EXECUTIVE SUMMARY

LONDRINA AIRPORT
GOVERNADOR JOSÉ RICHA
SBLO/LDB

November/2020

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INTRODUCTION

The Infrastructure Ministry published, in the Union Official Journal, in the Edition Number 52, on March 18th, 2019, the Public Call Notice 2/2019, with the main goal to select projects, surveys, investigation and technical studies to subsidize the modelling of the concessions for the expansion, exploitation, and maintenance of the following airports:

South Cluster

Curitiba/PR – Afonso Pena;
Foz do Iguaçu/PR – Cataratas;
Navegantes/SC – Ministro Victor Konder;
Londrina/PR – Governador José Richa;
Joinville/SC – Lauro Carneiro de Loyola;
Bacacheri/PR;
Pelotas/RS;
Uruguaiana/RS – Rubem Berta;
Bagé/RS Comandante Gustavo Kraemer.

North Cluster

Manaus/AM – Eduardo Gomes;
Porto Velho/RO – Governador Jorge Teixeira de Oliveira;
Rio Branco/AC – Plácido de Castro;
Cruzeiro do Sul/AC;
Tabatinga/AM;
Tefé/AM;
Boa Vista/RR – Atlas Brasil Cantanhede.

Central Cluster

Goiânia/GO – Santa Genoveva;
São Luís/MA – Marechal Cunha Machado;
Teresina/PI – Senador Petrônio Portella;
Palmas/TO – Brigadeiro Lysias Rodrigues;
Petrolina/PE – Senador Nilo Coelho;
Imperatriz/MA – Prefeito Renato Moreira.

According to the Public Call Notice 2/2019, the Grupo de Consultores em Aeroportos (GCA) presented the following reports for each airport: **Market Reports, Engineering Studies, Environmental Studies and Economic and Financial Evaluation**. Furthermore, it presented a complementary Economic Financial and Evaluation Report, for each Cluster, which aimed the economic financial feasibility assessment of the airports that form the Cluster.

The purpose of the Executive Summary is to present the main arguments, information and conclusions of each one of the Londrina International Airport/PR Governador José Richa – SBLO/LDB report. For a better understanding of the studies, it is recommended the reading of the reports.

1 MARKET REPORT

This section presents a Summary of the Market Report for the **Londrina Airport/PR - Governador José Richa** (IATA LDB or ICAO SBLO), which processed close to 1 million passengers in 23 thousand operations in 2018.

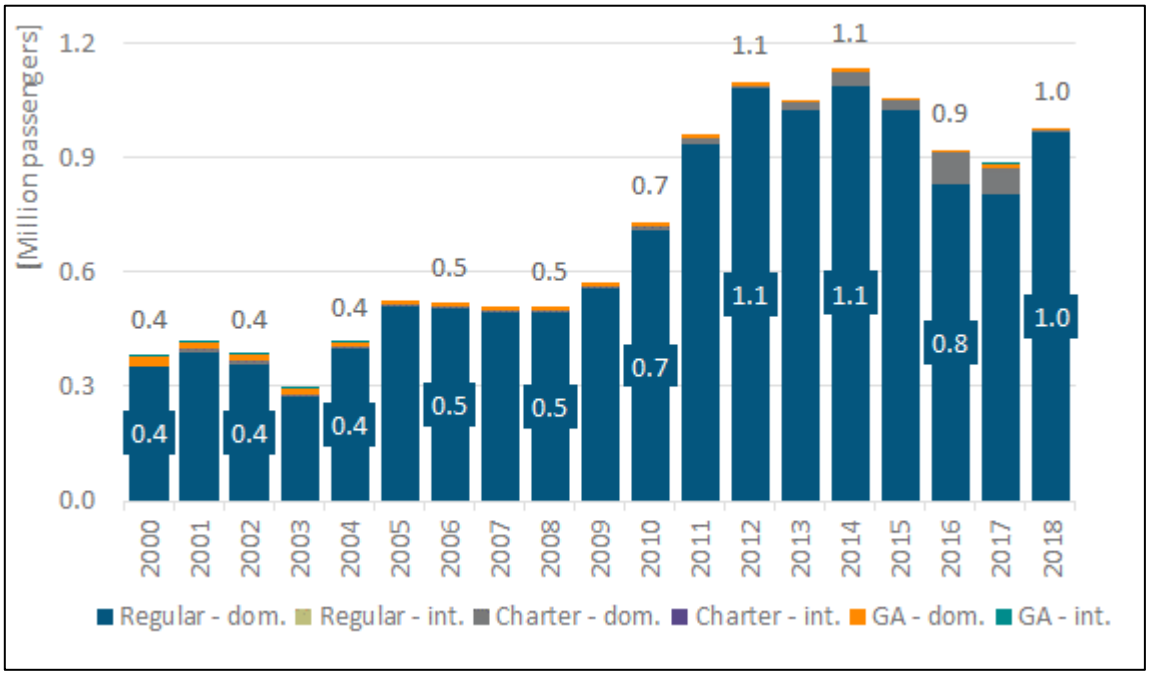
1.1 Overview

The Airport lies in the city of Londrina, the second most populated in the state of Paraná, and distant 381 km from the state capital, Curitiba.

In addition to serving as an important link between the South and Southeast regions of Brazil, Londrina stands out as the main health care hub in Paraná, with benchmark care facilities and industries dedicated to the sector. The region's economy also relies on commerce, farming, and local manufacturing in the metallurgy and food segments, for example.

Metropolitan Londrina is a strong source of demand for airport services and the number of passengers at SBLO tripled from 2000 to 2012, when it hit 1.1 million passengers. Throughout has since then oscillated until 2018, when the Airport processed 1.0 million passengers for an average annual growth rate of 5.4% in 2000-2018.

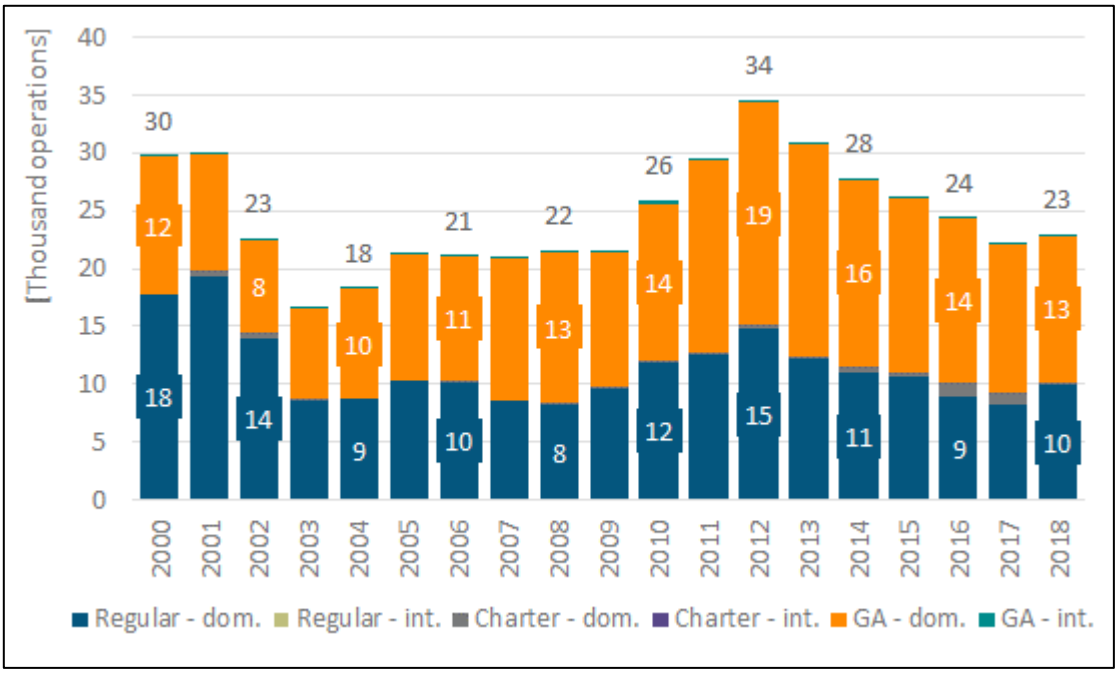
Figure 1-1: Passenger history (origin, destination and connections) for the Airport



Source: Infraero.

The Airport had 23 thousand aircraft operations in 2018, of which 56% were domestic general aviation and 44% were regular domestic flights (Figure 1-2). The drop in total commercial aviation operations seen in 2012-2018 is due to the evolution seen in Figure 1-1 and increased aircraft size.

Figure 1-2: Annual operations history (landings and take-offs) at the Airport



Source: Infraero.

In 2018, the Airport had 6 regular domestic routes[1] connecting with the South, Southeast and Center-West regions of Brazil, as Figure 1-3 shows (line thickness reflects relative route frequency).

[1] Only considers routes with twice-weekly or greater frequency (SBCT, SBCY, SBFL, SBGR, SBKP and SBSP).

Figure 1-3: Map of the Airport's domestic routes in 2018

Source: OAG and ANAC.

Regarding the pandemic impacts, it stands out that the airport continued to receive flights from the essential airline network in March. The demand in March 2020 was 53% of the previous month. However, in April, the airport had its operations completely interrupted.

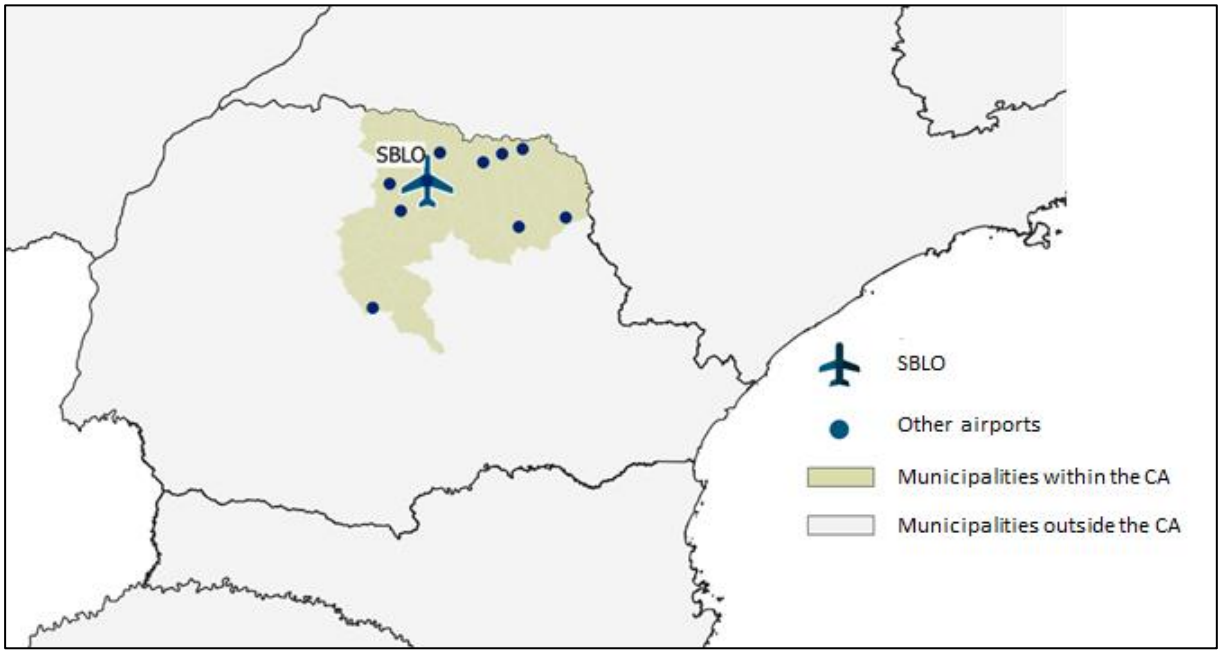
As concerns cargo handling, the Airport processed 2 thousand tons in 2018 in the holds of commercial aircraft.

Catchment area

SBLO's Catchment Area (CA) is defined based on the "City Catchment Areas" ("Regiões de Influência das Cidades" REGIC)[2], study, by the Brazilian Geography and Statistics Institute (IBGE), which comprehensively covers a range of economic and socio-cultural aspects of the population.

According to the REGIC, Londrina lies under the influence of the Metropolis of Curitiba, so that its CA is contained within Curitiba's. Overall, the Londrina CA, shown in Figure 1-4, covers more than 90 municipalities and a total area of 32 thousand square kilometers.

Figure 1-4: Airport CA according to the REGIC



Source: REGIC, ANAC and GCA Consortium.

To forecast the Airport's volumes and demand profile, the CA was adjusted to compatibility with the effective passenger catchment area according to the origins and destinations survey published in the study Brasil Que Voa (BQV), which EPL[3] conducted in 2014.

1.2 Demand forecasts

The Airport's demand has been forecast based on multivariate regression analyses whose parameters have been selected by means of tests with several potential independent variables for each flow analyzed.

1.2.1 Passengers

Commercial aviation passengers

[2] Source: IBGE. Regiões de Influência das Cidades 2007, IBGE, Rio de Janeiro, 2008. The IBGE has published other and more current Urban-Territorial Division studies, but they reference the same hierarchical review of municipalities as produced for the 2007 study, that is, their hierarchy is simplified, but consistent with the one in the 2007 study.
[3] EPL is a Federal-government agency focused on country-wide transportation & logistics planning.

To forecast domestic passengers with origin or destination in the Catchment Area, the study ran regressions using Brazil's GDP and the CA's average fares, adjusting GDP elasticity in the long term based on the passengers-to-per-capita GDP ratio of large countries to reflect the reduction of the marginal propensity to fly as average income increases.

Once domestic demand had been forecast for the CA, compatibility adjustments were made between forecast demand and 2019 volumes and adjustments regarding the COVID-19 pandemic.

Connecting and layover[4] passengers were forecast as function of the Airport's increased airline-network capillarity and domestic connections rate benchmarks. No international passenger flows are expected at SBLO.

General aviation passengers

SBLO's general aviation traffic is significant compared with other airports of similar size. For this segment, one first forecasts total aircraft operations based on several independent variables, such as Industrial GDP and Brazilian fleet (taking into account the effects of the pandemic). Then total passengers are estimated based on usual pax/operation parameters.

Total passengers

Figure 1-5 shows the consolidated results of the above forecasts. Total passengers at SBLO will grow 2.7% p.a. from 2021, the first, and 2050, the final full year of the concession, at which time 2.1 million passengers are expected.

Figure 1-5: Total passengers forecast at the Airport by flow type

Source: GCA Consortium.

[4] Passengers who do not deplane at the Airport and therefore generate no fee revenues.

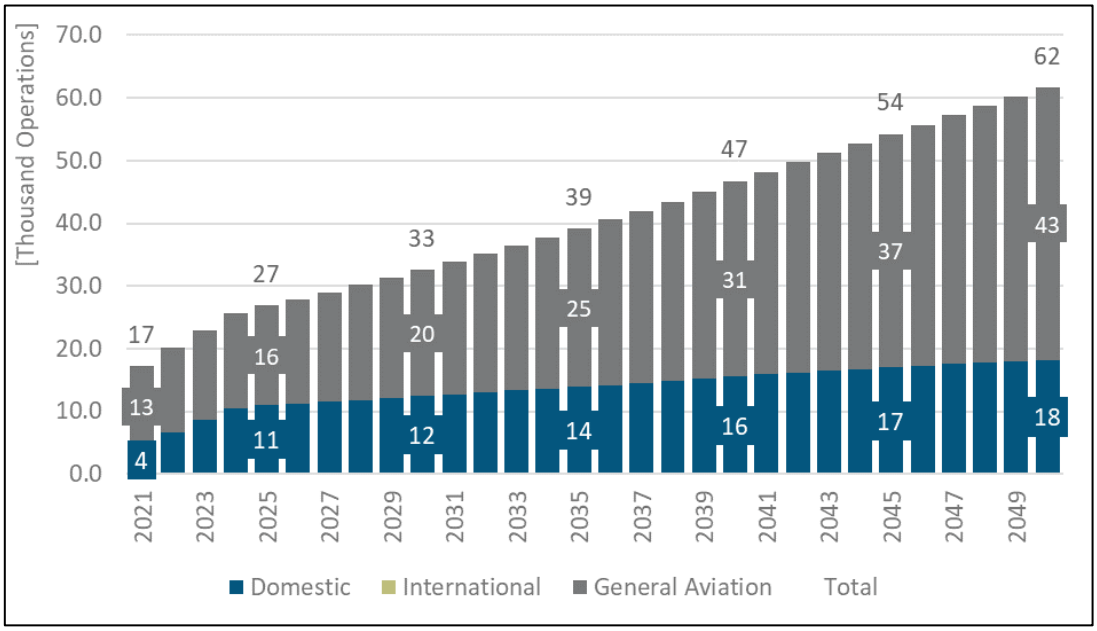
1.2.2 Aircraft operations and airline network

Domestic and international aircraft operations

Commercial aircraft operations were forecast based on passenger flows by origin-destination (OD) pairs, load factor, and aircraft mix, and are related with the evolution of the Airport's airline network. As demand for airport increases, so do flows on existing routes and new routes become justifiable (the triggers for route creation vary according to the distance and allocated aircraft type) – therefore, the mix and number of aircraft evolves in harmony with the forecast airline network.

The study forecasts that in 2050 the Airport will log 18 thousand domestic commercial aviation and 43 thousand general aviation operations, with average annual growth rates of 5.0% and 4.3%, respectively.

Figure 1-6: Total annual Airport operations forecast



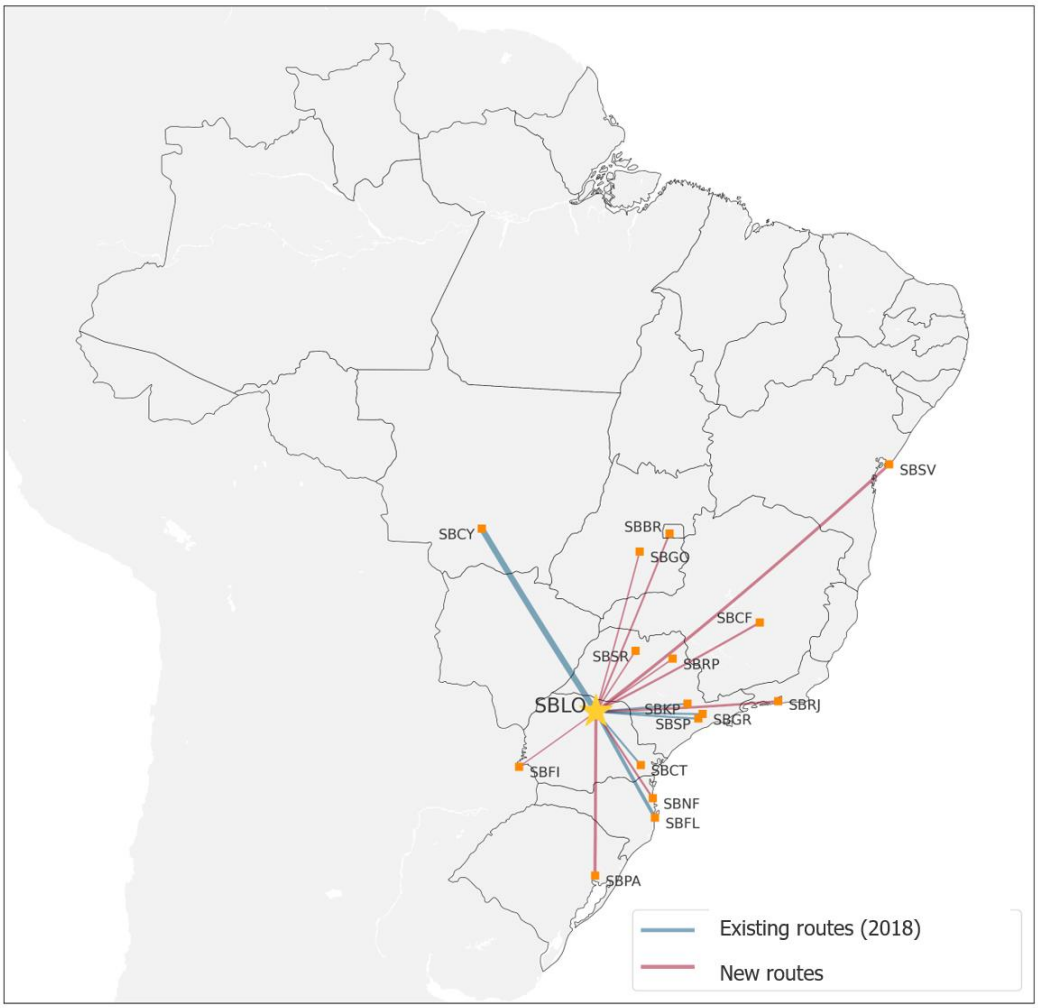
Source: GCA Consortium.

No international routes are expected at the Airport for the duration of the concession.

Airport insertion in the airlines network

During the concession, new connections between SBLO and as-yet unserved state capitals, reaching every Brazilian region. As Figure 1-7 shows, the number of connected domestic destinations from SBLO is expected to almost triple in 2018-2050, from 6 to 16. In 30 years' time, the number of routes at SBLO will reach SBCT's current level.

Figure 1-7: Domestic commercial routes in 2050



Source: GCA Consortium.

1.2.3 Peak demand and restrictions

The Airport's main systems have been sized to meet demands at more intense flow times, so that users will receive appropriate service levels according to previously established criteria and, no severe operational and economic impacts will take place.

For Passenger Terminal (PT) areas and processors at airports flying more than one million passengers per year from the beginning of the concession, as is SBLO's case, the applicable service level criterion is based on the 30th busiest hour of the year. The results have been calculated for 2018 based on Infraero records and forecast according to domestic peak-factor benchmarks (peak demand/annual demand).

Table 1-1: 1-hour peak demand (30th event) at the Airport – Baseline year, concession start and concession end

Nature	Flow	2018	2021	2050
Domestic	Departure	450	292	606
	Arrival	447	290	602
	Connecting	13	8	18
	Simultaneous	657	427	885
International	Departure	-	-	-
	Arrival	-	-	-
	Connecting	-	-	-
	Simultaneous	-	-	-
Simultaneous	Departure	450	292	606
	Arrival	447	290	602
	Connecting	13	8	18
	Simultaneous	657	427	885

Source: Infraero and GCA Consortium

For the runway system, the report considers maximum commercial aircraft operations per hour over a period of one year. As with passengers, the forecast embraces peak-factor benchmarks. It has been forecast that the Airport will have a peak of 11 commercial aircraft runway operations per hour in 2050.

Dimensioning also considers peak usage of apron positions based on 2018 maximum usage records[5] and peak factor benchmarks. According to the forecasts, a minimum 7 apron positions will be required by the end of the concession period.

Given the various systems' capacities (see Engineering Report), the study assesses potential restrictions on forecast demand. In the light of the Airport's forecast improvement and expansion works, no restrictions on growth are expected in connection with any of the Airport's systems.

1.2.4 Cargo

Concerning international cargo, forecasts show import flows only. These will be steady at the 1.4 thousand-ton level until 2050[6]. Domestic cargo flows are forecast at a total 3.5 thousand tons by the end of the concession period.

[5] Based on ANAC data.

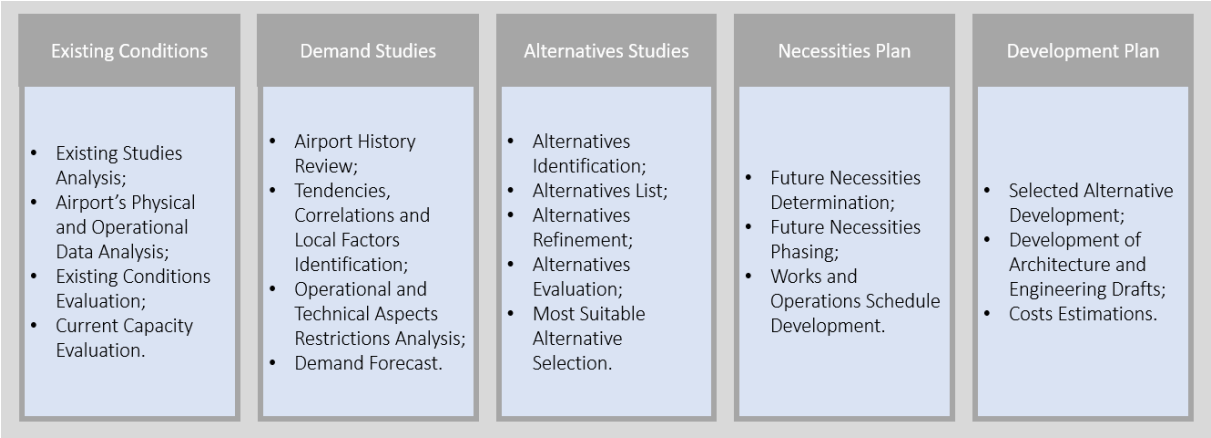
[6] Indirect non-air import flow with ground receipt under customs transit regime at the TECA, for clearance and subsequent release to the end customer.

2 ENGINEERING STUDIES

This section presents the Executive Summary of the Engineering Studies for the concession of the Londrina Airport/Governador José Richa – SBLO/LDB

The Engineering Studies Report has been developed according to the methodology presented in Figure 2-1.

Figure 2-1: Study Methodology



Source: GCA Consortium.

Below, in brief explanations, the results and premises of each phase of the studies are presented. For further details, please check the complete studies report.

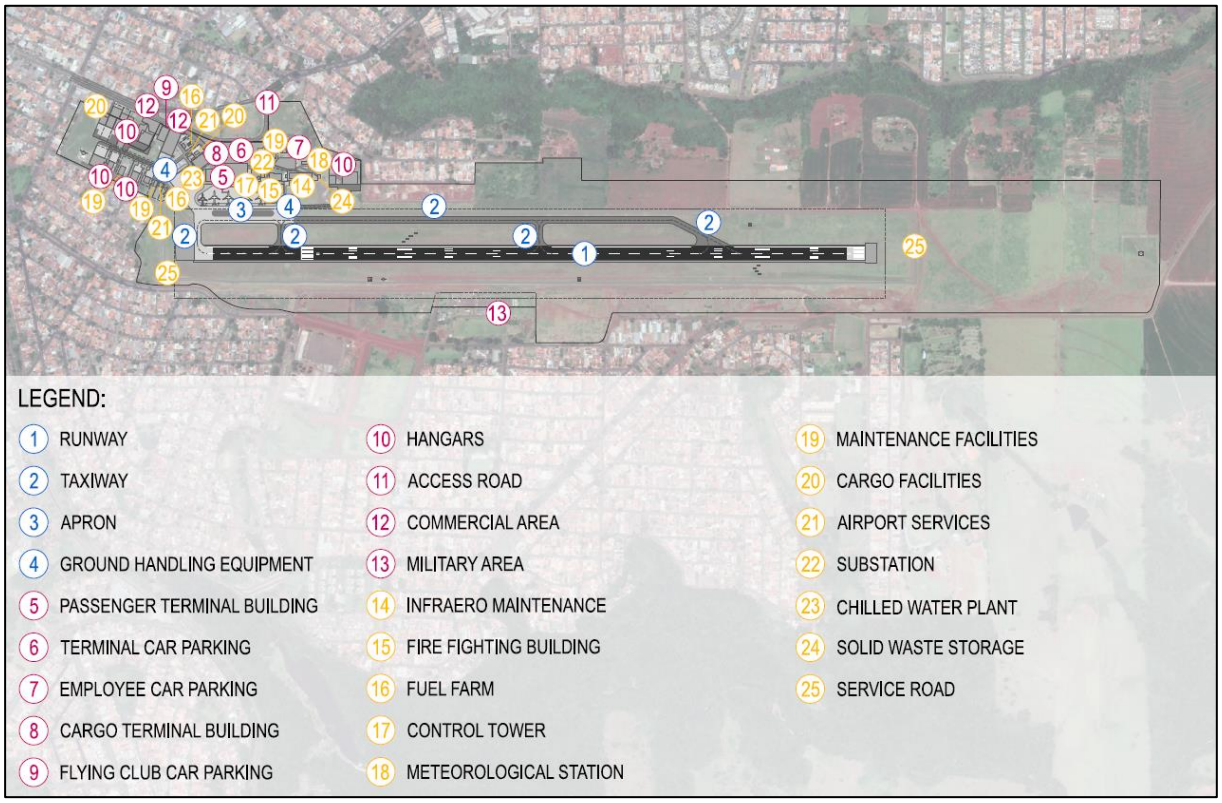
2.1 Existing Conditions

2.1.1 Current Situation

The current situation characterization is extremely important for an appropriate development of the Airport Site. Through it, it's possible to have an accurate understanding of the existing restrictions and opportunities for the expansion of the Airport complex. Among other aspects, the comprehension of the current situation involves operational, security, legal and social-environmental matters.

In order to characterize the present situation, it has also been evaluated the current operation and it has been done the identification of the existing infrastructures, by on-site visits, and of the main development plans and available studies. The Figure 2-2 illustrates the identification of the main existing facilities.

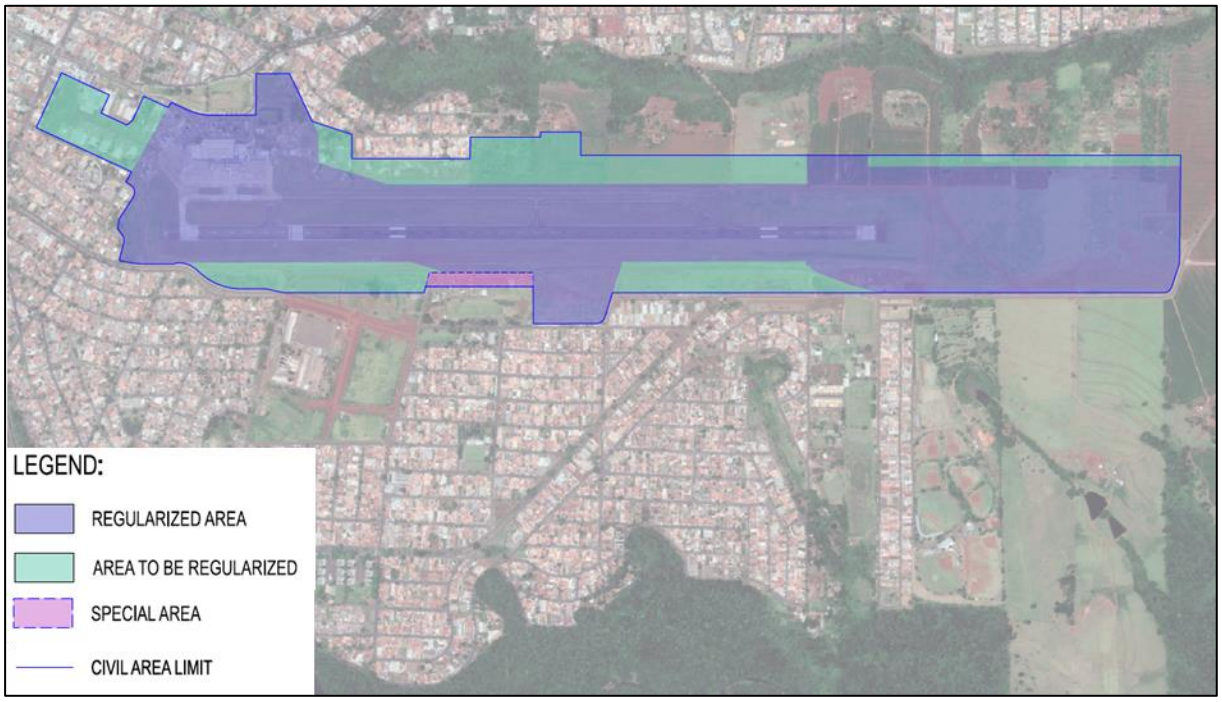
Figure 2-2: Current Facilities Situation



Source: GCA Consortium.

Furthermore, regarding the present patrimonial situation, it should be noted that the airport under study is in a patrimonial area divided in regularized area, area to be regularized and area to be expropriated. The regularized estates belong to the Federal Union in possession of INFRAERO. Now the estates to be regularized are properties of the Londrina City and third parties, going through the transference process, and the areas to be expropriated are under private third parties possession. The Figure 2-3 presents the patrimonial situation of the Airport.

Figure 2-3: Patrimonial Limits of the Airport Site



Source: Google Earth, GCA Consortium.

Currently, there are works in progress at the Airport, whose projects have been approved by INFRAERO. The purpose of these works is to install a power substation for the airport departure lounge. According to the SAC/MI guidance, until the start of the concession period, the ongoing works must proceed. From this date on, the remaining services must be completed by the concessionaire and the remaining costs considered in the financial modeling of this study. Since the works in the Airport are expected to be completed until this date, there won't be residual costs related to these works to be considered by CAPEX.

2.1.2 Installed Capacity Evaluation

The analysis of the installed capacity is one of the phases in the existing conditions evaluation process. In this stage are evaluated the capacity conditions according to the appropriate levels of service. Thus, it has been developed the capacity assessment for all airport systems. The installed capacities of the main systems are presented below.

2.1.2.1 Runway, Taxiway and Apron System

Table 2-1 and Table 2-2 summarize the results obtained from the installed capacity analysis and the existing demand for the runaways, taxiways and aprons systems. The taxiways were assessed based on geometric width and code of the aircraft design restrictions.

Table 2-1: Runway Capacity

Component	Current Capacity	Demand	Situation
Runway (mov/h)	28.0	9	Suitable

Source: GCA Consortium.

Table 2-2: Taxiways Capacity

Taxiway	Width (m)	Width Without Shoulders (m)	RBAC154 Code	Critical Aircraft	Situation
Taxiway A	21	21	B	AT72	Not Suitable
Taxiway B	21	21	B	AT72	Not Suitable
Taxiway C	21	21	B	AT72	Not Suitable
Taxiway D	21.5	21.5	B	AT72	Not Suitable
Taxiway E	21.5	21.5	B	AT72	Not Suitable

Source: AIP, GCA Consortium.

In order to measure the current capacity of the main aircraft aprons, the static and dynamic capacities were analyzed for five different scenarios. Each scenario prioritizes the maximum use of the most restrictive aircrafts, or rather, the occupying positions F, E, D and C in descending order of priority. The Table 2-3 shows the static capacity for the five scenarios evaluated.

- Scenario 1: Aircrafts code F, E, D, and C operating simultaneously, in descending order of priority;
- Scenario 2: Aircrafts code E, D and C operating simultaneously, in descending order of priority;
- Scenario 3: Aircrafts codes E and C operating simultaneously, in descending order of priority;
- Scenario 4: Aircrafts Codes D and C operating simultaneously, in descending order of priority;
- Scenario 5: Only aircrafts code C operating.

Table 2-3: Aprons Static Capacity

Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Boarding Bridge Positions	F/E/D/C	E/D/C	E/C	D/C	C
A	-	-	-	-	0
B	-	-	-	-	0
C	-	-	-	-	0
D	-	-	-	-	0
E	-	-	-	-	0
F	-	-	-	-	0

Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Remote Stands	F/E/D/C	E/D/C	E/C	D/C	C
A	-	-	-	-	6
B	-	-	-	-	2
C	-	-	-	-	6
D	-	-	-	-	0
E	-	-	-	-	0
F	-	-	-	-	0
Positions (Remotes + Boarding Bridges)	F/E/D/C	E/D/C	E/C	D/C	C
A	-	-	-	-	6
B	-	-	-	-	2
C	-	-	-	-	6
D	-	-	-	-	0
E	-	-	-	-	0
F	-	-	-	-	0
Total Boarding Bridges	-	-	-	-	0
Total Remote Stands	-	-	-	-	14
Total Number of Stands	-	-	-	-	14

Source: PDC Chart, GCA Consortium.

In order to evaluating the hourly dynamic capacity of the main apron, the static capacity obtained by the average occupation time of each aircraft code for the same scenarios was considered, obtaining the total dynamic capacity, as shown in Table 2-4.

Table 2-4: Aprons Dynamic Capacity

Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Average turning time (min)	F/E/D/C	E/D/C	E/C	D/C	C
A	-	-	-	-	15
B	-	-	-	-	25
C	-	-	-	-	45
D	-	-	-	-	75
E	-	-	-	-	85
F	-	-	-	-	130

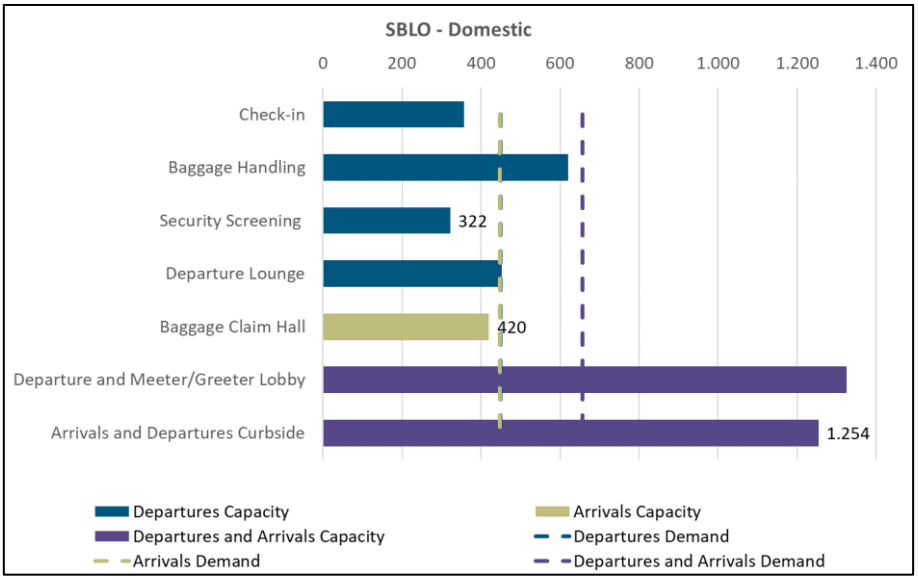
Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Capacity	F/E/D/C	E/D/C	E/C	D/C	C
A	-	-	-	-	24
B	-	-	-	-	5
C	-	-	-	-	8
D	-	-	-	-	0
E	-	-	-	-	0
F	-	-	-	-	0
Total	-	-	-	-	37

Source: GCA Consortium.

2.1.2.2 Passenger Terminal System

Figure 2-4 summarizes the results obtained from the installed capacity and the existing demands of the departures and arrivals flows.

Figure 2-4: Terminal's Components Capacity



Source: GCA Consortium.

2.1.2.3 Other Facilities

Regarding the current condition of other systems, the following observations can be noticed, about the present situation described on Table 2-5.

Table 2-5: Other Components Capacity Summary

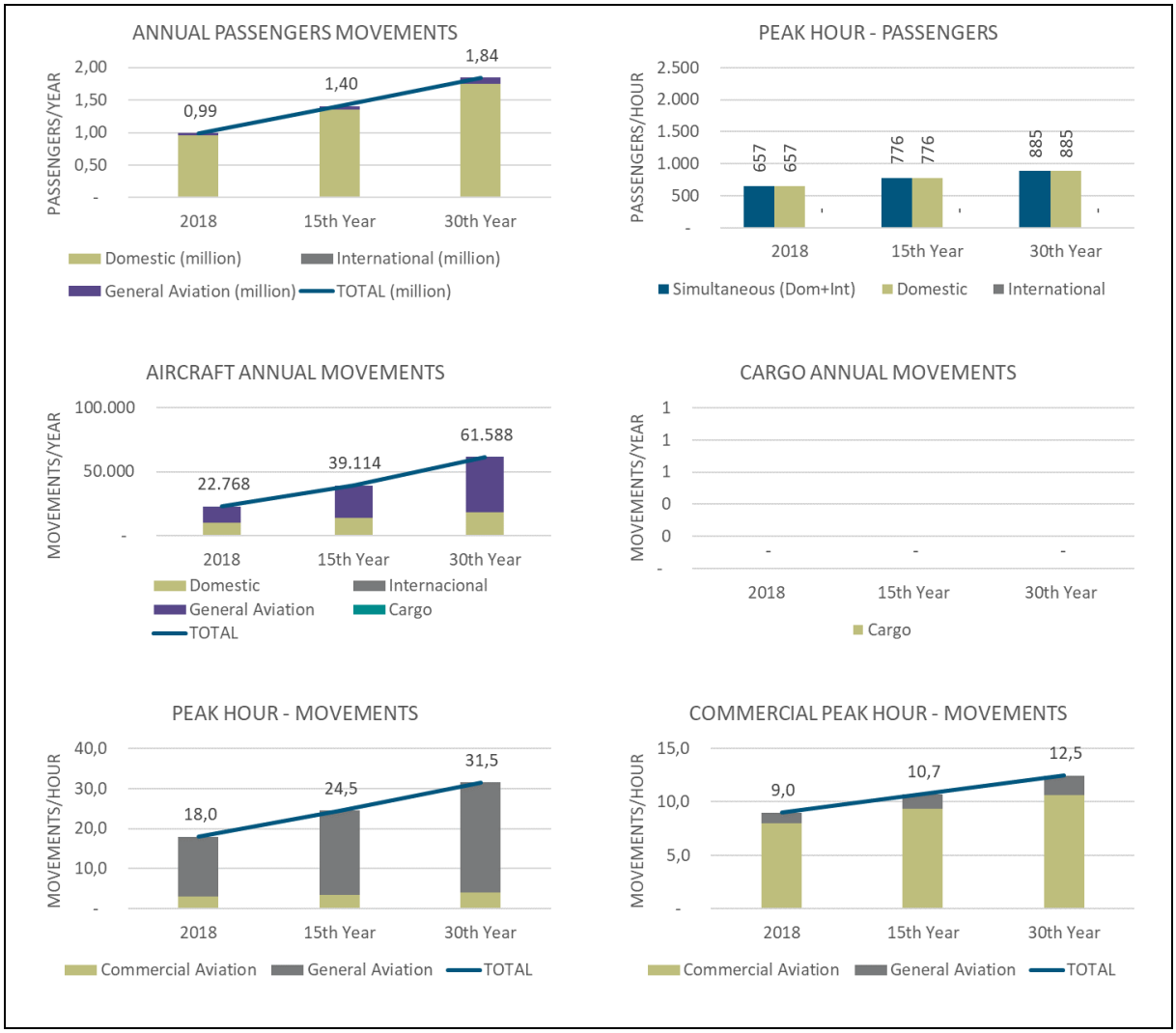
Component	Facilities Description
Aeronautical Infrastructure	• **Operation:** presents technical capability for day/night non-precision VFR/IFR operation for both thresholds (13-31). With PAPI systems at both thresholds, the runway is capable of landing jet aircraft by either threshold.
Cargo Terminal System	• **Cargo Terminal Building:** suitable to current demand. • **Airside Aprons:** suitable to current demand. • **Landside Aprons:** suitable to current demand. • **Cargo Terminal Parking:** not suitable to current demand.
General Aviation System	• **General Aviation Terminal:** there is no General Aviation Terminal currently and as the demand is more than 25,000, the sector is not suitable to current needs. • **General Aviation Aprons:** not suitable to current demand. • **General Aviation Hangars:** suitable to current demand. • **General Aviation Terminal Parking:** suitable to current demand.
Administration and Maintenance System	• **Administration:** suitable to current demand. • **Maintenance:** suitable to current demand.
Operation Support System	• **Fuel Farm:** suitable to current demand. • **Fire Fighting Installations:** not suitable to current demand.
Airlines Support System	• **Cargo Processing:** suitable to current demand. • **Airlines Support Maintenance:** suitable to current demand. • **Maintenance and Hangars:** not suitable to current demand.
Industrial Support System	• **Mail:** suitable to current demand. • **Catering:** does not apply, there is no specific area at the airport. • **Airport Services:** suitable to current demand.
Basic Infrastructure System	• **Electric Power:** suitable to current demand. • **Water Consumption:** not suitable to current demand. • **Sewage Treatment:** suitable to current demand. • **Solid Waste:** suitable to current demand.

Source: GCA Consortium.

2.2 Demand Studies

In order to evaluate the current capacity to accommodate the forecast demand and the investments needs over the concession period, market reports and forecasts of passenger demands, aircrafts operations and freight have been developed. The Figure 2-5 shows the results of the studies of demand.

Figure 2-5: Demand Forecast Summary



Source: Market Reports.

2.3 Necessities Plan

Given the demand projections and the installed capacity, the infrastructures required to meet the expected demand were evaluated for all airport systems. The following Figure 2-6, shows a summary of infrastructure needs for the airport throughout the development stages considered for the period of analysis. The requirements of each stage are based on the existing infrastructure in face of the projected demand. Thus, the installed infrastructures have been kept, reallocated or expanded according to the anticipated needs.

Figure 2-6: Necessities Plan

SBLO	Phase 1	Phase 2
Airside System		
Runway	Intervention	Suitable
Taxiways	Intervention	Intervention
Aprons	Intervention	Intervention
Ground Handling Equipments	Suitable	Suitable
Passenger Terminal System		
Passenger Terminal Building	Intervention	Intervention
Car Parking	Intervention	Intervention
Access Roads	Intervention	Intervention
Aeronautical Infrastructure		
Navigation Aids	Intervention	Intervention
Air Cargo Terminal System		
Air Cargo Terminal Building	Suitable	Suitable
Car Parking	Suitable	Suitable
Access Roads	Suitable	Suitable
General Aviation System		
General Aviation Terminal Building	Intervention	Suitable
Aprons and Taxiways	Intervention	Suitable
Car Parking	Intervention	Suitable
Access Roads	Suitable	Suitable
Administration and Maintenance System		
Administration	Suitable	Suitable
Maintenance	Intervention	Intervention
Operations Support System		
Fuel Farm	Intervention	Intervention
Firefighting Building	Intervention	Suitable
Airlines Support System		
Air Cargo and Maintenance Facilities	Suitable	Suitable
Maintenance and Hangars	Suitable	Suitable
Industrial Support System		
Mail	Suitable	Suitable
Catering	Intervention	Suitable
Airport Services	Suitable	Intervention
Basic Infrastructure System		
Eletric Power	Intervention	Intervention
Water Consumption	Intervention	Intervention
Sewage Treatment	Suitable	Suitable
Solid Waste	Intervention	Suitable

Source: GCA Consortium.

Furthermore, an infrastructure needs summary for the airport with its main information and components over the 30 years considered for the analysis period is presented in Table 2-6.

Table 2-6: Main Components Necessity Summary

SBLO	Current	Phase 01	Phase 02
DEMAND	**2018**	**15 Years**	**30 Years**
Annual Passengers Movements			
Regular Aviation	962,236	1,349,038	1,748,276
General Aviation	27,027	53,450	92,621
Total	989,263	1,402,488	1,840,897
Cargo (tons)			
Total	2,366	1,335	1,376
Aircraft Movements			
Passengers	9,957	13,892	18,244
Air Cargo	-	-	-
General Aviation	12,811	25,222	43,344
Total	22,768	39,114	61,588
RUNWAY SYSTEM			
Design Aircraft Code	C	C	C
Number of Runways	1	1	1
Runway Length (m) (1)	1,675	2,400	2,400
Operation Type	NPA	NPA	NPA
APRON SYSTEM			
Passengers Apron (2)			
Contact Stands	-	4C	4C
Remote Stands	6C	3C	4C
Total Number of Stands	6C	7C	8C
Cargo Apron (2)			
Total Number of Stands			
PASSENGERS TERMINAL SYSTEM			
Departure Peak Hour Capacity	272	532	606
Arrival Peak Hour Capacity	420	528	602
Terminal Building			
Total Area (m^2)	6,350	11,730	12,990

SBLO	Current	Phase 01	Phase 02
Baggage Handling System			
Processing Capacity (bhp)	287	329	377
Car Parking			
Total Area (m²)	11,475	16,710	20,485
Number of lots	425	619	759
Curbside			
Departure Curbside Length (m)	120	102	116
Arrival Curbside Length (m)	120	101	115
Total Length (m)	240	203[3]	231
Ground Handling Equipment			
Total Area (m²)	2,750	2,160	2,160
CARGO TERMINAL SYSTEM			
Cargo Terminal Building Area (m²)	1,520	1,520	1,520
GENERAL AVIATION SYSTEM			
General Aviation Terminal (m²)	-	6,350	1,200
Total Number of Stands	-	13	22
General Aviation Terminal Car Parking	-	525	760
Hangars and Aprons Area (m²)	37,040	37,040	37,040
ADMINISTRATION AND MAINTENANCE SYSTEM			
Administration [4]			
Total Area (m²)	1,030	899	899
Maintenance			
Total Area (m²)	1,850	910	1,160
OPERATION SUPPORT SYSTEM			
Fuel Farm			
Total Area (m²)	2,410	3,910	5,660
5-day storage (m³)	456	817	1,227
Fire fighting Building			
Category	6	7	7
Total Area (m²)	2,240	5,000	5,000

SBLO	Current	Phase 01	Phase 02
AIRLINES SUPPORT SYSTEM			
Maintenance Area (m²)	3,170	3,170	3,170
Cargo Processing Area (m²)(5)	2,180	2,180	2,180
Aircraft Maintenance Area (m²)	-	-	-
INDUSTRIAL SUPPORT SYSTEM			
Mail Area(m²)	-	-	-
Catering Area (m²)	-	600	600
Airport Services Area (m²)	1,550	1,550	1,850
BASIC INFRASTRUCTURE SYSTEM			
Water Tank (m³)	60	400	520
Solid Waste Area (m²)	90(6)	60	60
Electric Power Area (m²)	284	1,600	1,980
Sewage Treatment Units(7)	- (8)	-	-

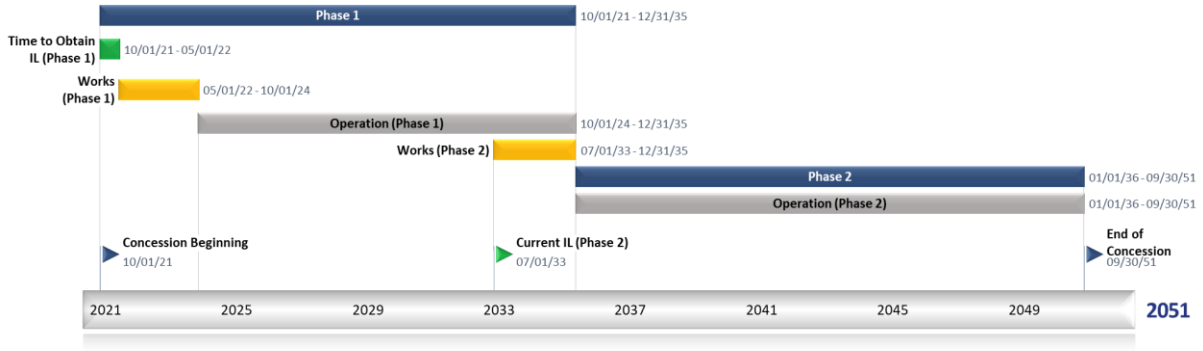
(1) It's been considered the Landing Distance Available (LDA).
(2) The cargo apron can be reversible, that means, shared with the commercial aviation.
(3) It is proposed a new PTB construction, and the current PTB, the current one being used for general aviation.
(4) The area can be considered inside the passenger terminal building.
(5) Area can be considered inside the PTB or Cargo Terminal Building.
(6) Existing Solid Waste Area is inadequate, a new system is proposed.
(7) Compact Sewage Treatment Unit, D70 model.
(8) Currently the airport has an area of 38,49 m² designated to Sewage Treatment Units.

Source: GCA Consortium.

After scheduling needs, based on the capacity of the airport systems, it was possible to define for each component when the interventions should be initiated, so that the service level can be maintained throughout the period.

Considering the concession starts in 2021, it's estimated a 7-month period to get the installation licenses (IL) necessary to start the works. After obtaining those licenses, the work can be started. Thus, as a result of the interaction of several planning elements, the work and operation phases were set, as shown in Figure 2-7.

Figure 2-7: Phasing and Works Estimated Schedule



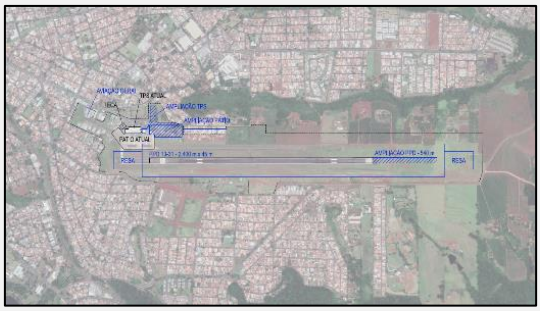
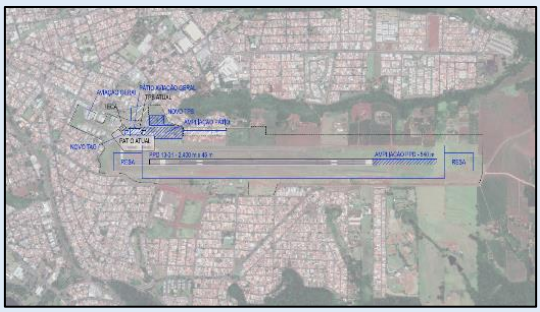
Source: GCA Consortium.

2.4 Alternatives Study

In order to choose the best alternative for the development of the airport site, it was considered the best solution for all infrastructure non-conformities, allowing the future development of the airport site in an optimized way, assuring a high level of service for all installations, minimizing the interference in the existing facilities and presenting compatible costs with the airport revenues during the concession period.

The proposed alternatives and their main characteristics are presented in Figure 2-8.

Figure 2-8: Proposed Alternatives

Alternative 01		• Runway extension of 540 m (Costs > R$ 10 MM); • Passenger terminal building reform and extension of approximately 8,000 m² (Costs > R$ 75 MM); • Apron extension of 25,000 m² (Costs > R$ 13 MM); • Expropriation of 14,000 m²; and • Limited possibilities for future expansion.
Alternative 02		• Runway extension of 540 m (Costs > R$ 10 MM); • New passenger terminal building implementation with 10,200 m² (Costs > R$ 95 MM); • Apron extension of 30,000 m² (Costs > R$ 16 MM); and • Expropriation of 14,000 m².

Alternative 03		• Runway extension of 540 m (Costs > R$ 10 MM); • New passenger terminal building implementation with 10,200 m² (Costs > R$ 95 MM); • New apron implementation with 30,000 m² (Costs > R$ 16 MM); • Expropriation of 640,000 m²; and • Better possibilities for future expansion.

Source: GCA Consortium.

The presented costs were obtained from reference figures by square meter (m²) and have the purpose to compare in a macro way the different alternatives. The detailed cost analysis was made only for the chosen alternative and it is presented in the CAPEX report.

From the studied solutions, it is observed that alternative 03 presents the best geometric configuration for the airport, considering that there would be reserved areas for future expansion and the works would not impact the existing facilities. However, in addition to the new PTB and aircraft apron, there would be significant additional expenses with expropriations and complementary works such as accesses, parking lots, among others. Thus, alternative 03 was discarded.

Although alternatives 01 have slightly lower implementation costs, alternatives 02 were evaluated as more advantageous from an operational point of view, being the chosen alternative for the development of the Airport.

2.5 Development Plan

After the selection of the most appropriate alternative and the Requirement Plans, it was designed the airport's development plan for the concession period. Furthermore, it was developed an architecture and engineering preliminary design. Thus, the costs of the project and operation along the implementation phases were estimated in order to enable the airport economic-financial modeling.

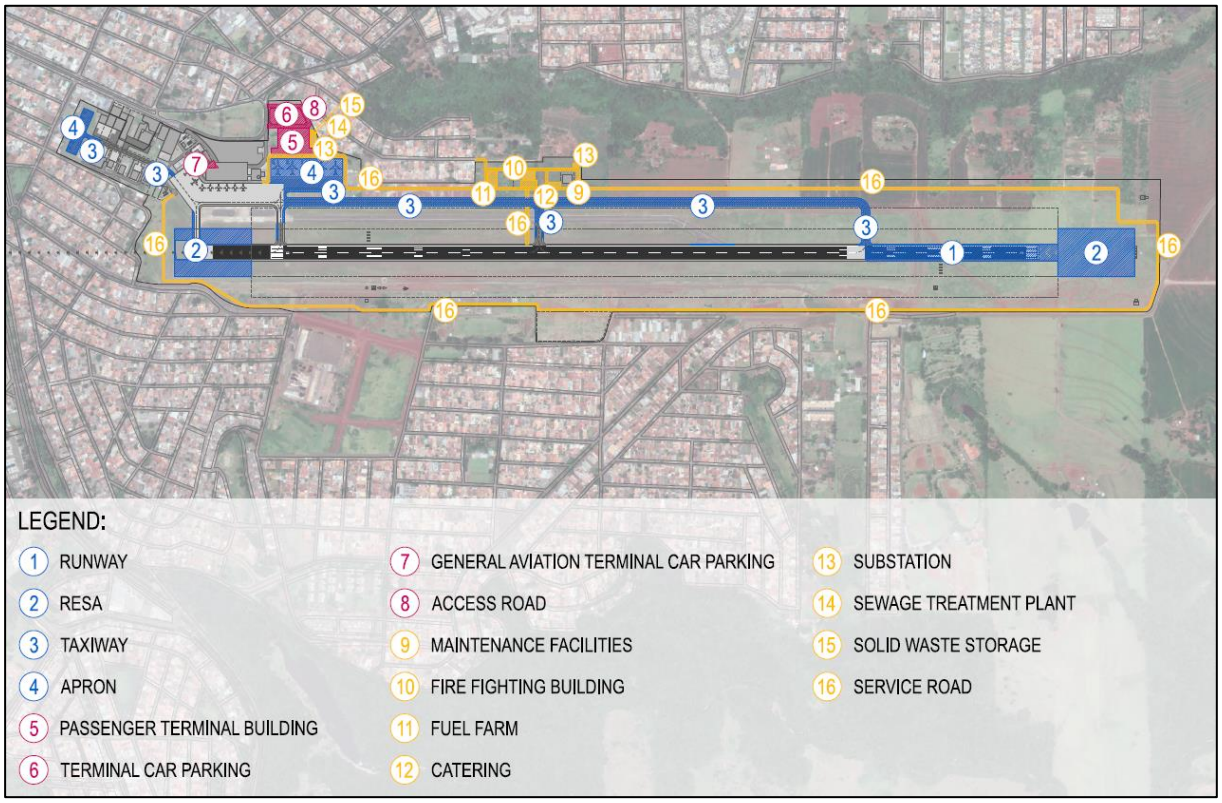
Below, the main investments for each phase of the planning are presented, as well as the implementation plants identifying the interventions at the airport and their subsequent level of details.

2.5.1 Phase 1

The first phase of the concession is expected to occur between the years 2024 and 2035, since the period between 2021 and 2024 will be used to get both the environmental licenses and carry out the constructions, so that all proposed works meet the demand of the year 2035.

In the Figure 2-9, it is presented the implementation proposed to Londrina Airport, considering Phase 01.

Figure 2-9: Development Plan – Phase 01 Implementations



Source: GCA Consortium.

The main interventions proposed in this phase are:

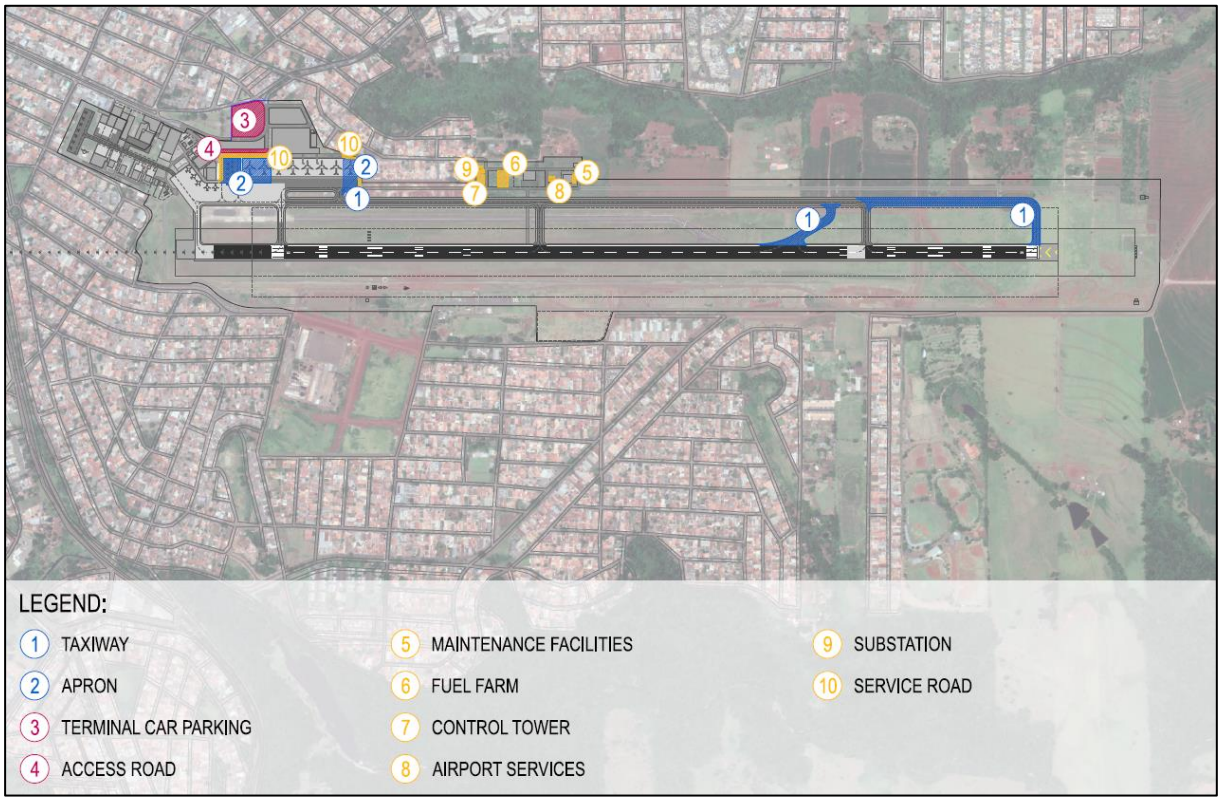
- Implementation of RESA on the thresholds 13 and 31;
- Threshold 13 displacement by 95 m;
- Runway 13/31 extension from 1,765 m to 2,400 m;
- Runway 13/31 shoulder and drainage system adequation;
- Access taxiways A and B shoulder adequation;
- Access taxiway C extension and adequation;
- Implementation of apron 2 for commercial aviation and apron 3 to general aviation;
- Parallel taxiway axis displacement E from 105 m to 158 m from Runway 13/31 axis;
- Construction of access taxiways D and G and taxilane F;
- New PTB and terminal car parking construction, the existing terminal being used for general aviation; and,
- Implantation of new boarding bridges.

2.5.2 Phase 2

The second phase of the operation is expected to be between the years 2036 and 2051, since the period for obtaining the environmental licenses and carrying out the constructions happen in the previous phase, in order to all proposed works meet the demands of the year 2050.

In Figure 2-10, it is presented the proposed implementation for the Londrina International Airport, considering the Phase 02.

Figure 2-10: Development Plan – Phase 02 Implementations



Source: GCA Consortium.

The main interventions proposed for this phase are:

- Parallel taxiway E extension to threshold 31;
- Construction of access taxiways H and J;
- Apron 1 and 2 extension;
- PTB and terminal car parking extension;
- Implementation of new boarding bridges.

2.6 CAPEX

To elaborate the budget for the planned investments, prices were considered in accordance with the reference tables of SINCRO and SINAPI, in order to get referential unit cost per airport component. It was also considered the BDI rate, according to the TCU guidance and SICRO methodology. So, from the planned investments, unit costs and BDI rate, it was obtained the budget for the investments to the airport development. The Table 2-7 summarize the investments by implementation phase.

Table 2-7: CAPEX – Summary per Phase

DESCRIPTION	VALUES [R$]
Phase 1 Airport Expansion	206,190,092.58
Phase 2 Airport Expansion	56,554,898.54
Airport Expansion Subtotal	**262,744,991.13**
Phase 1 Airport Expropriations	-
Phase 2 Airport Expropriations	9,982,602.19
Airport Expropriations Subtotal	**9,982,602.19**
CAPEX Total	**272,727,593.32**

Source: GCA Consortium.

The Table 2-8 compiles the investment, maintenance and expropriation expenses values for each phase, considering the investments used for the resurfaces in the runaway system (which is included in “Maintenance” in Table 2-8).

Table 2-8: Components Summary

DESCRIPTION	DEVELOPMENT (R$)	MAINTENANCE (R$)	EXPROPRIATION (R$)	VALUES [R$]
Phase 1 Airport Expansion	200,662,554.62	5,527,537.96	-	206,190,092.58
Phase 2 Airport Expansion	40,487,610.55	16,067,287.99	-	56,554,898.54
Airport Expansion Subtotal	**241,150,165.18**	**21,594,825.95**	**-**	**262,744,991.13**
Phase 1 Airport Expropriations	-	-	-	-
Phase 2 Airport Expropriations	-	-	9,982,602.19	9,982,602.19
Airport Expropriations Subtotal	-	-	**9,982,602.19**	**9,982,602.19**
CAPEX Total	**241,150,165.18**	**21,594,825.95**	**9,982,602.19**	**272,727,593.32**

Source: GCA Consortium.

3 ENVIRONMENTAL STUDIES

The Report 3 – Environmental Studies was elaborated to comply with the *Public Notice (Edital de Chamamento Público) N. 2/2019* regarding projects presentation, surveys, investigations and technical studies required to subsidize the concession modeling for expansion, exploration and maintenance of the Airport of Londrina.

The report presents all the environmental studies performed in the field and in the office, by means of primary and secondary data, including a detailed assessment of every document provided by the Secretariat of Civil Aviation (*Secretaria de Aviação Civil – SAC)*, disclosed in Data Room, and of environmental processes verified at by the Environmental Institute of Paraná (*Instituto Ambiental do Paraná - IAP*).

These data oriented the technical field visit to the Airport of Londrina, which occurred on May 13, 2019.

Environmental studies were conducted in order to meet the guidelines presented by the public notice, considering that all of the requirements were properly addressed in the report, according to certain analytical chronology, by means of careful evaluation of the airport's compliance with the respective licensing procedures, expansion studies, master plans and previous environmental studies.

The airport of Londrina is located in the East zone of Londrina city, North of Paraná state. The operations began in the beginning of the 40s, and, in 1956, 1957 and 1958, with the development of coffee agriculture in the countryside, the airport has been very busy, being in third place when compared to Congonhas (SP) and Santos Dumont (RJ).

Regarding environmental regularity, the Airport of Londrina is regular concerning the operating licensing of its current activities and infrastructure. The Environmental Institute of Paraná (*Instituto Ambiental do Paraná - IAP*), the environmental agency of Paraná state, is responsible for the environmental licensing of the enterprise. Information on the Operating Licenses (OL) is detailed below.

Chart 3-1: Operating license data

License	Issuing Agency	Process n.	Issue	Expiration	Status
178240_R1	IAP	16.239.285-9	Mar. 25th 2020	Mar. 25th 2025	Effective

Source: GCA Consortium.

We recommend thar, when taking over the airport management, the new manager request the transference of ownership for the current license from INFRAERO.

Since the beginning of its operations, the enterprise received several expansion and improvement constructions. The environmental report presents the main actions, constructions, intended constructions and their respective environmental licenses obtained after 2001.

The following documents were surveyed and reported, regarding the airport manager: authorizations, license agreements and other licenses, including those obtained by its concessionaire enterprises. A list of ongoing agreements, with the activities susceptible to licensing, was also presented.

Regarding the regularity of the enterprise, notifications and non-compliances of the airport were surveyed and exhibited to several agencies, National Agency of Sanitary Vigilance (*Agência Nacional de Vigilância Sanitária -Anvisa*) and National Agency if Civil Aviation (*Agência Nacional de Aviação Civil -ANAC*).

There is one process registered at the Fire Station of Paraná (3GB - SPCIP LONDRINA) for the airport's adequation regarding safety measures against fire and the signature of a Conduct Adjustment Term.

The information on past notices and fines do not oblige the next manager, which is not responsible for their payments. However, the current airport manager is responsible for eliminating the facts that originated such notices, as well as for managing ongoing mitigating or recovering actions.

A socio-environmental assessment of the Airport of Londrina was performed and presented by means of the socio-environmental diagnosis in this report, considering the following aspects:

- Soil Use and Coverage including approaches to water resources, permanent preservation areas (APP) and vegetation;
- Irregular superficiaries and occupations in the airport assets area;
- Potential of Cave Occurrence;
- Mining rights;
- Fauna and Fauna Risk;
- Noise;
- Atmospheric Emissions;
- Energy;
- Basic Sanitation including approaches to water supply, effluents, solid waste and drainage system;
- Degraded areas, erosions and silting;
- Environmental Risks/Emergencies;
- Conservation Units, Protected Assets and Communities, including the analysis of heritage, archeological or pre-historical sites and traditional communities;
- Stakeholders engagement;
- Environmental Management System.

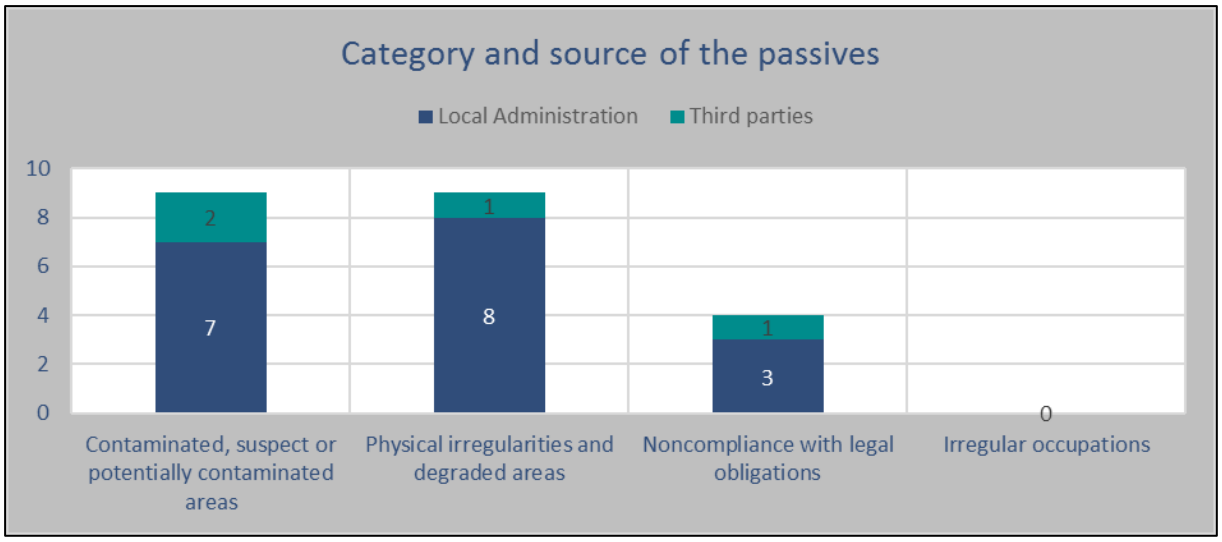
For this diagnosis we considered the current situations surveyed during the airport and its surroundings field visit, as well as relevant information, including those made available by environmental agencies by *Data Room*, the ones obtained from the surveillance agencies and the information obtained by bibliographical research.

Techniques of satellite images interpretation and geoprocessing were used and allowed identification and delimitation of socio-environmental components and aspects, such as water resources, vegetal coverture, permanent preservation areas (APP) in the airport site and its surroundings.

The Airport of Londrina has pending actions in environmental area that shall be improved or corrected by the new airport manager, such as: full compliance with all the constraints of the operational licensing, elaboration and implementation of PGRH, IPF and PGRF, establishing a dialogue with external stakeholders, especially regarding the ASA protection, effective monitoring of air emissions, actions for reducing energy and water consumption, elaboration of PGRS and its effective implementation and adequation of the effluent treatment system.

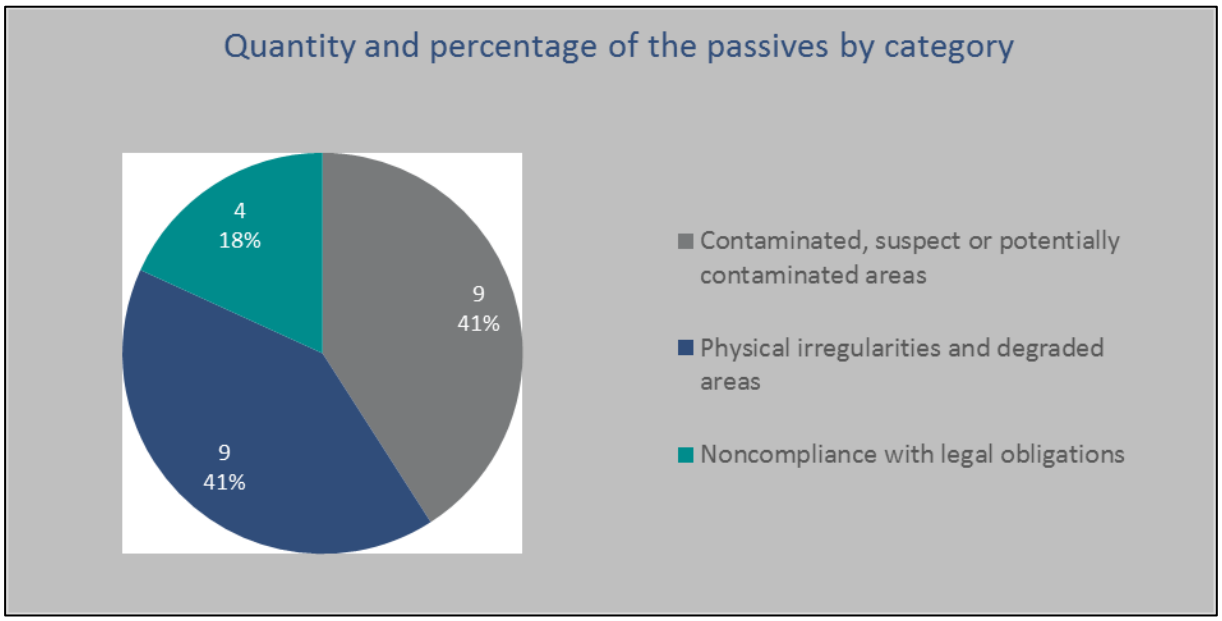
During the preparation of this document, existing socio-environmental passives were surveyed, evaluated and priced. For the Airport of Londrina, 22 passives were identified. From the four passive categories evaluated, 09 were related to contaminated areas, 09 to physical irregularities and degraded areas and 04 to noncompliance with legal obligations. No passives related to irregular occupations were identified.

Figure 3-1: Category and source of the passives



Source: GCA Consortium.

Figure 3-2: Quantity and percentage of the passives by category

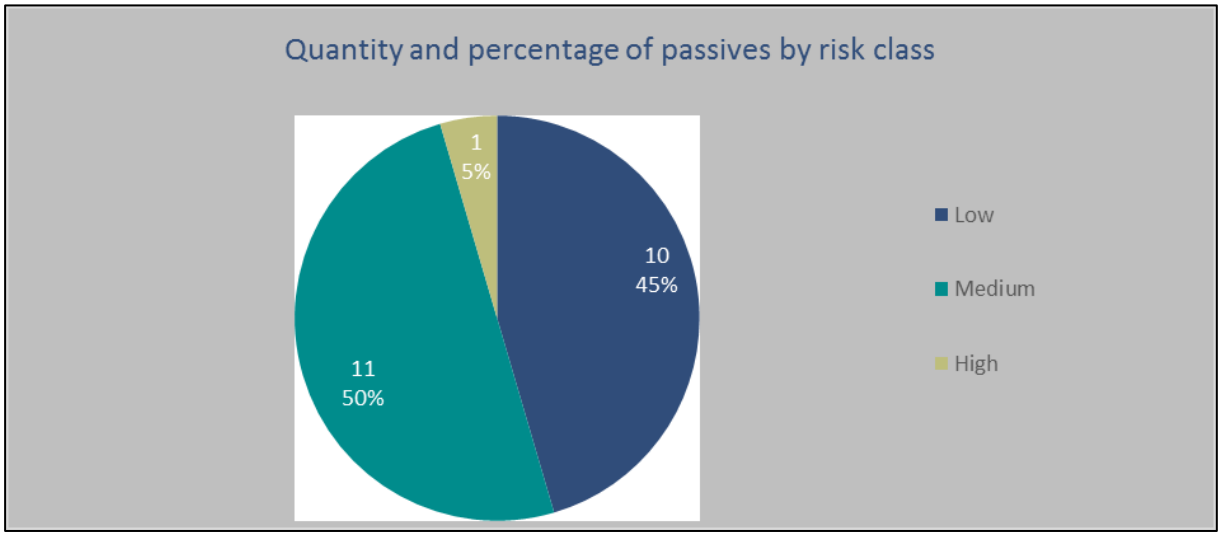


Source: GCA Consortium.

The classification of passives identified according to their Risk Class was assessed based on a methodology adapted from FMEA (*Failure Mode and Effects Analysis).*

Considering the current scenario, the Airport of Londrina presents passives classified as of *High, Medium and Low* risks. The passives classified as of High risk shall be managed in the short run, and the passives classified as of *Medium to Low* risk may be managed according to their respective criticalities in short or medium term.

Figure 3-3: Quantity and percentage of passives by risk class



Source: GCA Consortium.

The study includes a detailed analysis of current and future compatibility of the airport activities and soil use, dedicated to verify if the protection plan against obstacle, the noise zoning plan and airport safety area were properly incorporated in the guidelines and legislation that regulates the occupation of the airport's neighboring areas.

In order to guarantee the good development of the enterprise, the neighboring areas shall continue to be compatible with the airport activities. To achieve this goal, the airport manager shall update and approve the appropriate plans, especially in case of meaningful alterations in operation and infrastructure.

The study also estimated the quantity of people affected by the aeronautical noise levels, according to the chart below, for the Current and Future development scenarios.

Chart 3-2: Aeronautical noise impacts on the neighboring population in the future scenario

Area inside noise contours	Number of people living inside the contours		Number of residences inside the contours	
	Current Contours	Future Contours	Current Contours	Future Contours
65 -70dB	23	19	7	6
70 - 75dB	-	-	-	-
75 - 80dB	-	-	-	-
80 - 85dB	-	-	-	-

Source: GCA Consortium.

We highlight that, for the prediction on the number of people impacted in a Future Scenario, no projections on population densification were made, *i.e.*, we assume that planning measures on soil use will prevent an increased number of residences in the areas affected by unpleasant noises. Nevertheless, if the municipal administration of Londrina stimulates densification of the airport's surroundings, the estimated disturbance for the future population will became even greater.

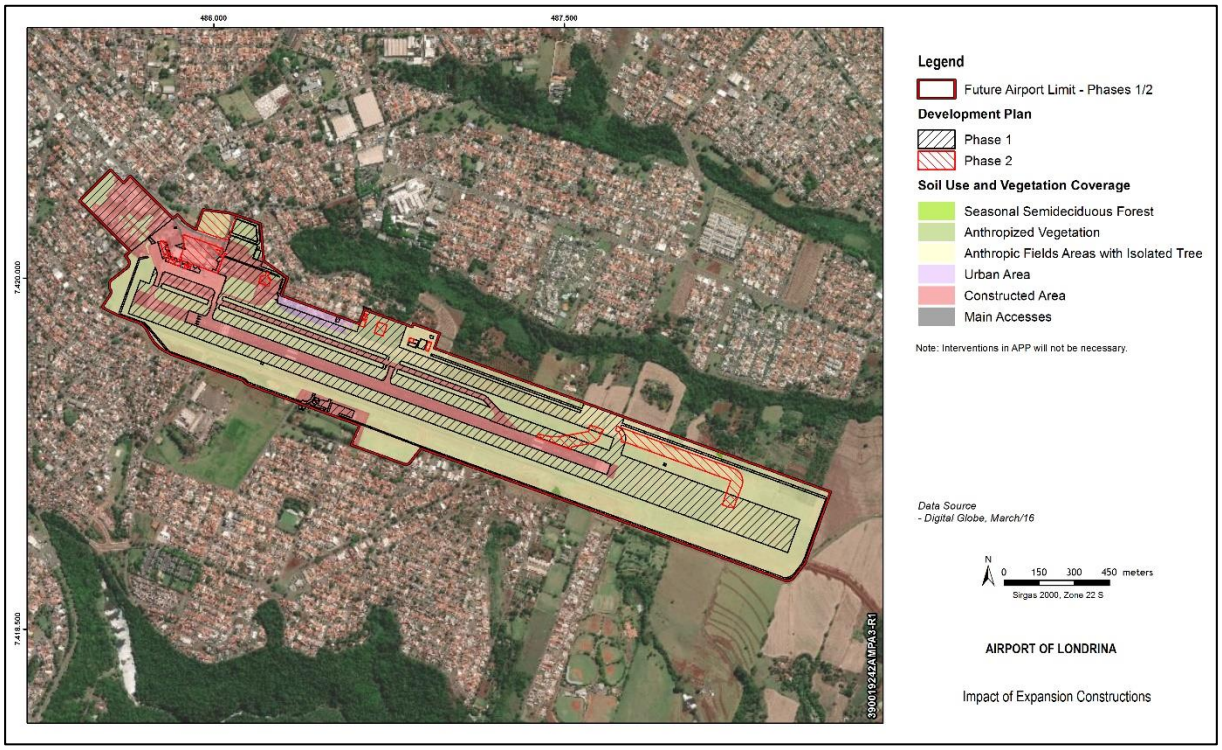
Regarding risks to the Fauna, the study identified the main focuses of attraction inside the Airport Safety Area (ASA), a circular area with 20 km of radius, marked from the geometric center of the longest runway. We highlight the focus related to irregular waste disposal, slaughterhouses, extensive agriculture, agriculture, landfills, tannery, dumpsites, water/sewage treatment stations free markets and food processing industries. Thus, the airport manager shall help the municipality to monitor the focuses and to develop educational actions in order to avoid the appearance of new focuses.

Based on all these surveys, the main goal of the study was fulfilled, especially regarding the legal and environmental restrictions of the airport and its neighboring areas. Socio-environmental criteria to be incorporated to the project were identified and oriented the Development Plan in order to minimize environmental impacts.

The airport presents areas of Semideciduous Seasonal Forest, besides of Wetlands, Reforestation with regeneration, portions of Anthropized Vegetation and Anthropic Fields with isolated trees.

Therefore, the Development Plan for the Airport considered every restriction and environmental criteria surveyed in the study. The solution proposed is the one with the lowest environmental impact in the airport region and that allows its compliance with applicable legislation. The following figure shows the impact of expansion works on soil use and coverage.

Figure 3-4: Impact of the adequation constructions on soil uses and coverage



Source: GCA Consortium.

Evaluating the construction works impact on soil use and coverage in the Airport of Londrina, during the Development Plan implementation in its two phases, two interventions shall be made: in the Anthropic Fields areas with isolated tree individuals (77.29%), in the Semideciduous Seasonal Forest (0.01%), Anthropized Vegetation (0.03%), and already constructed areas (20.70%), urban areas (1.51%) and main accesses (0.46%) . Interventions in APP will not be necessary.

Concerning socio-environmental risks associated to the project, *i.e.*, situations that may impair or delay the execution of foreseen activities and constructions, 04 risk situations were identified and summarized below, together with strategies to minimize the risk.

Chart 3-3: Risks and their respective strategies to minimization

Socio-environmental risk management at the Airport	
RISK SITUATION 1	Intense population density in the airport's surroundings
Identified risk	• Airport operations may affect the neighboring population with unpleasant levels of noise. • Conflicts between airport activities and surrounding soil use and occupations.
Strategies to minimize the risk	• To establish technical partnership with Londrina municipality to incorporate the Specific Noise Zoning Plan (PEZR) in municipal legislation and in the procedures of real estate approval in areas affected by the airport noise contours and other use and occupation restrictions concerning operational safety.

Socio-environmental risk management at the Airport	
	• To perform educational and awareness activities with the surrounding Community on the importance of preserving and respecting the airport's property limits.
RISK SITUATION 2	Difficulties on expropriation of Nishinomiya Square
Identified risk	• Difficulties with the population for expropriating the square; • Delay on the development of Phase 2 constructions, once that the site is essential for the airport's development.
Strategies to minimize the risk	• To perform technical partnership with municipal administration of Londrina in order to execute the required actions. • To perform a communication campaign informing the population on the need for using the area and its relevance to the airport's development. • If the expropriation does not fully occur up to the IL issue, the concessionaire may request a partial IL issue, authorizing the constructions only in the areas effectively expropriated and under its domain.
RISK SITUATION 3	Trespassing risk in the areas already expropriated and not delimitated by the airport
Identified risk	• Trespassing in the areas already expropriated and under INFRAERO domain; • Delay on the construction works development, if irregular occupations arise.
Strategies to minimize the risk	• To make a technical partnership with INFRAERO in order to follow up the construction of fences and walls, appropriately delimitating the areas.

Source: GCA Consortium.

Considering that the local availability of input and raw material suppliers, and of waste disposal sites required to implement the Development Plan are essential to the Project feasibility, the Environmental Report listed potential licensed suppliers to help estimating costs in the Report of Engineering and Related Issues.

The study also presents the licensing guidelines required for the entire concession period, accompanied by the respective schedules for the implementation and operation phases of the airport.

The Airport of Londrina has an effective Operating License valid until 2025 However, during the field the necessity of fully complying with the requirements was identified, regarding the ones related to appropriate storage and destination of solid waste and adjustment or implementation of containment systems for fuel, oils and chemical products in general.

Based on these conditions, the chart below presents recommendations to the future airport manager, regarding the conduction of the airport's operating licensing:

Chart 3-4: Recommendations for conducting the airport's operating licensing

Recommendations for conducting the airport's operating licensing
Once you took over the airport's management, you must request the license titularity transference to your name and CNPJ.
During the airport operation, all the constraints of the future Regularization Operating License (or similar) must be addressed. Periodical reports on the activities' execution must be presented to the environmental agencies.
To request the OL renewal at least 120 days before its expiration date, according to paragraph 4th of article 12 of Complementary Law n. 140, from December 8, 2011.
After the end of each construction phase, if authorized by means of an Installation License, the entrepreneurship shall request these constructions to be included in the current operating license, avoiding the issuing of several OL for the same airport enterprise.

Source: GCA Consortium.

Besides of the operating environmental licensing of the airport, the airport operating activities will be regular by the issuing of authorizations, exemptions and complementary grants and documentation approval by regulatory public agencies. The chart below presents the estimated timeframes used in the present study.

Chart 3-5: Estimated timeframes for other authorizations, grants and licenses

Description	Estimated timeframe	TOTAL
Regularization/Renewal/ Transference of Grant for water resources use (AA[1]) and Grant Issuing (OC[2])	2 months (AA[1]) 2 months (OC[2])	4 months
Regularization of Federal and State Technical Registration (AA[1])	2 months (AA[1])	2 months
Elaboration/Regularization/Renewal of IPF and PGRF (AA[1]) and validation in ANAC (OC[2])	15 months (AA[1]) 3 months (OC[2])	18 months
Elaboration /Regularization of noise contours and PZR (AA[1]) and validation and registration in ANAC (OC[2])	6 months (AA[1]) 3 months (OC[2])	9 months
Regularization of PBZPA and PZPANA(AA[1]) and validation in ANAC and DECEA (OC[2])	6 months (AA[1]) 4 months (OC[2])	10 months
Mining block request to DNPM (AA[1]) and mining block issue (OC[2])	2 months (AA[1]) 2 months (OC[2])	4 months

Notes:

[1] AA- Airport manager

[2] OC- Responsible agency

Source: GCA Consortium.

Regarding the expansion and adequation constructions phase, the Development Plan proposed for Airport of Londrina will be implemented in two phases. The chart below summarizes the licensing assumptions for each phase.

Chart 3-6: Licensing assumptions for the expansion and adequation constructions of Airport of Londrina

Evaluated aspects	Phase 1	Phase 2
Impact degree of the constructions	Medium	Medium
Licensing agency	IAP (State)	IAP (State)
Applicable licenses	LAS	LAS effective from Phase 1*
Studies to be performed	PCA	-
Maximum estimated timeframe for studies and licensing	7 months	Effective licensing

*Legislation foresees that the LAS may be renewed up to the execution of constructions from Phase 2.

Source: GCA Consortium.

The Development Plan constructions, on its two phases, were classified as of environmental impact of medium degree. Considering this category and the evaluation of the airport licensing history and environmental legislation of Paraná, the construction works that do not result in alteration on the airport's category (such as the ones foreseen for the Airport of Londrina) may be licensed by means of a Simplified Environmental License (*Licença Ambiental Simplificada – LAS*). The LAS expires in 06 years at maximum and shall be obtained on Phase 1 and renewed up to the Phase 2 constructions period.

The Environmental Control Plan (*Plano de Controle Ambiental - PCA*), a study to be elaborated for the LAS issue, shall describe all the expansion phases of the airport (phases 1 and 2), contemplating the impacts and control measurements of the enterprise during the constructions period.

At the end of each construction phase, the entrepreneur shall request the inclusion of the constructed and expanded infrastructure in the scope of the operating license effective for the airport.

The estimated timeframes for the environmental licensing of the constructions considered the impact degrees previously described, results being presented below.

Chart 3-7: Estimated timeframes for licensing constructions of medium environmental impact

Description	Estimated timeframe
RAS and PCA elaboration for LAS issue	3 months (AA[1])
RAS and PCA and new LAs issue	4 months (OA[2])
TOTAL	**7 MONTHS**

Notes:

[1] AA- Airport manager

[2] OA- Environmental Agency

Source: GCA Consortium.

The airport manager should also analyze verify other authorizations required to enable the Development Plan, concerning the licensing of all its three phases. The chart below summarizes this evaluation for Airport of Londrina.

Chart 3-8: Environmental authorizations and procedures required for the Airport of Londrina

Authorization/Procedure	Applicability for the Development Plan
Municipality Opinion	Applicable
Authorization for Vegetation Suppression (ASV) and/or Intervention in APP	Applicable
National Institute of Historical and Artistical Heritage (*Instituto do Patrimônio Histórico e Artístico Nacional - IPHAN*) Opinion	Applicable
Grant of water resources use	Applicable
Mining Block	Applicable
Authorization from Conservation Units Managers	Not applicable
Authorization for intervention in traditional communities or its surrounding zones	Not applicable

Source: GCA Consortium.

To achieve excellence in socio-environmental management, this study presented mitigation measures, suggestions on Sustainability Guidelines, Environmental Management System, Environmental Plans and Programmes and Environmental Development Indexes to the future airport manager, considering all the environmental subjects assessed herein.

Finally, the study presents the socio-environmental cost budget foreseen for the expansion constructions (CAPEX) and for the airport operation (OPEX), summarized below:

Chart 3-9: Socio-environmental costs in R$ estimated for the Airport of Londrina

Activity	Phase 1	Phase 2	TOTAL
Licensing and Analysis Fees	5,063.01	1,434.86	6,497.87
Environmental Studies	77,990.60	-	77,990.60
Environmental Management of the Constructions	1,985,050.09	2,052,654.34	4,037,704.43
Vegetation Suppression and Forest Compensation	322.74	-	322.74
Confirmatory Investigation of Passives	553,948.55	-	553,948.55
Environmental Passives Recuperation	-	-	-
Environmental Compensation SNUC *	-	-	-
Total	**2,622,374.99**	**2,054,089.20**	**4,676.464.19**

* Not applicable in this case

Source: GCA Consortium.

Chart 3-10: Environmental OPEX estimated for the Airport of Londrina

Item	Activity	Total Cost (R$)
2.1	Environmental Licensing Fees	702,986.88
	OL Renewal	*7,379.28*
	TCFA – IBAMA	*695,607.60*
2.2	Operation Environmental Management	9,548,810.18
2.3	Elaboration of PBZPA and PZPANA	205,678.91
2.4	Fauna Management Programme	3,574,361.15
	PF and PGRF Elaboration	*2,494,361.15*
	Fauna handling actions	*1,080,000.00*
2.5	Noise Management Programme	89,252.79
2.6	Energy and Air Emissions Management Programme	23,817.19
2.7	Water Resources and Effluents Management Programme	5,099,518.40
	Sampling Plan Elaboration	*23,817.19*
	Water Resources Monitoring	*5,075,701.21*
2.8	Solid Waste Management Programme	37,282.87
2.9	Social Communication, Environmental Education and Training	829,344.89
	TOTAL	**20,111,053.27**

Source: GCA Consortium.

The Environmental Studies maintained the innovations presented in the study is elaborated by GCA Consortium of the 5th Round of Airport Concessions from Federal Government, which culminated in the concession of 12 airports for private initiative. They are:

- Analysis of soil use and occupation inside noise contours, by means of identifying the quantity of residences and their respective areas, people and average quantity of people per residence based on census information (IBGE, 2010);
- Survey of focuses of fauna attraction, using criteria defined by specific aeronautical legislation;
- Survey and analysis of collision indexes involving aircrafts and fauna, according to data provided by CENIPA;
- Identification of areas vulnerable to the airport activities, since there are fauna and flora species of restrict distribution located in regions under the aerodrome influence, according to ICMBIO criteria;
- Risk evaluation of environmental passives based on a methodology adapted from FMEA (Failure Mode and Effects Analysis);

- Indexes proposition according to GRI Standards (version 2016) and GRI G4- Airport Op*erator Sector Disclosures* (version 2013) references, correlating them to the Sustainable Development Goals (*Objetivos de Desenvolvimento Sustentável -ODS*), to the IFC Performance patterns, and with the guidelines of Global Pact.

In addition, with the participation of several professionals specialized in the environment area and with effective practice on airport operation, the flowing innovations were performed in the Environmental Studies:

- Identification of all kinds of irregular superficiaries and occupations in the property and the expansion area;
- Survey of potential cave occurrences in the airport area and its surroundings;
- Information on the existence of mineral deposits in the airport area and its surroundings;
- Evaluation of mining rights in the airport area and its surroundings;
- Amplification of identified classes of environmental passives and its respective results presented by an Excel spreadsheet, with friendly and intuitive interface;
- Survey on receptors sensitive to aircraft noise – public institutions, hospitals and schools – located inside the airport noise contours;
- Indication of licensed potential suppliers of inputs and raw materials, close to the airport, for the Development Plan constructions;
- Indication of licensed sites for adequate waste disposal, close to the airport;
- Evaluation of the airport position on the ranking of airports used for animal traffic, as well as proposition of actions to prevent traffic;
- Use of indicators from the Guide of Good Practices for Elaborating Indicators of Operational Safety elaborated by the Brazilian Group of Operational Safety in Airport Infrastructure (BAIST), published in August 2019;
- Quantification of the expansion construction impacts in Permanent Preservation Areas (APP) and proposition of differentiated forest compensation, according to local legislation;
- Use of data on water, obtained by SPT drilling performed by GCA, to guide the estimated budget of Confirmatory Investigations and sites with suspected contamination in the airport;
- Incorporation of sustainable proposals in the Development Plan;
- Definition of Sustainability guidelines for the airport operations, aligned with the policies adopted by the Ministry of Infrastructure.

4 ECONOMIC AND FINANCIAL EVALUATION

This section presents the Executive Summary of the Economic and Financial Evaluation for the 30-year concession of **Londrina Airport - SBLO** modelled between 01/October/2021 and 30/September/2051. Currently, the airport's total revenue is R$23MM and its EBITDA margin is -25% (considering 2018 data)[7].

Revenues

The economic and financial evaluation is based on revenue projections which include:

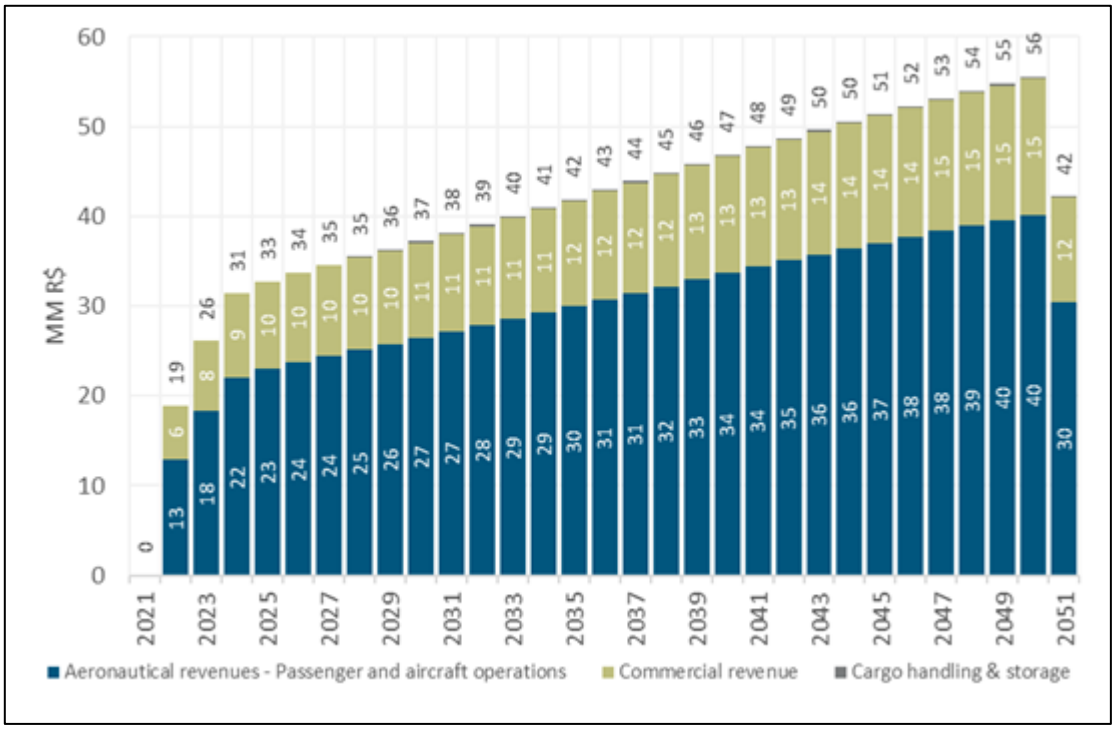
- Aeronautical revenues, resulting from regulated fees on the various operation types. These have been categorized as passenger and aircraft fees and cargo handling and storage fees;
    - Aeronautical revenues – passengers and aircraft operations: applicable to both passenger flows (domestic and international boarding or connection fees) and aircraft operation and parking, by operation type (domestic and international landing and parking fees, and landing and boarding and parking fees for general aviation);
    - Cargo handling and storage: due for cargo handling and storage services where rendered directly by the Airport operator at the air cargo terminal (TECA), and may divide into import, export and domestic cargo;
- Commercial revenues, related to services and goods provided to passengers, airlines and other business users, i.e. international air cargo terminal, retail, food & beverages, car parking, aircraft fuelling, car rental etc.

Forecasts for aeronautical revenues are based on expected Airport throughput, which include passenger flows, cargo, mix of aircraft types and aircraft operations, and their respective fees. Meanwhile, forecasts for commercial revenues consider not only expected demands and their respective impacts over each category of business, but also efficiency gains resulting from contract renegotiations between the concessionaire and the lessees of commercial areas, following market benchmarks.

Total revenues are expected to grow an average of 2.8%p.a. between 2023 and 2050. Aeronautical revenues share will increase during the concession period, from 70% in 2023 to 73% in 2050.

7 All monetary value presented in this report is given in constant Real (R$) values based on January/2019 real prices, following SAC/MI guidance.

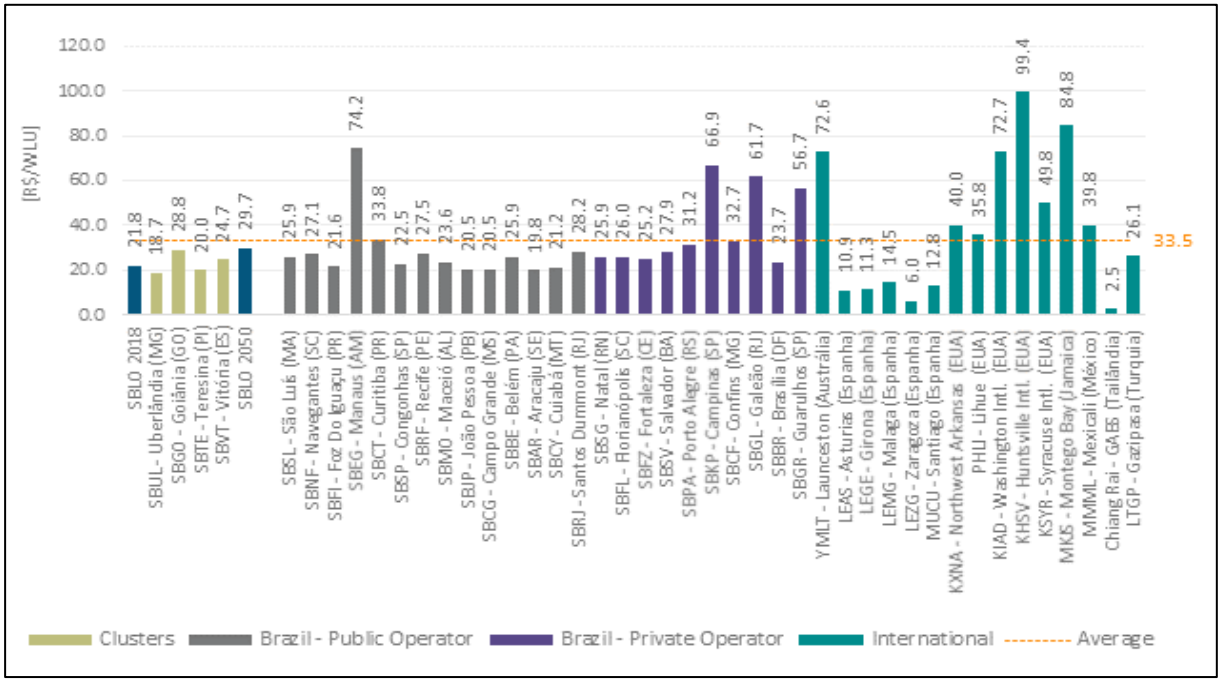
Figure 4-1: Total revenues during concession



Source: GCA Consortium.

In 2050, the Airport's revenue per WLU will be R$29.7. Airport indicators are below the average of comparable airports (Figure 4-2).

Figure 4-2: Revenue per WLU benchmark



Source: GCA Consortium.

Costs and expenses

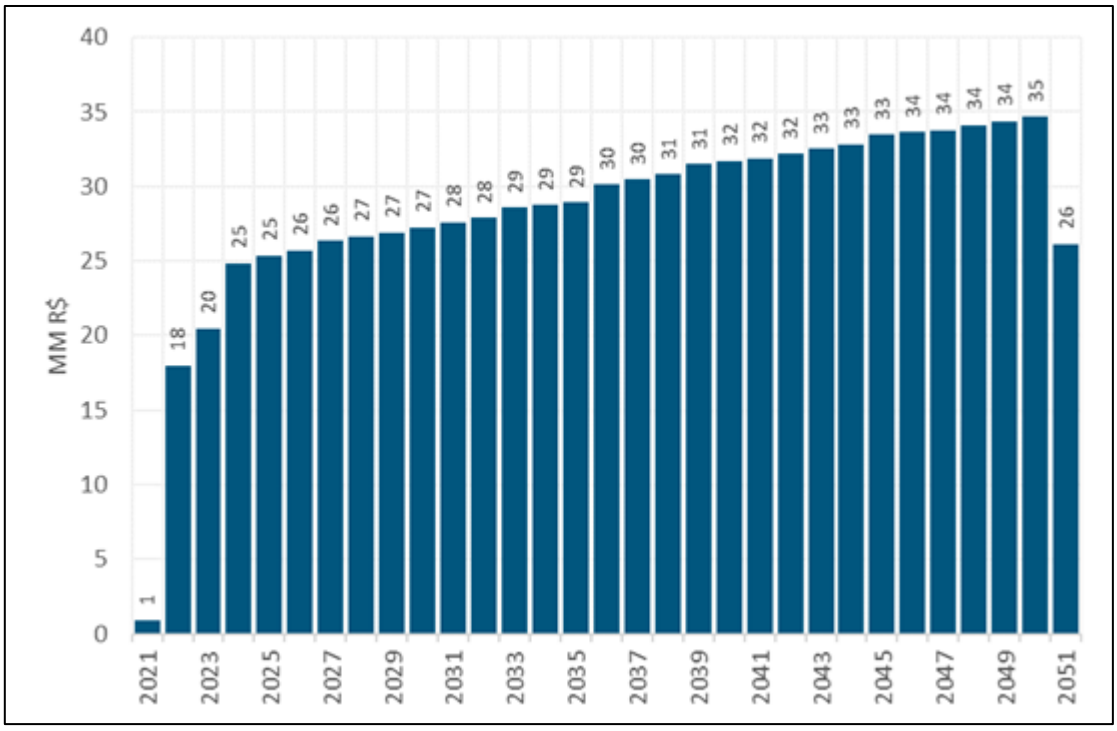
Airport operating costs and expenses are mainly related to personnel and outsourced services, in addition to utilities and public services and consumables.

After the concession, the concessionaire will take up new obligations, which include performance bond, socio-environmental expenses and property tax (IPTU). The concessionaire must also pay grants, applicable according to the feasibility of the concession and therefore not discussed under this item.

Costs and expenses forecast take into account the most appropriate forecast drivers for each item, that is, the variables that best explain the evolution of the observed costs. Additionally, costs and expenses forecasts were based on current values and considered initial efficiency gains derived from private management as well as economies of scale, determined from benchmark analyses.

Total costs and expenses forecasts show an annual average growth rate of 2.0% between 2023 and 2050, increasing from R$20MM to R$35MM (Figure 4-3). Personnel and Outsourced services costs are the most significant, representing 52% and 28% of total costs in 2050, respectively.

Figure 4-3: Costs and expenses during concession (prior to grant values)



Source: GCA Consortium.

It is important to emphasize that, before entering into the concession agreement, the concession holder will be required to settle funds for Infraero's staff readjustment program, reimbursement to authors of the feasibility studies, and compensation to São Paulo stock exchange (B3) for holding the auction (Table 4-1).

Table 4-1: Obligations to be met prior to signing the contract

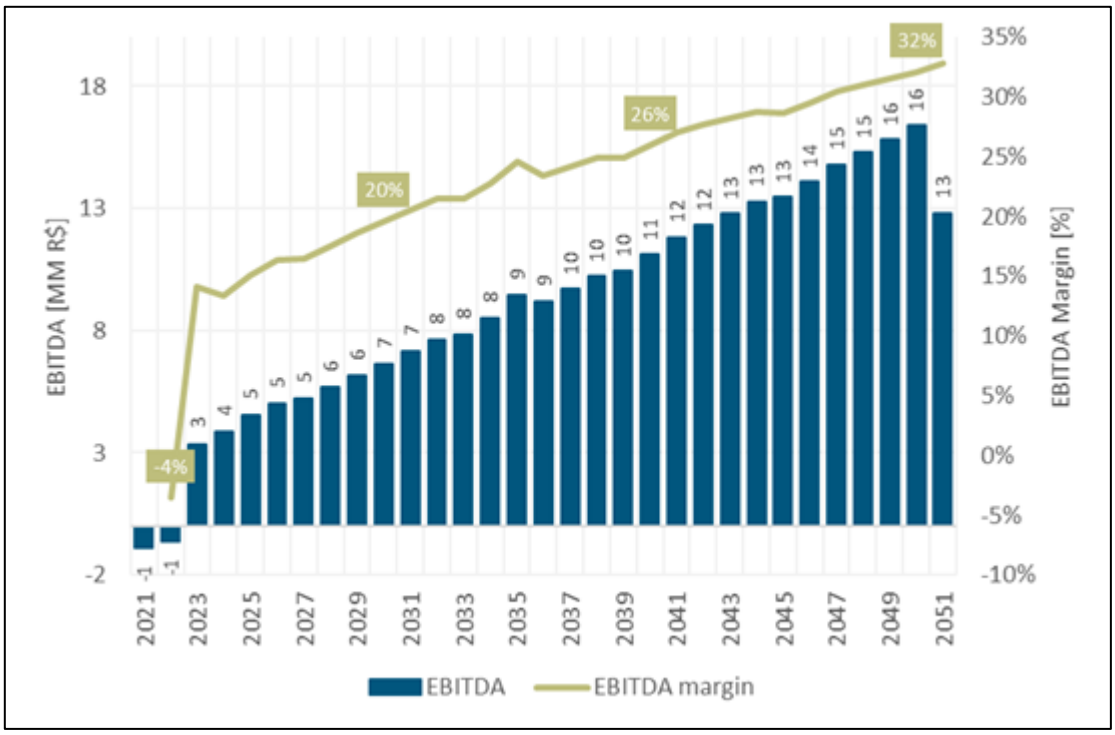
Values in MM R$	TOTAL
OBLIGATIONS TO BE MET PRIOR TO SIGNING THE CONTRACT	**(40,7)**
Funds for Infraero's staff readjustment program	(36,3)
Reimbursement to authors of the feasibility studies	(4,4)
Payment to B3 for holding the auction	(0,1)

Source: GCA Consortium.

EBITDA and margin

Net of grant payments, the concession EBITDA is forecast to be R$3MM in 2023 and to reach R$16MM in 2050 (Figure 4-4), with an average growth of 6.0%p.a. EBITDA margins increase is forecast throughout the concession due to expected economies of scale.

Figure 4-4: EBITDA and EBITDA margins during concession



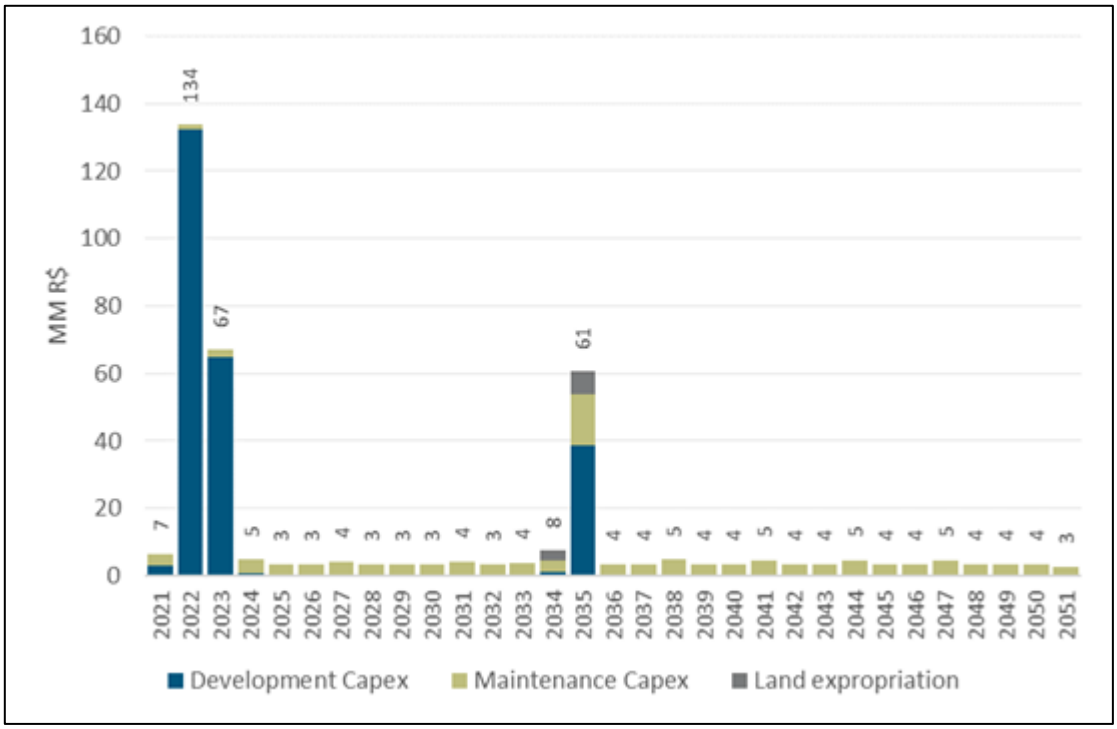
Source: GCA Consortium.

CAPEX

The development plan, expansion of airport assets to meet growing demands and ensure appropriate level of service, requires a total investment of R$374MM.

Development investments (topical and intended to expand airport assets, including expropriations) will be divided into different phases and amount to a total R$251MM. Maintenance investments (periodical and intended to maintain and replace assets, including re-paving cycles) add up to R$123MM throughout the concession period (Figure 4-5).

Figure 4-5: CAPEX during concession

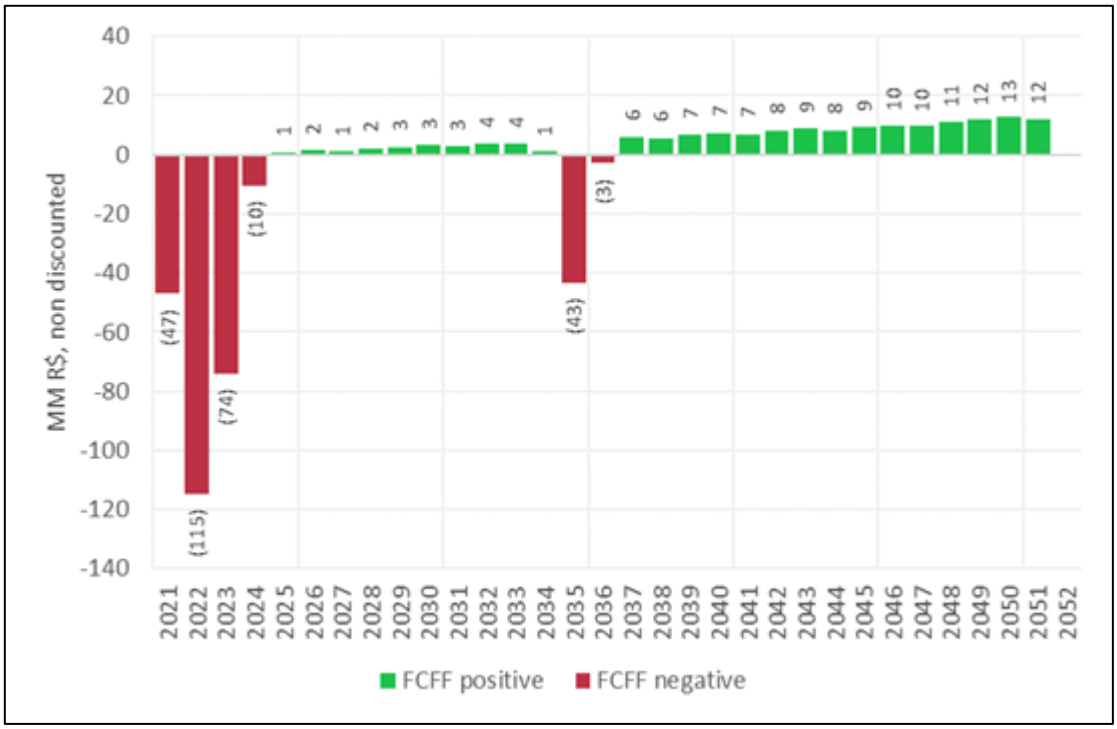


Source: GCA Consortium.

Evaluation of concession's financial feasibility

The project's forecasted free cash flow (FCFF) is presented in Figure 4-6, which shows the FCFF is slightly positive during most of the concession, except during investment cycles, which require funding. The project's IRR is negative (calculated as-3.2%p.a. real) and its MIRR is 3.7%p.a. (real), lower than the cost of capital of 7.23%p.a., thus the concession is not financially feasible.

Figure 4-6: Free cash flow to firm (non-discounted – prior to grant values)

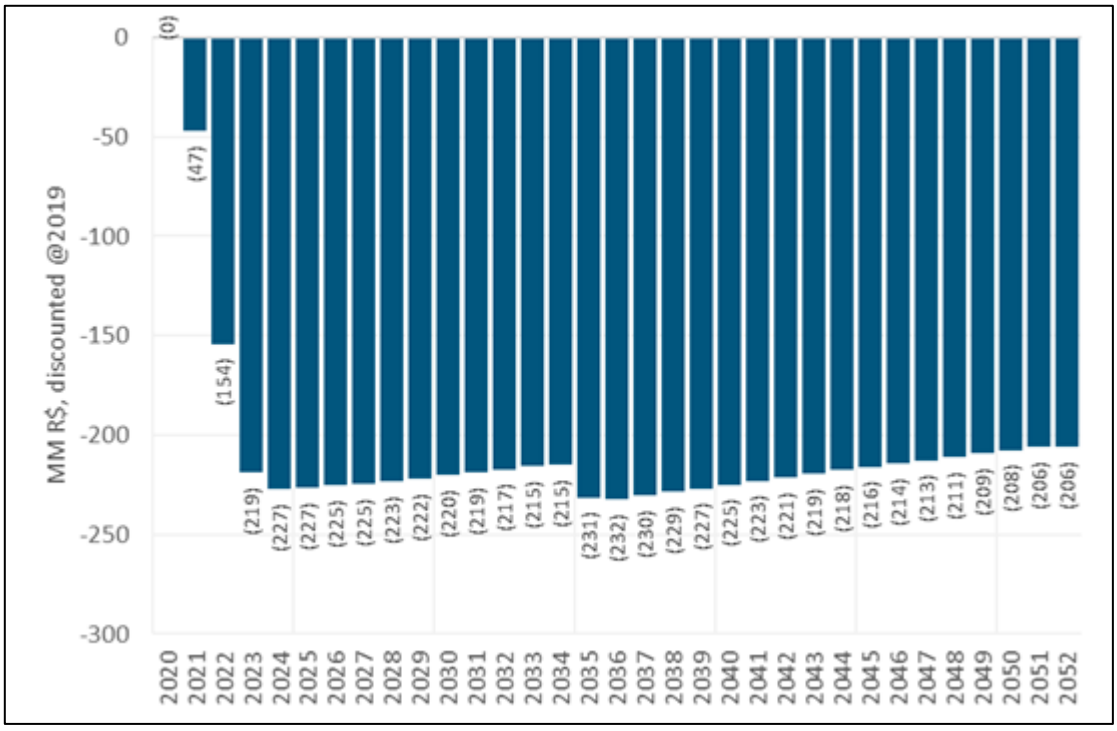


Source: GCA Consortium.

The cumulative discounted FCFF (given the referential weighted average cost of capital – WACC set at 7.23%p.a., real), from which the NPV net of grant payments is determined, is shown in Figure 4-7. Project does not offer a rate of return to its capital providers, consequently, the NPV is negative (**R$-206.1MM**). As such, the isolated concession of the Airport is not financially feasible and cannot support grant payments made out to the Government.

This result is mainly due to the high relevance of the initial investments to meet required airport's appropriate level of service in comparison with its restricted operating cash flow capacity (although this is positive).

Figure 4-7: Cumulative discounted free cash flow to firm (net of grant payments)



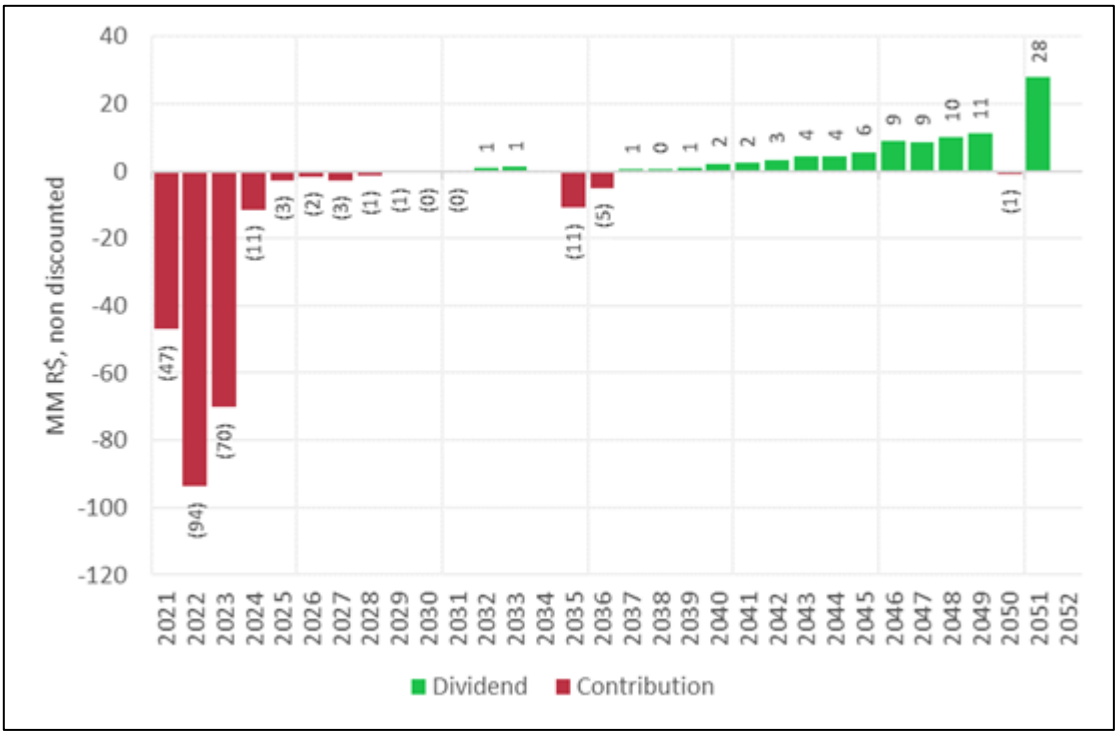
Source: GCA Consortium.

Attractiveness to shareholders

Analyses of the project's attractiveness to shareholders consider: (i) third-party funding (long term BNDES loan and issuing of debentures, given market conditions and minimum covenants); (ii) equity needs; and (iii) the possibility of dividend payments throughout the concession.

Figure 4-8 presents the forecast flows of capital injections and dividend distributions. The concessionaire needs to inject equity resourses during the first two development phases. Dividend distribution up to 2036 is limited due to debt service and during funding and respective grace periods. Thereafter, dividends will increase over the remainder of the concession period. By the end of the concession the paid-in capital is returned to shareholders. Given this scenario, the equity IRR is -4.0%p.a. (real), calculated based on contribution and dividend flows.

Figure 4-8: Contribution and dividend flows, non-discounted (post-payment of grants)



Source: GCA Consortium.