DEFINING ENVIRONMENTAL IMPACT ASSESSMENT FOR THE CONSTRUCTION OF THE SND ARENA

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Abstract - It was challenging to evaluate the environmental impact for the construction of the SND Arena, specially because we had to do in a very short period of time in April 2017. Such a building with modern concepts as light and heavy construction, and all the technological equipment for sports today. Main disciplines such as basketball, volleyball, handball, futsal FIFA, tennis, martial arts and other indoor activities. The modern concept of placement of a stadium for 10.000 people and all the surroundings, including parking areas, fire prevention system, and considering the building technology with the least negative impact on the ecosystem of the selected place, the minimum changes to the original stadium with a capacity of 6,000 spectators, and the modernization of the Stadium were all defying because it involved 15 Hectares of buildings and green areas, with a weak ecosystem. The final SND Arena will be about 8,000 square meters but it also includes other outdoor sports areas for football, athletics´ pitch, hotel for sports delegations, Sports Faculty and an Area for Education Faculty near a main Route for entrance and exit of Asunción, capital city of Paraguay. The modern stadium was opened in August 2018.

Keywords - Ecosystem, Main Concepts, Modern Building, Sports Arena.

I. INTRODUCTION

The project is titled: Extension Stadium of SecretaríaNacional de Deportes, locatedin a 15 Hectares land with the front part on Eusebio Ayala Street Km 4,5 at the city of Asunción, Paraguay.Planned extension will consist of two grades for 7,000 seated persons (3,500 persons on each) at the ends where the basketball bows and hoops area is.

II. PROCEDURE FOR PAPER SUBMISSION

A. Property data

Catastral reference: 14.1974.7; Land.s surface; 15 Hectares; Built surface: 4,349 m2; Surface to be built: 3,759 m2. Part of the project occupied by grass, gardens, landscaping, tracks and internal roads of the SecretaríaNacional de Deportes (From now on SND): more than 25% of the ground belonging to the SND.

B. Project Desciption

The Sports Center now has a capacity for approximately 3,000 seated persons and to access to it, it now has: Internal paved street; Rain water flow and due to runoff is controlled by a system of storm drain; Sewerage is connected to the sewerage system that ESSAP has in Asunción and the corresponding adjustments will be made for the new requirements of this extension; Detection and fight against fires. It is presently in the process of presentation to the Municipality of Asunción under previous technical study; Within the real estate several structures exist such as the Hotel named “DeportistaRoga” (Athlete´s House), SND offices, Athletic Track, field football fields, Swiss type football fields with synthetic grass; Children{s park and The surface to intervene would be the Sports Center that presently has 4,349 covered square meters and 3,759 square meters more are projected, the stadium totalizing 8,108 m2 of covered surface.Construction: After proceedings at the Municipality of Asunción have been concluded construction work of the extension of the Sports Center of the SecretaríaNacional de Deportes will begin, having planned drainage of the channel, internal streets, perimeter wall, complementary works, gardening, and proximity to neighboring lands, besides security at work and adjacent areas. [10], [11].



Fig. 1.Zone of Direct Impact [12].

III. LEGAL FRAMEWORK

Accordint to the Constituion and Paraguayan Laws the Envirnomental Impact Assesstment it has to be done before any project is made.

Article 7– Of the Right to a HealthyEnvirnoment.Every person has the right to live in a healthy and ecologically balanced environment. Priority objectives of social interest are preservation, recomposition and improvement of the environment as well as its conciliation with integral human development. These purposes will orientate legislation and pertinent government policy.

Article 8-Of Environmental Protection. Activities susceptible to produce environmental alteration will be regulated by law. In the same manner, the law will

be able to restrain or prohibit those activities considered dangerous….The ecological crime will be defined and sanctioned by law. All damage to environment will amount to the obligation to recompose and compensate.

Article 38– Of the Right to Defense of Difusse Interests. Every person has the right, individually or collectively, to demand to the public authorities measures for the defense of the environment, habitat integrity, public health, national cultural heritage, consumer interests and others which, because of their legal nature, belong to community and are related with quality of life and collective heritage.

LAW 1561/00– National System of the Environment; LAW 294-Environmental Impact Assessment, and its Modification Law 345/94; LAW 716/95–That Sanctions Environmental Crimes; LAW 3956/09–Integral Managament Plans of Solid Wast in the Republic of Paraguay;LAW 1160/97–Penal Code, and otherDecrees, Resolutions and Regulations. Such as Duties of people, containers, air pollution, etc. [6]

According to Article 84 of the National Constitution the National Sports Secretariat, from now on SND, will be in charge of the implementation and regulation of the Sports Law for which purpose it must present a National Sports Policy, promote sports culture and practice in all its fields. Educational Sport, Participation Sport and Performance Sport with the object of improving quality of life and health of the population besides assigning resources to sports activities and supervising sports entities throughout the national territory.

LAW 1100/97 – Prevention of Noise Polution.

Area and time of the day	Night 20:00 to 7:00 hs	Day 7:00 to 20:00 hs	Day (Occasional Peak) 7:00 to12:00 and 14:00 to 19:00
	Measurements in decibels "A" – db (a) 20-40		
Residential areas, areas for specific use, public spaces, recreation areas, parks and public roads	45	60	80
Mixed areas, transition zones, urban centers, of specific programs, service zones and public buildings	35	70	85

Table 1.Noise pollution normative.

IV. DESCRIPTION OF THE PROJECT DEVELOPMENT

A. Land Preparation

Before initiating works, the Company, within the land limits, will proceed to the total cleaning and clearing of the ground with the adequate pertinent equipment, removing all waste, weeds and plants it there are any. The Contractor will also adopt the necessary previsions for the correct preservation of trees and weeds which want to be kept. The Company will measure the perimeter and angles of the ground in order to verify its measurements. Any difference will be informed to the Construction Management before works are initiated. Perimeter fence must be composed of metallic pipe modules and painted sheet metal enclosure.

B. Perimeter enclosure, power and lightning

The Contractor must close the perimeter of the work with a 1,80mt. high fence, in accordance to requirements of the Building Code of the Municipality of Asunción and is obliged to maintain these fences on his own account and in perfect state of conservation. If works are done at night hours or in work areas without natural lighting, the Contractor will provide the possible illumination to personnel in general for the normal development of the works. Consumption of power for the execution of the work as well as for illumination, which is dealt with in previous indent, will be borne by the Contractor who will also take care of the laying of the provisional lines with adjustment to the technical requirements regulated for such installations.

C. Temporary constructions

Taking in account the needs of the work, the contractor will present the design, characteristics and any other element that allows Construction management to have a complete knowledge in order to approve these. They must be approved previous to the execution of all the temporary constructions for workshop, among these the construction of an adequate personnel bathroom must be included, other areas of the work not fit for this purpose will not be allowed to be used. Water will be appropiate for the execution of the work.

D. Cleaning at work

It is established that since the beginning of works, the Contractor will be responsible for the cleaning and preparation of areas affected by the works. Work Management will be entitled to demand, if they believe it to be convenient, the intensification of periodic cleanings. The loading and unloading of materials will be done through a single access to the workshop, the Contractor having to arbitrate the means to keep these areas perfectly clean. Materials, before and after downloads must be stored in planned places in common agreement with Work Management and if possible in metal sheet and/or wood containers.



Fig 2. Stadium demolished partially for the extension as Arena, during construction.

E. Sample section

In order to agree in reality with absolute precision the degree of perfection, completion, quality of materials and workmanship which is expected to be obtained in the execution of exposed and plastered masonry as well as to establish constructive techniques, the Contractor is obliged to execute a 1.50 m high by 2.00 m wide section of the complete work as sample, The section of work that must be executed will be determined by Work Management. If the grade of perfection obtained in the sample section is not satisfactory, to the Management´s sole judgement, the Contractor must repeat at his expense until obtaining samples that are accepted. The accepted samples will be maintained during the working period, unless otherwise indicated and will serve as permanent contrast to the effect of deciding each time in an unappealable form by comparing with the successive sections of the work built, if these adjust to desired perfection and finishings. If this is not attained, the Contractor will perform at his exclusive expense all the works that are necessary to improve constructive techniques and finishings. The degree of rejection that the badly executed sections of work may be liable to may reach to the point of ordering the Contractor their demolition and reconstruction at his own entire expense. The Contractor will maintain during the course of work the day and night personnel in charge of control tasks and custody of elements deposited in the work, whether they be or not the Contractor´s property.



Fig. 3. Another view of the construction

F. Occupation

After execution of work it will be open to public provided that good practice and internal regulation of SND are respected.

G. Project closure

An useful life of Stadium components of 100 years in projected. When this period is done the period of hability will be closed.

V. BASELINE

The project site is considered Direct Area of influence and the neighbourhoodHipódromowhere the project is established is considered as Indirect Influence Area.

A. Physical Environment

Topography: The ground has a good grade of approximately 2% towards Eusebio Ayala Route

Hydrography: Underground: Water table foreseen in Soils study. The presence of ground water could change depending on rainfall regime. Superficial: A temporary water course formed during important rains runs through a channel conveniently located on the ground which serves as drain to the upper basin. The project field is located in a relatively high area with respect to the zone and the simple concrete floor to be demolished is exactly on the place where the Extension will be built where it drains towards Eusebio Ayala Route and from there by the pavements with grades and storm drains.

Soil: On the surface, up to 2 meters deep, the soil is brown sandy clay, from 2 to 3 m. it is yellowish sandy clay with gravel, at 3.30 m. it is very compact sand. Ground- water level weak at 2.5 m deep.

Climate:Tropical climate with dry season. Average annual rainfall go from 1400 to 1500 mm. average annual temperature from 23º C, with a daily amplitude (difference between minimum and maximum temperatures) of up to 10º C. During the spring and summer months (October and February) temperatures higher than 40º C can be registered with humidity levels up to 90%. Main rainfall are also registered during these months.[9]

Air: When entering the property vehicle gases should not be darker than municipal standard.

Sound Pollution:Loud noises according to dB of intensity will adjust to Regulation of Access and Entrance to the surroundings and parking of the sports center.

Landscape: The landscape surrounding the property in the back corresponds to an urban and residential

area and towards Eusebio Ayala Route to a commercial area which has concrete pavement and public lighting. In the surroundings of the project there is a large green area with medium size native trees and ornamental shrubs which will not be intervened and will be respected during the work. There are also well kept pastures which will suffer some degradation during the execution of the work but their reposition will be considered (parking area).

B. Biotic Medium:

Flora: The property has low vegetation of several types of very little density. There are some low bushes. There are also very well maintained pastures of several types which will suffer some degradation during execution of work which will be considered. The biotic medium which the SND property has is weak but well taken care of thanks to the environmental policy which is being elaborated by SND.

Fauna: No animals are seen inside the property. It is probable that domestic animals will eventually enter the property or birds will stop there. It is also possible that some birds will nest in the trees in certain periods of the year. Batrachians like toads and frogs find an auspicious environment in the immediate vicinity.

C. Anthropic Medium

Area is commercial towards the north and residential towards the southeast and east, where there are single family homes which have drinking water from ESSAP (the water company), sewage system with channels that conduct rainwater. Among visitors, students, officials around 920 to 1000 persons enter the property each day.

VI. IDENTIFICATION OF ENVIRONMENTAL IMPACT

A. During the construction:

About the air: machinery combustion gases (carbon monoxide, carbon dioxide, sulfur), particulate material in suspension (powder) generated by the transit of machinery, demolition of simple and reinforced concrete and for excavation and movement of soil, in addition to that generated during the execution of masonry works due to the wind on the loose materials.

Sound: produced by machinery for soil movement, transportation of materials, machinery for drilling piles, mixers and pumps for loading concrete into formwork. Cutting machines (grinders, electric saws, etc.)

About biotic medium: change in land use, of existing perimeter street to bleachers and facilities as shown in plans presented together to the Municipality of Asuncipn.

About Water system: runoff coefficient without alteration. Exterior works include an improvement of the parking area which will not affect considerably due to the system of rain evacuation which the SND has.

About the soil: could be contaminatedbyspills of oil or fuel from machinery or chemical additives used for construction. There could be drag of soil materials on internal streets to be controlled by cleaning during the work and the protective perimeter fence. Eventual loss of minor vegetation or grassland.Weak water level at 2.5 m depth. Recommendation: Study of soils, found at 5 m., carrying capacity per pile 30 tons.

Generation of waste during construction: such as debris, pieces of rods, pieces of wood formwork, cement bags, bags of other packaged products, paint cans, plastic buckets as well as bags, bottles, left overs, papers and others.

Generation of efluents during construction: sewage effluents will be generated by the use of toilets and the cleaning of the construction personnel.

Employment generation: Project execution will generate employment in a direct way for an important number of workers of different jobs and in an indirect way to employees of companies supplying construction products, etc.

B. During the occupation period:

About air: Internal vehicular traffic will generate combustion gases (carbon monoxide, carbon dioxide).

Water System:The operationof the two drainage channels works as an adequate storm drain.

Soil: Use with anthropic landscaping maintained by gardeners, supervised by Agronomist, forest people in charge of SND´s environment.

Local temperature: Modification of environment with large built surfaces paved with materials with high thermic inertia and heat capacity may generate heat island effect during day and night [1]

Generation of solid waste: during the period of use of the arena solid domestic waste will be generated. Bad handling of these can cause unpleasant odours and attract the presence of vectors which should be foreseen.

Effluent Generation: During the period of occupation of households effluents that will go to ESSAP's sewage system will be generated.

VII. ENVIRONMENTAL MANAGEMENT PLAN

A. Mitigation of Impacts

The objectives of the following plan are to mitigate, prevent and control negative environmental and social impacts associated with the construction and operation of the project and also promote enhancement of positive environmental and social impacts of the project ensuring a good relationship with the community settled in the area of influence of the project.

During the construction

About air: The following mitigation measures are recommended:

a. to have irrigating trucks in case much dust is generated.
b. In case of work next to neighbouring properties it must be done during working hours and not resting hours in order not to disturb neighbours.
c. Use tarps to cover the load of the trucks.
d. With respect to combustion gases, since the construction is a temporary activity a significant contribution of these is not expected, however, vehicles and machinery must be in perfect maintenance conditions in order to avoid excessive emission of gases.
e. Avoid performing lime shutdown. In case it is necessary this work should not be done next to neighbours.
f. Poor disposal of solid waste will generate unpleasant odours, for this reason a solid waste collection system must be available that fulfills the following recommendation: First, waste must be classified in two general categories: recycable and non recycable. Recycable waste can be: debris, wood, rod cut, and all other material that can be reused. Non-recycable waste are: miscellaneous wastes, cardboard and plastic packaging of building materials, tree branches, waste of construction personnel, bags, etc. For both types of waste a work removal service will be available, previously having a place and convenient form of collection on site. For the case of recyclable waste an adequate place must be available on site where personnel do not transit, where it does not hinder the passage of machinery and equipment and cannot be washed away by rain and is easily accessible for the final retreat. For the case of non-recycable waste it must be done in containers to be removed from the site. As for cementitious building dust, they must be far from the rest of the facilities and neighbourhood by means of perimeter fence as required by the Municiipality of Asunción. h) Prohibit the practice of burning as a waste disposal method.i) A deficit effluent evacuation system may produce bad odours in the ambient, it is therefore recommended to use adequate existing sanitary services for personnel´s needs. These must be at all times be kept clean. Prohibit the evacuation of excreta and others in a field outside the sanitary facilities.

Sound Mitigation measures proposed are:

a. Carry out construction works during the day and not later than 6 p.m.
b. Avoid piloting machinery that produces excessive noise and vibrations such as the Strauss system. An alternative could be rotary piloting systems.
c. Avoid the uncontrolled use of horns of vehicles that enter and leave the premises with materials and debris.
d. Special isolated enclosures must be arranged for cutting site with electric saws of formwork boards, ceramics for floor and others. The operator in charge of cutting work must have all the necessary equipment for this work (mask and ear protector), and the cutting equipment should be provided with security mechanisms.
   e) Those responsible for the work must provide workers with the necessary hearing protection equipment in case noise generated by the work exceeds the limit of 85 dBA.
e. Perimeter fence will keep the noise far from persons so as to avoid that they be affected by it.

About biotic medium:Alteration of minimum green areas, restore green area after construction. Alteration of soil interactions with other components of the biome. Change of function. As mitigation measure it is recommended to allocate certain surfaces of the property to green areas. Also, minimize the number of trees to be affected by the project.

Another item to consider about impact that can be produced to biotic medium is that a bad sanitary facility attracts the fauna that becomes sanitary vector, therefore it is recommended that adequate sanitary services be incorporated for the needs of working personnel, prohibit the evacuation of excreta and others in a field other than sanitary facilities, establish storage points for solid waste in sealed containers and with lids, have a waste collection service to withdraw it periodically avoiding excessive accumulation and fumigate.

About water system:

Affectation to water system and the study of its behaviour are foreseen in what already exists and according to technical specifications it is recommended:

a) Arrange as many green areas as possible in the project (grass) in order to minimize the increase of flow that drains superficially.
b) Have a filtering pavement (ecological) in the internal street specially in what regards pedestrian pavement.
c) The hydraulic design of conduction structures must be such that they have the capacity to drain design flows of major storms for a recurrence time of 10 years.
d) It must also be verified by means of hydraulic models that the flows discharged to Eusebio Ayala Route do not cause unnecessary torrents and flood the area, i.e., that they do not surpass the level of the cord of sidewalks in such a way that they might put neigbouring constructions at risk of flood. The influence will be minimal since the extension area presently has concrete pavements which will be removed to give place to the Sports Center (Arena) expansion.
e) Anticipate, if necessary, during the construction of laminar flow hydraulic discharge devices, increasing the hydraulic section to decrease the output speed.

About the soil: The mixture of natural soil with construction materials produces its contamination As a mitigation measure it is recommended: To establish the specific sites where materials will be arranged in a way that a minimum area is affected. It is recommended to incorporate adequate sanitary services for the working personnel´s needs and that they be kept clean at all moment A site must be established for waste storage and there must be a service of removal and final disposal of construction waste in containers suitable to be removed from the work and reused as debris differentiating it from solid waste from the functioning of the entire institution. The fluid cement powders will temporarily affect the work and will remain within the convenient perimeter

fence of about 30 m away from the work so that workers may work easily without interruptions and the people who normally go to the place do not stop by the construction site.

About the landscape: The incorrect storage or disposal of solid waste could alter the landscape. It is recommended to manage solid waste sustainably. Accumulation of large volumes of soil could also alter landscape it is therefore recommended to perform soils movement working by layers either for filling or clearing, avoiding excessive accumulation. The clearing and accumulation of plant material also alters the landscape, therefore excessive accumulation must be avoided. Fencing of the entire perimeter of the work must be foreseen throughout the execution stage.

About construction companies: The application of strict safety standards for construction, mandatory use of personal protective equipment for workers and other construction personnel as well as for bosses and visitors must be widely regulated by the Contractor.[2]-[4].

During the occupation period:

About the air: Poor management of solid waste may cause unpleasant odours and attract the presence of vectors, as a mitigation measure it is recommended:

a. To maintain good waste management.
b. To establish In the Contract, with those that make use of the Arena, items about the management of waste, timetables, storage methods and other guidelines.
   c) To have marked trash cans in common areas-
c. To have a conditioned area or with waterproof containers with lids for the storage of waste within the premises.
d. Storage area must be cleaned periodically.
e. Classify waste in case there are persons interested in recycling.
f. Hire an adequate service for waste collection which is enabled for the purpose.

Generation of odours in case of deficiencies in sanitary facilities: Pipes – ventilation pipes. As a mitigation measure it is recommended to carry out maintenance in the sanitary units, registries and pipes. Vehicle flow will be generated on the site as well as combustion gases. To mitigate this it is recommended not to leave the engine running in the parking lot, combustion engines of vehicles must comply with requirements and emission controls of the Municipality of Asunción.

Sound: The presence of inhabitants within the premises may produce annoying noises., the following mitigation measures are proposed and must be included in the regulation of the condominium.

a) Limit the volume of sound equipment in case of events or parties. Limittheschedule of them
b) Se deberá evitar la presencia de vehículos con escape libre o muy ruidosos dentro del condominio. The presence of vehicles with open exhaust or very noisy should be avoided inside the condominium.
c) The use of machines that generate noises or impacts or vibrations in hours of rest should be avoided.

About biotic medium: The most important risk to be avoided refers to proliferation of animals that carry microorganisms that transmit diseases to the entire population, known as vectors, (flies, mosquitoes, rats and cockroaches) that besides food find in solid waste a favourable environment for their reproduction turning into a breeding ground for the transmission of diseases.

As mitigation measure it is recommended:

a) Maintain good waste management within SND´s site , specifically in the Sports Centre (Arena)
b) Perform periodic fumigations where inspection boxes of sewerage are included.
c) Sewerage Inspection boxes must remain closed.

Water System: During the period of occupation the correct functioning of the entire drainage system must be verified. It is recommended:

a) To properly manage the maintenance of pipelines, sinks and inspection boxes Perform preventive maintenance in order to avoid possible obstructions and structural deterioration.
b) Verify that structures that modify the drainage system or that may alter its operation are not built. .
c). The decrease of draining surface inside the property can alter the conditions of surface runoff. It is recommended to maintain green surfaces throughout the lifetime of the project.

Soil: Good solid waste management is recommended, and contamination of the soil by discharging untreated effluents will be avoided maintaining the sanitary system and controlling its proper functioning

About landscape: The incorrect storage or disposal of solid waste could alter the landscape. It is recommended to manage solid waste according to what has already been exposed.. Within the Complex, it is planned to establish expanded parking lots and entry and exit points.

Local Temperature: To avoid local temperature increase by heat island effect the following must be considered: parks with green areas, the use of ecological pavements for the internal road and parking, avoid hydraulic or asphalt concrete pavements or other materials with high levels of emissivity and transmissivity.

Solid waste: the volume of weekly solid waste is 18 m3, an increase of up to 30 m3 is expected.[7],[8].

B. SND´s environmental Policy

Practice of sports at the highest level demands from the institution to adapt to current technologies, the

possibility of reaching more people through sports as a healthy practice and that being man the main subject of the environment take care of it so that generations to come can find the same calm and the same conditions with the environment that exist today. SND´s commitment is twice as much and it is because of this that importance is given to matters such as inclusivity, inclusion of safe ramps and easy access to people with certain disabilities. The Arena is an excellent challenge which has been approached in the most rigorous way possible. [8].

VIII. CONCLUSION

It is necessary at our country to make the environmental impact assesstment for any civil or other projects that involves possible impacts to the environment by law based on International Agreements. So as Institution the Sports Ministry was ahead of others in doing so, before this construction and also for every construction placed at the same property of 15 hectares and with a good and cared natural environment in it.



Fig 4. Civil construction finished inside

REFERENCES

[1] V.Barros, R.Clarke and P.Silva Dias. El cambio climático en la cuenca del Plata. Consejo Nacional de Investigaciones científicas y técnicas. Buenos Aires. Abril, 2008.

[2] J.M.Cogolludo. Manual de Coordinación de Seguridad y Salud en Obras de Construcción. Hispánica Prevención. Cispraxis. Madrid. Abril, 2005.

[3] Ch.F. Hendriks, A.A.Nijkerk and A.E. van Koppen.O Ciclo da Construcao. Editora Universidade de Brasilia, 2007.

[4] F.Jaque R and I. Aguirre de Cárcer. Bases de la Física medioambiental. Ariel Ciencia. Barcelona. Mayo, 2002.

[5] I. Joppert Jr. Fundacoes e contencoes de edificios. Editora Pini. Sao Paulo, 2007.

[6] H.A. Pettit. Legislación de los Recursos Naturales y del Medio Ambiente. Intercontinental Editora. Asunción, 2005.

[7] J.Souza. Sustentabilidadenas obras e nos projetos. Editora Pini. Sao Paulo, 2012.

[8] R.Rojas and T. Zárate. Relatorio de Impacto Ambiental. Ampliación Estadio de la SND. 2017. www.seam.gov.py

[9] Dirección de metereología e Hidrología. Dirección Nacional de Aeropuertos Civiles. 2016. www.meteorologia.gov.py

[10] Planos y Especificaciones técnicas de la obra SND Arena. Secretaría Nacional de Deportes. Asunción.

[11] Secretaría Nacional de Deportes. Asunción. 2016. www.snd.gov.py

[12] Google Earth, 2017.

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