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Environmental, Social, and Health Impact Assessment (ESHIA) for Vista Onshore Operations

Impact Assessment

6 June 2019

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Impact Assessment

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6. IMPACT ASSESSMENT

6.1 Methodology

For environmental impacts identification and evaluation of, the methodology proposed by Vicente Conesa Fernández-Vítora (Conesa 2010) has been used, as it is one of the most complete methodologies. Conceptually, effects are considered as any change (positive or negative) that the actions of a certain project can generate in the environment (physical, biological, and socioeconomic-cultural factors) where it will be implemented.

The sequential development of the methodology for the evaluation of environmental impacts considers the following steps:

- Identification of Project Actions
- Identification of Environmental and Social Factors
- Identification of Environmental and Social Impacts
- Evaluation of the Magnitude of Environmental and Social Impacts

6.2 Identification of Project Actions

Based on the Project Description, actions capable of altering environmental conditions, enough to generate impacts, have been identified for each stage of the project. It is important to note that the Vista Project described herein is a combination of existing operations (brownfield) that have been in operation for some years, and a new program of unconventional well development and associated infrastructure.

The following table describes impacting actions, activities, and phases of the project observing their correlation for future environmental impact assessment.

Table 6-1: Description of Project's Actions

Stage	Activities	Project´s Actions
Construction	Access Roads enhancement and construction	Land access
		Enabling and improving existing access and construction of new accesses.
	New drilling facilities (PADs) construction and existing production facility enhancement (e.g., enhancement of motor-compressor stations-EMCs, water, gas, and oil pipelines, central production facilities, and three-phase separation facilities)	Use of vehicles and heavy machinery
		Soil movement
		Temporary camps (civil works, mechanical workshop, electrical works, and auxiliary and drilling equipment storage)
		Transportation of equipment, supplies and personnel
		Vegetation clearance
		Leveling and topography redefinition
		Civil works, security perimeter and infrastructure, sewage and drainage works (sanitary, pluvial, electrical, and procurement and use of arid aggregates)
		Electrical and mechanical works
		Drilling (vertical and horizontal drilling, foundation, blow out prevention, drilling mud

Stage	Activities	Project´s Actions
		materials and aggregates supply, geological control service and dry location service)
		Completion, flow profile logging, drilling test, (fracture and stimulation) and well testing
		Well platform installations (assembly of equipment)
		Additional production facilities
		Installation and construction of pipeline (gas, oil, and production water)
		Construction and assembly of oil, gas and production water treatment facilities
	Energy supply	Provisioning, energy generation, derivation, and energy consumption
	Water supply	Provisioning, derivation and consumption of water
	Supply of fuel, lubricants, and chemical products	Procurement, use or spill contingency of fuel, lubricants and chemical products
	Generation of liquid effluents, solid waste and atmospheric emissions.	Liquid discharges management
		Solid waste management
		Atmospheric emissions management
	Hiring/procurement of labor, supplies and materials	Labor hiring
		Acquisition of supplies and materials
		Personnel activities
Operation	Operation and maintenance of wells and treatment/transport facilities	Land access
		Transportation of equipment, supplies and personnel
		Production of existing wells, wells under development and reinjection
	Energy supply	Provisioning, derivation and consumption of energy
	Water supply	Provisioning, derivation and consumption of water
	Supply of fuel, lubricants and chemical products	Procurement, use or spill contingency of fuel, lubricants and chemical products
	Generation of liquid effluents, solid waste and gaseous emissions	Liquid discharges management
		Solid waste management
		Atmospheric emissions management
	Hiring/procurement of labor, supplies and materials	Labor hiring
		Acquisition of supplies and materials
		Personnel activities

Stage	Activities	Project´s Actions
		Transportation of equipment, supplies and personnel
Abandonment	Demobilization of equipment, materials and dismantling of infrastructure and auxiliary facilities	Land access
		Liquid discharge management
		Solid waste management
		Handling of Hazardous Substances (fuel, chemicals)
		Labor retrenchment
		Acquisition of supplies and materials
		Personnel activities
		Demobilization of equipment, supplies and personnel
		Use of vehicles and heavy machinery
		Dismantling of facilities and auxiliary infrastructure
		Leveling and topography restoration
		Revegetation

Source: ERM, 2019

6.3 Identification of Environmental and Social Factors

Environmental and Social factors include the physical (air, soil, water, etc.), biological (flora and fauna) and socioeconomic-cultural (social relations, economic, cultural activities, etc.) aspects, which are susceptible to change, positively or negatively, from an action or set of actions generated by a project.

The knowledge of the conditions provided by the environmental and social characterization of the study area has allowed the elaboration of a list of environmental factors, which have been considered as potential receptors of the impacts that the project may generate.

Table 6-2: Potential Environmental and Social Receptors of Impacts

Environmental component	Environmental sub-component		Environmental Factor
Physical component	Geology and Geomorphology		Structural stability
	Soils		Soil Quality
	Water resources		Surface Water Quality
			Groundwater Quality
	Air Quality and Noise		Air Quality
			Noise Levels
	Landscape		Scenic Quality
Biological component	Flora		Vegetation
	Terrestrial Fauna	Major and Minor Mammals	Abundance and Composition of mammals

Environmental component	Environmental sub-component		Environmental Factor
		Birds	Abundance and Composition of birds
		Herpetofauna	Abundance and Composition of herpetofauna
	Terrestrial ecosystem		Terrestrial ecosystem
Social component	Economic		Labor
			Economic Activities
	Cultural		Daily life

Source: ERM, 2019

6.4 Identification of Environmental and Social Impacts

The identification of environmental and social impacts (physical, biological and socio-economic-cultural) was carried out through an Impact Identification Matrix (IIM), which consists of a double entry box of the cause-effect type, in which the rows correspond to actions with environmental and social implications derived from the Project (Project Actions), and the columns are components, characteristics or conditions of the environment (Environmental and Social Factors) that may be affected.

In the interactions of the matrix (Rows vs. Columns), the possible resulting impacts are displayed in a qualitative way. To do this, an alphanumeric code is provided for each possible impact described. In the IIM, the interactions are indicated, both for beneficial effects and possibly harmful effects, that are relevant from the environmental and social point of view.

The following table shows an example model for the generic form in which the evaluation of possible impacts through a matrix of this type will be presented.

Tabla 6-3: Model of Impact Identification Matrix (MIII)

		Environmental Factors									
		Factor 1		**Factor 2**		**Factor 3**		**…**		**Factor n**	
Project Actions	Action 1										
	Action 2					C1	C2				
						C3	C4				
	Action 3										
	….										
	Action n										

Source: ERM, 2019

Crossing C1 (box with alphanumeric code) represents the possible impact that "Action 2" of the Project on "Environmental Factor 3" could generate.

The following table lists the Environmental and Social impacts identified in the Project:

Table 6-4: Environmental and Social Impacts of the Project

Component	Impact	Code
Physical	Alteration of structural stability	A1
	Alteration of soil quality	B1
	Alteration of surface water quality	C1
	Alteration of groundwater quality	C2
	Alteration of air quality	D1
	Alteration of noise levels	D2
	Alteration of the scenic quality	E1
	Recovery of scenic quality	E2
Biological	Alteration of vegetation cover	F1
	Reduction in plant regeneration capacity	F2
	Alteration of composition and abundance of mammals (minors and adults)	G1
	Alteration of composition and abundance of birds	G2
	Alteration of composition and abundance of herpetofauna	G3
	Recovery of the terrestrial ecosystem	H1
Social	Change in land use and landowners livelihoods	J1
	Local employment generation	J2
	Increased Demand of Local Goods and Services	J3
	Community Health, Safety, Security	J4

Source: ERM, 2019

In *Annex 6.1*, the Matrix of Identification of Impacts is presented.

6.5 Evaluation of Environmental and Social Impacts

Once the possible impacts on the physical, biological and socioeconomic-cultural receptors have been identified, as a result of the implementation of the Project in its different stages, the next step is to proceed to qualitatively evaluate them, in order to be able to identify the most significant impacts and define the most suitable prevention and mitigation measures.

6.5.1 Impact Index (II)

The Impact Index is defined by eleven (11) attributes of a qualitative type, defined by V. Conesa Fernández-Vítora (Conesa, 2010) and described below:

1. Nature (+ or -)/Character.

The nature of the environmental impact refers to the beneficial (expressed as +) or detrimental character (expressed as -) of each of the actions that will act on the different factors considered.

2. Intensity (I) / Degree of Disturbance

Intensity is defined as the degree of effect of the action on the factor, in a specific area in which it acts. This assessment is between minimum affectation (1) and total destruction (12).

Numerical value	Description
1	Low or minimum
2	Medium

Numerical value	Description
4	High
8	Very high
12	Total

3. Extension (EX)

It is the percentage of the area affected by a specific impact. If the impact has a specific effect, it is considered as a value of 1, if it is an impact that manifests itself in a generalized manner in the whole environment, its total value is 8. In the event that the effect is location specific and occurs at critical or highly sensitive location, its total value will be 12.

Numerical value	Description
1	Punctual
2	Partial
4	Broad or Extensive
8	Total: Effect of widespread influence on the entire Project environment
(+4)	Critical

4. Moment (MO)

Time elapsed between the appearance of an action and the beginning of the effect on the environmental factor considered. If any circumstance makes the term for the manifestation of the impact critical, 4 units may be attributed to it above those specified.

Numerical value	Description
1	Long term: The effect manifests after 10 or more years
2	Medium term: The effect is manifested in a period of between 1 and 10 years
3	Short Term: The effect is manifested in a period less than 1 year.
4	Immediate
(+4)	Critical

5. Persistence (PE) / Duration

Duration of the effect, from its appearance until its disappearance by natural means or through corrective measures.

Numerical value	Description
1	Duration less than one year
2	Temporary or Transitory
3	Persistent
4	Permanent and constant: Duration more than 15 years

6. Reversibility (RV)

Possibility that the affected factor has to return to its initial natural state by natural means, once the action stops acting on the environment.

Numerical value	Description
1	Immediate or Short Term: Reversible in less than one year
2	Medium Term: Reversible within a period between 1 and 10 years
3	Long Term: Reversible within a period between 10 and 15 years

Numerical value	Description
4	Irreversible: Reversible in more than 15 years or impossible to reverse

(*) For positive impacts, the evaluation is considered in an inverse manner

7. Synergy (SI)

Reinforcement of two or more single effects. Two simultaneous single effects is greater than what would be expected when the actions that cause them act independently.

Numerical value	Description
1	Without synergy
2	Moderate synergism
4	Very synergistic

8. Accumulation (AC)

Progressive increase in the manifestation of the effect, when the action that generates it persists on a continuous or repeated basis.

Numerical value	Description
1	Simple: Does not produce cumulative effects
4	Cumulative: Produces cumulative effects

9. Effect (EF)

Cause and effect relationship, the form of manifestation of the effect on a factor as a consequence of an action.

Numerical value	Description
1	Indirect: Secondary or additional impacts that could occur on the environment as a result of human action
4	Direct: Primary impacts of a human action that occur at the same time and in the same place

10. Periodicity (PR)

Regularity of manifestation of the effect, either cyclically or recurrently (periodic effect), unpredictably in time (irregular effect) or constant over time (continuous effect).

Numerical value	Description
1	Irregular or discontinuous
2	Periodic
4	Continuous

11. Recoverability (RC)

Evaluates the possibility of the factor to return to the initial conditions prior to the action, through human intervention (application of corrective or remediation measures).

Numerical value	Description
1	Immediate
2	Short term
3	Medium term

4	Long term
4	Mitigatable, substitutable and compensatable: If it is partially recoverable, or unrecoverable but with introduction of compensatory measures.
8	Irrecoverable

(*) For positive impacts, the evaluation is considered in an inverse manner

6.5.2 Importance of Impact (I)

Based on the attributes described above, the Importance of the Impact is calculated for each of the possible environmental impacts (physical, biological and socioeconomic-cultural), by applying the following formula:

$$I = \pm (3I + 2EX + MO + PE + RV + SI + AC + EF + PR + RC)$$

To rank environmental impacts, ranges have been established representing the minimum and maximum theoretical values of the Environmental and Social Impact. In this way, negative environmental and social impacts are classified as follows:

- Impacts with values of less than 25 are considered minor or insignificant, compatible or mild, with minimal impact on the environment.
- The Impacts with importance values between 25 and 49 are considered moderate, affecting the environment but that can be mitigated and/or recovered.
- The Impacts with importance values between 50 and 74 are considered severe. Special measures must be considered for their management and monitoring.
- Impacts with values greater than 74 are considered critical, with total destruction of the environment.

Table 6-5: Classification of Ranges for Negative Impacts

Impact Index Ranges	Negative impact
≥ -75 to -100	Critical
≥ -50 to -74	Severe
≥ -25 to -49	Moderate
≥ -13 to -24	Compatible or mild

Source: ERM, 2019

On the other hand, positive environmental impacts have been classified only as significant or not significant. It has been considered that the beneficial effect of an impact is extremely subjective, so they will only be identified and classified as:

- Significant, those impacts that can be considered almost universally beneficial regardless of how much benefit they generate.
- Not significant, those that in spite of being recognized as not harmful are not universally recognized as beneficial. Mostly those that generate doubts about their contribution to the improvement of the original state of the environment or only the state of the environment generated by the project.

6-6: Classification of Ranges for Positive Impacts

Classification of Ranges for Positive Impacts	Positive Impact
13 to 49	Not significant
50 to 100	Significant

Source: ERM, 2019

After the environmental and social impact assessment methodology is presented in more detail in *Annex 6.2 - Matrix of Impact Assessment*, the Assessment of Environmental and Social Impacts.

The context of each of the environmental and social components impacted is described below with the general description of the conditions under which the impact will be manifested due to the activities of the project.

6.6 Physical Impacts

6.6.1 Surface Water and Groundwater Hydrology (Quantity)

Impacts on surface water and ground hydrology are linked to the project's construction and operation stages. These impacts refer to physical changes to surface water by modification or alteration of water channels, runoff, and use of water resources. Groundwater hydrology could also be affected during drilling operation, if no proper measures are taken while drilling or reinjecting wastewater, or be affected by indirect impact from water or wastewater discharge.

The study area is crossed by a large number of alluvial channels, or runoff that are activated only for a few hours and as a consequence of torrential rains. Among them those that begin their course in the western sector of the concession area carrying mainly runoff from Bajo de Añelo. However, surface water will not be affected by the Project as the channels will not be temporarily obstructed and the case of runoff from Project lands, the Project will ensure runoff and pre-existing water flow is unchanged. Therefore, the Project will protect locations and their surroundings with alluvial protection works such as embankments, if applicable. The Project will also observe periodically the behavior of these sites in torrential and convective rains and apply corrective measures if anomalies are observed in the protection system. The tasks of re-contouring the land surfaces at the end of the construction stage will favor the return of the surface drainage to the initial conditions or towards a new state of equilibrium.

The amount of water to be used by the Project will be approximately 1,200 m^3 for the construction of each of 4-wells/6-wells PAD and 600 m^3 for the construction and conditioning of auxiliary roads. For drilling and completion, the amount of water to be used for the preparation of drilling mud and for cementing operations is estimated at 700 m^3. Water for drilling and completion operations has been provided and potentially will be provided from the water reservoir "Cruz de Lorena" operated by O&G Developments S.A. (Shell). Water sources for future requirements will be evaluated considering qualified surface sources close to the Project area, considering that well completion in each well-fracture stage will consume approximately 1,450 m^3, and with 33 fracking/stimulation steps at each well, the demand is 47,850 m^3 of fresh water per well.

The existing water permits for the existing facilities allow a maximum authorized volume 776,200 $m^{3.}$ This is stored in 5,400 m^3 reinforced pre-cast concrete or sheet steel ponds. There is also a complementary permit to use 200,000 m^3 from Cruz de la Lorena Reservoir transported by temporary water pipeline from O&G Developments S.A (Shell) tanks. This will ensure that the company is not using more water than that available in the capture basin, and therefore not generating significant adverse impacts on others. The water extracted from the authorized points will be used in the construction phase, particularly in the hydraulic test action, and in the irrigation of roads, pipelines construction, and service roads to reduce dust generation from vehicular traffic. It is worth mentioning that once the hydraulic test is finished, the water will be stored for reuse.. For this reason, the negative impact on the water supply would be of potential low intensity.

It is important to note that formation water—complex mixture of inorganic compounds (dissolved salts, metal traces, suspended particles), organic compounds (disperse and dissolved hydrocarbons, organic acids), and potentially chemical additives (e.g. scale and corrosion inhibitors added during drilling)—will be treated and reinjected due to its large volume, thus, reinjecting the largest wastewater product.

An approximate average rate of 100 m3/day of production water is estimated to be generated in the first month of production at each well. Since said generation of production water is drastically reduced by 95% during the following 6 months at each well, it is expected that when the drilling campaign finalizes and the 110 non-conventional production wells for VOG are in operation, a total of less than 1,600 m3/day of produced water will be generated and will need to be treated and injected into permitted disposal deep wells.

The design of reinjection programs will consider not only the adequate depth for the pressure control requirements, but also the protection of the confined aquifers of the Neuquén Group according to the particular characteristics of the Project area.

Below are simplified projected data regarding water consumption in well fracturing, well cementation activities, and the total water supply required for those activities.

Table 6-7: Water Consumption and Supply Data and Future Consumption extrapolation

Water consumption in wells					
Number of wells	**Water consumption per fracking well**	**Unit**	**Amount of fractures per well**	**Total Water Consumption**	**Unit**
110	1.450	m^3	33	5.263.500	m^3
Number of wells	**Water consumption for cementing**	**Unit**	**Amount of cementing processes**	**Total Water Consumption**	**Unit**
110	700	m^3	110	77.000	m^3

Additional water consumption needs have also been estimated such as water for construction and conditioning of auxiliary roads and new access roads.

Table 6-8: Water consumption in access roads

Water consumption	Unit	Location
600	m^3	Construction and conditioning of auxiliary roads
1.200	m^3	New access to PADs

It has been estimated that the construction of the compressor station EMC 11 will require 1,000 m^3 of fresh water. Additionally, the construction of the 12” oil pipeline connecting Battery 1 at BMo oil field and the PTC at EL area would require 2,800 m^3 of fresh water for the hydraulic proof (hydrostatic testing) of the pipelines and approximately 60 m^3/day for roads and pipeline route irrigation purposes. In addition, the construction of the oil, gas and production water pipelines connecting EPF 1 and Battery at BMo require between 1,900 m3 and 2,000 m3 of fresh water for conducting the pipelines hydraulic proof (hydrostatic testing).

On the other hand, pipelines are tested in order to verify operative conditions and integrity. Hydraulic proof testing includes operations such as internal cleaning, pressurization, final cleaning, and internal

drying. Pressurized fresh water is used as testing media. Two different types of test are conducted: a) resistance test; and b) integrity test. Once this is complete, water within the pipeline is displaced by means of a scrapper running on compressed air. After this displacement, a sponge scrapper is circulated along the whole length of the pipeline for drying purposes. In order to ensure the elimination of any remaining humidity within the pipeline, it is cleared out with compressed and dry air. In case any sediments deposits are observed during the evacuation of water used for the testing, cleaning scrapers are to be passed through the pipeline in order to ensure full cleaning.

Water used for the hydraulic proof of the pipelines is included within the production circuit of the oilfield and treated as production water at the saltwater treatment plant (PTAS) and later injected at saltwater permitted injection wells through the saltwater injection plant (PIAS).

Quantity of water to be used for the hydraulic proof of pipelines will basically depend on the length and diameter of each pipeline. The following table presents the water quantities estimated for the hydraulic proof of the oil, gas and produced water pipelines connecting EPF1 and Battery 1 at BMo oilfield in BP area, as well as the oil pipeline to be constructed between previously mentioned Battery 1 and the PTC present at EL area, and oil and fluids collection pipelines connecting PAD 5, 6, 7, 8, 9 and 10 with EPF 1.

Table 6-9 Volume of water for Hydraulic Proof of Pipelines

installation	Diameter (inches)	Length (m)	Volume (m3)
Aqueduct EPF 1 – Battery 1 BMo	6	13,602	248
Oil pipeline EPF 1 – Battery 1 BMo	10	16,602	689
Gas pipeline EPF 1 – Battery 1 BMo	12	13,602	992
Oil pipeline Battery 1 BMo – PTEC EL	12	39,280	2,800
PAD 5 y 6 – Existing collection pipeline	3	764	3.50
	3	764	3.50
	6	764	14
PAD 7, 8, 9 and 10 collection pipelines	3	2,610	11.90
	3	2,610	11.90
	6	2,610	47.60
PAD 7, 8, 9 and 10 collection pipelines – EPF 1	3	942	4.30
	3	942	4.30
	10	942	4.70

Source: CONFLUENCIA AMBIENTE & SEGURIDAD, 2018 and BIOSUM, 2018.

Independently of the type of facility to be constructed and whether these have been or are to be constructed, fresh water was and will be obtained from water production well YPF.Nq.BMo-4 located at BMo block. This well has been duly authorized by the Neuquén's Provincial Water Authority, Water Resources Provincial Direction, through Disposition Nº 281/18 for fresh water abstraction.

Water for human consumption has been estimated at 2 – 4 liters/person/day. Potable water will be provided in 10 or 20-liters cold/hot water dispensers, which will be distributed at the different work fronts.

Regarding all these considerations, from the project description and the baseline, from regulated sources and providers, waste water treatment actions, and water recycling opportunities evaluated in

by the Project, the impact has been established as ***moderate***. The significance of the impact will be mitigated by environmental management actions to be performed by the Project including:

- The main disposal alternative of produced water may include injection into the reservoir to enhance oil recovery, and injection into a dedicated disposal well drilled to a suitable receiving subsurface geological formation.
- Also, to reduce the disposal water, well completion activities have considered adequate management to minimize water production, recompletion of high water wells to minimize water production, use of downhole fluid separation techniques with water shutoff if technically and economically feasible.
- The disposal alternatives for test waters following hydrostatic testing include injection into a disposal well.
- The project has also considered to reuse the same hydrostatic test water for multiple tests.
- Other mitigating actions are described in the surface and ground water quality management plan in Chapter 8.

6.6.2 Geology and Geomorphology

Impacts related to geology and geomorphology refer to the possible changes resulting from surface activities, oil drilling and construction activities that include clearing, soil movements, changes to slopes and embankments, conformation of seismic tracks (if applicable), and underground drilling.

Since, 1) the most characteristic feature of geology and geomorphology of this region, is the presence of broad discontinuous plateaus that constitute the "Structural Plains by Obliteration" (González Díaz, 1978), originated from the degradation of highly erosive surface coverings until reaching a hard layer of great areal extension, and 2) most of this plain/plateau exhibits very flat surfaces (slopes between 2 - 5%) with occasional minor escarpments with slopes exceeding 16% and 30%, the impacts on geomorphology are expected to be of low relevance. The low impact prediction is also supported by the presence of other geo-forms observed in the area such as pediments, alluvial fans, low alluvial terraces, floodplains and small closed basins, which give the landscape a flat, stepped appearance with small, sharp slopes.

Regarding aeolian geoforms, those are not well expressed. The most common are the "dwarf dunes" that appear in scattered locations, and the fundamental morphological features in the area derive from the action of dominant fluvial geomorphic process, which are unlikely to be aggravated by minor soil removal for surface filling, levelling and compaction. For the impact of use of aggregates landfilling, it has been planned to minimize the use of granular material (calcareous) and extract and exploit material only from quarries authorized by the competent authority in the Province of Neuquén.

It is important to mention that the region under study can be qualified as having a very reduced seismic hazard. The seismic risk as a percentage of an acceleration of 10% of the severity in 50 years is less than 10.

In the case of conformation of aqueducts, pipelines and gas pipelines, there will be trenching as well as special stream crosses, however, the impact will not generate significant geological changes and subsequently the geomorphology will be restored and levelled after the installation of the pipeline works.

In addition, the assembly of the EMCs and FP will be located on the geological unit called "*Current deposits*", "*Endorheic basins and temporary and ephemeral tributaries*" and "*Pediments elaborated mainly on sediments (includes flank and convergent pediments)*", whose geomorphology were linked to mass removal processes, so the impacts to the geomorphology are predicted to be minor from regrading and compaction activities because the dominant slopes are regularly less than 2%.

Regarding underground drilling, impacts on structural stability of the subsurface geology, if failure in well completion or drilling is detected, has been considered as ***moderate*****.** Vista has an initial risk analysis for the completion of wells, which will control potential impacts (see Table 6-10).

Table 6-10: Risk analysis for temporary well completion activities

Hazard		INITIAL RISK			CONTROL MEASURES		RESIDUAL RISK		
Description of hazards and worse consequences without prevention or mitigation measures in place	Category of loss / Population Affected	Probability	Severity	Risk level	Place all current and planned measures Control, taking into account all the factors that contribute and aggravate Current and Planned Prevention measures to reduce Probability	Current and Planned Mitigation measures to reduce Severity	Probability	Severity	Risk level
1. Premature packer Settlement	Revenue Process Equipment	Possible (3)	Greater (-3)	Undesirable (-9)	Follow the recommendations of the descent according to revised procedure. Travel speed 2 min / shot. Do not circulate the well. And if needed, without exceeding a maximum of 600 psi differential pressure. Calibrating tools.	Retrieve the packer with retriever tool.	UNLIKELY (2)	Serious (-2)	Acceptable (-4)
2. Failure packer sealing system	Revenue Process Equipment	Possible (3)	Greater (-3)	Undesirable (-9)	Settlement with pump to have more precise pressures. In case of exceeding 2800 psi theoretical pressure, call engineering staff Completion SLB.	If gain is observed during displacement, close the well, check pressure and return/control with mud for drowning as per 1900 g/l.	UNLIKELY (2)	Serious (-2)	Acceptable (-4)
3. Failure sealing casing hanger 5 "x 11"	Revenue Process Equipment	Possible (3)	Greater (-3)	Undesirable (-9)	Having updated work procedures, operator experience and show certificates of tools.	Back up the tools and communication plan in case of an eventuality.	UNLIKELY (2)	Serious (-2)	Acceptable (-4)
4. Installation section "C" / Lift BOP's	Revenue Process Equipment	Possible (3)	Greater (-3)	Undesirable (-9)	Two tested barriers, packer system,BOP experienced operator and work procedures in place.	Having a communication plan and back up of materials and tools.	UNLIKELY (2)	Serious (-2)	Acceptable (-4)
5. Lower completion 2 7/8" EUE 1x1 with latch anchor	Revenue Process Equipment	Possible (3)	Serious (-2)	Undesirable (-6)	Calibrating tools Surface operator with proven experience.	In case of proven packer seals failure, have back up tools in place for LATCH anchor change.	UNLIKELY (2)	Serious (-2)	Acceptable (-4)

Source: Vista, HARC Completación Temporal Pozo 2019.

In addition, a blowout can be caused by the uncontrolled flow of reservoir fluids into the well borehole, which may result in an uncontrolled release of hydrocarbons. Blowout prevention measures during drilling will focus on maintaining well borehole hydrostatic pressure by effectively estimating formation fluid pressures and strength of subsurface formations. This can be achieved with techniques such as: proper pre-well planning, drilling fluid logging; using sufficient density drilling fluid or completion fluid to balance the pressures in the well borehole; and installing a Blow Out Preventor (BOP) system that can be rapidly closed in the event of an uncontrolled influx of formation fluids and which allows the well to be circulated to safety by venting the gas at surface and routing oil so that it may be contained. The BOP will be operated hydraulically and triggered automatically, and tested at regular intervals. Facility personnel will conduct well control drills at regular intervals and key personnel will attend a certified well control school periodically. During production, wellheads will be regularly maintained and monitored, by

corrosion control and inspection and pressure monitoring. Blow out contingency measures will be included in the facility Emergency Response Plan (Chapter 10).

6.6.3 Soil

Project footprints resulting from construction and production activities may include well pads, temporary facilities, such as workforce base camps, material (pipe) storage yards, workshops, access roads, airstrips and helipads, equipment staging areas, construction material extraction sites (including borrow pits and quarries), permanent processing treatment, transmission and storage facilities, pipeline right-of-way corridors, access roads, ancillary facilities, communication facilities (e.g. antennas), and power generation and transmission lines. Impacts to soil will be also related or could potentially originate loss of, or damage to, terrestrial habitat, creation of barriers to wildlife movement, soil erosion, and disturbance to water bodies including possible sedimentation, the establishment of non-native invasive plant species and visual disturbance. The extent of the disturbance will depend on the activity along with the location and characteristics of the existing vegetation, topographic features and runoffs.

The edaphic layer will be impacted by 1) tasks of clearing, land conditioning, movement of soil, and compacting in the area where the facilities will be built (temporary and permanent facilities during construction stage) and by 2) potential solid waste generation due to construction and operation activities. For example, in accordance with the Project description, EMCs location (EMC11 removes 20,656 m^2), location for the assembly of a torch (865 m2), preparation stage including the construction of an 18,400 m^2-PAD (approximately 160 m x 115 m), areas for camp, parking, materials storage and logging truck totaling 2,000 m^2, and the burning pit of approximately 200 m^2 (20 m x 10 m) to be located no less than 50 m down gradient from the well head. All locations require movement of soil and compaction.

Vista has considered the visual impact as permanent in their design so that impacts on the existing landscape are minimized. The design has taken advantage of the existing topography and vegetation, and has used low profile facilities and storage tanks when technically feasible and if the overall facility footprint will not be significantly increased.

Table 6-11: Amount of impacted areas by civil works

Location	Area	Unit
PAD	18.400	m^2 (aprox. 160 x 115 m)
Camp, parking, materials storage and logging truck	2.000	m^2
Burning pit	200	m^2 (aprox. 20 x 10 m)
Total PAD Area	20.600	m^2
Total Area for Water Management Facility	31.250	m^2

Table 6-12: Amount of projected PADs

PAD	Wells by PAD	Total wells
1	2	2
9	4	36
12	6	72
TOTAL		110

Since the project considers around 23 PADs of 4 or 6 wells each, and approximately each PAD could have around 20.600 m^2, the total area to suffer impact of soil removal and leveling of topography and compacting could be expected in 453.200 m^2. If the amount of soil removal for water treatment facilities is added, the total area of soil impacted could be around 484.450 m^2, as shown in the table below.

Table 6-13: Areas impacted by soil removal, leveling and compacting

Areas impacted by soil removal, leveling and compacting		
Total Area PADs	453.200	m^2
Total Area Water Management Facility	31.250	m^2
Total soil removal and compacting	484.450	m^2

Consequently, soil impacts will occur due to temporary facilities such as base camps for workers, storage of material (pipes), workshops and due to permanent facilities such as roads, production treatment facilities, water injection facilities, or drilling sites usually constructed of local materials such as gravel and also regularly paved with asphalt or concrete. Construction and operation activities will modify the characteristics of the soil in terms of its main characteristics such as structure, texture and porosity.

Soils of the order of the Entisols and the Aridisoles are the most predominant, most of their properties are inherited from their original parent materials, which have been little altered by the conditions of the natural environment but more from previous anthropogenic impacts in the area.

Aridisoles are soils of dry regions and are characterized by being associated with a sparse shrub steppe, so the organic matter content is very low, and have a water balance frankly negative that prevents or reduces the mobility of the constituents in the soil profile in case of spills. Entisols are very young with none to very incipient genetic development, so it is common that they lack diagnostic horizons. Most of their properties (color, texture, etc.) are inherited from the parent materials.

It is foreseen based on the analysis of physical risks that the sensitivity of soils in the area is low, since it involves attributes of the physical environment whose original conditions tolerate without problems the actions of the Project, and the recovery of soils could happen in a natural way, or with the application of low complexity mitigation measures.

The construction or enhancement of aqueducts, pipelines, gas pipelines, and production facilities will also generate a negative alteration of the soil relief. The compaction of the subsoils through site grading and levelling, and the presence of heavy vehicles and machinery during construction, will result in lower permeability of the soil and therefore decrease infiltration and increase run-off, altering the natural drainage characteristics of the soil within the PADs. The impacts of compaction and erosion of soils will be negative and restricted to onsite. Outside of the Project Footprint Area, potential limited impacts may be associated with erosion along access roads.. Therefore, regarding activities on different areas, soil removal will generate probably a high intensity effect, mainly at the specific site of each topographic relief impacted. It should be noted that, in the pipeline construction, there will be no blasting due to the fact that the terrain does not bedrock outcrops. This means that the release of airborne particles will be considerably reduced. It is also important to emphasize that use of existing roads will be opimized which significantly reduces the soil impact.

On the other hand, tasks, that require clearing of vegetal cover, favor the processes of compaction of the soil as will the circulation of heavy machinery. For this reason, the construction actions for facilities, assembly of temporary/permanent surface installations, and pipes will negatively affect compaction. About the aggregates that will be used in the reconformation of platforms for leveling after the movement of earths, it is estimated that 243 tons (18 boxes) of sand will be used in each well fracture, depending on the length of the well and the design of the fracture in each perforation. Additionally, if 4 wells are

assumed per PAD and a fracture speed of 5 stages/day, the necessary logistics is of almost 1200 trucks in less than 27 days.

The sand is extracted from quarries located in the provinces of Entre Ríos and Chubut, then processed in treatment plants and qualified according to API 19C Standard. The treatment plants will be located near the quarries or sources of energy and water. The treatment plant performs basically 3 processes: washing with water to remove impurities, drying to remove water from the previous operation and sorting by shakers. Afterwards, the treated sand is stored in bulk of 1.5 tons that are transported from Entre Ríos or Chubut to Añelo. For intermediate storage of aggregates of the Project, there is a warehouse in Añelo with a capacity of approximately 17M tons. This warehouse is covered and has the necessary machinery to pass the sand from the 1.5 ton bags to bulk. The bulk sand is transferred from the intermediate warehouse to the PAD where it will be consumed. This transfer is made in boxes of sand of 13.5 tons each. Two boxes are placed on each truck. The sand arrives at the PAD and is collected in hoppers. Each truck unloads full boxes, loads empty boxes, and returns to the warehouse to continue the transport process. At the drilling location, the sand is transferred to the fracturing equipment, which minimizes the sand in suspension and achieves superior safety conditions.

Thus, not only aggregates have been estimated but also the sand requirements for the well-drilling process.

Table 6-14: Aggregates and sand consumption estimated for the Project

Type	Quantity	Unit	Amount of PADs	Total Aggregates	Amount of wells	Fractures per well	Amount of sand
Aggregates	20.000	m^3/PAD	22	440.000 m^3	-	-	-
Sand	243	tons/fracture	-	-	110	33	882.090 tons

In the future, all those actions tending to return the environment the pre-project conditions, such as tasks of covering and recomposition of temporary tracks, will affect soils positively.

It should be also noted that the installation of works will be carried out in previously operated properties, so that the effect on soils is reduced.

Regarding all the aforementioned detail of the project description design and the baseline detail, the general impact on soil will be ***compatible*** but the alteration of the scenic quality has been estimated as ***moderate***. Therefore, Vista has considered the following measures which in addition to those detailed in Chapter 8, will control, mitigate and prevent environmental impacts to soil.

Additional prevention and control measures to minimize the footprint of onshore oil and gas developments may include the following:

- All facilities in locations have been sited to avoid vulnerable terrestrial habitat;
- Land requirements for aboveground permanent facilities and areas to be cleared have been minimized;
- Hand cutting (where possible) will be used, avoiding the use of heavy equipment such as bulldozers, especially on steep slopes, water crossings, and sensitive areas;
- The project will use a central processing/treatment facility for operations;
- Well pad size will be minimized for drilling activities;
- Construction of facilities in floodplains will be avoided, as feasible;

- The Project has also considered the use of existing utility and transport corridors for access roads and pipeline corridors to the extent possible;
- The Project has also considered the routing of access roads to avoid induced impacts such as increased access for poaching;
- The Project has minimized the width of pipeline right-of-ways or access roads during construction and operations as far as possible:
- Safety fences and other methods to prevent people or animals from falling into open trenches will be constructed;
- Clean-up and fully reinstate following construction activities (including appropriate revegetation using native plant species following construction activities) the pipeline right of-way and temporary sites such as workforce accommodation camps, storage yards, access roads, helipads and construction workshops, to the pre-existing topography and drainage contours;
- Implement repair and maintenance programs for reinstated sites;
- Install temporary and permanent erosion and sediment control measures, slope stabilization measures, and subsidence control and minimization measures at all facilities, as necessary;
- Regularly maintain vegetation growth along access roads and at permanent above ground facilities, and avoid introduction of invasive plant species. In controlling vegetation, use if applicable biological, mechanical and thermal vegetation control measures and avoid the use of chemical herbicides as much as possible. If it is demonstrated that the use of herbicides is required to control vegetation growth along access roads or at facilities, then personnel will be trained in their use. Herbicides that will be avoided include those listed under the World Health Organization recommended Classification of Pesticides by Hazard Classes 1a and 1b, the World Health Organization recommended Classification of Pesticides by Hazard Class II and Annexes A and B of the Stockholm Convention, with some internationally regulated exceptions;
- The Project has considered suitable paint color for large structures that can blend with the backgrounds lanscape.

6.6.4 Air Quality

The most important impact in terms of air quality is the increase in Atmospheric Emissions. This primarily refers to emissions of suspended particles, NOx, SOx, CO. Other pollutants include: hydrogen sulfide (H2S); volatile organic components (VOC); methane and ethane; benzene, ethylbenzene, toluene, and xylenes (BTEX); glycols; and polycyclic aromatic hydrocarbons (PAHS) present in the project area that may produce risk, harm or discomfort to people; during installation or operation. Additionally, there will be greenhouse gas emissions (GHG) from facilities and support activities.

In previous conventional well and midstream operations, the primary sources of air emissions were the engines (for power generation and gas compression), heaters and furnaces, gas venting without burning, and gas burning. Other relevant sources of air emissions were, in order of importance, methane evaporation from storage tanks, dehydration of gas, fugitive emissions, dehydration of glycol, and finally, scrapper y pigging.

Leaks of production-gases will not only affect human health but depending on the gas leakage, gas releases can generate explosive or toxic atmospheres, as in the case of releases of H_2S performed especially within confined spaces.

In addition, activities and infrastructure such as wells drilling, fracking, construction, operation and maintenance of pipelines, aqueducts, treatment facilities, injection plants, pumping and compression stations, storage facilities, mobilization of equipment and personnel for the project, welding and electro-mechanical activities, as well as the use of machinery and heavy equipment may increase the

concentration of particulates, combustion gases, noise and other atmospheric emissions temporarily affecting the air quality. Tasks to be carried out during the construction phase will generate dust and atmospheric emission which will negatively affect air. Also, gaseous emissions (carbon dioxide, carbon monoxide, hydrocarbons and nitrogen oxides) from vehicles and machinery will decrease air quality during construction, but this effect will be attenuated in the operation stage due to the decrease of vehicular traffic.

The tasks of covering and restoration of temporary tracks, will also affect negatively on this factor, due to particles released during scarification and grading.

According to 2015 Greenhouse Gases (GHG) inventory developed by Petrolera Entre Lomas S.A., PELSA,the generation of tCO_2e dropped from 436,716 in 2011 to 337,225 in 2015.(See Table 6-18)

Air emissions from stationary engines represented 59.4% of the total GHG emissions. Of these, 64.3% corresponded to emissions from power generators and 33.5% to gas compression. Emissions from heaters and furnaces represented 13.8% of total emissions, while gas venting without burning represented 8.6% of total emissions and gas burning represented 6.9% of the total emissions. Also, GHG emissions generated during 2015 at EL area were estimated to be 264,300 tCO2e (78,4%) while BP area generated 64,700 tCO2e (19,2%).

Emissions of CO2 represented 70.3% of the total CO2-equivalent emissions, while CH4 emissions represented 28.3% of emissions and N2O emissions represented 1.5% of emissions.

These emissions corresponded to 2015 production of:

- Oil: 700,694 m3
- Gas: 511,943,000 m3
- Water: 5,134,780 m3

Table 6-15: CO2 equivalent tons resultant from Project's previous activities 2011-2015

Sector	2011	2012	2013	2014	2015
Fugitives	3.521,03	3.661,23	3.661,23	3.661,23	3.661,23
Drilling Motors	7.576,47	7.092,60	6.801,72	7.268,49	6.316,52
Trucks	107,24	107,24	107,24	107,24	107,24
Drilling	1.354,88	1.305,66	750,00	870,00	810,00
Extinguishers	0,50	1,50	1,50	1,61	3,04
Flash Methane	12.568,35	10.149,88	21.569,64	18.354,40	16.140,64
Glycol Dehydration Tower	3.084,97	3.584,01	1.936,15	1.936,15	1.936,15
Kimray Pump	12.380,21	14.382,91	7.769,92	7.769,92	7.769,92
Process Tanks	-	-	-	-	-
Scrapper	1.917,24	2.866,82	2.884,94	1.400,89	1.424,39
Spills	-	-	-	-	-
Trucks - GLP load	-	-	-	-	-
Trucks - Product Load	-	-	-	-	-
Venting without Burning	36.074,91	36.383,55	36.576,41	34.003,22	28.993,88
Gas Flare	42.219,43	41.044,93	12.046,21	10.193,65	23.242,13
Heaters & Furnaces	92.912,45	92.560,15	71.781,76	46.580,58	46.680,01
Stationary Engines	222.979,07	192.377,88	217.660,75	209.047,19	200.136,21
Power Purchase	19,69	109,90	0	0	4,42
Total en tCO_2e	**436.716,44**	**405.628,26**	**383.547,47**	**341.194,57**	**337.225,78**

Source: PELSA, Atmospheric Emissions Inventory System. Report Year 2015, (November 2016)

In addition, as a baseline scenario for existing activities, some limited air quality monitoring was conducted at different points within the Project's area of influence to determine ambient conditions at the receptor level (please see Chapter 5). The guideline values used for analysing air quality are those outlined in Annex II of National Decree 831/93, and as a reference the regulations of the province of Buenos Aires (not applicable),and the Ambient Air Quality of the IFC General EHS Guideline (2007).

Table 6-16: Values Guide for Atmospheric Air Quality

Constituent Dangerous	Concentration (mg/m^3)	Period average (min)
Acetaldehyde	0.01	30
Vinyl Acetate	0.15	30
Ammoniac	1.5	30
Aniline	0.05	30
Arsenic	0.01	20
Benzene	0.2	20
Cadmium	0.01	30
Hydrogen Cyanide	0.015	30
Cyclohexane	1.4	30
Chlorine	0.01	20
Chlorobenzene	0.1	30
Hydrogen chloride	0.05	30
Cresols	0.6	30
Chrome	0.0015	30
Dichloroethane (1,2-)	3	30
Di-Isocyanate of Tolueno	0.05	30
Styrene	0.01	30
Phenol	0.01	20
Fluorides	0.02	30
Formaldehyde	0.035	30
Polynuclear Aromatic Hydrocarbon	5	30
Manganese	0.03	30
Meth Paration	0.008	30
Naphthalene	0.003	30
Acid fog (H2s04)	0.006	30
Nitrogen oxides	0.9	60
Ozone-Photochemical Oxidizers	0.3	60
Lead	0.002	30
Carbon Sulfide	0.03	30
Hydrogen sulfide	0.008	30
Carbon tetrachloride	4	30
Toluene	0.6	30
Trichlorethylene	0.2	30
Xylenes	0.2	30

Source: Annex II of National Decree 831/93, 1993.

There are no specific Atmospheric Air Quality values guideline in the Province of Neuquén, As a reference it is often taken the value Guidelines of the Province of Buenos Aires (not applicable):

Table 6-17: Values Guide for Atmospheric Air Quality

Constituent Dangerous	Guideline Value (mg/m3)	Guideline Value (ppm)	Period average
Sulfur dioxide (SO2)	1,300 0,365 0,080	0,50 0,14 0,03	3 horas 4 horas 1 año
Particulate Matter (PM 10)	0,050 0,150		1 año 24 horas
Nitrogen oxides (NO2) (expressed as nitrogen oxide)	**0,367 0,100**	**0,2 0,053**	**1 hora 1 año**
Ozone	**0,235**	**0,235**	**0,235**

Source: Ambient Air Quality Standard of Buenos Aires.

Table 6-18: Ambient Air Quality Guidelines

Constituent Dangerous	Period average	Guideline Value (ug/m3)	Guideline Value (mg/m3)
Sulfur dioxide (SO2)	10 minute	500	0.5
Nitrogen dioxide (NO2)	1 hour	200	0.2
Particulate Matter (PM 10)	24 hours	50	0.05
Particulate Matter (PM 2.5)	24 hours	25	0.025
Ozone	8 hours daily maximun	100	0.1

Source: Environmental, Health, and Safety Guidelines- General EHS Guidelines: Environmental Air Emissions and Ambient Air Quality, 2007.

The main sources of new air emissions for the oil and gas development associated with this project (110 non-conventional wells), is expected to include the following activities:

- 1 (one) new Crude Treatment Plant (PTC), to be located in Borde Montuoso, east of Bajada del Palo Oeste. The ultimate plant capacity will be 5,000 m3 oil per day. Operations are expected to start in May 2021 at a level of approximately 2,500 m3 per day. By January 2022, operations are expected to reach plant capacity.
- 3 (three) Early Production Facilities (EPFs), each of 2 modules of 2,500 m3 / d of crude oil, will be installed. Each EPF has a total capacity of 5,000 m3 / d, but it is reached in 2 stages.
- 1 (one) new gas compression station in Borde Montuso (EMC11): which increases its capacity over time. Total capacity by 3rd quarter of 2022 will be 1,500,000 m3 gas per day.
    - Initial capacity of 500,000 m3 / d and a use of ~ 200,000 m3 / d in March 2020. In March 2021
    - Capacity is increased by another 500,000 m3 / d and it is expected to reach capacity by May 2022.
    - Another capacity increase of 500,000 m3 / d to be used from Q3 2022, totaling a capacity of 1,500,000 m3 / d

The Project is in the early stages of design and therefore, details on specific air emission sources are not yet available. However, all sources will comply with applicable IFC air emission standards.

For permanent combustion sources associated with production and processing operations, it is expected that sources will be considered “small combustion source” and will fire natural gas (filed gas) or diesel (dual). Combustion equipment will be designed to meet or exceed the guidelines in Table 1.1.2 of the General IFC EHS standards:

Table 1.1.2 - Small Combustion Facilities Emissions Guidelines (3MWth – 50MWth) – (in mg/Nm^3 or as indicated)

Combustion Technology / Fuel	Particulate Matter (PM)	Sulfur Dioxide (SO_2)	Nitrogen Oxides (NOx)	Dry Gas, Excess O_2 Content (%)
Engine				
Gas	N/A	N/A	200 (Spark Ignition) 400 (Dual Fuel) 1,600 (Compression Ignition)	15
Liquid	50 or up to 100 if justified by project specific considerations (e.g. Economic feasibility of using lower ash content fuel, or adding secondary treatment to meet 50, and available environmental capacity of the site)	1.5 percent Sulfur or up to 3.0 percent Sulfur if justified by project specific considerations (e.g. Economic feasibility of using lower S content fuel, or adding secondary treatment to meet levels of using 1.5 percent Sulfur, and available environmental capacity of the site)	If bore size diameter [mm] < 400: 1460 (or up to 1,600 if justified to maintain high energy efficiency.) If bore size diameter [mm] > or = 400: 1,850	15
Turbine				
Natural Gas =3MWth to < 15MWth	N/A	N/A	42 ppm (Electric generation) 100 ppm (Mechanical drive)	15
Natural Gas =15MWth to < 50MWth	N/A	N/A	25 ppm	15
Fuels other than Natural Gas =3MWth to < 15MWth	N/A	0.5 percent Sulfur or lower percent Sulfur (e.g. 0.2 percent Sulfur) if commercially available without significant excess fuel cost	96 ppm (Electric generation) 150 ppm (Mechanical drive)	15
Fuels other than Natural Gas =15MWth to < 50MWth	N/A	0.5% S or lower % S (0.2%S) if commercially available without significant excess fuel cost	74 ppm	15
Boiler				
Gas	N/A	N/A	320	3
Liquid	50 or up to 150 if justified by environmental assessment	2000	460	3
Solid	50 or up to 150 if justified by environmental assessment	2000	650	6

Notes: -N/A/ - no emissions guideline; Higher performance levels than these in the Table should be applicable to facilities located in urban / industrial areas with degraded airsheds or close to ecologically sensitive areas where more stringent emissions controls may be needed.; MWth is heat input on HHV basis; Solid fuels include biomass; Nm^3 is at one atmosphere pressure, 0°C.; MWth category is to apply to the entire facility consisting of multiple units that are reasonably considered to be emitted from a common stack except for NOx and PM limits for turbines and boilers. Guidelines values apply to facilities operating more than 500 hours per year with an annual capacity utilization factor of more than 30 percent.

Other sources include storage vessels, dehydration units and fugitive emission components.

Methods for controlling and reducing fugitive emissions will be considered and implemented in the design, operation, and maintenance of facilities. The selection of appropriate valves, flanges, fittings, seals, and packings will consider safety and suitability requirements as well as their capacity to reduce gas leaks and fugitive emissions. Additionally, leak detection and repair programs will be implemented.

Estimates of emissions from drilling and completion activities have been developed based on expected drilling plans and knowledge of expected use of diesel-fired equipment supporting those activities. In order to provide an order of magnitude of future estimated emissions, it was assumed that ongoing emissions from production operations are estimated to be approximately 30% of the drilling and completions for non GHG pollutants.

The following assumptions were considered for drilling operations of the 110 wells over a period of 4-5 years:

Drilling Engines **368 hs x 2500 HP per well (Insulation drilling per well) + 135 hs x 1270 HP per well (Drilling of guides and intermediates per well)**		**Emissions per year**
GHG emissions (per well) **[Metric ton CO_2 /well]**	565	

GHG emissions per year [Metric ton CO2 /year]	13,812	13,812
GHG emissions for 110 wells [Metric ton CO2 total]	62,157	
Non-GHG Emissions for 110 wells (Assumed EPA Tier 2 Engines)		**Emissions per year**
NOx Emissions (metric tons NOx)	545	121
VOC Emissions (metric tons VOC)	29	6
PM Emissions (metric tons total PM)	18	4
CO Emissions (metric tons total CO)	313	70
SO2 Emissions (metric tons SO2)	20,80	4

The following assumptions were considered for completion operations of the 110 wells over a period of 4-5 years::

Completion Engines Hp-hrs per well: 112.5 hs / well x ((24 equipment x 2200 HP / equipment) + (5 equipment x 400 HP / equipment)). **Each well = 54,800 HP x 112.5 hs.**		**Emissions per year**
GHG emissions (per well) [Metric ton CO_2 /well]	3,192	

GHG emissions per year [Metric ton CO2 /year]	78,020	78,020
GHG emissions for 110 wells [Metric ton CO2 total]	351,092	
Non-GHG Emissions for 110 wells (Assumed EPA Tier 2 Engines)		**Emissions per year**
NOx Emissions (metric tons NOx)	3,076	683
VOC Emissions (metric tons VOC)	162	36
PM Emissions (metric tons total PM)	101	22
CO Emissions (metric tons total CO)	1,771	393
SO2 Emissions (metric tons SO2)	117.47	26

At this time, there was no modelling performed. But, given the low overall expected scale of impact due to permanent operations, it is not anticipated that modelling will be necessary to ensure air quality standards at sensitive receptors, since the project area is remote with low to no existing population.

An approximate preliminary order of magnitude of estimated emissions and GHG expected to be contributed by the VOG project are approx. 119,400 tnCO2e per year.

It is expected that, based on the climatic dynamics, the prevailing winds will keep the air quality high in the Project area during construction.

It is important to consider that in Neuquén province, there are regulations that prohibit gas venting in exploration wells and during production operations at gas wells, as well as limits on air emissions at oil wells. Provincial Law Nº 2.175 and National Resolution SE N° 143/98 are the regulations specific to flaring and venting. These regulations establish the mechanisms to request an exception for flaring/venting for exploratory and completion activities. Flaring during well testing will require approval by the enforcement authority (Undersecretariat of Energy). Exceptions for venting are considered in some cases, for example: well testing, gas treatment plants, and maintenance activities.

Project description activities, climate and environmental conditions in the area, and previous conventional operations estimations of CO_2 equivalent tons of GHG emissions previously shown it is expected that the project will have significant (>100,000 tons CO2 equivalent per year) greenhouse gas (GHG) emissions from all facilities and support activities that will be quantified annually as aggregate emissions in accordance with internationally recognized methodologies and reporting procedures.

As shown in Chapter 5 Baseline, VOG is complying with the Air Quality value guidelines for IFC and National regulations on the measured parameters. Considering that the moto generators present at the Entre Lomas Prower Generation Plant are engines with compression ignition and that for this type of sources the Ambient Air Quality of the IFC General EHS Guideline (2007) has only established a NOx emission guide level of 1,600 mg/Nm3, it can be assessed that all NOx results are in compliance with the guide level set by IFC.

Thus, impact on alteration of air quality has been identified as ***moderate*** because Vista is in compliance with the existing regulation, and Vista will generate among other environmental management activities detailed in Chapter 8, the following:

- Air emission specifications will be considered during all equipment selection and procurement.
- All reasonable attempts will be made to maximize energy efficiency and design facilities to minimize energy use. The overall objective will be to reduce air emissions and evaluate cost-effective options for reducing emissions that are technically feasible.
- The associated gas stream will be in the future routed to an efficient flare system, although continuous flaring of gas will be avoided if feasible alternatives are available.
- Methods for controlling and reducing fugitive emissions have been considered and implemented in the design, and expected operation and maintenance of facilities. The selection of appropriate valves, flanges, fittings, seals, and packings considers safety and suitability requirements as well as their capacity to reduce gas leaks and fugitive emissions. Additionally, leak detection and repair programs will be implemented.
- Vapor control units will be installed, as needed, for hydrocarbon loading and unloading operations.
- Feasible alternatives have been evaluated for the recovery of hydrocarbon test fluids, considering the safety of handling volatile hydrocarbons, for transfer to a processing facility or other alternative disposal option. Disposal alternatives for produced hydrocarbons will be adequately documented and recorded.
- Equipment calibration has been schedule in the project operational activities.
- Facilities will be equipped with a reliable system for gas detection that allows the source of release to be isolated and the inventory of gas that can be released to be reduced. Equipment isolation or the blowdown of pressure equipment will be initiated to reduce system pressure and consequently reduce the release flow rate. Gas detection devices will also be used to authorize entry and operations into enclosed spaces.
- Wherever hydrogen sulfide (H2S) gas may accumulate the following measures will be considered:
    - Development of a contingency plan for H2S release events, including all necessary aspects from evacuation to resumption of normal operations;
    - Installation of monitors set to activate warning signals whenever detected concentrations of H2S exceed 7 milligrams per cubic meter (mg/m3). The number and location of monitors will be determined based on an assessment of plant locations prone to H2S emission and occupational exposure;
    - Provision of personal H2S detectors to workers in locations of high risk of exposure along with self-contained breathing apparatus and emergency oxygen supplies that is

conveniently located to enable personnel to safely interrupt tasks and reach a temporary refuge or safe haven;

- Provision of adequate ventilation of occupied buildings to avoid accumulation of hydrogen sulfide gas;
- Workforce training in safety equipment use and response in the event of a leak

- Use of Ozone Depleting Substances will be avoided, mainly in refrigeration and air conditioning.

6.6.5 Surface Water and Groundwater (Quality)

These impacts refer to physical, chemical properties changes caused on surface water by potential toxic substances, sediments, solids, or waste water produced by the project.

Flow Back Water

Water to be used for wells fracking will be stored in 5,000m^3 reinforced concrete or steel sheet ponds, which will be connected with the storage tanks/ponds at the PAD by 8" to 10" portable and flexible aqueducts. The water storage ponds will be placed at a dedicated PAD known as Water Management Facility (CGA).

Once the well is drilled, it will be stimulated by using 1,450 m3 of fresh water for injecting approximately 5,000 sacks of support agents per stimulation step. It is estimated that 33 fracking/stimulation steps are to be conducted at each well, thus, totalling 47,850 m3 of fresh water per well.

Flowback water consists of the water used during each fracking step (fresh water + stimulation agents) along with production water. Although it has been initially considered that 15% to 40% of the total water used for fracking at each well will be converted to flowback water, the experience gathered during the drilling of the first four non conventional wells seems to indicate that the rate would be closer to 15% rather than 40%.

Taking this into account, it is expected that 7,180 m^3 will be converted to flowback water per well. Therefore, considering that the Project involves drilling a total of 110 non-conventional production wells, a total amount of 789,800 m^3 of flow back water is expected to be generated.

As previously mentioned, flowback water is characterized as a fluid with high concentrations of dissolved salts and solids, and other components such as sands, heavy metals, hydrocarbons and stimulation chemicals (agents). The following table shows an order of magnitude for the concentration of the main components of the flowback water.

Table 6-19: Order of Magnitude of Flowback Water Composition

Parameter	Unit	Result
Total Dissolved Solids	mg/l	100,000
Chlorides	mg/l	60,000
Sulphates	mg/l	300
Bicarbonates	mg/l	1,000
Total Hardness	mg/l	20,000
Magnesium	mg/l	100,000
Calcium	mg/l	10,000
Iron	mg/l	200
Sodium	mg/l	20,000

Flowback water will be collected in metallic containers/ponds at the PAD and transported to authorized and licensed hazardous wastes operators for proper treatment.

Alternatives are being considered and studied for recovering and reusing flow back water. In order for this to occur, flowback water will be returned to the CGA where it will be conditioned and treated at a flowback water treatment plant, and then reused in the fracking process at other wells.

Given the water quality required for the preparation of the fracking fluids, in order to reuse flowback water, it has to be treated to drastically reduce the concentration of dissolved solids. The primary anions and cations whose concentrations have to be diminished are chlorides, magnesium and calcium, and sodium to a lesser extent.

Solids separated during the flowback water treatment are to be collected and transported for off-site treatment at authorized and licensed third party contractor's facilities.

Regarding sanitary wastewater, according to the Project development plan, each well will be drilled approximately in 26 days, so for a location of x4 wells the team's camp will be on field around 104 days and for locations x6 about 156 days. Then the sewage production will be of 10.400 liters in a x4-well PAD and 15.600 liters in a x6-well PAD

It's important to consider that, the movement of water discharges reaching soil moves vertically form from the surface gravels until it contacts the typically less permeable sediments related to the Tertiary age continental and marine age formations. These strata slope to the east and this is the dominant direction of groundwater. Consequently, a potential percolation of contamination will be oriented to plateaus with basaltic cover through the system of vertical fractures present in the east side of the study area.

Regarding impacts on ground water quality, provision N° DPRH 0372/15, given in Neuquén December 9, 2015 by File No. 5951-001765 / 2013 of the Registry of the Provincial Water Resources Directorate, grants in favor of the project, a discharge authorization for deep injection through well BMo.s-2040, for the previously treated return fluids—including the return fluids resulting from the exploration/exploitation of unconventional hydrocarbon—that are generated from the operation/exploration and exploitation of the "Borde Montuoso" deposit or other deposits operated by the Project. The same provision N° DPRH 0372/15, also regulates maximum flows, cementing and water injection considerations, chemical quality of fluids authorized to be injected, protection of groundwater formations, sampling temporality and chemical parameters to be analyzed, casing air tightness assessment, casing technical conditions, civil liability, among other considerations of environmental management, which ensure groundwater pollution prevention good practices.

Thus, the formation water, or production water, will be initially separated from gas and oil in the PFS. From there, it will be conducted to a saltwater treatment plant (PTAS) where it is conditioned through skimmers (which separate the coarser or coarser hydrocarbon) and flotation units (where the finer or dissolved hydrocarbon is separated). After leaving this stage of treatment, water goes to a lung tank and from there it is pumped to the salt water injection plant (PIAS) for its injection into disposal wells (currently BMo 2040 and in the future the BMo (s) 3081 will be added). and BMo 10 and / or BMo 11). The production water is the largest liquid effluent stream, especially for the operation stage. In the construction stage, flowback water can compete in volume, since between 15 and 40% of the water used for the fracture / stimulation becomes flowback water.

Produced Water

Monitoring was conducted at Battery 1 BMo to determine produced water quality. The guideline values used for analysing produced water quality are those outlined in the referred Disposition N° 0372/15 from the SRH of the Province of Neuquén, and in the Emissions, Effluent and Waste Levels from Onshore Oil & Gas Development included in the IFC EHS Guideline for Onshore Oil and Gas Development (2007) for discharging treated produced water.

Table 6-20: Neuquén Guideline Values Guide for Treated Produced Water

Constituent	Unit	Guideline Level
Total Petroleum Hydrocarbons	mg/l	< 300
Majority Ions (chlorides, sulphates, carbonates and bicarbonates)	mg/l	≤ 110% of majority ions concentration in produced water
Phenols	mg/l	0.450
Arsenic	mg/l	< 0.005
Total Lead	mg/l	< 0.003
Cyanides	mg/l	< 0.01
Hexavalent Chromium	mg/l	< 0.002
Mercury	mg/l	< 0.001
Cadmium	mg/l	< 0.003

Source: Disposition SRH N° 0372, 2015.

Table 6-21: WBG/IFC Guideline Values for Treated Produced Water

Constituent	Unit	Guideline Value
Total Petroleum Hydrocarbons	mg/l	10
pH	UpH	6 – 9
Biological Oxygen Demand	mg/l	25
Chemical Oxygen Demand	mg/l	125
Total Suspended Solids	mg/l	35
Phenols	mg/l	0.5
Sulfides	mg/l	1
Chlorides	Mg/l	600
Arsenic	mg/l	5
Cadmium	mg/l	5
Total Chromium	mg/l	5
Copper	mg/l	5
Lead	mg/l	5
Mercury	mg/l	5
Nickel	mg/l	5
Silver	mg/l	5
Vanadium	mg/l	5
Zinc	mg/l	5

Source: IFC EHS Guideline for Onshore Oil and Gas Development (2007).

The following table presents a summary of the results obtained for a raw produced water sample at the Borde Montuoso monitoring point in 2018 and 2019.

Table 6-22: Result of Sampling of Raw Produced Water (2018)

Parameter	Unit	Result
Electrical Conductivity (25 °C)	µohm/cm	416,605.40
pH	UpH	5.86
Temperature	°C	33.40

Parameter	Unit	Result
Saline Residue	mg/l	230,750
Total Petroleum Hydrocarbons	mg/l	2,93
Oil and Grease	mg/l	4,18
Phenols	mg/l	0.119
Detergents	mg/l	< 0.10
Chlorides	mg/l	124,048.98
Sulphates	mg/l	150.00
Carbonates	mg/l	0.00
Bicarbonates	mg/l	7,322.16
Total Hardness	mg/l	101,000.00
Calcium	mg/l	39,278.40
Magnesium	mg/l	683.90
Sodium	mg/l	36,766.23
Iron	mg/l	17.50
Manganese	mg/l	5.30
Arsenic	mg/l	0.39
Fluoride	mg/l	< 0.02
Aluminum	mg/l	< 0.50
Total Chromium	mg/l	< 0.10
Hexavalent Chromium	mg/l	< 0.10
Trivalent Chromium	mg/l	< 0.10
Zinc	mg/l	< 0.03
Copper	mg/l	< 0.06
Nickel	mg/l	0.80
Vanadium	mg/l	0.60
Mercury	mg/l	< 0.001
Cyanide	mg/l	0.041
Lead	mg/l	0.34
Cadmium	mg/l	< 0.02
BTEX (Benzene, Toluene, Ethylbenzene and Xylenes)	mg/l	0.463
Poli Aromatic Hydrocarbons (PAH)	mg/l	< 0.003

Source: INDUSLAB, 2018.

Table 6-23: Result of Sampling of Treated Produced Water (2019)

Parameter	Unit	Result	Neuquén Disposition SRH N° 0372/15 treated produced water for re-injection	IFC EHS Guideline for Onshore Oil and Gas Development (2007).
Electrical Conductivity (25 °C)	µmhos/cm	387,826.20		
pH	UpH	6.82		6 – 9
Temperature	°C	20.50		
Saline Residue	mg/l	235,510		
Total Petroleum Hydrocarbons	mg/l	11.01	<300	10
Oil and Grease	mg/l	15.67		
Phenols	mg/l	< 0.002	0.450	0.5
Detergents	mg/l	0.852		
Chlorides	mg/l	119,047.01	⩽ 110% of majority ions concentration in produced water	600
Sulphates	mg/l	500.00	⩽ 110% of majority ions concentration in produced water	
Carbonates	mg/l	0.00	≤ 110% of majority ions concentration in produced water	
Bicarbonates	mg/l	3,661.80	⩽ 110% of majority ions concentration in produced water	
Total Hardness	mg/l	103,000.00		
Calcium	mg/l	36,072.00		
Magnesium	mg/l	3,126.83		
Sodium	mg/l	31,395.49		
Iron	mg/l	63.00		
Manganese	mg/l	17.20		
Arsenic	mg/l	< 0.05	0.005	5
Fluoride	mg/l	< 0.02		
Aluminum	mg/l	< 0.50		5

Parameter	Unit	Result	Neuquén Disposition SRH N° 0372/15 treated produced water for re-injection	IFC EHS Guideline for Onshore Oil and Gas Development (2007).
Total Chromium	mg/l	0.18		5
Hexavalent Chromium	mg/l	< 0.10	<0.002	
Trivalent Chromium	mg/l	NA		
Zinc	mg/l	0.21		5
Copper	mg/l	< 0.06		5
Nickel	mg/l	1.10		5
Vanadium	mg/l	1.10		
Mercury	mg/l	< 0.001	0.001	5
Cyanide	mg/l	< 0.002	<0.01	
Lead	mg/l	0.40	<0.003	5
Cadmium	mg/l	< 0.02	0.003	5
BTEX (Benzene, Toluene, Ethylbenzene and Xylenes)	mg/l	NA		
Poly Aromatic Hydrocarbons (PAH)	mg/l	NA		

Source: INDUSLAB, 2019.

Concentrations for total petroleum hydrocarbons, mercury, cyanide and phenols are in compliance with guidelines levels established for deep well injection as permit Disposition SRH N° 0372/2015. Given that detection limits for hexavalent chromium, cadmium and arsenic are greater than the value established in Disposition SRH N° 0372/2015, it is not possible to assess whether concentration of these parameters in treated produced water complies with guidelines levels established for deep well injection. Lead concentration resulted in a higher value than the established by Disposition SRH N° 0372/2015. Lastly, when comparing the concentrations of majority ions of the treated produced water with the results for these parameters of the raw produced water, it can be noted that all values are in compliance with limits established in Disposition SRH N° 0372/2015, with the exception of sulphates and magnesium.

Given that **treated produced water is reinjected in permitted disposal deep wells** and that IFC EHS Guideline for Onshore Oil and Gas Development are established for discharging treated produced water to surface water stream or to the land, no analysis of the compliance of the results for the treated produced water was done.

Taking into account the results of them monitoring, it will be necessary to adjust the laboratory's detection limits in order to allow assessing whether treated produced water complies with guidelines levels established for deep well injection. Additionally, once compliance (or not) is determined, it will be necessary to adjust the produced water treatment in order that those exceeded parameters reach the guideline levels set by Disposition SRH N° 0372/2015.

It has been estimated that, although the non-conventional production wells will start generating about 50 m^3/day of produced water, its generation curve will rapidly decrease to 25 m3/day in 3 months, to 10 m3/day in 6 months, and achieving 0 m3/day almost 1.5 years after entering in production.

Considering the above mentioned produced evolution curve, it is expected that an approximate total of 170 m3 of produced water is to be generated during the whole life of each well. This roughly means that 0.32 m^3/day during approximately 1.5 years is to be generated by each well. Taking into account that the Project includes drilling 110 non-conventional production wells, it can be considered that approximately 18,700 m3 of produced water will be generated and will need to be treated and disposed.

According to the Project description, treatment of the produced water will be carried out at BMo's PTAS and injected into deep wells through the BMo's PIAS. Currently, there is one disposal well in use, BMo.s 2040, allowing an injection rate of 2,200 m^3/day, as authorized by Disposition SRH N° 0372/2015. As part of the Project, it is being under study the conversion of production well BMo 10 and/or BMo 11 to injection wells and it connection to the PIAS as well as drilling and installation of new injection well BMo.s 3081 and its connection with the PIAS. Results of this evaluation will need to ensure that projected injection capacity supports all produced water generated at the non-conventional wells, treated at the PTAS and injected through the PIAS.

Thus, regarding impacts on groundwater, the project must present a final report of the hydraulic stimulation executed in each of the wells and send proof of transport and acceptance of return fluids (back fluids) issued by an authorized processor. The water permit also states that the owner is exclusively responsible for the damages caused to third parties or the environment.

In addition, in line with applicable regulations that forbids excavation of ponds to recirculate drilling muds or dispose oily waste streams generated during drilling, pulling, or workover activities, wells will be drilled using "dry location" methods, which include using metal ponds for recycling of muds. Sanitary wastewater will be treated in-situ via mobile wastewater treatment plants.

Waste Water

It is estimated that 100 liters/day per person of sewage is generated at bathrooms, kitchen and the dining room of the camp. Sewage is currently collected by a dedicated network and conducted to a portable wastewater treatment plant provided by the drilling and completion contractors as part of the rigs, for proper treatment. Treated wastewater is finally used for irrigation purposes at the nearby areas (for example for access road and internal roads irrigation). The next table shows waste water estimation for the project operation.

Table 6-24: Waste water estimation for project's operation

Type	Amount	Unit	Location
Sewage production	100	liters/dayx person	Bathrooms, kitchen and dining room of camp

Monitoring was conducted at the domestic wastewater treatment plants (WWTP) at three drilling rigs to determine domestic wastewater quality. The guideline values used for analyzing domestic wastewater quality are those outlined in Disposition N° 0084/17 from the SRH of the Province of Neuquén, in which BACS S.A., the manufacturer of the WWTP, is authorized to treated wastewater from the WWTP for natural vegetation irrigation, as well as the Indicative Values for Treated Sanitary Sewage Discharges included in the IFC EHS General Guidelines (2007) for discharging treated sanitary wastewater.

Table 6-25: Values Guide for Sewage

Constituent Dangerous	Unit	Guideline Level
Electrical Conductivity	µS/cm	6 - 8
pH	UpH	1,750
Biological Oxygen Demand	mg/l	< 100
Chemical Oxygen Demand	mg/l	< 250
Residual Free Chlorine	mg/l	0.05 - 2
Total Nitrogen	mg/l	< 50
Total Phosforus	mg/l	< 5
Detergents	mg/l	< 3
Phenols	mg/l	< 0.05
Oils and Fats	mg/l	50
Total Petroleun Hydrocarbons	mg/l	< 0.2
Esterichia Coli	mg/l	250

Source: Disposition SRH N° 0084, 2017.

Table 6-26: EHS General Guidelines for Effluent

Constituent Dangerous	Unit	Guideline Value
pH	UpH	6 - 9
Biological Oxygen Demand	mg/l	30
Chemical Oxygen Demand	mg/l	125
Total Suspended Solids	mg/l	50
Total Nitrogen	mg/l	10
Total Phosphorus	mg/l	2
Oils and Grease	mg/l	10
Total Coliform Bacteria	mg/l	400

Source: IFC EHS General Guidelines, 2007.

All the parameters analysed in treated sanitary wastewater are below the guideline values established in Disposition SRH N° 0084/2017 (See Chapter 5).

With regards to IFC standards, all results for pH, BOD, COD and total phosphorus, are below the guideline levels, while all oil and grease exceeded the standard. In addition, the result for total nitrogen at the WWTP present at drilling rig H-103 is below the correspondent guide level established by IFC, while results obtained for WWTP present at drilling rigs NB F-19 and Q-12 do not comply with IFC guide levels. Lastly, it is not possible to assess compliance with IFC guideline levels for total suspended solids and total coliform bacteria, given that sludge and fecal coliform bacteria were analyzed instead of these parameters.

In order to estimate, total quantities of sanitary wastewater to be generated and treated during the construction phase of upstream and midstream facilities included in the Project, the following construction and installation periods and number of persons employed informed by VOG have been considered:

1. Well drilling and completion – 26 days and 45 persons;
2. Oil pipeline connecting Battery 1 at BMo and PTC at EL area – 210 days and 200 persons;
3. BMo power generation plant – 210 days and 50 persons;
4. EMC 11 – 280 days and 150 persons;
5. Gas pipeline to EMC 11 – 210 days and 200 persons;

6. EPF 2 – 250 days and 150 persons;
7. PTC at BMo – 360 days and 200 persons;
8. Upgrade PTC at EL – 180 days and 20 persons;
9. Revamp PTG at EL – 284 days and 20 persons; and
10. PTG at BPO + gas pipeline connecting PTG at BPO and CT at BMo oilfield – 290 days and 200 persons.

The following table presents the total amounts of sanitary wastewater to be generated during the construction phase of the facilities listed above. In order to be conservative and consider the worst scenario, it has been considered the maximum quantity of persons for calculations purposes.

Table 6-27: Sanitary Wastewater Generation

Facility N°	Sanitary Wastewater (m3)
1 (*)	12,870
2	4,200
3	1,050
4	4,200
5	4,200
6	3,750
7	7,200
8	3,600
9	568
10	5,800

Source: ERM, 2019.

Note: (*) – Calculations were made considering a total of 110 wells

As a result, regarding all these considerations, from baseline and the Project description related to water quality, which will be impacted mainly by operational discharges or other waste waters routinely generated at onshore oil and gas facilities such as sewage waters, drainage waters, tank bottom water, fire water, equipment and vehicle wash waters and general oily water, the impact has been considered as ***moderate*** for risk of spills could exist but pollution prevention and treatment measures will be considered by the Project, according applicable EHS Guidelines, specifically the EHS General Guidelines and the EHS Guidelines for Onshore Oil & Gas Guidelines (2007) such as:

- Selected treatment technologies have considered a combination of gravity and mechanical separation and chemical treatment, through a multistage system to meet environmental discharge limits.
- The sufficient waste-water treatment backup capability has been considered to ensure continual operational and contingencies plans have been prepared in case of spills.
- To minimize environmental hazards related to residual chemical additives in the produced water stream where surface disposal methods are used, production chemicals will be selected carefully

by taking into account their volume, toxicity, bioavailability, and bioaccumulation potential. Thus, effluent discharge to surface waters will not result in significant impact on human health and environmental receptors.

- The project will also generate a disposal plan that considers points of discharge, rate of discharge, chemical use and dispersion analysis in case of spills. Discharges will be planned away from environmentally sensitive areas if applicable after a thorough analysis of biodiversity and endemic species behavior in the direct influence area, with specific attention to high water tables, the main water receptor, in this case stationary runoffs.
- Hydrostatic test water and produced water will be treated to at least meet the following limits referred by the IFC's Environmental, Health and Safety Guidelines for Onshore Oil and Gas development:
  - Total hydrocarbon content: 10 mg/L
  - pH: 6 - 9
  - BOD: 25 mg/L
  - COD: 125 mg/L
  - TSS: 35 mg/L
  - Phenols: 0.5 mg/L
  - Sulfides: 1 mg/L
  - Heavy metals (total) a : 5 mg/L
  - Chlorides: 600 mg/l (average), 1200 mg/L (maximum)
- If waste water is discharged to land, the discharge site has been selected to prevent flooding, erosion, or lowered quality of the receiving land.
- Water discharge during cleaning pig runs and pretest water will be collected in holding tanks and will be discharged only after water-quality testing to ensure that it meets the previously refered discharge criteria.
- In addition, gray and black water from showers, toilets and kitchen facilities will be treated appropriately, and separate drainage systems for drainage water from process areas that could be contaminated with oil (closed drains) and drainage water from non-process areas (open drains) will be available to the extent practical.
- All process areas will be bunded to ensure drainage water flows into the closed drainage system and that uncontrolled contaminated surface run-off is avoided. Drainage tanks and slop tanks will be designed with sufficient capacity for foreseeable operating conditions, and systems to prevent overfilling will be installed. Drip trays, or other controls, will be also used to collect run-off from equipment that is not contained within a bunded area and the contents routed to the closed drainage system. Stormwater flow channels and collection ponds installed as part of the open drainage system will be fitted with oil/water separators. Separators may include baffle type or coalescing plate type and will be regularly maintained. Stormwater runoff will be treated through an oil / water separation system able to achieve an oil and grease concentration of 10 mg/L
- The accumulation of tank bottom waters will be minimized by regular maintenance of tank roofs and seals to prevent rainwater infiltration. Consideration will be given to routing these waters to the produced water stream for treatment and disposal, if available. Alternatively, they could be treated as a hazardous waste and disposed of in accordance with the facility waste management plan. Tank bottom sludges will also be periodically removed and recycled or disposed of as a hazardous waste.
- Firewater from test releases will be directed to the facility drainage system.

- Equipment and vehicle wash waters will be directed to the closed drainage system.
- Oily water from drip trays and liquid slugs from process equipment and pipelines will be routed to the closed drainage system.
- Among other actions described in Chapter 8.

6.6.6 Aesthetics and Noise

The main aesthetic impact corresponds to Landscape Visual Alteration. The landscape evaluation will refer to green spaces and use of land with respect to nearness to a town, the number of potential observers, accessibility to observation and communication points.

The visual quality of the landscape in the study area is fair-good, with an important visual of the Bajo de Añelo and the Auca Mahuida Volcano, in the Borde Montuoso sector. The most important alterations of the landscape will result during the construction phase of pipelines or enhancement of facilities within this area, where the movement of people and vehicles, added to the tasks of temporary roads, road access, and transportation of pipes and materials will contrast with the natural landscape.

The main visual alteration could occur in the intersection of Provincial Route No. 8, which already presents a degree of anthropogenic effect due to the development of hydrocarbon activity. However, the landscape will be affected only temporarily during pipeline assembly, due to the permanence and circulation in the place of machinery, vehicles, and people, and land clearance. Impacts will cease once works are completed.

Operation of oil & gas facilities, aqueducts, pipelines, wells, treatment facilities, injection plants, pumping and compression stations, storage facilities, mobilization of equipment and personnel for the project, as well as the use of machinery and heavy equipment were also considered as impacting the landscape because of the presence of such facilities/activities, which will remain in place and the former landscape of ranches and or fluvial area will be changed during long-term operation.

Once the drilling activities end, it is expected that the effect on the visible landscape will cease. In addition, tasks to be carried out during the covering and restoration of tracks or temporary/permanent facilities dismantling, will tend to return the site to its original conditions (which presented previous anthropogenic alteration).

There are no environmental Noise assessments available at this time. Considering that the project area is approx. 35 km distant from the nearest town, the sources of noise during construction and operations that have the potential to result in **moderate impacts** on noise sensitive receptors are: drilling, wells completion and construction of new accesses. While the rest of the construction and operation activities are considered Compatible.(,

Noise impacts are calculated via evaluations of noise in the near local activities or population settlements. Noise impacts will be variations in the acoustic pressure levels (L) measured in decibel units (dB), that are represented by (Leq), (Lmin), and (Lmax). The greatest impact would be in areas with no previous or minor current noise impacts.

Construction stage will definitely generate noise in all its related activities, and during the operation stage, potential noise impacts would be related to the generation of noise from drilling activities, transportation, energy generation system or gas-fired/power generators, workshops, air traffic, gas burning during well tests, among other operational activities. Because of aforementioned activities, the alteration of the sound pressure level has been identified as ***moderate***, for significant noise sources will be continuously in operation and impacts of noise will be evaluated on environmental effect and the occupational health effect. Consequently, the project has presented the following initial management actions:

- Field related vehicle traffic will be reduced as far as possible and access through towns will be avoided when not necessary. Flight access routes and low flight altitudes, if required, will be selected and scheduled to reduce noise impacts without compromising aircraft and security.

- Identify areas and time periods sensitive to wildlife such as feeding and breeding locations and seasons and avoid them when possible;
- If sensitive wildlife species are located in the area, monitor their presence before the onset of noise creating activities
- In areas where significant impacts to sensitive species are anticipated, experienced wildlife observers will be used if necessary.
- Slowly buildup activities in sensitive locations.

6.6.7 Soil Chemistry

The main impact to soil chemistry is Soil Quality Alteration, this refers to possible changes in the chemical properties of the soil, such as pH, Cation Exchange Capacity, salinity, nutrient content and organic matter or a reduction of the possibilities of life in the soil due to waste concentrations (cement, iron, resins, lubricants, fuel, etc.).

In addition, the physico-chemical characteristics of the soil could be affected during construction stage, as well as during the perforation and termination stage, by wastes, effluents, or leaks coming from surface activities, temporary camps, construction of roads, transport of materials, construction fronts, hydraulic tests, well tests and location of facilities, drilling and operational activities. Depending on the contingency that may arise, impacts to soil will be moderate and likely of isolated occurrence, especially considering the use of lubricants, fuels, chemicals and solid waste to be used in the project and their potential spills.

Table 6-28: Fuel and lubricants consumption

Type	Amount	Unit	Wells	Total fuel	Unit	Destiny
Diesel	180.000	Liters/well/power generation	110	19.800.000	liters	drilling power generation
Diesel	520.000	Liters/well/power generation	110	57.200.000	liters	drilling oil-based muds preparation
Lubricants	6.000	liters/well	110	660.000	liters	drilling lubrication
Diesel	400.000	liters/well	110	44.000.000	liters	Well completion
Lubricants	1.500	liters/well	110	165.000	liters	Well completion
		Total		121.825.000	liters	

The action of restoration of temporary tracks to be carried out, when possible, in the construction phase of aqueducts, pipelines, gas pipelines and similar infrastructure once the laying has been completed, will favor the revegetation processes along the track and therefore, an improvement in the physical-chemical characteristics of the soil.

Since impacts on soil are more related to potential spills that could appear on chance basis, impacts have been considered in general as ***compatible***, because spills will be strongly discouraged and, if they occur, will be controlled and mitigated at the location. Thus, considering that, spills from onshore facilities, including pipelines, can occur due to leaks, equipment failure, accidents, and human error or as a result of third party interference, the following environmental management measures have been considered by the project (among other considered in Chapter 8):

- Establishment of a spill prevention and control plan (See Chapter 10).

- Conduct a spill risk assessment for the facilities and design, drilling, process, and utility systems to reduce the risk of major uncontained spills;
- Ensure adequate corrosion allowance for the lifetime of the facilities or installation of corrosion control and prevention systems in all pipelines, process equipment, and tanks;
- Install secondary containment around vessels and tanks to contain accidental releases;
- Install shutdown valves to allow early shutdown or isolation in the event of a spill;
- Develop automatic shutdown actions through an emergency shutdown system for significant spill scenarios so that the facility may be rapidly brought into a safe condition;
- Install leak detection systems, pipelines will consider measures such as telemetry systems, Supervisory Control and Data Acquisition (SCADA), pressure sensors, shut-in valves, and pump-off systems;
- Develop corrosion maintenance and monitoring programs to ensure the integrity of all field equipment. For pipelines, maintenance programs will include regular pigging to clean the pipeline, and intelligent pigging will be considered as required;
- Ensure adequate personnel training in oil spill prevention, containment, and response;
- Ensure spill response and containment equipment is deployed or available for a response.
- All spills will be documented and reported. Following a spill, a root-cause investigation will be carried out and corrective actions will be undertaken to prevent reoccurrence.
- A Spill Response Plan will be prepared, and the capability to implement the plan will be in place. The Spill Response Plan will address potential oil, chemical, and fuel spills from facilities, transport vehicles, loading and unloading operations, and pipeline ruptures. The plan will include:
    - A description of the operations, site conditions, logistic support and oil properties;
    - Identification of persons responsible for managing spill response efforts, including their authority, roles and contact details;
    - Documentation of cooperative measures with government agencies as appropriate;
    - Spill risk assessment, defining expected frequency and size of spills from different potential release sources;
    - Oil spill trajectory in potentially affected surface water bodies, with oil fate and environmental impact prediction for a number of credible most-probable spill simulations (including a worst case scenario, such as blowout from an oil well) using an adequate and internationally recognized computer model;
    - Clear demarcation of spill severity, according to the size of the spill using a clearly defined Tier I, Tier II and Tier III approach;
    - Strategies and equipment for managing Tier I spills at a minimum;
    - Arrangements and procedures to mobilize external resources for responding to larger spills and strategies for deployment;
    - Full list, description, location, and use of on-site and off-site response equipment and the response time estimates for deploying equipment;
    - Sensitivity mapping of the environment at risk. Information will include: soil types; groundwater and surface water resources; sensitive industrial, landscape features of significance; seasonal aspects for relevant features, and oil spill response types to be deployed;
    - Identification of response priorities, with input from potentially affected or concerned parties;

- Clean up strategies and handling instructions for recovered oil, chemicals, fuels or other recovered contaminated materials, including their transportation, temporary storage, and treatment / disposal.

- Use chemical hazard assessment and risk management techniques to evaluate chemicals and their effects.
- Selected chemicals have been tested for environmental hazards;
- Select chemicals with least hazard and lowest potential environmental or health impact, whenever possible;
- Use of persistent organic pollutants present in fire extinguishing foams will be voided.

6.6.8 Waste and waste disposal

Solid wastes generated as part of the Project, include:

- Domestic wastes;
- Metallic wastes;
- Non-metallic wastes;
- Hazardous wastes;
- Drilling cuttings with water-based mud;
- Drilling cuttings with oil-based mud;
- Soil and cuttings with oil; and
- Fracking sand.

Solids wastes are to be managed according to the wastes management procedure developed as part of the integrated management system hold and implemented by VOG. Collection, transportation, treatment and/or final disposal of wastes will be contracted to third party companies duly authorized and license by the Neuquén Province Environmental Authorities. General wastes management policy adopted by VOG is to, primarily, reduce wastes generation, recycle and reuse as much as possible, and finally to treat and final dispose of wastes.

Biodegradable domestic solid wastes will be collected within metallic or plastic containers which will be temporary stored at the PAD or facility until they are sent to the BMo's wastes storage area near Battery 1 BMo. Periodically, these residues are transported and disposed at the Añelo's municipal landfill.

Metallic wastes are to be transported to the BMo's wastes storage area and later sold as metallic scrap. Components, parts, pieces, etc., from this metallic residues can be recovered and internally reused as much as possible.

Empty drums will be recycled and reused as much as possible, particularly as wastes containers. Those drums which have contained hazardous substances, will be temporarily stored at the facility, then sent to the BMo's wastes storage area and finally transported to authorized and licensed hazardous wastes external operators for treatment.

Non-metallic wastes such as paper, cardboard, glasses, plastics, etc., will be collected separately within metallic or plastic containers which will be temporary stored at the PAD or facility until they are sent to the BMo's wastes storage area for later recycle through external operators. Non-metallic wastes could also be transported and disposed at the Añelo's municipal landfill.

Hazardous wastes including solids impregnated with oil, drilling, muds, chemical products, production water, lubricants, gasoil, etc., will be collected separately within proper containers, conditioned, and temporary stored at the PAD or facility until they are sent to the BMo's wastes storage area for later transportation to duly authorized and licensed hazardous wastes external operators.

With regards to the characteristics of the drilling muds, as previously mentioned, two types of muds will be used: i) water and bentonite-based mud; and ii) oil-based mud.

It is important mentioning that chemical substances used for the preparation of water-based mud as well as it quantities, will be finally defined by the specialized third party company contracted by VOG for providing mud services and agreed with VOG mud specialists.

Drilling cuttings with water-based mud are initially separated from the drilling mud at the shakers, hydro cyclones and centrifugation equipment that form part of the "dry location" system used for drilling the wells. Once separated, cutting is collected in metallic containers and transported for dehydration at a dedicated and authorized area within BMo block identified as Water-based Mud's Cutting Repository (placed at BMo 2020's) quarry. After undergoing this dehydration, cutting are sampled and analyzed for chemical parameters, and when getting authorization from the Environmental Authority of the Province of Neuquén, cutting is transported and disposed at an authorized quarry in exploitation and/or rehabilitation.

Drilling cuttings with oil-based mud are initially separated from the drilling mud at the shakers, hydro cyclones and centrifugation equipment that form part of the "dry location" system used for drilling the wells. Once separated, cutting is collected in metallic containers and transported for proper treatment at authorized and licensed hazardous wastes external operators.

Flow back sands and solids coming from the fracking steps will be collected in metallic containers/tripper at the CGA, and transported and treated through authorized and licensed hazardous wastes external operators.

The following tables show estimated quantities of solid wastes to be generated.

Table 6-29: Solid Waste Generation

Type of Solid Waste	Upstream	Midstream (*)	
	Construction Phase	Construction Phase	Operation Phase
Biodegradable domestic	12 kg/day	35 – 60 kg/day	80 kg/day
Metallic wastes	10 kg/day	10 – 100 kg/day	5 – 50 kg/day
Non-metallic wastes	5 kg/day	20 – 55 kg/day	30 kg/day
Hazardous wastes	3 kg/day	10 – 30 kg/day	30 kg/day
Drilling cuttings	240 m3/well	---	---
Oil-based drilling muds	80 m3/well	---	---
Water-based drilling muds	10 m3/well	---	---

Source: VISTA, 2018. CONFLUENCIA AMBIENTE & SEGURIDAD, 2018. BIOSUM, 2018.

Notes: (*) – Amounts will depend on the facility to be constructed and operated

Taking into consideration that the drilling process for each well will last for 26 days, the following total amounts are expected to result per well:

- 312 kg of biodegradable domestic wastes;
- 260 kg metallic wastes;
- 130 kg of non-metallic wastes; and
- 78 kg of hazardous wastes.

Given that the Project includes drilling 110 non-conventional wells, the following total amounts of wastes are estimated to be generated during the drilling campaign:

- 34,320 kg of biodegradable domestic wastes;
- 28,600 kg metallic wastes;
- 14,300 kg of non-metallic wastes;
- 8,580 kg of hazardous wastes;
- 26,400 m3 of drilling cuttings;
- 8,800 m3 of oil-based drilling muds; and
- 1,100 m3 of water-drilling muds.

In order to estimate, total quantities of wastes to be generated during the construction phase of different major facilities included in the Project, the following construction and installation periods informed by VOG have been considered:

- Oil pipeline connecting Battery 1 at BMo and PTC at EL area – 210 days;
- BMo power generation plant – 210 days;
- EMC 11 – 280 days;
- Gas pipeline to EMC 11 – 210 days;
- EPF 2 – 250 days;
- PTC at BMo – 360 days;
- Upgrade PTC at EL – 180 days;
- Revamp PTG at EL – 284 days; and
- PTG at BPO + gas pipeline connecting PTG at BPO and CT at BMo oilfield – 290 days.

The following table presents the total amounts of the different types of wastes to be generated during the construction phase of the facilities listed above. In order to be conservative and consider the worst scenario, it has been considered the higher wastes generation rate for calculations.

Table 6-30: Solid Waste Generation

Type of Solid Waste / Facility N°	Biodegradable domestic	Metallic	Non-metallic	Hazardous
1	12,600 kg	21,000 kg	11,550 kg	6,300 kg
2	12,600 kg	21,000 kg	11,550 kg	6,300 kg
3	16,800 kg	28,000 kg	15,400 kg	8,400 kg
4	12,600 kg	21,000 kg	11,550 kg	6,300 kg
5	15,000 kg	25,000 kg	13,750 kg	7,500 kg
6	21,600 kg	36,000 kg	19,800 kg	10,800 kg
7	10,600 kg	18,000 kg	9,900 kg	5,400 kg
8	16,724 kg	28,400 kg	15,620 kg	8,520 kg
9	17,400 kg	29,000 kg	15,950 kg	8,700 kg

Source: ERM, 2019.

Thus, during the midstream phase, solids wastes are to be managed according to the wastes management procedure developed as part of the integrated management system hold and implemented by VOG. Collection, transportation, treatment and/or final disposal of wastes will be contracted to third party companies duly authorized and license by the Neuquén Province Environmental Authorities. General wastes management policy adopted by VOG is to, primarily, reduce wastes generation, recycle and reuse as much as possible, and finally to treat and final dispose of wastes.

As mentioned, waste streams and effluents that will be generated during construction/drilling and operation phases, will contribute with volumes/quantities of wastes that if not treated appropriately will be disposed on the ground. Therefore, the project will require approval for treatment and disposal methods by authorized companies that could provide such treatment/disposal for contaminated soil or materials. Also, wells will be drilled using “dry location” methods, which include using of metal ponds for recycling of muds for preventing soil affectation.

Since waste and waste disposal will directly affect to soil and water if applicable, and mainly by contingencies that will be very occasional and of controlled extension, impacts by waste management have been established as ***compatible***, because they will be routinely classified into non-hazardous and hazardous wastes, treated and disposed by legal acceptable final disposal procedures.

In addition, the project will also consider specific environmental management conditions, such as the following, among other detailed measures defined in Chapter 8:

- Waste management planning will establish a clear strategy for wastes that will be generated including options for waste elimination, reduction or recycling or treatment and disposal, before any wastes are generated.
- A waste management plan documenting the waste strategy, storage (including facilities and locations) and handling procedures will be developed and will include a clear waste tracking mechanism to track waste consignments from the originating location to the final waste treatment and disposal location.
- Feasible alternatives for the treatment and disposal of drilling fluids and drilled cuttings have been evaluated and included in the planning for the drilling program. Alternative options may include one, or a combination of, the following: injection of the fluid and cuttings mixture into a dedicated disposal well; injection into the annular space of a well; storage in dedicated storage tanks or lined pits prior to treatment, recycling, and final treatment and disposal; on-site or off-site biological or physical treatment to render the fluid and cuttings non-hazardous prior to final disposal using established methods such as thermal desorption in an internal thermal desorption unit to remove NADF for reuse, bioremediation, landfarming, or solidification with cement and concrete.
- Final disposal routes for the nonhazardous cuttings solid material has been established, and may include use in road construction material, construction fill, or disposal through an authorized landfill. In the case of landfarming, it will be demonstrated that subsoil chemical, biological, and physical properties are preserved and water resources are protected;
- Recycling of spent fluids back to the vendors for treatment and re-use will be considered if feasible.
- Minimizing volumes of drilling fluids and drilled cuttings requiring disposal will be evaluated by: use of high efficiency solids control equipment to reduce the need for fluid change out and minimizing the amount of residual fluid on drilled cuttings; use of coiled tubing drilling techniques, when feasible, to reduce the amount of fluids and cuttings generated.
- Pollution prevention and control measures for spent drilling fluids and drilled cuttings will include: minimizing environmental hazards related to residual chemicals additives on discharged cuttings by careful selection of the fluid system; careful selection of fluid additives taking into account technical requirements, chemical additive concentration, toxicity, bioavailability and bioaccumulation potential; and monitoring and minimizing the concentration of heavy metal impurities (mainly mercury and cadmium) in barite stock used in the fluid formulation.

- Well completion will aim to reduce the production of sand at source using effective downhole sand control measures.
- Produced sand will be treated as an oily waste, and may be treated and disposed of along with other oil contaminated solid materials. If water is used to remove oil from produced sand, it will be recovered and routed to an appropriate treatment and disposal system.
- Completion and Well Work-over Fluids Completion and well work-over fluids (including intervention and service fluids) can typically include weighted brines, acids, methanol and glycols, and other chemical systems. These fluids are used to clean the wellbore and stimulate the flow of hydrocarbons, or simply used to maintain downhole pressure. Once used these fluids may contain contaminants including solid material, oil, and chemical additives. Chemical systems will be selected with consideration of their volume, toxicity, bioavailability, and bioaccumulation potential. Feasible disposal options will be evaluated for these fluids. Alternative disposal options may include one, or a combination of, the following: collection of the fluids if handled in closed systems and shipping to the original vendors for recycling; injection to a dedicated disposal well, where available; inclusion as part of the produced water waste stream for treatment and disposal; spent acids will be neutralized before treatment and disposal; and on-site or off-site biological or physical treatment at an approved facility in accordance with the waste management plan.
- Where Naturally Occurring Radioactive Materials - NORM are present, a NORM management program will be developed so that appropriate handling procedures are followed.
- Sludge, scale, or NORM-impacted equipment will be treated, processed, or isolated so that potential future human exposures to the treated waste will be within internationally accepted risk-based limits. Recognized industrial practices will be used for disposal. If waste is sent to an external facility for disposal, the facility must be licensed to receive such waste.

6.7 Biological Impacts

6.7.1 Terrestrial Flora

6.7.1.1 Change in vegetation cover and alteration floristic composition

Decrease of the vegetation cover and floristic composition will occur due to clearing and soil removal activities in the areas where the temporary facilities will be installed such as access roads and areas where the new drilling platforms will be located among other components.

The Bajada del Palo Area is included within the so-called Monte Fitogeográfica Province, which occupies a large area covering arid regions. The climax community of the zone is the "jarillal" that develops in dunes and plains of sandy soils. This community can be defined as an association of *Larreas cuneifolia* and *divaricata* "jarillas", *Bougainvillea spinosa* "black mountain", *Cyclolepis genistoides* "palo azul" and *Prosopis alpataco* "alpataco", *Cercidium praecox* "chañar". The mentioned species reach a maximum height of 1.5 m and in some sectors they do not reach 1 m, which indicates that the environmental variables together with the edaphic variables, do not allow them to express their maximum development potential, possibly due to the previous anthropic intervention in area.

In the particular case of the 12" pipeline from BMo in the area surrounding the EMC-11 in Bajada de Palo, to the PTC Charco Bayo in the Entre Lomas area, certain areas with larger shrubs have been registered but do not exceed 3 m in height. These shrubs branch from the base or have very short trunks of hard wood, and short internodes, with three characteristics: green branches, resinous permanent foliage and seasonal foliage. In the track of the pipelines, colonies or floristic specimens are isolated from each other, showing portions of bare soil that are covered with ephemerals that appear after the first rains at the end of the dry season and quickly get dry and then disappear, constituting a very fleeting forage resource.

Due to the vegetation clearance and soil movement, the impact for Change in vegetation cover and alteration floristic composition has been considered **Moderate** for the construction phase.

However, in all the study area, in the secondary shrub layer *Atriplex lampa* "zampa", *Acantholippia seriphiodes* "thyme", *Chuquiraga erinacea* "chilladora", *Senecio subulatus* "romerillo", *Cassia aphylla* "pichana, pichanilla or retama", and *Gutierrezia solbrigii* stand out. The herbaceous stratum is made up of grasses where the perennial grasses are the most abundant among which stand out *Stipa speciosa, Stipa humilis* and *Poa ligularis* which are usually browsed by domestic animals.

The vegetation in the study area also presents anatomical and physiological adaptations that allow it to ensure resistance to prolonged drought conditions such as photosynthetic stems or serous cuticles. Generally, vegetation does not manifest their maximum development potential due to the edaphoclimatic conditions of the environment.

Figure 6.1 General view of the vegetation and its surroundings

Source: Environmental Authorization 16 wells MdM

Shrubs play a fundamental role in the initiation of processes of recomposition of degraded areas, the reduction of the vegetation cover in the areas where the temporary facilities will be installed, access roads, new drilling platforms and other components constructed, will alter not only the floristic composition but also will have important effects in the specific intervention area of the project such as changes in the habitat conditions for the wildlife; alteration in vertical (stratification) and horizontal steppe distribution patterns and microclimatic modifications.

6.7.1.2 *Disturbance in* plant regeneration capacity

Loss in soil quality due to compaction processes as a consequence of the circulation of vehicles, potential spills of hazardous substances and erosion processes due to the reduction of vegetation cover, will affect the settlement of new plant recruits and subsequently the regenerative capacity of the vegetation. Also loss of air quality due to gaseous emissions or removal of particulate material that could be deposited on the aerial organs of the plants, could prevent their normal development and diminishing their vitality.

That is the case of analysis in aqueducts, pipelines, gas pipelines, and other facilities construction, where flora will be affected by the tasks to be developed in the construction stage in a direct manner, since it will require the removal of the vegetation—for example, for the pipelines and aqueduct, in an area of 60,564 m^2 for the opening of the rights of way and 14,850 m^2 for roads/tracks extension. Also, as previously mentioned, vehicular traffic will also indirectly affect this factor due to the lifting of dust by the circulation of vehicles, which is deposited on the foliage, hindering photosynthetic processes. In spite of being short-term activities, the effect on the plant cover will last for a long time due to the low natural recovery capacity of vegetation.

As a result, considering that vegetation cover protects soil from erosion and helps maintain its physical-chemical properties, the removal of this cover will affect negatively new seedlings settlement. Loss in soil quality due to compaction processes as a consequence of the circulation of vehicles and machinery will affect the settlement of new plant recruits and subsequently the regenerative capacity of the vegetation. Loss of air quality due the transit of vehicles may add particulate material like dust that could be deposited on the leaves and flowers of the plants, preventing their normal development and diminishing their vitality. Use of vehicles and heavy machinery will have a **Moderate** impact in the construction phase on Reduction in plant regeneration capacity.

Finally, activities to be developed during the completion of work and in the phase of abandonment will modify this factor in a positive way.

6.7.1.3 Restoration of the floristic and vegetation cover (revegetation)

The restoration activities will have a positive effect on the floristic composition and vegetation cover. The purpose of this process is to give the revegetated area the capacity to return to an ecological condition equivalent to the original conditions.

The decompaction of the soil should be considered, which will allow its aeration and oxygenation, allowing the regeneration of the physical - chemical conditions for growth of microorganisms, rooting, germination and root penetration. The reestablishment of soil morphology conditions will allow the minimization of erosive processes and promote the regeneration of water balance.

As a result, the final revegetation activities will tend to contribute to the restoration of the total area impacted by the project. Which means that, performing cleaning, restoration, and scarifying of lateral surfaces will affect in a positive, synergistic way to soil, flora, fauna and landscape factors, generating at the level of vegetation management the necessary conditions for the revegetation and natural succession of native species. These native species will help complementarily to reduce erosion, improve runoff surface, and improve soil capacity of water absorption, among some other positive properties.

6.7.2 Terrestrial Fauna

6.7.2.1 Change in the abundance of individuals and composition of fauna

In the study area, we find autochthonous species in coevolution with a very dynamic environment, exposed to great changes, especially in recent years due to anthropogenic actions and the introduction of exotic species. Among the latter we can mention cattle, goats, horses, sheep, European hare,

European boar etc., who have not only competed for resources with native species, but also applied pressure on the flora species of the region.

The rodents of the area are represented by guinea pigs (*Galea musteloide*), tucu-tucus (*Ctenomys sp*.), Vizcachas de la sierra (*Lagidium sp.*) and maras (*Dolichotis patagonum*); and as a naturalized exotic species the European hare (*Lepus sp.*) stands out. The "Edentados" include furry (*Chaetophractus sp*.) and piches (*Chlamyphorus truncatus* and *Zaedius pichiy*).

Specifically, in the oilpipeline area, the most frequent carnivorous mammals found in place are the gray fox (*Pseudalopex griseus*) and the skunk (*Conepatus humboldti*). The most notable birds are the black eagle (*Geranoaetus melanoleucus*), common martineta (*Eudromia elegans*), barranquero parrot (*Cyanoliseus patagonus*), choique (*Rhea pennata*), black-headed jay (*Coragyps atratus*), red-headed jot (*Cathartes aura*), common eaglet (*Buteo polyosoma*), chimango (*Milvago chimango*) and carancho (*Polyborus plancus*). Another bird of prey that is usually observed is the little vizcachera lechucita (*Athene cunicularia*). However, those that most stand out in diversity and abundance are the Passerines such as the chingolo (*Zonotrichia capensis*) and the brown cacholote (*Pseudoseisura gutturalis*).

The region is also a passageway for birds linked to aquatic environments such as the southern bandurria (*Theristicus melanopis*), biguá (*Phalacrocórax olivaceus*), white heron (*Egretta alba*), tero common (*Vanellus chilensis*) and a variety of ducks such as the duck overo (*Anas sbilatrix*) and the duck barcino (*Anas flavirostris*). The reptiles that stand out are the lizards (*Liolaemus sp. And Leiosaurus sp.*), Matuastos, geckos, turtles (*Chelonoides sp*.) and snakes. The vipers are represented by four poisonous species, the coral viper (*Micrurus pyrrhocryptus*), the big yarar or viper of the cross (*Bothrops alternatus*), yayará chica (*Bothrops neuwiedi*) and the yarará ñata (*Bothrops ammodytoides*). The most common and abundant insects are Coleoptera (beetles), Hymenoptera (ants, bees and wasps), Orthoptera (locusts and tucuras) and Diptera (flies, mosquitoes and horseflies).

Also, three species of endemic lizards and one snake (See Table 5-21) were registered, and four species with an endangered/critical endangered status on the IUCN Red List (See table 5-22), according to Integrated Biodiversity Assessment Tool (IBAT), have probability of occurrence within the Project area.

The reduction of the number of individuals of terrestrial fauna during the construction stage of the project is mainly related to the loss of habitat and ecological niches caused by the clearing activities and personnel presence, which will generate a disturbing effect on the fauna behavior and may alter the ecological niche. At this point it is important to consider that the development of the Project is not the first activity that takes place in the area, but on the contrary, the area has a high prior intervention and related hydrocarbon activities, which potentially moderate the impact of the Project on this factor.

Thus, in spite of **compatible** impacts, the reduction of the number of individuals of terrestrial mammals and the change in their composition during the construction, operation and abandonment stages of the project will be mainly related to the noise generated from almost all the activities. The circulation of vehicles will be also a repelling and disturbing factor for mammals affecting potentially their behavior. Clearing and soil removal may generate loss of ecological niches specially of the small and medium mammals because nesting sites and source of food for some species will be impacted, therefore, affecting species' ecological niches. Other aspects in the drilling stage that could disturb the fauna, causing its displacement to other areas, include the presence of workers and light emissions.

The aforementioned presence of workers and vehicles displacement and subsequently the noise generated from construction activities may cause birds to abandon their nests, refuges and/or eating areas. In the study area, herpetofauna are the most common vertebrate species, mainly related to arid ecosystems and which may be the most sensitive group to be affected by the project activities, especially in the construction stage due clearing and soil removal and for their slow or medium mobility

capability. Herpetofauna may rely on the shrubs for shade in the arid environment of the project, as well use shrubs to scape predators and hide in burrows dug by rodents under the shrubs.

Consequently, considering their mobility and small distribution range, individuals of the herpetofauna group may not be able to escape in time from clearing or soil removal activities, making it necessary to create an specific management plan regarding potential rescuing and relocation. The impacts on herpetofauna due to Soil movement has been considered **moderate.**

6.7.2.2 Fauna Displacement

Fauna displacement is the modification of the distribution area of the population of one or more species. This displacement may imply abandoning nesting sites, refugees, or eating areas.

The fauna found in the Province of Monte are adapted both in anatomical structure and in physiology to the prevailing environmental conditions. In general, they have crepuscular, nocturnal or cave habits and present adaptations oriented towards water economy. In the study, it is possible to find autochthonous species in coevolution with a very dynamic environment, exposed to great changes, especially in recent years due to anthropgenic action and the introduction of exotic species. Among the latter we can mention cattle, goats, horses, sheep, and the European hare.

Hence, it is important to consider that, native fauna of the area alternate with natural habitat with the presence of domestic livestock that are raised in rain fed conditions, which use for their nutrition the natural pastures. In the region, cattle, sheep and goats are breeding but in the area under study, only bovines have been seen; however, in the vicinity where PADs will be built, caves with large numbers of turtles and guinea pigs have been observed.

The displacement of terrestrial endemic or local fauna is directly related to activities of clearing because it involves the loss of their habitat. Likewise, in the construction stage the presence of vehicles, machinery, heavy equipment (for the formation of the drilling platform and the construction of drilling facilities), sounds, as well as the presence of workers in the area may cause a significance disturbance on local fauna. Nonetheless, regarding fauna distribution data in base line studies, it is expected that, during operation the native fauna will be scarcely affected in its natural habitat by the activity of drilling and subsequent exploitation because there will not be stable activity, and during operation daily face-to-face controls will be carried out by one or two employees and a vehicle. It is considered **a compatible** impact.

Regarding livestock activity, there are no permanent human settlements in the vicinity and domestic livestock show their presence sporadically.

Thus, impact on fauna displacement would occur mainly during construction, and its intensity will affect mainly groups of vertebrates with greater mobility capacity such as big mammals, birds and those of low mobility such as herptofauna. The impact on herpetofauna displacement during construction was considered **moderated**. In general, for operational activities, the fauna species remaining in the area will become "accustomed" to the Project's noise. However, it is possible that there is a displacement of fauna in the Project area also during operation.

As a result, during the drilling stage, the potential impact is fauna displacement due to the generation of noise that could temporarily scare away the terrestrial fauna. The main noise sources as outlined above road construction, facilities enhancement or construction, drilling activities, operation of power generators, air traffic, and gas burning. Other aspects in the drilling stage that could disturb the fauna, causing its displacement to other areas, include the presence of workers and light and atmospheric emissions in the project area. These aspects will have a distracting or repelling effect.

6.8 Socio Economic Impacts

The impacts identified in the socioeconomic aspect are the result of a qualitative assessment of the baseline conditions and the social effects expected to be carried out by the Project within the social influence area. The impact valuation is a consequence of the magnitude of the effect and the vulnerability of the receptor.

6.8.1 Change in land use and landowners livelihoods

As mentioned in the Social Baseline section (5.4 Social Component), the use of land in the direct area of influence was mainly for cattle purposes. The lands are very large fractions of desert terrain bordering the 250 hectares and above. It is a subsistence economy mainly based on cattle; therefore, it is assumed that most Project landowners (see Figure below) used to be very vulnerable actors, at least in terms of income and lack of access to basic services, as observed during the site visit.

Since the land purchase requires willingness to sell, and causes speculation and delays in the process, while expropriation is a slow and complicated process, Vista decided to guarantee the Project access to land through right of way agreements in between Vista and landowners. Before Vista, many companies (South American Petroleum, Oil, YPF, etc.) came first and all of them had different ways of dealing with the matter. There was no systematic way to access land. *"At that time (1985), they did not respect us"* refers a landowner. The relationship between landowners and oil companies was characterized by problems of coexistence.

Vista's land access process is framed under the following regulations: At the national level, the Law Nº 17.319[1], the Decree 861/96 Indemnifications Cuyana and Neuquén Areas[2] and the Decree 860/96 Indemnifications South Zone[3], whose values were updated in 2018 through the Joint Resolution-E 1/2018[4] and Joint Resolution-E 2 / 2018[5]. One year later, the values were re-established through the Joint Resolution 1/2019[6] and the Joint Resolution 2/2019[7]. At Neuquén provincial level, the Law 2183[8] and the Provincial Decree 353_98[9] clarify that the terms and amounts are those established in National Decree 861/96 and the regulations that modify / update it.

Regulations set reference tables of compensation values according to installation (well, roads, pipelines, conduits) and surface; the amount of compensation is a result of the agreement between the parties, and in that sense, refers to the negotiating power of the landowners. The easement compensations correspond to 1) lost profit, and, 2) control and surveillance. First, the norms assume that the producer will continue producing while receiving the compensation, which does not happen in the majority of cases. Second, the compensation for reimbursement of expenses for controlling / supervising the activity of others within their lands, understood as pawns, petrol, fences, etc.; whose reference values correspond to the surface. Once the negotiation has been completed, a negotiation act is signed. Most agreements are re-negotiated annually, meaning that this impact runs during construction and operational phases. Although the holders are the only ones with the right to collect compensation, not all the landowners have property titles. To avoid social risks, Vista is implementing a policy of compensating occupants with occupation rights, even if it is a state or private land, in which cases Vista pays double easement.

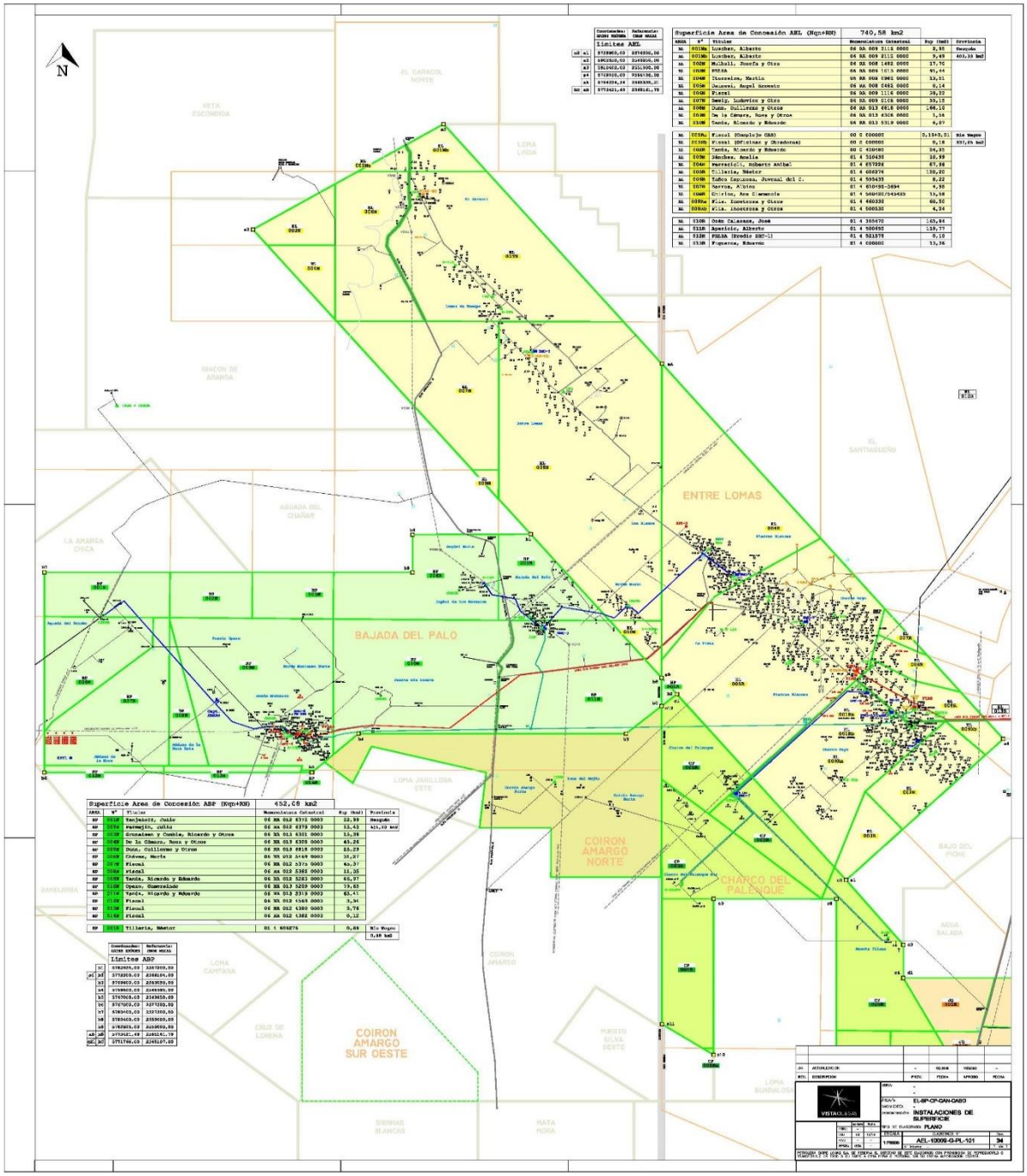
[1] http://servicios.infoleg.gob.ar/infolegInternet/anexos/15000-19999/16078/norma.htm
[2] http://servicios.infoleg.gob.ar/infolegInternet/anexos/35000-39999/38236/norma.htm
[3] http://servicios.infoleg.gob.ar/infolegInternet/anexos/35000-39999/38235/norma.htm
[4] http://servicios.infoleg.gob.ar/infolegInternet/anexos/305000-309999/305499/norma.htm
[5] https://www.argentina.gob.ar/normativa/nacional/resoluci%C3%B3n-2-2018-305500/texto
[6] http://servicios.infoleg.gob.ar/infolegInternet/anexos/320000-324999/322396/norma.htm
[7] http://servicios.infoleg.gob.ar/infolegInternet/anexos/320000-324999/322397/norma.htm
[8] http://hidrocarburos.energianeuquen.gov.ar/MARCOLEGAL/LEYESPROVINCIALES/Ley%202.183.pdf
[9] http://hidrocarburos.energianeuquen.gov.ar/MARCOLEGAL/DECRETOS_PROVINCIALES/Dec0353_98.pdf

Now well, the landowners, now converted into rent holders, receive an income from easement agreements that far exceeds the one from livestock activity. Although their income does not reflect a state of vulnerability, a considerable part of the compensation is usually used for paying their representatives in the negotiations. There is not an investment plan for said money that would guarantee sustainable wealth for local families either.

While rural uprooting has multiple causes, the Project might increase incentives to migrate to other economic activities, mainly among the younger generation. There is a risk of generating dependency on easement income. Although there are some landowners interested in working or providing services to the Project, this could encourage further uprooting. Vista has chosen to apply a meritocratic criterion among interested landowners.

The vast majority of landowners do not live in the Project area any longer. In their place are caregivers, who are the most vulnerable due to local living conditions and lack of basic services (water and sanitation). A permanent patrol, security, access and mobile telephony are some of the benefits that the Project brought to the landowners properties. However, the impact on daily life translates into the multiplicity of foreigners, trucks, etc., in the area. In sum, during the construction and operational phases, the impact is considered to be negative and ***moderate***, while the impact during the abandonment phase is positive and ***not significant***.

Figure 6.2 Project Landowners



Source: Vista.

6.8.2 Local employment generation

According to the FAO (2014), the workers within the "mining and oil" sector in the Province of Neuquen are equal to 15 800 people, nearly 15% of Neuquen wage labour. In the Province of Rio Negro, the amount is way lower, being 2 900 workers linked to the sector (2.5% of Rio Negro wage labour).

Table 6-31: Wage-earning labour in the private sector (Neuquén)

Sector	% of Neuquén wage labour (2014)	N (thousands)
Agriculture, livestock and fishing	4.9	5.3
Mining and oil	14.6	15.8
Industry	7.1	7.7
Commerce	20.5	22.3
Services	38.9	42.2
Power, gas and water	1.7	1.9
Construction	12.2	13.3
Total	100.0	108.4

Source: http://www.fao.org/americas/programas-y-proyectos/utf017arg/es/

Table 6-32: Wage-earning labour in the private sector (Rio Negro)

Sector	% of Rio Negro wage labour (2014)	N (thousands)
Agriculture, livestock and fishing	22.0	25.0
Mining and oil	2.5	2.9
Industry	8.5	9.7
Commerce	20.8	23.7
Services	37.8	42.9
Power, gas and water	1.5	1.7
Construction	6.9	7.9
Total	100.0	113.7

Source: http://www.fao.org/americas/programas-y-proyectos/utf017arg/es/

Currently, Vista has 231 direct employees, in between managerial and professional/technical ones. It does not have unskilled workers among its staff. Most of current staff is local, except 43 people from Buenos Aires. Meanwhile, Aleph has 225 employees, 15 of which are unskilled. Additionally, approximately 2000 contract workers, mainly supply chain workers, are employed by Vista operations, most of which are local.

The Project will now require new personnel. The construction phase altogether will require up to 1058 workers, 277 of which are unskilled. When it comes to the total projected employment by the 5th year of operations, Vista projects 255 projected workers, while Aleph projects 275.

Based on the amount of local workers (local staff and contractor workers from both Vista and Aleph) employed by the Project, the impact is considered to be positive and ***not significant***, during

construction and operation. When it comes to the abandonment phase of the Project, the impact is negative and ***compatible.***

Table 6-33: Vista Workforce

Vista				
	Current Employment	**Projected Employment** by the 5th year of operations	**Total Projected Employment** by the 5th year of operations	**Construction Phase**
Managerial	47	4	51	54
Professional/Technical	184	20	204	97
Unskilled Labor	0	0	0	227
Total	231	24	255	378

Source: Vista.

Table 6-34: Aleph Workforce

Aleph				
	Current Employment	**Projected Employment** by the 5th year of operations	**Total Projected Employment** by the 5th year of operations	**Construction Phase**
Managerial	22	0	22	30
Professional/Technical	188	50	238	600
Unskilled Labor	15	0	15	50
Total	225	50	275	680

Source: Vista.

Regarding associated risks, back in April 2018, when Vista acquired the Project concession, an optimization process was carried out and approximately 200 people were fired in Entre Lomas and Medanito areas. The relation between Catriel and Vista was initially complicated as a result. The situation has improved ever since and new jobs are expected to be generated. Vista has been maintaining weekly contact with union representatives. There are four different local unions[10], two of which are the most significant ones. Top management employees are excluded from both.

- *Rio Negro, Neuquén and La Pampa private Oil and Gas Union*, which groups all unskilled workers related to the industry, has a signed agreement (644-12) with business cameras (CEPH, CEOP). Its Secretary is public figure Guillermo Pereyra, representing Neuquén Province Party.
- *Neuquén, Rio Negro and La Pampa hierarchical and professional staff of private oil and gas Union* brings together all skilled workers related to the industry. Its signed agreement is the 637-11.

An addendum to collective bargaining agreements above mentioned (644-12 and 637-11) was signed as guidelines for unconventional development. The addendum allowed the hiring by term or project. The hours of rest on the site stopped being counted as overtime, and night work was introduced. As it is now, the working day lasts for 12 hours, under difficult climatic conditions and constant exposure to dust. These risky tasks demand physical effort. The work regime usually consists of 07 first days of day

[10] Construction and truck drivers unions bring together certain contract workers.

shifts, one day of rest, followed by 07 days of night shifts and 07 days of rest. Additionally, the transportation back and forth the site, can extend up to 4 hours of travelling both ways. No information regarding the contractor workers accommodation was provided. On the other hand, the hierarchical personnel of the contractor company and the "Company man" or representative of Vista, overnight in trailers at the side of the operations. The union is opposed to this practice, because their workers say that they cannot get a real rest, so they prefer to return to their respective homes or stay in a hotel in Añelo. During construction phase, Vista should prevent conflicts with local unions based on working conditions not meeting expectations of local workers due to the Addendum changes. Conflict might also arise from occupational health and safety risks above described.

6.8.3 Increased Demand of Local Goods and Services

The *Oil Industry and Affines Business Chamber of Neuquén* (CEIPA)[11] emerged in 1993, after the privatization of YPF, due to the need to group together new oil projects in defense of the rights of employees and companies. CEIPA entrusted the main services companies in the Neuquén basin and favored the development and investment in the region. CEIPA is composed of 60 companies distributed throughout the Neuquén basin. It is made up of the most important SMEs of services in the Province of Neuquén. These companies are contractors of the oil operating companies authorized in the region.

Similarly, the *Chamber of Oil Service Companies of Río Negro* (Casepe)[12] brings together the oil services companies of Rio Negro, with headquarters in Catriel and offices in General Roca Department. Currently there are more than 60 companies associated with the Chamber, most of them family-based companies, which contribute to regional socioeconomic level and more than 1 700 jobs. Currently, the Chamber maintains good relations with Vista, despite the complications given at the beginning.

Gastón Remi, CEO of Vista, meets regularly with the Federation of Neuquén Chambers in order to improve relations with the local business sector, the main challenges being security, technological innovation and financing schemes.

The Provincial Purchase Laws of Neuquen and Rio Negro seek to prioritize the creation of jobs at the local level. According to the Vice President of Casepe and provider of multiple services to Vista through his company called *Luis Arceo*, there is a "preference for the local", due to the opening of indirect employment opportunities, lower costs and higher profitability. Undoubtedly, local costs are lower. However, although there are services in which suppliers are competitive, mainly because of the oil legacy of the area, there are other services, in which capacities have not been developed, such as drilling services. According to him, the Chamber trains less consolidated local companies and audits them. Similarly, the Municipality of Catriel, despite not being an enforcement authority, proposes structural solutions such as productive re-conversion, adaptation of local providers, serving as a link between companies and the Chamber. Therefore, the vulnerability of the local providers seems diverse, from low to moderate depending on how consolidated the company is.

The following table includes information regarding the main services currently contracted by Vista.

Table 6-35: Main Project Providers' Services

Company	Client	Type of service
ALLIED HORIZONTAL WIRELINE SERVICES SRL	Vista	
ARENAS ARGENTINAS DEL PARANA S.A.	Vista	Warehouses

[11] http://ceipa.com.ar/

[12] https://www.rionegro.com.ar/camara-de-servicios-petroleros-de-rio-negro-NQRN_1007923/

Company	Client	Type of service
BAKER HUGHES ARGENTINA SRL	Vista	Production Engineering
BAKER HUGHES ARGENTINA SRL	Vista	Development
BARROMAN S.A.	Vista	General services
BOLLAND Y CIA. S.A.	Vista	Production Engineering
BRENT ENERGIA Y SERVICIOS S.A.	Vista	Programing
CAMERON ARGENTINA S.A.I.C.	Vista	CoPo
CAMERON ARGENTINA S.A.I.C.	Vista	CoPo
CHAMPION TECHNOLOGIES DE ARGENTINA S.R.L	Both	Production Engineering
CIA ADMIN.MERC.MAYORISTA ELECTRO S.A.	Both	General services
CRISTAMINE S.A.	Vista	Warehouses
DELTA ARENAS INDUSTRIALES S.A.	Vista	Warehouses
GABINO CELSO CORREA COMPANIA DE SERVICIO	Both	Programing
HALLIBURTON ARGENTINA S.R.L.	Vista	CoPo
HALLIBURTON ARGENTINA S.R.L.	Vista	CoPo
HERNANDEZ LUIS Y HERNANDEZ HECTOR S.H.	Both	Programing
INDUSTRIAS JUAN F.SECCO S.A.	Aleph	Plants
INGENIERIA SIMA S.A.	Aleph	Operation & Maintenance
INGENIERIA SIMA S.A.	Aleph	Operation & Maintenance
INGENIERIA SIMA S.A.	Aleph	Operation & Maintenance
INGENIERIA SIMA S.A.	Aleph	Operation & Maintenance
INGENIERIA TERRA SA	Both	Warehouses
INTERNATIONAL HEALTH SERVICES ARG S.A.	Both	HSE
METALMECANICA S.A.	Vista	Warehouses
NABORS INTERNATIONAL ARGENTINA SRL	Vista	CoPo
NALCO ARGENTINA S.R.L.	Both	Warehouses
NEUVIAL S.A.	Aleph	Engineering
OIL ADDPER SERVICE SRL	Vista	Production Engineering
OIL ADDPER SERVICE SRL	Vista	Production Engineering
OLEODUCTOS DEL VALLE S.A.	Vista	Comercial
PAMPA ENERGIA SA	Vista	Comercial
PECOM SERVICIOS ENERGIA S.A	Aleph	Bajada Del Palo-CAN
PETREVEN S.A	Vista	CoPo
POLYAR SACIF	Vista	CoPo
PRODENG S.A.	Vista	Production Engineering
QUINTANA WELLPRO SA	Vista	Production Engineering
QUINTANA WELLPRO SA	Vista	CoPo
QUINTANA WELLPRO SA	Vista	Production Engineering
REFI PAMPA S.A.	Vista	Comercial
REINFORCED PLASTIC S.A.	Aleph	Warehouses
SAN ANTONIO INTERNACIONAL SA	Vista	CoPo
SAN MARCOS TRADING S.A.	Vista	Warehouses
SCHLUMBERGER ARGENTINA S.A.	Vista	CoPo
SERMA S.A.	Aleph	HSE
SERV. ESPECIALES SAN ANTONIO S.A.	Vista	CoPo

Company	Client	Type of service
SERV. ESPECIALES SAN ANTONIO S.A.	Vista	Production Engineering
SIDERCA S.A.I.C.	Vista	CoPo
SIDERCA S.A.I.C.	Vista	Warehouses
SIDERCA S.A.I.C.	Vista	CoPo
SUCESION DE COLETTI RUBEN OSCAR	Aleph	Maintenance
SWACO DE ARGENTINA S.A.	Vista	CoPo
TRANSPORTES RADA TILLY S.A.	Vista	Warehouses
TUBHIER S.A.	Vista	Warehouses
TUBOSCOPE VETCO DE ARGENTINA S.A.	Vista	Production Engineering
VALVULAS WORCESTER DE ARGENTINA SA	Both	Warehouses
W.D.VON GONTEN&CO.	Vista	Development
ZILLE S.R.L.	Aleph	Engineering
ZILLE S.R.L.	Aleph	Engineering

Source: Vista.

Clearly, during construction and operation of the Project an increased demand of local goods and services is expected, mainly engineering, maintenance, warehouses, attention to camps, catering, cleaning, security, etc.

6.8.4 Community health, safety and security

In alignment with the Equator Principle 3, the Performance Standard 4 of the International Finance Corporation, and the Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development, the assessment of community health and safety impacts and risks has been carried out with the information available at this point. This is detailed in the table below.

Physical Hazards

There are dispersed and temporary residents of ranches dedicated to livestock within the Project area. The lands are very large areas of desert terrain of 250 hectares and above. It is a subsistence economy mainly based on cattle. There is a low risk of affecting one of these landowners' families who could use the access roads to their properties that are shared with the Project.

When it comes to the nearest communities, Añelo is 14 km away from the Bajada del Palo area. Similarly, Catriel is 39 km away from the Entre Lomas area. Therefore, no significant risks related to physical hazards affecting nearby communities are expected.

In relation with the Emergency Response and Preparedness Plan, this were largely focused on site impacts and response actions. Community actions were included.

Although communities are located far away from the Project area, to prevent public contact with dangerous locations and equipment and hazardous materials, access deterrents such as fences and warning signs were placed on the sites

Traffic Safety

During the Project construction activities, an increased amount of vehicles is expected to increase.

The Municipality of Añelo connects to multiple roads, such as Provincial Route N° 7, N° 8, and N° 7. According to the Provincial Road Direction of Neuquén[13], the Neuquen-Añelo stretch covers 99 kilometers of road. It is a paved road with intense traffic, ongoing construction works in several locations,

13 https://w2.dpvneuquen.gov.ar/ParteDiario.pdf

regular presence of loose cattle or domestic animals (dogs) and potholes. .The following is a photo of the said road.

Figure 6.3 Provincial Route 7

Source: https://www.rionegro.com.ar/ruta-7-la-principal-via-a-vaca-muerta-sufre-imprudencia-y-falta-de-mantenimiento-AD5432983/

The dented guardrails that are seen along the route of Provincial Route 7 demonstrate that the provincial state does not invest in the maintenance of the corridor through which pass around 30,000 vehicles daily. The agencies that work to assist when incidents occur on the route, which is very badly damaged by the vehicles of the oil industry.14

Since the Project contribution to the Provincial Route 7 transit will be due to the transportation of workers, materials and suppliers, but not oil, it is foreseeable that the contribution would be mostly during the construction phase.

Road safety initiatives within the Transit Management Program are proportional to the scope and nature of project activities. Measures include:

- Emphasizing safety aspects among drivers
- Improving driving skills and requiring licensing of drivers
- Establish and monitor compliance with speed limits to reduce accidents and speed-related injuries.
- Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.
- Avoiding dangerous routes and times of day to reduce the risk of accidents.
- Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads.
- Collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns).
- Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents.

Due to the limited transport needs, no limits for trip duration or driver rosters arrangements were considered. The distance between site facilities and communities prevents pedestrian interaction with construction vehicles.

In relation with transportation of hazardous materials, UN Model Regulations of other international standards, as well as local requirements for land transport were included in the design of the hazardous materials transportation procedures (Chapter 10).

Air Emissions – Hydrogen Sulphide

Given the large distance between site facilities and nearest communities, the risk of community exposure to hydrogen sulphide is considered low. Vista will implement as part of its Action Plan dispersion modeling to assess risks.

Community exposure to diseases

The water for the Project is taken from the Neuquén River through the irrigation channel of San Patricio del Chañar. Shell has a permanent installation to take the water from the source and transfer it to a pool in Cruz de Lorena. This installation has pumps and three intermediate pools. The first section is approximately 5 km to the first pool. Then the intermediate section is another 7 km to the second pool. Finally, the last section is approximately 7 km to the last pool in Cruz de Lorena. Given that it is an associated facility, Vista must guarantee that Shell operates within its permitting guidelines in order to avoid affecting the other users of that water source (purposes of human or productive consumption). The water goes through pipes and the source is the river, which receives impact from all sides, but which is not under the control of Vista. As for drinking water, this is distributed by truck.

While the hierarchical personnel of the contractor company and the "Company man" or representative of Vista, overnight in trailers at the side of the operations; no information regarding the contractor workers accommodation was provided. In this sense, the risk of transmission of diseases due to the presence of foreign workers in the communities cannot be defined at this point.

It should be noted that in the Province of Neuquen, the HIV rate is 15 per 100,000 inhabitants, and the AIDS mortality rate is 2.7 per 100,000 inhabitants.

Security

All sites have full time security presence. Adequate signage, fencing and gates establish the areas where security controls begin at the property boundaries. Controlled access points (guarded gates) were seen onsite.

In sum, given the distance between the Project site and local communities, the dispersed and temporary residents (landowners), and the restricted access to the Project area, it is considered unlikely that community members will be exposed to community health, safety and security risks. The vulnerability of the communities is considered to be ***minor***.

The following are measures within the ESMS to guarantee the health, safety and security conditions of the communities that could be directly affected by the Project:

- The Stakeholder Engagement Program provides an understanding to the communities concerning the activities and precautions to be adopted for safety;
- The Emergency Preparedness and Response Program includes an identification of areas where accidents and emergency situations may occur, communities and individuals that may be affected, response procedures, provision of equipment and resources, designation of responsibilities, communication, including that of potentially affected communities and periodic training to ensure an effective response;
- The Third-party Management Program includes monitoring activities in order to assess contractors E&S performance. It covers occupational health and safety (OHS), community health and safety, gender-based violence prevention, labour conditions, safety and security, resettlement, biodiversity, cultural, heritage, stakeholder engagement, procurement, and supply chain management;
- The Security Personnel Program manages and controls potential security risks and impacts resulting from the recruitment and performance of the Project’s security personnel.

Additionally, the Project has the following environmental mitigation measures:

- Air and Noise Management Program
- Soil Management Program
- Surface water and Groundwater Quality Management Plan
- Drilling Muds Management Plan
- Waste Treatment and Disposal Facilities
- Hazardous Substances Management Program
- Structural Stability Management Plan
- Transit Management Program
- Monitoring Program (Water and Effluent Monitoring; Air and Emissions Monitoring)
- Risk Management Plan

With the implementation of the mitigation above defined, the residual impact of community, health, safety and security is assessed as ***minor.***

6.9 Environmental Impact Assessment Results

Once the methodology of environmental impact assessment has been stablished, the impacting actions have been recognized, and the conditions of impact assessment of each environmental component have been described, the IIM and the Importance of Impact (I) formula are applied in the following sections and the following environmental impact results have been identified for the project implementation activities.

Annexes 6.1 and 6.2 have the full Impact Identification Matrix (IIM) and Importance of Impact (I) Matrix. The following sections will describe the results in each environmental component.

6.9.1 Environmental Impacts in the Physical component

Most of the impacts in the Physical Environmental Component are negative but compatible and moderate as shown in the following figure and table.

Figure 6.4 Percentage of occurrence of impacts in the Physical component

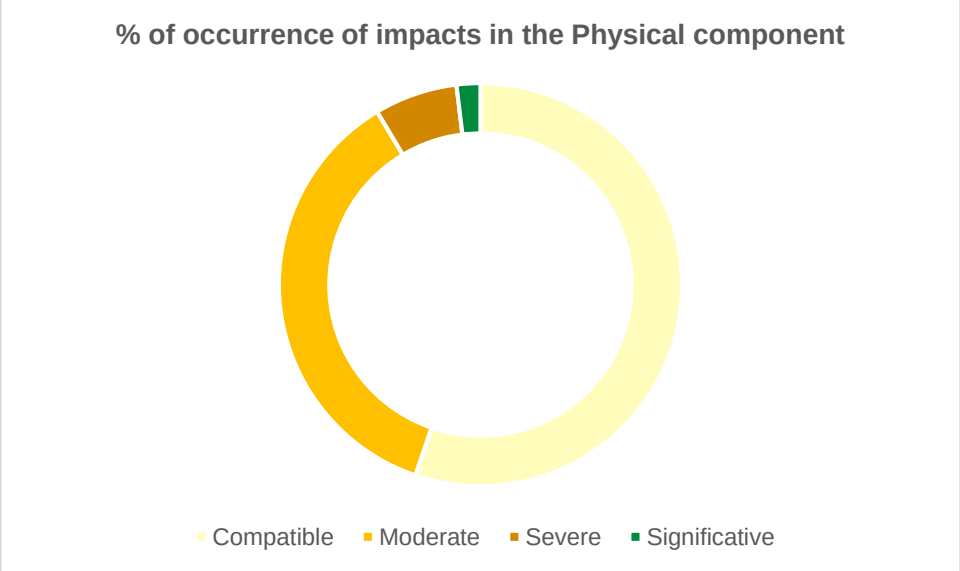


Table 6-36 Impact classification by phase, environmental factor and impacting actions in the physical component)

Phase	Factor	Impact Classification	Impact	Impacting Actions
Construction	Water resources	Compatible	C1 - Alteration of surface water quality	Additional production facilities Civil works, security perimeter and infrastructure, sewage and drainage works (sanitary, pluvial, electrical). Completion, flow profile logging, drilling test, (fracture and stimulation) and well testing Enabling and improving existing accesses and construction of new accesses. Solid waste management Temporary camps enabling (civil work stations, mechanical workshop, electrical works, and auxiliary and drilling equipment storage)
			C2 - Alteration of groundwater quality	Civil works, security perimeter and infrastructure, sewage and drainage works (sanitary, pluvial, electrical). Completion, flow profile logging, drilling test, (fracture and stimulation) and well testing Liquid discharges management Provisioning, derivation and consumption of water
		Moderate	C1 - Alteration of surface water quality	Drilling (vertical and horizontal drilling, foundation, blow out prevention, drilling mud supply, geological control service and dry location service) Liquid discharges management
			C2 - Alteration of groundwater quality	Drilling (vertical and horizontal drilling, foundation, blow out prevention, drilling mud supply, geological control service and dry location service) Procurement, use or spill contingency of fuel, lubricants and chemical products
		Severe	C1 - Alteration of surface water quality	Procurement, use or spill contingency of fuel, lubricants and chemical products Provisioning, derivation and consumption of water
	Air and Sound Pressure Levels	Compatible	D1 - Alteration of air quality	Additional production facilities Enabling and improving existing accesses and construction of new accesses. Installation and construction of pipeline (gas, oil, and production water) Leveling and topography redefinition Temporary camps enabling (civil work stations, mechanical workshop, electrical works, and auxiliary and drilling equipment storage) Well platform installations (assembly of equipment)
			D2 -Alteration at the sound pressure level	Additional production facilities Civil works, security perimeter and infrastructure, sewage and drainage works (sanitary, pluvial, electrical). Electrical and mechanical works Installation and construction of pipeline (gas, oil, and production water) Provisioning, energy generation, derivation, and energy consumption Temporary camps enabling (civil work stations, mechanical workshop, electrical works, and auxiliary and drilling equipment storage) Transportation of equipment, supplies and personnel Use of vehicles and heavy machinery Well platform installations (assembly of equipment)
		Moderate	D1 - Alteration of air quality	Provisioning, energy generation, derivation, and energy consumption Soil movement Transportation of equipment, supplies and personnel

Phase	Factor	Impact Classification	Impact	Impacting Actions
				Use of vehicles and heavy machinery
			D2 -Alteration at the sound pressure level	Completion, flow profile logging, drilling test, (fracture and stimulation) and well testing Drilling (vertical and horizontal drilling, foundation, blow out prevention, drilling mud supply, geological control service and dry location service) Enabling and improving existing accesses and construction of new accesses.
	Soils	Compatible	B1 - Alteration of soil quality	Additional production facilities Civil works, security perimeter and infrastructure, sewage and drainage works (sanitary, pluvial, electrical). Electrical and mechanical works Installation and construction of pipeline (gas, oil, and production water) Solid waste management Temporary camps enabling (civil work stations, mechanical workshop, electrical works, and auxiliary and drilling equipment storage) Transportation of equipment, supplies and personnel Use of vehicles and heavy machinery Well platform installations (assembly of equipment)
		Moderate	B1 - Alteration of soil quality	Drilling (vertical and horizontal drilling, foundation, blow out prevention, drilling mud supply, geological control service and dry location service) Leveling and topography redefinition Procurement, use or spill contingency of fuel, lubricants and chemical products Soil movement
	Geology and Geomorphology	Compatible	A1 - Alteration of structural stability	Civil works, security perimeter and infrastructure, sewage and drainage works (sanitary, pluvial, electrical). Enabling and improving existing accesses and construction of new accesses. Leveling and topography redefinition Use of vehicles and heavy machinery
		Moderate	A1 - Alteration of structural stability	Soil movement
		Severe	A1 - Alteration of structural stability	Drilling (vertical and horizontal drilling, foundation, blow out prevention, drilling mud supply, geological control service and dry location service)
	Landscape	Compatible	E1 - Alteration of the scenic quality	Solid waste management Civil works, security perimeter and infrastructure, sewage and drainage works (sanitary, pluvial, electrical).
		Moderate	E1 - Alteration of the scenic quality	Electrical and mechanical works Temporary camps enabling (civil work stations, mechanical workshop, electrical works, and auxiliary and drilling equipment storage) Transportation of equipment, supplies and personnel Use of vehicles and heavy machinery Vegetation clearing
		Severe	E1 - Alteration of the scenic quality	Soil movement
Operation	Water resources	Compatible	C1 - Alteration of surface water quality	Solid waste management
			C2 - Alteration of groundwater quality	Liquid discharges management Production of wells in development and reinjection
		Moderate	C1 - Alteration of surface water quality	Liquid discharges management Production of wells in development and reinjection
			C2 - Alteration of groundwater quality	Procurement, use or spill contingency of fuel, lubricants and chemical products

Phase	Factor	Impact Classification	Impact	Impacting Actions
		Severe	C1 - Alteration of surface water quality	Procurement, use or spill contingency of fuel, lubricants and chemical products Provisioning, derivation and consumption of water
			C2 - Alteration of groundwater quality	Provisioning, derivation and consumption of water
	Air and Sound Pressure Levels	Compatible	D1 - Alteration of air quality	Transportation of equipment, supplies and personnel
			D2 -Alteration at the sound pressure level	Transportation of equipment, supplies and personnel
		Moderate	D1 - Alteration of air quality	Production of wells in development and reinjection Provisioning, derivation and consumption of energy
			D2 -Alteration at the sound pressure level	Production of wells in development and reinjection Provisioning, derivation and consumption of energy
	Soil	Compatible	B1 - Alteration of soil quality	Solid waste management Transportation of equipment, supplies and personnel
		Moderate	B1 - Alteration of soil quality	Liquid discharges management Procurement, use or spill contingency of fuel, lubricants and chemical products Production of wells in development and reinjection
	Landscape	Compatible	E1 - Alteration of the scenic quality	Solid waste management
Abandonment	Water resources	Compatible	C1 - Alteration of surface water quality	Solid waste management
		Moderate	C2 - Alteration of groundwater quality	Handling of Hazardous Substances (fuel, chemicals)
		Severe	C1 - Alteration of surface water quality	Handling of Hazardous Substances (fuel, chemicals)
		Significant	C2 - Alteration of groundwater quality	Dismantling of facilities and auxiliary infrastructures
	Air and Sound Pressure Levels	Compatible	D1 - Alteration of air quality	Dismantling of facilities and auxiliary infrastructures
			D2 -Alteration at the sound pressure level	Demobilization of equipment, supplies and personnel
				Dismantling of facilities and auxiliary infrastructures
				Use of vehicles and heavy machinery
		Moderate	D1 - Alteration of air quality	Demobilization of equipment, supplies and personnel
				Use of vehicles and heavy machinery
	Soil	Compatible	B1 - Alteration of soil quality	Demobilization of equipment, supplies and personnel
				Solid waste management
				Use of vehicles and heavy machinery
		Moderate	B1 - Alteration of soil quality	Dismantling of facilities and auxiliary infrastructures
				Handling of Hazardous Substances (fuel, chemicals)
	Landscape	Compatible	E1 - Alteration of the scenic quality	Use of vehicles and heavy machinery
		Moderate	E1 - Alteration of the scenic quality	Demobilization of equipment, supplies and personnel
				Dismantling of facilities and auxiliary infrastructures
		Significant	E2 - Recovery of scenic quality	Revegetation

Source: ERM, 2019

6.9.2 Environmental Impacts in the Biological component

Regarding the environmental impacts in the biological component, most of them are negative but compatible with the project's activities due mostly to the current impact in the area.

Figure 6.5 Percentage of occurrence of impacts in the Biological component

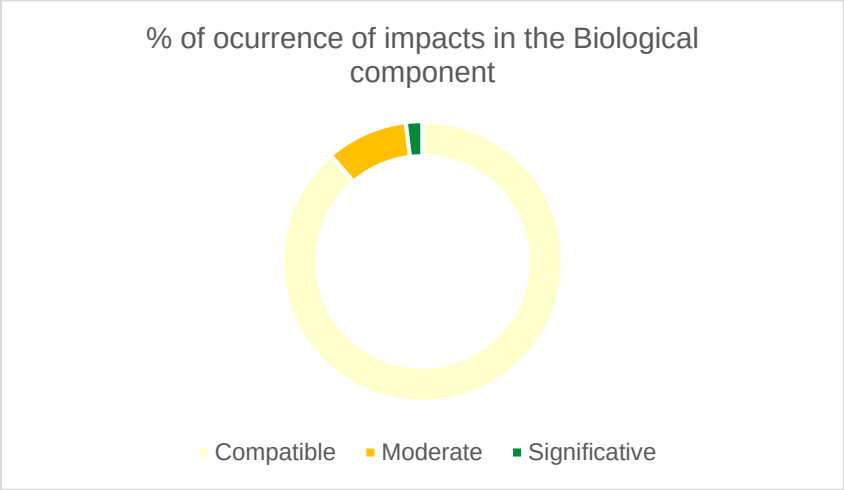


Table 6-37 Impact classification by phase, environmental factor and impacting actions in the biological component

Phase	Factor	Classification	Impact	Impacting Actions
Construction	Flora	Compatible	F1 - Alteration of vegetation cover	Use of vehicles and heavy machinery
			F2- Reduction in plant regeneration capacity	Soil movement Vegetation clearing
		Moderate	F1 - Alteration of vegetation cover	Soil movement Vegetation clearing
			F2- Reduction in plant regeneration capacity	Use of vehicles and heavy machinery
	Terrestrial Fauna	Compatible	G1 – Alteration of composition and abundance of mammals (minors and adults)	Civil works, security perimeter and infrastructure, sewage and drainage works (sanitary, pluvial, electrical) Enabling and improving existing accesses and construction of new accesses. Personnel activities Provisioning, energy generation, derivation, and energy consumption

Phase	Factor	Classification	Impact	Impacting Actions
				Soil movement Use of vehicles and heavy machinery Vegetation clearing
			G2 – Alteration of composition and abundance of birds	Civil works, security perimeter and infrastructure, sewage and drainage works (sanitary, pluvial, electrical) Enabling and improving existing accesses and construction of new accesses. Personnel activities Provisioning, energy generation, derivation, and energy consumption Soil movement Use of vehicles and heavy machinery Vegetation clearing
			G3 – Alteration of composition and abundance of herpetofauna	Civil works, security perimeter and infrastructure, sewage and drainage works (sanitary, pluvial, electrical) Enabling and improving existing accesses and construction of new accesses. Personnel activities Provisioning, energy generation, derivation, and energy consumption Use of vehicles and heavy machinery
		Moderate	G3 – Alteration of composition and abundance of herpetofauna	Soil movement Vegetation clearing
Operation	Terrestrial Fauna	Compatible	G1 – Alteration of composition and abundance of mammals (minors and adults)	Provisioning, energy generation, derivation, and energy consumption Solid waste management Transportation of equipment, supplies and personnel
			G2 – Alteration of composition and abundance of birds	Provisioning, energy generation, derivation, and energy consumption Solid waste management Transportation of equipment, supplies and personnel
			G3 – Alteration of composition and abundance of herpetofauna	Provisioning, energy generation, derivation, and energy consumption Solid waste management Transportation of equipment, supplies and personnel
Abandonment	Flora	Compatible	F1 - Alteration of vegetation cover	Leveling and topography redefinition Use of vehicles and heavy machinery
			F2- Reduction in plant regeneration capacity	Leveling and topography redefinition Use of vehicles and heavy machinery
	Terrestrial ecosystem	Significant	H1 - Recovery of the terrestrial ecosystem	Revegetation
	Terrestrial Fauna	Compatible	G1 – Alteration of composition and abundance of mammals (minors and adults)	Demobilization of equipment, supplies and personnel Dismantling of facilities and auxiliary infrastructures Personnel activities Use of vehicles and heavy machinery
			G2 – Alteration of composition and abundance of birds	Demobilization of equipment, supplies and personnel

Phase	Factor	Classification	Impact	Impacting Actions
			G3 – Alteration of composition and abundance of herpetofauna	Dismantling of facilities and auxiliary infrastructures Personnel activities Use of vehicles and heavy machinery Demobilization of equipment, supplies and personnel Dismantling of facilities and auxiliary infrastructures Personnel activities Use of vehicles and heavy machinery

Source: ERM, 2019

6.9.3 Environmental Impacts in the Social component

Regarding the environmental impacts in the social component most of them are negative but compatible with the project and in less proportion but also important are positive- not significant. The following figure and table show impacts proportion and also the main activities generating social impacts.

Figure 6.6 Percentage of occurrence of impacts in the Social component

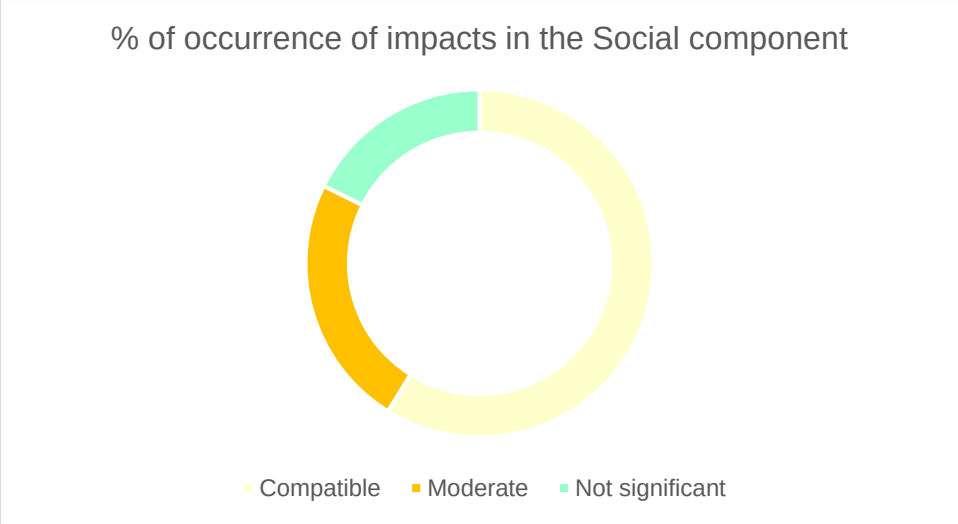


Table 6-38 Impact classification by phase, environmental factor and impacting actions in the social component

Phase	Factor	Classification	Impact	Impacting Actions
Abandonment	Sociocultural	Compatible	J3 - Increased Demand of Local Goods and Services	Dismantling of facilities and auxiliary infrastructures
		Moderate	J4 - Increased Transit of Vehicles	Dismantling of facilities and auxiliary infrastructures
	Socioeconomic	Not significant	J1 – Change in land use and landowners livelihoods	Labor hiring
Construction	Sociocultural	Compatible	J3 - Increased Demand of Local Goods and Services	Transportation of equipment, supplies and personnel Use of vehicles and heavy machinery Acquisition of supplies and materials
			J4 – Community Health and Safety	Provisioning, derivation and consumption of water
		Moderate	J4 - Community Health and Safety	Transportation of equipment, supplies and personnel

				Use of vehicles and heavy machinery Acquisition of supplies and materials
	Socioeconomic	Compatible	J2 – Local employment generation	Electrical and mechanical works Provisioning, energy generation, derivation, and energy consumption Soil movement Transportation of equipment, supplies and personnel Use of vehicles and heavy machinery
		Not significant	J1 – Change in land use and landowners livelihoods	Labor hiring
Operation	Socioeconomic	Not significant	J1 – Change in land use and landowners livelihoods	Labor hiring

Source: ERM, 2019.

Environmental management measures will be appropriately addressed for each environmental and social impact, especially for the moderate one.

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