ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

UPPER SALADO RIVER CAPACITY EXTENSION -SECTION IV, STAGE 1B

Support to the Integrated Management of the Salado River basin and Execution of Works Contemplated in Section IV, Stage 1B of the Salado River Basin Management Plan (PMI)

EXECUTIVE SUMMARY

December 2016

GLOSSARY

ABS A.S.	Building Company (Agabios Borrelli Serrano Sociedad Anónima)
WB	World Bank
DPOH	*Dirección Provincial de Obras Hidráulicas,* (Provincial Direction of Waterworks)
ESIA	Environmental and Social Impact Assessment
FFCC	*Ferrocarriles* (Railroads)
IWRM	Integrated Water Resource Management
INDEC	*Instituto Nacional de Estadística y Censos,* (National institute of Statistic and Census)
OPAP	*Observatorio de Protección del Patrimonio Arqueológico y Paleontológico*, (Protection Observatory of Archaeological and Paleontological Patrimony)
PBA	Province of Buenos Aires
ESMP	Environmental and Social Management Plan
SRB	Salado River Basin
PMI	*Plan Maestro Integral de la Cuenca del Río Salado,* (Comprehensive Master Plan of the Salado River Basin)
UTN	*Universidad Tecnológica Nacional* (National Technological University)

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1. INTRODUCTION

In 1997 – 1999, the Province of Buenos Aires, with the support of the World Bank, elaborated the Comprehensive Master Plan of the Salado River Basin (PMI – Plan Maestro Integral de la Cuenca del Río Salado) in response to the higher flood and drought risks of the River Basin. PMI implementation started in 2000 and progress has been made since then in particular in the execution of structural measures.

The works object of this environmental and social impact assessment (ESIA) are part of the Comprehensive Management of the Salado River Basin Project (P161798), to be financed by the World Bank (hereinafter "Project"). The purpose of the Project is to contribute to the implementation of the PMI components that are still valid. In particular, the primary targets of the Project are i) to strengthen the capacities of the competent organisms in the basin (eg. Provincial Water Authority (*Autoridad del Agua*, ADA); Provincial Hydraulic Works Department (*Dirección Provincial de Obras Hidráulicas*, DPOH)); ii) to support and improve the implementation of a comprehensive management approach for the basin; and iii) to improve the drainage capacity of the Salado River by means of canalization works of a specific section 34 km in length (Section IV, Stage 1B; hereinafter "Project works").

The ESIA summarized in this document has been carried out to identify and predict environmental and social impacts of such works of the upper Salado River in its Section IV, Stage 1B (Component 2 of the project). Additionally, this ESIA makes reference to the environmental and social implications that other project components could have. In particular, Component 1 focuses on the comprehensive management of the Salado River water resource and includes the elaboration of an *Environmental Management and Natural Resources Plan* at the basin level, for which the ESIA offers general environmental and social guidelines.

Thus, the works of the projects cannot be understood if they are not contextualized within the PMI, as part of the so-called "global canalization project of the Salado River" (hereinafter, "global project"), since the river and the basin as a system operate holistically. It is important to specify that the global project works in practice do not imply rectifying the course of the river, but rather focus on maintaining the fluvial/natural biological river corridor. The works have been split into sections. Currently the works are completed from downstream to upstream in sections I, II, and III. The Upper Salado River work continues sections IV and V, between the exit of Las Flores Grande Lagoon to the Salado River and the discharge of El Carpincho Lagoon in Junín. Section IV, Stage 1B, the river section object of this study, begins at the bridge of the road that communicates the location of Begüeri with the city of Lobos, and continues to the bridge of route 205 at the division of Roque Pérez. The works projected in this section of the Salado River basically arise, as part of the global Project, as a measure to control and mitigate floods in the North East region. The direct consequence of the drain works is an increase of the flows entering the upper Salado.

This document presents a summary of the ESIA process carried out for the expansion of the Salado River channel in Section IV, Stage 1B.

2. OBJECTIVES OF ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

According to the operational policy 4.01 of the World Bank's Environmental Assessment (EA) safeguard, the Project is classified in category "A", which represents a situation where the project requires of a detailed environmental and social impact assessment (ESIA).

The objectives of the ESIA are:

- Identify and predict environmental and social impacts of the works for the expansion of the upper Salado River capacity in its Section IV, Stage 1B;
- Identify and evaluate environmental and social aspects key for the works, according to the World Bank's Operational policies (OP);
- Elaborate the prevention, mitigation, and corrective measures that, being technically and economically feasible, minimize the possible negative impacts and/or potentiate the positive ones, all in compliance with the country's applicable regulations and the World Bank's OP.;
- Setup an environmental monitoring program during the preparatory, constructive and operational phases of the Works.

The ESIA is presented in order to analyze the interaction between works, environment and institutional strengthening in the natural resource management at the basin's level, facilitate decision-making in relation with this project and propose prevention, mitigation or correction measures of adverse impacts produced by actions projected both on the natural and the anthropic environment.

In this case, the study is specific and tries to cover the most important aspects and problems related to the execution and the operation of the canalization works, through the expansion and excavation of the Salado River, as well as the replacement of 7 bridges and 2 supplementary works, with recreational purposes (2 Spa resorts) along the tracing thereof.

3. BACKGROUND

The PMI established guidance principles as a way to assure a flexible and sustainable framework for the management of water and land resources in the Salado River basin. The principles of particular relevance to environmental sustainability (in comparison with the economic and technical ones) included:

- Adopting successful institutional models as the *Landcare* system in Australia,
- Assuring consultation at all levels and promoting common property;
- Assuring that all stakeholders can participate efficiently;
- Be prudent, take one step at a time; assure a broad monitoring and evaluation to learn from the experience (iterative);
- Adopt long-term objectives to consider the needs of future generations;
- Impose restrictions in the use of water to safeguard environmental assets;
- Impose restrictions in the use of water to control contamination of surface and ground water;
- Formalize the use of water and emission standards;
- Hold extraction and discharge licenses;
- Hold licenses for works affecting the bed, the margins or the flows of any water course;

- Keep floods in areas that depend thereon for their ecologic diversity in order to protect existing wetlands;
- Maintain the rivers' natural functions and processes;
- Maintain and increase biodiversity;
- Respect cultural/historic properties and patrimony;
- Respect human communities and increase access to services and recreation areas; and
- Promote a sustainable management of fisheries and other natural resources

The PMI develops a series of institutional, structural and nonstructural measures and alternatives to project its implementation in a series of phases.

For such aim, the PMI divides the River basin in sub-regions, which try to provide appropriate geographic units to separate the PMI implementation in phases and for a future integrated management of the river basin. During the development of the PMI different sub region divisions arose based on hydrological, ecological, sociological and physical units. However, it was decided that mainly the regional division of the basin should allow an efficient long-term management of the hydric environment and the promotion and implementation of the PMI.

The PMI proposed the following regions, based on the hydrological sub basins (which in turn are divided into subregions), for the implementation and future management of the Salado River basin:

- Region A to the Northwest (66,000 km^2),
- Region B Salado – Vallimanca – Las Flores (99,000 km^2), and
- Region C of Las Encadenadas to the West (11,000 km^2).

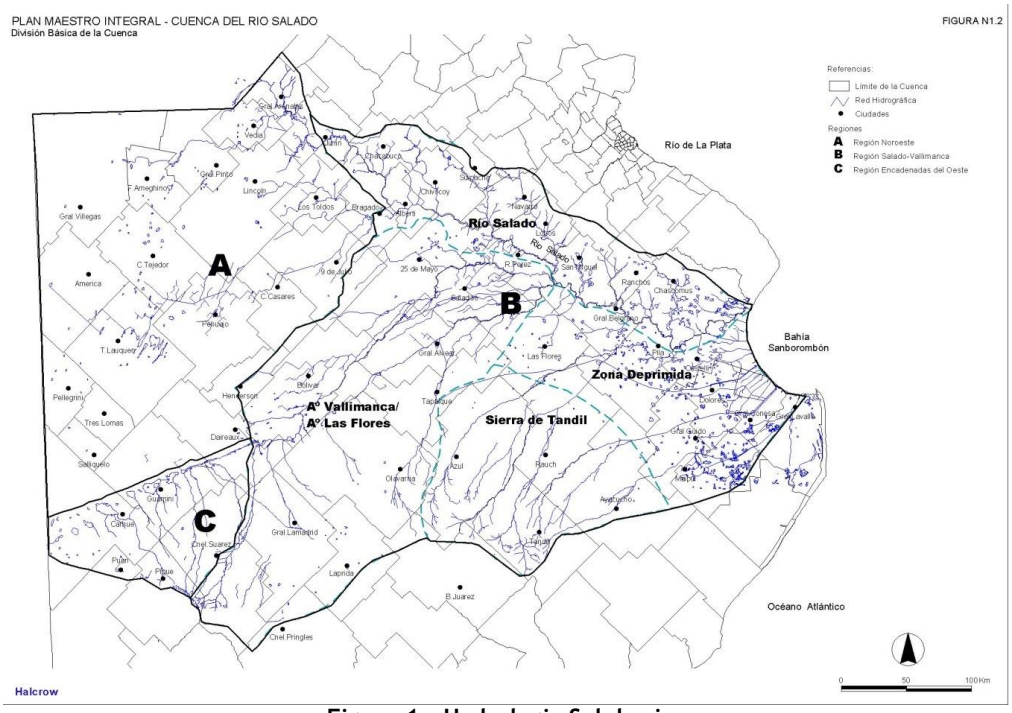

Figure 1 - Hydrologic Sub basins

The PMI proposes a broad set of structural, institutional and nonstructural measures developed through and iterative hypothesis design and evaluation process, carried out by a multidisciplinary team of engineers, economists, agronomists and ecologists. In respect thereof, a large part of

potential environmental impacts have been assessed with the possibility to be relieved, reduced or improved (with respect to environmental risk) through the implementation of measures inherent to the PMI design or of non-structural institutional proposals.

The clearly interconnected nature of the basin, the important dynamic of change established in natural systems according to the wet or dry periods and the different land uses indicate an important degree of uncertainty on the ecologic impact of the structural measures on the basin's ecologic integrity.

The strongly regional nature of the measures to be implemented, necessarily imply the certain possibility of synergic effects of the actions outlined in the PMI and unknown responses of the natural systems. It shall not be forgotten that the current characteristics of the basin natural systems, including the soils with agricultural suitability, were developed with the conditions of that drainage period, therefore a key aspect of the PMI is the detailed follow-up of those areas that are considered as recovered and that represent the basis of the investment.

The characteristics of the implementation and the development of the PMI provide a unique opportunity for a detailed follow-up of the effect of the main actions. It must be understood that the projected action plan does not include one single works of localized effect, but rather a set of actions that cover a surface of 140,000 km^2 and that demand a regional analysis mainly based on the cumulative effect of the works and the delayed responses, the tolerance limits and the response before the overcoming of the natural systems' thresholds.

In 2001, the consulting firm ABS S.A. was hired for conducting a study for the development of the Executive Project of the upper Salado River works. This study set the basis for the elaboration of the Executive Project of the canalization of the upper Salado River. The main objectives of the study were:

- ✓ Identify and predict environmental impacts of the upper Salado River canalization.
- ✓ Evaluate environmental quality in the current condition and with the performance of the project.
- ✓ Elaboration of recommendations on corrective measures that, being technically and economically global, minimize possible negative impacts.
- ✓ Propose on environmental monitoring program.

The main environmental effects identified included not only those directly related to the canalization works of the river's main course, but also the potential indirect effects of the works of the North East region of the Salado River basin.

In 2006, the Facultad Regional Avellaneda, which depends of the Universidad Tecnológica Nacional was hired to update the PMI, in its environmental, economic and territorial context. The update was completed in 2009. Among the main products of the PMI update the following were obtained:

- ✓ Updating of the environmental baseline in order to obtain a characterization and an updated trend of ecosystems.
- ✓ Elaboration of an environmental management manual of hydraulic works in the basin which included:
    - Adoption of the approach of integrated management of basins-vulnerability/risk.

- Procedures and management guidelines measures.
- Training measures.
- Environmental analysis and monitoring program: particularly for surface and ground water quality and terrestrial ecosystems.

4. LEGAL AND INSTITUTIONAL FRAMEWORK

INTERNATIONAL

Operational policies of the World Bank

The World Bank (WB) has developed various safeguard policies, based on international agreements, and whose prevention and protection scopes may match with the national standard even without being explicitly included in the national Argentinian law. For the project, the following safeguard operational policies (OP) are triggered:

OP 4.01: **Environmental Assessment**: it is used in the WB to identify, avoid, and mitigate negative potential environmental impacts and optimize positive impacts associated to its lending operations. The objective of the EA is to improve decision-making, assure that the considerations proposed by the project are environmentally sound and sustainable, and that they include the participation of the population involved. This policy is considered by the WB as the general framework from which the other safeguards and policies can be included.

The project is classified as category "A". This implies that it is likely to have important negative environmental impacts of a delicate, diverse or unprecedented nature. These repercussions may affect an area broader than that of the locations or facilities where physical works are carried out. For that matter, in the EA, for a category A Project, possible negative and positive environmental impacts are examined and compared with those produced by feasible alternatives (including the "no Project" situation) and the necessary measures to prevent, minimize, mitigate or compensate adverse repercussions and improve performance, from the environmental point of view, are recommended.

OP 4.04: **Natural Habitats**: Guidance is provided so that projects supported by the WB consider the conservation of biological diversity, as well as the numerous environmental services and the products that natural habitats provide to society. It strictly limits the circumstances under which any project supported by the WB may damage natural habitats (terrestrial and aquatic with presence of native flora and fauna species).

In general, due to the characteristics of the study area which correspond to an agro-ecosystem with a high anthropic intervention, product of a history of the use of agricultural land, the natural grassland habitat of the Pampas has been restricted to only a few sectors of corridors on the margins of roads or to environments related with aquatic environments (permanent or semi-permanent lagoons) (Soriano et al., 1992, Ghersa & León, 2001, Bilenca, 2012). Due to this, there are no areas of high conservation value or of highly vulnerable ecosystems within the area of influence of the Project. As such, the works will not generate direct impacts in terms of modifications to and/or

losses of existing wetlands, natural habitats in general,[1] or critical habitats as defined by the World Bank's OP 4.04. It is also worth mentioning that the Project design incorporates positive environmental approaches to maintain the biological/fluvial corridor as an element of the landscape to allow for maintaining the area's defining ecological characteristics and environmental services, preserve potential conservation areas, and, to the extent possible, restore the natural habitat of the Pampas grasslands ecosystem.

OP 4.10: Indigenous Peoples: The particular circumstances that expose Indigenous peoples to different types of risks and impacts arising from development projects are acknowledged. As social groups with identities that are often different from those of dominant groups in their national societies, they must be considered in a culturally sensible manner within the framework of the projects financed by the WB. Although in the area object of this ESIA where the works are to be developed there are no indigenous communities, this policy is triggered due to the measures related to the comprehensive management of the basin under component 1 of the project that could reach indigenous communities present elsewhere in the basin.

OP 4.11: Cultural property: Its objective is to avoid or mitigate possible adverse effects produced in physical cultural resources by the development projects financed by the WB. To this regards, impacts on physical cultural resources resulting from project activities, including mitigation measures, cannot be in contradiction with the national legislation in virtue of the relevant treaties and international environmental agreements.

OP 4.09: Handling of Pests: This policy is triggered in those projects or activities where the use and application of chemical substances for the control of pests is foreseen. In these cases it must be included, as part of the environmental evaluation, the appropriate management and use of this type of substances and establish and identify the products that will be prohibited due to the negative effects to the natural and social environment.

OP 7.50: International waters: It is applied in the projects that involve international waters according to the type of interventions foreseen and to the concept considered by the policy. It requires of a notification procedure to other coastal countries involved with international waters. This Project activates this policy by i) the location of the Salado River basin as a tributary of the Rio de la Plata, a water course shared with Uruguay and subject to the regime of the Rio de la Plata and its Common Marine Front Treaty, approved by Law 20,645, and II) because the Project involves infrastructure works to improve the drainage of the Salado River basin. Nevertheless, the Project deserves an exception of the obligation to inform to the neighboring country, in this case Uruguay, since Argentina is the country that is found more downstream to the River basin and the Salado River basin is in its full length inside Argentina.

Note: In relation to **OP 4.12**: **Involuntary resettlement,** stands out that in the Project under analysis, the acquisition of lands is performed through voluntary agreements, for which reason the policy has not been activated. The Provincial Direction of hydraulic works (DPOH), which depends from the Ministry of Infrastructure of the Province of Buenos Aires, has been the institution in charge of the

[1] Natural Habitats are land and water areas where (i) the ecosystems' biological communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the area's primary ecological functions.

implementing agreements with the owners, in the sections where canalization works have been executed, for more than ten years. It has also incorporated improvements in the communication and negotiation mechanisms used. The voluntary agreements system has proven to be successful in terms of the works progress rhythm and the very low level of conflict presented. For that reason it has been proposed to continue using this mechanism. Agreements are reached both with the owners in whose properties it is anticipated to build *recintos* (in that case an owner that does not want a *recinto* built on his or her land, they can choose to reject it and *recintos* will be built in other properties), as in the cases of owners whose properties need to be accessed to perform works in the public domain zone bordering their property. In both cases in the sections that have already been executed, measures that tend to avoid or mitigate the impacts on the use of the property have been implemented. In those cases the owners have made a decision being appropriately informed and the process has been duly documented in authorization minutes and conformity minutes. On the other hand, complementary works, such as bridges, do not require land acquisition nor affect private buildings.

NATIONAL

Both at national and provincial level, Argentina has a broad legal framework related to works subject to evaluation in the present ESIA. This framework is introduced in Section 2.2 of ESIA Report, related to the environmental thematic (free access to information; conservation and reasonable use of natural resources; protection of archaeological and paleontological patrimony and hazardous waste) and water resource management.

5. DESCRIPTION OF THE PROJECT

The canalization works of the Salado River were in general designed in line with the Executive Project of Works of the Salado River basin, which proposes the channeling of the Upper Salado River, for the maximum capacity condition, that could be assimilated to a volume of approximately 10 years of recurrence, while receiving the surpluses of the northwest region through its Main channels system to be executed in the A3 sub-region. These surpluses would have contribution volumes equivalent to events of 10 years of recurrence (Figure 2). The works under evaluation (section IV - Stage 1b) are located in the B1 sub-region, within that denominated as Upper Salado River.

For this simultaneity condition, a retention of water accumulated during a sixty days period in the systems and contribution areas, is also considered resulting therefore the volume referred that in each section remains approximately constant, with the variations given with the lateral input located.

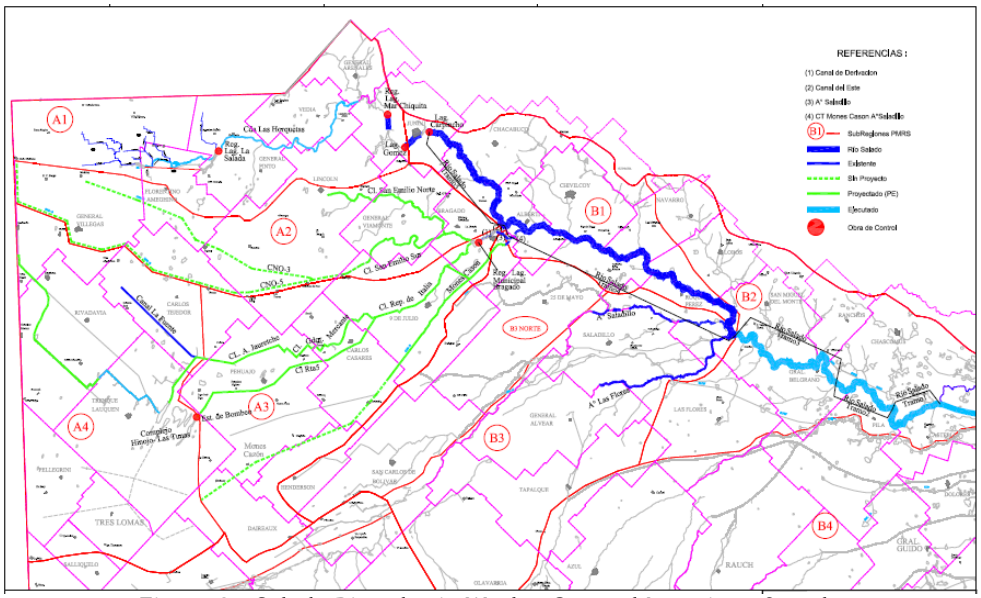

Figure 2 - Salado River basin Works. General Location of works

Analysis of alternatives at basin level

It must be highlighted that in the definition of the works to be executed in the river basin of the Salado River different analysis alternatives were taken into consideration, based on criteria from the PMI and presented under Section 7.

Description of the Project under Evaluation

The purpose of Component 1 of the Project is to identify actions to promote the **Integrated Water Resource Management (IWRM) of the Salado River Basin**, which implies developing institutional capacities to manage the resource with a sustainable, participative, holistic - systemic vision, (with all the stakeholders that have interests in the basin). This objective would be reached through two main subcomponents: institutional development and water risk management in the Salado River basin (SRB).

The institutional development subcomponent will include actions such as i) Normative update of institutional roles and functions in the water resource management sector in the province of Buenos Aires and in the SRB in particular; II) Strengthening institutional capacities of the organisms involved in the water resource management in the SRB, primarily of the DPOH and the ADA; III) Design and startup of a River Basin Management System for the SRB; IV) Design of an *Environmental and Natural Resources Management Plan* for the Salado River basin (this plan is described in more detail in Chapter IV of the ESIA Report). On the other hand, the water Risk Management subcomponent in the Salado River basin will include activities focused on the development of knowledge, inventories, information systems and other management instruments for the alert of critical events and the support to the planning and operation of information systems such as Geographic Information System, Hydrologic and Hydraulic modeling of the SRB and Carrying out studies and inventories to support planning and management of the basin.

The works of component 2 of the Project under evaluation are the **Stage (sub-section) 1B of Section IV**. This sector has a defined channel but with little formation and depth, which favors its expansion

during the risings of the river. This requires as main intervention the deepening of the channel, besides providing a suitable section to channel the river risings.

In this sub-section/ stage IV-1-b, 34.638m of the River channel will be adapted, in a section between the road Bridge that connects the Carlos Beguerie location with the city of Lobos (Prog. 311.762) Partido de Roque Perez and S.M del Monte and the Bridge of the National Route N°205 (Progr. 346.400), excavating the ground about 25.465.128 m3 (Figure 3).

Figure 3 - Salado River Section IV - Stage 1

The works contemplated aim to conform the sections of the river to give it an appropriate conduction capacity adapted to the passage of a river rise corresponding to an event of 10 years of recurrence[12]; locating excavation grounds in sectors such that will increase the surface over the flood level, and improve the edaphic profile and consequently the productive aptitude; and other complementary works like shifting fences, gates and demolitions.

Hydraulic works

The Project design envisions the execution of a compound section, given by an inner or smaller section, tapered type with 40.00 meters in width, with a depth of 1.20 meters, which is intended to drain average and dry season river flows, and lateral slopes of 1:3. This section is complemented by a larger section, given by two lateral shoulders (*banquinas laterales)* of variable width and strap *(tirante)*, designed to conduct the maximum flow determined for each section, in correspondence with the variations of tributary river basins inflow. The largest section extends in lateral shoulders (*banquinas laterales)* to both sides of the smaller channel, which amounts to 60.00 meters. External excavation slopes are built with a 1V: 4H inclination. In this way low waters channeled runoff, and the containment of the design floods in the large section, are ensured.

[2] The recurrence period is a statistical concept that tries to provide an idea of to what extent an event can be considered rare. It is usually calculated by means of extreme variables distributions, on the base of series of extreme values registered within equal and consecutive periods. It is usually a fundamental requirement for engineering works design, since it allows establishing the minimum value of a certain parameter that must be supported by the work to consider that it is sufficiently safe.

The excess of soil from the excavations will be deposited in *recintos,* taking into consideration the morphology of the land, the status of the plots, and the environmental conditions of each site. *Recintos* must be located in the area between 200 and 800 m of the river's current edge, in order to maintain the biological/fluvial corridor.

The analysis identified marginal low area located between 500 and 800 meters from the axis of the river. This generates two strips parallel to the river axis throughout all the section, where improvements will take place in land of relatively low topography.

Throughout the fluvial corridor, the continuity and horizontal connectivity of the plain was respected, trying not to interrupt natural runoff through existing watercourses and channels flowing to or from the river. Within this area, potential sites were selected for the *recintos*, using variables such as the compensation between the volume excavated and that required to reach a given design specification, the presence of cables or wires, and the undulation of the terrain between the closest and furthest points from the river.

It is important to highlight that parcels identified at the level of the engineering designs as potential *recintos* for dredged material throughout the 34 km of canalization works that would be financed by the Project do not include any natural habitats as defined by OP 4.04 of the WB.

During the preparation of the final design for the *recintos* by the works contractor and under the supervision of DPOH, eligibility criteria for the *recintos* include the following environmental criteria: i) Exclusion of interference with natural surface runoff from wetlands or permanent lagoons; ii) Exclusion of any remaining natural parcels of Pampas ecosystem grasslands; and iii) establishment of a biological corridor free of *recintos* within 200 meters of the riverbanks. These criteria will be applied through modifications when necessary to the final designs of the *recintos*.

Complementary works

The works include, in addition, the replacement and execution of seven bridges within the present Stage 1B:

1. Railroad bridge FFCC Roque Perez - Rescuing Maria (marker 338,400),
2. Road bridge Roque Perez - Rescuing Maria (marker 338,447),
3. National highway bridge 205 (marker 346,400),
4. Road bridge Ernestina - Elvira (marker 379,780),
5. FFCC bridge Ernestina - Elvira (marker 379,830).

Apart from the progressive ones of this Stage:

1. National highway bridge 3 (marker 258,990) - Section 3,
2. FFCC bridge Videla Dorna - Gorchs (marker 276,240) Section 3.

Likewise, it has been anticipated to jointly execute, with works already indicated for the present section, support to the tourism sector; like the development of a resort Spa in the location of Roque Perez in the eponymous partido, and improvements in the resort Spa of Villanueva, located in the General Paz partido. It stands out that these works must have a specific ESIA, according to the requirements of the bidding terms Article 3: Study of Environmental impact of specific or special projects (for more details, see Section 8 of the ESIA).

6. ENVIRONMENTAL AND SOCIAL BASELINE

REGIONAL AND SUBREGIONAL SCALE

The study area at regional scale includes both the Salado River Basin and those areas annexed by the works executed in the last century, encompassing an area of approximately 170,000 km^2, reason why it is natural that such an extensive area is not homogenous.

The PMI states that the most important factor to decide on a new area subdivision into sub-regions, is based on identifying how a more efficient management of the water resources can be achieved. This is consistent with the recent global experience and the trend towards water management at basin or sub-basin level that allows autonomous control and an integrated approach of the water sector problems. Therefore, this extensive surface was divided into three regions, denominated Region A, B and C, in which different sub-regions are developed. Each one of them has its own hydric identity, establishing hydric systems, works and specific activities of each one of them.

Its delimitation is the result of overlapping different criteria, among which the hydrologic one prevails, but the productive, economic, environmental, social and cultural criteria also contribute, in a plain with little relief for its definition with strict hydric criteria.

Figure 4 shows the sub-regional division agreed for the development of the PMI.

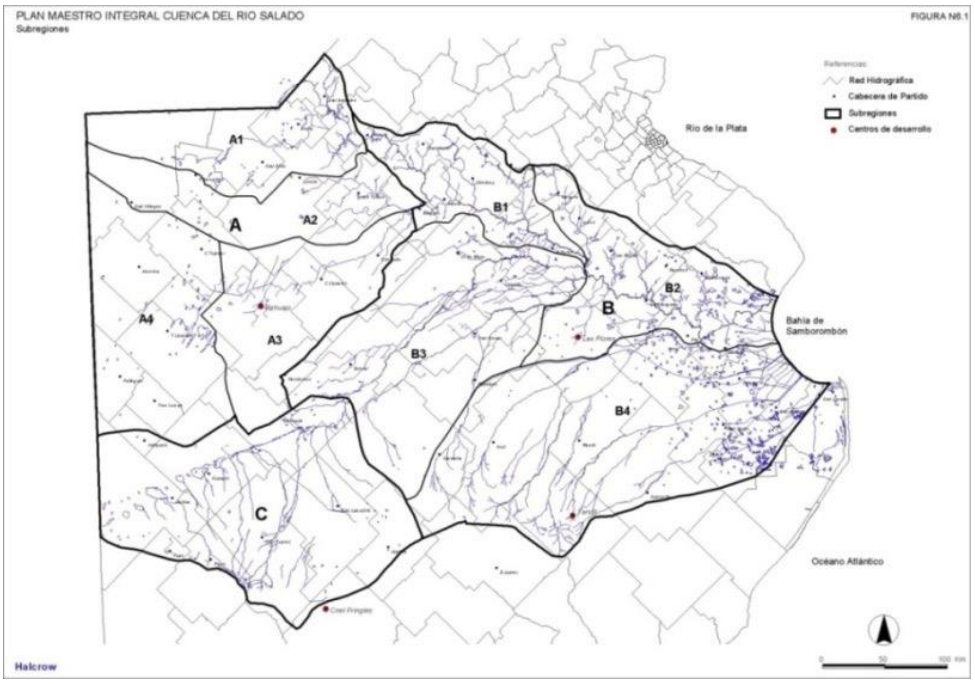

Figure 4 – Sub-regions of the PMI

The works under study of Section IV-Stage 1.B, are fully located in the B1 sub-region (Upper Salado) of the PMI.

This sub-region, includes the partidos (administrative divisions within each province) of Junín, Navarro, Chacabuco, Chivilcoy, Alberti, 25 de Mayo, Roque Perez, Bragado, Nueve de Julio, Monte,

and Lobos. Whereas the *direct affectation* area of the works that include the Project under analysis is delimited by the Salado River's own path that runs between: the road Bridge that communicates the location of Carlos Beguerie with the city of Lobos, the Roque Perez and San Miguel del Monte partidos, and the Bridge of the National Highway Route 205; on the Salado River to the north of the city of Roque Pérez.

a. Physical characteristics

Probably, the most remarkable characteristic of the area is the lack of relief. Excepting the mountain ranges in the south of the region, some of which climb to more than 1,000 m, most of the area is below 100 m above sea level. In turn, within a radius of approximately 100 km from the coast, in the denominated Salado Depressed basin, the slopes are of the order of 1:10,000.

The study area forms part of the Pampean Plain, an extensive plain supported on a crystalline rock basement of the Precambric era. Based on the relief of the superficial deposits, the region can subdivide itself in Undulated Pampa, Depressed Pampa and Sandy Pampa, being the Upper Salado confined mainly in the undulated Pampa.

Aeolian processes have had a considerable influence on the landscape of the area, where there are noticeable evidences of relictic dune systems. The fluvial processes originated the formation of a series of alluvial fans that emanate to the North from the mountain ranges south of the basin. These characteristics of the landscape reflect that in the past dryer conditions prevailed. The fluvial and natural drainage system has not adapted yet to the climate change experienced.

Basically, the system does not have yet the capacity required, neither in terms of water course density nor in its geometric properties and as a result thereof generalized and prolonged floods occur.

In the fluvial section that corresponds to the present Works the course is not practically restricted and it forms irregular meanders all along a continuous flood plain. Due to its low gradient its dynamic evolution is limited and its adjustment to the changes in the volume regime is very slow.

The Upper Salado River course is more reduced than what would be expected of its basin's extension, due to the little contribution during water deficit times. Capacity at full section is scarce, therefore the flooding of its Valley occurs in a frequent and prolonged manner aggravated by anthropogenic factors.

In general, the upper course of the Salado River does *not receive large inflows,* the largest of which is the Saladillo stream that drains into the upper part on the right bank, which is foreseen to be the natural discharge of the Bragado lagoons, and on the left bank of the Salado are the Hinojo, Chivilcoy, de las Saladas creeks and the Saladillo de Rodriguez stream.

Section 4.1.10 of ESIA Report describes in detail the generation and evolution of floods since 1980 to its 2012.

Regarding the works executed in section III of the lower Salado (B2), a significant improvement in the evacuation capacity of the channeled section, together with a reduction in the high waters residence times, was observed.

The high waters period that occurred between April and November 2014, were characterized by successive flood events as a result of intense rainfall which maintained favorable conditions to the establishment of high waters in the fluvial axis.

Runoff in the Salado River did not surpass *20 m³/s in the beginning of year 2014, a value associated to level* 90% of the curve of historical duration. On the other hand, conditions characteristic of prolonged low water periods where checked, as illustrated in the high value of electric conductivity registered in that moment in the system of 9600 and 9800 µS/cm.

The noticeable growth rate of precipitation in the last months of 2014 stands out, being the growth rates greater than those expected in normal years. In 2014, a year expected as normal, the annual accumulated precipitation was also broadly exceeded. In consequence, in the first days of August the maximum flood levels in the lower Salado where achieved (*Q measured = 680 ms ³ /s*).

From the temporary evolution of levels and volumes in the context of 2014 rises, important conclusions were obtained:

1. There are zones that respond quickly with rising volumes, especially the stream Las Flores and eventually the upper Salado when it is already saturated and fed by channeled surpluses. The Vallimanca-Saladillo subsystem, because of its geomorphological characteristics, arrives with a certain delay to Las Flores lagoon. Something similar occurs with the upper Salado, in relation to the surpluses that arrive from the West system to the Bragado zone.
2. In consequence, for pluviometric events as the one observed, discharges from Puente Romero provide certain continuity depending of the different subsystems that reach Las Flores complex, with their corresponding delay.
3. In 2014, major affectations have been observed in the eastern region of the basin, streams and linking of low streams south of the Salado River (Gualicho, channel 9, rains in Tandil, Dolores and Castelli).
4. Low streams usually present a slow rhythm during rainy periods but, to the extent that no occurrence of rain events persists, levels quickly descend due to the largest discharge capacity of the lower Salado section.
5. Multi-temporal analysis performed, ratifies the aspects observed in the hydrodynamic modeling in respect of *response times being reduced in the canalized section.* An interesting reflection comes up when evidencing that for one same date the flood level that results negligible in the lower section, in sectors that have not been canalized significant areas of flooding are observed, and whose persistence in time, in the case of the flood studied is greater than three months.
6. The existence of roads and railroads infrastructure with crossing works that are not compatible with the new riverbed heights constitutes a problem awaiting to be solved. In crossings where new bridges were built, performance versus 2014 flood event was the one expected by the project.

The most recent history of this failure, corresponds to the flood that took place during 2012, which was observed and monitored as part of the activities of the hydro-meteorological monitoring program of the PGA of the Works in section III, although in 2014 the maximum values of 2012 were not reached, it's residence time was greater, being the mean annual volume of 2014.

The rain events that happened between July 30 and August 10 of 2015 strongly impacted on the PBA, especially in the center and north thereof, affecting urban and rural regions of the north of the province, mainly on the Arrecifes, Areco and Lujan River Basins and in an extensive region linked to the Salado River basin of 273 m^3/s. As a consequence of the intense rainfall important flooding events and overflows of the above-mentioned rivers ocurred.

Among the causes of the flood event standout the critical precedent conditions of humidity the basin was in, in particular the upper section of the Salado River, with high phreatic levels evidencing potential for the generation of surpluses.

The behavior of the system observed during the 2015 flood event recognizes in relation to the analysis of temporary evolution, the following:

1. There are zones that quickly respond with flood event volumes, especially Las Flores stream, and eventually the upper Salado, when it is already raised and is fed by channeled surpluses (behavior similar to the flood event of 2012).
2. The Vallimanca-Saladillo subsystem, for its geomorphological characteristics, arrives with certain delay with respect to the previous ones, to Las Flores Lagoon.
3. Surpluses originating from the Gualicho-Zapallar-Camarones system, added to the flood events in Channel 9, have had a behavior similar to the flood event of 1980.
4. *For intense rain events, in full section conditions in the upper Salado and with the marginal low flows and full lagoons, volumes that are efficiently driven by the lower Salado are generated, without attenuation of the wave.*
5. The discussion around the management and connectivity of Lagoon systems as a mean of attenuation and control is raised since, in this opportunity, the days where higher levels where established in the Salado did not produce flows to the chained systems.
6. It was checked that, *at the expense of the NO occurrence of new rain events the reduction of the levels is ensured by the largest conduction capacity of the channeling.*

In the underground component, in previous reports, groundwater balance models (simulation of the 1963-1995 period), yield results of interest for the analysis of the behavior of the upper Salado sector, observing:

a) Increase in the storage volume, due to the fact that the accumulated recharge is greater than evapotranspiration; however it is important to point out than 80% of this rechange took place previously to the great flooding event of 1985.
b) The hypothesis of the predominance of the vertical components of the balance is verified. Horizontal flows are several orders of magnitude inferior to the vertical recharge flows and evapotranspiration (Example: the outflow of the system through the Samborombón Bay is 0.08% of the volume coming into the system as recharge and approximately a 3% of the net evapotranspiration volume).
c) The contribution of the aquifer to the fluvial system is very low due to the reduced conductivity of the valleys' filling material. However, the contribution of the courses to the aquifer is greater (probably when phreatic levels are relatively low) than the contribution of the aquifer to the base flow of the rivers, probably due to the local relief control on phreatic levels when they are close to the land surface, and therefore the difficulty to get a gradient between underground water and the level of the courses.
d) In the case of the Northeast region channel system, there is an increase of contribution from the aquifer to the system toward the end of the 1980s, with the construction of the main channels in the region.

b. Water Quality

The Salado River constitutes an open system with a broad interaction with the terrestrial ecosystem and with Linthicum bodies that constitute the basin. The water bodies of the Salado Basin belong to the eutrophic category (Carlson 1974).

Eutrophication of water bodies causes a loss of aesthetic and sanitary quality of the resource, because there is a reduction in the transparency of the water, an increase in the frequency of algal bloom that produce unpleasant aspect and odors, proliferation of mosquito larvae, etc. There is a loss of diversity of the communities, there can be fish mortality because of anoxia conditions in the bottom of the lagoons in the summer months, also the disappearance of fish of commercial and sports interest and toxicity problems for cattle produced by certain algae species involved in blooming. However, floods affecting the zone facilitate the capacity of auto-purification of the water bodies.

The sampling points selected on the river's main course constitute historical sampling points which have data that allow a systemization and joint measurements with gauging and hydrometric measurements of the province. The Province Direction of Sanitation and Hydraulic Works (today DPOH), has performed seasonal samplings (in June/98, October/98, December/98 (additional, February/99, March/02 and fall/02,) in the basin, to which monitoring carried out by the consultant firm ABS S.A., was added, in 2001 and subsequent updates carried out by the National Technological University (UTN), in 2006/09.

From the analysis of these determinations performed, both by DIPSOH and by ABS consulting and the UTN, for their stations located in the upper sector of Salado, eutrophication conditions were observed in the water body, similar to those registered in the PMI although with a mild increment in the total recorded phosphorus levels.

c. Biodiversity

Vegetation cover in the basin is dominated by grass and grass-like vegetation, constituting a pseudo-steppe originally dominated by the "flechillar" (*Stipa, Piptochaetium*, etc.) in the high sectors. *It has practically disappeared, because of the use of the ground for agricultural production.*

Edaphic and geomorphological limitations are determinant conditions to numerous azonal vegetal communities in the area: halophyte grasslands, straw-covered land (reed beds, "totorales") and sandy areas ("psammophile") that due to their low potential productivity have been less affected by farming activities.

Pampean fauna, especially, mammals and terrestrial reptiles has been severely affected by the disappearance of the natural habitats which constituted vegetal communities due to the land use for farming activities and the population densification process of the territory, including construction of infrastructure, urban centers, etc.

Replacement of ecosystems and natural grasslands by agro-ecosystems, and the destruction of the natural environment, added to the action of indiscriminate hunting, have led to a notable reduction of the diversity of mammals both in the SRB, and in the PBA, in general (PMI, 1999).

Regarding ichthyofauna, the specific diversity varies according to the time of the year and the type of biotope, being higher in macrophyte environments or located at streams entrances (Ringuelet, 1975; Barla, 1991).

In the region, linked to this faunistic group, recreational fishing activity is common, particularly in lagoon environments.

Birds constitute one of the most represented groups in the region, particularly linked to less artificial sectors that show an important abundance and specific diversity, particularly linked to lagoon environments.

Planktonic community present in the area responds to a typical eutrophic – mesotrophic system equivalent to what has been registered in other plains environments with similar characteristics (Reynolds, 1984).

Phytoplankton from the Salado River turns out to be significantly adapted to the hydrologic dynamics of the system, maintaining aquatic environments and *acceptable degree of conservation and biodiversity* (Gabellone *and others*, 2013).

d. Ecological Zoning

The study area is located within a unique biogeographic region: **THE PAMPAS**, characterized by Daniele & Natenzon (1988), as **Humid Pampa grasslands**. (PMI, 1999)

*Formerly, features of the plains area were related to pampas pastures **WITHOUT** trees, but nowadays it has been modified, due to the agrification (agriculture development) undergone in the region. Both agriculture, predominant activity in the upper Salado sector (subregion B1] and cattle raising have altered the landscape, remaining only traces of the natural grassland in the limits of the systems exploited by men.*

From the classification carried out by PMI, the upper Salado subregion B1, results as **Hdscupu8:** global hydrological sensitivity, intense farming activity, with important urban development and significant use potential **(figure 5)**

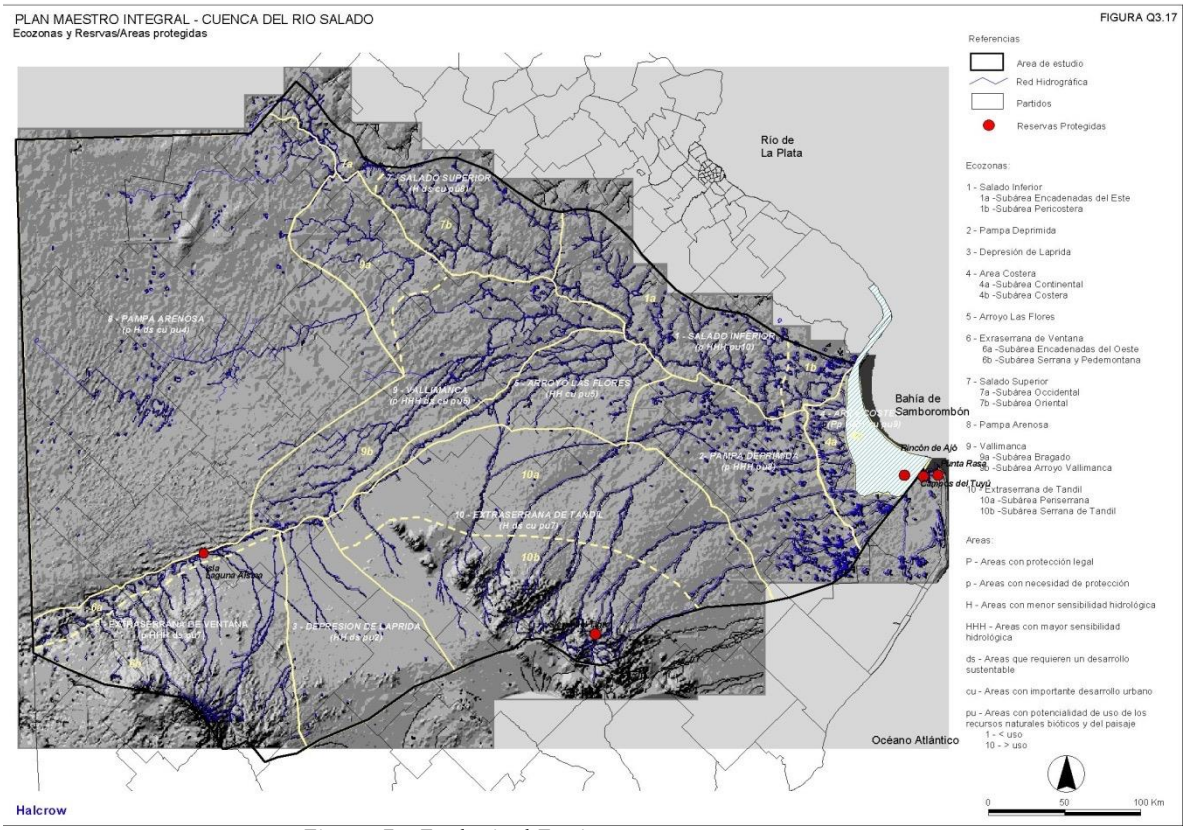

Figure 5 - Ecological Zoning

e. Protected areas

The study area does NOT include Protected Natural Reserves zones. However it stands out, that the PMI identifies the upper Salado ecosystem as an area that requires sustainable development.

f. Current agricultural model

The SRM is situated within the Pampean Prairie. Numerous agricultural productions closely interact in it with numerous lagoons and "bañados", constituting regions of great biodiversity. It is a region characterized by a fluctuating phreatic layer, conditions of salinity, periodic tufa presence, floods, areas with clayish horizon that influences permeability and radical penetration, among other conditions. All these factors, captured in the different capacities of land use and productivity indices analyzed below, condition high input technological agriculture models.

Regarding land use, the greater amount is being used by natural pastures and to a lesser extent by implanted fodder, occupying more than half of the Salado basin surface. It is observed that the predominant activity continues to be cattle ranching, with the cultivation of annual crops having a lower relative weight. The marked increase in cultivation of soybeans is one aspect to highlight, being a pattern repeated in the entire Pampean production (Pengue, 2000).

This series of modifications have come together so that the Pampas will definitively be restructured as a *domesticated ecosystem (sensu* Kareiva *et al.,* 2007).

The higher elevation sectors in the landscape and hills present soils with fewer limitations for plant development. These environments are able to produce abundant forage all the year, and are safe sectors in case of flood. These characteristics turn the ground of the area into optimal pastures during winter, for which a strategic pasturing by the end of the summer to eliminate remnant summer forage is necessary, favoring the emergence and regrowth of winter species that will begin their new growth cycle and contribute to forage. This cyclical management should be done the other way round in pastures known as "*bajos dulces*", those that can remain flooded during the winter, and are dominated by summer species of very good nutritional quality, therefore being excellent forage producers at outset of spring and during the summer, provided that the persistence of fodder species is guaranteed. Finally, alkaline lows are less productive due to strong edaphic limitations, and are dominated by summer species of low nutritional quality, that are mainly produced in the summer, but it is recommended that cattle consume them in autumn, so that in the summer a greater coverage of the ground is assured to reduce evaporation and resulting salt build up. (Ing. Agr. Casal, Otondo, St Cesaop; EEA Salado basin)

g. Key Environmental aspects at regional level

The SRB, and the upper Salado zone in particular, is part of an ecological zone known as Humid Pampas grasslands, within the biographical region of the Pampas. This great plain once had extensive pampa-like pastures, deprived of trees. At present, there is virtually nothing left of this natural habitat, since the area was altered both by cultivation and by cattle ranching. Within this context, there are several environmental aspects that are relevant for the entire basin, among which the following deserve to be detailed:

- ✓ Samborombón Bay, is a RAMSAR site and it is probably the most important singular ecological characteristic of the basin.
- ✓ The total complex of rivers, riverside wetlands, coastal lagoons and wetlands is of great importance for birds' populations.
- ✓ The complex floods regime, that involves seasonal and long term cycles, is a key factor in maintaining the ecological dynamics of the wetlands/pastures systems.
- ✓ The lower basin of the Depressed Zone and the lower Salado is the receptor of human activity effects (agriculture) in the basin's water sources, with the consequent risk of water quality problems and eutrophication of lagoons.

h. Social-economic considerations

The PMI includes 58 partidos and 145 localities, with different population density, from localities of less than 500 inhabitants to urban centers of more than 90,000 inhabitants (INDEC, 2010).

Although the Salado River basin encompasses more than half of the province, the population of almost **1,428,307 inhabitants** (Census of 2010) represents less than 9.1% of the total of the province. This number corresponds to an average population density of only 8.55 people/km^2, existing considerable variations between partidos. The urban population represents almost 80% of the total.

For the sector **upper Salado,** under consideration in this report, the data according to the last population census result in **494,502 inhabitants**, including the totality of the partidos that integrate this sector (INDEC, 2010).

Among the factors affecting the distribution and growth of the population in the area are education, health services and rural electrification. The provision of these services affects the quality of life and, therefore, the decision of the families to live in a certain place. Therefore many producer families choose to live in the cities of the interior, or in Buenos Aires, where the social facilities and opportunities are superior.

Recreation and Tourism

Tourist and recreational activity in upper Salado, is organized based on the different water bodies, particularly around the lagoons (permanent lotic bodies), with recreation and camping modality essentially.

In these lagoon environments, the practice of nautical sports, fishing and other activities linked to leisure predominate. It is important to highlight that the Salado River **is NOT navigable**, nor is used for such effects.

According to the criterion proposed by the PMI for the diagnosis of the tourist-recreational activity, it is understood that the partidos that are in a better disposition for this development, within the study area, are: Roque Perez, Lobos and Montes.

As was indicated previously, part of the complementary works of this Project includes the development of a resort spa in Roque Perez, as well as the valorisation of existing recreation sites, like the resort spa of Villanueva, in the General Paz partido.

The registry of numerous fishing facilities must be highlighted. Those are generated instantaneously at the shore of the Salado River in those sectors that already have channel extension works executed eg: fishing facility Salado River in Guerrero Bridge Route 2 zone; that has Municipal qualification by the Municipality of Lezama and the fishing facility located downstream from the bridge on RPN° 57, in the location of El Destino, given in concession to a group of bordering neighbors.

The development and implantation of these fishing facilities, are considered to have positive effects and with a potentiality of uses.

Physical cultural resources

The PMI registered for the river basin a series of archaeological sites listed in Table 11 of ESIA report. From the analysis of this information, stands out that for the area under study, **physical cultural resources are not recorded.**

LOCAL SCALE

Baseline description at this scale emphasizes the characterization of water quality, soils, trophic status of the aquatic ecosystem, natural biodiversity and natural areas components and cultural and physical resources, of the area of direct affectation of the work under evaluation.

a. Aquatic ecosystems

Quality of surface water

In order to set up a more updated baseline, limited to the area of the Project under analysis, the main results related to water quality obtained within the framework of the monitoring plan are included below.. To do so, the following monitoring and control points were set up throughout the Salado River corridor (from the upper section to near the river mouth), which are in correspondence alsowith the water measuring stations operated by ADA:

1. *Achupallas (Prov Route 51)*
2. *Roque Perez (Nac Route 205)*
3. Gral. Belgrano (Prov Route 41)
4. Location El Destino – Pila (Prov Route 57)
5. Guerrero (Nac Route 2)
6. Canal 15 (Puente de Pascua)

For Sub-region B1, **sites 1 and 2** are considered**,** the remaining correspond to sub-region B2. The results obtained reflect the average conditions of the river, highlighting the *high content of dissolved salts (conductivity) and the low levels of turbidity.* Until the moment no significant changes in turbidity levels and total suspended solids have been observed with respect to those reported in the regional baseline by previous studies.

As far as the monitoring of polluting agents like chromium, zinc, copper, mercury and lead, the levels observed are relatively low to non-detectable. Those that registered greater concentrations like arsenic, respond to the nature of the fluvial system, since this metal is naturally found in the system.

The dissolved oxygen (DO) level is an indicator of water quality. In pristine waters the oxygen concentration ranges between 8 and 12 mg/l, whereas lower values credit organic contamination. During the monitoring plan carried out, dissolved oxygen levels registered a seasonal variation characteristic of plain environments, ranging between **6.5 and 12.2 mg/l**.

The range of pH monitored fluctuated between 6.5-9 units with a mean value of 8.7. This value is similar to the reference value observed in the previous samplings. Also, this value is within the levels recommended for ictic life by the norms in effect.

The temperature values recorded show a remarkable seasonality and are consistent with the registries in the region, being higher during the warm months.

Historical measurements of suspended sediments, performed throughout the Salado River, ranged between 100 and 500 mg/l, with more frequent values of the order of 180-220 mg/l.

In relation to the monitoring of the quality of the water of the Salado River carried out in the period 2011-2013, it can be concluded that no appreciable evidence of the alteration of the physical-chemical parameters has been found with respect to what was reported in the PMI (1999), and later studies carried out (ABS, 2001/03, UTN, 2006/09, DPOH, 2011). In addition, in the sections of the river affected by channel extension works (Sections II and III, Lower Salado), no remarkable differences between the measured pH values, electrical conductivity, dissolved oxygen, temperature, have been registered.

Aquatic communities. Plankton

Recent studies carried out by the research team of the Limnology Institute "Dr. Raul A. Ringuelet" from La Plata (ILPLA), (who have been monitoring this river and associated lentic environments for more than 15 years), inform that the aquatic environments in the Salado river basin *remain in an acceptable degree of conservation and biodiversity,* in spite of the hydric fluctuations (drought and flood periods), salinity changes product of marine influence and the contribution of farming effluents. (Gabellone *et al*, 2013)

Fish Populations

With respect to the Ictiofauna, the Salado River basin is highly impacted by global change and anthropic action (Gómez et al., 2008). This basin is an open system, able to exchange species with the Rio de la Plata basin by two routes: headwaters of El Salado, next to the Parana River (34° ls), and by its mouth into the Samborombón Bay at 36° LS (Menni, 2004).

In the region, fishing activity is recreational and for sport, and is largely undertaken in lagoon environments. There is also a small presence of commercial - recreational fishing activity that can put certain species at risk, including the Cyprinodontidae.

More than 40 species of fish are found in the rivers and lagoon. The most common, among others, are the carp (*Cyprinus carpio*), shad (*Prochilodus lineatus*), loach (*Mugil sp*.), and the "pejerrey" (*Odontesthes bonariensis*) which is the most popular for recreational fishing. This fish is common throughout the SRB through to the system of lagoons known as "Encadenadas del Oeste". Except in the case of the "pejerrey", fishing activities are not regulated.

Of the total of species mentioned (46), 41.3% are occasional (19 species). In addition, 28.3% (13 species) undergo extraction with ornamental, sport purposes or for human consumption.

Bird Populations

This EIAS identified that birdlife related to aquatic environments will be adversely affected during the construction phase and located in the area of the works; thus the potential impact will be temporary and reversible at the end of the work. On the other hand, the species of this type of birds identified in the study area do not present a state of vulnerability or threat, according to the current international categorizations; therefore, no species of these categories will be adversely affected by of the works (Aves Argentinas y Secretaría de Ambiente y Desarrollo Sustentable de La Nación, 2008).

Regarding birdlife related to pastures, the evidence shows that those species that present some degree of conservation status (state of vulnerability (Cauquén colorado) or threat (Loica pampeana)), have their preferential habitat outside the study area (Blanco et al, 2008; Gabelli y colaboradores, 2004; Secretaría de Ambiente y Desarrollo Sustentable de La Nación, 2013).

b. Terrestrial ecosystems

Within the framework of the PMI update, terrestrial ecosystems status were monitored in referential sites of the basin, considering hydrologic and land use dynamics in selected sectors (UTN; 2006/09).

For the Sub-region B1, where the section of the river to be dredged under this project is located, (Section IV Stage 1B), **Site B** is taken as reference, found nearby the crossing of the Prov Route. 205 and the channel of the Salado River, in the Roque Perez partido, Northwest from the head location (Figure 6).

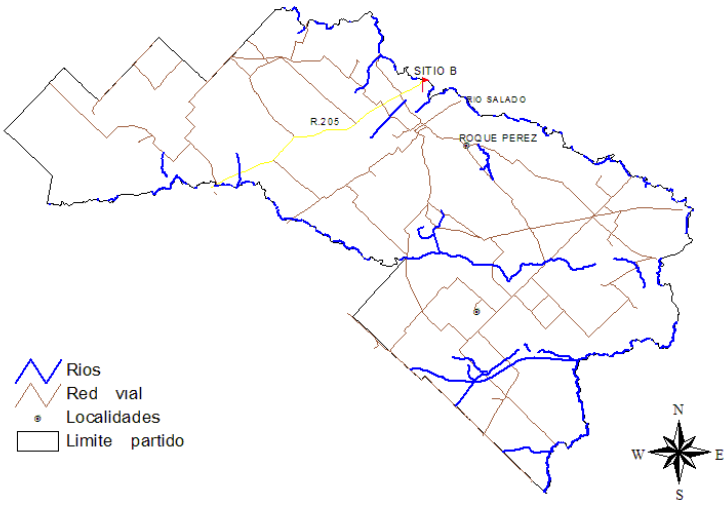

Figure 6 - Roque Perez Partido

One monitoring parcel and three sampling points were defined in the zone: B1, B2 and B3, located in the low and intermediate terrace of the river.

The main limitation in the ground comes from the deficient *Drainage* conditions both internal and external.

The presence of a phreatic layer near the surface - 0.5 to 1.0 m, and the proximity to the River course, determine flooding risks. In addition to these two factors, soil texture, low permeability and sodium contents contribute to deficient drainage.

In low terraces, flooding risk is higher than in intermediate terraces.

Associated to the drainage limitation, soils present, in different intensities and depths, a limitation by *Sodium content* and *alkaline PH* from the surface. *Salinity* is generally light, although in parcels with over grazing, saline efflorescence on naked ground appear.

Soil use Aptitude – USDA Classes VIws or VIIws - corresponds with *Current Use* of the lots: extensive cattle ranch of low receptivity on natural field or with some improvements through the introduction of species. Some sampling points of the intermediate terraces do not present current cattle use because they are associated to predominant soils of agricultural use.

With respect to *Natural Vegetation, the* predominance of the *"Humid Prairie*" or *"Halofític Prairie*" was observed according to the different levels of sodium and soil drainage conditions. Likewise in some sampling points, there was degradation of the natural prairies for over grazing.

Protected areas and biodiversity

The study area, does not include Protected Natural Reserve zones, highlighting these zones with a red dot in the coast zone (Rincón de Ajó, Punta Rasa, Campos del Tuyú), the "Encadenadas del Oeste" (Alsina lagoon) and the Sierra del Tigre in Tandil (Source: Provincial Department of Natural Protected Areas, Provincial Entity for Sustainable Development, (*Organismo Provincial para el Desarrollo Sostenible*, OPDS)). However, as described at regional level in this document, the *Upper Salado* ecosystem, has been identified as an area that requires sustainable development according to the PMI **(**Figure 7**)** (Source: PMI, 1999).

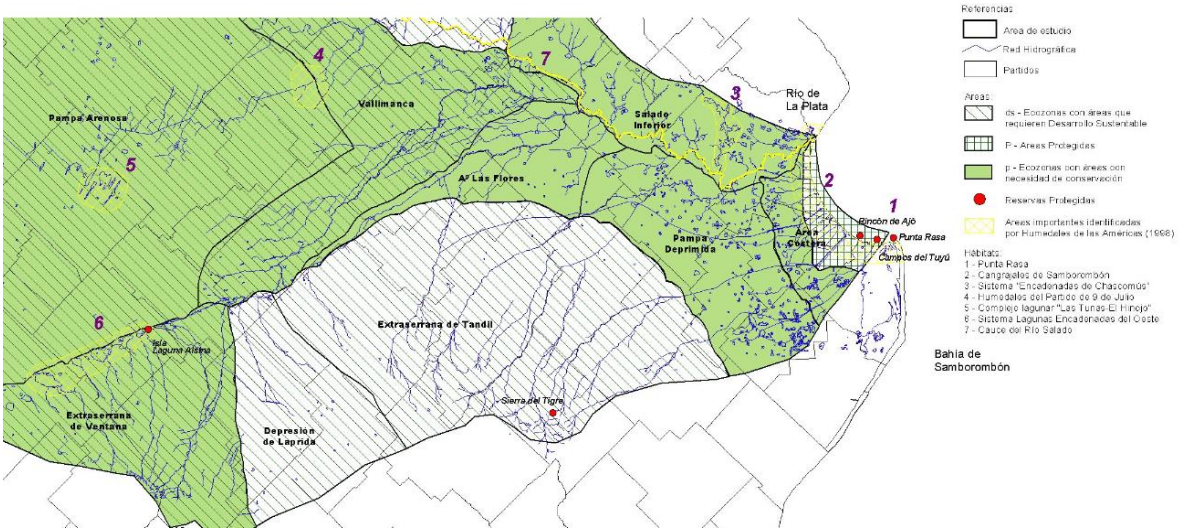

Figure 7 - Reserves and protected areas of the Salado River basin. Identification of ecosystem zones with potential for sustainable development and/or recommended conservation (Source. PMI, 1999)[3]

Due to the characteristics of the study area that correspond to an agro-ecosystem with high anthropic impact resulting from a history of farming, the natural habitat of Pampas grasslands has been restricted only to some corridor sectors in the margins of roads and shoulders (*banquinas laterales*) or to environments related to aquatic environments (permanent or semi-permanent lagoons) (Soriano et al., 1992, Ghersa & León, 2001, Bilenca, 2012). Consequently, no high value conservation areas or highly vulnerable ecosystems are present in the sector to be intervened by the works. As such, the works will not generate direct impacts in terms of modifications to and/or losses of existing wetlands, natural habitats in general,[4] or critical habitats as defined by the World Bank's OP 4.04.

[3] The identification of ecosystem zones is as recommendation that arose from the PMI, as such there is no normative framework in place.

[4] Natural Habitats are land and water areas where (i) the ecosystems' biological communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the area's primary ecological functions.

Recreation and Tourism

Due to the high conductivity, water of the Salado River as a resource, is not being utilized for irrigation or other uses. The river is neither used as a navigable route (mainly because of its shallowness and its flood and drought cycles) or a source of hydroelectric power (due to shallow slope).

However, the river provides recreational services, such as sport or recreational fishing, that can be seen particularly in associated lentic environments (Lobos lagoon, Indio Muerto lagoon, etc.), as well as to the riverside with the establishment of informal fishing facilities. These *informal fishing facilities*, are indeed an indirect positive effect generated by expansion works of the channel in the lower section of the river (eg: established downstream from the Guerrero bridge, on Route N° 2, currently with municipal endorsement and the one on the left margin of the Salado river, in the location El Destino, Provincial Route 57).

Physical cultural resources

With the aim to update the existing data for the Project's direct influence zone, meetings with specialists on the themes of the Natural Sciences School and Museum of the National University of La Plata were held within the framework of the preparation of this study, specifically with Dr. Clara Paleo Vicedean. Sheinformed about the **non-existence of registries of indigenous settlements** in the sector, as well as **of archaeological and paleontological rescue sites, for the area of the Project under study**. The latter is also guaranteed by the Registry Center of Archaeological and Paleontological Patrimony, dependent of the Provincial Direction of Cultural Patrimony, of the Cultural Institute of the Government of the province of Buenos Aires. These entities, through their observatories for the Protection of Archaeological and Paleontological Patrimony (OPAP), informed about the absence of official sites identified or under study to date, for the area of the Project.

Anthropic aspects

The section of the work to be executed is located in the polygon comprised by the localities of Lobos, Roque Perez, Beguerie, General Belgrano and Monte. Two urban centers are in the proximity of this polygon: Roque Perez at 2 km on route 205, and Beguerie by local road 8 km away from the works. (Figure 8)

Figure 8 - Demographic polygon described

The work's direct affectation zone is not within a consolidated urban area, but rather in rural estates with dimensions that vary from 5 to 1000 hectares per lot, mainly with a farming land use.

In many cases, two or more parcels belong to one same owner. Considering this factor, it was found that the smallest properties have 15 hectares. Likewise, there are cases where two or more properties integrate one same company, although this latter data is not registered in cadastre. These particularities are taken into consideration not only when describing the area affected by the works but also other relevant aspects such as the characteristics of the plots and productive uses.

It is estimated that the works under the proposed Project will benefit approximately 71,271 inhabitants, both directly and indirectly (INDEC, 2010).

The re-adaptation of the river channel, together with the predicted *recintos* and the improvement in existing (eg. Villanueva) and anticipated (eg Roque Perez) resort areas, will allow to sanitize this section of the river from the hydraulic and economic-productive points of view, resulting in improved productivity and accessibility. The intervention will also give a socio-environmental response to the urban needs, both from the point of view of service infrastructure and considering also landscaping and recreational uses, where the main localities in the area, will gain entailment and have a stronger relation with the river. It must be emphasized that these areas along the river were affected due to the destruction of existing resort spas and/or free zones for relaxation and tourism, by the constant floods that occurred in the region in the last years.

In accordance with the National Registry of Indigenous Communities, prepared by the National Institute for Indigenous Affairs, there are no indigenous communities in the area of influence of the works subject to this ESIA. To complement this information, the Natural Sciences and Museum Studies Department of the Universidad Nacional de La Plata (UNLP) was hired to carry out a study of the area. It confirmed that that no indigenous communities exist in the Project area that could be impacted by the Project works. Additionally, based on a map of current indigenous communities prepared by indigenous communities within the framework of the so-called 'National Meeting of

Organizations of Indigenous Peoples' ('Encuentro Nacional de Organizaciones Territoriales de Pueblos Originarios - ENOTPO'), a total of four indigenous communities are present throughout the Province of Buenos Aires today: the Querandies, the Mapuches, the Tonokotes and the Tehuelches (see: 'mapa pueblos naciones originarias' available at http://enotpo.blogspot.com/2015/06/mapa-pueblos-naciones-originarias.html). It is worth highlighting that **none** of these groups is present in either the direct or indirect area of influence of the civil works to be carried out under the Project.

However, in the area potentially affected by Component 1 of the Project, which will finance studies and technical assistance for integrated basin management, the presence of indigenous communities has been detected. In this regard, necessary measures will be taken into account to ensure that these indigenous communities are not only disproportionately affected by the impacts that may result from actions under Component 1 of the Project or other potential interventions, whether funded or not by the Bank. Culturally appropriate measures will also be implemented to ensure that these communities are able to participate in the development of the actions to be developed under component 1 and are equally benefited by the project. To that end, recommendations are included in the chapter 6 section corresponding to the guidelines for the Environmental Management and Natural Resources Management Plan.

Infrastructure of the direct work area

The area to be intervened by the Project under study, does not present constructions or infrastructure near the river that could be affected.

Land Use

The use and cover of the land, determined within the front parcels for the sector under study, currently presents 63.14% coverage of pastures (preferential use cattle breeding), approximately 30% with agricultural use and 7.58% water in dry periods. (Table 1)

Uses	**%**
Water	7.585
Pastures/grassland	**63.143**
Wheat	2.270
Corn	**20.312**
Sunflower	0.239
Soybean	6.452

Table 1 - Percentage of the use of the land in front parcels. Source. Own elaboration. DPOH

From the analysis of cartography (Soil charts, National Institute of Farming Technology, INTA), as well as the data collected in the terrestrial ecosystems monitoring, it turns out that the areas that will be used for the *recintos*, are characterized by their *low or moderate capacity of use and productivity index*, all of them with limitations regarding root development and deficient drainage.

In that context, the construction of recintos would offer, from the point of view of the use of the land in the region, a *potential benefit in the agro- productive development of the area.*

7. EVALUATION OF ENVIRONMENTAL AND SOCIAL IMPACT

ANALYSIS OF ALTERNATIVES

The PMI balances the technical proposals, the economic viability and the environmental impact of the different alternatives with respect to the problem of floods that the basin faces. To this end, diverse strategic options/alternatives have been suggested, evaluated (both formally and informally) and rejected or maintained.

The formal aspects of the evaluation process were carried out in the following way:

Initial evaluation: In June 1998 a 'long list' of options/ alternatives and potential PMI components were compiled. This evolved into the development of a 'short list' of options used to carry out additional development and evaluation.

Preliminary EIA: In March 1999 a preliminary evaluation of the options in the short list was performed, which concluded in the initial outline of the PMI.

The strategic options considered as part of the PMI were essentially different ways to consider the structural, institutional and non-structural components, which form part of the elements proposed, as part of a progressive plan that will require a continuous evaluation revision. For such purpose, the only real options of `doing something' represent the actual choices that are part of the strategy. These strategic options (each one containing diverse sub-options) are described as follows:

Do Nothing: It would probably result in:

- No strategic structural, institutional or nonstructural intervention;
- Continuing with the ad-hoc structural intervention at a local level; and
- Non-planned nor integrative evolution of institutional changes and nonstructural interventions associated.

Strategic Options to do the Minimum: These options concentrated on:

- Programs of limited institutional changes (perhaps concentrated in a pilot sub-region);
- Small programs of soil improvement measures;
- Implementation of important agricultural improvement measures;
- A limited implementation of nonstructural environmental measures;
- Implementation or not of limited structural measures (to a large extent, new drainage works in A1 area, besides the rehabilitation and extension of existing channels); and
- Implementation of urban defense schemes against floods and improvement of rural routes, only in high priority sites.

Limited Strategic options:

- A substantial program of institutional changes;
- Broader measures of soil and agricultural improvement;
- Public awareness and education programs;
- Greater implementation of nonstructural measures for environmental improvement, tourism, fisheries management, etc.;
- Drainage works in two sub-regions of the northwest (A1/A3 or A3/A4); and
- Embankments for flood protection on Upper Salado and other improvement works in Lower Salado.

Intermediate strategies: They concentrate on the implementation of those measures described in the previous option, but with:

- A complete program of institutional changes;
- Broader nonstructural measures of environmental management;
- Drainage works in the entire northwest region (A1, A2, A3 and A4);
- Attenuation/storage of floods in reservoirs/lagoons in the northwest and in Las Flores Grande and Vicahuel;
- Expand the construction and improvement of channels in the Depressed area; and
- Greater implementation of works for control of urban floods and improvement of rural routes.

Extensive strategies: These include a total implementation of the PMI measures, although with optional approaches for the deflections of the river and basin transfers from the Vallimanca /Las Flores region and for the interventions in Streams of Sierra del Tandil. It is the alternative of the denominated global canalization project of the Salado River[5], that from a general perspective comprises the accomplishment of a set of actions and works whose objective is handling and mitigating the impact of the floods in order toachieve a protection of the cities and infrastructure in their area of influence, increasing the level of safety of the populations and their economic activities.

Results of the Alternatives Comparison

The analysis of the alternatives at the basin level concluded that the “Do-nothing” option (without project) is unacceptable, since it would not solve any of the environmental, social and economic problems existing in the basin. The most likely outcomes of this scenario are the following:

- Continued flooding in urban and agricultural areas, resulting in the continuation of economic losses and unacceptable social impacts;

5 Canalization is the terminology used to define the extension of the Salado River capacity, which does not imply the rectification of the river course.

- Incapacity of the province in increasing current levels of agricultural and cattle production, resulting in the loss of market share in international markets and incapacity to take advantage in the expected openings in these markets;

- Continuation, and perhaps increase, of the environmentally negative use of agro-chemical products, resulting in the reduction of water quality and in potential water provision problems; and

- Ad-hoc continuation of the inadequate management, (over-exploitation), of the natural resources (including rare species, protected sites and fisheries).

With respect to the other alternatives (with project), the analysis in favor of the global canalization project of the Salado River concluded that, assuming a suitable operation thereof, it would generate a series of effects that contribute to reduce the environmental and social impacts of the floods in wet times and droughts in dry times.

In wet times, the operation of the global project would cause hydric surpluses to drain through the network of channels, limiting the flooding of rural and urban sectors and stabilizing the regional landscape. These improvements would generate positive impacts when influencing both the improvement of productive activities (extension of productive surfaces, improvement of soil quality in *recintos*, etc.) and the improvement of the quality of life of the inhabitants of the basin, in relation to their health and with the possibility of accessing services that are always affected when the infrastructure is damaged.

One of the most significant potential adverse impacts that could be generated during the wet times is the alteration of aquatic ecosystems due to the increase of water conductivity. At the moment, the water entering the Upper Salado River (B1 Sub-region), originating in a great portion of the northwest region, drains the system through a series of lagoons and preexisting channel systems upstream. Since the northwest region has a high farming activity, the canalization works in the B1 Sub-region could affect in an adverse and cumulative way the quality of the water in the Salado River in general, by increasing the flow of nutrients, fertilizers and salts downstream. In order to mitigate this adverse impact, the PMI incorporated in the global project design different mechanisms of flow regulation thus increasing the existing management options; this facilitates the maintenance of the ecological and recreational functions of the Salado River, therefore avoiding the risks of flood and the recirculation of nutrients and salts, downstream thereof.

With respect to the effects of the global project during dry times, the PMI strategy implied, on the one hand, the creation or extension of permanent water bodies that serve as reservoirs during these times. Channels would be designed in a way that, by means of regulation works, avoid water drainage at times of drought, maintaining therefore the wet conditions. In turn, this causes a reduction in agricultural losses, erosion and soil degradation during dry times.

Alternatives analyzed during the definition of works to be executed

In the definition of the works to be executed, different alternative analysis were considered using criteria established in the PMI , and those ultimately adopted by the province through the DPOH.

Possible direct affectations due to the execution of the work were considered in the analysis of the alternatives, such as the possible upheavals that the works would cause to productive land, natural environments, the hydro-dynamics of the system, and to the population as a whole. Likewise, it

must be clear that the context of the design and execution of the works on the main course of the river happened during a moment in which the province was undergoing a flood emergency.

The scheme posed by Halcrow in the PMI assumed that the Upper Salado River is a condition of "full section" that is, carrying a volume of water equivalent to approximately2 years of recurrence. Surpluses entering from the northwest zone of the province are added upstream of the National Route 5 (Sub-regions A-1, A-2, A-3 and A-4), equivalent to 10 years of recurrence (to this was called Q2-5).

This volume of water exceeds the channel's capacity, so in order to make possible the drainage of this large volume of water downstream Route 5, , the PMI proposed the execution of *parallel embankments* in both margins making possible excessive runoff to flow elevated with respect to the natural land.

It was observed that that proposal would bring along the following disadvantages before the occurrence of rain in the Upper Salado's own basin (which will surely happen frequently):

- The discharge of the emissaries that laterally contribute to the river would not have defined draining lines; with the consequent affectation by flood events to the areas bordering the river, which additionally conditions the discharge speed due to the difference of existing levels. The existence of lateral embankments prevents the normal runoff of rains (since they are within the flood plain of the Salado River), generating damages to the bordering properties. This would require as a solution, the placement of numerous control works in each depression of the land, which becomes economically nonviable. To think about reducing the amount of control structures, by the execution of collecting channels that would connect several of them; it would be necessary to think about building culverts and fauna passages, to allow free transit by the animals. This will generate additional disadvantages linked to the potential affectation to the operation of the fields located between them and the river; as well as alterations to the operation of the works and potential risk to the animals.
- Likewise, due to the degree of subdivision of the land, the ravines and local low lands affect more than one property. For such cause, legal conflicts between individuals or with the provincial state would appear as inevitable due to presumed real or bad management of the floodgates or defective conservation thereof and/or in favor of the proposed collectors channels, that cause damages to those who were naturally outside the zone of affectation of the river.
- Cities, like for example Roque Perez, would have serious flood problems due to inability to drain the river on account of its level height.

a) Criterion adopted by the DPOH (at the time DIPSOH)

From the considerations described above, and before the conditions of water excess and emergency in which the basin was in 2001, DPOH (at the time DIPSOH), as the competent Provincial Entity, adopted a criterion which combined water-drainage conditions in the northwest of the basin, with the 10 years rise in the Salado River. The alternative of *lateral natural ditches* with overelevated runoffs, proposed by Halcrow in the PMI was rejected, replacing it for an extension of the channel with runoff within a composed section, without overflowings for a Q10-10 recurrence. Throughout the tracing of the global project, different sections with capacities given by passage volumes were

defined, with section variations resulting from it and slopes determined by the characteristics of the morphology of the land, represented in the longitudinal profile of the river.

With this new scenario, the volume of surplus soil product from the extension of the channel section, constituted the main effect to consider. Therefore, the alternative emerged of disposing of the dredged material in some low lying areas of river bordering lands, which were called "*recintos*." This would bring an additional benefit for the zones flooded before, by allowing to transform them into productive or pasture zones. In the design of these *recintos, a* series of environmental premises were contemplated, like their disposition at a maximum distance of 1000 m of the axis of the river, leaving free a parallel strip of land to allow the expansion of the river during flood events, as well as for the maintenance of fluvial/ biological corridor, as well as wetlands contained in that strip. From the technical aspect, the compensation between the extracted volume and the one required to reach a certain land level was taken as an adjustment variable, as well as the existence or not of fencings, and the topographic unevenness.

It was also necessary to find a balance regarding the availability of sites for placing the recintos between both margins of the river, considering that the excavation would be done from each margin of the river.

Likewise, in the design of the works the continuity and horizontal connectivity of the plain was respected, throughout the fluvial corridor, trying not to interrupt natural runoff by existing dells and channels to (or from) the river. This is manifested in the discontinued pattern that the *recintos* zones present throughout the canalization.

EVALUATION OF ENVIRONMENTAL AND SOCIAL IMPACTS OF THE WORKS

From a general perspective, the global canalization project of the Salado River comprises the accomplishment of a set of actions and works whose objective is the management and mitigation of the impact of floods in order to obtain a protection of the cities and infrastructure in its area of influence, offering an opportunity to improve the safety of the populations and economic activities.

The execution of the canalization of the Upper Salado River responds to a declared need of the community to have a set of structural and nonstructural measures that reduce the vulnerability of the main administrative areas of the region (partidos), especially of Roque Perez, Monte, and Lobos as well as the other partidos included in its contribution basin, versus the recurrent problems of water excesses verified in the last few decades.

Below is a summary of the environmental and social impact assessment (ESIA) of the Project works (Upper Salado River-Section IV, Stage 1B) during the construction and operation/functioning phase. This evaluation has been elaborated on the basis of the existing information in the PMI and the one generated in subsequent environmental and social studies, executed at the level of feasibility in the Sub-region B1 and Sub-regions A1, A2 and A3.

This ESIA also considers the *Environmental Management and Natural Resources Plan* that will be developed under component 1 of the Project.

Methodologically, the environmental and social criteria and measures that have been used to identify and to evaluate the environmental impacts and that could be generated with the Project

works, match with what is specified in the PMI , as well as what was proposed in the environmental and social safeguard norms of the World Bank.

The methodology is based on the use of a cause-effect matrix, which follows the qualitative evaluation guidelines contemplated in the Manual of Environmental Management for Hydraulic Works in the PMI. For the qualitative valuation, a calculation procedure with the following attributes was applied:

1. NATURE		**Beneficial +**	**- Detrimental**	X Foreseeable difficult To describe	
2. INTENSITY	*Degree of Affectation*	1 Low	2 Medium	3 High	
3. EXTENSION	*Area of Influence*	a Precise	b Partial	c Extensive	
4. MOMENT WHEN IT TAKES PLACE	*Term of Manifestation*	A Immediate	B Mediate	C Long	
5. PERSISTENCE	*Permanence of the Effect*	1 Temporary	2 Permanent		
6. REVERSIBILITY	*Reconstruction from Natural Processes*	a in the short term	b medium Term	c long Term	d Impossible
7. RECOVERABILITY	*Reconstruction by Human means*	A Mitigable, totally recoverable, immediate	B Mitigable, totally recoverable to medium term	C Partially recoverable	D Non-recoverable

* In the algorithm the sequence is: Nature - Intensity - Extension - Moment at which Persistence takes place - Reversibility of the effect - Recoverability.

The impacts that will take place on natural and anthropic environments during the construction and operation stages of the work were analyzed, and an Environmental and Social Management Plan (ESMP) was elaborated to assure the prevention, mitigation and control of the adverse impacts, as well as to boost positive impacts. The detailed valuation is synthesized in the matrix for the Evaluation of Environmental and Social impact that appears in Annex V (Impacts Matrix) of theESIA.

The approach of the ESIA consisted of two steps:

i) Identification of the impacts from the unitary effects; and
ii) Valuation of the impacts according to different criteria.

Environmental and Social Impacts of the Project Works

When considering the global project on the main course of the Salado River, the EIA for the PMI identified two types of effects with incidence on the natural and human environment: a) those belonging to the construction and the operation of the projected work—the canalization of the Salado River—, and b) the effects that arise due to the projected interventions upstream in the northwest region which indirectly affect the fluvial corridor of the river.

The connectivity of the flood plain of the Upper Salado will function for flood events of the order of 1/10 or greater. The events associated to minor recurrences (i.e. 2 to 5 years) will have connectivity only through the tributaries and existing channels that drain marginal sub-basins or lowlands and "bañados".

The horizontal connectivity of the fluvial corridor will be affected during the construction period, but the environmental diagnosis conducted for the area under study (Section IV, Stage 1B) has indicated the almost absence of areas of high environmental and/or landscape value, at least of national and international recognition. According to the ESIA baseline, due to it is a dominantly rural landscape and significant human influence, there are none or few wild or pristine zones.

The affectation of the fauna of the sector, particularly the birds, is considered negative, but concentrated to the work area and reversible once the work is completed. The species identified for the Project area (mainly present in aquatic environments) do NOT present a vulnerable or threaten status, according to the international categorizations in effect (*Aves Argentinas* and the Secretariat of Environment and sustainable Development of the Nation, 2008). For the group of birds in the basin with a concerning conservation status (species related to pastures)— sheldgoose in critical condition and the meadowlark in danger—, the baseline demonstrates that their preferential habitat is *outside the area of study of this Project*. (Blanco et al, 2008; Gabelli and collaborators, 2004; Secretariat of the environment and sustainable Development of the Nation, 2013).

The canalization will indirectly mean a loss of habitat for the organisms that depend directly or indirectly of the Salado River channel. Nevertheless, this loss is considered to be localized, temporary, and reversible, due to the capacity to restore similar conditions throughout the biological/ fluvial corridor. The biological corridor is considered an environmental asset, as the design incorporates an approach to maintain the biological/fluvial corridor as an element of the landscape to allow for maintaining the area's defining ecological characteristics and environmental services, preserve potential conservation areas, and, to the extent possible, restore the natural habitat of the Pampas grasslands ecosystem.

Aiming to mitigate these impacts, it stands out, in the design of the canalization work, the *maintenance of a low water channel for the ecological volume* that corresponds approximately to the medium annual low water condition, with a permanence of six months. This supposes an optimal operation for the minimum volumes with high probability of occurrence. Its objective is to *guarantee a channeled current with speeds that prevent sedimentation*.

In conclusion, the Project will not cause direct impacts in terms of substantial modifications and/or losses of existing wetlands or in general natural habitats[6] or critical habitats, according to the definition of Operational Policy 4.04 of the WB. In the direct influence area of the works, there are no physical cultural resources identified[7], neither are there areas with recreational uses that could be affected by potential conflicts.

Additionally, there will be impacts related to the movement of workers and equipment whose activities can alter the area's own tasks such as circulation by secondary ways, productive activities related to seedtime and harvests, cattle mobilization, etc. and affect the terrestrial ecosystems (i.e., quality of soil, alteration of wild fauna, riparian vegetation, etc.) and aquatic ecosystems (water quality, biotic diversity). The area occupied by the workshop and deposits implies a generation point of liquid and solid wastes, of domestic nature (organic matter, plastics, paper, glass, etc.) and industrial (i.e., oils, fuel spill). On the other hand, the movement of equipment (excavators, dredges, etc.) and ground, necessary for the dredging works, as well as the construction of enclosures, bridges and accessory works, will generate airborne contamination (i.e., noise, gases, atmospheric dust), compaction of the ground, increase of suspended solids in the water, with the consequent increase of its turbidity and modifications in the aquatic ecosystem, all this in an area adjacent to the activities anticipated during the works.

The ESIA identified that during construction stage diverse positive impacts will be generated, essentially in anthropic means related to job generation, demand and local services, increase of investments, improvement of the infrastructure (roads, bridges, etc.), improvement in the accessibility to the productive rural properties (replacement of bridges), and to the areas of natural cultural interest (landscape, recreational areas, and river beaches) through the maintenance and recovery of the development of recreational and leisure activities, particularly linked to lagoons.

On the negative side, during the construction of the bridges, culverts, as well as other minor works, temporary interruptions of communication pathways will be generated, that can interfere with the normal development of the activities in urban and rural areas (especially at sowing and harvests time). However, the new bridges to be built are designed to confront the new hydraulic situation contemplated by the canalization design, which will offer more safety, accessibility and transitability; than what the region presents at the moment.

Evaluation of Environmental and Social impacts. Analysis of the impact matrices

The negative impacts identified in the construction stage are confined mainly to the natural environment: Modifications or alterations in the normal pattern of water flow will take place as a result of the excavation work in the river bed and surrounding grounds. This will bring about disturbances and losses of existing natural habitats in the river and its margins and will affect soils

[6] Terrestrial and aquatic areas in which i) the biological communities of the ecosystems are to a large extent formed by native vegetal and animal species and ii) the human activity has not substantially modified the fundamental ecological functions of the area.

7 Personal and physical property, places, structures, natural groups of structures, and characteristics and landscapes that have archaeological, paleontological, historical, architectonic, religious, esthetic meaning or, in general terms, cultural. The physical cultural resources can be located in urban or rural zones and to be in the surface or underneath the Earth or of the water. Its cultural interest can be of local, provincial or national reach, or for the international community.

of the flood plain, producing a reduction of edaphic quality of the riparian zone and the associated benthonic micro-fauna. Likewise, during this stage a negative impact on landscaping structure takes place. All these impacts will be localized, temporary impacts and partially reversible in a natural way in a midterm after the completion of the works.

Impacts related to the movement of workers and equipment, the workroom and depots can be prevented or minimized by means of the instrumentation of mitigation measures and a suitable ESMP of the works.

With respect to the anthropic component, effects of net positive nature linked not only to the generation of employment due to the demand of qualified manpower, but also through the generation of induced economic activities like services (commerce, health systems) are evidenced, and improvements on roads and related infrastructure, with the consequent change in productivity and regional economy. On the other hand, the negative impacts on the anthropic environment that could take place during the construction stage, such as the temporary modifications on communication pathways due to the works, or other derivatives of the construction's own tasks, are temporary and their minimization or mitigation is regulated by the corresponding programs of the ESMP of the works, whose fulfillment is mandatory for the contractor.

In order to assure that a good relation takes place with the bordering land-owners to the canalization works and those in whose estates *recintos* are constructed, a protocol of voluntary agreements, mentioned in Section 8, was elaborated. This protocol allows to minimize or mitigate the impacts, if any, and ensure the operation an effective communication system. This protocol is of mandatory compliance for the contractor and the representatives of the DPOH, the entity responsible for the work.

During the functioning or operation of the works, most of the impacts are of positive nature, related to improvements in regional economy, infrastructure, in defense of the urban center against floods, reduction of the risk of loss of farming productivity, etc.

The commissioning of the works will mitigate the negative effects caused by the floods. The improvements will also generate benefits for flows greater than those used for Project design, although in a partial way. It is anticipated that the improvement of the conditions in the zones near the fluvial corridor will generate a positive impact on the active population, and as a consequence of the changes in the entailment conditions and the accessibility to the properties, in vehicle transit and transport in general. All this will translate in rural development promotion.

Indirect and Cumulative Impacts

The indirect and cumulative impacts potentially caused by the canalization works are those related with: i) water quality (sedimentation and turbidity during the construction phase and potential increases of nutrients and fertilizers due to the increase of drainage from agricultural areas); and ii) ichthyofauna affectation (fish's populations and fishing quality). However, the contribution of this project works to those global impacts cannot be considered as significant. In the first place, the extent of the canalization works of this project is small (33 km.) in relation to the total length of the Salado River (640 km.) and the previously channeled river sections located downstream (477 km.). Secondly, the turbidity sediment load in the river will be temporal (only in the construction phase), localized and reversible. Third, as a consequence of the filling soil disposal, it has been estimated that the land located along the river corridor will be beneficiated, with better conditions for

agriculture. Although the recovery of marginal lands could potentially contribute to increases in the concentration of nutrients, fertilizers and salts concentration as a consequence of the increased agrarian activities, the effect would be minimal due to the small area of soil that is going to be recovered (estimated in approximately 24 km^2)[8] in relation to the River Basin size (170,000 km^2).

On the other hand, it should also be emphasized that since the pre-feasibility project phase a number of measures and actions aimed at decreasing those indirect and cumulative impacts have been included. For instance, the design of mechanisms regulating incoming and outgoing water flows in the subregion 1 (the region where the project is located); this will facilitate the maintenance of the ecological and recreational river services and the decrease of flooding risks and of downstream pollution by nutrients and fertilizers.

Finally, it should be highlighted that the *Environmental and Natural Resources Management Plan* of the Salado River Basin (Component 1) will entail a number of initiatives such as an Environmental Monitoring Program at the River Basin level, initiatives for promoting sustainable soil and land use management practices and proposals for the promotion of sustainable management of fisheries (See Section 8).

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This section presents a summary of the basic guidelines for the development of an Environmental and Social Management Plan (ESMP) that includes the set of institutional and mitigation measures and monitoring targets to: a) prevent, mitigate, repair and/or compensate adverse environmental and social impacts caused by Project's works execution; and b) improve and strengthen the quality of the basin's wetlands under environmental risk. The implementation of the ESMP is fundamental to assure the sustainable use of natural resources involved in the Project and the protection of the environment, including both the aspects that have to do with the integrity of the natural environment and those that assure a suitable quality of life for the community involved. The ESMP includes the actions necessary to put these measures into practice.

The activities are scheduled for the work's lifespan, reason why the programs required for the good management of the environmental and social system will be incorporated, both in the construction stage and in operation and maintenance. The ESMP also includes a summary of criteria and environmental and geomorphological measures that were included in the design of the works, whose function is to prevent and reduce potential adverse impacts on natural and anthropic ecosystems. On the other hand, it is possible to indicate that the programs and measures offered for the operation and maintenance phase of these works, will be implemented within the framework of the *Environmental and Natural Resources Management Plan* that will be developed under the component: 'comprehensive management of water resources for the Salado River' of the Project. As was mentioned previously, the Project will also identify non-structural actions necessary to develop a IWRM of the Salado River, which implies developing institutional capacities to manage the resource, with a holistic, viable and participating vision (with all the actors having interests in the basin).

Adequate environmental and social management contributes to the works performance and the reduction of its global costs: minimizing unexpected events, attenuating future conflicts and

[8] This is a preliminary figure that will be adjusted with the detailed design of 'recintos'

concurring to the articulation of the work and the environment and social, within the framework of a comprehensive use (integrated management).

The ESMP will contain detailed information about i) the institutional framework and general guidelines for environmental and social management of the work; ii) the measures proposed to prevent, mitigate, remedy and compensate adverse impacts (both for hydraulic works and for complementary works); iii) monitoring plans; IV) programming and costs. In addition, it will present a series of basic recommendations and guidelines for the design of the E*nvironmental Management Plan and Uses of Natural Resources, for the Salado river basin.*

Table 2 summarizes the measures proposed for the construction and operation phases as well as the agent responsible for its implementation.

Works Stage	*Measure*	*Responsible*
CONSTRUCTION		
Before the beginning of works	*Process works permits, authorizations, and other institutional arrangements* *Make agreements with land owners following the protocol for voluntary agreements* *Plan soil movements* *Define areas for works installations* *Define the responsible people for the supervision and implementation of the ESMP* *Implement the communication with the community* *Design and implement a training program*	*DPOH and Contractor*
During construction	*Making sure health and security condition for workers are in place* *Minimize disruptions with activities in the area* *Minimize potential contamination* *Minimize disruptions with fauna* *Minimize negative effects on cultural heritage* *Implement precautionary measures to avoid accidents* *Implement the communications with the community (including the grievance mechanism)*	*DPOH and Contractor*
After works finalization	*Repair any damages to the natural conditions of the site* *Repair any damages to the original infrastructure*	
OPERATION		
Operation and functioning	*Maintain the river channel, bridges, and complementary works* *Implement the Environmental Management Plan and Uses of Natural Resources* *Implement the Environmental Monitoring Plan*	*DPOH*

Table 2 - Summary of Measures for the construction and operation phases of the work

Below is a synthesis of the main ESMP programs of the works, these programs should be complemented with other that arise from the monitoring or other management procedures and that are considered important to include. The contractor company, responsible for the works, will prepare a detailed version of the ESMP at the beginning of its contract.

1. Social-economic and cultural programs

1.1. Agreements with owners according to the protocol on voluntary agreements
1.2. Sub-program for dissemination, participation and claims
1.3. Sub-program for monitoring of transit ordering systems (preparation and construction)
1.4. Sub-program for Attenuation of disruptions to public services and infrastructure
1.5. Sub-program of physical cultural resources

2. Environmental programs

1.1. Management of soil and vegetation in *recintos*
1.2. Management and disposal of waste (domiciliary, construction, special wastes), and especial effluents (sewage, sanitary, fuels, lubricants and hydraulic fluids)
1.3. Water quality: surface and underground
1.4. Air quality : noise, particulate material, gases and vapors
1.5. Management of fauna and flora

3. Other programs that the contractor must prepare and submit

1.1. Safety Program (first aid training, personal protection and fires elements)
1.2. Environmental training
1.3. Management of contingencies (emergencies) that include among others: fuel spills, fire control, floods, alert system, dissemination and training, manual of works management.
1.4. Environmental Monitoring

The costs estimated for the environmental and social component in the preparation and construction stages of Project works total **(ARS 5,000,000.00) (US$ 319,488.82).**

General guidelines for an integrated environmental management in the basin

In order to effectively manage these aspects, the *Environmental Management Plan and Uses of Natural Resources* must be designed with a regional strategy approach for the use and conservation of natural resources and environmental services (currently or potentially provided by the ecosystems) of the Hydrographic basin of the Salado River. The scope of an appropriate management is related to their utility in the context of the measures proposed in the PMI, reason why it must include:

- A regional scale;
- A vision of the hydrographic basin, that includes all the areas that naturally or artificially drain towards the Salado River;
- A comprehensive management approach, with consideration of both the biophysical component and socioeconomic and institutional, tending to guarantee the use and conservation of all the natural resources existing in the basin; and
- A concept of ecological system, in which natural resources and other environmental services of the region are intimately related to others by means of ecological functions such as biogeochemical cycles, productivity and decomposition, succession and regulation.

On the other hand, it should be noted that the preparation of the *Environmental and Natural*

Resources Management Plan of the basin must be a ***participative process*** where local and regional agents are consulted about the scope and content of the plan. This process must include consultations with the competent organisms to determine the existence and location of indigenous communities in the basin and based on that, establish the most suitable consultation and participation procedures, according to the operational policy of the WB on indigenous peoples (OP 4.10), to assure that their needs and concerns are contemplated in the measures and activities of the Plan. In addition, the different participation instances carried out as part of the Plan elaboration, must contemplate the issue of gender to assure the adequate participation of all the sectors.

The main measures and proposals to be designed under the *Environmental and Natural Resources Management Plan* must be focused to institutional strengthening and training of environmental management. In general, the development of the following is expected:

- Measures aiming to create an organizational structure;
- Training programs to reach environmental sustainability through the environmental awareness among decision makers and land owners; and
- Specific environmental management and natural resources use measures.

Regarding specific environmental management and natural resources use measures, the PMI identified a broad range of measures and programs designed to strengthen the existing capacity for the sustainable environment and natural resources management. The objectives of these measures are those of protection, environmental management and sustainability, in addition, to the achievement of ample environmental benefits through better land use practices, integrated management of natural resources, and organizational restructuring. These measures proposed in the PMI include:

- Management of wetlands and flooding plains
- Farming guidelines for environmental protection
- Ordering fishing resources in the Salado River basin
- Strengthening control and administration of continental fishing in the Province of Buenos Aires
- Integrated Natural Resources Management Program
- Analysis and environmental monitoring plan

These measures should be considered as a start and reference point for the design of the *Environmental and Natural Resources Management Plan*. The costs for the elaboration of the Environmental and Natural Resources Management Plan total **ARS 40,694,880 pesos (US$ 2,616,958).**

9. PUBLIC PARTICIPATION

In the framework of the PMI and in regarding the works of the Salado River, there have been different participation instances that allowed the inclusion of community concerns to the global project. In the case of the PMI, the results of that interaction with representatives of the academic sector and nongovernmental organizations (NGO) relevant to the basin, fed the formulation of the different projects. As far as works of Section IV, Stage 1B, a public meeting (summoned by the Provincial Ministry of Infrastructure) was carried out on September 27, 2016 in the city of Roque

Perez, Province of Buenos Aires. In the meeting, the community was informed about the characteristics of the works. The concerns and questions of the participants were received, responded and, when feasible – as was the case of the proposals for the improvement of recreational beaches existing in the area, or the interest in the physical cultural resources program- these items were incorporated in the Project.

Finally, in order to allow for the continuation of community participation during the different stages of the Project the ESMP foresee communication actions for each works stage, and includes a Dissemination, Participation and Claims Attention program.

10. CONCLUSIONS

This document has presented a summary of the evaluation of the environmental and social consequences of the design, construction and operation of the works of the Integrated Management Project of the Salado River basin, to be funded by the World Bank; expansion of the Salado River channel, Section IV, Stage 1B, corresponding to the B1 Sub-region of the PMI.

The results of this evaluation indicate that the environmental and social criteria and measures that have been used to define each one of the components and activities that conform the global project works coincide, in general, with what appears specified in the PMI (1999). On the other hand, according to what is presented in Section 1.3 and Chapter V of ESIE Report, the criteria and measures of the PMI remain valid, and at the level of the structural works executed to date, they have shown to be functional.

Likewise, the re-adaptation of technical and environmental criteria performed under the analysis of alternatives, done as part of the global project, has allowed to incorporate environmental guidelines in the design of the works. Particularly, the design of the river section (with ledges) that allow to conserve a minimum flow during low water levels, the development of the fluvial/biological corridor (as a design measure to increase the added environmental value), and the *Recintos*. As well, nonstructural measures have been incorporated such as the development of communication and social dissemination mechanisms; instances of participation (public hearing) and definition of an Environmental and Social Management Plan (ESMP) of works. Until now, the ESMPs have rendered a good result in the field. It must be mentioned that the ESMP of the Project's works complies with the WB's applicable safeguards.

The main impacts of both the global project and evaluated works can be summarized in:

- ✓ Reduction of the floods frequency due to the increase of drainage capacity.
- ✓ Maximization of ecological and recreational benefits through: the design of the river section— with environmental and geomorphological criteria—, the maintenance of a biological corridor on both river margins, and the selection criteria for sites for soil disposal (*recintos)*, reducing loss of wetlands of interest in the region.
- ✓ Change in the soil condition that will favor the development of agricultural and cattle breeding activities in the sector.

During the construction stage, it was identified that diverse positive impacts will be generated in the anthropic environment: jobs generation and increase in local services demand, investments increase, improvements of the infrastructure and, in accessibility to productive rural properties. Social negative impacts in terms of temporary interruptions of the road transit will be manageable due to the implementation of the ESMP.

In order to ensure a good relation with land owners in the vicinity of the works, and with those in whose estates *recintos* will be built, there is a protocol of voluntary agreements (see Section 8) that will allow reducing or mitigating any negative impacts, if any, in a suitable manner. This protocol ensures the operation of an effective communication system. The protocol will be of mandatory compliance for the contractor and the DPOH representatives.

Regarding environmental impacts, the Project will not cause direct impacts in terms of substantial modifications and/or losses of existing wetlands or in general to natural habitats or critical habitats, according to the definition of the Operational Policy 4.04 of the WB. In the direct influence area of the works, there are no physical cultural resources identified either, neither areas with recreational uses that could be affected by potential conflicts.

The indirect and cumulative impacts potentially caused by the canalization works are those related to water quality and ichthyofauna affectation (fish's populations and fishing quality). However, this study demonstrates that the contribution of this project works to these global impacts cannot be considered as significant.

In order to minimize identified negative environmental and social impacts and to ensure a good management of the environmental and social system, diverse mitigation measures have been considered and developed to be implemented during the construction and operation phases of the development of the Project, these measures are incorporated to the proposed ESMP included in this evaluation. This ESMP also includes a summary of criteria, and environmental and geomorphological measures that were included in the works design, whose function is to prevent and reduce potential adverse impacts on natural and anthropic ecosystems. The contracting company responsible for the works will prepare a detailed version of the ESMP at the beginning of its contract.

In order to generate information that allows an efficient operation of the system and a control of environmental impacts concerning the basin, it is possible to emphasize that Component 1 includes, for the first time, financing for nonstructural measures to enable a IWRM at the river basin level. Component 1 will include the elaboration of the *Environmental and Natural Resources Management Plan* to design programs oriented to the generation of hydrologic and environmental information of terrestrial and specific aquatic ecosystems. These programs would be carried out within the frame of guidelines for: wetlands management; sustainable farming practices; sustainable management of fisheries; strengthening of control and management capacities of fishing resources; all of them key input for the sustainable use and conservation of natural resources and other environmental services provided currently or potentially by the ecosystems of the Salado River Hydrographic basin.

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