Measurement at El Jobo

Average speed 0.698 m/second.
Area 156.62 m^2
Resulting in a flow volume of 109.31 m^3/second

4. Measurement at Finca Los Reyes

Average speed 0.872 m/second
Area 158.42 m^2
Resulting in a flow volume of 138.12 m^3/second

5. Measurement at Zapotal

Average speed 0.682 m/second
Area 165.91 m^2
Resulting flow volume 113.13 m^3/second

6. Measurement at San Juanillo

Average speed 0.397 m/second
Area 61.49 m^2
Resulting flow volume 24.38 m^3/second

7. Measurement at mouth of San Juan River.

Average speed 0.569 m/second
Area 299.68 m^2
Resulting flow volume 170.45 m^3/second

The flow volumes in the critical section from the Delta to the San Juanillo River average 144 m^3/second. And the speeds with their hydraulic sections give us a Froude number of less than 1, which implies a Subcritical flow, which gives us a stable channel or riverbed.

The current flow volumes of the river with irregular sections barely require 144 m^3/seconds of flow, and therefore would require an additional flow volume with the new channel of 15 meters in width at the base and 20 meters in width at the upper water line and a depth of 2.5 meters.

Area = ½ (B+b)xh , ½ *(20*15)*2.5 = 43.75 m^2.

Considering the average speed above, we have:

Q = A*V = 43.75m^2* 0.75 = 32.81 m^3/s.

That is to say, we require just 2.01% of additional flow volume for the section of the new channel to function permanently, maintaining the same current characteristics of the channel or San Juan River.

[…]

Annex 9

Specific Terms of Reference for the Preparation of the Environmental Impact Study for the Project "Dredging of the San Juan River", Ministry of the Environment and Natural Resources (MARENA)

[logo]
Government of Nicaragua
Ministry of the Environment
and Natural Resources
MARENA

Department of Environmental Quality

SPECIFIC TERMS OF REFERENCE FOR THE PREPARATION OF THE ENVIRONMENTAL IMPACT STUDY FOR THE PROJECT "DREDGING OF THE SAN JUAN RIVER"

CONTENTS OF THE ENVIRONMENTAL IMPACT STUDY

General Aspects

I. LEGAL AND REGULATORY CONSIDERATIONS

The consultant should frame the project in terms of the economic and political development of the country. Pertinent legal documentation will be analyzed, and the laws that will affect the project will be investigated; these include, but are not limited, to labor laws, those for the protection of geographic, environmental and municipal spaces, quality standards, technical standards, and environmental standards; protected and sensitive areas; protection of endangered species; use and control of marine and lake areas; and international agreements. In the absence of national legislation, international legislation will be used as a guide.

The consultant should consider that the site where the project will be developed is recognized as a wetland of international importance…under the Convention on Wetlands (IRAN, 1971) known as the RAMSAR Convention.

II. DESCRIPTION OF THE PROJECT AND ITS ALTERNATIVES

2.1 General Description of the Project

2.1.1. Position: Determine the department and municipality, as well as the area identified for the development of the project, detailing the extension and delimitation of the same.
2.1.2. Location: Locate on a geo-referenced plane, with UTM coordinates, the area of study and the area in which the project will be located, including on the plane basic information such as: contour, etc. and delimitation of the areas that will be involved (1:1,000 and 1:500 scale maps).

2.1.3. Justification for the Project: Indicate the facts that support the need to develop the project, current demand in the regional and national contexts, the good or service offered, considering the rehabilitory effects on the hydro-biologic connectivity of the San Juan River, which will benefit the migration of euryhaline species.

2.1.4. Objectives: General and specific objectives of the project and of the Environmental Impact Study.

2.1.5. Present the plan for each surface that will contain one of the works (scale of 1:1,000, 1:500).

Km. 12.5 North Highway
Facing Corporación Zonas Francas
Telephones 263 – 2830 and 263-2832 // Fax: 263-2354, 263-2620 and 233-1504
Section 5123, Managua, Nicaragua, C.A.

2.2. Description and Technical Characteristics of the expansion of dredging activities

Develop a detailed description of the activities, methodologies, and processes to be utilized in every phase of the project, indicating the location where each activity will be conducted, as well as the technologies, logistics, equipment, supplies, goods and services that will be required. The following activities should be described:

2.2.1. Technical description of the dredging and expansion:

- Configuration of the riverbed (cross sections every 500 meters at most)
- Configuration of minimum depths
- Geometric design, channel alignment, depth of the channel
- Identification of the areas to be dredged
- Quantity and physiochemical quality of the material to be dredged (granulometry, concentration in sediments of chlorinated organic chemical compounds, pH, heavy metals (Cd, Cr (total and hexavalent), Pb, Zn, among others). The sampling locations should match the geodetic points (BM) used by INETER.
- Description of the dredging techniques and methods both during the performance of the project and during the maintenance of the channel.

2.2.2. Processes, machinery and equipment

Present the information on the machinery and equipment to be utilized, indicating its principal technological characteristics, including but not limited to: size, capacity, performance, service life, fuel usage, energy and vibration.

Describe the processes, requirements and schedule of operation and maintenance for the machinery and equipment to be utilized.

2.2.3. Fuel supply: Fuel volume, and techniques for storing and supplying fuel to the dredge.

2.2.4. Waste management:

Describe and present in detailed lists the estimated volumes of solid wastes, oils generated by the dredging machinery and equipment, and the filters and fibers used in any activity to be conducted during the development of project, and the management alternatives, indicating as well the final deposit sites.

Describe the activities and type of discharges (liquid, solid, and gaseous) that will affect water quality, as well as the municipal, agriculture, livestock, mining, and agro-industrial contributions.

2.2.5. Management of dredged material:

- Identification of the sites for the final depositing of the dredged material.
- If heavy metals are present in the sediments, bioavailability and theoretical bioaccumulation potential should be evaluated.
- If heavy metals are present, perform modeling of metal discharges according to the type of dredge and final deposit site, analyzing the movement of sediments and the impact on the water column.
- For deposition on land, alternative sites must be presented, including their volumetric capacity, drainage controls, water retention time, maximum allowable concentration of solids, and additional work for sediment retention.
- If the deposition is in the ocean, the selection of proposed site must be justified.
- Methods for transporting to final deposition sites, pumping methods, use of floating structures.

III. DESCRIPTION AND ENVIRONMENTAL CHARACTERIZATION OF THE AREA OF INFLUENCE

3.1. Border of the Area of Influence:

Characterize the potentialities and vulnerabilities of the study area without the project, before the activities take place that will transform them (directly and indirectly). Serve as a baseline to characterize the action area before it is affected by the project, in order to identify the potential impacts on the study area.

The geographic limits the area to be influenced both directly and indirectly by the project should be defined.

3.2. Abiotic Environment

This section should describe the physical characteristics of the project's area of influence. Geological characteristics of the area, with an emphasis on the tectonic, stratigraphic, geomorphologic, seismic (seismic zoning) aspects, as well as climatology and meteorology, emphasizing the probability and frequency of hurricanes and the presence of contamination sources (fixed and mobile).

3.2.1. Geology and Geomorphology

- Description of the geomorphology and sedimentology of the project's area of influence.
- Analysis of the sedimentologic processes, and the size, color, odor, and presence of fats and oils in the particles of the riverbed.
- Results of the bathymetry in the area.
- Identify the natural drainage networks in the area of influence
- Identify the erosion and sedimentologic processes in the channel and the natural erosion and stability controls on the banks

3.2.2. Soil: If the dredged materials will be deposited on land, the following must be presented:

The current and potential use of soils, identifying the compatibility of uses, including the corresponding cartographic representation of these two aspects. In the areas likely to be affected by the project, the physico-chemical characteristics (depth, permeability, porosity, humidity, texture, structure, pH, cation exchange capacity and base saturation, alkalinity) and the capacity and adequateness for soil use should be determined. The edaphic characterization of the soil will be the reference point for the restoration of the areas affected by the project.

3.2.3. Hydrology:

- Dynamics, flow, velocity of the river in the section to be dredged
- Hydrographic description of the project area, with information on the hydrological conditions of sediment contributing rivers and other waterbodies, channels and outlets to the sea.
- Analysis of water quality, salinity (for delta zones), temperature, dissolved oxygen, pH, color, transparency, oils and fats, dissolved solids, total solids, DBO, DQO, pesticides, and the presence of contaminants, among other parameters.
- Define the current uses of the waters of the San Juan River (ecological, human consumption, fishing, watering hole, irrigation, and touristic, among others).

The analysis of water quality in the area should be conducted in estuarine waters and in the surface waters, in order to have a baseline study establishing the existing quality of the waters in the project area.

If deposit sites are planned in the ocean, the ***Dynamic Marine Behavior*** should be described.

- General System
- Bathymetry
- Coastal Transport System
    - ✓ Circulation and patterns of Marine Currents
    - ✓ Depth
- Composition of the Sea Floor
- Physico-chemical composition of the substratum of the sea floor
    - ✓ Physical-chemical characteristics of the waters

3.3. Biotic Environment (Flora, Aquatic and Terrestrial Fauna)

Based on existing information, characterization of the ecosystem in which the project will be developed, describing the existing vegetation and fauna, identifying habitat, nesting and breeding grounds for species of aquatic fauna, protected species, and ecological connectivity.

When areas of land are to be utilized (removed, eliminated or cut) for the deposition of dredged materials and this use is not itself a forestry use, the following information should be provided:

Describe the plant coverage, expressed as forests (primary, secondary), bushes, crop residues, forest plantations, agri-silviculture systems, pastures, natural grasslands, or isolated trees. Georeference with their respective locations in plans with a detail scale of 1:10,000. Estimation of the areas to be affected if the dredged material is deposited on land adjacent to the channel of the river, and specify when it is to be within a protected area.

3.4. Socio-Economic Environment:

During the elaboration of the Environmental Impact Study, for the project's direct area of influence, the levels of participation should be taken into account in accordance with the national legislation in force. Information on the project and its implications in the area of study should be provided. Based on existing information, a characterization of the following should be conducted:

3.4.1. Municipal Characterization

The current political-administrative structure of the municipalities involved in the project's direct area of influence should be described as well as the structures of population centers, communities surrounding the project, land management, social facilities (schools, hospitals, health centers, hotels and ports, among others).

3.4.2. Population

Characteristics of the density of the current and predicted populations, urban-rural distribution, age and gender composition, growth and migration trends, economically active population, income level, distribution of active population by activity sectors, indigenous peoples, residents in the project's area of influence.

3.4.3. Economy

Perform a characterization of the established economic activity in the area of influence, indicating occupational distribution and the interrelationships between different activities that constitute the economic structure of the subject areas.

3.4.4. Road Network

Identify roads located in the project's area of influence and the different modes of transportation used by the population and for goods and services.

3.4.5. Historical and Cultural Heritage

Identify and characterize the sites considered to be aspects of the historical and cultural heritage of the project's area of influence (archeological sites, historic cultural monuments), in order to prevent dredged materials from being deposited in sites that contain archaeological or historical artifacts.

IV. IDENTIFICATION, EVALUATION AND ANALYSIS OF ENVIRONMENTAL IMPACTS

4.1. Identification of Impacts

Identify and describe the impacts potentially caused by the actions, activities, tasks and work to be conducted as part of the project, and the cause-effect relationships, and evaluate the magnitude and importance of the same, in every environment (physical or abiotic, biotic, socioeconomic and cultural).

In this chapter, the procedure and techniques used for the identification of impacts should be presented. The impact assessment should preferably be conducted based on quantitative and qualitative methods. Whenever possible, quantify future environmental quality in terms of values calculated using simulations or models such as (but not limited to): gas dispersion models, and models of the dispersion of pollutants in the sea and rivers.

Emphasize the following aspects, without limiting the analysis to them:

- Impact on the hydraulic dynamics of the San Juan River;
- Impacts on water quality caused by the resuspension of sediments in the water column;
- Mobilization of chemical compounds and other dangerous soluble substances contained in riverbed sediments into the water column;
- Attraction of occasional species and impacts to benthic communities;
- Ecosystem losses, the alteration of aquatic habitats, and harm to fishing;
- Impact on emblematic endangered and economically important species (manatee, shark, lizard, sea bass, gaspar [fish], and river shrimp); and
- Impacts stemming from the deposition of dredged materials.

4.2. Evaluation and analysis of the impacts

For this task, analysis methods available to the designer of the project should be utilized, and they must be explained in detail so that they can be understood.

<u>Define the following:</u>

a) Methodology utilized
b) Identification of the project Actions and the Components of the Environmental System

c) Identification and Description of the Environmental Impacts of greatest relevance that will be mitigated based on the evaluation.

V. ANALYSIS OF RISKS:

5.1. Analysis of risk: Based on nationally and internationally accepted methodologies and procedures, as well as existing information, analyze the probability of occurrences resulting from natural and human phenomena, identifying the potentially affected areas.

[logo]
Government of Nicaragua
Ministry of the Environment
and Natural Resources
MARENA

Department of Environmental Quality

GENERAL GUIDELINES

FOR THE PREPARATION OF THE ENVIRONMENTAL IMPACT STUDY FOR THE PROJECT "DREDGING OF THE SAN JUAN RIVER"

I. OBJECTIVE

Provide the technical elements necessary to orient the multidisciplinary group charged with the formulation of the Environmental Impact Study so that all important aspects will be integrated in the review of the potential impact of the works and activities of the project "**DREDGING OF THE SAN JUAN RIVER**," in accordance with what is established in the procedures outlined in subsection j of Article 5 of Decree 45-94, which establishes the applicable procedures.

II. GENERAL GUIDELINES AND REQUIREMENTS FOR THE PREPARATION OF THE EIS

1. The preparation of the Environmental Impact Study (EIA) and the Environmental Impact Document will be carried out under the direct responsibility of the proponent, and it should be conducted by a qualified consulting firm, comprised of a group of professionals with work experience in the environmental area. Throughout the development of the study, clarifying meetings can be conducted between the regulators (MARENA, MTI, INETER) and the proponent.

2. The technical description of the project should provide the geographic coordinates of the area where the project is to be conducted, as well as the name given to the project by the proponent.

3. Given the dimension of the project, and to aid in clarifying the information and its analysis, the Environmental Impact Study should contain only pertinent information and present it in a progressive fashion, highlighting fundamental aspects, for which the following is recommended:

   - Avoid ambiguous or subjective comments; everything expressed should be based on accepted and valid criteria, standards, records, and data.

   - The language utilized should be the same throughout the whole EIA in order to ensure uniformity in linguistic criteria and coherence between each chapter of the EIA that is developed.

   - In the preparation of the EIA, a harmony of terms should prevail, so acronyms should be utilized, a glossary developed, the International System of units (SI) utilized, aerial

photos [provided], and references to geographic location should be made with geographic coordinates.

- The original and (5 copies) of the Environmental Impact Study and 6 copies of the Environmental Impact Document should be provided, signed by the proponent, its legal representative, and all the members of the multidisciplinary team responsible for their preparation.

III. ENVIRONMENTAL IMPACT DOCUMENT

The Environmental Impact Document should be prepared, and provided for public comment by the affected population, and to the governmental organizations and other interested social groups, with the goal of informing and clarifying any doubts regarding the aspects and actions of the project and to learn the opinions of the population.

The Environmental Impact Document should translate the results of each of the activities and works of the Environmental Impact Study into language that is simple and easy for the population to understand. This document should contain a summary of:

3.1. Executive Summary
3.2. Description of the Project (location, objective, justification, and scope of the project)
3.3. Characterization of the project's area of influence
3.4. Description of the activities to be conducted and the positive and negative impacts that will be caused by each of those activities
3.5. Present plans on the geometry of the river channel
3.6. Management of the dredged material
3.7. The proposed environmental measures to prevent, mitigate or compensate for the negative impacts
3.8. Environmental Management Program

4. PUBLIC CONSULTATION

The whole project will be subject to public consultation, in accordance with what is established in the terms of reference prepared by the technical team, classified in two types:

a. Availability of the Environmental Impact Document in previously established sites (location or locations in which the project or activity will be carried out) in a location accessible to the public, for all of the activities established in Decree 45-94.

b. Presentation of the Environmental Impact Document (DIA) by the proponent and on-site discussion determining the participants in the process (at the national or local level), inviting the different sectors interested in the project to participate.

In this case, it is determined that the public consultation for the project "**Dredging of the San Juan River**" will be conducted per the procedure outlined in subsection a.

5. INFORMATION ON THE MEMBERS OF THE TEAM

Include the following information regarding the members of the team that participated in the preparation of the Environmental Impact Study.

i. Full name
ii. Telephone & fax
iii. Profession
iv. Environmental Impact Studies in which they have participated, indicating the name of the project, business, proponent, and date
v. Signature and identity card number

Annex 10

Executive Summary; Environmental Impact Document
"Improvement for Navigation on the Nicaragua San Juan River"
(Delta - Nicaragua San Juan River Stretch)

ENVIRONMENTAL IMPACT DOCUMENT
(EID)

PROJECT

"IMPROVEMENT FOR NAVIGATION ON THE NICARAGUA SAN JUAN RIVER"

(DELTA – NICARAGUA SAN JUAN RIVER STRETCH)

EXECUTIVE SUMMARY

ENVIRONMENTAL IMPACT DOCUMENT
"IMPROVEMENT FOR NAVIGATION ON THE NICARAGUA SAN JUAN RIVER"

(DELTA – NICARAGUA SAN JUAN RIVER STRETCH)

The Dredging Project **"IMPROVEMENT FOR NAVIGATION ON THE NICARAGUA SAN JUAN RIVER"** along the Delta-Nicaragua San Juan River Stretch, conceived within the strategy of the Nicaraguan Government to improve communication routes by rehabilitation of this waterway to increase and streamline traffic for boats and larger vessels, and in this way allowing for self-sufficient management of export and import merchandise dispatched from facilities built one hundred percent in Nicaragua. Eighty percent (80%) of Nicaraguan exports to the Atlantic area pass through Honduran and Costa Rican ports. The El Rama Port on the Escondido River is the only port available to Nicaragua in this area. All exports from Nicaragua's Central Region will be able to pass to the Atlantic through the San Carlos and the Nicaragua San Juan River Lake ports by commissioning this new route.

Currently, the main restriction for navigation on the Nicaragua San Juan River toward El Castillo and San Carlos Ports is the river's shallowness.

One of the considerations analyzed by the Consultant, proposed for maintenance of continuous current flow from the San Juan River to the Caribbean Sea, is the need to increase depths at the outlet. To achieve this, it is necessary to deepen and build a canal, which in addition to allowing access for dredges from the sea to the San Juan River, will also avoid transportation of sediment (sand) from the ocean toward the estuary from which the San Juan River debouches.

The features of the proposed canal are as follows:

Canal Length:	2,000 meters
Canal Width:	40 meters
Depth:	6.00 meters above sea level
Lateral Slopes:	1:10

The width was determined based on the type of dredge that has to operate to dredge the canal, considering a minimum 40 meter width. Similarly, this is the required depth for a tugboat to transport the cut and suction dredge up to the river's entry. The basis for the lateral slopes takes into account the sand's repose slope.

Dredging will prevent the flow of the San Juan River from losing speed when it reaches the estuary, which causes the formation of sandbars upstream and hampers navigation. Dredged material would deposit along the coast to form a dike or dune to reduce the energy of the waves and reduce the volumes of sand that enter through the bar. This would avoid reduction in the river's depth.

A double entry matrix known as the cause-effect matrix has been used to identify environmental impacts. The cause-effect matrix determined the nature, magnitude and type of the impacts, as well as their behavior.

The nature of the impact identified whether it is negative or positive by using colors: blue indicates positive impacts and red indicates negative impacts. The importance of the environmental impacts weighted in terms of their importance and established the following ranking: Not significant for values between 13 – 30 points; Moderate impacts for those that attain rankings between 31 – 37 points; Severe for those between 38 – 45 points; Critical for value above 46 points. The importance equation used to arrive at these values:

Importance I = ± (3I + 2E + M + P + R + A + PB + EF + EF + PR + SP)

The basis for this equation is 10 attributes with their respective scoring so that negative and positive impacts are separately determined. The value attained with this equation is the average value in importance, proceeding to determine the standard deviation. Then, the ensuing operation is a subtraction between the average values of importance for a negative value of the standard deviation (as of the negative importance values), providing the minimum value or non-significant negative impacts. The same operation for positive impacts provides non-significant positive impacts. By adding the average value of importance with the standard deviation, you obtain the critical value of importance.

The attributes are the following:

Intensity (I): This refers to the degree of incidence over the environmental factor. A value of 1 states a low affectedness and a value of 12 states total affectation; values encompassed between these reflect intermediate situations.

Extension (E): This refers to the area of influence of the impact with the project's surroundings. If the action produces a much focalized effect, the impact deemed as having a punctual character; if the effect occurs within the project's surroundings, it has a total impact; and for intermediate situations, partial or extensive impacts used; and if the impact is very important, you add the critical value (+4).

Moment (M): This is the term of the impact's manifestation and expresses the time lag the action that appears (t0) and the initial effect (t1) over the factor under consideration.

Persistence (P): This refers to the time that the effect will remain since it appeared:

- Fleeting (< 1 year) 1 point
- Temporary (1 – 4 years) 2 points
- Permanent (> 10 years) 4 points

Reversibility (R): This indicates the possibility for rebuilding the affected factor because of the action carried out. Namely, the possibility of returning to the initial conditions prior to the action through natural means:

- Short term: 1
- Mid-term: 2
- Irrecoverable: 4

Accumulation (A): This refers to the progressive increase of a simple impact without synergy 1; synergistic 2; accumulative 4.

Probability (PB): This indicates the certainty of appearance; it gives maximum value to known environmental impacts because of an action: probable 1; doubtful 2; definite 4.

Effect (EF): This refers to the cause of the effect, whether it is direct or indirect. To this end, impacts identified through a network system: Indirect (secondary) 1; Direct 4.

Periodicity (PR): This indicates the regularity with which the impact appears. As the impact is more continuous, it receives the maximum value: irregular and discontinuous 1; regular 2; continuous 4.

Social Perception (SP): The view of the population about the environmental impact incorporated: 1. minimum (25%); 2. average (50%); 3. high (75%); 4 Total (>100%) 8 points.

Environmental impacts identified and classified according to the environmental attribute that will affect, being as follows:

- **Environmental Impacts on Abiotic Elements:** increased contaminating gases; increased noise
- **Environmental Impacts on the Landscape:** changes in drains and channels
- **Environmental Impacts on Water Quality:** reduction in dissolved oxygen; reduction in water transparency; alteration to water coloring; increased turbidity by suspended sediments; changes in pH values; changes in water hardness; variation in the electric conductivity of the water; variation in the DBO; water eutrophication; changes in the thermic stratification of the water column; water contamination by hydrocarbons
- **Environmental Impacts on Fauna:** affectation to benthic communities; affectation to fish habitat; affectation to mammal populations; affectation to bird populations
- **Environmental Impacts on the Vegetation:** affectation to the wetlands; species under risk
- **Environmental Impacts to Ecological Processes:** changes in the diversity of species; changes in the abundance of populations; affectation to protected areas; affectation to the trophic network
- **Impacts to the Socioeconomic Sector:** affectation to the population's health; changes in local economies; changes in the regional economy; increased employment; increased employment; increased traffic flows; changes in tourism; changes in the quality of life.

To minimize, compensate and restore the negative impacts identified and classified by their importance, an Environmental Management Plan structured to include several programs: Supervision and Monitoring Program; Contingency Program; Environmental Education Program; Environmental Restoration Program.

The Supervision and Monitoring Program sets forth indicators to guarantee project development without causing damages to the environment and its users. In addition, it identifies the person directly responsible for the action and the person responsible for supervising the environment.

The Contingency Program encompasses a series of actions aimed at providing adequate solutions in an emergency caused by an accident that may create a disaster. This includes an emergency plan in the event of an accidental oil spill.

The Environmental Education Program targets the benefits associated to the dredging project of the Nicaragua San Juan River, structured in two modules: the first module aimed for EPN officials and contractors; the second module aimed at the local population.

The Restoration Program contemplates a plan to recover vegetation with native species to the humid tropics in the 21 dumping sites that involve a total 142 hectares; each site created with the deposited materials, extending these to give them a flat vision, one meter high.

CONTENT

Annex 11

C.S. Diseño, "Study of flow behavior in the bifurcation
San Juan River – Colorado River"

Study of flow behavior in the bifurcation San Juan River – Colorado River

By the area of hydraulic engineering, C.S. design, ICE

1. Introduction

As shown in Figure 1, the San Juan River, a Nicaraguan river, is divided into two branches. The largest one, corresponding to the Colorado River, belongs to Costa Rica, while the shortest is still the San Juan River. The boundary between the two countries corresponds to the yellow line shown in Figure 1.

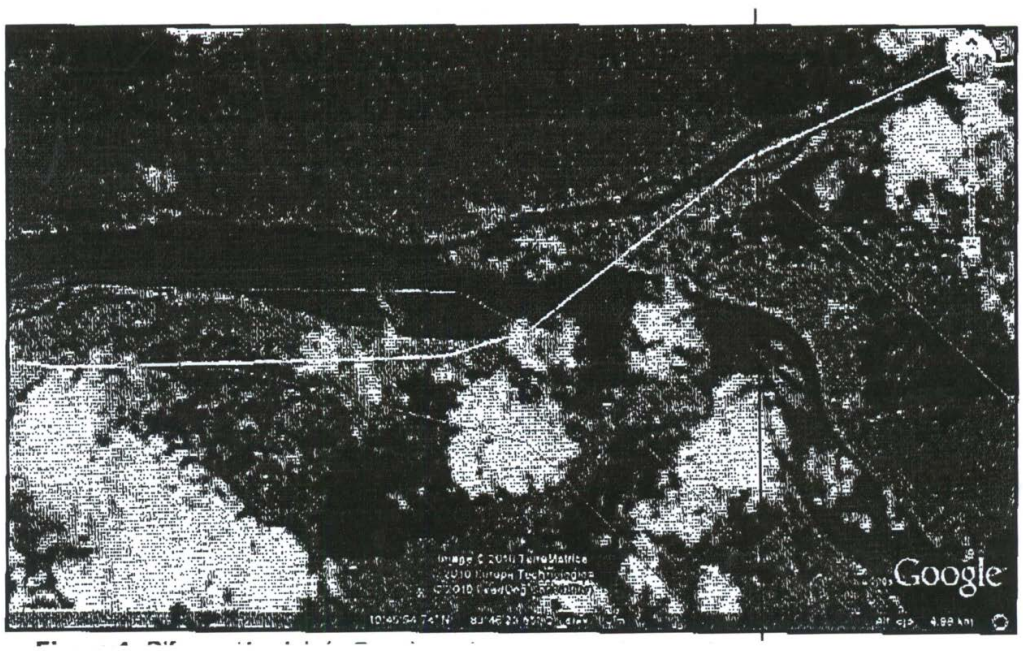


Figure 1: bifurcation of the San Juan River, the top branch corresponds to the San Juan River, the bottom branch corresponds to the Colorado River
Source: Google Earth, 2010

The geometry of the branches can be seen that most of the flow that flows through the San Juan before the bifurcation goes to the Colorado River.

The government of Nicaragua has been interested in dredging the branch that corresponds to the San Juan River in order to divert more of the flow to the Nicaraguan territory. A work of this magnitude would represent a daunting undertaking for the government of Nicaragua, however, raised the question of how to divide the flows in the event that such work came to be.

Objectives

General

Study the behavior of the flows in the bifurcation of the San Juan River, in order to determine the impact on them of an eventual dredging in the smallest branch of the bifurcation.

Specifics

- Determine the division of flows in the present condition.
- Observe the impact of an eventual dredging in the division of original flows.

Methodology

To determine the current division of flow in the bifurcation it was used information from two flow measurement conducted by ICE in the Colorado River, as well as geometry data provided by those flow measurements.

Note that the information available was limited, thus approximations were made using Google Earth to plot the geometry of the San Juan River before the bifurcation and the branch of the San Juan before the bifurcation.

With the above mentioned information we proceeded to find the balance division between the flows in the current condition, to this effect it was used HEC-RAS 4.0 program.

This program has two methods to resolve bifurcations, the method of the energy equation and the method of the momentum equation. In this case, the method based on the energy equation has been chosen.

Having determined the equilibrium flows, three scenarios for changing in the geometry of the lower branch of the river San Juan have been proposed and proceeded to find the new equilibrium flows for each scenario.

Theoretical framework

In this section we will summarize using a method based on the energy equation used by the HEC-RAS to determine the equilibrium flows in a bifurcation.

This method uses the following equation

$$Z_2 + Y_2 + \frac{\alpha_2 * V_2^2}{2 * g} = Z_1 + Y_1 + \frac{\alpha_1 * V_1^2}{2 * g} + h_e$$

Ecuación 1

Equation 1.

For the case in study the flow is divided and that the regime is subcritical, given the river conditions. In this case the program proceeds to calculate water profiles in sections 2 and 3 (see Figure 2), from these profiles the program calculates specific forces in the 2 sections, the section with the highest specific force is used as the edge condition to compute the water profile in Section 4.

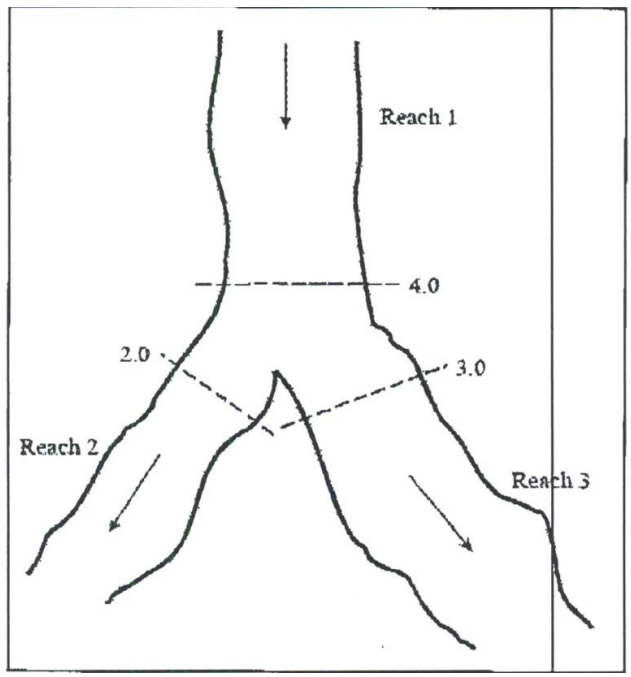


Figure 2. Flow simulation scheme used by the HEC-RAS
Source: Reference Manual

It should be noted that the program assumes that the flows entered for each of the sections are correct, thus an iterative process should be performed by the user in order to find the equilibrium flow, the process is as follows:

1. Assuming a flow division.
2. Running the program for obtaining energy and water profiles in sections near the bifurcation.
3. Comparing the energy in Sections 2 and 3. If it does differ significantly, the flows are assumed wrong. We proceed to redistribute the flow passing part of the flow to a section with lower energy.
4. Running the program again, until the energy difference between sections 2 and 3 is within an acceptable tolerance.

4. Results

Based on available flow measurements it proceeded to find the hydraulics slope of the river and the geometry in the branch of the Colorado River, as 2 flow measurements has been available, an average of them has been used. The hydraulic slope was calculated using the following equation.

Equation 2

$$\frac{Q.n}{\sqrt{S}} = \frac{A_3^5}{P_3^2}$$

Manning's n used in this case is 0.035. The results are summarized in the table below:

Table 1 : Average section on the Colorado River

Section	Q (m3/s)	L (m2)	A (m2)	P (m)	Y med (m)	S (m/m)
A	1436.30	450.00	1537.50	451.16	3.42	2.09E-04
B	1581.86	465.00	1470.05	466.76	3.16	3.07E-04
Average	1509.08	457.50			3.29	2.58E-04

Since information on site over different sections was ignored on the San Juan River, before and after the bifurcation, a simplification to the section in the branch of the Colorado River was done. To do so, we considered a rectangular section for analysis, with a width of 457.5 m and 6.29 m high. The additional 3 m were obtained from visual approaches, during the site visit.

The section just before the branch of the San Juan River, is also considered rectangular, with a width of 480 m (measurements obtained in Google Earth) and a high of 6.29 m., which is considered equal to the section of the Colorado River.

For the small branch of the San Juan River a width of 90 m was taken as a reference (measurements obtained in Google Earth) and a height of 4.75 m, as it was considered a water depth of 1.75 plus 3 additional meter of channel, this was obtained through observations in the field.

These sections were introduced to the HEC-RAS to obtain steady flows; the results are summarized in the following Table:

Table 2:

Section	h (m)	b (m)	Q 8m3/s	%Q
Whole San Juan	6.29	480	1796.4	100%
Colorado	6.29	457.5	1509	84%
Little San Juan	4.75	90	287.4	16%

Three different scenarios were taking into consideration, in order to study the effect that might cause any eventual extension in the small branch of the San Juan River. The flow balance was calculated in each case. The changes of section were made only in the small branch of the San Juan, the other two sections and the hydraulic gradient remained constant.

The proposed scenarios are presented below.

Table 3: Changes in geometry in the small branch of the San Juan River

Scenario	**Depth (m)**	**Width (m)**
1	5.75	120
2	6.75	150
3	7.75	180

Presented below equilibrium flows obtained for each of the scenarios:

Table 4: flow equilibrium obtained for each scenario

	Scenario 1		Scenario 2		Scenario 3	
Section	Q (m^3/s)	% Q	Q (m^3/s)	% Q	Q (m^3/s)	% Q
Whole San Juan	1796.4	100%	1796.4	100%	1796.4	100%
Colorado	1428.14	79.5%	1356.28	75.5%	1293.41	72%
Little San Juan	368.26	20.5%	440.12	243.5%	502.99	28%

Conclusions

- If an expansion as proposed in Scenario 1 is realized, the flow in the Colorado River would present a decrease of 4.5%.
- In Scenario 2, the decrease would be 8.5%.
- In the most critical case, an expansion as described in Scenario 3, which corresponds to twice the initial width and almost twice the depth, the decrease in the flow of the Colorado River would be 12%.

- The results obtained in this study represent approximate values to those that actually can occur in natural conditions of the site, it would require much more information and rigorous analysis to simulate those conditions.

Annex 12

Technical Opinion, Environmental Impact Study Project
Improvement of Navigation on the San Juan de Nicaragua River

28 November 2008

MINISTRY OF THE ENVIRONMENT AND NATURAL RESOURCES
MARENA
General Department of Environmental Control

TECHNICAL OPINION
ENVIRONMENTAL IMPACT STUDY PROJECT:
IMPROVEMENT OF NAVIGATION ON THE SAN JUAN DE NICARAGUA RIVER

1. Name of the Project: Improvement of Navigation on the San Juan de Nicaragua River.

2. Proponent: Empresa Portuaria Nacional [National Port Company] (EPN).

3. Location of project: San Juan River, from the point known as Punta Petaca to its mouth in the Caribbean Sea, covering a total of 42 kilometers. Department of Rio San Juan:

Site Coordinates	
North	East
1189857	189947
1210770	204124

4. Brief Description of the project and its alternatives:

The project consists in the cleaning and maintenance of the navigation channel along a section of 41,963.57 linear meters that extends from the site known as Punta Chingo Petaca to the mouth of the San Juan River. The project is located in the jurisdiction of the municipality of San Juan de Nicaragua, Department of Rio San Juan, within the limits of the Rio San Juan Wildlife Refuge, in the agroforestry usage area.

A cutter and suction dredge will be used to dredge the riverbed.

For the effects of the environmental impact study the area of direct and indirect influence for the project has been calculated at 100 meters wide x 42,000 meters long, equivalent to 420 (hectares).

The area of direct influence affected through the depositing of cleaning material has been calculated at 130.8 (hectares), this being the sum of the areas (m2) of the 23 sites selected for depositing, plus the right of way or easement for the sediment discharge piping (0.069 hectares).

The area directly affected by the restoration of the Rio San Juan navigation channel has been calculated at 126 hectares (30 meters wide x 42,000 meters long).

The material extracted will be deposited in small deposits distributed along the northern bank along the section of the river to be cleaned. A total of some 23 potential sites have been identified to be used as deposits of dredged material as well as an additional alternative site if necessary, No. 0, which are detailed below.

List of Authorized Sites by UTM Coordinates

Table No. 1

No.	NAMES OF THE DEPOSIT SITES	UTM COORDINATES		AREA (MZ)	VOLUME m^3
		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	Juan Popa	1207078	207805	2.08	14,579
4	Public property	1 206 540	207 309	15.73	110,532
5	Chepe huevo	1 205 357	207 314	5.61	39,404
6	Daniel Reyes	1 204 649	208 162	1.19	16,744
7	Noel Castillano	1 203 662	208 278	13.39	188,184
8	Calixto	1 202 463	207 727	2.13	29,958
9	José Gómez	1 200 692	207 477	14.65	102,941
10	José Gómez	1 199 981	207 762	4.73	66,436
11	Alejandro Reyes Aragón	1 198 453	208 250	27.41	192,571
12	Socorro López S.	1 197 832	208 809	19.22	135,019
13	Darío Sánchez (El Jobo)	1 196 615	208 689	9.01	63,283
14	Isla Salomón	1 194 306	205 891	2.40	33,700
14A	Isla Salomón	1 193 874	205 266	2.12	21,226
14B	Ricardo Salinas	1 194 151	204 172	2.12	21,226
15	Silvio Reyes	1 194 453	203 651	1.86	26,090
16	Rubén Reyes	1 193 900	202 322	25.16	
17	Felipe Espinoza	1 193 247	200 549	13.73	363,801
18	Gregorio Chamorro	1 193 136	199 890	5.34	75,074
19		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 alternate and it has been selected because of its evident environmental benefits; however, a technical and economic evaluation is required to determine its use. Total volume (1,693,787 mts3).

The physical characterization of the sites identified for deposits of materials coming from the cleaning of the river indicates that they are located in the agroforestry area, in accordance the Rio San Juan Wildlife Refuge Management Plan. They are areas that are affected by human activities (agricultural and livestock systems), low-density and dispersed humanized areas, with a small amount of vegetation in the riverbank area between site No. 24 and No. 15. The area with the greatest amount of vegetation is between Site No. 15 and the mouth of the San Juanillo rivers; the rest are wetlands (zacate gamalote and yolillo palms), among other species inherent to that ecosystem.

5. Environmental Impacts Identified and their mitigation measures

Environmental impacts on the quality of the water due to the removal of sediment from the bottom of the section to be cleaned. (Parameters)

- Reduction in dissolved oxygen
- Reduction in the transparency of the water
- Change in the color of the water
- Increase in turbidity due to suspended sediment
- Changes in the pH values
- Changes in the hardness of the water
- Change in electrical conductivity of the water
- Change in the Biochemical Demand for Oxygen (BDO)
- Changes in the temperature stratification of the water column.

Environmental impacts on Vegetation and Landscape

- Effect on the landscape through elimination of vegetation because of disposal of material from the cleaning.
- Effect on the forest (principal species found in the identified sites: *Yolillo*, trumpet-wood, *chilamate*, *jocote, jobo*, plantain, *zacate gamalote*, royal palm, heliotropes, banana plants, coconut palms, *pejibaye*, grass and trees such as sparrowhawks, silk-cotton tree, cedarwood, *chilamates*, *sotocaballo*, *guaba*, *yema de juevo, camíbar*, *sangre grado,* balsa, *guácimo*, *zacate* for cattle, weeds, bamboo, among other species of bushes inherent to the region.

Environmental Impacts on Aquatic and Terrestrial Fauna

- Impact on the fauna because of emigration to other areas faced with the loss of their ecological niche and because of the elimination of vegetation.
- Effect on the benthonic communities **due to removal of sediments**
- Effect on fish habitats
- Effect on mammal populations
- Effect on species of fauna because of an increase in noise during the operations.

Environmental Impacts on Ecological Processes

- Changes in the diversity of species
- Changes in the abundance of the populations
- Effect on the wildlife refuge area.

Evaluation of the environmental impacts on the water quality

1. Benthonic and planktonic organisms will be affected because of the removal of sediments, the former because they are on the riverbed, and the latter because of an increase in the turbidity of the water, **however**:

    - Little density of species of these organisms was found in the San Juan river and the section to be cleaned.

    - The bottom sediments are not a substrate suitable for the settlement of species there and moreover because the makeup of nutrients is low, the greatest makeup of nutrients by instantaneous load into the San Juan River was transported by the tributary rivers Boca de Sábalos, Santa Cruz, and Melchora. This entry of nutrients will be beneficial to the dredged section because the low diversity of species is attributed to the lack of food for primary and secondary organisms in the food chain.

    - The fine particles will settle on the bottom and start colonization by benthonic organisms and their consequent effect on the food chain.

2. **The impacts are considered low intensity and inevitable**, they are located along the length of the channel, their permanence over time is fleeting, and their effect is indirect. The recovery of the physiochemical parameters of the water (transparency, color, turbidity) depend on the amount of dissolved solids in the water, and it is going to depend on the time the operations last, which are considered immaterial due to the size of the grains (sand), because the Granulometry study shows that:

    - The material does not have a significant presence of fine materials that might remain suspended in the water while operations subsist.

    - Only the section next to Punta Petaca had clayey-silty material that could increase the solids suspended in water; however, the suspension of this fine material will be beneficial for the settlement of benthonic communities, once they settle.

3. The study shows a percentage of oxygen saturation (OD) of 90% in the San Juan delta, therefore the entry of water with a high concentration of OD, toward the dredging area, will be beneficial for the development of organisms.

4. The ionic content in the San Juan River is within the limits allowed for human consumption; however, there are periods when sulfates exceed these limits. **The**

concentration at which sulfates appear will depend on the time when the operations are performed; they may be altered principally during the start of the rainy season, therefore the impact on the quality of the water in terms of ionic content **is not significant**. Moreover the iron content found along the San Juan River and in the section to be cleaned exceeds water quality standards, and therefore the makeup of this cation from the San Juan River, will not negatively affect the project activities.

5. The addition of pesticides in the water of the San Juan River to the dredging area from the main current will be increased because of the removal of sediment if it is done in the peak of the rainy season (June) when the highest concentrations of pesticides are reported. It would fall in the dry season; however, the concentration of pesticides in the sediments tends to increase.

6. The pH of the water is affected because this physical parameter is a function of the dissolved CO_2, and it is intimately related to photosynthesis and respiration. Both parameters will be affected by the action of cleaning the river (by the suspended particulate matter).

7. The changes in the hardness of the water is due to the release of some compounds that are in the sediment that will be released by the cutting and suction action, as well as because of the effect of depositing the material (sediments) on the soil.

Environmental Measures

- Avoid the use of areas near the mouth of the San Juan and Sanjuanillo River for the depositing of materials, considered a critical and vulnerable area.

Mitigation Measures to prevent impacts on fish

- Areas near the mouth of the San Juan and San Juanillo rivers will not be used for depositing materials, due to the confluence of the Sea and River, the areas of the mouth of the San Juan River are responsible for the regeneration of the local biota and a large number of organisms that form part of the food chain.

- Maintain strict control over the handling of hydrocarbons to avoid spills.

Environmental measures to prevent and mitigate the impacts on the landscape, the fauna, and the soil

- The deposits of materials resulting from cleaning the river will be located in the identified, described, and geo-referenced sites established in the environmental authorization issued by MARENA.
- In a 9-month period a plant restoration program will be implemented in the deposit areas with species of trees and bushes inherent to the humid tropics that characterize this project zone and the plant life inherent to the area will be recovered by natural regeneration.

Environmental Measures to prevent fuel spills on water and soil resources

- Waste from lubricants derived from maintaining the equipment and machinery must be collected in hermetic containers for their subsequent elimination outside the refuge area.

- Compliance with international regulations regarding the shipping, handling of hydrocarbons and oily waste, which must be established under the terms of the contract with the company responsible for the cleaning activity.

- The storage and handling of hydrocarbons in the dredger and auxiliary equipment must be performed by duly trained personnel, in order to prevent ignorance on the method of handling the fuel.

- The contingency plan will be implemented in case of an accidental spill of hydrocarbons; the proponent must have onsite all of the equipment and materials (absorbent barriers) to stop and control any fuel spill that might occur.

Environmental Measures (noise and air quality contamination)

- Workers will be provided with job protection equipment to prevent effects on their health from contaminating gases derived from the combustion of the equipment used in cleaning the San Juan River.

The impacts that the San Juan River cleaning project will produce on the socioeconomic aspects are positive in nature.

- The quality of life of the population is improved by resolving the navigation problem, which blocks complete inclusion of the entire municipality of San Juan de Nicaragua into the dynamic of national life.
- Increase in the number of tourists who go to the San Juan River area.
- Savings in the costs of transport due to a reduction in transport time.
- Increase in the Flow of Transport
- Shipping of cargo
- Improvement in local fishing by increasing the fish population and as a result of the better living standard of the inhabitants
- Increase in the Source of temporary employment
- Changes in the Local Economy
- Changes in the Regional Economy.

Environment Measures due to Socioeconomic Impacts

- The residents who reside on the outskirts of the material deposit sites will be informed at least thirty (30) business days in advance, on the start of operations near their dwellings.
- Project staff and the people near the deposit sites will be trained regarding safety measures and restrictions on movement to the site where the deposit work on the extracted material will be performed.

6. Other environmental management measures proposed in the EIS:

6.1 Environmental Supervision and monitoring plan

The objective of environmental supervision is to guarantee the performance of the project without causing damage to the environment and to its users. It also has the following objectives:

Through follow-up, they seek to be able to perform an *ex post* evaluation, once a reasonable period of time has elapsed, to see to what degree the forecasts are met and if it is necessary to adopt new corrective measures.

The supervision includes 7 main activities, which are:

1. Cutting and suction of the material

- Evaluate physiochemical parameters in the water. Samples must be taken twice a day.
- Evaluate the quality of the sediment, which they suggest must be performed on the dredger itself.
- Supervise compliance with workplace safety and hygiene regulations.

2. Transfer of the material = sediment

- Install visible lighted signs to prevent accidents.

3. Depositing of material = sediment

- Evaluate physiochemical parameters in the liquid content of the dredged material (this is the same as point 1).
- Evaluation of the granulometry of the sediment to be dredged.
- Determine and evaluate the surface flow of the deposit (the site must be outside the areas affected by currents to avoid water erosion).

4. Storage and supply of hydrocarbons

- Evaluate maintenance operations on the dredge's engines.
- Supervise the supply operations and do not allow fuel to be spilled on deck or on the river's water.

5. Evaluate the signage and signaling implements. In the work area visible signs should be posted on banderoles at the beginning, middle and end. At night lighted signs should operate to prevent accidents.

6. Evaluate the plant material that is going to be used. The seedlings to be used in the replanting program must have a height of 0.50 meters or more, and be healthy.

7. Evaluate the implementation of the plant restoration, reforestation, and natural regeneration program.

7. Summary of opinions received and the respective comments:

The public consultation on the project was held from August 9 to 15, 2006, by making the Environmental Impact Document available at City Hall in San Juan de Nicaragua, City Hall in El Castillo, MARENA-Rio San Juan Office located at the departmental offices of San Carlos and in the MARENA – Central Documentation Center, and the following results were obtained:

Comment of Mr. Mario Mallorquín and Ronald Estrada, from San Carlos: We wonder, what will happen with the tributaries of the San Juan River that come from the reservoir?
Why is there no replanting to be done over the (dredged) material to prevent erosion?
How will the sediments be handled in the wetlands areas?
He indicates that mangroves do not prosper under these conditions and he suggests reviewing the plants to be replanted well, and they recommend native species?
They note inconsistencies in the EIS report because activities in Bluefields Bay are mentioned but not in the San Juan River, which should be corrected.

On landfills with dredged material he requests clarification on whether the material is going to be placed in hollow spaces or in the creek. He states his concern in relation to the change of speed of the river current which could be caused by the dredging and wonders how traditional fishing will be affected, in particular royal shad and sea bass?

Messrs. Mallorquín and Estrada are correct in the sense that native species must be required for the reforestation effort, which must also be used in the mounds of dredged material to reduce the erosive processes. In terms of the depositing of sediments in the wetlands area, the work group will evaluate the arguments presented by the consultants who prepared the EIS to make use of those areas. According to the EIS the deposit sites for the dredged materials are all located on dry land and the members of the workgroup will require that the soil layer be removed in each deposit and used for plant coverage recovery activities.

Mr. Antonio Ruiz Meléndez and Davis Morales: They claim that no reference is made to the existing population in the area who live on the shore of the river. They think that the waste and trash of the people who will participate in the work was hidden, the same as with the transfer of lubricant waste. The high rainfall levels of the area and the risks of natural phenomena are not discussed, and therefore there are no mitigation measures for emergency situations.

The cause / effect matrix does not have the terminology of the nomenclature used in that matrix. They claim that one area is reflected in the description and the environmental management plan reflects another. The DIA does not take into account the summer season for a full evaluation of the parameters. In relation to the DBO in one part, it indicates that 1,000 meters is going to be taken, and in the other 500 meters.

He notes that the bathymetry is missing, the type of dredger to be used, the useful life of the

dredging, and no mention is made of international commitments like the RAMSAR convention.

8. Conclusions

- After the Delta the flow volume that goes through the San Juan River falls considerably, because a large part of that flow volume is discharged into the Caribbean Sea through the Colorado River.

- The flow obstruction conditions that exist in the channel bed of the San Juan River in the last 40 kilometers of its trajectory have affected several species of aquatic fauna, because a lot of those species penetrated through the river to complete their biological cycle upstream from the River.

- The San Juan River is the only travel route that the people of the municipality of San Juan de Nicaragua and the people who live on the banks of the river, both on the Nicaraguan side and the Costa Rican bank, currently have. The conditions of the channel bed make transportation in that part of the country more expensive.

- In the sites where the riverside forest has been eliminated, the banks of the river are subject to a significant process of water erosion which sometimes drags a large amount of the soil that is deposited in the river's channel.

- The workgroup believes that the dredging to improve navigation along the San Juan River is a necessity, and the execution of this project must be exploited to correct a series of problems that are being caused along the banks of the river that are affecting the biodiversity and the water. It is important to recover the riverbank plant coverage to protect the channel bed of the river, the biodiversity, and the water source itself.

- The inter-institutional technical team that evaluated the EIS believes the project is environmentally feasible if EPN complies strictly with the environmental measures established in that study and the provisions issued by MARENA under an administrative resolution to prevent, mitigate, and offset possible negative impacts.

8. Recommendations on the most important aspects for decision-making

a) Maintain constant and fluid communications between the National Port Authority and the bodies responsible for monitoring the environmental performance of the activity.

b) The EPN must document all of the environmental management activities, by sending to DGCA/MARENA, the MARENA-Rio San Juan office, the Environmental Unit of the Municipal Government of San Juan de Nicaragua, and the DGTAN-MTI, all of the documentation related to environmental performance at the site where the project will be performed.

c) Qualified personnel must be hired to meet the commitments acquired by the project's proponent, as per the Environmental Impact Study presented.

d) All events that affect or threaten to affect the environment must be reported to the competent authorities immediately, such as MARENA, the municipal government of San

Juan de Nicaragua, or the MARENA-Rio San Juan territorial office.

e) The company must ensure the technical and financial resources needed to undertake the Environmental Management Program suggested in the EIS.

Names of the members of the Workgroup	**Signature**
Mr. Milton Medina Calero, DGCA/MARENA	[signature]
Ms. Elsa Vivas, DGCA-MARENA	[signature]
Mr. José Luis Galeano, MARENA-Rio San Juan Office	[signature]
Ms. Liliana Diaz, DGAP – MARENA	[signature]
Mr. Luis Garcia, DGTAN-MTI	[signature]
Mr. Sergio Cordonero, INETER	[signature]
Mr. José Tomas Valle, INETER	[signature]

Managua, November 28, 2008

Annex 13

EPN, "Environmental Management Plan for Additions to the Project Improvement of Navigation in the San Juan de Nicaragua River," September 2009

ENVIRONMENTAL ACTION PROGRAM (PGA, by is Spanish acronym)
FOR EXPANDING WORK ON
RÍO SAN JUAN IMPROVED NAVIGATION PROJECT
NICARAGUA

Photograph

PRESENTED BY

NATIONAL PORTS COMPANY

(EPN)

SEPTEMBER 2009

CONTENTS

INTRODUCTION

The Environmental Action Program (PGA, by is Spanish acronym) for expanding work on Río San Juan Improved Navigation Project consists of elaborating out a series of coordinated actions regarding the environment to be carried throughout all stages of the project in order to strengthen its protection of the environment.

The present plan mainly foresees environmental protection by way of the implementation and oversight of measures designed in order that expansion activities are in harmony with the environment.

It is important to bear in mind:

First Since the activities are similar to others already carried out in the national territory, they will have a low level of environmental impact due to the low risk and little effects on the environment. On the other hand, the area directly impacted upon will be the riverbed and the bed of the spring and the places identified for depositing dredge residue material and debris.

Second Due to the low impact of the human activity presently carried out in the area of the project, at present the environment is in a good state of conservation. Nonetheless, some aspects of the socio-economic situation of the population have led to greater agricultural activity in some sectors of the protected area that is regulated under its management plan.

Objectives:

- To evaluate diverse activities in view of prevention, mitigation and compensation of environmental impact caused by activities of the project in order to protect the environment (flora, fauna; soil; air and water).
- To implement the Environmental Action Plan in conformity with stipulations of different plans that are part of the PGA (the Plan for Environmental Measures, the Monitoring Plan, the Environmental Oversight Plan, the Contingency Plan, the Restoration Plan, and the Environmental Education Plan.)
- To foresee any environmental action that may hinder the project, and impact of the project on the environment[?].
- To maintain the physical integrity of the workers as well as the local citizenry in the event of situations unforeseen in the project's design and development.

Compliance with the objectives of the present plan requires the development of four mutually complementary programs:

Description of the activities:

Expansion activities of the National Ports Company have the objective of cleaning a tributary of the Río San Juan that flows into Laguna Harbour. This stage will be labour intensive. Expansion activities also involve cleaning stretch of the river with dredging and stationary suction equipment. This will allow for the creation of an alternate more direct navigation route and will reduce the time required for travel between different points along the river. It will have a positive socio-economic impact as decreased fuel requirements will decrease the cost of transportation for transport companies and the citizenry.

This expansion of the cleaning and dredging project will be in the following coordinates. Two places are referenced with the purpose of specifying the location.

Activity No. 1 (Clean-up of the spring)

- Coordinates: North 1208638 and East 863133 and coordinates North 1209823 and East 863450.
- Maximum width of the canal: 30 meters.
- Approximate length: 1,560 meters.
- Minimal depth reqauired: 2.5 meters.

Clean up will take place in two stages. The first stage will involve manual labour consisting mainly of the extraction of river plants, ruff, tree logs and mud accumulated on the bank and bed of the canal. Between 200 and 250 local men will be hired for this task. All environmental measures will be taken to lessen as much as possible impact on the bank of the spring. This work will prepare the way for the dredging work that follows.

The second stage consists of dredging the spring while attempting to lessen as much as possible impact on the vegetated areas that have not been previously impacted upon. The scope of the dredging will be 30 meter in width at a minimal of 2.5 meters in depth. Two sites for the deposit of mud have been identified. These satisfactorily conform to all technical specifications of the sites chosen in the Environmental Impact Study. Approval and environmental authorization of the Ministry for the Environment and Natural Resources is being sought for this stage.

Activity No. 2 (cleaning stretch of the Río San Juan with dredging and stationary suction equipment)

- Coordinates: North 1208439 – East 863131 and Coordinates North 1208134 – East 863136 and North 1208138 East 863196
- Estimated width of the canal: 59 meters.
- Length: 250 meters.
- Maximum required depth: 6 meters.

Site No. 2 is located in the above mentioned coordinates. Cleaning in this location will consist of dredging a width of 59 meters with a depth of 6 meters. The dredging will have the greatest depth and reach in this stretch. The purpose is to increase the strength of the current and to facilitate water transport. Thirty workers will be hired for this work and three sediment deposit sites have been identified for the deposit of dredge residue. All necessary measures will be taken in order to minimize any type of impact.

Expansion activities for cleaning and dredging will have negative as well as positive impacts. The National Ports Company designed an Environmental Action Plan to serve as a methodological instrument that will facilitate the corrective and compensatory measures under the Environment and Natural Resources Law and in compliance with Decree 76-2006 which binds the executor of the project. It is important to mention that the Environmental Impact Study of the Río San Juan Improved Navigation Project include the basic studies[?].

Plan for Environmental Measures

- Environmental measures are actions that will be taken to prevent and mitigate any negative environmental impact generated by project activity.
- The Environmental Action Program (PGA) is an instrument that will guide project initiatives regarding the environmental management strategy of the activities in each stage.
- The purpose of the measures is to prevent, diminish or reduce the adverse effects of the cleaning activities on the natural resources of the Río San Juan Protected Wildlife Refuge, and, in conformity with present protection norms and criteria, implementation of all actions for minimizing to acceptable levels the project's impact on the environment.

- Actions required by mitigations measures, as well as those contained in the contingency, monitoring and follow-up plans, will be included in the general PGA of the Río San Juan Improved Navigation Project which includes dredging activities in the 42 kilometres from a point known as Chingo Punta Petaca all the way to the point where the Río San Juan flows into Caribbean Sea.

Re: Activity No. 2	
Environmental element affected:	Soil, flora and fauna
Environmental Impact:	Erosion and loss of species of flora and fauna

ENVIRONMENTAL MEASURE No. 1: To avoid soil erosion, boundaries of the dumping site will be established before depositing begins; primarily using areas cleared of vegetation. This will limit impact on the flora and fauna of the area's ecosystem.

ENVIRONMENTAL MEASURE No. 2: To avoid erosion processes and prevent sediment from being carried back to the River, sediments derived from the use of dredging equipment must be deposited at a distance greater than 50 meters from the riverbank; and soil particles should not be allowed to be carried toward the body of water.

ENVIRONMENTAL MEASURE No. 3: Barriers in the sediment deposit areas shall consist of tree logs and pieces of trees.

SPATIAL LOCATION:	Sediment deposit sites
RESPONSIBILITY OF:	Environmental Supervisor

Re: Activity No. 1	
Environmental element affected:	Soil and water
Environmental Impact:	Erosion and deteriorated water quality

ENVIRONMENTAL MEASURE No. 4: To reduce effects on water quality, clearing for maintenance of the spring will be done by manual labour (and the use of shovels and rakes.)

ENVIRONMENTAL MEASURE No. 5: To avoid erosion and prevent sediment from being carried back to the spring's current, sediments derived from the use of manual equipment must be deposited at a distance greater than five (5) meters from the bank of the spring; and soil particles should not be allowed to be carried back toward the body of water.

ENVIRONMENTAL MEASURE No. 6: Stabilization of the slope along the sides of the spring will be accomplished by shaping and compressing the slope uniformly; erosion and carriage of sediment will be prevented.

SPATIAL LOCATION:	Sediment deposit sites
RESPONSIBILITY OF:	Environmental Supervisor

Re: Activities Nos. 1 and 2	
Environmental element affected:	Soil and water
Environmental Impact:	Contamination of water and soil due to the deposit of liquid and solid residue, and domestic solid waste

ENVIRONMENTAL MEASURE No. 7: To prevent water and soil contamination, portable toilets will be installed for use by project personnel. The number of portable toilets will depend on their capacity and design as well as the number of workers. Authorized personnel will be responsible for final treatment and disposal of residue which will take place outside of the work area.

ENVIRONMENTAL MEASURE No. 8: To prevent water and soil contamination during the activities all domestic waste will continually be collected and disposed of outside of the work area in conformity with the technical environmental rules for nontoxic waste management. The disposal site shall be designated by the San Juan de Nicaragua Municipality. Also, plant waste should be handled away from the edge of the river's current.

SPATIAL LOCATION:	Area designated for cleaning activities
RESPONSIBILITY OF:	Environmental Supervisor

Re: Activities Nos. 1 and 2

Environmental element affected:	Soil and water
Environmental Impact:	Contamination of water and soil due to the deposit of liquid residue derived from hydrocarbons

ENVIRONMENTAL MEASURE No. 9: To prevent water and soil contamination, transport and storage of hydrocarbons for use in project activities shall comply with measures established in the contingency program that is part of the project's Environmental Impact Study approved through Administrative Resolution 038-2008.

ENVIRONMENTAL MEASURE No. 10: To prevent water and soil contamination at the fuel storage facility location a basin against spills must be built for the tanks at that location. These must conform to the technical specifications regulating this area. Also, adequate equipment will be set up for the transport of fuel to supply the boats.

SPATIAL LOCATION:	Area designated for fuel storage
RESPONSIBILITY OF:	Environmental Supervisor

Re: Activities Nos. 1 and 2	
Environmental element affected:	Flora and fauna
Environmental Impact:	Clearing of vegetation and loss of habitat of the area's species

MITIGATION MEASURE No. 9: To compensate impact on vegetation, reforesting will be in a proportion of 10 new trees of the same species found in the area for each tree cut down. Further, natural regeneration of species of the area directly impacted by the project shall be promoted.

MITIGATION MEASURE No. 10: To prevent and reduce impact on the area's landscape, pruning and cutting of trees unsupervised by a forest technical shall be avoided. Further, all domestic waste shall be continually collected and disposed of outside of the area.

SPATIAL LOCATION:	Area designated for fuel storage
RESPONSIBILITY OF:	Environmental Supervisor

Restoration plan

A plan for the restoration of area's species shall be implemented in conformity with a tree and bush planting plan for each side of the riverbank. Thus, a vegetation net shall be formed which will hold the soil and prevent erosion, improve the landscape and also enrich the vegetation so it may serve as a refuge and food source for the fauna. This will create a situation where the project shall not significantly impact the natural environment, the refuge areas, or the work itself. Some refuge areas are presently severely degraded by human activity and incipient agricultural development.

Re: Activities Nos. 1 and 2	
Socio/environmental element:	Human resources
Social Impact:	Risks of accidents among project workers.

MITIGATION MEASURE No.11: To prevent cuts, snake bites and drowning due to working conditions, the project will make available equipment and implements such as boots, life vests, ponchos and first aid kits, etc., and take security measures.

MITIGATION MEASURE No. 12: To prevent incorrect use of natural resources and accidents, the EPN shall offer training sessions to all project workers. The Training Plan shall be the responsibility of the San Juan de Nicaragua MARENA Office.

SPATIAL LOCATION:	Area designated for fuel storage [?]
RESPONSIBILITY OF:	Environmental Supervisor

3. Environmental Supervision and Oversight Plan

The National Ports Company shall have an Environmental Unit responsible for onsite follow up regarding compliance with each measure determined in the PGA as part of the project's Environmental Impact Study.

Also, the following environmental measures shall be taken to guarantee mitigation and prevent impact in the areas of clean up and dredging expansion.

This program will establish indicators that guarantee that project activities take place with no harm to the environment and its users. Further, it designates the person directly responsible for the action and the person responsible for environmental oversight.

Follow up to incidents will allow **"ex-post"** evaluation after a reasonable period of time in order to determine to what degree measures were complied with and whether new corrective measures are necessary.

Environmental Supervision and Oversight Plan

PROJECT ACTIVITY	SUPERVISION & CONTROL ACTION	INDICATORS	RESPONSIBILITY	ENVIRONMENTAL SUPERVISOR
CLEAN UP, CLEARING AND SUCTION OF MATERIALS	Evaluate compliance with environmental measures. Evaluate sediment to be dredged as to its grade. Evaluate compliance with sanitary, health and occupational Safety.	*Reports, logs, photographs. *Evaluations should be done in the dredge boat with adequate instruments. *Workers must be provided with pro-tection equipment consistent with MINTRAB rules.	**National Ports Company (EPN)** **EPN** **EPN**	EPN Environmental Supervisor **IDEM** **IDEM**
TRANSPORT OF DREDGING RESIDUE	Verify system of signs incl. re boundaries of sites for final deposit of dredging residue.	*Sediment must be 50 meters from the riverbank.	**EPN**	**IDEM**
STORAGE & DISPENSING OF HYDRO-CARBONS	Evaluate maintenance operations for the motor boats. Evaluate fuel supply operations. Evaluate signs intended to avoid accidents.	*Lubricant waste must be collected in metal barrels. *Waste should be transported outside the project area for its handling. *Fuel spills on the ship deck or in the river water are to be avoided. *In work areas at their beginning, middle and end, and on both sides of the river there should be visible signs. *Luminescent signs must be in place to avoid danger during night navigation.	**EPN** **EPN** **EPN**	**IDEM** **IDEM** **IDEM**

The best way to resolve problems deriving from hydrocarbons contamination is to prevent the incident. Normally these happen as a result of equipment defects and human error. Risk of equipment failures can be resolved with periodic inspections and adequate maintenance, while the risk of human error can be resolved with personnel orientation and training. The sections below address the following topics: Steps for detecting a hydrocarbons spill in the project area, and actions to take in the event of a spill.

a) The contingency plan should be implemented when spills of hydrocarbons used as fuel in the project area and the general area are above 1 m^3.
b) When the spill is less than this, immediate containment actions should be taken as well as follow up to determine the direction of its flow depending on the direction of the wind, current and tide in the area. The competent MARENA authorities must immediately be informed of the incident.
c) When the slick is going toward the "beach zone" control actions should always be taken along the coastline; the situation should be notified to pertinent authorities for the pertinent follow up.

Operations under the Plan of Action are divided into four categories. Before beginning any of them, a quick evaluation of the spill should be done in order to determine the strategy to be followed and the equipment and personnel that will be needed.

a) First will be set up of a Commend Center at the site of the spill, set up of other communications, contact with interested parties, and all necessary preparations for initiating control action.
b) The second important stage is the beginning and maintaining of control actions in the area of the accident. The primary action area is the immediate area of the spill. At this stage it is important to have enough logistical support, preferably a helicopter since a helicopter provides a perfect view and action can be directed from the air through helicopter – land – beach communication.
c) The third operation involves support of control actions taking place at the coastline. The recommended action is protection of those coastal areas of high ecological, economic and touristic value, or areas that are difficult to clean. An effort should be made to direct the hydrocarbons to areas where they can be cleaned without damage to the area's ecology.

d) Lastly, there are wrap up operations, that is, the gathering of equipment, analysis of the effects and costs of the spill, and finally a complete report on the accident.

e) The National Ports Company should provide storage facilities for the required equipment and the necessary materials for handling a spill of great proportions (the maximum capacity of the storage tanks), as well as for their transport to the site of the spill. It is also important to bear in mind other equipment that may eventually be needed (cranes, boats, etc.)

4.6 Personnel Security Matters

- Life vests should be used in all river operations. Footwear should be resistant to slipping. Other implements that prevent accidents, such as helmets, gloves, etc., should be mandatory.
- Because of its highly combustible nature, the potential risk of fire should be considered when handling a hydrocarbon spill.
- The use of *exposímetros* [light measuring devices[?] are crucial in spills involving light hydrocarbon spills, especially when they take place under piers or tight spaces.
- Equipment to be used in the event of a spill should be inspected as to their possibly emitting sparks. When handling the spill of highly flammable materials, explosion-proof equipment should be used.
- Personnel should always be alert to the risk of fire and fire-fighting equipment should be available. It is important to bear in mind that hydrocarbons float on water, including when they are on fire.

VI. Plan for the Mobilization and Demobilization, and the construction of a temporary encampment.

The inconvenience of dredging equipment and its operation in an area is temporary. The establishment of an encampment will have direct and indirect positive effects that will be reflected as follows: the local population can provide certain goods and services to the persons that will live in the encampment. The following table lists the expected impacts and proposed environmental measures for mitigating such impact.

EXPECTED IMPACT	ENVIRONMENTAL MEASURES	TIME LINE	SUPERVISION & CONTROL ACTION	ENTITY RESPONSIBLE FOR CARRYING OUT	ENVIRONMENTAL SUPERVISOR
Living conditions such as heat, cold, humidity, etc., are a determining factor in workers performance. These work conditions are determined by the ecosystem. Location of the encampment is fundamental for maintaining the workers' health.	Presence of machinery on the water-way should be indicated by signs that are visible in daytime so that appropriate measures may be taken by those using the waterway. To reduce the risk of accidents, non authorized personnel should be banned from the dredging project area; for this a fence should be built because the river is only means of transit between San Carlos and San Juan de Nicaragua. Dormitories for workers living in the encampments must be constructed with enough ventilated areas; the floors should be made of material that is easy to clean. The area for each bed should be 1.6 x 2.5m^2 and the distance between each is 1m.	The time required for cleaning and dredging stage.	Signs should be situated 100 meters from the work area and 100 meters past the work area.	The contractor.	MARENA and EPN.

EXPECTED IMPACT	ENVIRONMENTAL MEASURES	TIME LINE	SUPERVISION & CONTROL ACTION	ENTITY RESPONSIBLE FOR CARRYING OUT	ENVIRONMENTAL SUPERVISOR
When the encamp-ment is dismantled solid waste may endanger the health & natural resources of the local population. The encampment is where construc-tion machinery and equipment used in the project get maintenance. The most common maintenance is oil change which could spill if not properly handled, thereby reaching the floor, and contaminating superficial water, filtering into and contaminating underground water.	Outhouses are the sanitary services to be used in the encampment. These will be protected against flies, and will be well ventilated. We recom-mend the use of **VIP** (Improved Traditional Outhouses) because the encampments are temporary and six months after it closes the material degrades. Proportion should be one outhouse for every ten persons. Their location should be a minimum of 30 m from a water source and al-ways in the low lying areas. The lo-cation of outhouses and baths should be leeward and some 30 m from the dormitories. A minimum of 25 gallons of water for personal grooming should be guaranteed to each worker in the encampment. The kitchen area and mess halls should be constructed so as to have enough ventilation and should have screens for protection against flies. The kitchen and mess halls should not be used as dormitories. Used water from the kitchen should pass				

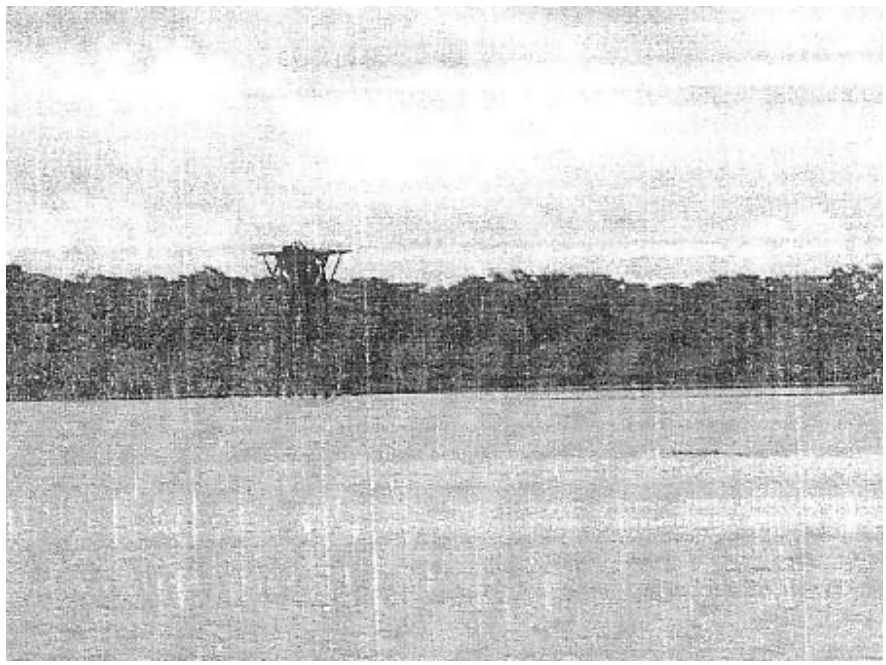
	through a PVC pipe into a filtering tank located 20 m from the kitchen. Organic solid waste should be prev-iously sorted and put in adequate containers for burning or burying. In-organic solid waste should be stored in adequately sealed containers and discarded in the area's municipal dump. All construction waste, including of sanitary services, and other material should be removed and eliminated. Disinfectants should be applied to septic tanks. They should also be filled with soil.				

Annex 14

MARENA Technical Monitoring Report from Inspection
Conducted 24-26 November 2010

TECHNICAL MONITORING REPORT

PROJECT "IMPROVEMENT OF THE NAVIGABILITY OF THE SAN JUAN RIVER"
From the 24th to 26th of November 2010



Participants:

Omar Brenes, MARENA Delegate – San Juan River
Elsa Vivas Soto, Environmental Specialist – DGCA/MARENA
Diana Castillo Herrera, Environmental Specialist – EPN
Mr. Luis Felipe Marín, Dredging Captain – EPN
Mr. Jorge Agustín Soza, Technical Assistant – EPN

Introduction:

The Project **"IMPROVEMENT OF NAVIGATION IN THE SAN JUAN RIVER OF NICARAGUA** consists entirely of the improvement of the navigation route that will permit the river connection between existing communities in the extreme south-eastern territory and the rest of the country. The navigation channel will have the following dimensions: in its cross section it will be 20 meters wide on the bottom, 30 meters wide on the surface, and 2 meters deep in the dry season, along a stretch of 41,963.57 meters that extends from the site known as Punta Chingo Petaca until the Mouth of the San Juan River, as well as the construction of an access channel for the transportation of equipment to carry out the dredging, from the Caribbean to the Mouth of the San Juan River of Nicaragua, which will have the cross-section dimensions of 40 meters wide [at the bottom], 60 meters wide on the surface, a minimum depth of 6 meters, and a total length of 2,000 meters," as well as the clearing – using manual equipment – a *caño* [i.e., small channel] that connects the San Juan River to the Harbor Head Lagoon, in Nicaraguan territory. The clearing will be conducted along a length of 1,560 linear meters and up to a maximum of 30 meters wide, according to the reference coordinates North 1208638-East 863133 at the initial point, to final coordinates North 1209823-East 863450; and to clear, using a dredge, a stretch [of the San Juan River] that has filled with sediment, located in the reference coordinates North 1208439-East 863131 to (the end) coordinates North 1208134-East 863136 and North 1208138-East 863196, up to 59 meters wide, 300 meters long, and 6 meters deep, in which 37,500 m³ will be extracted, with the goal of facilitating navigation in those stretches.

In Nicaragua, the Ministry of Environment and National Resources (MARENA), the environmental regulatory entity, issued in 2008 an environmental permit through Administrative Resolution No. 038-2008 to the *Empresa Portuaria Nacional* [National Port Company] (EPN) as well as through an addendum to Administrative Resolution No. 038-2008-A1, issued in 2009 for the development of the project.

MARENA, by way of monitoring, organized and coordinated with others a monitoring inspection to verify the environmental compliance of the project located in the Municipality of San Juan de Nicaragua within the protected area "*Refugio de Vida Silvestre Rio San Juan*" [San Juan River Wildlife Reserve].

The instrument adopted to measure compliance with the prevention and mitigation measures was the Environmental Impact Study, as well as the Environmental Monitoring Program derived from that Study. The following environmental legal norms were also used: the Environmental Assessment Regulation (Decree 76-2006) [sic; correct: Decree 45-94], the General Law on the Environment and its Regulations (Law 217) and its Revision (Law 647) and the Regulation of Nicaragua's Protected Areas (Decree No. 01-2007).

It is important to mention that the EPN designated an environmental specialist to ensure the supervision and compliance with the environmental measures, in accordance with that established in condition 11 of the Resolution 038-2008.

This report only contains the results of the visit to monitor the activities initiated at the time as part of the stages of the project.

OBJECTIVE OF THE INSPECTION

A. GENERAL OBJECTIVE

To evaluate the compliance with the provisions established in the Environmental Permit issued by the Ministry of the Environment and Natural Resources (MARENA) for the project ***IMPROVEMENT OF NAVIGATION IN THE SAN JUAN RIVER OF NICARAGUA*** through Administrative Resolution No. 038-2008 and its expansion (A-1).

Specific Objectives

- Verify compliance with the environmental provisions established in the environment permit and its expansion, in accordance with the environmental instruments and current regulations that apply.

- Evaluate the clearing and navigation improvement activities in the area where the beginning of the dredging activities is being carried out, a site known as the Finca José Sánchez, as well as the maintenance and manual clearing works in the Caño, a tributary of the San Juan River that empties into the Harbor Head Lagoon.

- Conduct a tour of the sites where sediments will be deposited along the 42 kilometer stretch, in order to ensure that the sites will be marked before the activities are conducted.

III. FIELD OBSERVATIONS:

The visit begins at the Project Campus located in the Municipality of San Juan de Nicaragua. In this site the administration and local management offices of the project.

At this same site they have established the storage point for the fuel to be used for the project, and to supply to the population if necessary.

Storage capacity:

- 4 tanks, each with the capacity to supply 1,000 gallons of diesel fuel
- 23 barrels where approximately 1,265 gallons of gasoline are supplied
- A tank with a capacity of approximately 250 gallons of gasoline

The fuel is transported by a barge from the facilities of the Petronic company in Puerto del Bluf to San Juan de Nicaragua.

Tour of Site 1:

In the field a brief meeting was conducted with personnel from the project, to whom it was explained that the objectives of the visit were oriented toward the environmental monitoring of

the activities that had been initiated that included the cleaning of a stretch of the River that had become full of sediments using a dredge, located at reference coordinates North 1208439-East 863131 and North 1208134-East 863136 and North 1208138-East 863196 [to the end], with a georeferenced width of up to 59 meters, length of 300 meters, and depth of 6 meters.

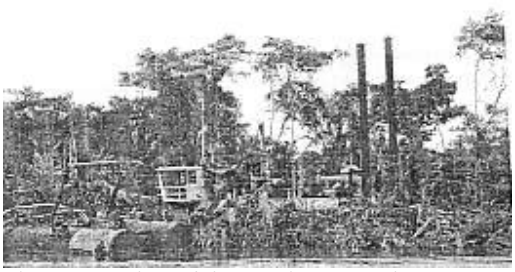
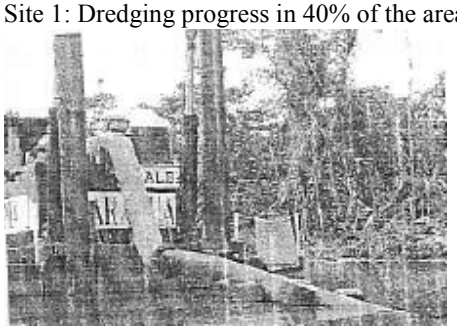


Photo: Location of the Dredge – North 1207586 and East 0207244

At the time of the visit, the equipment of the *Soberanía* Dredge was parked at the site, without conducting any activity; however, the dredging activities had advanced to approximately 40% (cut, suction, and deposition of sediments totaling 12,000 m³, according to the information supplied.

We observed the affect on vegetation that is characteristic to the area, which belongs to a very wet tropical forest (species like *Soto caballo*, *yolillales*, papaya tree, banana and grass cultivations, etc). Likewise, the area used for sediment deposits had been used for agricultural activities.

Site 1: Dredging progress in 40% of the area



Site 1: Area already cleared of Vegetation (60%)

All of the vegetation affected has been located on the left and right banks of this stretch in Nicaraguan territory. In 60% of the site, the trunks (stumps) of the trees have not yet been removed.

The sediment will be deposited in three sites, two of which have already been used to deposit approximately 12,000 m³ of sediments. For the insertion of the tubing to the deposit site, an initial easement of approximately 10 meters wide was created.

At this site, 22 people are working in shifts of 11 people.

A total of 42 gallons of used oil is generated per month. These wastes are stored in 55-gallon barrels with hermetic lids.

It was observed that the solid wastes of domestic origin (plastic bottles, plastic plates and wrappers) were collected temporarily on site and later transported to a final deposit site in the town of San Juan de Nicaragua.

Vegetative wastes from the pruning of trees, primarily *yolillales* (palms) and grass vegetation, were also observed, which must be removed from the temporary site.

Location of vegetative wastes

SITE No. 2: Works to maintain and clear the caño.

The clearing of the caño, tributary of the San Juan River that empties into the Harbor Head Lagoon in Nicaraguan territory, begins at coordinates North 1208638 and East 863133, observing the clearing of the navigation channel of approximately 10 meters wide (at the beginning) and between 1-1.2 meters of depth, with a length of around 1,560 meters. The works are conducted manually (using shovels, pickaxe and chainsaw used for tree pruning).

Distance toured during the inspection:

Point 1 (beginning) coordinates North 1208638 and East 863133
Point 2. Coordinates: North 1209162 and East 862956
Point 3. Coordinates: North 1209352 and East 862948
Point 4. Coordinates: North 1209564 and East 863011
Point 5. Coordinates: North 1209678 and East 863093
Point 6. Coordinates: North 1209728 and East 863436
Point 7 (exit into the Harbor Head Lagoon). Coordinates: North 1209823 and East 863450

The vegetation that was affected on the left bank of Nicaraguan territory is part of the very wet riparian and flooded forest of the caño, which obstructed the navigation of the channel.

In these activities, around 248 people (male) are working, equipped with rubber boots, shovels and pickaxes for the manual work, and given that the water level was making these cleaning efforts difficult, other types of equipment might be required.

The solid wastes generated by the workers are managed in the same way as described for site 1.

Type of vegetation on the banks (*yolillo* and grasses)

Beginning of the manual clearing

Sedimented caño and in its current state

Exit from the caño toward Harbor Head Mangrove type vegetation

SITE 3: Area of the 42 kilometers where the dredging activities will be conducted from the mouth of the San Juan River to the site known as Chingo Punta Petaca **(These activities have not commenced).**

One of the primary activities to be conducted before the work begins in this section is the on-site marking of the deposit sites.

CONCLUSIONS:

- The environmental impacts that have been generated by the project's activities are short-term and reversible, primarily the recuperation of vegetation.

- The impact on water quality conforms to the physico-chemical parameters and is considered to be of low intensity, inevitable, and is located along the stretch of the

cleaning activities initiated with short duration and indirect effect. The recuperation of the physico-chemical parameters of the water (transparency, color and turbidity) depend on the quantity of solids dissolved in the water and will depend on how long the activity lasts, which is not considered significant because of the size of the sediments extracted, which confirm that the granulometry studies conducted for the project were correct.

RECOMMENDATIONS:

- EPN should present to MARENA in January 2011 its first trimester compliance report, in accordance with what is established in section 11 of Resolution 038-2008 and its expansion (A1).

- In light of the progress of the dredging activities in site 1, delimit the third area for depositing sediments, using primarily area that has been cleared of vegetation in order to reduce the impact on the flora and fauna of this ecosystem.

- Install ecological (mobile) latrines for the use of the personnel working on the project.

- Ensure the safety equipment and measures necessary to avoid working accidents, especially in the case of snakebites.

- At the campus site where fuel is stored, an anti-spill basin should be built, according to the relevant technical specifications.

Prepared by: Elsa Vivas Soto

Annex 15

Annex 4, Declaration of Lester Antonio Quintero Gomez,
Technical Manager of EPN

16 December 2010

QUINTERO ANNEX 4

CHARACTERISTICS OF THE TYPES OF DREDGES TO BE USED

STATIONARY CUTTER AND SUCTION DREDGE *SOBERANÍA*

Length:	30.49 m
Beam:	6.86 m
Draft with Full Load:	1.22 m
Capacity:	350 m^3/hour

CUTTER AND SUCTION DREDGE *AMMCO* (PROPERTY OF EPN)

Length:	24.18 m
Beam:	6.0 m
Draft with Full Load:	0.80 m
Capacity:	150 m^3/hour

ENAP D-1 CLAMPSHELL DREDGE, SELF-PROPELLED WITH DERRICK

Capacity:	75 m^3/hour
Hopper Capacity:	150 m^3
Length:	30.50 m
Beam:	8.70 m
Height:	2.50 m

Annex 16

INETER, Summary of Measurement of liquid and suspended solids content during the years 2006, 2011, 2012

DS-JCM-0733-06-12
Managua, June 26, 2012

Mr. **Samuel Santos Lopez**
Ministry of Foreign Affairs
Hand delivered.

Dear Minister Santos Lopez:

We refer to the verbal request of Dr. Carlos Argüello, an official at the Ministry under your care, at the meeting last May 24th, in which he asked us to obtain hydrological data and information on the San Juan de Nicaragua River. In this regard, I wish to inform you that INETER delivered the following documents to Mr. Edgardo Sobenes, First Secretary of the Embassy of Nicaragua in The Netherlands:

1. Final Report on "MEASUREMENTS OF VOLUME FLOW RATES, SUSPENDED SEDIMENTS AND BATHYMETRIC SURVEY IN THE SAN JUAN DE NICARAGUA RIVER" containing data on flow rates from the 2011 gauging campaign.

2. Final Report on "MEASUREMENTS OF VOLUME FLOW RATES, SUSPENDED SEDIMENTS AND TOPOGRAPHIC SURVEY IN THE SAN JUAN DE NICARAGUA RIVER" containing data on flow rates from the April 2012 gauging campaign.

3. Comparative table of volume flow rates measurements performed in 2006, 2011 and 2012.

4. San Juan River Hydroelectric and Navigation Project, prepared by the Governments of Nicaragua and Costa Rica, with technical assistance from the Department of the Interior, Bureau of Reclamation, 1977.

I take this opportunity to reiterate to you the assurances of my consideration and esteem.
Sincerely,

/s/ illegible
JORGE CASTRO MEDINA
Executive Director

[Seal:] NICARAGUAN INSTITUTE FOR TERRITORIAL STUDIES
EXECUTIVE DIRECTOR
REPUBLIC OF NICARAGUA
CENTRAL AMERICA

MINISTRY OF FOREIGN AFFAIRS
COMMAND POST
RECEIVED
Date: 6/26/12
Hour: 14:43
Signature: Illegible

cc: Dr. Cesar Vega Masis / Advisor to the Minister and Director of Legal Affairs, Sovereignty and Territories, MINREX
Eng. Isaias Montoya / Director General, Water Resources, INETER
File

[H/written:] */s/ illegible*
6/27/12
8:25 am

Table No. 1, 2011 Measurement of liquid and suspended solids content

Location			Coordinates						Qm^3/s			
Date	River	Location	Longitude	Latitude	BM? elevation	Zero elevation of levelling rod	Water level	V (m/s)	Qm^3/s	Qm^3/s Average	Solid Q	Observatoins
1/29/2011	San Juan	Loma del Gallo	84°46'32"	11°07'32"	34.678	30.476	2.23	0.619	564,433 521,193	542.813	1,042.83	
1/29/2011	San Juan	Boca de Sabalos	84°28'59"	11°02'10"	31.310			0.687	563,788 559,668	561.728		Measurement done at 300m upstream from the mouth of the Sabalos.
1/29/2011	San Juan	En la Flor	84°27'59"	11°00'25"	32.250	26.982	1.97	0.627	565,987 580,010	572.998	1,835.46	
1/29/2011	San Juan	Castillo	84°24'48"	11°01'00"	31.476	27.257	1.81	0.904	570,487 600,062	585.274	2,452.59	
1/28/2011	San Juan	Boca de San Carlos	84°12'22"	10°47'20	17.774			0.547	634,833 628,369	631.601	1,646.69	Measurement done at 600m upstream from the mouth of the San Carlos.
1/28/2011	San Juan	Boca de San Carlos	84°11'02"	10°47'27	19.005			1.054	835,112 809,615	822.363	2,883.23	Measurement done at 500m downstream from the mouth of the San Carlos.
1/27/2011	San Juan	Boca de Sarapiquí	83°56'02"	10°53'42	30.245	8.083	1.25	0.884	808,154 829,499	818.826	1,840.85	Measurement done at 80m upstream from the mouth of the Sarapiquí.
1/27/2011	San Juan	Boca de Sarapiquí	83°55'33"	10°42'40	13.185			0.940	1,077,536 1,133,631	1105.583	2,900.56	Measurement done at 800m downstream from the mouth of the Sarapiquí.
1/24/2011	San Juan	The Delta	83°45'58"	10°46'28	14.961	6.692	0.92	0.997	1,219,961 1,281,365	1250.663	2,616.63	Measurement done at 500m upstream from the delta.
1/24/2011	San Juan	The Delta	83°45'37"	10°46'33	16.356		No	0.531	104754 107,384	106.069	182.481	Measurement done at 450m downstream from the delta with no reference to water level.
1/25/2011	San Juanillo	San Juanillo	83°41'24"	10°53'37	No				8.003 8.200	8101.000		Measurement done at 500m upstream from the mouth with the San Juan with no reference [?]

Table No. 2, 2012 Measurement of liquid and suspended solids content

Location			Qm^3/s			
Date	River	Location	Qm^3/s 1	Qm^3/s 2	Average Qm^3/s	Solid Q Daily [?]
5/2/2012	San Juan	Loma del Gallo	332.253	343.127	337.690	646.29
5/1/2012	San Juan	Mouth of the Sabalos	319.648	325.319	322.483	743.391
5/1/2012	San Juan	La Flor	362.566	359.846	361.206	862.29
5/1/2012	San Juan	Castillo	356.019	362.636	359.327	1,052.37
4/28/2012	San Juan	Mouth of the upper San Carlos	370.703	333.460	352.081	1,015.07
4/28/2012	San Juan	Mouth of the lower San Carlos	407.231	409.250	408.240	1,702.08
4/28/2012	San Juan	Mouth of the upper Sarapiquí	481.656	495.277	488.466	1,928.71
4/28/2012	San Juan	Mouth of the lower Sarapiquí	751.799	657.370	704.584	2,525.28
4/26/2012	San Juan	Mouth of the upper Delta	727.752	695.604	711.604	3,175.27
4/26/2012	San Juan	Mouth of the lower Delta	66.228	65.028	65.628	337.274
5/2/2012	Frío	La Esperanza	6.056	8.643	7.349	28.571

Table No. 3, Summary of Measurement of liquid and suspended solids content during the years 2006, 2011, 2012

Location	Date	Volume in 2006	Date	Volume in 2011	Date	Volume in 2012
Río San Juan at Loma El Gallo			29/01/2011	542.813	02/05/2012	337.690
Río San Juan at La Flor			29/01/2011	573.499	01/05/2012	361.206
Río San Juan north of Sábalos			29/01/2011	561.728	01/05/2012	322.484
Río San Juan, en El Castillo			29/01/2011	585.275	01/05/2012	358.825
Río San Juan at waters north of Boca San Carlos			28/01/2011	631.599	28/04/2012	352.082
Río San Juan at waters south of Boca San Carlos			28/01/2011	822.334	28/04/2012	408.241
Río San Juan at waters north of Sarapiquí			27/01/2011	808.827	28/04/2012	488.467
Río San Juan at waters south of Sarapiquí			26 y 27/01/2011	1090.548	27 y 28/04/2012	679.150
Río San Juan, waters north of the Delta	01/08/2006	1643.567	24/01/2011	1201.969	26/04/2012	711.678
Río San Juan, waters south of Delta	01/08/2006	177.412	24/01/2011	116.370	26/04/2012	65.628

OBSERVATIONS:

- Measurements of liquid volume carried out on 1 August 2006 reflect that the volume of the Río Colorado is 1,466,155 m3/s. This is based on subtracting from the measured volume of waters in the upper Río San Juan delta, the measured volume of waters in the lower south Río San Juan delta. The result of this exercise indicates that the liquid volume of the Río San Juan of Nicaragua past the delta of the Río Colorado was equivalent to 12 per cent of the volume of the Río Colorado.

- Regarding measurements of liquid volume carried out on 24 January 2011, it can be concluded that the liquid volume of the Río Colorado is 1,085,599 m3/s. This is based on subtracting from the measured volume of waters in the upper Río San Juan of Nicaragua delta, the measured volume of lower delta waters. This simple exercise indicates that volume of water of the Río San Juan of Nicaragua past the delta of the Río Colorado was equivalent to 10.7 per cent of the volume of the Río Colorado.

- Regarding measurements of liquid volume carried out on 26 April 2012, it can be concluded that the liquid volume of the Río Colorado is 646.05 m3/s. This is based on subtracting from the measured volume of waters in the upper Río San Juan of Nicaragua delta, the measured volume of the lower delta waters. The result of this exercise indicates that volume of water of the Río San Juan of Nicaragua past the delta of the Río Colorado was equivalent to 10.1 per cent of the volume of the Río Colorado.

- Upon analyzing the results of measurements of liquid volume in the years 2006, 2011 and 2012, it can be concluded that the liquid volume of the Río San Juan of Nicaragua in the lower Río Colorado delta, is equivalent to a volume of between 10 and 12 per cent of the volume that flows through the Río Colorado.

- In the latter sights, especially in the waters of the upper delta it was observed that great deposits of sand have formed which has contributed to significant changes in the riverbed and distribution of the water itself.

Annex 17

Dredging Project
Technical Evaluation Analysis (EPN 2011 Annual Report)
23 January 2012

Managua, 25 June 2012
GT-LAQG-0491-06-2012

Doctor
Cesar Vega
Ministry of Foreign Affairs of the Republic
Your Office

Dear Comrade Vega,

Please receive the assurances of my esteem and consideration. The purpose of this letter is to send you the information described below, related to the project Improvement of Navigation on the San Juan de Nicaragua River, as input for the documentation required by the Embassy of Nicaragua in the Netherlands, which is handling the case of our San Juan de Nicaragua River.

The information is as follows:

- Quarterly reports from the year 2011 on the project
- Annual report from 2011 on the project

We are at your disposal for any other information that is required.

Fraternal regards,

[EPN seal] [signature]
Ing. Lester A. Quintero G.
Technical Manager

Cc: Executive presidency
General Management
Chronological Archive PE-VSM-344-06-2012

Gobierno de Reconciliación y Unidad Nacional

El Pueblo, Presidente!

EPN EMPRESA PORTUARIA NACIONAL NICARAGUA

DREDGING PROJECT TECHNICAL EVALUATION ANALYSIS

"Improving Navigation on the San Juan River"

January 23, 2012

1. GENERAL ASPECTS OF THE PROJECT

1.1 INTRODUCTION

The San Juan River has played a major role in our colonial history, having been the main gateway used by the Spaniards during the Conquest to access the country's interior, and was also sailed for some time by pirates to attack Spanish positions. Later on, it was used as a major communication route by the United States in the mid-nineteenth century for passenger transportation to the U.S. West Coast (California during the Gold Rush).

To date, rapids on the San Juan River have caused a decrease in watercraft traffic. It is worth mentioning that the only communities in the area are: San Carlos, located at the source of the San Juan de Nicaragua River along the shores of Lake Nicaragua, the town of Sábalos on the confluence of the Sábalos River, the town of El Castillo and the town of San Juan de Nicaragua.

An extremely important issue related to the San Juan de Nicaragua River is the presence of the Colorado River, which begins at a place known as Delta, some 40 kilometers upstream the mouth of the San Juan de Nicaragua River. Flow rate measurements taken on the San Juan River before Delta at Punta Petaca showed an average 1,381 m^3/s water flow rate. Another measurement taken at Los Reyes, some 5 kilometers downstream Delta showed an average 136 m^3/s. This flow rate difference evidences the large water mass running to the Colorado River and the small water amount that continues through the San Juan de Nicaragua River, namely, a mere 10% of the flow rate.

That navigation conditions on the San Juan de Nicaragua River are difficult is a reality that worsens during the dry season, in addition to the presence of several rapids on the stretch between El Castillo and Punta Petaca, very shallow areas with sand shoals located mainly between Delta and Caño San Juanillo.

The place where the San Juan de Nicaragua River current meets the sea is affected by morphological processes on the Caribbean coastline contributing to river channel sedimentation and little circulation volume. The estuary opens and closes at different times of the year, depending on coastline drift and storm conditions often found in this part of the country. The presence of moving dunes is evident in the mouth area.

In order to improve navigation conditions and riparian communication between towns in the municipality of San Juan de Nicaragua, the Government of Nicaragua, through the National Port Authority (*Empresa Portuaria Nacional*, EPN), as well as all State agencies, decided to carry out dredging works, known as "Improving Navigation on the San Juan de Nicaragua River," along the stretch between Delta and San Juan de Nicaragua. The idea is to expedite navigation of watercraft regularly traveling along this river section. An additional goal consists of ensuring safe navigation, protecting human life, and avoiding damage to vessels and transported goods.

3

1.2 PROJECT OBJECTIVES

a) General Objective

Perform maintenance dredging on the navigation channel at a 2.0 m depth during minimum water level conditions for river navigation from Delta to the mouth of the San Juan River on the Caribbean, in order to build a safe navigation channel throughout the year.

b) Specific Objectives

- Provide a safe and continuous navigation channel for passenger and cargo vessels.
- Maintain and increase safety navigation levels for vessels traveling on the San Juan River.
- Promote trade along the San Carlos-San Juan de Nicaragua route.

3

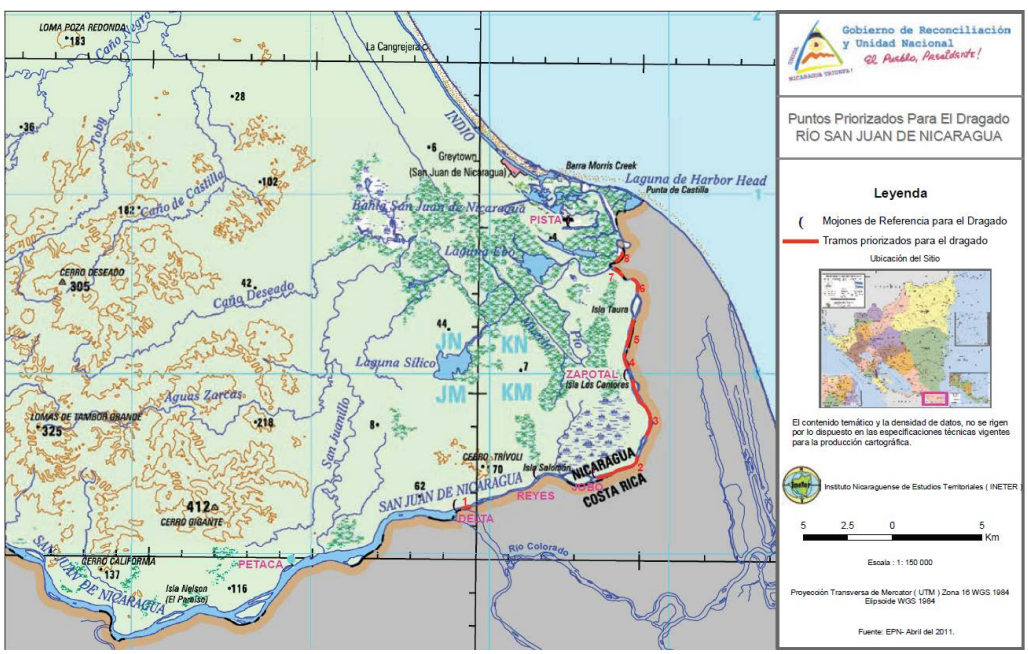
TECHNICAL REPORT

1.3 GENERAL PROJECT INFORMATION

Name:	Improving Navigation on the San Juan de Nicaragua River
Location:	Municipality of San Juan de Nicaragua Department of Rio San Juan
Owner:	Government of Reconciliation and National Unity
Contractor:	National Port Authority (EPN)
Financing Source:	National Treasury Funds

1.4 DESCRIPTION OF PROJECT WORKS

The "Improving Navigation on the San Juan de Nicaragua River" Project plans to implement dredging works in the river sector between Delta and San Juanillo (22 km) where 8 problem areas affecting dry-season navigation (sand shoals) have been identified. The project area has been subdivided into main stretches as follows (see Map):



1.5 REVISED PROJECT SCOPE

Due to the high cost of dredging forty-two kilometers, as defined in studies made by the consulting company CORASCO Y ASOCIADOS in 2006, and aware that ensuring navigability for small- and medium-sized vessels was a priority at this stage of the Project, plans were made for dredging only the most critical stretches and cleaning smaller streams.

An update to the previous bathymetry carried out by the EPN technical team taking the revision of the project into account has estimated a dredging volume of 395,395.02 m^3 to achieve a 2.20 m flow depth at the most critical time of the year.

Based on the results of this study, drawings were developed for the navigation channel, including cross-sections every 25 meters and channel alignment along stretches described below for a total of 32,775 km:

a. La Bocana—San Juanillo	(6.65 km) Dredging volume: 4,564.86 m^3
b. San Juanillo—El Zapotal	(8.00 km) Dredging volume: 95,959.32 m^3
c. El Zapotal—El Jobo	(7.625 km) Dredging volume: 128,562.23 m^3
d. El Jobo—Reyes	(3.85 km) Dredging volume: 67,008.53 m^3
e. Reyes—El Delta	(5.35 km) Dredging volume: 93,735.71 m^3
f. El Delta—1.3 km upstream Delta	(1.3 km) Dredging volume: 5,564.37 m^3

2. MAIN EQUIPMENT USED IN DREDGING WORKS

2.1 BASIC INFORMATION

SOBERANÍA 3

- Dredge type: Stationary cutter suction dredger
- Year Built: 1975
- Type of dredged material discharge pipe: Metal and Plastic
- Maximum cut width: 30.0 meters
- Production output per hour: 120 m^3/hour

SOBERANÍA I

- Dredge type: Stationary cutter suction dredger
- Year Built: 2009
- Type of dredge material discharge pipe: Plastic
- Maximum cut width: 30.0 meters
- Production output per hour: 300 m^3/hour

SOBERANÍA II

- Dredge type: Stationary cutter suction dredger
- Year Built: 2010
- Type of dredged material discharge pipe: Plastic
- Maximum cut width: 3.60 meters
- Production output per hour: 10.0 m^3/hour

SOBERANÍA 4

- This is the fourth equipment recently built in Nicaragua to be used as support for dredger pipeline movement.

ENAP D-1 DREDGER

- Dredge type: Self-propelled clamshell dredger
- Year Built: 1981
- Maximum draft: 2.40 meters
- Length: 30.0 meters
- Maximum production output: 300 m^3/hour

3. ANALYSIS OF DREDGING OPERATIONS

3.1 SOBERANÍA III - OPERATING ANALYSIS

- Difficulties in moving anchors in water due to lack of support equipment and difficulties in moving plastic pipes on the ground on account of terrain conditions.

- Quick silting of already dredged areas mostly caused by sediments carried by strong river currents, particularly at high water (in November 153.68 meters had to be dredged again at Delta).

- Long downtimes caused by mechanical problems in Soberanía III dredge (hydraulic system and main engine breakdowns). This equipment was built in 1975 (obsolete), which makes it difficult to find some spare parts in the international market.

- Presence of highly compacted material under the -3.0 m mark (presence of high plasticity clay at Delta and nearby sites).

- High engine and hydraulic equipment maintenance costs.
- High consumption of main engine lubricants and oil.

Cleaning "Soberanía III" dredger cutter head

SOBERANÍA I

- Although this equipment is new, it has been having mechanical problems in different parts, particularly in the hydraulic system (spud-lifting hydraulic cylinders, dredger pump shaft constantly worn out by sediments going through).

"SOBERANÍA I" worn-out pump bushing

"SOBERANÍA I" hydraulic cylinder oil leak

- Difficulty in dropping anchors on the port side (Costa Rican side), since this is located on the border, thus resulting in delayed dredging operations.

- Delays caused by broken connection between plastic pipeline and dredger discharge pipe.

Abundant wood debris found at the bottom of the river

SOBERANÍA II

■ It arrived in San Juan de Nicaragua in April 2011. During equipment testing there were problems with the original dredger pump drive system (chain with belts).

■ The original system was replaced with a gear reduction box to drive the hydraulic system. Dredging performed near disposal site # 18 has resulted in low outputs (power factor). The equipment is unable to shoot materials beyond 120 meters, thus limiting dredging operations in the natural access channel. It had mechanical problems again in December, and it is currently being repaired in San Juan de Nicaragua.

■ It can only cut a maximum 3.60 m wide area and has only a linear forward motion.

4. OPERATING REPORT OF DREDGING EQUIPMENT

4.1 EQUIPMENT TYPE AND CONDITIONS

Four dredgers are planned to operate, only two of which –Soberanía I and II– are currently dredging and are described below:

SOBERANÍA I DREDGER

This equipment was entirely built in Nicaragua. It is a modern dredger but has some limitations affecting output, including the following:

■ The dredger anchoring system (spuds) has a slow free fall and lift preventing spuds from sinking deep enough to provide proper dredger anchorage and resulting in backward shifts. Spuds should go up and down quickly for proper anchorage and operation.

- According to the dredger manufacturer's data, the cutter has 97kw power (a similar dredger, CSD 450 DAMEN, has 110kw power). Current dredging operations have encountered highly compacted materials (clays with high plasticity sands) that have an impact on the cutting job. Therefore, the cutter engine power needs to be reviewed to determine whether or not it has the right capacity.

SOBERANÍA II DREDGER

It was assembled in Nicaragua. It is not optimal dredging equipment for this river due to its variable currents. Spuds are weak on account of their small diameter and height to the point that when they are anchored and river levels rise considerably dredging operations have to be suspended for safety reasons.

The cutter can only perform linear cuts at a maximum 3.60 m depth (the channel base is 30.0 m wide), which is not enough for this river because floods may often be up to 3 m high, thus making cutter operation impossible. Based on previous experiences, the danger of dredger becoming stuck in the riverbed should be taken into account. This is a trailing cutter suction dredger with a chain system that ensures movement. Thus far, results obtained with this dredger show it is not operational for the works being carried out in the San Juan River, mainly because its design is unsuitable to site conditions.

SOBERANÍA III DREDGER

Manufactured in the U.S. under the AMMCO brand, it has proven to be a legendary dredger mostly used to dredge the navigational channel at El Bluff-Bluefields Port and in the San Jorge Port turning basin. Its current conditions warrant a total renewal of main engines, hydraulic system, cutter system, and electric system, as well as streamlining the bridge.

There are no problems with the floating system and spuds, as attested by the fact that in spite of its mechanical conditions and manufacturing date, 1975, it has proven to be effective with an output close to Soberanía I dredger.

ENAP D-1 DREDGER

This equipment was built in Denmark in 1981. It is a self-propelled dredger (a ship) with output limitations affecting dredging operations, such as:

- It requires a 9-foot minimum depth to operate.
- Dredging is done by a crane using a clamshell.
- It is capable of loading material in the hopper (hold) and discharging it at a long distance.
- Low output with this operating system (50 m^3/hour).
- It is currently being repaired at El Bluff Port.
- Ideal for dredging hard materials, extracting trees, etc.

SOBERANÍA IV SUPPORT EQUIPMENT

Built in Nicaragua, it was transferred to the San Juan de Nicaragua River to be used for extracting trees from the river through a hydraulic system. Its navigation structures and spud anchoring characteristics are similar to Soberanía II dredger. Experience has shown these pieces of equipment with such navigation and anchoring structures are an imminent hazard, given the natural currents of the San Juan River.

Of the new pieces of equipment built for this task, Soberanía I dredger is the closest to the recommendations of CORASCO S.A., which can be viewed as acceptable despite its less than 100% efficiency.

4.2 DREDGING EQUIPMENT LOCATION

Soberanía I dredger joined Soberanía III on July 17, 2011 to provide support at the San Juan River Delta, with dredging operations starting at coordinates UTM 197980X, 1192446Y, and ending at the channel expansion at coordinates UTM 197660X, 1192289Y.

On orders from Commander Edén Pastora, the dredger was transferred to coordinates 199868X, 1193051Y on October 18 near disposal site 18. To date, December 19, the dredger is located 1,735.46 m downstream its previous location at Delta at coordinates UTM 199524X, 1193993Y.

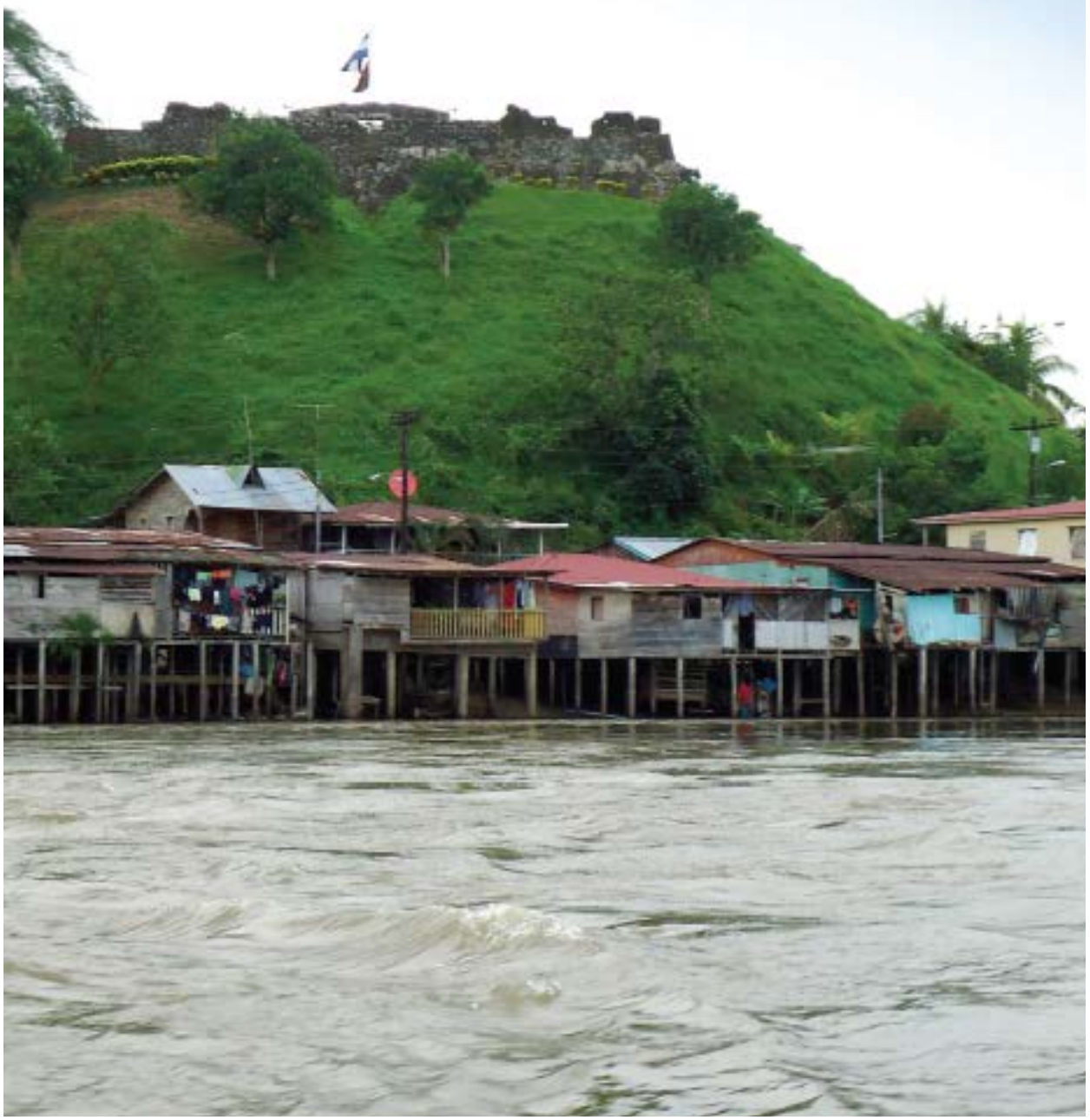
In November, Commander Pastora gave instructions to dredge with Soberanía I along a straight line regardless of the natural river channel, which involved dredging bigger volumes (cutting height went from 7 to 9 feet). Currently, Soberanía I dredger is back to the original channel position mainly because there was too much wood debris in the area where it was dredging.

While planned dredging criteria were to operate in the more complex stretches (sections with higher sediment accumulation), working at this not-so-critical place has enabled a greater water flow, with sediments being carried downstream.

The design channel is located on top of the natural channel because required dredged volume is smaller there and flow velocity is higher and directly proportional to flow rate. These conditions are found on the outside of meander curves, instead of the inside or center of meander curves where suspended sediments transported by water are deposited on account of lower flow velocity.

As of December 19, the Soberanía III dredger was located at position UTM 197703X, 1192348Y.

SOBERANÍA I AND III DREDGER LOCATION SITES



5. ANALYSIS OF DREDGING IMPLEMENTATION STRATEGIES AND NEW DREDGING PERIODS

5.1 INTRODUCTION

Project implementation is currently led by Commander Pastora with techical support provided by the National Port Authority.

The initiative of having Soberanía III dredger available at Delta from the onset of dredging operations, together with the subsequent support given by Soberanía I dredger, had a positive effect since during this year's dry season such typical situations as 1-foot maximum water depth and grounded watercraft were no longer found due to an increased hydraulic cross-section on this part of the San Juan River. The resulting enlarged water channel has made it possible for some types of watercraft to navigate more safely on the river. Dredging positive impacts will be particularly seen in the dry season, where vessels have historically encountered navigation problems.

Dredging operations, however, have been hindered particularly along the Delta–Los Reyes stretch by the poor mechanical condition of the Soberanía III dredger, the inefficiency and limited working hours of the Soberanía II dredger, and the quick sedimentation process resulting from natural river currents.

It is worth mentioning that both the CORASCO study in its different work alternatives and the recent bathymetric study performed by EPN technicians identified the most critical points with their respective required dredging volumes, which provides guidance for project implementation.

5.2 NEW IMPLEMENTATION PERIOD

The table below shows the period of time needed by Soberanía III to carry out dredging operations just in the DELTA–LOS REYES stretch based only on actual outputs obtained so far this year and considering low outputs from different causes (such as mechanical problems, silting of already dredged areas, and other minor factors).

SOBERANÍA 3

WORKING ONE SHIFT	1	
ACTIVITY	U/M	
CURRENT OUTPUT	M^3/HOUR	120
TOTAL PER MONTH (MAXIMUM OBTAINED)	11,045.78 m^3	
REQUIRED DREDGING VOLUME ACCORDING TO CORASCO	233,269.19 m^3	
EXTRA VOLUMES FROM Re-dredging	93,080.81 m^3	
NEW IMPLEMENTATION TIME 326,350.00 M^3	2.46 Years	

Extra volumes shown on the table are due to quick channel sedimentation (5 feet) increasing dredging volumes, which led to longer implementation time.

The table is the best case scenario without adverse conditions or further factors affecting dredging operations in the Delta–San Juanillo stretch, and does not represent the current situation. This scenario is not taking into account delays caused by weather (dry season) and other factors, such as:

- New potential mechanical breakdowns in Soberanía III dredger on account of equipment obsolescence.
- Regular personnel attrition.
- Heavy rains in this sector of the river, or dredger operator turnover.

Re-dredging required to prevent quick dredged channel silting has not been taken into account.

SOBERANÍA 1

WORKING ONE SHIFT	1	
ACTIVITY	U/M	
CURRENT OUTPUT	M^3/HOUR	300
TOTAL PER MONTH (MAXIMUM OBTAINED)	17,419.28 m^3	
REQUIRED DREDGING VOLUME ACCORDING TO CORASCO (SAN JUANILLO–EL ZAPOTAL–EL JOBO STRETCH)	709,293.14 m^3	
NEW IMPLEMENTATION TIME 709,292.16 M^3	3.39 Years	

The dredger has outputs higher than 300 m^3/hour, which could increase dredging volume up to 35,000 m^3 per month, thus shortening implementation time.

Soberanía I dredger could increase dredging volume provided no new mechanical breakdowns occur, also considering other factors that might impact operations, such as:

- Regular personnel attrition.
- Heavy rains in this sector of the river, or dredger operator turnover.
- Limited 8-hour working days.

5.3 OTHER DREDGING STRATEGY CONSIDERATIONS

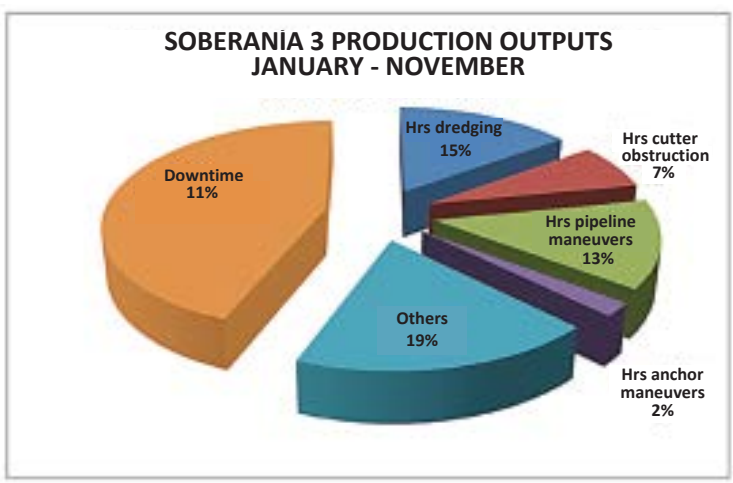
- No dredging has been performed at the mouth of the San Juan River to enable sediments accumulated along the river course to be displaced by current ebb and flow.

- To this end, a dredger capable of operating under swell conditions would be required (an alternative could be the ENAP D-1 dredger equipped with a DOP submersible pump or a trailing suction dredger – foreign company).

5.1 ASSESSING SOBERANÍA III AND I DREDGER OUTPUTS

Dredging works began on January 27 at the Delta sector with the EPN-owned Soberanía III dredger. The table below shows time spent by Soberanía III dredger in dredging operations until November 30.

MONTH	HRS DREDGING	HRS CUTTER OBSTRUCTION	HRS PIPELINE MANEUVERS	HRS ANCHOR MANEUVERS	OTHERS	DOWNTIME
JANUARY	12.68	8.65	0.00	0.00	28.67	
FEBRUARY	28.90	7.34	33.43	0.00	23.08	158.78
MARCH	80.65	20.50	43.46	0.00	74.06	86.78
APRIL	94.82	22.74	34.14	22.89	50.63	80.22
MAY	67.27	35.88	227.65	14.18	86.93	48.72
JUNE	10.09	6.15	0.45	0.00	0.00	259.31
JULY	0.00	0.00	0.00	0.00	0.00	240.00
AUGUST	6.00	3.42	0.00	0.00	15.18	214.33
SEPTEMBER	43.89	31.51	32.26	9.22	68.25	40.00
OCTOBER	51.49	41.21	7.21	9.38	77.06	64.00
NOVEMBER	27.30	19.93	34.59	2.00	100.75	56.00
	423.09	**197.33**	**378.60**	**57.67**	**524.61**	**1,248.14**



5.2 FACTORS INFLUENCING LOW SOBERANÍA III DREDGER OUTPUTS

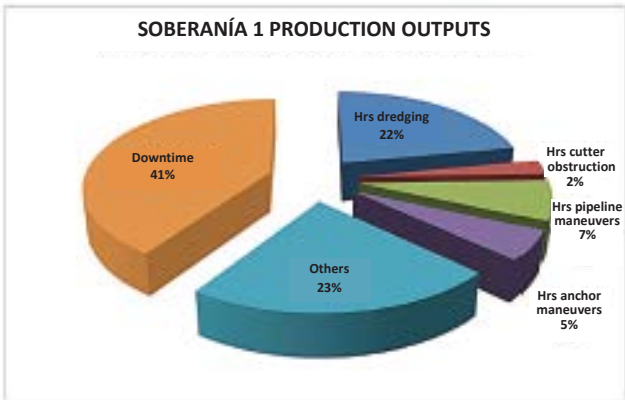
- Mechanical failures in hydraulic systems, dredging pump, main and ancillary engines (44%) 1,248.14 hours (156 days assuming 8-hour working days).
- Delays from other causes.
- Cutter constantly obstructed by wood debris at the bottom of the river (7%).
- Working days consist of only one shift because obsolete engines cannot operate for longer periods.
- Minor repairs on the connecting pipeline (metal pipeline is in poor conditions).
- Constant relocation of pipeline on the ground, as well as anchors (15%).
- Soil type: mostly compact with a density above 2,100 kg/m^3.
- Silting of areas already dredged mainly due to strong sector currents resulting from rainy season precipitation. The dredged channel became silted for approximately 153.68 m. As a consequence, the dredger had to be moved back and the pipeline was relocated on the ground.

"OTHERS" includes fuel transfer, minor repairs, equipment greasing, and other minor activities.

5.3 REASONS TO START WORKING AT DELTA

According to a strategic decision, and considering studies performed by the Dredging Project Consultant, CORASCO, dredging works began at the site known as DELTA, which is at the end of one the 8 critical stretches found between San Juanillo and Delta. This is a particular site because, in addition to being a critical sector, the flow rate in said section was very low (a mere 10% as per the CORASCO consultant study). The study particularly notes the presence of a high plasticity clay layer approximately 500-meter long and 1.50- to 2.0-m thick acting as a clog to prevent a higher flow rate through the San Juan River downstream from Delta.

MONTH	HRS DREDGING	HRS CUTTER OBSTRUCTION	HRS PIPELINE MANEUVERS	HRS ANCHOR MANEUVERS	OTHERS	DOWNTIME
JANUARY						
FEBRUARY	19.29	0.00	0.00	0.00	28.71	
MARCH	9.67	0.33	0.00	4.16	9.84	
APRIL	17.27	2.49	13.42	4.37	8.25	0.66
MAY	42.71	7.23	42.24	20.26	25.65	229.24
JUNE	21.42	1.57	12.25	7.07	17.52	204.15
JULY	57.78	2.32	6.00	18.22	37.69	125.10
AUGUST	110.39	8.53	1.16	22.13	96.67	16.00
SEPTEMBER	46.35	12.81	24.33	9.58	46.04	99.76
OCTOBER	60.92	8.26	16.08	11.74	87.00	32.00
NOVEMBER	39.64	4.18	23.92	4.49	80.26	80.00
	425.44	**47.72**	**139.40**	**102.02**	**437.63**	**786.91**



5.4 FACTORS INFLUENCING LOW SOBERANÍA I DREDGER OUTPUTS

- Mechanical failures in hydraulic systems and main dredging pump (41%, 98 days assuming 8-hour working days).
- Delays from other causes.
- Cutter constantly obstructed by wood debris at the bottom of the river (2%).
- Working days consist of only one shift, even though main engines are capable of running for longer periods.
- Minor repairs on the plastic pipeline due to broken dredger connection.
- Constant relocation of pipeline on the ground, as well as anchors (12%).
- Soil type: mostly compact with a density above 2,100 kg/m^3.
- Silting of areas already dredged mainly due to strong sector currents resulting from rainy season precipitation. Over 100 meters became silted as a result of rains.

"OTHERS" includes fuel transfer, minor repairs, equipment greasing, and other minor activities.

6.0 DREDGED VOLUME SUMMARY FOR 2011

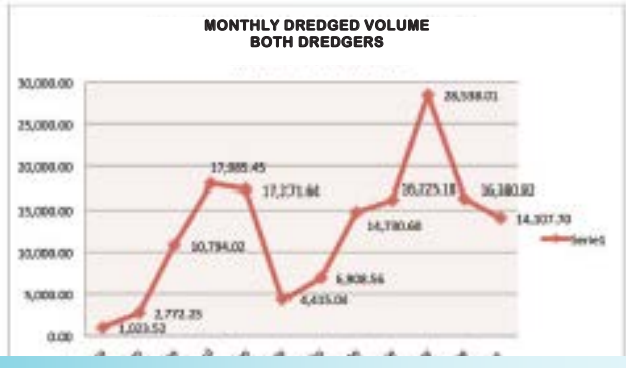
Based on the above output, the table below shows monthly volumes dredged by project equipment as of December 17, 2011, adding to a total 151,152.79 m^3, of which 131,988.79 m^3 have been dredged in the Delta–Los Reyes stretch and the remaining 19,164.00 m^3 in the San Juanillo–El Zapotal stretch.

TABLE N° 3 DREDGED VOLUMES

MONTH	SOBERANÍA 3 DREDGED VOLUME	SOBERANÍA 1 DREDGED VOLUME	SOBERANÍA 2 DREDGED VOLUME
January	1,023.52		
February	2,772.46		
March	9,094.02	1,700.00	
April	14,758.35	3,000.00	
May	9,330.35	7,740.00	
June	852.54	3,562.50	
July	0	6,828.56	80
August	1,611.90	13,118.70	
September	8,226.48	7,998.70	
October	11,045.78	17,492.23	
November	5,406.60	10,974.22	
December	4,162.80	9,944.90	450
January		29,031.81	
TOTAL	**68,673.38**	**111,391.62**	**530**

SUMMARIZED CUMMULATIVE DREDGED VOLUME AS OF DECEMBER 17

EQUIPMENT	DREDGED VOLUME
Soberanía 1 Dredger	11,391.62 m^3
Soberanía 2 Dredger	530.00 m^3
Soberanía 3 Dredger	68,673.38 m^3
TOTAL	**180,595.00 m^3**



ENVIRONMENTAL REPORT

INFORME AMBIENTAL

As per conditions set forth in Administrative Resolution 038-2008, EPN requested environmental authorities the inspection and approval of proposed disposal sites and the respective stream cleaning. Said requests were authorized before dredging operations started.

OBJECTIVES

- Help prevent, minimize and offset environmental impacts caused by dredging for "Improving Navigation on the San Juan de Nicaragua River" (Delta/San Juan de Nicaragua).
- Propose feasible alternatives for preventing, controlling or mitigating negative impacts.
- Anticipate any potential environmental occurrence that could affect the project, as well as the impacts of the project on the environment.
- Report progress of the Project's environmental activity to MARENA.

The Environmental Management Plan is thought to have been complied with as planned. It started with a reforestation plan in August, with 15,390 plants reforested to date, which amounts to 83.2% over-compliance since the Project's Environmental Management Plan had anticipated 8,400 plants.

Reforestation has been carried out mostly along streams, in private farms, and in public areas. Similarly, it also started at disposal sites for extracted riverbed materials.

Likewise, there has been a close coordination with the Environmental Office of the San Juan de Nicaragua Mayor's Office, MARENA staff assigned to this municipality, the Nicaraguan Army, the National Police, and the general community.

The Nicaraguan Army is providing support to environmentalist brigades coming in and out of the area, as well as watching over security in this area.

Safety and hygiene issues are considered to be adequate, taking into account access limitations prevailing at the site.

CONCLUSIONS AND RECOMMENDATIONS

In view of low production outputs found in dredging operations, particularly the constant mechanical equipment breakdowns (Soberanía III is very obsolete), three options remain to successfully complete the "Improving Navigation on the San Juan de Nicaragua River" project.

Should a decision be made to continue working with current pieces of equipment, particularly with Soberanía III, it should operate only one shift because its main machines do not have the capacity to yield more (large fuel consumption and very obsolete parts).

An additional shift may be operated with Soberanía I, provided that often mechanical problems are overcome.

EPN, however, has set forth other options that should be analyzed in order to complete the project in the least possible time. These are the following:

OPTION A

- Total renewal of Soberanía III dredger (36 years old), which would involve replacing the 2 main engines with two new ones, replacing the hydraulic system main engine (cat 3306), a new dredging pump, a new cutter pump, and a new cutter with a large suction pipe (18 inches).

Estimated investment: approximately US$ 350,000.00

OPTION B

Acquiring a new engine for the ENAP D-1 dredger and equipping it with a DOP submersible pump, so it is able to operate as a cutter suction dredger.

OPTION C

Should a decision be made to build dredging equipment, we recommend it to be supervised and endorsed by EPN technicians o another body with knowledge of this equipment characteristics, given the equipment recently bought and built in Nicaragua does not have the required intended output.

RECOMMENDATIONS FOR ACQUIRING NEW DREDGERS

ACQUIRING TWO CUTTER SUCTION DREDGERS (SIMILAR TO SOBERANÍA 3 DREDGER)

MAIN CHARACTERISTICS

PRINCIPAL DIMENSIONS
Length o.a. incl. ladder and spud-keepers 33.00 m
Length over pontoons 20.80 m
Beam o.a. 6.95 m
Depth 1.80 m
Draught (100 % filled bunkers) approx. 1.15 m
Air draught (spuds removed/ ladder up) approx. 6.10 m
Total weight approx. 115 ton

TANK CAPACITIES
Fuel oil approx. 2 x 9 m3 (for ± 100 running hours)
Ballast water (fore and aft) 2 x 6 m3 and 2 x 6 m3
Hydraulic oil 1.5 m3

DECK MACHINERY
Ladder winch (1x) 80 kN, 0-15 m/min
Side wire winches (2x) 80 kN, 0-15 m/min
Spud hoisting (2x) by hydraulic cylinder, stroke 1500 mm

PROCESS INSTRUMENTATION

Electronic vacuum and pressure indicator
Mechanical dredging depth indicator

DREDGING FEATURES

Min / max dredging depth 1,5 / 12 m (cutter ladder angle of 2,5 / 45º)
Dredging width at 40º swing angle 32 m (at max dredging depth)
DREDGE INSTALLATION
Dredge pump type BP45-1100
Impeller design high efficiency, double curved, 4 bladed
Impeller diameter / width / spherical passage 1100 / 215 / 200 mm
Diameter suction- and discharge pipe 450 mm
Cutter 5-bladed, diameter 1500 mm
Cutter power 110 kW
Cutter speed continuously variable from 0-30 rpm
Mooring system two spud poles and two swing winches

ENGINE INSTALLATION

Total installed power 865 kW
Dredge pump diesel Caterpillar 3508B SCAC-IMO Version
Continuous power rating 637 kW (A-rating) @ 1600 rpm
Auxiliary diesel Caterpillar 3406C DITA JWAC
Prime power rating 228 kW (Auxiliary) @ 1800 rpm
Hydraulic installation driving cutter, winches and spuds
Electric installation 24 Volt DC for controls, emergency lighting, auxiliaries
230/400 Volt AC for engine room ventilation, lighting and auxiliaries. The DAMEN cutter suction dredger - model 450 - is one of the standard models within a range of well proven, dismountable cutter suction dredgers. There are several options possible to meet any ºoperational requirement.

BASIC FUNCTIONS

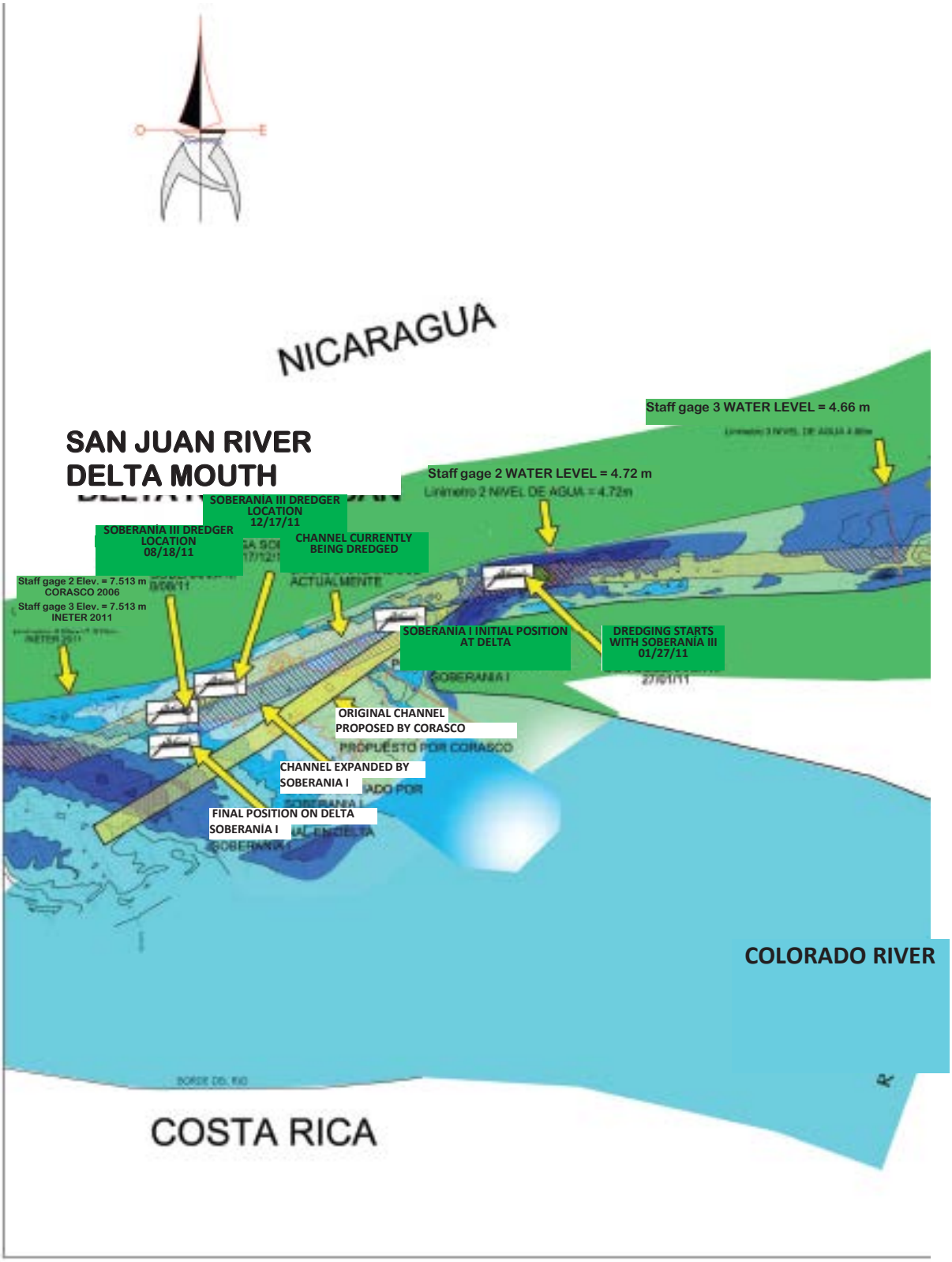
- Maintenance dredging
- Capital dredging
- Mining

STANDARD DESIGN FEATURES

- Heavy duty robust design
- Scantlings in excess of class regulations
- Spacious ergonomic designed operating cabin
- Well powered, to ensure simultaneous operation of all functions
- Highest quality of installed equipment and components to ensure continuous operation

CUTTER SUCTION DREDGER 450

Production curves
Cutter suction dredger 450
General arrangement


NICARAGUA
SAN JUAN RIVER
DELTA MOUTH
Staff gage 3 WATER LEVEL = 4.66 m
Staff gage 2 WATER LEVEL = 4.72 m
Linimetro 2 NIVEL DE AGUA = 4.72m
SOBERANÍA III DREDGER LOCATION 12/17/11
SOBERANÍA III DREDGER LOCATION 08/18/11
CHANNEL CURRENTLY BEING DREDGED
ACTUALMENTE
Staff gage 2 Elev. = 7.513 m CORASCO 2006
Staff gage 3 Elev. = 7.513 m INETER 2011
SOBERANIA I INITIAL POSITION AT DELTA
DREDGING STARTS WITH SOBERANÍA III 01/27/11
SOBERANIA I
ORIGINAL CHANNEL PROPOSED BY CORASCO
PROPUESTO POR CORASCO
CHANNEL EXPANDED BY SOBERANIA I
FINAL POSITION ON DELTA SOBERANÍA I
COLORADO RIVER
COSTA RICA


RIVER BANK
CANAL NATURAL DEL RIO
ISLA
ISLA
CANAL ORDENADO
POR EL CMDTE. PASTORA
Staff gage 5
Staff gage 4
ISLAND
SOBERANIA I
DREDGER LOCATION
12/19/11 4
COSTA RICA
NATURAL RIVER CHANNEL
CHANNEL ORDERED
BY CMDR. PASTORA
RIVER BANK
ISLAND
NOTE: RIVER LEVEL AT DELTA = 5.02 m
FEBRUARY 12, 2011
EMPRESA PORTUARIA NACIONAL


EPN
EMPRESA
PORTUARIA
NACIONAL
NICARAGUA

Annex 18

Ministry of the Environment and Natural Resources (MARENA),
Report on site visit to the San Juan River Dredging Project,
from 21- 25 March 2006

[PRECEDED by Original P. 1]

REPORT ON SITE VISIT TO SAN JUAN RIVER DREDGING PROJECT

FROM 21 THRU 25 MARCH 2006

OBJECTIVE OF THE VISIT: To assess the areas along the 42 kilometer stretch of the San Juan River proposed for the dredging project in order to obtain evidence to facilitate the evaluation of the Environmental impact Study to be prepared for the project, as well as possible sites for the deposition of dredged materials.

Background:
The San Juan River is a waterway which due to its characteristics and dimensions has traditionally been used as a transportation route and which in the XIX century was exploited by a North American company as an alternate route for crossing the United States from the East to West.

Conditions for navigation along the river have been deteriorating in recent years due to the great amount of solid material carried by the tributaries of the river which flow downstream from the Costa Rican basin and settle along the San Juan River thus reducing the depth of the river to only 30 or 40 centimeters. This makes navigation along the waterway impossible and very dangerous for most boats utilized by local townspeople for transportation or to move goods and merchandise.

The situation is more critical along the stretch of the river beginning some two kilometers before the area known as Chingo Petaca Point and the mouth of the San Juanillo River, which is a tributary that flows down from the Nicaraguan basin. The final stretch of approximately six kilometers consists of the bay and lagoons which are not difficult to navigate.

This field work is carried out in the context of an environmental permit applied for by the National Ports Company (EPN, by its Spanish acronym), and as part of the required procedures for development of the Environmental Impact Study.

A multidisciplinary technical team was conformed in order to gather on site field information.

Fieldwork methodology:

- ✓ The fieldwork required that we first gather all the necessary information.
- ✓ Consultations with the Mayor of San Juan de Nicaragua and persons with extensive knowledge of the area such as the leadership of the Nicaraguan Army stationed in the area, park rangers who guard the Southeast Nicaraguan Biosphere, settlers and the local fisherman from SERB-SEN.
- ✓ Visits *in situ*: photographs, geographic reference using GPS.
- ✓ Use of maps.
- ✓ Meeting for discussion and analysis of information.

ACTIVITIES CARRIED OUT AT THE VISITED SITES:

The technical team commenced its activities by departing from the San Carlos Wharf by way of the river towards the Municipality of El Castillo, where they organized the visit and defined the sites of interest to be visited over the course of the route, considering principally the six triangulation points geographically referenced and identified by INTER and that are detailed below:

1. Petaca Point
2. Colorado River Delta
3. Botijuela Island
4. El Zapotal Farm
5. Mouth of the San Ruanillo [sic] River
6. Runway in San Juan de Nicaragua (GREY TOWN)

These six points are found in the 42 kilometer stretch proposed for dredging, with the objective of referencing the bathymetry study, defining volumes of material to be dredged, and monitoring the levels and dimensions of the navigational canal.

From Punta Petaca (8 km. of river above the Delta) the navigational difficulties begin, which become even more critical after the Delta. The descent of the river's water level, normal in the summer, allows the observation of sandbanks emerging on both sides of the River, and in some sites, in the center of the channel. During the most intense months of the summer, between April and the first two weeks of May, there are areas of the river where almost no water flows, causing the people who travel in boats to have to push them.

In the delta, where the San Juan River is bifurcated and where the Colorado River originates (the latter flowing in Costa Rican territory), in this spot the San Juan's navigational canal is located on the edge of the left river bank, observing in the direction of the right river bank an extensive area where a large quantify of sediment has accumulated. Continuing down river, the route of the navigational canal is variable and it can be found on the right river bank, or even to the center of the river bed or the left river bank.

It was verified that there are no navigational difficulties 8.5 km. before the point where the San Juan River flows into the Caribbean Ocean, and that the depths vary between 3 and 4 meters. According to information provided by those that steer the launch boats that navigate the river, this stretch maintains good navigational depths year round.

During this visit it was observed that there are two places where the San Juan River flows into the Caribbean Sea. This peculiar situation is due to changes in the position of the sand banks that accumulate along the coast. Sometimes there is just one place where it flows to sea or it closes. When the places where it flows to sea are closed, the San Juan River then flows to sea at the breakwater (jetty) of the Indio River, which also sometimes changes position but never closes.

Sites where sediment material from the dredging could be deposited were identified along the 42 kilometer stretch on the left bank. These were identified taking into account the characteristics of the protected area known as the San Juan River Wildlife Reserve. The places identified on a preliminary basis are located in the agriculture and forestry development zone, according to information offered by SERBSEN technician Róger Gómez.

sites where sediment material from the dredging may be deposited were identified During the Environmental Impact Study this information should be verified based on the boundaries established in the Management Plan for the protected area.

Conclusions and Recommendations:

- After having conducted the on-site visit throughout the entire area experiencing critical navigation issues, which principally affect the populations of San Juan de Nicaragua, El Castillo, and San Carlos who use the river as a transport route, it is the opinion of the technical team that the development of the project should be one of the priorities of the Government.
- Travel through the 42 kilometers confirmed the need to dredge this stretch of the river, through use of the six BMs [?] network developed by INETER and which help study and monitor water depths in given areas.
- Through observations of the left-hand side of the River it had identified sites or areas affected by human intervention which could potentially be used as deposit sites during the dredging project. This information will be compared to the sites proposed for this purpose in the Environmental Impact Study.
- Depth in the 8.5 kilometers before the mouth of the river, vary between three and four meters so it may not be necessary to dredge in this area.
- Along the stretch of the river to be dredged, there are several places the depth should be determined with topographical equipment because shallowness will make it impossible to navigate in those places.
- Determination of depths is vital for identifying impact and for designing environmental protection measures in the Environmental Impact Study.
- Between Petaca Point and further downstream there are slopes beyond the bank which would serve as natural barriers protecting the San Juan River.
- The critical zone was determined to be mainly between Petaca Point and San Juanillo because the river's depth in that zone drastically diminishes due to sedimentation and the formation of banks consisting of sediment.
- The dredging project should meet two main objectives:
    - ✓ To salvage conditions in the waterway
    - ✓ To re-establish, through other work plans, the current between the right bank and the small islands that are a part of our national territory.

- To inventory the islands we are losing due to the rapid sedimentation in order to avoid future allegations by Costa Rica of rights over these islands as part of its national territory.
- The Environmental Impact Study should consider as an alternative the use of dredge material (sand) for production of blocks. At present, cobblestones are produced in San Juan del Norte.
- The Environmental Impact Study should include the possible correction of the river's course between Chingo Petaca and the delta.
- The mouth of Indio River is the possible access of the dredging equipment due depth and dimension considerations. It has a breakwater that is movable.

7BMs Network Coordinates

Number	BM Identif.	WGS 84 Coordinates			Observations
		North	East	Elevation	
1	Petaca	1189866.951	189861.716	11.507	Unpopulated
2	Delta	1192386.629	197439.796	23.513	Army command post
3	Reyes	1193868.866	202295.673	8.236	Property of Mr. Silvio Reyes
4	Jobo	1194333.124	205887.357	6.993	Housing development
5	Zapotal	1199570.074	207846.099	5.291	Property of Mr. Socorro López
6	Pista	1208476.997	203836.976	3.128	Old San Juan del Norte settlement
7	3448-l-1	1211616.205	201139.382	2.194	Present San Juan de Nicaragua settlement

* * *

Annex 19

Report of Inspection Visit, Project "Improvement of Navigability of the San Juan River", from 17 to 20 September 2006

REPORT OF INSPECTION VISIT
PROJECT "IMPROVEMENT OF NAVIGABILITY OF THE SAN JUAN RIVER"
From 17 to 20 September 2006

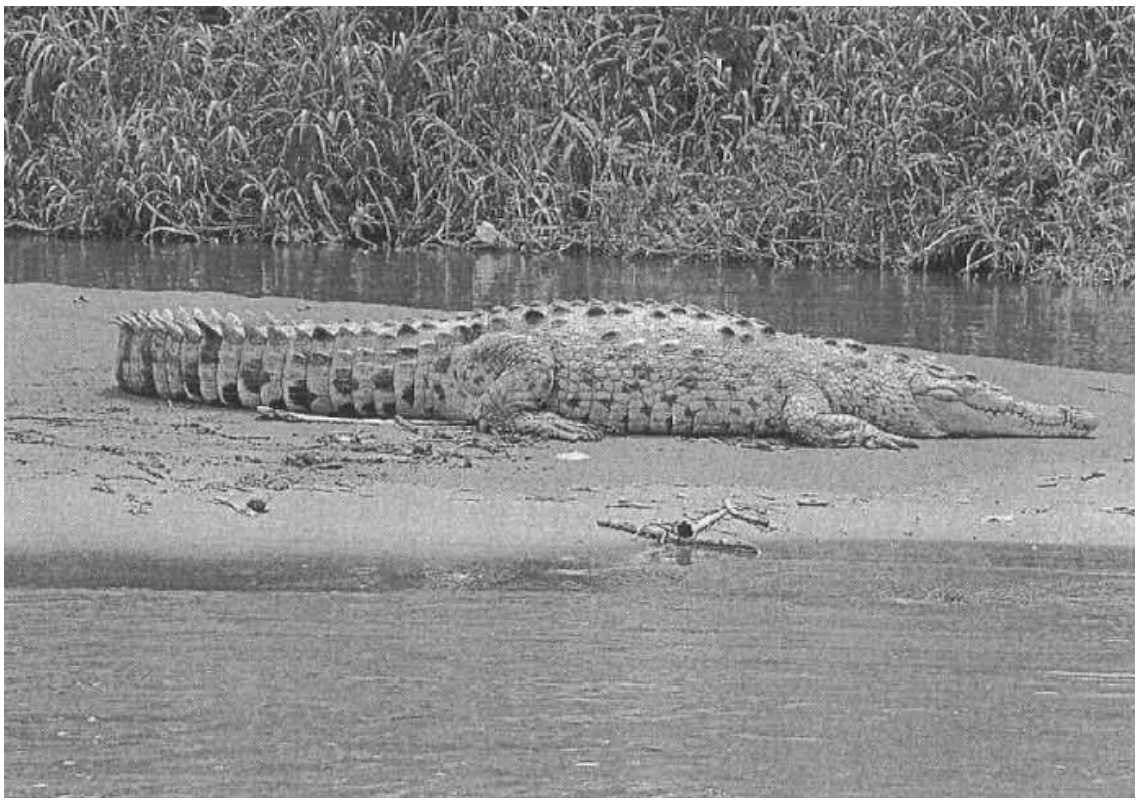


Photo taken by Mario Aguilar, in front of the Sarapiquí Control Post

Participants:

Elsa Vivas Soto, Engineer, DGCA-MARENA
Milton Medina C., Engineer, DGCA-MARENA
Rigoberto López, Engineer, DGPN-MARENA
Luis García, Engineer, DGTA-MTI
Tomas Valle, Engineer, INETER
Arosman Mendieta, Architect, EPN
Mario Aguilar, Licenciate, CORASCO
Felix Romero, Engineer, EPN

REPORT OF INSPECTION VISIT
PROJECT "IMPROVEMENT OF NAVIGABILITY OF THE SAN JUAN RIVER"

Objectives:

1. To reassess the sites for deposits of dredged material located in areas that are part of the wetlands ecosystem, near the mouth of the San Juan River, where the leaching of such material would generate major impacts to said ecosystem, which is part of the Rio San Juan Wildlife Reserve.

2. Identification of alternative sites with better conditions to serve as a repository for the material and to reduce in this way the potential impacts.

Development of the visit:

During the work visit, the design plans for the navigation channel were available, which is to be built to facilitate navigation on the section that corresponds to the last 42 kilometers of the San Juan River and that ends before it flows into the Caribbean Sea.

The assessments made by the team showed that the deposit site identified as No. 4 "Juan Popa", has the necessary dimensions and firm ground where it is feasible to deposit material from a stretch of the river, however, because of its proximity to the wetlands (approx. 300 meters), in order to use this site it is required to construct barriers to prevent the dredged material with a high water content (approximately 60%) from moving towards the gamalotes and yolillales mainly, which are wildlife habitat.

Point No.3, located as proposed by the consulting team at the coordinates 1207319 North and 207736 East, was eliminated for being in one of the spots considered critical and under protection; in this section a new site was determined, now No. 3 "Called Isla del Boludo"; it is an island artificially formed approximately more than 8 years ago when a resident of the area opened a channel to reduce the distance and time of navigation it took to go around a small peninsula that formed naturally in that part of the River. As a result of that the riverflow went through the newly constructed canal and stopped following its natural course around the peninsula. Another consequence is that the original riverbed has filled with sediments and threatens to merge with the Costa Rican territory.

Given this situation the members of the evaluation team consider it a necessity to reactivate the original watercourse to assert national sovereignty and avoid losing that portion of land that is adhering to the Costa Rican territory as an effect of the deposition of sedimentary material on the riverbed. This point was identified with the coordinates 1207078 North and 207805 East.

The members of the evaluation team ascertained that the sites previously identified with number 1 and number 2, do represent a potential for significant impacts on the

wetlands, if they would be used as depositories of dredged material. To overcome this problem alternative sites were identified which are located at the following coordinates:
No. 1, UTM coordinates 206250E and 1209201N, and
No. 2, 207205E and 1207483N

These alternative sites have very dense vegetation composed of the species of Guarumo, Yolillo (70%), Chilamate, Jocote Jobo and grass and in the interior they have solid ground where that dredged material can be deposited.

The identified sites can be used under the following conditions:

1. EPN must determine with certainty the volume of material to be deposited in each of them. When defining the volumes accurately, it also enables EPN to determine the area required for deposition. The environmental supervision should not allow unnecessary affectation of surrounding areas.
2. The work teams that will be performing the cleanup at each site should only disturb the riverside vegetation to allow access of a person, where the pipe will be installed later to unload the material as the dredger progresses. The workers should receive prior training to help them identify the importance of riverside vegetation in maintaining stability in the riverbed, in order for them to apprehend the need to protect this vegetation.
3. The sites in general should be identified with visible signs, such as can be placed easily during the development of the activities (it is proposed 30 days prior to the start of the work).
4. The barriers that will be used to contain the dredged material should be installed prior to the discharge of material.

According to the plan for dredging submitted by EPN, point No. 2 is located at station 5 + 700, where a cumulative volume of material to be dredged equal to 359 thousand cubic meters is estimated and according to explanations of the representatives of EPN, this volume includes what is expected to be extracted from the access channel that they plan to build to facilitate the penetration of the dredge from the Caribbean Sea to the San Juan River, which is about 140 thousand cubic meters. If this material is deposited on the seabed, then the volumes that would be deposited at dump sites 1 and 2, are reduced and that indicates that less land area will need to be affected.

At the same time it was found that in front of the town of San Juan de Nicaragua, there is a strip of land where a large amount of material can be deposited. This site has been identified with the number "0" (zero), with the coordinates 1211244 North and 202220 East, which is an excellent depository solution from an environmental

point of view, however it is required to be assessed from an economic and technical point of view.

The use of this site represents the formation of a bank of arid material that could be used by the Municipality of San Juan de Nicaragua or by the citizens themselves for the construction work they are carrying out. On this aspect it should be noted that the Municipality is currently constructing pedestrian streets and walkways for which they extract sandy material from the river and from the seaside area, and the formation of this bank of material would lead to a reduction in the costs for this type of work and would also reduce the environmental impact that arises from the extraction of material from the riverbanks as is being done at present. It is an option as well for the project of constructing the Juan del Norte airstrip.

Deposit site No. 9 initially called Calixto with the coordinates 207534 North and 1201426 East was eliminated because it presented very compact primary and secondary vegetation, therefore a new site was located 700 meters away which has a disturbed primary forest with the species Sotocaballo, yolillo, Guaba, Yema de huevo, Camibar, sangregrado, balsa and Guasimo. This alternate site is located at coordinates 1200692 North and 207477 East.

Isla Salomón was considered as an alternative place to deposit dredged material, the main reasons are economic in nature, taking into account the type of cutter suction dredger with a discharge distance from 1 to 1500 meters that EPN will use. To that effect, because the island has a length of 1.752 meters and about 50 meters of width, in view of this EPN requested that two alternative sites for disposal of material be assessed.

From an environmental standpoint, Isla Salomón is one of the biggest in the Río San Juan Wildlife Reserve. It was observed that part of its primary forest vegetation has been disturbed; there are some clearings with another type of vegetation (bamboo, heliotropes and gramineous plants, amidst other species native to that ecosystem) with significant ecological value.

If it is accepted to have two disposal sites on this island (in areas with the most disturbance of primary forest) strict environmental measures, under supervision of the Ministry, are required, such as:

1. Due to the width of the island (approx. 50 meters) the volumes of material to be deposited at each site must be monitored, to prevent it from getting back into the riverbed (both sides).
2. Leave the riverbank protected by the existing vegetation.

Type of vegetation at a site on Isla Salomón. In the interior the human intervention in the primary forest is evident .

3. Erosion control, using barriers to contain the dredged material, which should be installed prior to the discharge of material.
4. Mark and delimit each dump site.
5. Cleaning of the low vegetation.
6. A plan for recovery of the affected areas through natural regeneration.
7. Alternative sites with UTM coordinates No. 14A: 205266 1193874 and point 14B: 204172 1194151.

Photo: Isla Salomón, eastern part

Type of riverside vegetation at a site.

CONCLUSIONS:

It is considered that the locations that replace the sites labeled 1 and 2 represent a lower potential for environmental damage than those originally proposed for the deposit of dredged material.

The use of the depository labeled with the number "0" represents the possibility to make available to the population of San Juan del Nicaragua a large amount of material that can be used in the construction of streets, houses and the potential airport of San Juan de Nicaragua.

In relation to the sites most environmentally vulnerable, such as Isla Salomón and sites 1 through 4 the mitigation measures establised by MARENA must be strictly adhered to.

RECOMMENDATIONS

The members of the evaluation team agreed to recommend to EPN the dredging of the river channel surrounding the site 'identified as dump site No. 3, since it is the original course of the San Juan River which has silted by settled material, in order to prevent that portion of national territory from merging with the Costa Rican territory, considering that according to the Cañas-Jerez treaty, the right bank of the river is the border. Equally there are other places along the San Juan River with the same sedimentation problem, which merits a cleaning.

To start the dredging from Punta Chingo Petaca, so that from that point the flow is channeled and directed towards the San Juan River and not towards the Colorado River as is happening at present. Nicaragua and the aquatic ecosystem lose much of the water in the River because it flows towards the Colorado River.

To suggest EPN to make an agreement with INTUR or the EAAI (Airports Management Company) since there is a wish to build a airstrip, which will require a large amount of material (sand), and the construction company will surely try to obtain local borrow materials, which will represent environmental impact. The material that will be extracted from the riverbed of the San Juan River, is mostly sand and is precisely the material to be used for the airstrip. It is possible to encourage a mechanism to share the costs of transferring the dredged material to site "zero" located in front of San Juan de Nicaragua since this possibility would normally be eliminated because of criteria of economic nature, however, it is the best choice from an environmental point of view.

EPN should coordinate with the various local institutions (Municipality of San Juan de Nicaragua), the population close to the dump sites, the Army and the MARENA Delegation in Rio San Juan to establish security measures during the activities of cleaning and depositing of material, to prevent accidents and / or posterior squatter settlements in areas used as a deposit for dredged material.

Photo: Experts who participated in the inspection visit

Report compiled by: MARENA Technical Team 24.09.2006

Annex 20

Report of Site Inspection Conducted 11-16 October 2006

FIELD REPORT
VISIT TO DEPOSIT SITES
PROJECT FOR IMPROVED NAVIGATION ON THE RÍO SAN JUAN

This inspection visit was organized by the institutional commission between 11 and 16 October 2006. The following officials, all engineers, participated:

No.	Full Name	Institution
1	Milton Medina	Commission Coordinator – MARENA
2	Elsa Vivas	MARENA
3	Luis García	DGTA – MTI
4	María Lourdes Bravo	EPN Superviser
5	Félix Romero	CORASCO
6	Mario Aguilar	CORASCO

The main objective of the Commission was to inspect each of the 21 sites proposed for depositing the dredging residue.

Deposit sites no. 1, 2, and 3 were reconsidered as in the analysis of the project it had been proposed by the Consultant that they be eliminated because they might impact on existing wetlands systems.

For approval of these sites the following criteria were taken into account:

1. Height to be reached by the residue material to be deposited.
2. Type of material to be deposited.
3. Existing vegetation (tall grass, small palm trees).
4. Distance from the riverbank to the palm trees groves.

Besides using these criteria, the following measures were taken:

1. That the minimal distance between the riverbank and the deposit area should be 15.0 meters.
2. The riverbank should remain protected with the existing vegetation.
3. Specificity of the deposit site locations.
4. Presence of an environmental supervisor to ensure compliance with these measures.

In response to the request of Engineer María Lourdes Bravo, EPN representative, seven additional deposit sites were identified because it was her opinion that the distance between the deposit sites was too great (2.0 km between each one).

An alternative deposit site that was not too close to Bocana de San Juanillo was identified between deposit sites no. 4 and no. 5. The main criteria used to decide that it not be close to Bocana de San Juanillo was the recommendation of fish biology experts that this place is one of the principal locations for the nesting, reproduction, and production of primary nutrients for the food chains of various types of fish requiring calm waters.

The site reflects human activity, since wooden structures of what used to be a ranch, a well, and some starchy vegetable plots, can still be observed, although at present the area is covered with weeds with no economic value.

One important point is that the riverbank is protected by vegetation and trees of different sizes, which protects from erosion and adds to the landscape of the area. The area is approximately 150 meters long and 60 meters wide.

On suggestion of the commission, deposit site no. 9 was eliminated because it has compact secondary herbaceous vegetation typical of a tropical wetland; Thus, another new deposit site (no. 9-A) was identified approximately 700 meters from the first since is has less compacted herbaceous vegetation and would be less impacted.

Recommendations for use of the deposit site are:

1. To clear the area and place all vegetation somewhere it can later be used as mulch or compost organic material.
2. To place piping at no less that 20 meters from the riverbank.
3. To maintain vegetation in the riverbank to protect it from erosion.

In deposit site no. 14 which is in Jobo because this is a small area, alternative sites were identified on Isla Salomón.

These additional deposit sites will be designated 14-A and 14-B. Recommendations for these are the same as those for alternative site no. 9-A.

There were suggested measures for sites no. 18 and no. 19 because water flows within the deposit site boundaries and this flow should be protected. Some protective measures are: a) boundaries of the deposit sites should be well defined. b) protective barriers should be put in place in order to prevent residue from reaching the water currents.

A very important matter to be taken into account is that the distance between the riverbank and the deposit sites. This distance varies in each of the sites mainly depending on

the distance from the house on the site.

In places where there are no houses 15.0 to 20.0 meters will be left between the riverbank and the deposit site in order to prevent the material from returning to the river.

A deposit site was identified near the village of San Juan de Nicaragua near the warehouse owned by Mr. Edén Pastora. This site has an area 60 meters wide and 200 meters long, and existing vegetation is a combination of natural grass with low-lying herbaceous vegetation and some palm trees.

The coordinates of the selected alternate sites (in UTM units) are as follows:

Site No.	**Coordinates**	
	East	**North**
0	**202220**	**1211244**
4-A	**206828**	**1205746**
4-A1	**206843**	**1205733**
4-B	**207036**	**1205615**
9-A	**207477**	**1200692**
14-A	**205266**	**1193874**
14-B	**204172**	**1194151**

A map with the location of all the deposit sites is annexed.

Conclusions

It was generally determined that there is no problem with the location of the residue deposit sites, and no problems were revealed by the inspection. Three (3) sites (no. 1, 2, and 3) that had initially been discarded by the consultant were reconsidered and decided upon; and two existing sites were substituted. One of them because it was too close to Bocana de San Juanillo which, in the food chain, is an area key to primary food production; the other because of secondary compact herbaceous vegetation in the area. In both these cases alternative sites for depositing residue were identified.

Similarly, upon the suggestion of the EPN representative, alternative sites for sites no. 4, no. 9, and no. 14 were identified because the EPN representative considered that the sites were too far apart.

The distance between the riverbank and the deposit sites should be determined by the following criteria:

1. The presence of houses.
2. Vegetation on the riverbank.
3. Protection for preventing deposit material from spilling toward the river.

Annex 21

EPN "Report on the Visit Conducted to the San Juan River and Considerations regarding its Cleaning and Dredging to Guarantee its Permanent Navigation", based on 6-7 February 2008 visit to the site.

Government of Nation Reconciliation and Unity

EPN – *Empresa Portuaria Nacional* – Nicaragua

THE SAN JUAN RIVER IS OURS!

REPORT ON THE EXPLORATION PERFORMED IN THE NICARAGUA SAN JUAN RIVER AND CONSIDERATIONS FOR ITS CLEANSING AND DREDGING TO GUARANTEE PERMANENT NAVIGATION

VIRGILIO SILVA M., EXECUTIVE PRESIDENT

I. Introduction

On February 6 and 7 of the current year, an exploration trip for an "in situ" assessment of the severity in the current level of sedimentation in the Nicaragua San Juan River, particularly the span from The Delta where the Kip Colorado River is born up to the Nicaragua San Juan River Mouth. The assessment included the scope and dimension of the necessary works to cleanse and dredge the Nicaragua San Juan River in order to guarantee permanent navigation.

For an effective reconnaissance and aerial view of the situation, we rented a helicopter from the Air Force of the Nicaraguan Army, within the framework of the Inter-Institutional Agreement undersigned by both parties. An "Ad Hoc" Inter-Institutional Commission composed of the officials below stated travelled to the area.

II. Participants

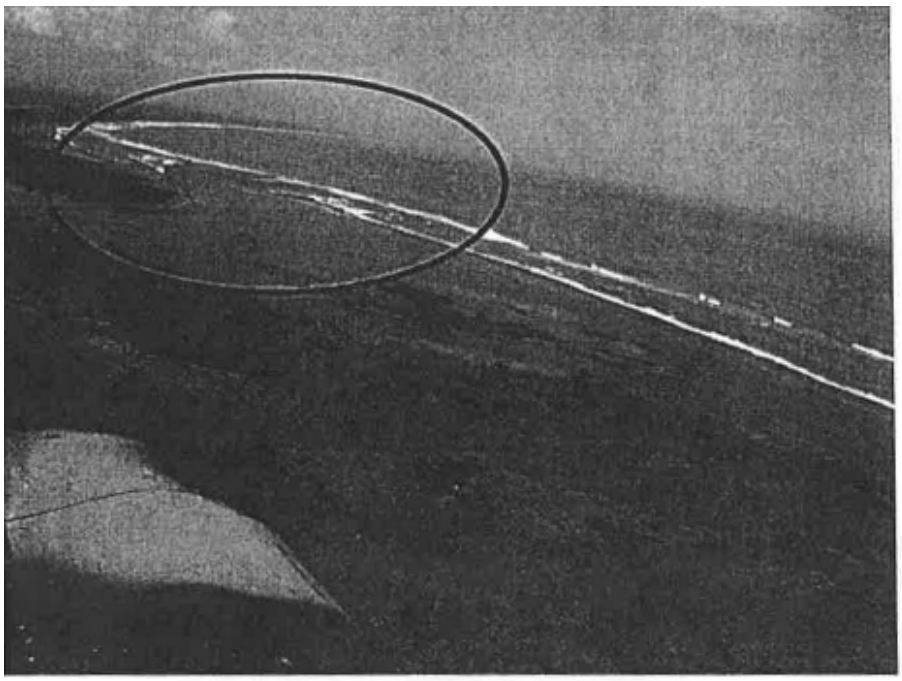
1. Mr. Virgilio Silva M., Executive President, EPN
2. Commander Eden Pastora, Member of the Commission
3. Engineer Jose Genet B., Port Coordinator, EPN
4. Mr. Javier Morales, Director of Port Security, EPN
5. Mr. Diomaso Bracamonte, Captain of Dredge b-1, EPN
6. Engineer Omar Miralles Fernandez, Cuban Technical Advisor
7. Engineer Felix Romero L., Director of Engineering, APC
8. Mr. Arjuna Estrada, Public Relations, EPN
9. Engineer Alvaro Flores, Consultant, CORASCO
10. Captain Manuel More, Director DGTA-MTI
11. Commander Santos Montoya, National Chief of Captaincies (or National Chief of Harbor Masters)

III. Development of the Trip

- Leaving Augusto C. Sandino Airport on 02/06/08 at 7:40 AM to San Carlos, where we landed at 8:41 AM to resupply fuel; we took advantage of this moment to visit and assess conditions at the San Carlos Wharf, managed by EPN. We took off once again at 9:42 AM toward the Nicaragua San Juan River, where we landed at 10:50 AM.

- The following municipal authorities of the Nicaragua San Juan River received us:
  1. Mr. Jose Zambrana, Deputy Mayor
  2. Mr. Sebastian Alvarado Thomas, Head of Municipal Services
  3. Mr. Humberto Calero Morales, Legal Advisor of the Municipal Hall

- Upon landing, the Commission held preliminary conversations with the municipal authorities and agreed to immediately travel to the river and hold a work session at 6:00 PM, once the tour was over. We embarked at the municipal dock in two kayaks toward the San Juan River, from the line toward The Delta, where the Colorado River begins, with a distance of 32 km.

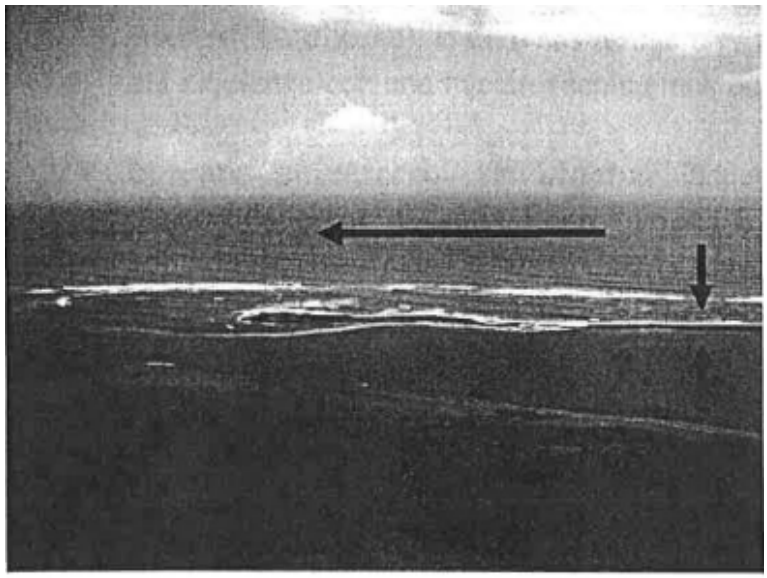


- We began the tour by inspecting the river line at the Indio and San Juan Rivers.

- The tour began with an inspection of the river line at the Indio and San Juan River Mouths.

- The Indio River Mouth was obviously open in a different manner to what it was during the rainy season. Currently, the breakwater that use to run parallel to the coastline no longer exist.

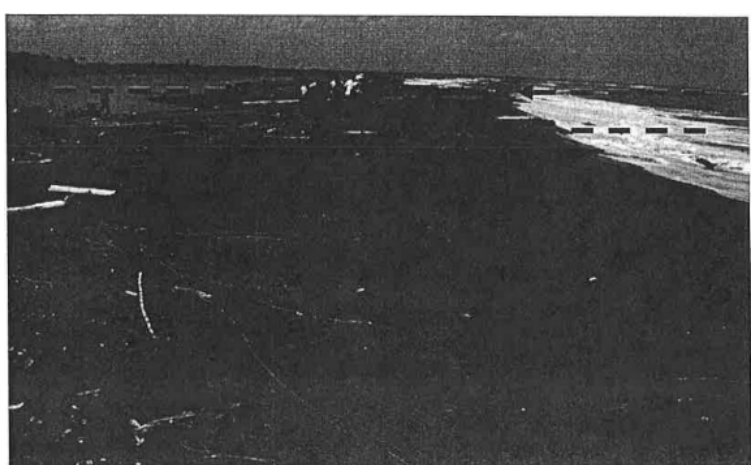
- Then, we travelled toward the current San Juan River Mouth, where changes took place, such as:



- ✓ The breakwater that separates the sea from the river has an approximate width of 20 meters, which is somewhat less than what was visible a year and half ago.

- ✓ The river mouth takes on an angular form toward the northwest, observing that the length of the breakwater has extended and then narrows at outlet, which results in a cyclical phenomenon during the winter and summer seasons.

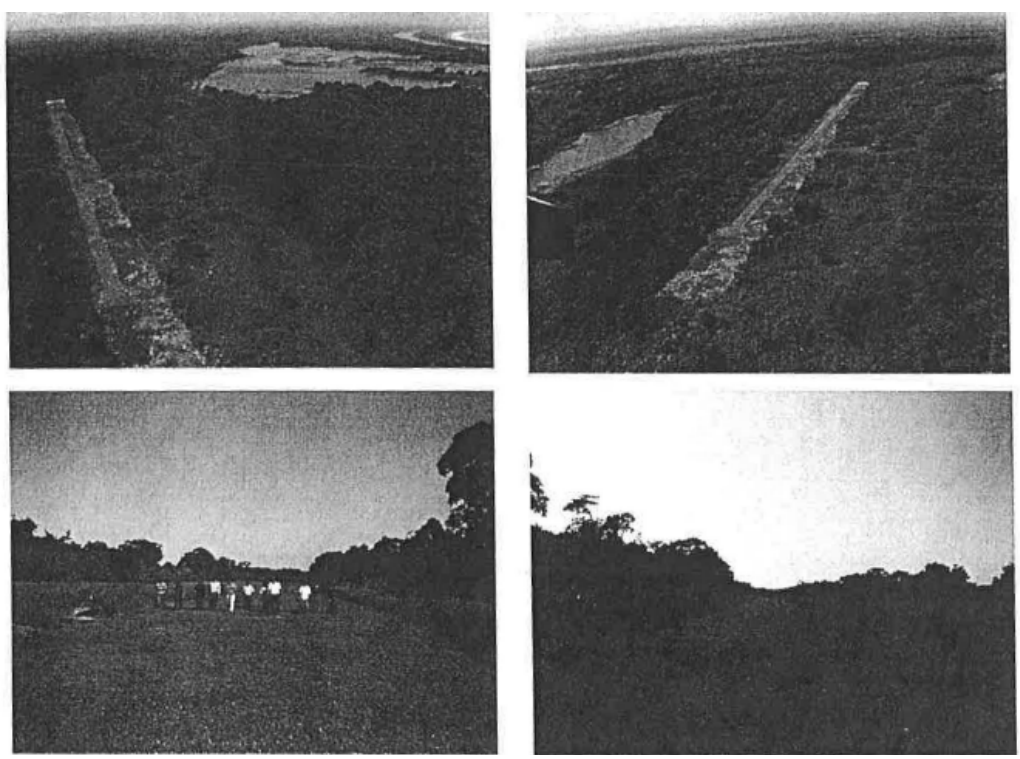
At this location, we assessed the most convenient site to break or dredge the line, the type of equipment to use, work procedures, the direction of the canal, etc. We also assessed the convenience of simultaneously breaking in two work fronts: at The Delta and at the Line, as well as other necessary organizational aspects.



- Afterwards, we continued the tour by navigating 500 meters on the San Juan River; then, we navigated on the San Juanillo River Mouth, where we could no longer navigate due to the high levels of sedimentation in the channel, forcing us to return and reschedule for the following day with a smaller technical mission in order to navigate.

    - As we returned, we inspected the landing strip built and developed by Commander Eden Pastora, which is located near to Greytown, which has very good landing conditions for small aircraft. It is 1000 meters long and approximately 50 meters effective width, with a well-leveled grass surface.

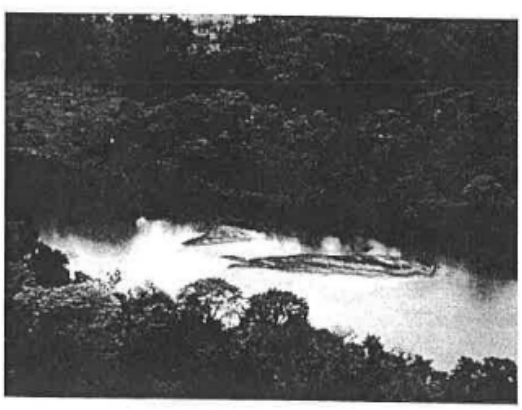
      This landing strip represents a great opportunity for air connection with this location. It is necessary to foster, as soon as possible, its complete rehabilitation and commercial use, as well as its access and connectivity with the current town, which would be a great advantage to ensure the Nicaragua San Juan River cleansing and dredging project. It is worth mentioning that Commander Pastora formally delivered this landing strip to the Civil Aviation Authorities in 2006. These authorities have not used it and have not provide due maintenance; Commander Pastora continues to assume these tasks. The project needs a small plane and the Police have one that is an option.

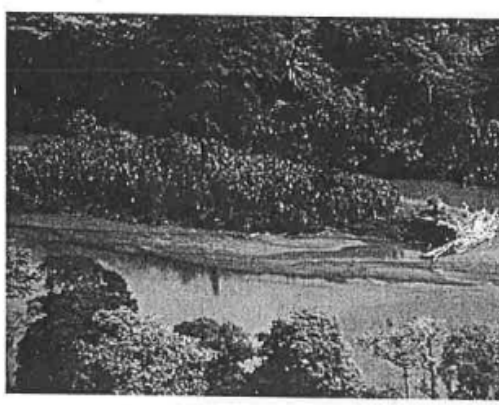


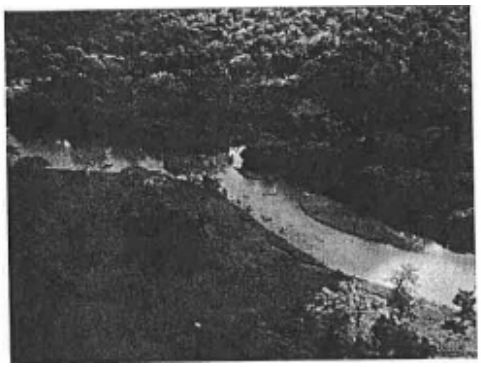
- On the following day 02/07/08, exploration of the Nicaragua San Juan River continued. We carefully inspected several Nicaraguan islands, already formed, which are very close to the borderline Riviera with Costa Rica; due to the high levels of sedimentation, these are under imminent danger of annexing to Costa Rican territory, evidenced as follows:

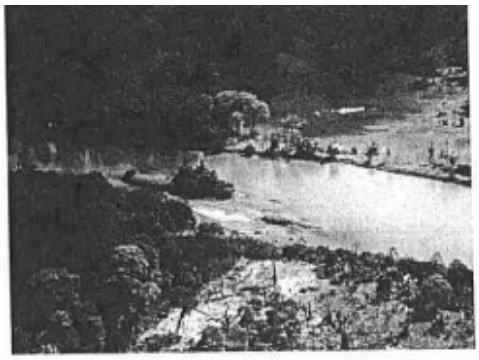
- During navigation, we also observed the shallow depth that in general exists in this stretch of the river, the product of the currents and accumulated sedimentation, which limits quick and safe navigation, a situation which caused the team on two occasions to disembark and push the boat.". In some sections, we found one foot depths.

This accumulated drag and sedimentation phenomenon is creating sandbars that limit navigation and significantly reduce the river flow, requiring cleansing and dredging as soon as possible with cut and suction equipment to guarantee permanent navigation. This would also reactivate economic activity, which is currently very depressed in the area.

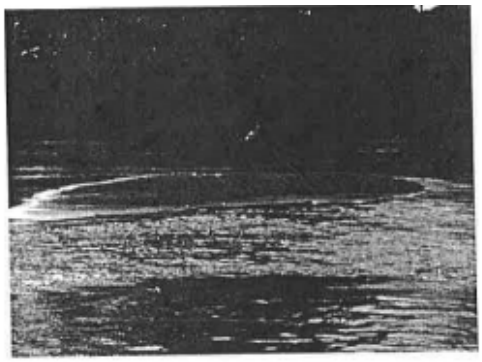


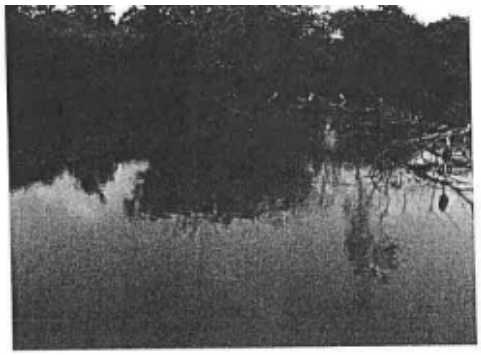


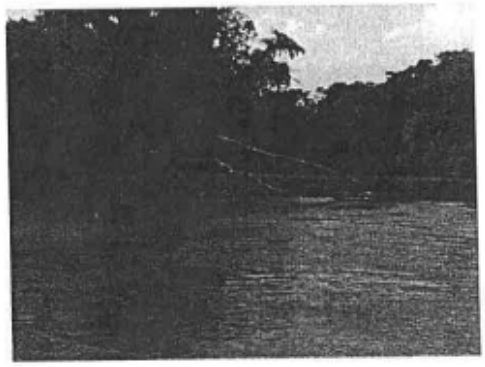


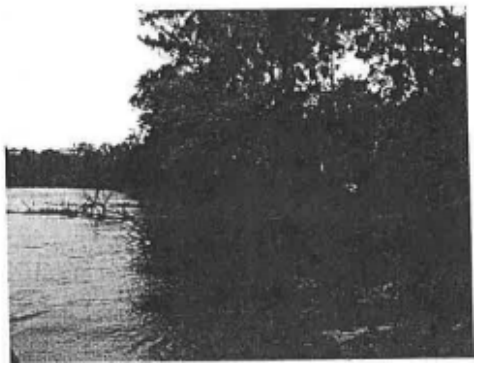


- On the other hand, trees and palisades entrapped in the San Juan Riverbed represent serious danger for navigation; these create accelerated sedimentation and new islets.



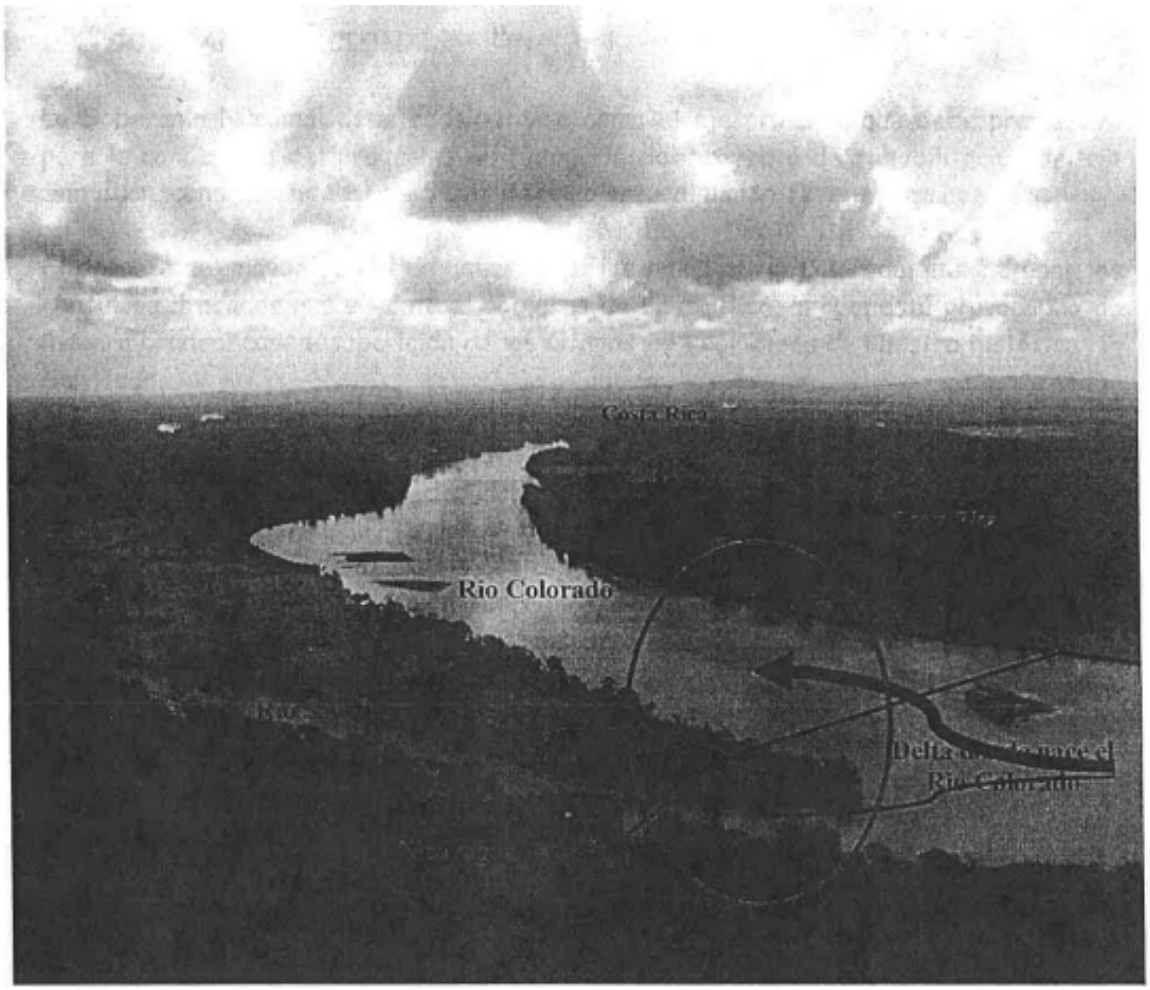






- At 11:00 am, we arrived at the point known as The Delta, where the Colorado River begins and steers toward Costa Rica. It is evident that a high flow of the San Juan River and a reduced volume of water towards it, continuing with the natural route of the San Juan River. In the same manner, a great difference between the width of the first (Colorado River) in regard to the San Juan River is notorious, which has a negative

impact for permanent navigation toward San Juan del Norte, critically evident during the summer or dry season.



- At the Delta, where the Nicaragua San Juan River forks and the Colorado River begin, the capacity measured, calculating a volume of 1700 m^3/second. - Measurements made downstream from the San Juan River, obtaining a volume of 170 m^3/second. - Namely, 90% of the original volume of the San Juan River, situation that requires attention to preserve navigation and sovereignty from that point and up to San Juan del Norte.

IV. Scope and Content of the Project Execution Program

Based on the site assessment, we consider that it is essential to execute the Cleansing and Dredging Project of the Nicaragua San Juan River along this span of approximately 42 kilometers, based on the subsequent principles.

1. NATIONAL SOVEREIGNTY

National Sovereignty should be the backbone for execution of the Nicaragua San Juan River Cleansing and Dredging Project along this 42-kilometer span, taking into consideration the natural borderline between both nations.

Drainage of the major water volumes goes toward the Colorado River, induced by continuous dredging performed by the Government of Costa Rica, which is causing gradual disappearance of the last 28 kilometers of our historic San Juan River.

Likewise, the small amounts of water that flow through the channel produces low speeds that bear high volumes of sediments, tree trunks and limbs that deposit throughout the channel, reducing the river slope. This provokes sandbars that transform into small and large islands that reduce the hydraulic section of the channel, which also serve to retain tree trunks and limbs transported by the river and sometimes close at the border with Costa Rica. This implies the loss of national territory due to hydraulic problems in the river.

2. PERMANENT NAVIGATION

During the months of February, March, April and part of May, river levels drop considerably, obstructing the only manner of transportation that the population relies on. Passengers on commercial and non-commercial vessels have to get out and push the boats, taking long and dangerous trips to arrive at their destination.

It must be clear that this rehabilitation project should encompass at least 33 kilometer of the river channel to guarantee permanent navigation at all times for vessels that currently transit along the San Carlos – Nicaragua San Juan River. Larger vessels with a deeper draft cannot navigate in the diverse torrents, such as: Machuca, El Castillo, El Toro, etc.

3. INCREASED FLOW AND REDIRECTION OF THE RIVER MOUTH

3.1 REDIRECTION OF THE RIVER MOUTH

The Nicaragua San Juan River presents a constant dynamic, i.e. depending on the rainy season the outlet line moves from east to west, with natural sand banks on the surface or underwater that appear and disappear, which protect the outlet or hamper navigation. All of this requires further study to understand the predominating winds to determine the point of the outlet, their direction, their depth, width and protection works, etc.

3.2 REDIRECTION OF THE DELTA FLOW VOLUME

Dredging should begin at the point where the river forks, known as the Delta, to direct the river flow about 3 kilometers upstream to direct the water volume toward the Nicaraguan border; this will allow the San Juan River to maintain its permanent water volume at all

times, guaranteeing permanent navigation on the watercourse at all times. This is the key point for the entry of the necessary water volumes required by the river.

4. MASTER PLAN FOR SOCIOECONOMIC DEVELOPMENT OF THE REGION

Furtherance of socioeconomic development investments is of vital importance. The Government of National Reconciliation and Unity must prioritize comprehensive sustainable investment for this population in order to guarantee the feasibility of this project, such as:

4.1 Support tourism development, which may be complementary to the Waterway Route by building a marina to facilitate access and a dock for ships during the high tourism season in the region.

4.2 Reactivate the old airstrip, which requires some funds for buildings and means of communication. This airstrip may serve as a link for the arrival of international tourism, with guaranteed logistical support to the program.

4.3 Reconstruction of the PETRONIC gas station should provide fuel for the population at favorable prices.

4.4 Reactivate fisheries as a very important heading and work source for the population.

It is worth mentioning that fostering a National Development Plan in the region, during and after cleansing and dredging the Nicaragua San Juan River, is extremely important. Otherwise, the main beneficiaries of this effort would be Costa Ricans as they navigate and exploit the river for tourism during the high water volume period.

V. PROJECT PHASES OF THE NICARAGUA SAN JUAN RIVER CLEANSING AND DREDGING

A. FIRST PHASE: RIVERBED CLEANSING WITH INTENSIVE LABOR

To ensure that the process for future dredging of the Nicaragua San Juan River is not subject to accidents or delays due to existing lumber obstacles in the riverbed, to avoid sediment retention and reaffirm national sovereignty, a PRELIMINARY PROJECT PHASE requires cleansing with INTENSIVE LABOR. The initial six brigades should include 10 men each, including their chiefs, equipped with a support kayak, tools and the necessary supplies to perform such task. Personnel selection and hiring should take place in coordination with the Nicaragua San Juan Municipal Hall.

Cleansing with INTENSIVE LABOR will take place along the span encompassed from the San Juanillo River Mouth up to the Delta, where the Colorado River begins and steers toward Costa Rican territory, representing an approximate distance of 24 kilometers. These should divide in six sub-stretches or work sectors, with a distance determined by the level of palisades and existing obstacles in each sub-stretch, according to a previous inspection.

To perform this phase, the work team should include:

a. Resident Engineer who will be responsible for organizing, directing and supervising all project dimensions to guarantee its success. He will have a kayak and communications equipment.

b. Manager in charge of guaranteeing material supplies, tools and equipment for the project in a timely and adequate manner, as well as control of personnel, payrolls, etc. He will have a kayak and communications equipment.

c. Accountant will be responsible for financial control of project resources, with communications equipment.

d. Three (3) supervisors who will support the Resident Engineer in field supervision tasks; each supervisor will be in charge of a span and two work brigades. Each supervisor will have a kayak and communications equipment.

e. Six (6) brigades with ten men, headed by a responsible and well-recognized leader, who will be directly responsible for carrying out the fieldwork; each brigade will have a kayak and communications equipment.

To implement INTENSIVE LABOR, all personnel must receive an introductory workshop so that all workers fully understand the activity that they will perform, safety measures, tool management, maintenance and upkeep. In the same manner, all workers must understand the definition and have full command of the work organization, communications systems, supplies, campuses, manner of payment and liquidation, theoretically and in practice.

Once brigade form, river cleansing procedures will begin. Namely, tree trunks, limbs and rocks removed from the riverbed and its banks will proceed with chainsaws for cutting large and medium sized diameters, hatchets and machetes used for cutting shorter diameters. Kayaks for extraction used as necessary. All material that represents a potential obstacle removed from the river and deposited about 30 meters from Nicaraguan riverbank. Tree trunks removed from the river delivered to community members so they may use it as firewood.

On the other hand, national sovereignty of the Nicaragua San Juan River highlighted, particularly along the sides of the islands that are close to the borderline, especially those in danger of annexing to Costa Rican territory due to palisades and sedimentation. These brigades must remove palisades, rechanneling and deepening the river volume with shovels in order to guarantee permanent river flow in such sectors.

All cleansing and dredging activities performance should take place during the dry season, when the river as its minimum water level along its course; i.e., during the months of March, April and part of May. After these months, the Nicaragua San Juan River begins its brusque growth, making this activity very difficult.

The estimated cost to implement the first project phase is US$ 450,000.00, including purchase of a backhoe, rental of 11 boats; six brigades composed of ten people each, project management, etc.

Execution time for this first project phase is approximately sixty calendar days.

B. **SECOND PHASE: NICARAGUA SAN JUAN RIVER DREDGING ALONG THE DELTA-NICARAGUA SAN JUAN RIVER SPAN OR VICE VERSA**

GENERAL CONSIDERATIONS

According to capacity measurements made by INETER in the downstream direction, before reaching the Delta, where the Colorado River begins, calculations indicate an approximate volume of 1700 m^3/second. This greatly contrasts with capacity measurements carried out in the same direction of the Nicaragua San Juan River until reaching the San Juan del Norte River Mouth, which only represents between 8% and 10% of the above-stated volume. This leads to the conclusion that approximately 90% of the original volume of the Nicaragua San Juan River deviates toward the Costa Rican Colorado River.

The Nicaragua San Juan River outlet to the sea also affected by morphological process along the Caribbean Coastline, which contributes to sedimentation in the river course and to the low circulation volumes. The river mouth opens and closes during different times of the year, depending on the littoral drift and storm conditions that frequently occur in that area of the country, causing mobile dunes in the river mouth area.

To guarantee permanent navigation along the river, even during the summer and particularly along the referenced span, it is necessary to dredge the riverbed and rehabilitate the natural canal. This will redirect an important volume to it, which currently deviates toward the Colorado River, as above-stated.

The dredging project will begin at the site known as the “Petaca” Point, located about 8 kilometers upstream on the Delta, site where the flow of the San Juan River forks to create the Colorado River that flows toward Costa Rica. A narrower branch of the San Juan River continues until reaching the Nicaragua San Juan River with a total length of 42 kilometers.

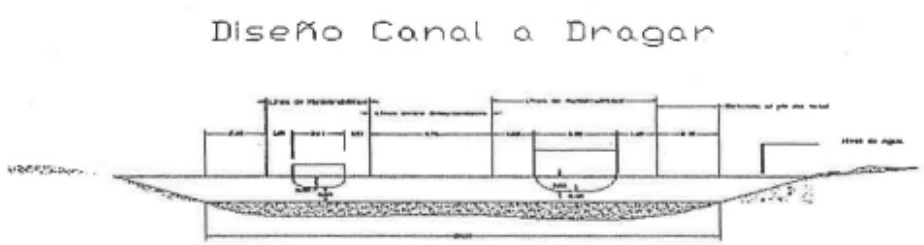
INTERNATIONAL RECRUITMENT OF DREDGES:

Based on the above, we consider that it is necessary to arrange and request support from friendly countries, particularly Cuba or Venezuela, to transport and operate, at cost price, a cut and suction dredge in movement and a stationary one. The latter should have minimum discharge pipes 2000 meters long to perform sediment deposits on dumping sites approved by MARENA, with an average distance of 3,630 meters between each other. Otherwise, MARENA would have to approve new dumping sites in areas that are closer to each other. This would delay project execution.
According to studies performed by the National Consultancy Company, COREA & ASOCIADOS, S.A. (CORASO), the total volume for dredging along this span is 1.574.595 m^3. This includes dredging the breakwater and access channel, with a typical channel section in a trapezoid shape of 20 meters in the inferior base (bed) and 30 meters on the superior base (water surface), with 2 meters permanent depth during the summer months.

To determine the typical canal section on a one-way route, larger vessels that currently navigate in the area used as reference, as well as anticipated access for larger vessels operated by the National Port Company (EPN) and other organizations:

Keel Clearance:	0.60 meters (from the dredged riverbed to the ship keel)
Distance for Maneuverability:	3.20 meters x 2.0 times – 6.40 meters (B.T Hosepipe x factor)
Distance at the Foot of the Slope:	3.20 meters x 2.0 times – 4.8 meters (B.T Hosepipe x factor)
Free Distance between Vessels:	3.20 meters x 1.6 times – 4.8 meters (B.T Hosepipe + Distance for Maneuverability)

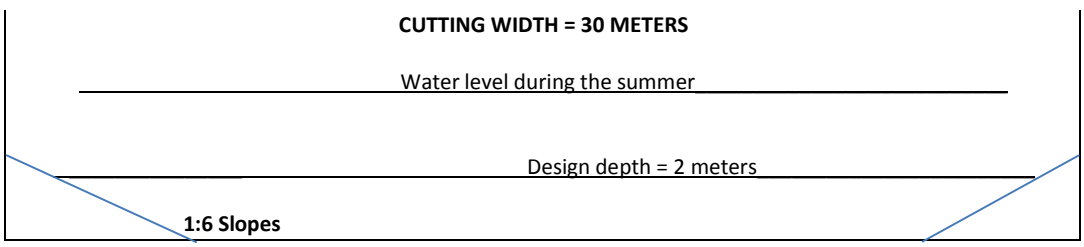
Design of Channel to Dredge



)

DIMENSIONS OF THE CANAL:
Depth = 1.60 / 2.50 M (designed with 2.00 meters)
Includes over dredging = 0.20 meters
Width of the riverbed= 20/15 meters

CUTTING SECTION FOR DREDGING:



A cutting and suction dredge in movement with a hopper to discharge dredge material offshore will serve to break the San Juan River line at the river mouth. This is also necessary to build the access canal for the Nicaragua San Juan River, which will also allow entry of the Stable Dredger to dredge from San Juan del Norte up the Delta of the Colorado River, namely upstream.

If dredging does not begin along this route, we would need to request due authorization from the Government of Costa Rica to introduce the Stable Cutting and Suction Dredger through the Colorado River Line up to the Delta. Then, we would have to assemble it in the area and begin the works at least 3 kilometers upstream on the Delta and dredge along the Delta route toward San Juan del Norte, viz. downstream.

A stable cutting and suction dredger with similar features to the 4600MP Beaver IHC Dredger, with a 1,500 and a 2000-meter discharge pipe length. Estimated execution timeframe for this second phase is 3.2 months, involving dredge transfer from wherever country it may be. After transferring, it to the site and termination of dredging works in the river.

In the event of using a dredge with lesser performance, such as the 2400 MP Beaver IHC Dredger, effective dredging performance of 900 m^3/hour, the timeframe for execution is 4.4 months.
According to this study, the estimated project budget is US$ 7.533.124.80, including direct and indirect costs, mobilization, dredging and project supervision.

NICARAGUA SAN JUAN RIVER DREDGING
(DELTA-NICARAGUA SAN JUAN RIVER MOUTH)

ESTIMATED COST FOR DREDGING WORKS

ITEM	DESCRIPTION	TOTAL COST US$	%
	DIRECT COSTS		
A	Fuel, lubricating oil and energy	850,000.00	32%
B	Labor and Employment Benefits	532,000.00	20%
C	Maintenance, Materials and Consumption	466,000.00	17%
D	Auxiliary and Rental Equipment	171,200.00	6%
E	Direct General Project Expenditures	365,440.00	14%
F	Personnel Hired “in situ”	99,400.00	4%
G	SUBTOTAL	2,484,040.00	
I	Allocation for Inflation, 1.5% of G	37,260.60	1.4%
J	Contingencies, 6% of G	149,042.40	5.6%
	TOTAL DIRECT COSTS (G + H + I)	2,670,343.00	58.61%
	INDIRECT COSTS		
K	Capital Recovery (Internal Return Rate) 12%	320,441.16	40%
L	Indirect General Expenses 18% x J	480,661.74	60%
M	**TOTAL INDIRECT COSTS (K + L)**	**801,102.90**	**17.58%**
N	**PRIMARY GENERAL COSTS (J + M)**	**3,471,445.90**	
O	Risk and Earnings in Dredging the NSJR 25%	867,861.48	19.05%
P	SALE PRICE SUBTOTAL (N + O)	4,339,307.38	
Q	Commissions 2%	86,786.15	1.90%
R	Finance and Insurance Costs 3%	130,179.22 2.	86%
	Total Sale Price for Dredging the NSJR (P + Q + R)	**4,556,272.74**	**100%**
V	Unit Cost for Dredging Works per cubic meter of fill US$ 4,556,272.74/1,300,000 m^3	3.50	
	2 KM ACCESS DREDGING		
S	Dredging Equipment (Moving Suction Dredger)	875,000.00	
T	Risks and Earnings in Sub-Contracts 10%	87,500.00	
	TOTAL PRICE FOR SUB-CONTRACT SALES (S + T)	**962,500.00**	**12.78%**
W	Unit Cost for Dredging Works per cubic meter of fill US$ 4,556,272.74/1,300,000 m^3	3.85	
	MOBILIZATION AND DEMOBILIZATION		

U	Mobilization and Demobilization Cost 25%	1,379,693.19	
V	Risk and Earnings on Mobilization 10%	275,938.64	
	SALES PRICE FOR MOBILIZATION	1,655,631.82	23%
W	TOTAL COST FOR DREDGING CONTRACT		
X	SUPERVISION COSTS 5%	358,720.23	
	TOTAL PROJECT COST (W + X)	7,174,404.57	100%

UTILIZATION OF THE EPN AMMCO DREDGER

If it is not possible to obtain this equipment with international aid, a small dredger of this type is available in Nicaragua administered by the Administration of the *Empresa Portuaria Nacional* (EPN), the Lake Regional Offices, in Lake Nicaragua, which also suffers serious problems due to sedimentation dynamics. In the same manner, this dredger goes to other projects of interest for short periods, such as the docks in Lake Managua, San Carlos, and the Granada Islands.

Features: AMMCO Stable Cut and Suction Dredger

Performance: 150 m^3/hour

Diameter of the Discharge Pipes: 12 inches

Length of the Existing Pipes: 300 lineal meters with their floaters

Timeframe: This dredger has a 150 m3/hour production or performance capacity, equivalent to 1800 m^3/day work average, which means 2.43 years of effective work during an approximate three-year period. This timeframe takes into account interruptions, maintenance and repair for the equipment.

BUDGET:

The estimated cost for project implementation, using this dredger, is US$ 4,100,000.00, mainly taking into account the current price of fuel, which tends to increase.

Upon choosing the option to use the AMMCO Dredger for this project, it becomes necessary to predetermine the operational options and the investments required, in order to preserve safe port conditions at San Jorge.

AUXILIARY RIVERBED DEBRIS CLEANSING TEAM

Independently of the alternative used to carry out dredging works, this requires an auxiliary team to extract trees and tree trunks that are currently submerged in the riverbed and that can be the cause of delays for the dredging. This equipment should remain on site, for as long as the dredging team requires its assistance. It will be necessary to acquire a rack-hoe with its accessories, mounted on a flat plane, which could be the one that is currently operating in Granada, with its

dugout canoes and support staff. This operation is independent of the riverbed surface cleansing with intensive manual labor.

C. THIRD STAGE. BREAKING THROUGH THE SAN JUAN RIVER SANDBANK:

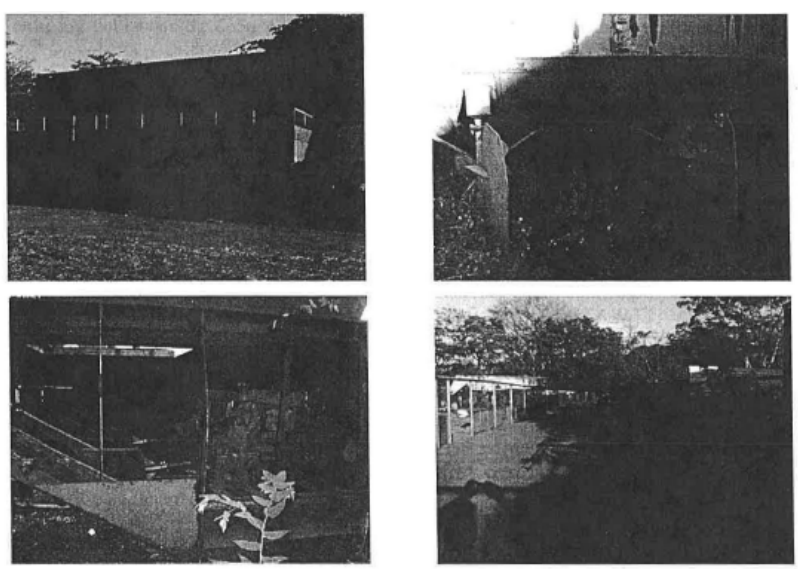
As indicated above, the CORASCO study considers beginning the Project by breaking through the San Juan Sandbank, using a Moving Cut and Suction Dredger, in order to introduce through this route the other Stable Cut and Suction Dredger.

In this regard, considering that there are no complete technical studies about the behavior of the sandbank, we recommend waiting and analyzing the behavior of the San Juan River during the dredging operation along the length of the stretch from San Juan del Norte to El Delta, or vice versa. This will allow us to observe if breaking through the sandbar with another dredger is necessary or if the river itself, with the new volumes of flow carried in its bed can overcome the current symmetry between the estuary and the river mouth and establish natural drainage toward the sea.

D. FOURTH STAGE: MAINTENANCE OF THE NICARAGUA SAN JUAN RIVER

In order to guarantee the stability of the Nicaragua San Juan River Cleansing and Dredging Project, river maintenance needs upkeep. The summer season is the adequate time to perform this part by cleansing brigades and the other parts with a small permanent dredger, which could be either cut and suction or clamshell, to guarantee permanent navigation along the channel in summer, when the river level is low.

In this regard, it is worthwhile to point out that for some time now, Commander Edén Pastora has been building a small Cut and Suction Dredger, with a design based on the EPN AMMCO dredger. If concluded, this could be a real alternative for the stage of future sustainability. According Commander Pastora's estimates, US $500,000.00 needed to conclude and equip the dredger. Observe the progress completed below:



V. Conclusions and Recommendations

1. Primarily, this Project must begin by cleansing the Nicaragua San Juan River along the length of the last 32 kilometers. This requires intensive manual labor to avoid small delays caused by obstacles in the river during the subsequent dredging stage.

2. In light of the high financial project costs, we suggest negotiating with the Governments of Cuba and Venezuela, who we understand have dredging teams and equipment, and the possibility of their carrying out the operation.

3. A special budget line needs negotiations and design to cover the different phases of stages that the project should include.

4. The dredging study carried out in September 2006 by the Consulting Firm CORASCO S.A Reviewed and analyzed in order to update some data, such as the Bathymetries, to guarantee effective project implementation.

5. Establish immediately a Permanent Inter-institutional Commission with the participation of MARENA, INETER, ARMY, EPN, DGTA-MTI, MUNICIPAL GOVERNMENT and the MINISTRY OF FOREIGN AFFAIRS for collegial project management.

6. In order to demarcate National Sovereignty, MARENA needs to proceed as soon as possible to label each of the islands that exist in the Nicaragua San Juan River, especially those that are very close to the Costa Rican riverbank and are in imminent danger of annexation to their territory, given the high levels of sedimentation.

As the specialized body in official geographic measurements and demarcations, INETER should also support the dredging process with staff and equipment.

The Ministry of Foreign Affairs should advise the Permanent Commission about doubtful cases, where dredging is needed, and maintain constant communication with the Project through the Permanent Commission.

The army should provide permanent protection and vigilance of the staff and dredging equipment for use during the implementation of the project.

7. The Engineering University can contribute its knowledge by monitoring the hydraulic changes that are taking place continually in the course of the San Juan River and, if possible, preparing a mathematical or physical hydraulic model of the last 42 kilometers of the river.

8. Dredging and cleansing of the San Juan River is a project that requires substantial amounts, with a very important social benefit for a small community but a significant national character because of the associated National Sovereignty problems. We recommend that, once it concludes, the central government assign a budget to ensure maintenance and sustainability of permanent navigation.

9.- Should the project be carried out with the EPN AMMCO Dredger, it will be necessary to consider first how to resolve the sedimentation problem that permanently appears in the Port of

San Jorge, which would operate most of the year, given that it would be transferred for approximately 3 years.

10.- Attached to this report, a CD is submitted containing the FINAL REPORT OF THE DESIGN OF THE PROJECT “IMPROVEMENT OF NAVIGATION ON THE NICARAGUA SAN JUAN RIVER (DELTA-SAN JUAN DE NICARAGUA)”, prepared by the Nicaraguan consultant COREAS & ASOCIADOS S.A. (CORASCO), which at present represents the most complete and up-to-date study on this topic.

Annex 22

Report of Site Inspection for Proposed Project Additions
Conducted 7-8 September 2009

TECHNICAL REPORT ON THE INSPECTION REGARDING THE EXPANSION OF THE PROJECT "IMPROVEMENT OF THE NAVIGABILITY OF THE SAN JUAN RIVER"

TECHNICAL REPORT
ON

THE INSPECTION REGARDING THE EXPANSION OF THE PROJECT "IMPROVEMENT OF THE NAVIGABILITY OF THE SAN JUAN RIVER"

Conducted the 7th and 8th of September 2009

Participants:

Milton Medina, DGCA-MARENA
Elsa Vivas Soto, DGCA-MARENA
Lester Quintero, Technical Director, EPN

I. GEOGRAPHIC LOCATION

The activities to expand the project of improving the navigation of the San Juan River are to be located in the Municipality of San Juan de Nicaragua, specifically between the Delta of the Colorado River and the mouth of the San Juan River at the Caribbean Sea, in the Department of Río San Juan. The study area is located in the Delta of the San Juan River until the Mouth of the San Juan River of Nicaragua, with the coordinates of Latitude 10º55' North and Longitude 85º42' West.

Objective of the inspection:

1. Inspect the site where the activities to expand the project Improvement of the Navigation of the San Juan River of Nicaragua is to be developed and propose the corresponding environmental measures.

The activities include the cleaning, with manually-operated equipment, of a *caño* that connects the San Juan River to the Harbor Head Lagoon, in Nicaraguan territory. The cleaning will be conducted along 1,560 meters and to a maximum of 30 meters wide, based on the reference coordinates of North 1208638-East 863133 at the starting point, and coordinates North 1209823-East 863450 at the end; and the cleaning using a dredge of a stretch [of River] that has become full of sediments, which is located at reference coordinates: North 1208439-East 863131 [at the starting point], and coordinates: North 1208134-East 863136 and North 1208138-East 863196 (at the end), with a width of up to 59 meters, a length of 300 meters, and a depth of 6 meters.

The intention is to utilize a dredge with the following dimensions:

a) *SOBERANIA* DREDGE

Stationary characteristics:	*SOBERANIA*, cut and suction dredge
Capacity:	200 m3/hour
Diameter of the discharge tube:	12 inches
Length of existing tubing:	1,000 meters long with its pontoons

Development of the visit:

The visit begins at the Project Campus located in the Municipality of San Juan de Nicaragua at the coordinates North 1211128-East 0202026. At this site the administrative and local management office of the project operations are located.

At this same site, an area to manage the fuel to supply the project will be established:

- 4 tanks will be installed, each one with the storage capacity for 1,000 gallons of diesel fuel, and others will be installed for the storage of gasoline.

The fuel will be transported from the facilities at the Petronic company at the Port of Bluf in Bluefields to San Juan de Nicaragua.

Tour of Site 1:

Observations:

At this site, the intention is to use the dredge *Soberanía* to clean a stretch of approximately 1.8 hectares with the objective of causing the flow of water to travel through a channel with the following dimensions: 59 m wide x 300 m long.

The preliminary activities will be developed beginning at the coordinates: North 1207742-East 207189 and ending at the coordinates: North 1207437-East 207188, right side: North 1207440-East 0207248.

The site is located at a bend in the San Juan River which, according to the leader of the project, was formed by accelerated processes of sedimentation that this body of water has suffered. The vegetation is of the type characteristic of zone of the *Area Protegida Refugio de Vida Silvestre del Río San Juan* [San Juan River Wildlife Reserve], belonging to a very wet, tropical forest. The area has been affected by agricultural activities, but the predominant type of vegetation are crops of banana, *yolillo* [raffia], grasses (grass for livestock), *Guanacaste* trees, *soto caballo*, papaya trees, etc.

Three sites will be identified and characterized for the deposition of sediments on the right bank of the Property of Mr. José Sánchez. In the disposal of the 37,500 m3 of sediments, deposition on the banks of the river should be avoided in order to prevent sediments from draining back into the navigation channel that is to be rehabilitated; it is also necessary to protect the habitat of the fauna, primarily that of reptiles and amphibians.

At this site, the proposal is that around 30 people will conduct two turns of 10 hours of continuous work.

Site No. 2: maintenance and cleaning of the caño.

The cleaning of the caño, tributary of the San Juan River that empties into the Harbor Head Lagoon, in Nicaraguan territory, will begin at the coordinates North 1208638-East 863133. The intention is to manually clean a channel of approximately 30 meters wide and around 1,560 meters long. The work will be conducted manually (using shovels, pickaxes, and chainsaws for pruning, and the cutting of trees if necessary).

GPS was used to take the (starting) points: coordinates North 1208638-East 863133 and ending points (exit to the Harbor Head Lagoon): coordinates North 1209823-East 863450.

The cleaning will affect vegetation that is found in the channel where sedimentation has occurred. The area to be directly affected by this activity has been identified as including approximately 4.68 hectares.

In this activity, around 250 persons (male) will be working, who will perform the cleaning work.

RECOMMENDATIONS

1. EPN should provide the bathymetry information and current studies in the sites that are the object of study, to complement the information presented in the Environmental Impact Study.

2. The representatives of the project at the local level should strengthen their coordination with MARENA's Delegation in San Juan de Nicaragua.

3. Given that the Environmental Permit was issued to EPN, the works should be permanently supervised and the environmental compliance ensured by the environmental specialist that EPN has designated.

4. It is recommended that EPN incorporate the following environmental measures into the Environmental Management Program for the Project:

    - The sediment disposal sites should be identified and delimited using primarily areas cleared of vegetation in order to reduce the impact on flora and fauna of this ecosystem.

    - The sediments that are extracted by the use of the dredge should not be disposed of less than 50 meters away from the bank of the river in order to avoid erosive processes and the return of those sediments to the river channel.

    - Use logs or pieces of trees as barriers in the areas where the sediments are deposited.

    - All of the work should be supervised by EPN, and environmental monitoring should be conducted by MARENA specialists and the environmental agent delegated by EPN.

    - The cleaning for the maintenance of the caño should primarily be conducted using manual equipment, such as (shovels and pickaxes).

    - Install ecological (mobile) latrines for the use of the personnel who will work on the project.

    - Ensure the equipment and safety measures to prevent worker accidents; mainly in the case of snake bites.

- For the transfer and storage of fuel for the project activities in this phase, the measures established in the contingency program established in Resolution 038-2008 should be complied with.

- During the development of the activities, all of the solid wastes must be collected and permanently disposed of outside the area, in accordance with the environmental standards for the handling of non-hazardous waste.

- If it is not possible to avoid cutting vegetation, the affected vegetation must be replaced and offset through the planting of 10 trees for every one that is cut, with species that are native to the area. This will promote the natural regeneration of species.

September 2009.

Annex 23

Excerpt of the "Judgment of Central American Court of Justice", available at http://www.fonare.org/index.php?option=com_content&view=article&id=59:fallo-de-la-ccj-ira-al-juicio-de-la-haya&catid=3:newsflash&Itemid=18

3 July 2012

The Central American Court of Justice (CACJ) issued the ruling in which it condemns Costa Rica for the construction of a road parallel to the San Juan River, which is seriously affecting the ecosystem of the area.

In its judgment, the CACJ reiterates that Costa Rica is subject to the "jurisdiction and binding powers of the Central American Court of Justice", which the government of Laura Chinchilla has sought to ignore, "as long as it is a State Party of the Protocol of Tegucigalpa to the Charter of the Organization of American States (ODECA) and for the other reasons set forth in this verdict".

In this regard, the Court let stand its order to suspend the construction of the road and condemned the Costa Rican State "for committing contempt by breaching the provisional measures ordered by the Central American Court of Justice", on January 17th this year.

The regional court also noted that Costa Rica began a work "of high risk and environmental hazard" which had no environmental impact studies, "ignoring the collaboration, mutual understanding and communication that should exist among the States Parties of all those conventions in the field of environment and sustainable development". Below we present the transcription of the REASONS of the ruling of the CACJ:

For these reasons:

The Central American Court of Justice, on behalf of Central America, based on Articles 3, 4, 12 and 35 of the Protocol of Tegucigalpa and 22(c) of its Convention of the Statute UNANIMOUSLY,

RULES:

FIRST: It is declared that the State of Costa Rica is subject to the "jurisdiction and binding powers of the Central American Court of Justice, as long as it is a State Party of the Protocol of Tegucigalpa to the Charter of the Organization of American States (ODECA) and for the other reasons set forth in this verdict.

SECOND: The lawsuit filed by the National Recycling Forum (FONARE) Association and the Nicaraguan Foundation for Sustainable Development against the State of Costa Rica is deemed admissible, because the claims made in this trial are well-founded in law.

THIRD: It is declared that, when it built the road in question, the State of Costa Rica acted unilaterally, without consultation, inappropriately and hastily, violating the bilateral and multilateral international commitments validly entered into, which can not be ignored claiming internal rules.

FOURTH: It is declared that the State of Costa Rica began the work of merit, without the previous studies and analysis required under the obligations imposed by Regional and International Community Law, ignoring the collaboration, mutual understanding and communication that should exist among the States Parties of all those conventions in the field of environment and sustainable development.

FIFTH: It is declared that the State of Costa Rica constructed a work of high risk and environmental hazard that it should have avoided under community obligations, because it exposes the shared river basin and the joint ecosystem that it has with Nicaragua and the region to serious and unpredictable risks, which this Court could observe during its in situ verification of the area in question.

SIXTH: Consequently, the State of Costa Rica is hereby condemned for having violated Articles, inter alia, 3, 4 and 6 of the Protocol of Tegucigalpa; Articles 26 and 35 of the Protocol of Guatemala; Articles 1, 2 a, b and g of the CCAD; Article 3 of the CCAD Regulations; Articles 2, 10, 13, 25, 29, 33 and 37 of the Convention for the Conservation of the Biodiversity and the Protection of Priority Wilderness Areas in Central America; goals 3 and 7 of the Alliance for Sustainable Development (ALIDES), as well as provisions of existing International Conventions such as RAMSAR (Article 5) and other Treaties, Conventions and Agreements on the matter described in CONSIDERING XIV and measures arising from the Protocol of Tegucigalpa which are part of the regional acquis communautaire.

SEVENTH: the State of Costa Rica is hereby condemned for being responsable for the environmental and related damages to the San Juan de Nicaragua River and the joint ecosystem, which is part of the Central American Biological Corridor, and to the respective river basin. Also, to the shared wildlife biodiversity that surrounds and is held around the river and which maintains the ecological balance of the wildlife, the plant life and the environment that the State of Costa Rica is obliged to respect and support because it is a Natural World Heritage Site.

EIGHTH: Let the State of Costa Rica be condemned for committing contempt by breaching the provisional measures ordered by the Central American Court of Justice on January seventeenth of the year two thousand and twelve, and let the order to definitively suspend the construction of said road stand.

NINTH: This Court refrains from determining the amount that is claimed as compensation for the liability incurred because the plaintiff did not provide the information needed to quantify the environmental damage caused.

TENTH: BE IT NOTIFIED. (signed) Carlos A. Guerra G.. (signed) Alejandro Gómez V. (signed) F. Darío Lobo L. (signed) R. Acevedo P (signed) Guillermo A P (signed) Silvia Rosales B (signed) OGM

Annex 24

Speech of Mr. Rene Castro Salazar, Former Minister of Foreign Affairs and Worship, before the Environmental Commission of the Legislative Assembly

September 8, 2010.

Ladies and gentlemen,

I thank you for this summons as it gives me the opportunity to refer to a theme that should be understood in its true dimension both by the Costa Rican and Nicaraguan people. I say this because what most people have heard in relation to the announced dredging of the San Juan River by Nicaragua has been broadcast by some media, and this information, unfortunately, is not always accurate. So I want to take this opportunity to explain, first of all, the legal framework regulating the dredging of the San Juan [River] and the rights of Costa Rica in relation thereto. I will also refer to the actions taken by the Chancery to safeguard national interests in previous administrations and during this administration. Finally, I will be happy to explain to the deputies a novel approach that I propose to promote for adequate environmental and social management not only of the San Juan River watershed, but our country's watersheds in general, and particularly useful and relevant for our border zones.

As regards the legal framework that specifically regulates the dredging of the San Juan River, we should recall the general principle set out in the Cleveland Award of 1888. Paragraph 6 of the third article of the Award reads as follows:

"*The Republic of Costa Rica cannot prevent the Republic of Nicaragua from executing, at her own expense and within her own territory, such works of improvement, provided such works of improvement do not result in the occupation or flooding or damage of Costa Rica territory, or in the destruction or serious impairment of the navigation of the said river or any of its branches at any point where Costa Rica is entitled to navigate the same."*

Further, as it is well known, the International Court of Justice ruled on this issue in its judgment of July 13, 2009, whereby the dispute between Costa Rica and Nicaragua related to navigational and related rights in the San Juan River was resolved. The Court ruled on this matter because among the issues that Nicaragua asked the Court to rule on the following request was included:

"(*v) Nicaragua has the right to dredge the San Juan [River] to recover the flow of waters that existed in 1858, even if that affects the flow of other current recipients, such as the Colorado River."* (Paragraph 151 of the Judgment)

The Court, however, gave the reason to Costa Rica by admitting Costa Rica's thesis that this issue had already been resolved by the Cleveland Award. Accordingly, paragraph 155 of the Judgment reads as follows:

"In any event it suffices for the Court to observe that the two questions thus raised were settled in the decision made in the Cleveland Award. It was determined in paragraphs 4 to 6 of the third clause of the Award that Costa Rica is not bound to share in the expenses necessary to improve navigation on the San Juan river and that Nicaragua may execute such works of improvement as it deems suitable, provided that such works do not seriously impair navigation on tributaries of the San Juan belonging to Costa Rica."

It should be noted that in the operative part of the Judgment, the Court rejected Nicaragua's petition.

In conclusion, Nicaragua can dredge the San Juan River, provided it does not cause injury to Costa Rican territory or affects Costa Rica´s right of navigation in the San Juan River or its tributaries, such as the Colorado River.

Based on this premise, the Government of Costa Rica has been vigilant that the announced dredging does not cause damage to the Colorado River or to Costa Rica´s wetlands in the zone. In particular, it must be taken into account that in 2009 when the Government of Nicaragua officially announced the dredging of the San Juan River, Mr. Virgilio Silva, Manager of the National Port Enterprise, said Nicaragua intended to divert 1,700 cubic meters per second in the San Juan River from the current flow of Costa Rica's Colorado River, as reported in the newspaper La Prensa of Nicaragua on August 25, 2009. Identical statements were attributed to Eden Pastora, responsible for the dredging project, as reported by the EFE agency on that same date. That volume of water would have undoubtedly affected Nicaraguan rivers like the San Juan [River] and Costa Rican rivers like the Colorado [River] and also a great part of the economic activity along the entire watershed, particularly affecting the poorest people of both countries who live from agriculture.

(Project the image of the region)

In this picture you can see the extension of the San Juan River from the delta of the Colorado [River] up to its mouth in the Caribbean Sea and it serves to illustrate the area where the dredging works would be carried out. Logically, the dredging should begin at the mouth of the San Juan River in the Caribbean Sea and advance up to the delta of the Colorado [River].

(Project image of the delta of the Colorado [River])

The picture that you see on the screen is the region known as the delta of the Colorado [River], which is the point where the Colorado River originates. You can see that the vast majority of the waters of the San Juan River, after entering Costa Rican territory, become the waters of the Colorado River. The lower branch of the San Juan [River] that bifurcates upstream constitutes the boundary line between Costa Rica and Nicaragua on its right bank. It is clear that the Colorado River is the natural continuation of the San Juan [River]. It is precisely at this point that the waters of the Colorado River average 1,400-1,600 cubic meters per second during the rainy season, and although more studies are necessary, it is relevant to note that the Colorado River is one of the most plentiful of Costa Rica.

When you see this photograph, you might think that the statements made by Messrs. Silva and Pastora are scarcely supported professionally, especially if it publicized that the dredging budget is around $7 million, which is rather modest for this type of work. However, the Chancery has the obligation to ensure that the sovereign interests of Costa Rica are not affected and that the provisions laid out in the Cleveland Award of 1888 and in the Judgment of 13 July 2009 are met.

That is why the Ministry of Foreign Relations has consistently sent diplomatic notes to the Government of Nicaragua requesting technical information on the dredging works to ensure that they will not cause damage to the national territory, in particular the Colorado River, and recalling the international legal regime that protects the rights of Costa Rica, based, inter alia, on the Cleveland Award of 1888 and the recent judgment of the International Court of Justice on July 13, 2009. These notes include those by former Chancellor Roberto Tovar in 2006, former Chancellor Bruno Stagno in 2009 and the recent note signed on 12 July 2010 by Deputy Minister Carlos Roverssi as A.I. Minister.

All these notes are intended to sustain the legal position of Costa Rica in case it becomes

necessary to resolve this issue before international judicial bodies in the event that a serious impact is caused to our interests, as set out in the Cleveland Award and in the recent resolution of the International Court. This would certainly be an extreme hypothetical scenario, and if it did occur, we would have to be in the presence of an actual or imminently potential damage that can be duly proven. The statements made by Messrs. Silva and Pastora do not constitute sufficient proof in and of themselves that this damage will occur, but, as I have said, they justify that the Government is vigilant of the situation and monitoring the project.

In relation to this surveillance work, I should also note that the Chancery set up an inter-institutional working group in 2009 to monitor the Colorado River, integrated by the Ministry of Foreign Affairs and Worship, the Ministry of Environment, Energy and Telecommunications, the Ministry of Government, Police and Public Security, the Costa Rican Electricity Institute, the Costa Rican Water and Sewerage Institute and the National Meteorological Institute. Among the first tasks were to establish a benchmark that could serve to determine if any eventual dredging works in the San Juan River would affect the Colorado River.

As part of the work of this inter-agency group, a trip was made in November 2009 to take measurements in the Colorado River. Among the work carried out, an appraisal was made to measure its flow and basic equipment was installed to regularly measure the water level. An analysis of the sedimentation of the river and water quality was also made. Costa Rican experts developed a volume calculation model that projects the impact on the volume of the Colorado River from the different types of projects and dredging operations in the San Juan River. Without going into details, I can say that the results of these studies are in general tranquilizing for the country since all the models analyzed calculate volume reductions of less than 12%. Moreover, for the announced $7 million investment, the reduction of volume would be even smaller and, therefore, will not produce the alarming environmental and economic impact that some media have suggested. Nobody has been able to prove volume calculations or reductions close to 60% as published in some media.

In addition, we have reviewed the costs of the dredging works in Caldera and in the Panama Canal, which has allowed us to establish an approximate cost of $700K to $1M per linear kilometer for the dredging of the river. Based on this, we estimate that the budget announced

by Nicaragua will allow them to dredge or clean between 7 and 10 linear kilometers of the San Juan [River], which would represent a small segment of the river.

It has been public and notorious that the recent note of July 12th spawned a political reaction on the part of the Government of Nicaragua. The note, like its predecessors, mainly had a legal rather than a political purpose, so after satisfying that need I deemed it was opportune to travel to Nicaragua to directly manage the political relation, not only on this subject, but also other aspects of the bilateral relation. During the meeting held with Chancellor Samuel Santos in Managua, Chancellor Santos gave verbal assurances that the current dredging project will not have an impact on the flow of the Colorado River because it is rather a modest work to clean the San Juan River that seeks to improve navigation over the river from its mouth up to the delta of the Colorado [River]. President Daniel Ortega, on his part, also affirmed in his statements to the media in his country that no damage would be caused and that his intention is to develop his country.

This verbal assurance is sufficient for us to have peace of mind that no damage will be caused to the national territory. Actually there are no reasons to doubt the words of the Foreign Minister of Nicaragua or its President. In addition, our own studies suggest something similar. However, we will certainly carry out natural and logical monitoring activities, including field visits, real time monitoring via satellite, among others, in respect of any project that could impact the Costa Rican side of the watershed.

Also, based on the aforementioned inter-institutional group, we will establish through a decree a Technical Commission to Monitor the Border Watersheds, to which technical teams from the country's universities, like the National University and the University of Costa Rica, will be invited. In other words, the work of the inter-agency group will not only continue, but we want to expand its functions to monitor the whole area of the watershed that belongs to our country, including 16 municipalities on the Costa Rican side and close to 300,000 inhabitants. The Nicaraguan side is larger in size and population. It would be modern and rational for both countries to agree on an integral management of the entire watershed.

In this regard, and according to the classical definition of Diez de Velazco "a *watershed can be defined as a zone where all currents of water are fed by a common spring and flow through a common route or routes to the sea, a lake, or any internal place without a visible*

outlet to the sea, including rivers, lakes, tributaries, groundwater and even subsurface aquifers, provided that all these waters are united in a single riparian system." In other words, with this approach, the concept of a watershed is conceived as a factor of integration and not division, as the notion of river is traditionally presented.

We precisely want to give a more modern approach to bilateral relations in the sustainable management of shared watersheds, not only of the San Juan River watershed, but also the Sixaola River watershed we share with the Republic of Panama, an initiative that would be framed in turn in a major effort that we are calling Trans-Boundary Watersheds for the Central American borders. In fact, on September 2, in the context of a meeting of the Council of Ministers of Foreign Affairs of the Central American Integration System (SICA) held in Antigua, Guatemala, we signed an agreement with Panama to be the first in our region to think and plan, in an integral manner, the entire trans-boundary watershed and its respective ecosystem. In other words, we want to work together around the entire watershed, and that includes rivers, urban areas, agricultural and industrial activities that affect, for good and bad, each of the rivers that comprise a watershed. For example, we will examine the actions on both sides of the Sixaola [River] that affect security, water quality, employment, etc.

This concept could also be applicable in the northern border in the immense watershed of the San Juan or in the watershed of the Lempa [River] in the border between Honduras and El Salvador. The concept of watershed has been used around the world and with success in the watersheds of the Amazon River, Danube River and La Plata River, thus becoming opportunities for integrated development rather than sources of litigation.

Mr. Chair, ladies and gentlemen:

I am confident that this presentation adequately answers the questions that motivated your decision to summon me today. In particular, I hope that I have been able to explain the true dimension of the dredging project, so that there is peace of mind that it is not correct to say that this work in particular will divert 80% of the flow of the Colorado River towards the San Juan [River], or that it will cause imminent damage to the territory of Costa Rica. I also hope that I have clarified the actions that the Government intends to carry out not only to monitor the dredging works, but, more importantly, the novel approach of trans-boundary watersheds in Central America that we aim to promote with support from SICA and funding from the

European Union.

As you can see, the Chancery has been diligently taking the necessary actions to ensure adequate protection of national interests. Costa Ricans can rest assured that the legal position of Costa Rica is solidly supported, although we are confident that it will never be necessary to resort to international courts to enforce the rights of our country. At the same time, the necessary technical and scientific work has been carried out to adequately monitor the works that the Nicaraguan Government will carry out and these actions will continue and, in fact, will be expanded. And with this new approach that we aim to promote in relation to the integral management of border watersheds, we hope that a border zone that is today a zone of poverty, illegal immigration and division will become an area of development and happiness through a bi-national effort, for which we are seeking to obtain funds from the European Union through SICA for cross-border watershed management programs.

With this, Mr. Chair, I conclude my remarks. I have of course the best disposition to answer questions that the deputies want to ask me. However, any questions on certain aspects of the issue in question that refer to legal protection of national interests under international law or ongoing diplomatic relations could require an elaborate answer, so keeping in mind what I previously explained I would reserve the right to ask that those questions be made in writing, so that we can also answer them in writing, and thus ensure the most effective protection of Costa Rican interests under international law.

Thank you for your attention.

Annex 25

Excerpt of the Statement by the Deputy Minister of Environment of Costa Rica, Ana Lorena Guevara, in the radio program "Nuestra Voz" (Our Voice) hosted by Amelia Rueda

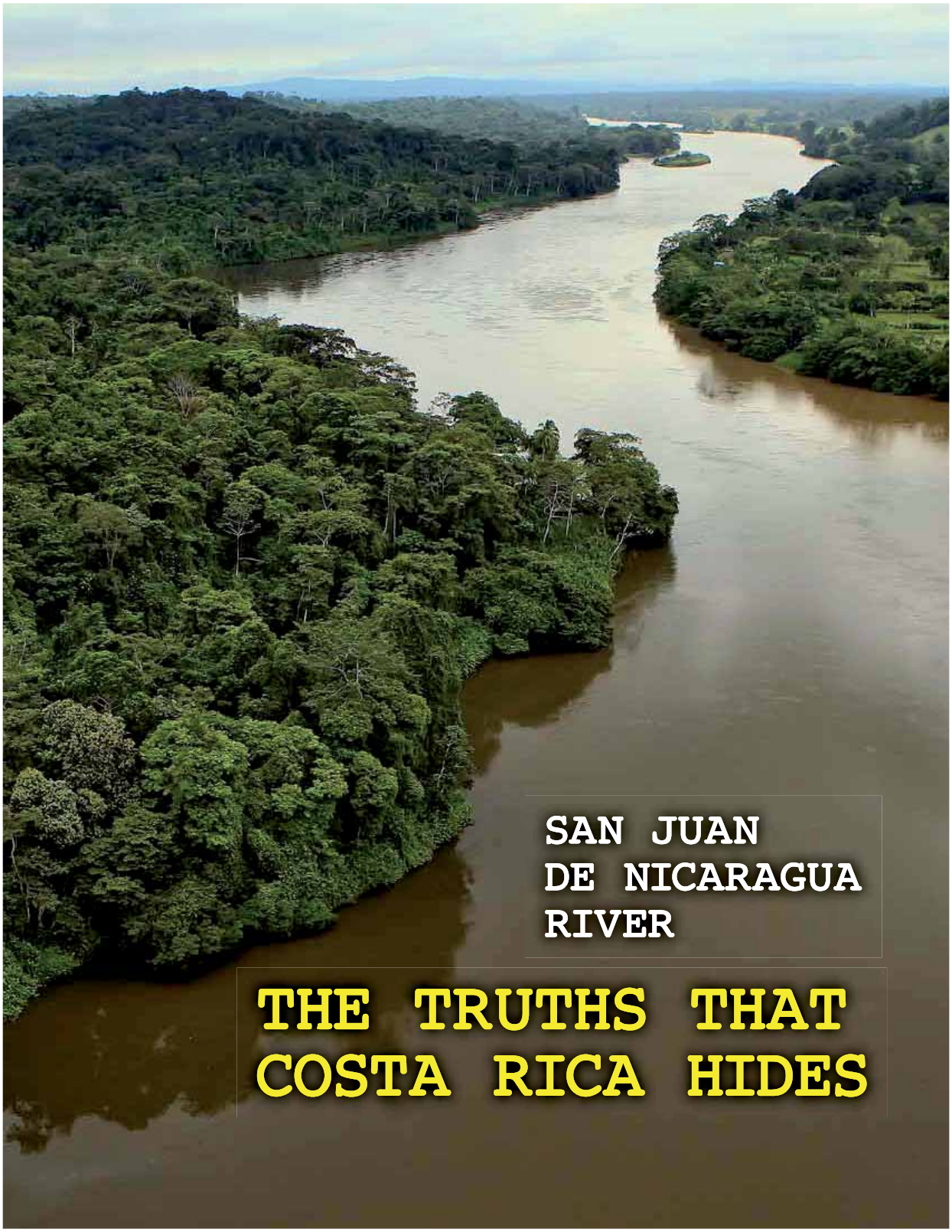
April 6, 2011

Ana Lorena Guevara: Yes, there are interesting things, for example, some measurements could be taken in terms of water flow rate and indeed these are very fast measures obviously because we didn't have much time. For example, some photographs and water and soil samples were taken. For example, it has been noticed along the artificial channel that, as a result of the rain, the slopes of this artificial channel have already began to fall on the channel and vegetation has started to grow. They also mentioned interesting fact that they have already seen fish along the channel, which suggest to our technicians that to the extent that no intervention takes place, the wetland tends to recover quickly. This tells us that we would obviously like a strict recommendation of no interference of any kind and the possibility of a permanent monitoring in the area because changes can be seen as a result of the rains and climate change.

Annex 26

Complete NicaraguanWhite Book,
San Juan de Nicaragua River, The Truths That Costa Rica Hides

26 November 2010


SAN JUAN
DE NICARAGUA
RIVER
THE TRUTHS THAT
COSTA RICA HIDES

SAN JUAN DE NICARAGUA RIVER

2

CONTENIDO

PRESENTATION

The State Council, in the defense of peace and sovereignty, and the constitutional institutions of the Republic of Nicaragua make available to the people of Nicaragua and to the international community ample information that permits to illustrate the scope of the dispute created by Costa Rica as of October 22, 2010.

The content of this compendium of information permits to easily establish judgments of value on the truths that Costa Rica hides and, moreover, to identify that its pretension is, again, to cut off part of the territory of Nicaragua as occurred in different episodes of our history.

The truths that Costa Rica hides are expressed in the historical, legal, environmental order and aspects that are today binding, such as those referring to the incidence of drug trafficking in the State policies of the Government of Costa Rica and the pretended propagandization of an aggression by Nicaragua, which is totally false. On the contrary, there is sufficient evidence that Nicaragua is the offended party.

THE TRUTHS THAT COSTA RICA HIDES

With the content of this document we seek to illustrate actions of bad faith and to demonstrate how the documents presented by Costa Rica are full of defects and nullities precisely to hide the truth.

We have no doubts that Nicaragua is backed by reason and truth because we are acting in strict compliance of the Political Constitution and laws, as well as the principles of International Law that we have always respected.

Costa Rica has ignored the boundary treaties and awards consigned in its Political Constitution, has violated the principles of International Law in environmental matters and, even more deplorable, its claims originate from and are based on people who have been fully identified as active agents of international drug trafficking.

Nicaragua has systematically fostered a bilateral dialogue and that the solution to the demarcation of the boundary according to the treaties and awards passes through the persistent position of the Nicaraguan nation and the recent statements of the President of the Republic, Commander Daniel Ortega Saavedra, to proceed to the marking of the boundary, which process is rejected by Costa Rica.

Nicaragua always acquiesces and ratifies that disputes arising between sister nations can be settled through peaceful means and that when boundary disputes are involved, they must be brought before the International Court of Justice.

Nicaragua has been prudent and has acted in a responsible and constructive manner. It was Costa Rica that deployed troops, air and navy means, and special forces equipped with military weapons.

The declaration of a Costa Rica without armed forces is past history. This country budgets 240 million dollars for its armed forces, which is five times greater than the budget allocated by Nicaragua.

The cleaning of the San Juan river is a sovereign right of Nicaragua, which will continue with the intention of recovering the volume that enables full navigability and contributes to the management of river basins of strategic water resources.

No environmental damages are being caused. Nicaragua's leadership in this area is so deep-rooted that it is beyond questioning.

SAN JUAN DE NICARAGUA RIVER

In Nicaragua we take care of the environment in conformity with the constitutional mandate that provides: "Nicaraguans have the right to live in a healthy environment and it is the obligation of the State to preserve, conserve and reclaim the environment and natural resources of the country".

Consequent with our Magna Carta, Nicaragua has 76 protected areas, 3 biosphere reserves and the support and recognition of environmentalist organizations and the same International Court of Justice.

Contrary to the foregoing paragraph, Costa Rica has cut down trees in its northern zone, contaminated rivers, destroyed tropical forests and wetlands, authorizing open-sky mining operations, spilling chemicals, cyanide and agrochemicals into the San Juan River, attempting to channelize the water of Lake Nicaragua to other projects of a commercial nature, and depriving its own citizens of this vital liquid.

The reports on presumed incursions of the Nicaraguan Army and violation Costa Rica's sovereignty, accompanied by a disproportionate deployment of armed forces by Costa Rica, are nothing more than a coarse manipulation that seeks to influence national and international opinion to justify and strengthen the objective of its strategy, which is the suspension of the cleaning work that Nicaragua is carrying out in the San Juan River since October 18, 2010, all in conformity with the sovereign rights of Nicaragua, ratified in the judgment of the International Court of Justice of July 13, 2009.

THE TRUTHS THAT COSTA RICA HIDES

The Council of the Powers of State and constitutional institutions of the Republic of Nicaragua have the hope that Costa Rica will think it over and that this exaltation of spirits that is being fueled against Nicaragua do not result in hostilities and discriminatory and xenophobic attitudes towards the hundreds of thousands of Nicaraguans that give their work and talent for the benefit of Costa Rica.

Nicaragua and Costa Rica are sister nations not only by vicinity, but by the mixed blood of their populations.

PODER EJECUTIVO

PODER LEGISLATIVO

PODER JUDICIAL

PODER ELECTORAL

FISCALIA GENERAL DE LA REPUBLICA

CONTRALORIA GENERAL DE LA REPUBLICA

TESTIGO DE HONOR: CARDENAL MIGUEL OBANDO Y BRAVO

THE CONTROVERSY

The truth that Costa Rica hides is that its Public Forces, Judicial Investigation and Public Ministry authorities knew from Nicaraguan authorities that from October 1 to October 5 the Army of Nicaragua carried out an operation against drug trafficking in Nicaraguan territory in localities of the municipality of San Juan de Nicaragua along the border with the Republic of Costa Rica.

Costa Rica was informed about the disarticulation of an international drug trafficking cell that operated in Nicaraguan territory and from Costa Rica, as well as the dismantling of an operational base in the Municipality of San Juan de Nicaragua, in which weapons, naval means and sufficient evidence on areas destined for drug concealment were recovered and six Honduran drug traffickers were arrested.

Costa Rican authorities were informed that as a result of these operations, Nicaraguan criminals who form part of this criminal network entered Costa Rican territory to flee from justice in our country, for which reason they were being alerted so that they took the necessary measures to detain these Nicaraguan drug traffickers whose surname is Reyes Reyes and Reyes Aragón.

THE TRUTHS THAT COSTA RICA HIDES

On October 18, Nicaragua commenced in its territory the work to clean the San Juan River with the "Sovereignty" dredge, which motivated Costa Rica to manipulate information on a presumed incursion by forces of the Nicaraguan Army to its territory, which is totally false.

In this sense, it is worth to mention that on October 21st, three days after the work to clean the San Juan River began, Costa Rica issued a press release in which the Ministry of Foreign Affairs and Worship and the Ministry of Public Forces base their official complaint on the versions given by the drug traffickers Reyes Reyes and Reyes Aragon pursued by Nicaraguan justice.

- **Nicaragua has not invaded Costa Rican territory.**
- **There have been no injuries or deaths. There has been no armed confrontation. The tranquility of the residents has not been altered.**
- **Nicaragua has never severed territory from Costa Rica.**
- **It has been Costa Rica that has severed our national territory.**
- **Historically, Costa Rica has always sought spaces of the national territory, including its strategic resources.**
- **Costa Rica's true strategic goal is to have direct access to the Lake of Nicaragua and San Juan River.**
- **Costa Rica's falsehoods are not something of today, they have always existed.**

COSTA RICA SAYS THAT NICARAGUA INVADED ITS TERRITORY MILITARILY

FALSE!

NICARAGUA HAS NEVER INVADED NOR WILL INVADE COSTA RICAN TERRITORY

COSTA RICA MOBILIZED A LARGE MILITARY CONTINGENT TO THE BORDER WITH NICARAGUA ON OCTOBER 22, 2010.

The Army of Nicaragua has always exercised full sovereignty, surveillance and operations to fight drug trafficking and organized crime in the south border. This includes the municipality of San Juan de Nicaragua on the border with Costa Rica.

Costa Rica has maintained a systematic campaign against the exercise of sovereignty in the waters of the San Juan River and Nicaraguan border territory, particularly against the presence of the Nicaraguan Army forces that protect these zones.

Costa Rica has never patrolled the adjacent border zone of the municipality of San Juan de Nicaragua, nor has made any captures or taken any actions against international drug trafficking.

The complaints of Costa Rica on the presence of Nicaraguan authorities in the zone of Harbor Head occurred after Nicaragua announced the beginning of the work to clean and improve the San Juan River.

The disproportionate lie about the invasion is nothing more than a manipulation to hide its interest to suspend the work to clean the San Juan River.

THE TRUTHS THAT COSTA RICA HIDES

IT IS COSTA RICA THAT HAS DEPLOYED ITS ARMED FORCES, BEARING MILITARY EQUIPMENT AND COMBAT GEAR, TO THE BORDER ZONES WITH NICARAGUA.

IT IS COSTA RICA THAT HAS THREATENED NICARAGUA, STATING THAT: "THESE GENTLEMEN WILL WITHDRAW BY REASON OR BY FORCE."

The true reason behind the complaint of Costa Rica is to try to prevent Nicaragua from recovering the volume and use of the San Juan River.

Warmongering language does not fit in these times. Nicaragua is giving examples of dialogue to overcome disputes in a constructive manner.

LA NACIÓN

The Security Minister expressed strong criticism against the Nicaraguan government

MONSERRATH VARGAS LOPEZ movargas@nacion.com 02:43 P.M. 11/02/2010

San Jose (Editorial). The Security Minister, Jose Maria Tijerino, stated this morning in ADN News that he trusts in the collaboration of international organizations to solve the military presence in the north border of the country.

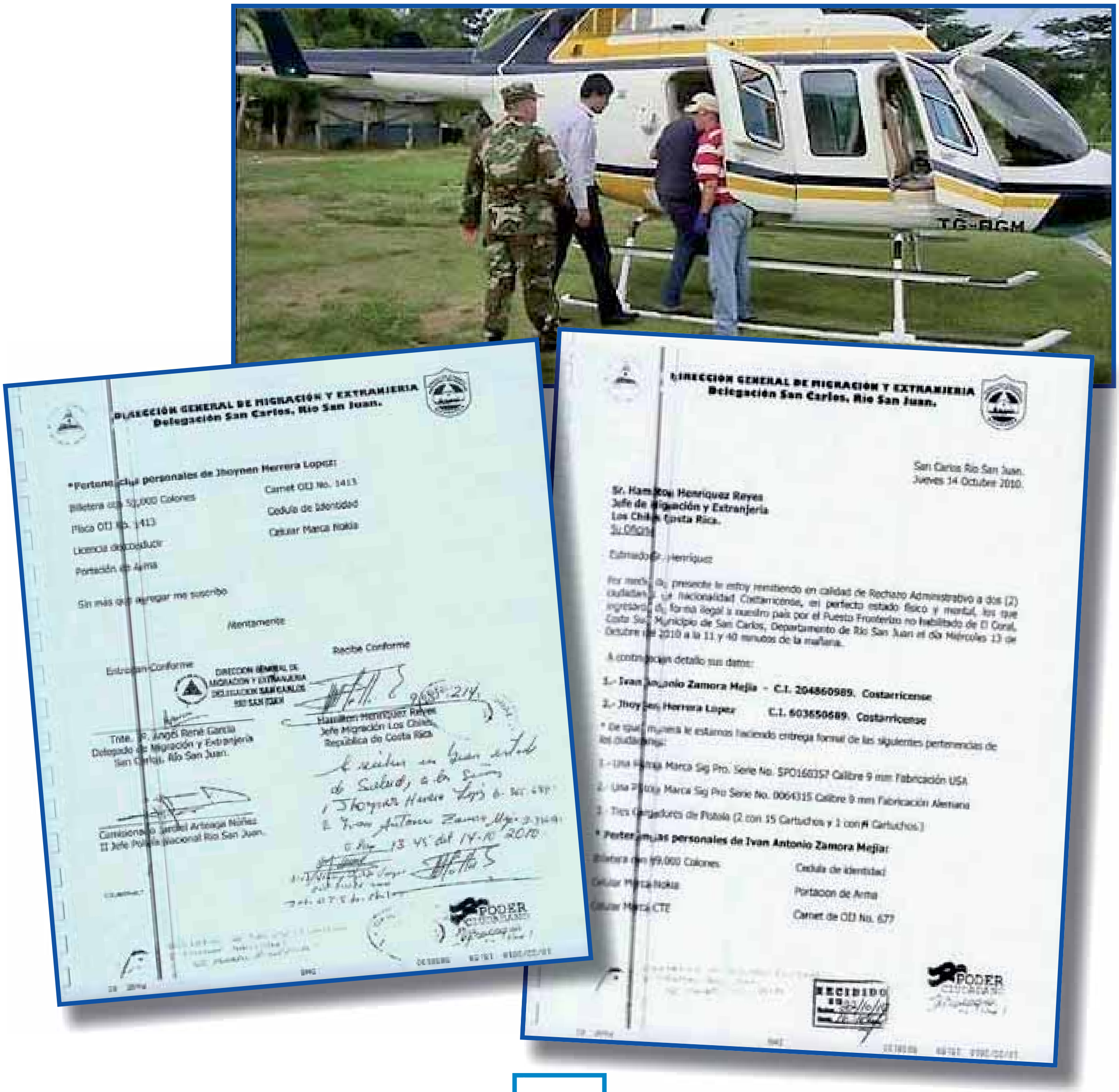
"These gentlemen will withdraw by reason or by force. We are supported by international law, by the mechanisms that international law has available, including the use of force".

CONTRARY TO COSTA RICA, NICARAGUA ACTS WITH MATURITY AND PRUDENCE

On October 13, 2010, two officials of Costa Rica's Judicial Investigation Organization were detained after illegally entering Nicaraguan territory with weapons, vehicle and official identification.

A GESTURE OF GOOD WILL OF NICARAGUA

On October 14, 2010, the Government of Nicaragua, in a gesture of good will, turned over to Mr. Hamilton Henríquez Reyes, Head of Immigration in Los Chiles, Costa Rica, Costa Rican citizens Ivan Antonio Zamora Mejia and Jhoyer Herrera Lopez, both identified as officials of Costa Rica's Judicial Investigation Office, who were carrying their weapons and moving in a Costa Rican vehicle in Nicaraguan territory after illegally entering, according to their statements, to carry out investigations and surveillance.



COSTA RICA SAYS THAT NICARAGUA INVADED AND ILLEGALLY OCCUPIES CALERO ISLAND

FALSE!

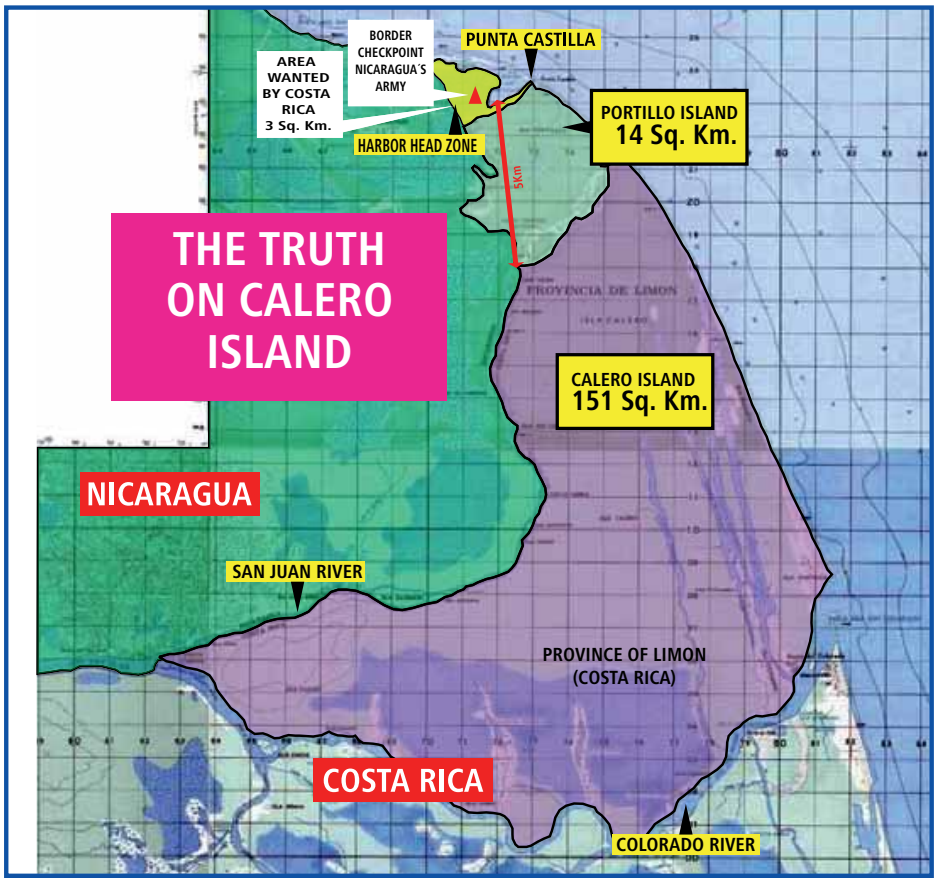
COSTA RICA'S CLAIM

"I asked specifically in Nicaragua about Calero Island, they told me that Calero Island is in Costa Rica and Nicaragua would never question that.

We are not referring to Calero island…, we are referring precisely to that which is called Aragon farm. …because this is a swamp; in the most common language it is called a swamp, but in reality, nowadays the word wetland is used…"

Jose Miguel Insulza, Secretary General of the OAS in the Special Session of the General Assembly. 11/9/2010

THE ARMY OF NICARAGUA HAS CARRIED OUT ITS MILITARY ACTIONS IN THE ZONE OF HARBOR HEAD AND RIVER OF THE SAME NAME, A SOVEREIGN AND UNQUESTIONABLE TERRITORY OF NICARAGUA.



Calero Island is located between the margin of the Colorado and Taura rivers, in a southerly position, which Costa Rica calls Portillo Island, that is to say, distant from the permanent location of the Army of Nicaragua in the Harbor Head River in the locality of San Juan de Nicaragua.

NICARAGUA DOES NOT DISPUTE COSTA RICA'S SOVEREIGNTY OVER CALERO ISLAND.

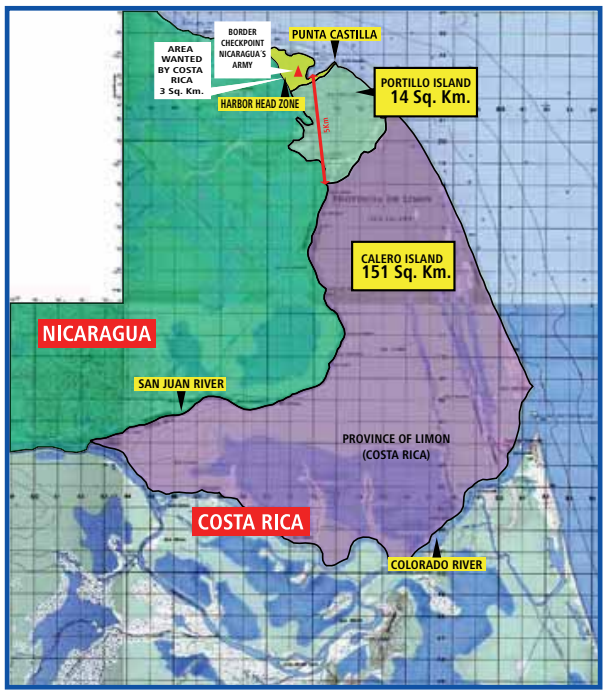
NICARAGUA HAS NEVER INVADED NOR WILL INVADE COSTA RICAN TERRITORY. ON THE CONTRARY, NICARAGUA HAS BEEN ATTACKED.

LA NACIÓN

OAS team did not see any nicaraguan flag or army soldiers at Calero Island

ALVARO MURILLO AND CARLOS A. VILLALOBOS
alvaromurillo@nacion.com 11:51 A.M. 11/08/2010

San Jose (Editorial). The Secretary General of the OAS, Jose Miguel Insulza and his team, as well as officials from the Costa Rican Chancellery flew over Calero Island on the border with Nicaragua and did not observe the flag of that nation raised in Costa Rican territory or the presence of military forces of the Nicaraguan Army.



alDía

November 4, 2010

Police visits neighbors of Calero Island

Yesterday four coastguard boats were taking a census of farms in Calero Island and talking to the neighbors about the situation of security in the zone, while in the central command in South Colorado, police remains vigilant and on alert, , but without startles.

The inhabitants said that it is a calm zone and the main problems are drug trafficking, the absence of immigration authorities and theft of cattle and pigs.

COSTA RICA HAS NEVER MAINTAINED A MILITARY PRESENCE IN THIS ZONE

Three members of Costa Rica's public force are located in Barra Colorado, about 24 kilometers from the bordering Harbor Head River.

LA NACIÓN

Population of Barra Colorado complains about the lack of policemen

CARLOS HERNANDEZ P. CORRESPONDENT GN
09:18 A.M. 10/24/2010

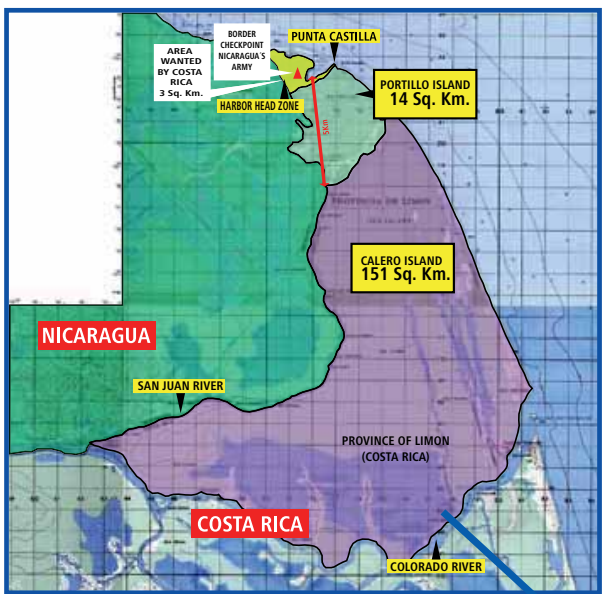
Barra del Colorado (Pococí). Within the frame of an unusual police presence yesterday, the inhabitants of this Limon locality in the border with Nicaragua complained again about the regular lack of public forces.

One of the most upset is hotelkeeper Guillermo Cunningham, who said that in terms of security they have been "always forgotten".

The complaint is not uncalled for because Barra del Colorado in Pococí has three permanent police officers that occupy an improvised facility near the landing field and must watch over an extensive mountainous area and channels that, according to reiterated reports, are used by drug trafficking groups to transship narcotics.

"Here we live alone, like ships without a captain. Many people come here and we don't know who they are and they disappear as mysteriously as they come", stated Cunningham.

The businessman said that to a certain extent Eden Pastora Gomez, who is directing the dredging of the San Juan River, is right when he says that: "This is no-man's land" because nobody has a property title. In addition, they have been asking the State for many years to define this situation and the only thing they have obtained are promises that they will be taken care of.



3 COSTA RICA POLICE OFFICERS

LA NACIÓN

Reacción pobla

'En seguridad se olvidaron'

NOMBRE: GUILLERMO CUNNINGHAM
OCUPACIÓN: EMPRESARIO
LUGAR: BARRA DEL COLORADO

"La presencia de la Fuerza Pública nos pone contentos porque en materia de seguridad hemos estado abandonados toda la vida. Por lo general solo hay tres efectivos en el puesto".

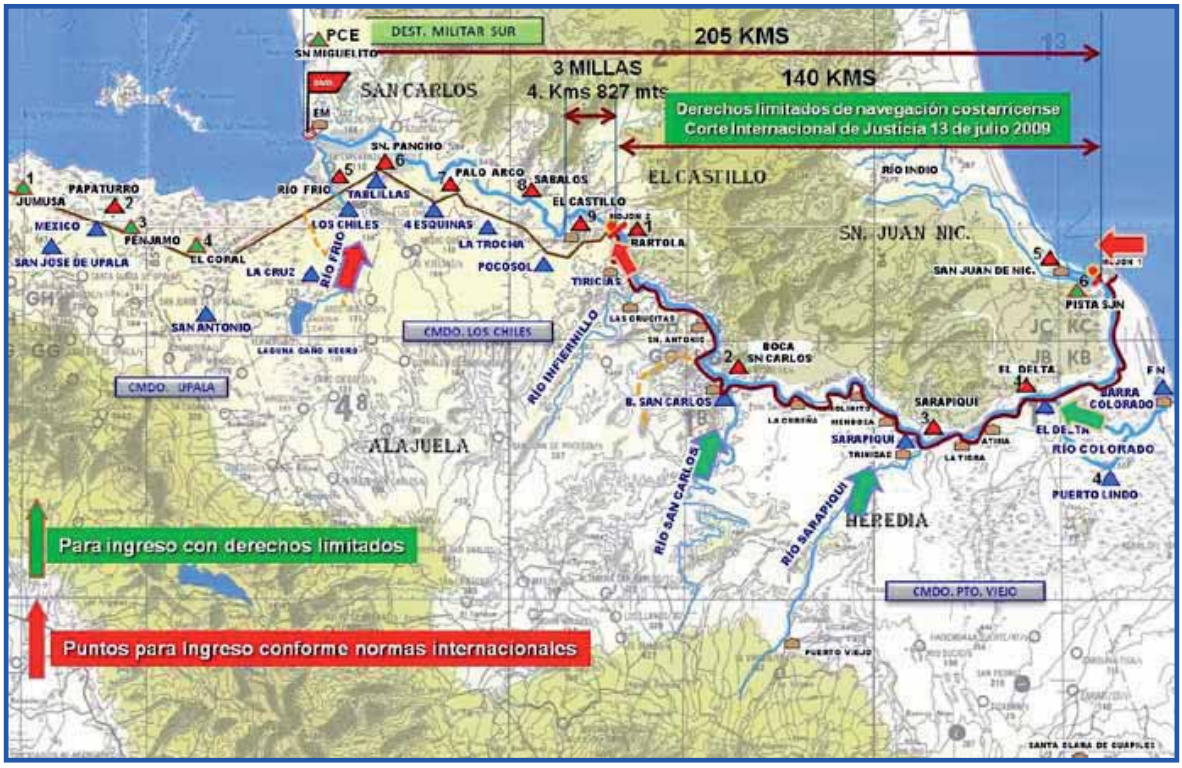
La Policía no hizo sobrevuelos al área, motivada principalmente

COSTA RICA AFFIRMS THAT THE ARMY OF NICARAGUA CONTINUES TO VIOLATE ITS SOVEREIGNTY

FALSE!

The Nicaraguan Army has always patrolled our territorial waters, lagoons, waterways, outlets and the entire extension of the San Juan River.

NICARAGUA MAINTAINS EXCLUSIVE SOVEREIGNTY AND DOMINION OVER THE COURSE OF THE SAN JUAN RIVER



COSTA RICA SAYS WE ARE ATTACKING AND WE ARE PUTTING REGIONAL PEACE AND SECURITY AT RISK

FALSE!

IT IS NICARAGUA THAT HAS DEALT ACCURATE BLOWS TO DRUG TRAFFICKING

Nicaragua has shown forceful results in the fight against drug trafficking, seizing 110 tons of drug in the last 10 years.

In 2009, nearly 300 tons of cocaine did not get to their final destination because of the operations undertaken by Nicaragua's Army and Police.

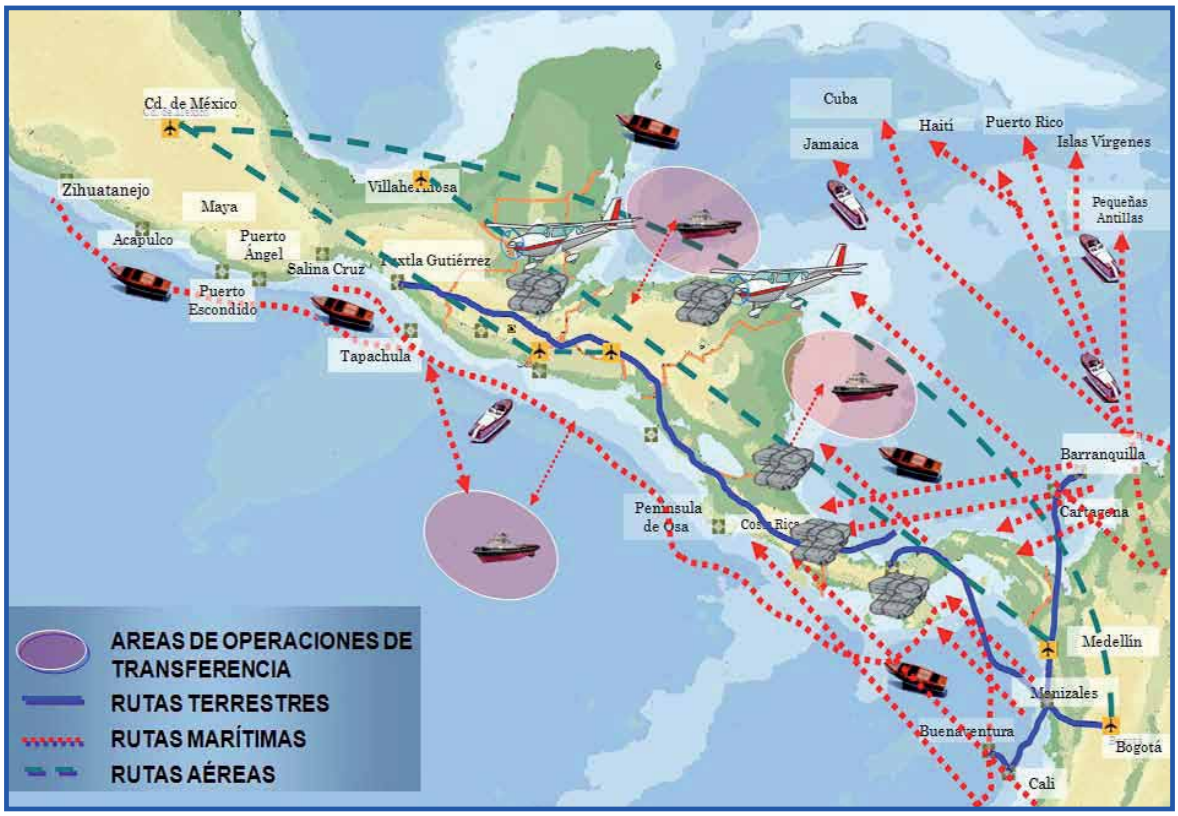
Map presented by Cinthya Alvarado Giuttia (Intelligence officer of Costa Rica's Coast Guard Service) during a CNIES conference in Panama City on September 16, 2008, on drug trafficking activities in Costa Rica.

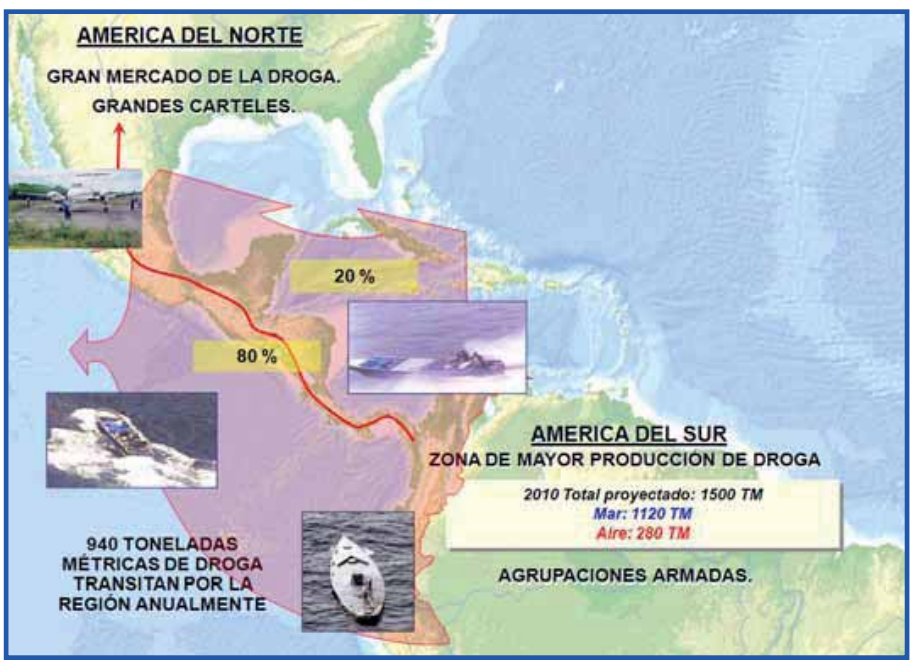
"IT IS PAINFUL THAT THE COUNTRY HAS BEEN INCLUDED FOR THE FIRST TIME IN HISTORY IN THE LIST OF THE PRESIDENT OF THE UNITED STATES THAT IDENTIFIES COUNTRIES WITH THE MOST INTENSIVE TRANSIT OF ILLEGAL DRUGS".

Mauricio Boraschi, Deputy Minister of the Presidency of Costa Rica and National Antidrug Commissioner, September 16, Presidential Press.

SAN JUAN DE NICARAGUA RIVER

DRUG TRAFFICKING ROUTES IN THE REGION





WITH THE STRUGGLE WAGED BY NICARAGUA AGAINST DRUG TRAFFICKING AND INTER-NATIONAL ORGANIZED CRIME BENEFIT NICARAGUANS, BUT ALSO THE COUNTRIES OF THE NORTH AND SOUTH.

NICARAGUA: RETAINING WALL AGAINST DRUGS

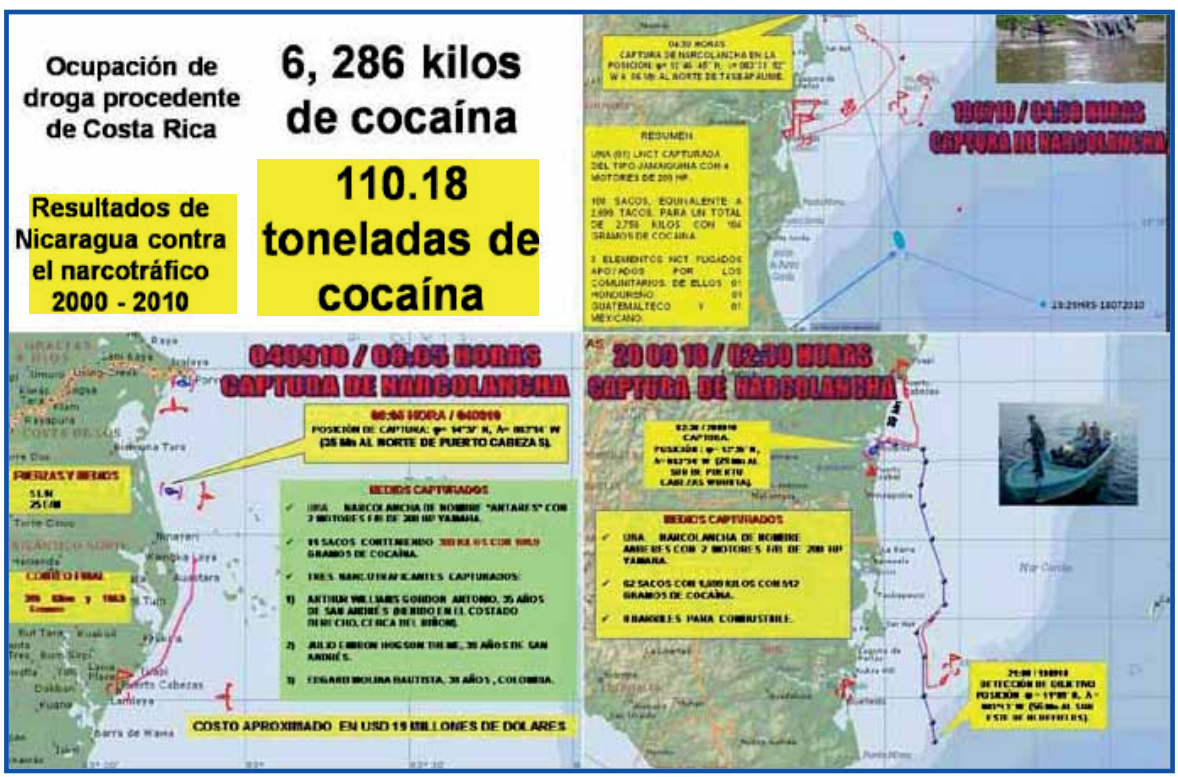
"In 2009, military and police forces continued joint cooperation in interdiction operations". "…both the police and military forces continued to stand out in their respective efforts against narcotics and strengthened their collaboration with neighboring countries and U.S. law enforcement agencies."

2009 International Narcotics Report by the Department of State, Chapter on Nicaragua.

The Nicaraguan Army has always carried out operations against drug trafficking and organized crime in all its south border and Costa Rican authorities have never been present in the border zone to Harbor Head in San Juan de Nicaragua.

Nicaragua has been internationally recognized as one of the countries with the best results in the fight against drug trafficking.

During his visit to Nicaragua in October 2010, Arturo Valenzuela, Assistant Secretary of State for Western Hemisphere Affairs at the U.S. Department of State, highlighted that his agenda was centered on cooperation in security matters, mainly the fight against drug trafficking that his government is pushing forward with President Ortega.



SAN JUAN DE NICARAGUA RIVER

NICARAGUA HAS CONTINUED TO CONFRONT DRUG TRAFFICKING AND ORGANIZED CRIME IN SOUTH BORDER THROUGH "BLACK HAWK" OPERATION. NOVEMBER 20, 2010.

Efraín Rodriguez Duarte, a captured drug trafficker of Honduran nationality: "… we got to a point on the border of Costa Rica with Nicaragua, to a river, where they were waiting for us".

NICARAGUA HAS CONTINUED TO CONFRONT DRUG TRAFFICKING AND ORGANIZED CRIME IN SOUTH BORDER THROUGH "BLACK HAWK" OPERATION. NOVEMBER 20, 2010.

SEIZED DRUGS AND EQUIPMENT:

- A Yamaha 200-HP boat with 4 engines.
- 53 bags with 1,286 cocaine bricks weighing 1,451 kilos and 370 grams.

CAPTURED:

1. Pedro Cedeño Gomez, Panamanian
2. Juan Fernando Pantoja, Colombian
3. Baudilio Allan Galindo, Honduran
4. Nataniel Roberto Haylock, Honduran
5. Efrain Rodriguez Duarte, Honduran

COSTA RICA SAYS THAT "PEACEFUL COSTA RICAN CITIZENS" WERE CAPTURED BY THE ARMY OF NICARAGUA

FALSE!

OPERATION AGAINST DRUG TRAFFICKING IN BORDER TERRITORY FROM 1 TO 5 OCTOBER 2010 CAUSES OFFICIAL REACTION OF COSTA RICA

CAPTURED

1. Carlos Alberto Barriento Lopez
2. Policarpo White Casildo
3. Pedro Alberto Ortega Ramirez
4. Jose Israel Ayala Funez
5. Lorenso Casildo Alvarez
6. Rafael Antonio Garci'a Rivera

LOCATION OF THE OPERATION:

Latitude: 10º 54.771' north and length: 083'' 41.283' west, located in Nicaraguan territory.

SEIZED WEAPONS:

- One (1) AK-47
- Three (3) AKM guns.
- One (1) AKMS gun.
- One (1) CAL 5.56 gun

IT WAS A BLOW AGAINST A GROUP OF DRUG TRAFFICKERS KNOWN AS "THE TARZANS" THAT USED COSTA RICAN TERRITORY TO CARRY OUT DRUG TRANSSHIPMENT OPERATIONS IN NICARAGUAN TERRITORY

THE FACTS:

- October 1-5: the operation of Nicaragua against drug trafficking
- October 3: the Reyes flee to Costa Rica
- October 18: Nicaragua initiates the cleaning of the San Juan River de Nicaragua.
- October 21: Costa Rica denounces "military invasion" of Nicaragua

SAN JUAN DE NICARAGUA RIVER

COSTA RICAN AUTHORITIES WERE ALERTED ON FLIGHT PLAN

On October 23, 2010, the flight plan of drug traffickers imprisoned in Bluefields was neutralized.

Colombian hired assassins from Costa Rica were planning to assault the National Police headquarters in that municipality.

This type of activity has background.

A NICARAGUAN DRUG TRAFFICKER IS THE MAIN SOURCE OF COSTA RICA'S OFFICIAL REPORT.

IT IS TOTALLY INCONCEIVABLE THAT COSTA RICA GIVES CREDIBILITY TO THE REPORT OF A DRUG TRAFFICKER TO ESCALATE A DISPUTE AGAINST NICARAGUA.

WE ARE STILL WAITING FOR COSTA RICA TO STOP DRUG TRAFFICKERS AND TO RESPOND.

LA NACIÓN

Family denounces invasion of Nicaraguan leader

ESTEBAN OVIEDO eoviedo@nacion.com 11:27 A.M. 10/21/2010

A Costa Rican family reported that the director of the dredging operation of the San Juan River, former Nicaraguan guerilla fighter Eden Pastora Gomez, forcefully entered and took over his farm. According to the complaint, the fact occurred in the Aragon farm in Calero Island, to the north of Limon. Giovanni Incera, lawyer of the family of Marcos Reyes Reyes and his brothers, affirmed that Pastora entered with the help of the Nicaraguan Army, hit workers and took some of them, in addition to attacks on cattle and other animals.

The case will be taken to the judicial instances in Limon, he stated. Danilo Castillo, police supervisor in Sarapiquí, Heredia, also reported that he sent a report to the Ministry of Security with testimonies from neighbors of the zone, who give faith of the incursions.

COSTA RICA SAYS THAT IT DOES NOT HAVE AN ARMY

FALSE!

COSTA RICA: SECURITY BUDGET AND NUMBER OF OFFICERS			
	POLICE FORCES		
SECURITY BUDGET FOR 2010	2009	2010	OBSERVATION
US$ 240.3 Million	12,553	13,270	Costa Rica destines five times more in military spending than Nicaragua.

THEY USE SURFACE UNITS, AIR MEANS, AND ARTILLERY AS ANY CONVENTIONAL ARMY

Piece of 81 millimeter caliber mortar manufactured in the United States

DEVELOPMENT OF MILITARY OPERATIONS OF COSTA RICA

COSTA RICA SAYS THAT NICARAGUA HAS CAUSED AND IS CAUSING ENVIRONMENTAL DAMAGES TO THE FLORA AND FAUNA IN ITS TERRITORY

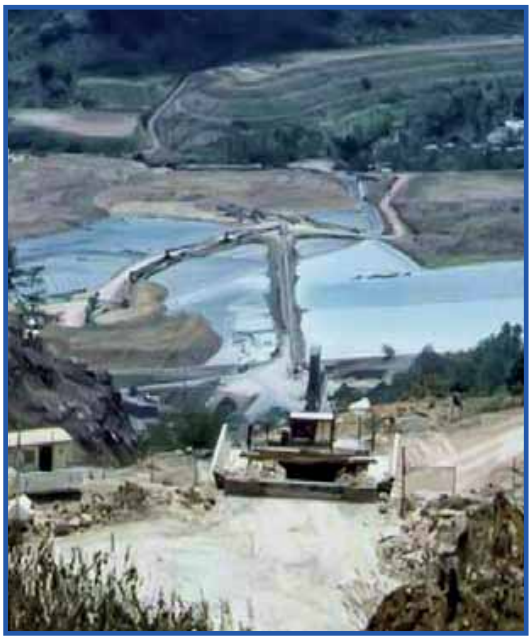
FALSE!

THE ENVIRONMENTAL CONTAMINATION OF THE SAN JUAN RIVER HAS BEEN PERMANENT AND SUSTAINED.

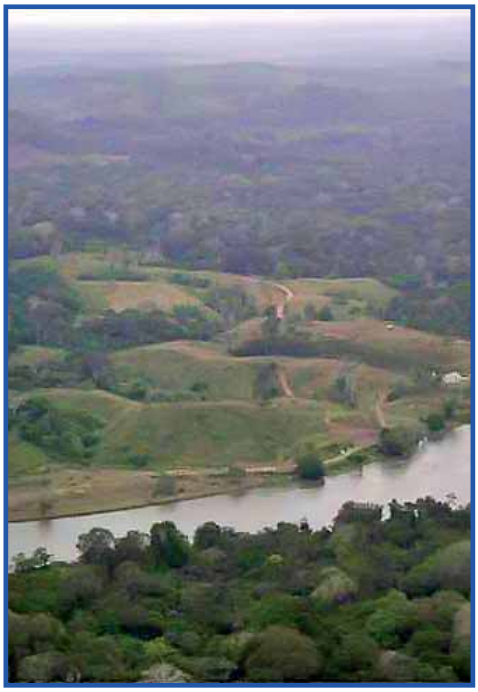
From Costa Rican territory, companies dedicated to mining and hydrocarbon exploration in the border zone have spilled incalculable amounts of pollutants (cyanide and agrochemicals among others) into the river. On the other hand, the dredging of rivers by Costa Rica in different moments has had a direct impact on the volume of the San Juan River, fundamentally in the delta of the Colorado River where most of its volume is directed until it empties into the Caribbean Sea.

IT IS COSTA RICA WHO IS POISONING THEIR RIVERS AND ALSO SAN JUAN DE NICARAGUA RIVER

THE ENVIRONMENTAL DAMAGES CAUSED BY THE ADVANCEMENT OF THE AGRICULTURAL FRONTIER OF COSTA RICA ALONG THE BORDER ARE INCALCULABLE



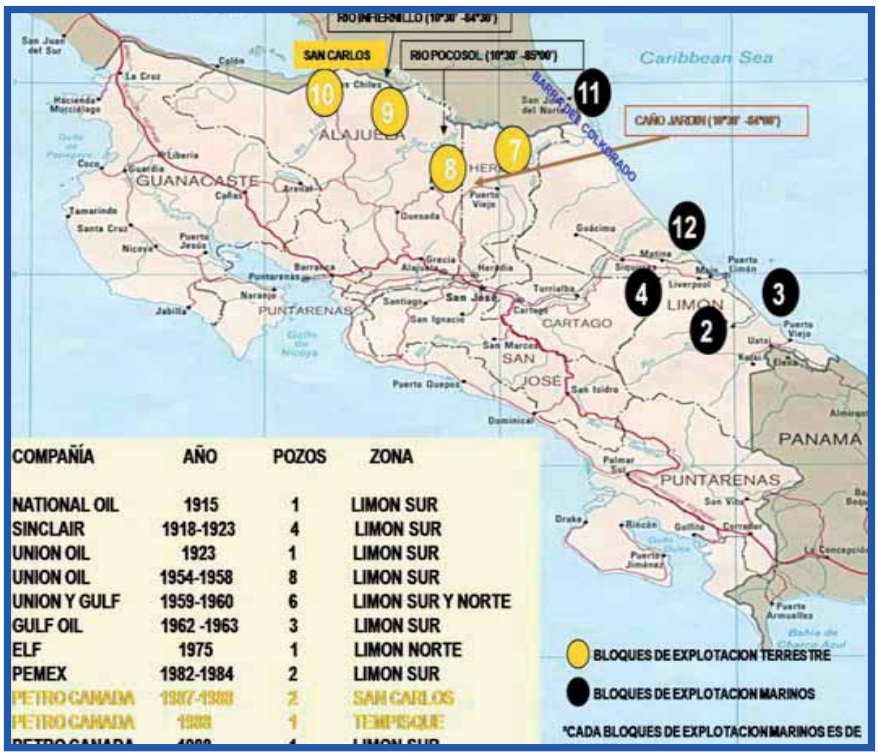
The advancement of the agricultural border from Costa Rican territory, the felling of trees and opening of roads has also impacted the environment of the river, causing great sedimentation.



THE ENVIRONMENTAL DAMAGES CAUSED BY THE ADVANCEMENT OF THE AGRICULTURAL FRONTIER OF COSTA RICA ALONG THE BORDER ARE INCALCULABLE

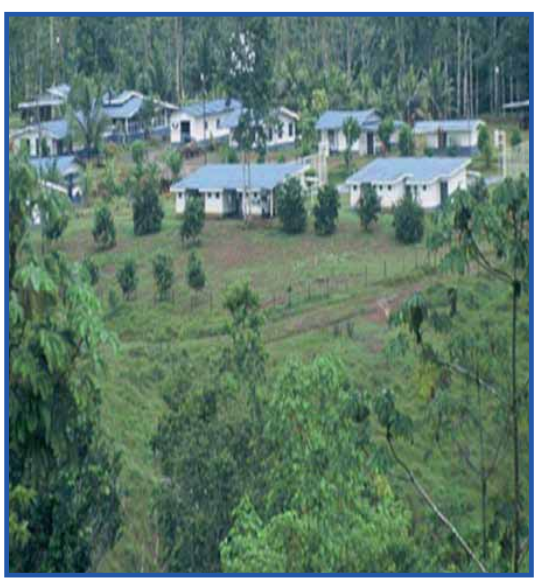
THE CONTAMINATION OF THE SAN JUAN RIVER HAS BEEN PERMANENT AND SUSTAINED

Map of concessions to explore and exploit hydrocarbons in the south bank of the San Juan River



COMPAÑÍA	AÑO	POZOS	ZONA
NATIONAL OIL	1915	1	LIMON SUR
SINCLAIR	1918-1923	4	LIMON SUR
UNION OIL	1923	1	LIMON SUR
UNION OIL	1954-1958	8	LIMON SUR
UNION Y GULF	1959-1960	6	LIMON SUR Y NORTE
GULF OIL	1962 -1963	3	LIMON SUR
ELF	1975	1	LIMON NORTE
PEMEX	1982-1984	2	LIMON SUR
PETRO CANADA	1987-1988	2	SAN CARLOS
PETRO CANADA	1988	1	TEMPISQUE

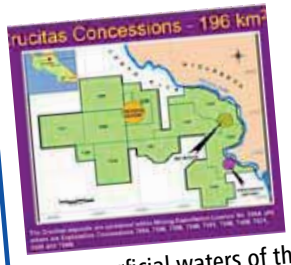
CAMP OF THE PLACER DOWN MINING COMPANY, LOCATED IN LAS CRUCITAS, COSTA RICA, 13 KILOMETERS TO THE SOUTHEAST OF EL CASTILLO AND 3 KILOMETERS FROM THE SAN JUAN RIVER. CYANIDE WASTE WAS SPILLED INTO THE WATERS OF THE SAN JUAN RIVER.



THE TRUTHS THAT COSTA RICA HIDES

COSTA RICA IS RESPONSIBLE FOR ENVIRONMENTAL DAMAGES OF INCALCULABLE VALUE

UNIVERSITY OF COSTA RICA / UNIVERSITY COUNCIL



SPECIAL REPORT ON OPEN-SKY CHEMICAL MINING: LAS CRUCITAS CASE,

MAY 2009.

2. ENVIRONMENTAL IMPACT OF OPEN-SKY GOLD MINING: LAS CRUCITAS CASE. Yamileth Astorga, M.Sc., ProGAI Coordinator. Alteration of superficial water resource.

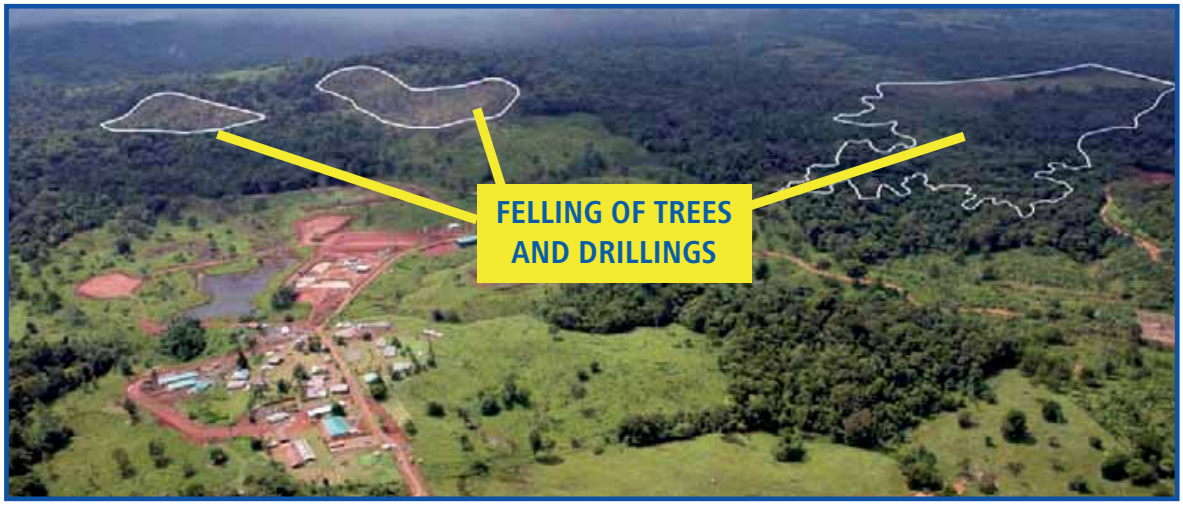
The superficial waters of the gorges and rivers that pass through the zone of Las Crucitas, which represent the area of direct influence (ADI) and indirect influence (AII) of the mining project or drainage area, are the micro watersheds of the Zabayos and La Mina gorges up to their confluence with the Infiernito River and up to its confluence with the San Juan River.

The area to be occupied by the Las Crucitas project is two square kilometers, which cover 73% of the Infiernito river basin and 27% of the Crucitas river basin.

The environmental impact of this project is not limited to the aforementioned micro river basins, but to the drag by the flow of both water bodies towards the bi-national river basin of the San Juan River, which could cause an international conflict between Costa Rica and Nicaragua.

"THE ENVIRONMENTAL IMPACT OF THIS PROJECT IS NOT LIMITED TO THE AFOREMENTIONED MICRO RIVER BASINS, BUT TO THE DRAG BY THE FLOW OF BOTH WATER BODIES TOWARDS THE BI-NATIONAL RIVER BASIN OF THE SAN JUAN RIVER, WHICH COULD CAUSE AN INTERNATIONAL CONFLICT BETWEEN COSTA RICA AND NICARAGUA". AREA OF THE LAS CRUCITAS PROJECT IN COSTA RICA, LOCATED ONLY THREE KILOMETERS FROM THE SAN JUAN DE NICARAGUA RIVER.

AREA DEL PROYECTO LAS CRUCITAS EN COSTA RICA, UBICADO A SÓLO 3 KILÓMETROS DEL RIO SAN JUAN DE NICARAGUA



DESCRIPTION OF LAS CRUCITAS MINING PROJECT

Violations of international law and possible environmental impacts, August 19, 2008

AIDA
Asociación Interamericana para la Defensa del Ambiente

The project, operated by Infinito Gold Ltd., which was granted a license on March 17, 2008, will be located in the district of San Carlos, Alajuela province, a few kilometers from the San Juan River and the border with Nicaragua. Based on existing information, it can be concluded that the project will exploit more than three hundred hectares in the La Fortuna and Botija mountains that are primary and secondary forests. The company expects to produce a million ounces of gold in hard rock from an 85-meter deep open pit a few kilometers from the San Juan River.

Costa Rica has international obligations that limit its sovereignty and demand that it does not damage the environment of other countries

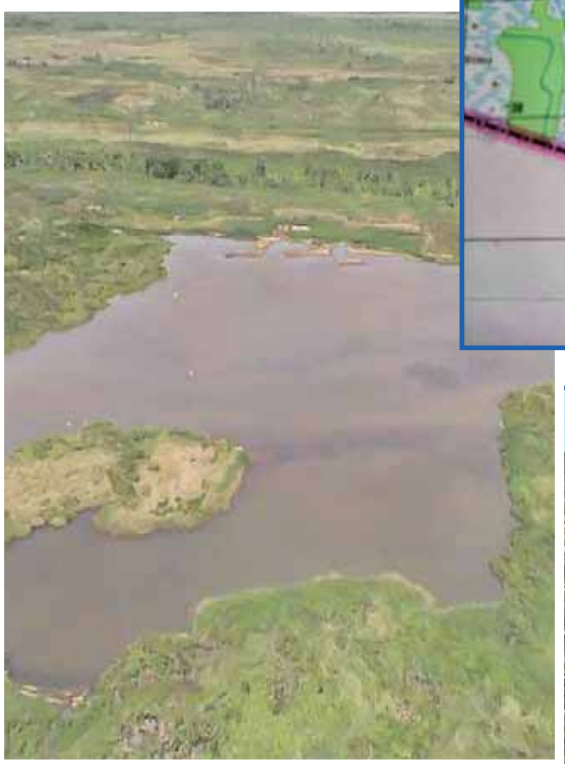
International Law enshrines the principle of sovereignty of the States, which is limited in accordance with: 1) international treaties and conventions, and 2) international common law derived from historical and common practice of the States.

According to both sources, even though it has the right to dispose of its territory within its borders and in accordance with its jurisdiction, Costa Rica cannot allow activities that damage the environment of other States.

THE TRUTHS THAT COSTA RICA HIDES

IN 2008, COSTA RICA CAUSED DAMAGES TO THE NICARAGUAN LA UVA LAGOON, REDUCING THE WATER MIRROR OF THIS LAGOON FROM 100 TO 3 HECTARES

THE WORLD MUST KNOW HOW COSTA RICA DEGRADES THE ENVIRONMENT



COSTA RICA SAYS THAT NICARAGUA DOES NOT HAVE THE RIGHT TO DREDGE THE SAN JUAN RIVER FALSE!

As concerns the right of Nicaragua to dredge the river, the Cleveland Award is very clear. Nicaragua raised 11 questions to Arbitrator Cleveland. Question number 6 was as follows:

"Can Costa Rica prevent Nicaragua from executing, at its own expense, improvement works?"

President Cleveland's answer was forceful:

"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…"

COSTA RICA CONTRADICTS ITSELF: TWO DIFFERENT VERSIONS

On September 8, 2010, before the environment commission of the Legislative Assembly, Engineer Rene Castro Salazar, Minister of Foreign Affairs and Worship of Costa Rica, shared Nicaragua's criteria in relation to the cleaning of the San Juan River, stating:

"…Costa Rican experts developed a volume calculation model that projects the impact on the volume of the Colorado River from the different types of projects and dredging operations in the San Juan River. Without going into details, I can say that the results of these studies are in general tranquilizing for the country since all the models analyzed calculate volume reductions of less than 12%. Moreover, for the announced $7 million investment, the reduction of volume would be even smaller and, therefore, will not produce the alarming environmental and economic impact that some media have suggested. Nobody has been able to prove volume calculations or reductions close to 60% as published in some media."

LA NACIÓN

ENDORSES JUSTIFICATIONS WITHOUT SEEING ENVIRONMENTAL IMPACT STUDY

Chancellery accepts Nicaraguan plan to dredge San Juan River

ESTEBAN A. MATA emata@nacion.com 11:02 P.M. 9/08/2010

The Minister of Foreign Affairs, Rene Castro, stated yesterday to the members of the Environment Commission of the Congress that he sees no major ecological problems in the dredging of the San Juan River that Nicaragua aims to carry out.

He added that the excavation in the waterway is "a sovereign decision of Nicaragua and we must ensure that it does not have negative impacts on the Costa Rican side".

Castro said that he was satisfied with Nicaragua's technical environmental impact justifications, even though the official acknowledged that he has not seen them.

"There is an environmental impact study made by Nicaragua and we have made our own analyses", justified Chancellor Castro.

NICARAGUA HAS THE RIGHT TO CLEAN THE RIVER

During the trial brought by Costa Rica before the International Court of Justice claiming the right to navigate with weapons of war in the river, which was settled by the Court on July 13, 2009, Nicaragua requested the Court to reaffirm its rights to dredge and, in general, make improvements in the river.

The Court ratified the effectiveness of the resolution laid out in the Cleveland Award, which states in paragraph 6, clause three, as follows:

San Juan River.

"Nicaragua can execute works of improvement as it deems advisable provided such works of improvement do not result in the serious impairment of the navigation of the said river or any of its branches at any point where Costa Rica is entitled to navigate the same." (Paragraph 155, Judgment of July 13, 2009).

When the river cleaning work began, the Chancellor of Costa Rica reaffirmed the right of Nicaragua to dredge the river and made public statements on September 8, 2010, affirming that the dredging projected by Nicaragua would not affect more than 12% of the waters of the Colorado River and that it did not imply problems for Costa Rica.

Nicaragua accepts the statement of the Chancellor of Costa Rica as regards the recognition of its right to dredge the river, but not with regard to the arbitrary limits that he imposes on the right to recover the traditional volume of the river. The Cleveland and Alexander awards clearly state that the situation that prevails in the river is that which existed in 1858 when the Cañas Jerez Treaty was signed.

In this respect, the Cleveland Award clearly states:

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

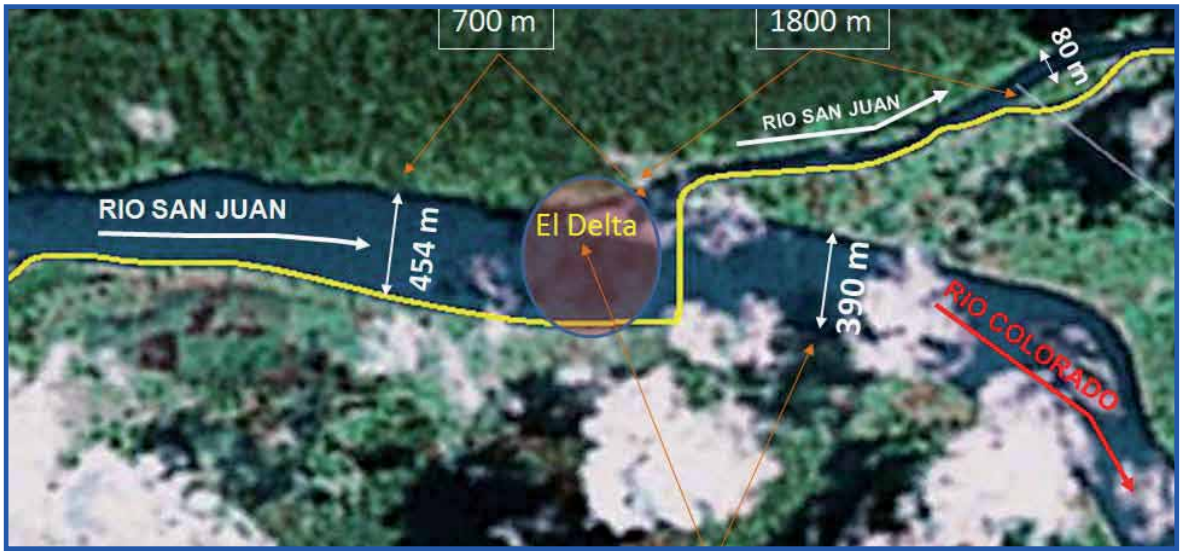
THE CLEANING OF THE SAN JUAN RIVER IS DONE IN NICARAGUAN TERRITORY

On October 22, 2010, the Nicaraguan Institute of Territorial Studies certified the exact location where the Sovereignty dredge is parked, describing that it is located on the San Juan river at a distance of 218 meters to the southeast of the confluence of the Sucio watercourse and San Juan River with coordinates 10º 54' 55.9' north and longitude 083º 40' 43.2'' west in Nicaraguan territory.

IT WAS COSTA RICA THAT DIVERTED THE VOLUME OF THE SAN JUAN RIVER TO THE COLORADO RIVER WITHOUT REQUESTING PERMISSION FROM NICARAGUA AND WITHOUT MAKING ENVIRONMENTAL IMPACT STUDIES

In the graphs that follow can be seen the relative dimensions of the Rio San Juan and the Colorado branch of comparing the way it was drawn flow either in a contemporary map with the signing of the Treaty of 1858. The map of A. Baron to Bülow, 1851.

On the other hand, a satellite photograph taken this year shows the situation of the delta zone that separates the branch of the Colorado River from the San Juan River. As can be seen, most of the water of the River is now diverted to the Colorado River.

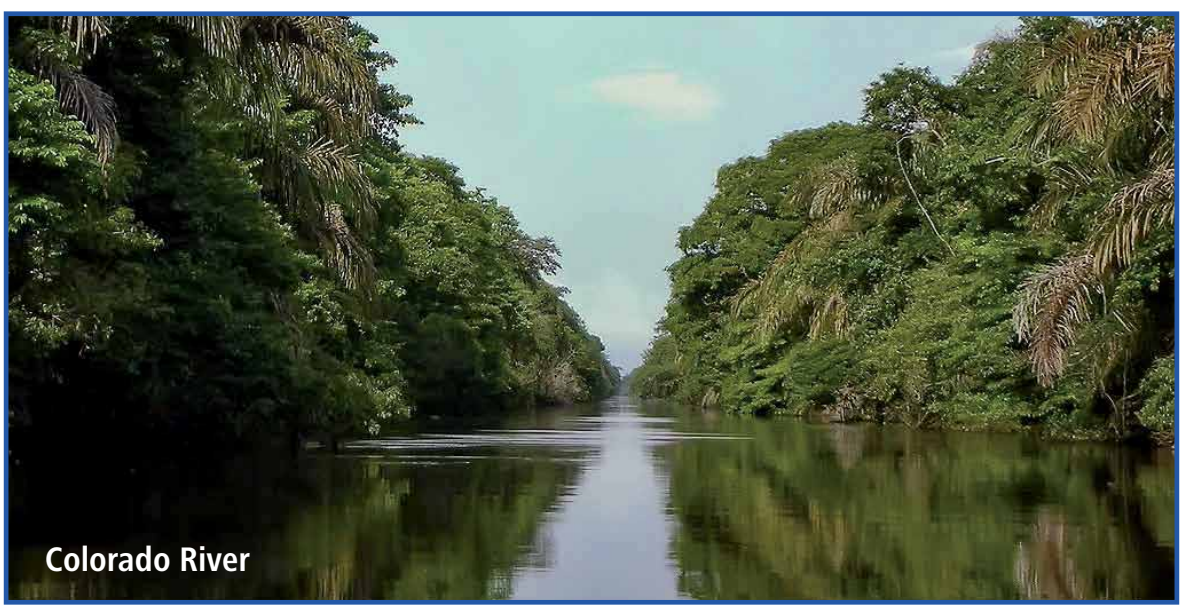


COSTA RICA SAYS THAT WE DO NOT HAVE THE RIGHT TO NAVIGATE OVER THE COLORADO RIVER FALSE!

Nicaragua has the right to dredge and make improvements in the San Juan River and to recover its original natural condition.

As long as the river is not navigable as it was in 1858, Nicaragua has the right to use the branch of the Colorado River.

The San Juan River is a totally Nicaraguan river and in its main branch - at least the main branch at the time of the Treaty of 1858 and the Cleveland Award of 1888 and the Alexander Award of 1897 before the waters were diverted by Costa Rica - also flows out in Nicaragua. However, the normal and traditional mouth of the San Juan River in Nicaraguan territory is not navigable at the present time and the only navigable branch of the San Juan River is the Colorado River located in Costa Rican territory. Nicaragua cannot navigate through the mouth of the San Juan River at all times. Only the branch of the Colorado River provides these navigation



Colorado River

conditions. By virtue thereof, and as long as the main branch of the San Juan River has not been dredged and made navigable as it was in 1858, Nicaragua has the right to freely navigate over the Colorado River.

During the trial before the International Court of Justice, Nicaragua made express reservation of its right to demand, as long as the branch of the Colorado River was the only navigable outlet of the San Juan River, that this branch is an international river and Nicaragua had the right to freely navigate over it. (See page 251 of the Counter-Memorial of Nicaragua of May 29, 2007). It is inconceivable that Costa Rica denies to Nicaragua the right to navigate in the branch of the Colorado River, while at the same time it tries to prevent the dredging of the main branch to be able to go out to the sea.

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.

The cleaning of the San Juan River has the objective of recovering the historical volume of the river, so as to improve navigation for the benefit of Nicaragua and all Central Americans, including Costa Ricans.

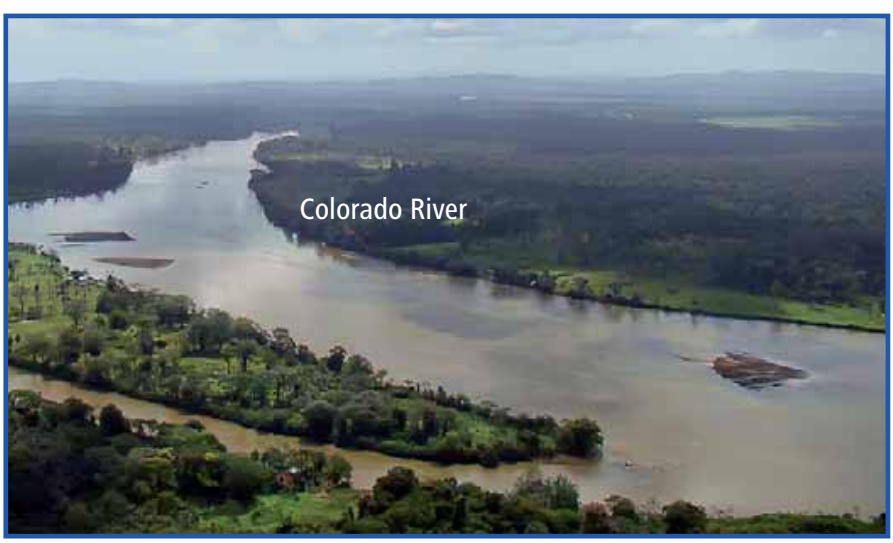
WHAT COSTA RICA DID NOT REPORT AND NOW DEMANDS NICARAGUA TO REPORT

THEY DREDGED THE COLORADO RIVER AND BUILT THE TORTUGUERO CANAL, DIVERTING THE WATERS OF THE SAN JUAN DE NICARAGUA RIVER WITHOUT REQUESTING PERMISSION

BY NICOLAS LOPEZ MALTEZ,
Director of La Estrella de Nicaragua,
nicolas@estrelladenicaragua.com.

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

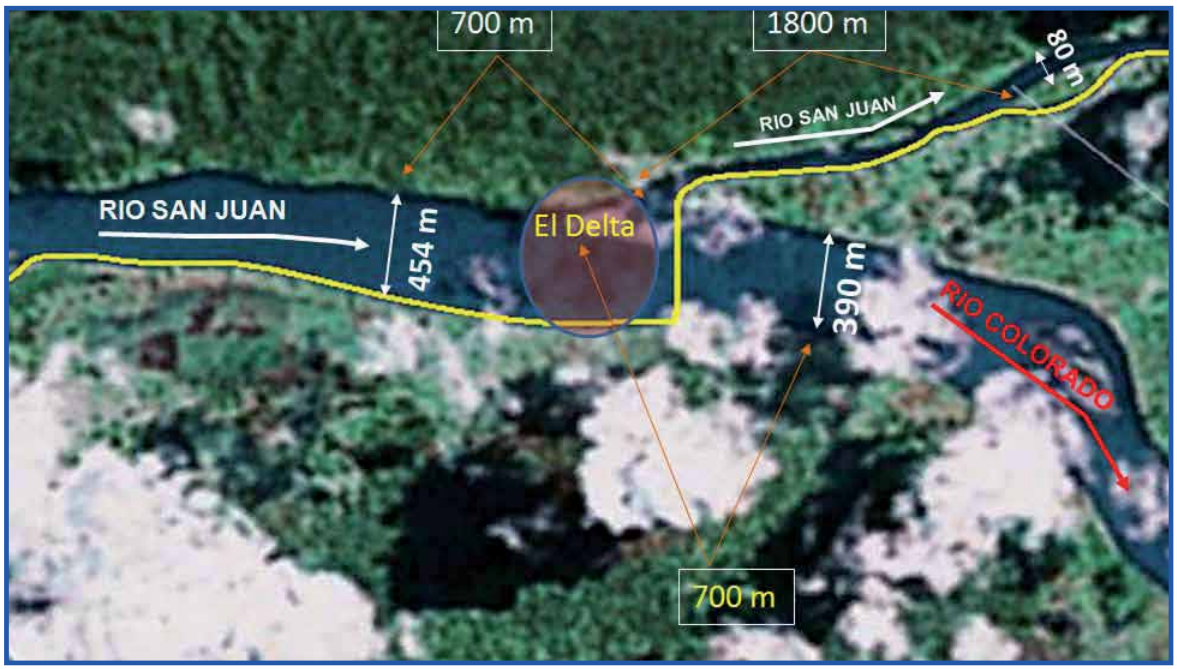
This facilitated the diversion of the waters of the San Juan de Nicaragua River towards Costa Rica's Colorado River, reducing the volume of the San Juan River, which in 1855 continued to empty into the Caribbean Sea in front of the port of San Juan del Norte. With the dredging of the Colorado River by Costa Rica, it would seem that the course of water of the San Juan River originates in Nicaragua and continues in Costa Rica.



It took Costa Rica seven years to dredge the Colorado River, from 1948 to 1955, without notifying or requesting permission from Nicaragua or making a study on the damage being caused to the San Juan River and to Nicaragua.

SAN JUAN DE NICARAGUA RIVER

NINETY PERCENT OF THE VOLUME OF THE SAN JUAN RIVER WAS DIVERTED TO THE COLORADO RIVER



Costa Rica wants to prevent Nicaragua from cleaning the San Juan River, ignoring the judgment of the International Court of Justice.

In paragraph 121 of its judgment of July 13, 2009, the International Court of Justice stated that Nicaragua was an example of environmental management in the zone of the San Juan River.

The true reason why Costa Rica does not want Nicaragua to exercise its right to clean the San Juan River

The dispute began when Nicaragua decided to begin cleaning the river. Nicaragua has assured that such cleaning will not cause any environmental damage.

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

FALSE!

HISTORY SHOWS THE CONTRARY

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.

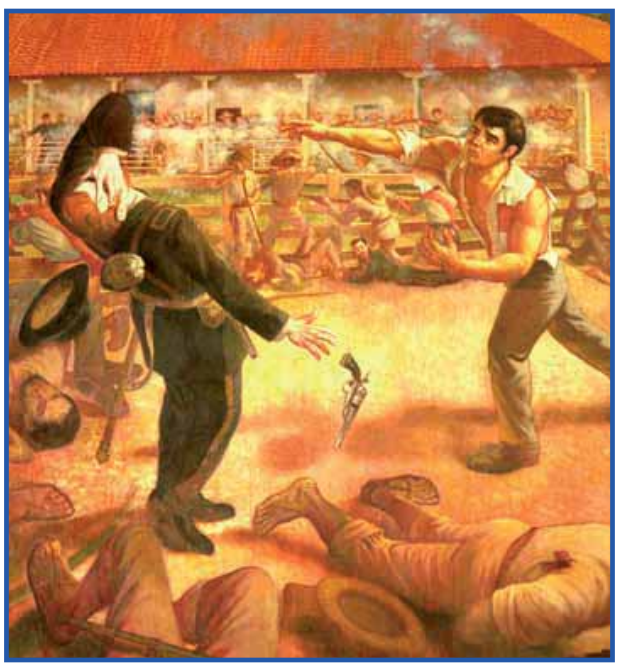
Costa Rica based its annexation of the department or party of Nicoya on a referendum held in that territory once it was under its control.

SAN JUAN DE NICARAGUA.—1853.

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 adventurous 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 Nicaragua, 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 that 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.

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 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.

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.

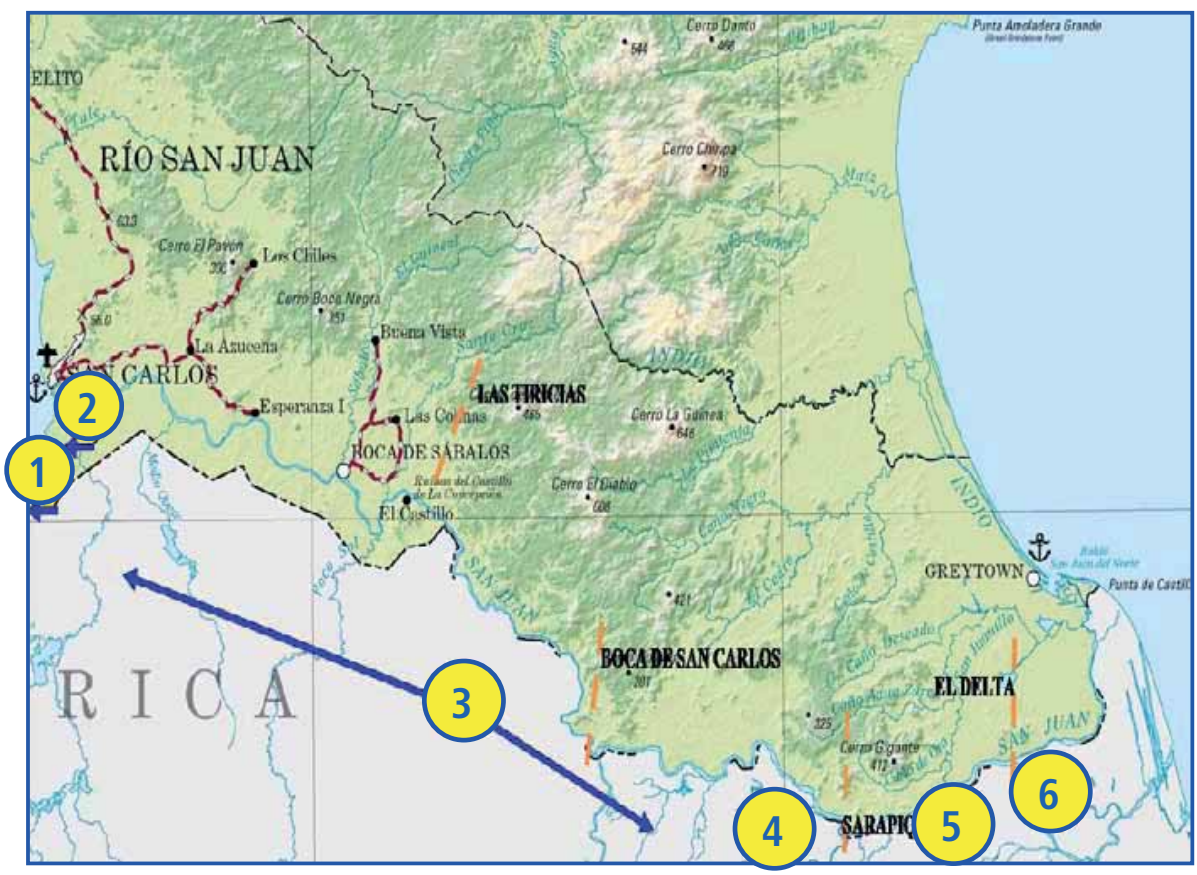
And now that some modest cleaning activities have been carried out in the river, including some waterways that were obstructed, Costa Rica has gone to international political bodies like the OAS seeking support for its claims against the rights of Nicaragua and has even dared to mention the possibility 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:

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.



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.

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".

nacion.com

San José, Costa Rica
Lunes 15 de marzo, 1999
Carlos Hernández
Corresponsal de La Nación

Límites confusos

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.

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.

nacion.com

San José, Costa Rica, Jueves 20 de enero, 2000
Carlos Hernández, *Corresponsal de La Nación*

Persiste confusión

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 (Ineter), aumentó la confusión que históricamente ha existido en torno al trazado de la línea divisoria.

"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.

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 Ineter.

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.

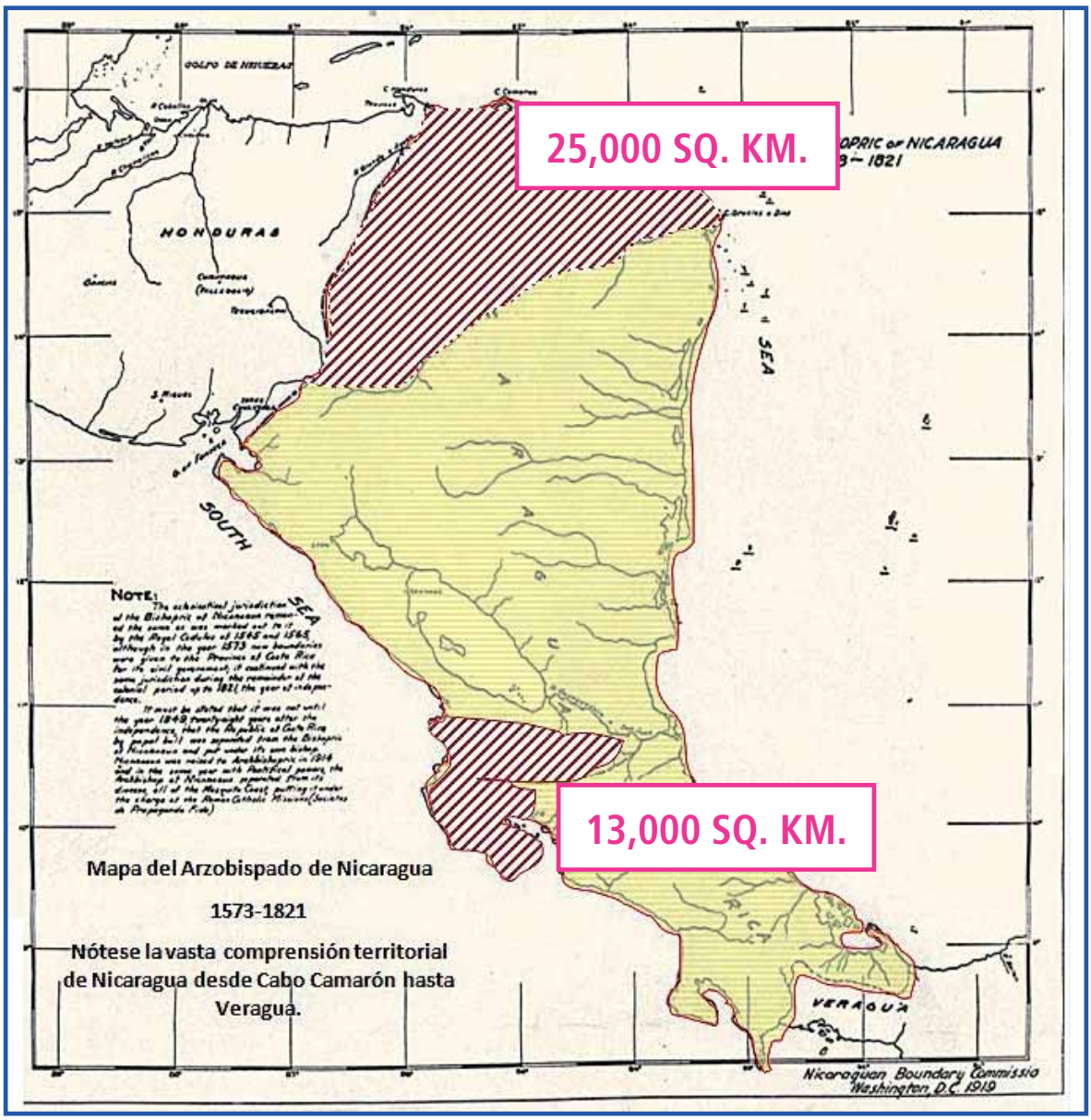
Since 1824, Nicaragua lost 13,000 square kilometers of its territory —Guanacaste and Nicoya.

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.

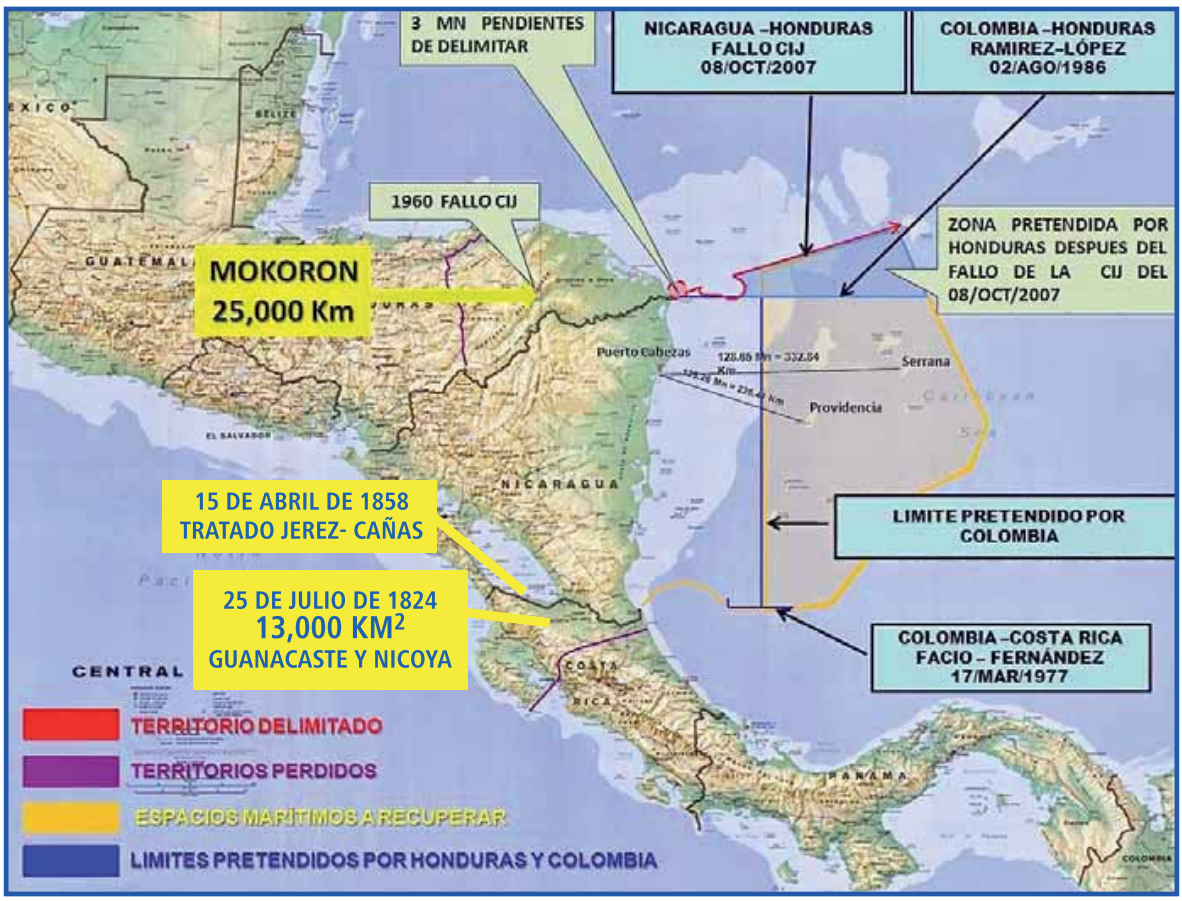
THESE TERRITORIAL CLAIMS NEVER DISAPPEARED, THEY WERE ALWAYS ALIVE

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.

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.

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

FALSE!

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.

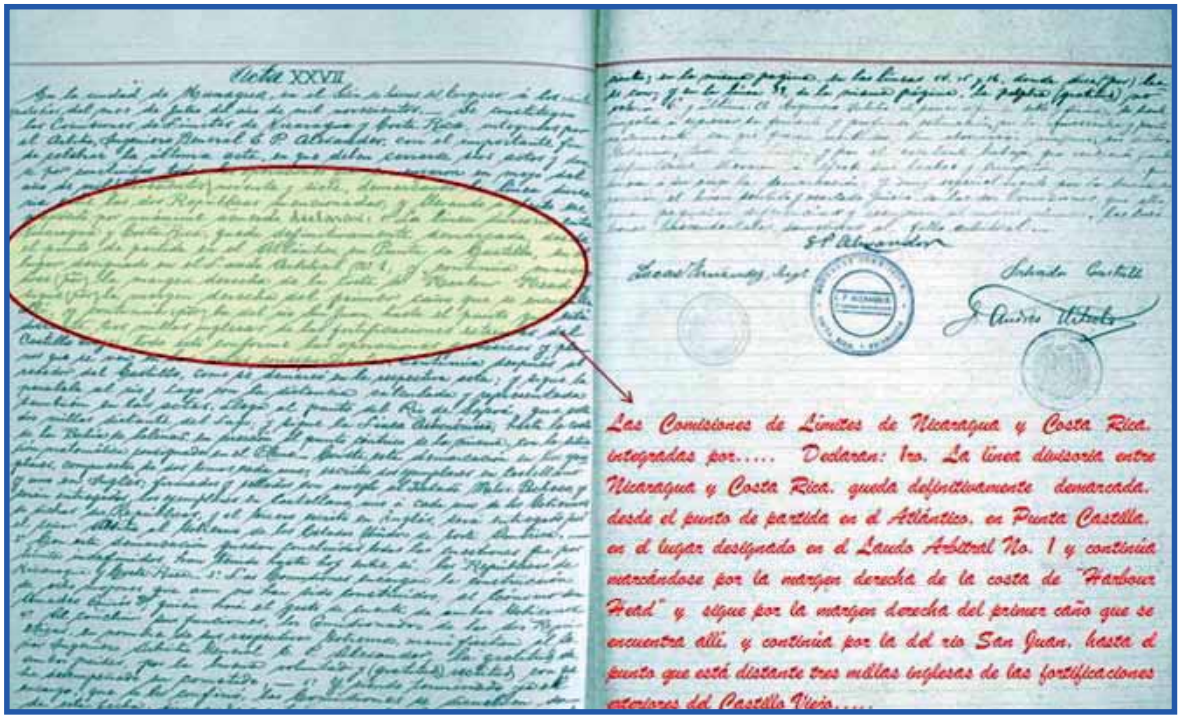
CURRENT BORDER BETWEEN NICARAGUA AND COSTA RICA

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.



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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.

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".

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:

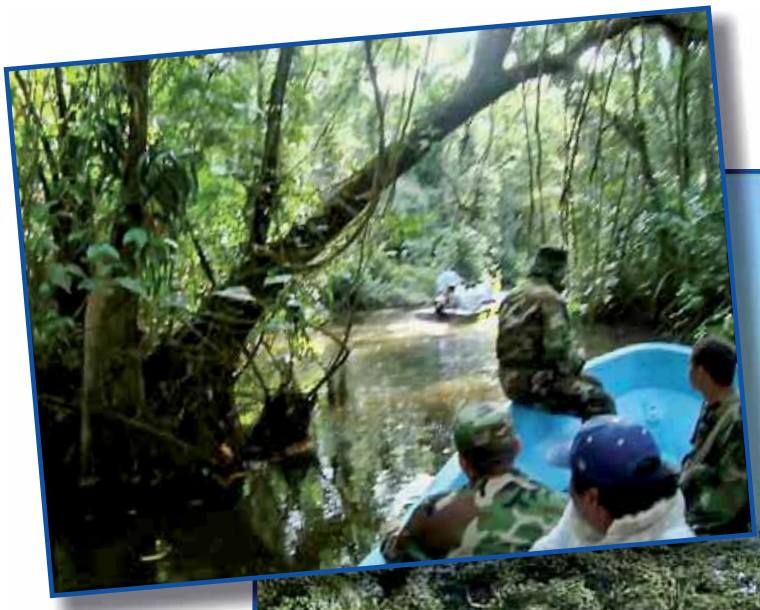
"…the San Juan River runs through a flat and sandy delta in the lower portion of its course and that it is obviously possible that its banks will not only gradually expand or contract but that there will be wholesale changes in its channels. Such changes may occur fairly rapidly and suddenly and may 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

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

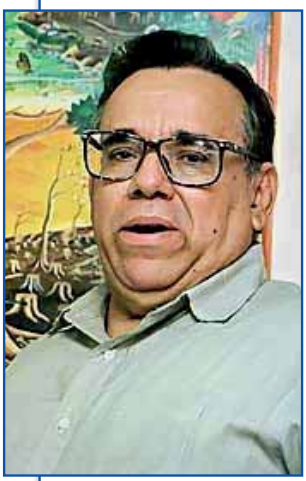


ENTRANCE TO HARBOR HEAD LAGOON, NICARAGUAN TERRITORY, SEPTEMBER 8, 2010

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 Arbiter Alexander have not been adequately read."

LO QUE OPINAN, CONOCEDORES DEL TEMA

Doctor Norman Caldera

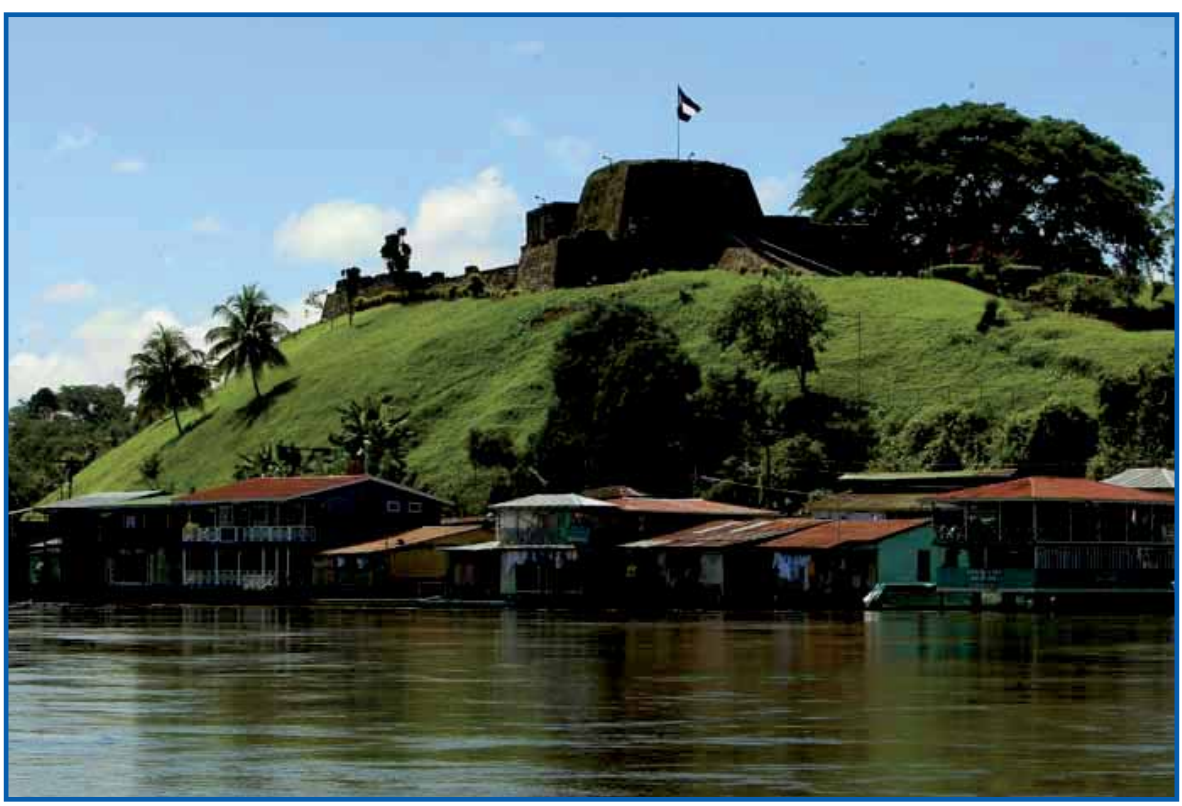
ex-Chancellor of the Republic of Nicaragua, November 14, 2010:

"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."



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.

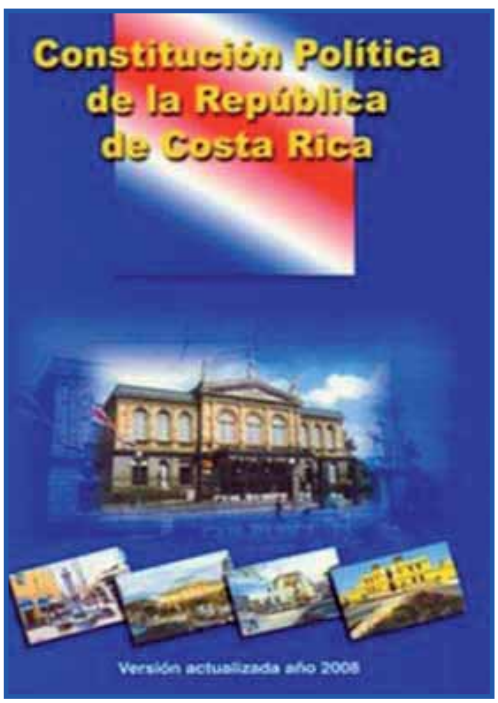
Nicaragua also reserved the right on the limits in the mouth of the San Juan River. That point was not under discussion before the Court and for that reason Nicaragua simply clarified that it reserved its rights in all matters related to the attribution of territory between both countries in the general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

"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."

Harbor Head Lagoon

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 Fernanddez Jaen 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."

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 TRUTH THAT COSTA RICA HID ON THE MAPS THAT IT DISCLOSED

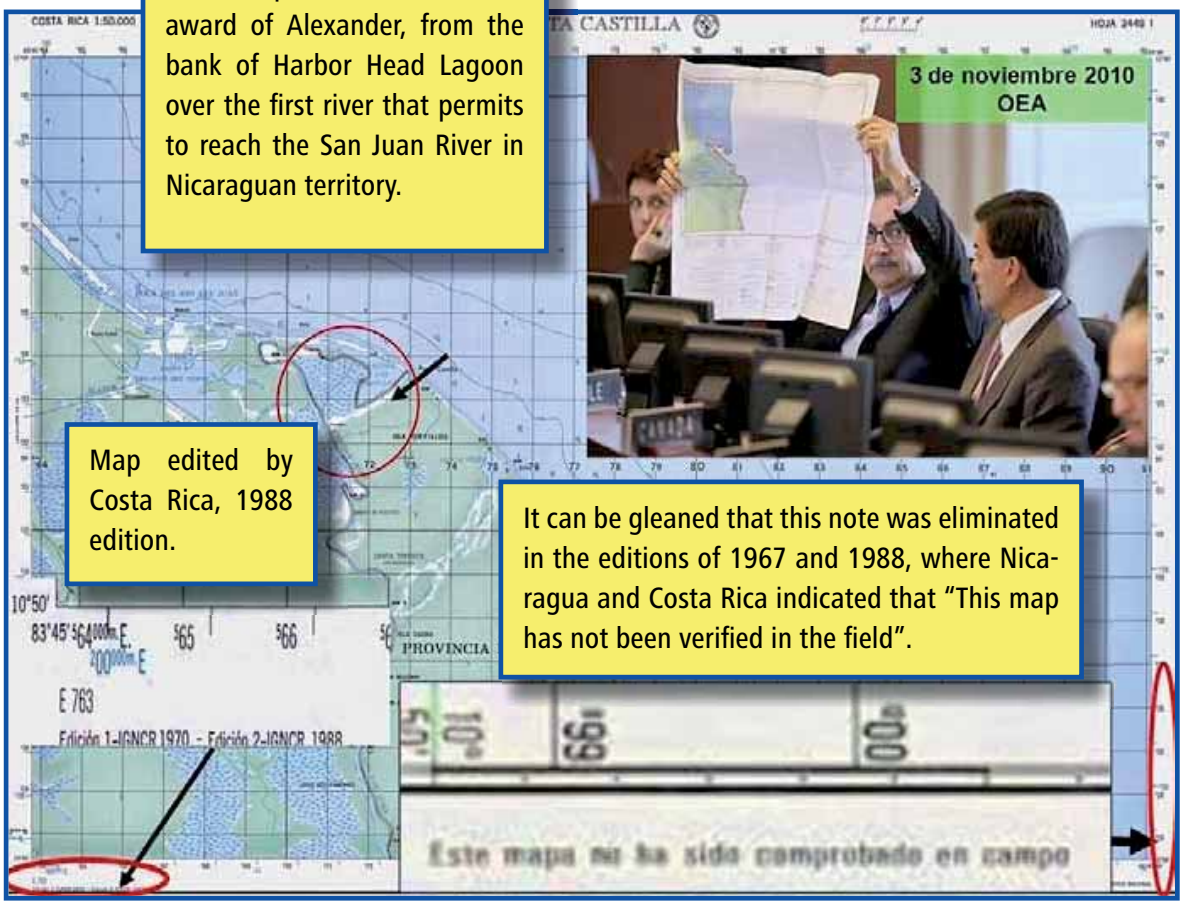
The maps do not substitute the provisions of the Cañas-Jerez Treaty, the Cleveland and Alexander Awards, and the ratifications of the International Court of Justice on July 13, 2009.

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.



COSTA RICA SAYS IT IS RESPECTFUL OF TREATIES AND AWARDS ON THE LIMITS WITH NICARAGUA. WHY HAS IT REFUSED TO MARK THE BOUNDARY?

DISTRIBUCIÓN DE MOJONES AUXILIARES ENTRE HITOS PRINCIPALES																		
AÑO DE INSTALACIÓN	TOTAL INSTALADOS	TRAMOS ENTRE HITOS PRINCIPALES																
		2 al 3	3 al 4	4 al 5	5 al 6	6 al 7	7 al 8	8 al 9	9 al 10	10 al 11	11 al 12	12 al 13	13 al 14	14 al 15	15 al 16	16 al 17	17 al 18	18 al 19	19 al 20
1994	17												17					
TOTALES	17												17					

DISTRIBUCIÓN DE MOJONES AUXILIARES ENTRE HITOS PRINCIPALES																		
AÑO DE INSTALACIÓN	TOTAL INSTALADOS	TRAMOS ENTRE HITOS PRINCIPALES																
		2 al 3	3 al 4	4 al 5	5 al 6	6 al 7	7 al 8	8 al 9	9 al 10	10 al 11	11 al 12	12 al 13	13 al 14	14 al 15	15 al 16	16 al 17	17 al 18	18 al 19	19 al 20
1996	10																4	4	2
1998	16															8	4	4	
2000	13						4	3	2	4									
2001	30	1	2	6	6									4	11				
2002	10						3	1		4	2								
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 ...viene	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.

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.

Nicaragüenses 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 woman 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

WITH ALL THESE TRUTHS, NICARAGUA PROVES TO THE NATIONAL AND INTERNATIONAL COMMUNITY THAT:

President of the República, Commander Daniel Ortega S.

One of the great truths is that Costa Rica presents itself as the greater defender of nature and the environment, while it has depredated and totally destroyed the zone of the San Juan River.

Costa Rica boasts that it does not have an army, but it actually has an army. That army that occupied Nicaraguan territory after the war against Walker in 1857 and militarily occupied from the San Juan de Nicaragua River to the Lake of Nicaragua.

This territorial claim has been imposed via military rather than legal means. In the end, Costa Rica divested Nicaragua of Guanacaste and Nicoya. In addition they wanted to keep the San Juan River and the Lake of Nicaragua by imposing a military force.

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

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.

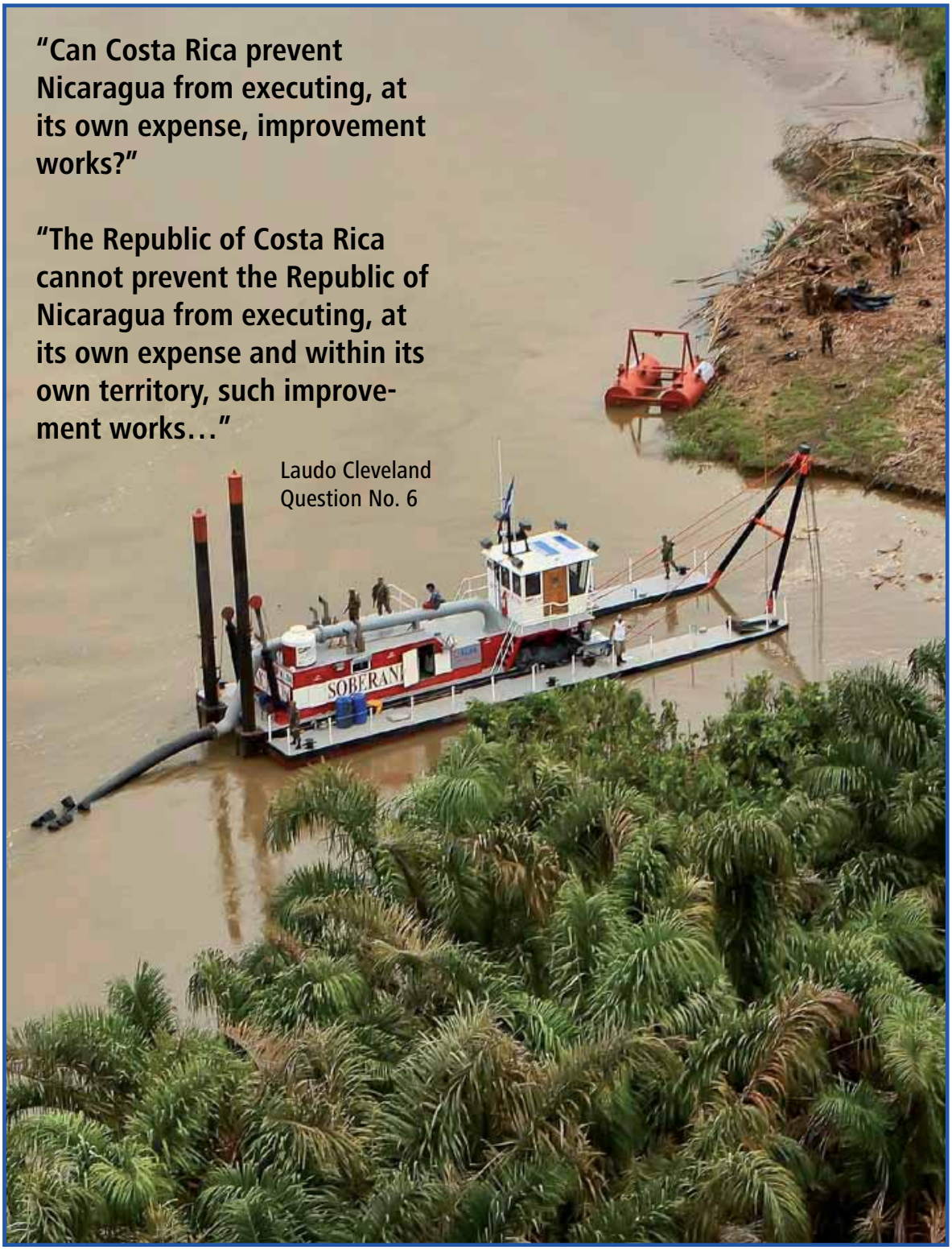
The National Army and Police will stay in the national territory as they have been so far. They will continue to fight drug trafficking and organized crime.

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)


"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
SOBERANI