

# Initial City Assessment for Arequipa

---

*August 2018*



## Table of Contents

<b>Table of Contents</b> .....	<b>2</b>
<b>List of Tables</b> .....	<b>3</b>
<b>List of Figures</b> .....	<b>3</b>
<b>Acronyms</b> .....	<b>4</b>
<b>1. Introduction</b> .....	<b>5</b>
<b>2. Methodology</b> .....	<b>5</b>
<b>3. General Information on Arequipa</b> .....	<b>6</b>
3.1. Political and Administrative Organization .....	6
3.2. Geography and Climate .....	7
<b>4. Municipal Solid Waste Management in Arequipa</b> .....	<b>8</b>
4.1. Institutional and Regulatory Framework .....	8
National Context .....	8
Local Context.....	10
4.2. Waste Generation and Composition .....	12
Peru .....	12
Arequipa.....	12
4.3. Waste Collection and Transport .....	13
Transfer Station.....	14
4.4. Recycling .....	15
Source Segregation Programs and Recyclers Associations.....	15
Recycling Plant .....	16
4.5. Final Disposition.....	16
Open Dumpsites.....	16
Sanitary Landfill.....	17
4.6. Financing and Costs .....	18
Sanitary Landfill.....	18
Transfer Station.....	18
<b>5. Organic Waste Treatment Project</b> .....	<b>19</b>
5.1. Project Description.....	19
5.2. Potential Site .....	19

5.3. Potential Organic Waste Sources.....	20
Markets.....	20
Parks and Green Areas.....	21
Other Sources.....	22
5.4. Compost Market.....	22
5.5. Relevant Stakeholders.....	22
5.6. Financing.....	23
<b>6. Next Steps.....</b>	<b>24</b>
<b>Appendices.....</b>	<b>25</b>
Appendix I. Relevant national regulation on solid waste in Peru.....	25
Appendix II. Relevant local regulation on solid waste in Arequipa.....	25

## List of Tables

Table 1: Population and Districts of the Provincial Municipality of Arequipa.....	6
Table 2: Average temperature and precipitation in the Province of Arequipa.....	8
Table 3: Solid Waste Generation in Arequipa.....	13
Table 4: Solid Waste Composition by type of recoverable material in Arequipa.....	13
Table 5: Waste Generation in the Markets of the District of Arequipa.....	20

## List of Figures

Figure 1: Maps of the Province of Arequipa at national and local scales.....	7
Figure 2: Organigram of the Direction of Citizen Services of the Province of Arequipa.....	10
Figure 3: Peru’s national average solid waste composition.....	12
Figure 4: Solid Waste Composition in Urban (left) and Rural (right) Districts in Arequipa.....	13

## Acronyms

CCAC	Climate and Clean Air Coalition
CCAP	Center for Clean Air Policy
CONAM	Environment National Council
GHG	Greenhouse Gas
MINAM	Ministry of Environment
MPA	Provincial Municipality of Arequipa
MSW	Municipal Solid Waste
NAMA	Nationally Appropriate Mitigation Action
NDC	Nationally Determined Contribution
PIGARS	Integrated Environmental Solid Waste Management Plan
PLANAA	National Plan of Environmental Action
PLANRES	National Plan of Solid Waste
SLCP	Short-Lived Climate Pollutant

## 1. Introduction

The Center for Clean Air Policy (CCAP), an implementing partner of the Climate and Clean Air Coalition (CCAC) Municipal Solid Waste Initiative, is providing on-the ground financial, policy and technical assistance to the Provincial Municipality of Arequipa (MPA) to develop a financial work plan and support implementation of an organic waste management project already pre-identified by the municipality that can reduce short lived climate pollutants (SLCPs) and greenhouse gas (GHG) emissions, and deliver other social and economic co-benefits.

CCAP conducted a preliminary scoping mission to Arequipa, Peru, to assess the enabling environment necessary for successful project financing and implementation. This report provides an initial assessment of the municipal solid waste management context in the municipality of Arequipa and the starting situation of the identified organic waste management project in need of technical assistance.

## 2. Methodology

CCAP conducted a data collection and scoping mission to Arequipa in April 17-19, 2018. The main objectives of the mission trip were: gathering data to characterize the city's waste management system, conducting site visits and making on the ground observations, identifying potential sources of organic waste for the project, building relationships with key stakeholders, assessing political will, and collecting information on regulations, financial barriers and opportunities for the intended organic waste management project.

CCAP worked collaboratively with counterparts of the MPA Sub-Direction of Environmental Management to schedule and facilitate the scoping mission, including meetings and site visits. In advance of the trip, CCAP began by collecting data from publicly available sources and from municipal officials through email exchanges and conference calls. During the mission, data was verified and updated based on information obtained during stakeholder meetings and site visits to the municipal landfill, waste transfer station, recycling collection center and one of the main municipal markets.

CCAP conducted meetings with the following actors:

- MPA Sub-Direction of Environmental Management
- MPA Direction of Tax Management
- MPA Direction of Planning, Budgeting and Rationalization
- MPA Sub-Direction of Sanitation and Public Health
- MPA Unit of Parks and Gardens
- MPA Unit of Public Cleaning
- Interaseo – Arequipa's landfill operator company
- Recyclers association representatives
- Municipal Market San Camilo workers' representatives
- Peru Ministry of Environment
- Libelula – Peruvian climate and environmental consulting firm

CCAP conducted visits to the following sites:

- MPA municipal landfill – Quebrada Honda
- MPA waste transfer station
- Recycling collection center
- Municipal market – Mercado San Camilo

### 3. General Information on Arequipa

#### 3.1. Political and Administrative Organization

Arequipa is a city and metropolitan area of Peru, and the capital of the Province of Arequipa. With a population of 1,043,491 inhabitants, Arequipa is the second largest city of Peru.

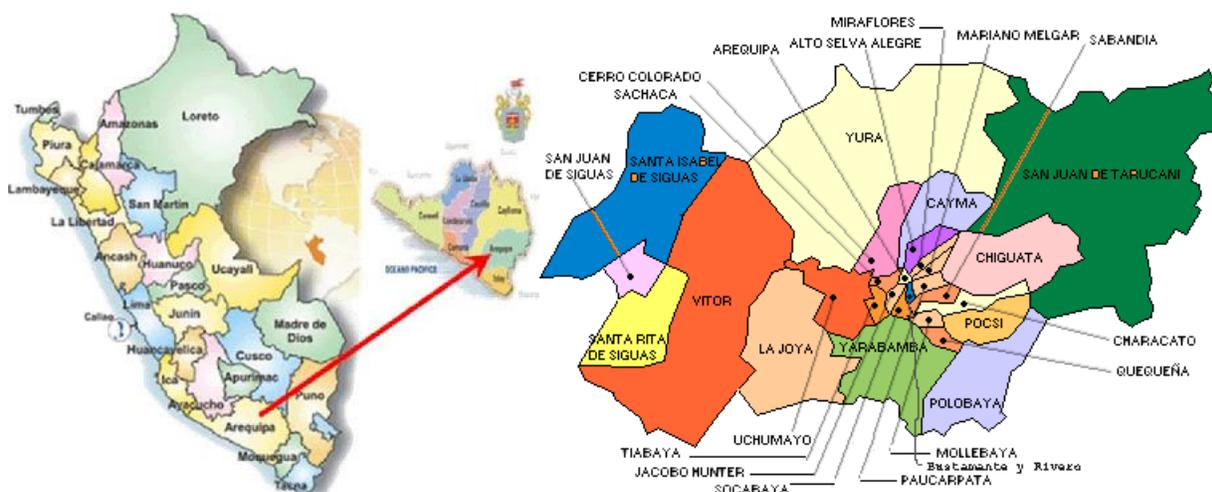
The Provincial Municipality of Arequipa (MPA) is the political authority governing over all the territory of the Province of Arequipa, which is organized in 29 districts (including urban and rural districts). The MPA regulates at the city, metropolitan and provincial level in matters such as urban planning, transportation, taxes, public cleaning, etc. Within the metropolitan area, there are also District Municipalities with jurisdiction in matters relative to their own districts, including municipal solid waste management.

**Table 1: Population and Districts of the Provincial Municipality of Arequipa**

District Type	District Name	Population
<b>Urban (17 districts)</b>	Alto Selva Alegre	986,921
	Arequipa	
	Cayma	
	Cerro Colorado	
	Characato	
	Jacobo Hunter	
	José Luis Bustamante y Rivero	
	Mariano Melgar	
	Miraflores	
	Paucarpata	
	Sabandía	
	Sachaca	
	Socabaya	
	Tiabaya	
	Uchumayo	
	Yanahuara	
	Yura	

<p><b>Rural (12 districts)</b></p>	<p>Chiguata La Joya Mollebaya Pocsi Polobaya Santa Isabel de Sigwas San Juan de Sigwas San Juan de Tarucani Santa Rita de Sigwas Quequeña Vítor Yarabamba</p>	<p>56,570</p>
<p><b>Total</b></p>		<p><b>1,043,491</b></p>

Figure 1: Maps of the Province of Arequipa at national and local scales



### 3.2. Geography and Climate

The Province of Arequipa is located at 2,328 meters above sea level in the valley of Arequipa and it has an extension of 10,340 km<sup>2</sup>. It is surrounded by the Andean mountains to the north and east, and by low mountain ranges to the south and west.

Arequipa presents a dry, warm, semi-arid climate. According to the Aeronautical Meteorological Service of Peru, precipitation in the Province of Arequipa is higher during the summer months compared to the rest of the year, with an average annual precipitation of 94.4-180.4 mm in 2016. Average annual temperatures range between 9.63°C and 23.93°C. As for relative humidity, it is high in summer and low in winter, ranging between 73% and 18%.

**Table 2: Average temperature and precipitation in the Province of Arequipa**

Year	Month	Temperature (°C)		Precipitation (mm)	
		Min	Max	7am	7pm
2015	January	23.73	10.62	0	12.5
	February	15.06	21.13	41.2	61.8
	March	11.84	21.53	36.1	55.2
	April	11.04	22.83	0	0
	May	8.75	23.26	0	0
	June	8.24	23.98	0	0
	July	6.7	22.66	0	0
	August	7.88	23.61	0	0
	September	8.68	24.27	0	0
	October	9.22	23.49	0	0
	November	11.83	23.07	0	0
	December	10.55	32.89	0	0
2016	January	10.49	24.58	0	0
	February	12.66	23.74	12.7	35.4
	March	11.4	24.27	0	0
	April	10.84	23.98	4.4	15.5
	May	8.36	24.59	0	0
	June	7.08	23.47	0	0
	July	7.21	23.29	0	0
	August	7.32	23.41	0	0
	September	7.56	23.83	0	0
	October	8.43	23.79	0	0
<b>Average/Total</b>		<b>9.63</b>	<b>23.93</b>	<b>94.4</b>	<b>180.4</b>

## 4. Municipal Solid Waste Management in Arequipa

### 4.1. Institutional and Regulatory Framework

#### National Context

Solid waste management has become a priority for national government in Peru due to public health and local pollution issues. In 2002, 73.3% of municipal solid waste was effectively collected by municipal authorities, and only 19.7% of total solid waste generated was disposed in sanitary landfills.

In this context, the Peruvian Environment National Council (CONAM) developed Peru's National Plan of Integrated Solid Waste Management, which defined the strategic lines and activities to improve the conditions in the solid waste management at the national level for the period 2005-2014.

The Ministry of Environment (MINAM) has focused on integrated solid waste management as part of its efforts to improve environmental quality at the national level. In this regard, the National Plan of

Environmental Action (PLANAA) for the period 2011-2021 included integrated solid waste management as a priority objective, defining four specific targets to be achieved by 2021:<sup>1</sup>

1. Ensuring adequate treatment and final disposition of MSW
  - 100% of non-recyclable MSW are treated and disposed adequately by 2021
2. Minimizing generation, improving segregation, selective collection and recycling of municipal solid waste
  - 100% of recyclable MSW is recycled by 2021
3. Reducing generation of non-municipal hazardous waste, improving its treatment and final disposition
  - 20% reduction of hazardous waste generation compared to baseline by 2021
  - 100% of hazardous waste is adequately treated and disposed in specialized facilities by 2021
4. Increasing re-use and adequate disposition of electrical and electronic equipment waste
  - 100% of electrical and electronic waste is re-used and adequately disposed

In addition to this, the MINAM has worked to improve the operational aspect of solid waste management at the municipal level through different initiatives and projects aimed at improving municipal public cleaning services, the construction of solid waste management infrastructure, increasing recycling, and promoting environmental education.

In line with the goal of 60% recycling of all recyclable materials by 2017 and 100% by 2021 established at the PLANAA 2011-2021, the MINAN has focused on actions to create incentives for the municipal government to implement programs of segregation at source that include recyclers in the solid waste collection routes.

In this context, the MINAN updated the National Plan of Solid Waste (PLANRES) for the period 2016-2024 to include the new priorities and actions to be implemented at national level in order to achieve the 2021 goals established by the PLANAA. The PLANRES 2016-2024 created a national framework to articulate the efforts on solid waste management at all government levels (national, regional and local) based on their competences.<sup>2</sup>

In addition to this, in its Nationally Determined Contribution submitted under Paris Agreement, Peru has committed to reducing by 30% by 2030 the GHG emissions coming from five prioritized sectors, including the solid waste sector. In this context, in 2015 Peru developed a Nationally Appropriate Mitigation Action (NAMA) for the solid waste sector. The NAMA has the objective to minimize GHG emissions from the solid waste sector by promoting a transformational change in the sector based in waste disposal minimization and waste recovery, reuse, treatment and recycling. Among the waste recovery and treatment technologies highlighted in the NAMA are landfill gas capture and use, mechanical-biological treatment and organic waste composting. That said, the organic waste treatment

---

<sup>1</sup> [http://www.minam.gob.pe/wp-content/uploads/2013/08/plana\\_2011\\_al\\_2021.pdf](http://www.minam.gob.pe/wp-content/uploads/2013/08/plana_2011_al_2021.pdf)

<sup>2</sup> <http://sinia.minam.gob.pe/documentos/plan-nacional-gestion-integral-residuos-solidos-2016-2024>

project evaluated here would contribute to these national objectives, achieving emissions reductions that will contribute to meeting Peru’s NDC.

For more specific details on Peru’s regulation on solid waste at the national, a compilation list of the relevant national legislation on this issue can be found in Appendix I.

### Local Context

As mentioned before, the political-administrative organization of Arequipa distinguishes between the Provincial Municipality of Arequipa (MPA), the provincial government with jurisdiction over the whole Province of Arequipa, and the District Municipalities, with competences in their own districts. In regard with solid waste management, the competences are shared among the MPA and the District Municipalities that constitute Arequipa.

The MPA is responsible for planning, coordinating and supervising municipal solid waste management in the Province, with oversight of the District Municipalities MSW activities. In addition to this, the MPA also has direct jurisdiction and control over the District of Arequipa (commonly referred as Cercado), the capital district of Arequipa.

Within the MPA, the Direction of Citizen Services is responsible to plan, direct, execute, control and supervise the provision of public services. Figure 2 shows the organization of this Direction, which is constituted by three Sub-Directions responsible for environmental management, local development and public health services respectively. In particular, the Sub-Direction of Environmental Management and the Sub-Direction of Sanitation and Public Health have competence on solid waste management.

Figure 2: Organigram of the Direction of Citizen Services of the Province of Arequipa



While the MPA has a planning, coordination and supervision role, the District Municipalities are directly responsible to ensuring the adequate provision of municipal public cleaning services<sup>3</sup> in their respective

<sup>3</sup> The term public cleaning refers to the municipal services related to solid waste management, including waste collection, transport, treatment and disposition, but also street cleaning.

districts. Nonetheless, the MPA is the direct responsible of the sanitary landfill of Arequipa, where the District Municipalities are required to dispose their waste.

Among the MPA competences are determining the sanitary landfill waste gate-fees, evaluating the location of infrastructure for MSW and emitting the relevant land use compatibility certificate, approving public and private investment infrastructure projects for municipal solid waste management.

These competences are particularly relevant for the organic waste management project evaluated here, since the MPA will be ultimately responsible for determining and approving the organic waste treatment project, the site where the facility will be located, and the financing model.

In 2017, the MPA, in collaboration with the District Municipalities, developed the Integrated Environmental Solid Waste Management Plan (PIGARS) for the period 2017-2028 with the goal to improve the solid waste management in the Province of Arequipa. The PIGARS includes all the different aspects of solid waste management, from generation to final disposition, and has a provincial scope seeking to transcend political-administrative district divisions by laying out strategic lines and actions for all the 29 districts of Arequipa, while recognizing the autonomy of the District Municipalities.

The PIGARS has established the following six strategic objectives:

1. **Service Coverage:** Promote and achieve universal coverage of the public cleaning service and re-use of solid waste, recyclables, considering health and occupational safety aspects.
2. **Institutional Strengthening:** Strengthen the management capacity of the solid waste management units, through an adequate MSW management framework, information platforms, and inclusive approaches.
3. **Capacity Building:** Strengthen the public authorities' capacity, public cleaning workers and recyclers for a continuous improvement of solid waste management, considering a gender and equity approach.
4. **Environmental Citizenship:** Raise awareness and generate a commitment among the population to pay for the public cleaning service.
5. **Waste Valorization:** Promote valorization of solid waste through source segregation, composting, collection and treatment of electrical and electronic equipment waste, and promotion of green jobs.
6. **Investment:** Promote and facilitate investment projects to implement and improve the services of public cleaning and re-use/recycling of waste.

In order to achieve these objectives, the PIGARS establishes targets for the short term (2017–2019), medium term (2020–2023) and long term (2024–2028), defining responsibilities, budgets for each activity, indicators and monitoring processes.

Objective 5 is of particular relevance to the project that CCAP will be assisting the MPA with to formulate and develop a financial work plan that supports its implementation. Within the PIGARS, Objective 5 includes specific targets to achieve 5 District Municipalities composting by 2017-2019, 10 by 2020-2023 and 20 by 2024-2028. The implementation of the identified organic waste project would help

Arequipa to meet these targets and has a demonstration project to facilitate replication around the Province.

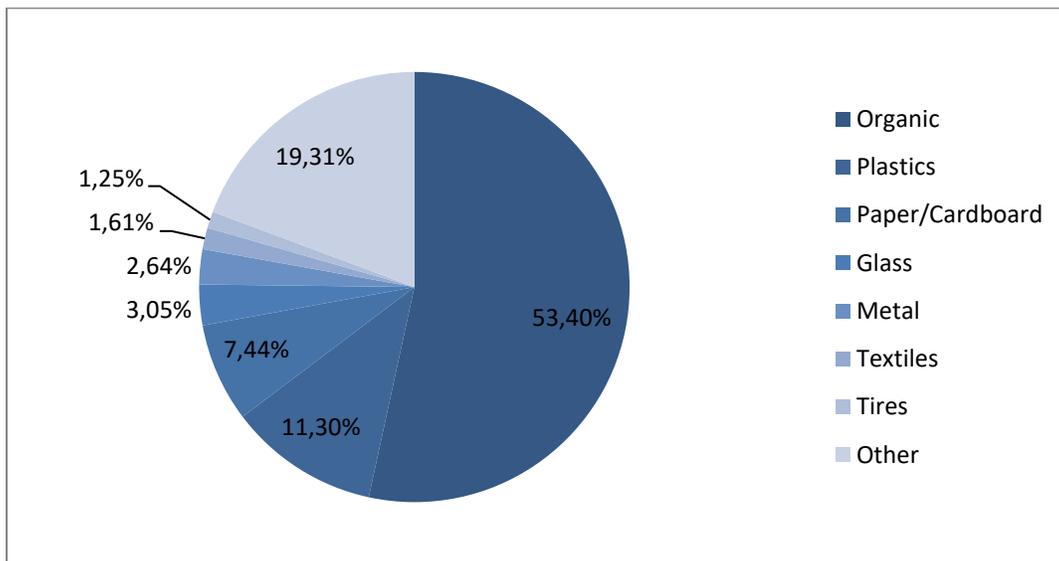
## 4.2. Waste Generation and Composition

### Peru

In 2013, Peru generated 7.5 million tons of municipal waste, of which 64% came from households. The national average generation of solid waste was 13,244 tons/day. The per capita household solid waste generation was 0.56 kg/person/day in 2013.

As for the waste composition of the solid waste generated at the national level (including hazardous waste and other waste), around 53% was organic waste and around 25% reusable waste and recyclables.<sup>4</sup>

Figure 3: Peru's national average solid waste composition



### Arequipa

In 2015, the solid waste generated in the Province of Arequipa was 268,671 tons/year or 736.1 tons/day, with most of the solid waste coming from households in the Urban Districts of the Arequipa as shown in

<sup>4</sup> <http://redrrss.minam.gob.pe/material/20160328155703.pdf>

Table 3. The household per capita generation was 0.48 kg/person/day.<sup>5</sup>

---

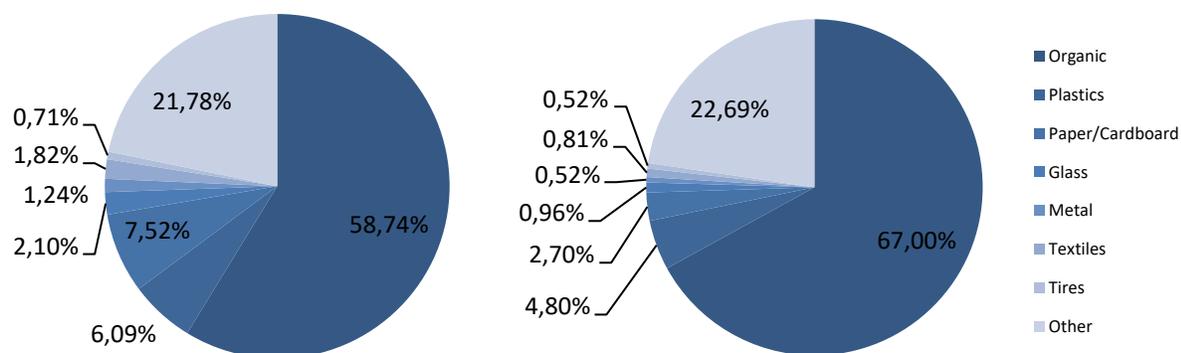
<sup>5</sup> <http://www.muniarequipa.gob.pe/descargas/gestionmanejoresiduos/PIGARS%202017-2028/PIGARS%20final%2022%20de%20Diciembre.pdf>

**Table 3: Solid Waste Generation in Arequipa**

Districts	Population	Household Per Capita Generation (kg/person/day)	Household Generation (tons/day)	Non-household Generation (tons/day)	Municipal Generation (tons/day)	Municipal Generation (tons/year)
<b>Urban (17)</b>	986,921	0.492	482.78	226.7	709.5	258,951
<b>Rural (12)</b>	56,570	0.371	21.02	5.6	26.6	9,720
<b>Total</b>	<b>1,043,491</b>	<b>0.483</b>	<b>503.8</b>	<b>232.3</b>	<b>736.1</b>	<b>268,671</b>

In terms of characterization, the urban and rural Districts present different waste compositions, which are shown in Figure 2Figure 4. In the whole Province of Arequipa, there is a significant amount of organic waste and other recyclable waste generated, as shown in Table 4.

**Figure 4: Solid Waste Composition in Urban (left) and Rural (right) Districts in Arequipa**



**Table 4: Solid Waste Composition by type of recoverable material in Arequipa**

	Organic Waste	Recyclable Material	Non-recoverable Material
<b>Urban Districts</b>	58.74%	16.42%	24.84%
<b>Rural Districts</b>	67%	14.33%	18.67%
<b>Province of Arequipa</b>	<b>59.1%</b>	<b>16.3%</b>	<b>24.6%</b>

### 4.3. Waste Collection and Transport

In Arequipa, each District Municipality has its own collection system and fleet. In the Urban Districts, the waste collection fleet is comprised by 160 vehicles, while 13 vehicles provide the collection service in the Rural Districts.

In total, in the Province of Arequipa there are 173 waste collection vehicles: 92 compactor trucks, 30 trucks, 18 tipper/dump trucks, 5 pickup trucks, and 24 three-wheelers. The estimated total waste collection capacity of the waste fleet is 1,337 tons/day, considerably higher than the daily waste generation of 677 tons/day. This indicates that 50.46% of the fleet is underused and perhaps collection routes could be optimized.

**Image 1: Waste collection truck being weighted at the entrance of the landfill**



This is of particular relevance considering that the waste collection vehicle fleet is considerably old (several vehicles are from 1972, 1980 and 1990), with less than 20% of the vehicles within their useful life.

In terms of collection coverage, in the Urban Districts it ranges from 75% to 100%, with average collection coverage of 89.2%. In the Rural Districts there is not data on coverage except for two Districts where coverage is 90% and 100% respectively.

### **Transfer Station**

The MPA approved the construction of a waste transfer station for Arequipa, which was funded by the local copper mining company (Cerro Verde) to meet part of its environmental compensation obligations.

**Image 2: MPA Transfer Station**



The transfer station has an area of 2,000 m<sup>2</sup> and is located 10 km from the city center, halfway between the landfill and the center of Arequipa. The main objective is to optimize the transportation of the waste to the landfill for final disposition, providing the District Municipalities with a closer intermediary disposal point so the collection vehicles do not have to go all the way to the landfill and therefore increasing service coverage and frequency, and lowering the waste transport costs. However, currently only the District of Arequipa (Cercado) partially uses the transfer station.

The transfer station receives around 85 tons/day from Cercado and having a compacting capacity of 44 tons, two trips per day are currently required to transfer the compacted waste to the landfill. Two more compactors are expected to be acquired in order to cover the current amount of waste received daily. This will be still insufficient to meet the 677 tons/day generated in all the Districts, which currently dispose their waste directly in the landfill, even though there are Districts that are about 80 km far away from the landfill. However, there are plans to construct another waste transfer station in the south of the city.

As of today, there are not waste separation or segregation activities at the transfer station, in spite of the fact that there is a recycling collection center just next to the station. In this regard, it is to be noted that separation of waste at the transfer station before it is compacted could provide a potential source of organic waste for the municipality's project while an additional source of recyclable for the recyclers working next door.

#### **4.4. Recycling**

##### **Source Segregation Programs and Recyclers Associations**

In Arequipa there are several programs of waste source segregation and selective collection of recyclable materials. Some Districts have implemented these programs for several years now, but most of the Districts started implementing them in 2011 in the context of the MINAM's Incentives Program for the Improvement of Municipal Management – Implementation of an Integrated System of Municipal Solid Waste Management. Among the Urban Districts, 16 District Municipalities have source segregation programs that meet the requirements to achieve the goal of the MINAM's Incentives Program.

In addition to this, there are several recyclers associations in Arequipa, most formalized or in process of formalization. In the Urban Districts, there are 19 recyclers associations, while in the Rural District only one District Municipality has a recyclers association.

Up to 17 District Municipalities work with 19 recyclers associations as part of their source segregation and selective collection programs. Around 36.17% of the Districts' households are participating in the source segregation programs, with some District Municipalities accounting with up to 42% of households' participation.

Each District with a source segregation program has established a recycling collection center, usually run by the recyclers associations, where recyclables are separated by type and store before they are commercialized.

Image 3: Recycling Collection Center



In 2016, the amount of solid waste recovered and commercialized in Arequipa was of 154 tons per month. However, the potential recoverable solid waste in Arequipa is estimated to be 2,457 tons per month. According to this, the effective segregation and collection rate of recyclable materials in Arequipa is only 6.26%.

### **Recycling Plant**

The District Municipality of Yanahuara built a recycling plant in 2008 which is directly operated by the municipality. The plant accepts only dry recyclables (not organic waste), receiving around 1.2-1.5 tons/day of paper, cardboard, cans, glass, metals, etc.

The plant receives solid waste partially segregated at source, where full separation is conducted through semi-mechanical processes. Some recyclables are processed to produce plastic bags that are delivered for free to the population to be used for source segregation. The plant employs 17 people.

## **4.5. Final Disposition**

Currently, solid waste final disposition in Arequipa takes place both in open dumpsites and the provincial sanitary landfill.

### **Open Dumpsites**

There are 21 open dumpsites in the Province of Arequipa, of which 12 are receiving waste. In the Urban Districts there are 10 open dumpsites, with only 2 being currently used. In the Rural Districts there are 11 open dumpsites, with 10 being active.

These open dumpsites present a health and environmental problem for Arequipa, since there are not formalized and controlled disposal procedures. In these places open burning and informal recovery by waste pickers, have negative health and environmental impacts.

The ultimate goal is that all the District Municipalities dispose their solid waste in the provincial sanitary landfill. However, the open dumpsites offer an attractive free of charge option in contrast with the landfill, in spite of the legal, health and environmental consequences.

### Sanitary Landfill

The sanitary landfill Quebrada Honda is owned by the Provincial Municipality of Arequipa and was built 2014. The operation and maintenance of the landfill was awarded through a public tender to Interaseo, a private Colombian company operating in several countries in the region.

Image 4: Sanitary Landfill Quebrada Honda



Currently, all the 17 Urban Districts and 3 Rural Districts dispose their solid waste in Quebrada Honda. The total solid waste disposed by these 29 districts is 710 tons/day, however the actual amount should be 823 tons/day which means that some municipalities are disposing part of their solid waste in open dumpsites.

The landfill is located about 20 km from the city center and the site has 155 hectares, although the disposition area currently occupies only 31 hectares. While there is not waste treatment before disposal, the level of waste decomposition and therefore leachates is minimal due to the dry semi-arid climate of Arequipa.

The landfill operations comply with all the regulations, however due to informal settlements invasions (with around 100 people living informally within the landfill limits) it has not receive yet official certification of sanitary landfill. This presents a main risk for the MPA intended organic waste management project, since it is expected to be located within the landfill. However, until the landfill is not officially formalized, the organic waste management facility cannot be built.

As of today, there is no study assessing the greenhouse gas emissions generated by the landfill. It is expected that an emissions assessment will be conducted by 2019. However, it is estimated that emissions are low since the landfill has been operating for only 4 years and due to the low humidity and therefore lower organic waste decomposition.

#### 4.6. Financing and Costs

The total annual cost of public cleaning for the Province of Arequipa, including street cleaning, waste collection, transport and final disposition, is of \$9.3 million (30.5 billion Peruvian soles).

The financing of the public cleaning service should be covered through taxation by users, and each District Municipality establishes their own fees or taxes for the different public cleaning services. However, the effective tax collection for public cleaning service covers only 34% of the cost of the service. About 66% has to come from different municipal financing mechanisms, such as the compensation municipal fund, other budgets, etc. There is a clear problem of non-payment of taxes that affects the financial viability of the public cleaning service, with an average 61% non-payment in the Province.

##### Sanitary Landfill

The sanitary landfill was financed and built by Cerro Verde as part of its environmental compensation obligations. However, the operation and maintenance of the landfill is granted to a private operator through an annual public tender since the MPA lacks the technical resources to operate it. The yearly public tender was devised as a mechanism to ensure that the operator can be easily replaced if there are problems in the operation and maintenance of the landfill, while providing an opportunity for Peruvian companies to bid for the concession contract. However, since the landfill started operating in 2014, the concession contract has been consecutively granted to Interaseo, a private Colombian company.

The disposition gate-fees are 7.8 soles/ton for the District Municipalities, and 25 soles/ton for private companies that dispose their waste in the landfill. However, the actual cost of disposition for the landfill operator is 31 soles/ton, which means the MPA has to cover the rest of the cost from other sources.

Since the MPA is the owner of the landfill and the one with a contract with the operator, the MPA is the responsible for paying the operator for all the municipal waste disposed in the landfill by the different District Municipalities. The District Municipalities are expected to pay to the MPA for each ton of waste they dispose at Quebrada Honda. However, the District Municipalities do not pay the total costs due to the non-payment taxes problems mentioned before, forcing the MPA to cover this gap.

##### Transfer Station

The transfer station, also financed and built by Cerro Verde, has a gate-fee of 20 soles/ton (8 soles/ton for waste disposal and 12 soles/ton for waste transfer to the landfill). This gate-fee is considerably higher than the landfill gate-fee (8 soles/ton), which discourages most District Municipalities to dispose their waste at the transfer station. However, the municipalities are not factoring the savings from avoiding waste transport to the landfill, which could make economically more attractive disposition at the transfer station, particularly for those municipalities located farther away from the landfill.

## 5. Organic Waste Treatment Project

### 5.1. Project Description

The Provincial Municipality of Arequipa is interested in implementing a composting project for the treatment of the organic waste generated in Arequipa, which accounts for 59% of municipal solid waste as seen in Section 4.2.

The project would help the MPA to achieve the Objective 5 of the PIGARS as well as the Activity 3 of the MINAM's Incentives Program, which requires the implementation of an organic waste treatment pilot project.

Additionally, it is expected that the project helps to reduce the waste disposed at the landfill, with the subsequent cost-savings and other benefits such as extending the landfill lifetime, reducing the generation of leachate and SLCP emissions, and producing compost that can be used for agriculture activities and the maintenance of green areas<sup>6</sup>.

### 5.2. Potential Site

The landfill Quebrada Honda has been identified by the MPA as the most suitable site for the composting facility. There is a plot of 90 hectares where the plant could be located, an area significantly larger than the required for a composting plant with a treatment capacity of 100 tons per day that ranges between 2 and 5 hectares depending on the composting technology used.

Image 5: Potential site within the landfill



However, the formalization of the certification of Quebrada Honda as a sanitary landfill is a pre-requisite for the plant to be located within the landfill. As mentioned before, while the landfill complies with established regulations, it has not been certified as sanitary landfill due to informal settlements

---

<sup>6</sup> According to the local experts, compost is now mostly imported from Lima since there are no local providers.

invasions within the landfill limits, with around 100 people living informally in the landfill buffer zone. This is a pressing issue for the municipality, and it is expected to be solved by this year, especially due to pressures coming from MINAM. However, it is a matter of political will and the incoming municipal elections could affect the soon resolutions of the problem. In any case, until the landfill is not officially formalized and registered as a sanitary landfill, the organic waste management facility cannot be built in this location.

### 5.3. Potential Organic Waste Sources

The availability of source-segregated organic waste is a critical requirement for a composting project to be feasible.

In an initial assessment, different potential sources that could provide the project with readily-available separated organic waste in the short-term have been identified: municipal markets and municipal green areas maintenance.

#### Markets

Given the MPA only has direct jurisdiction over Cercado (District of Arequipa), the municipal markets located in this District could easily become the first source of organic waste for the project. There are four municipal markets in Cercado which it is estimated generate about 6.5 tons of waste per day.

**Table 5: Waste Generation in the Markets of the District of Arequipa**

Market	Generation (ton/day)
<b>Mercado No. 1 Mariscal Castilla</b>	0.30
<b>Pesquero Palomar</b>	1.24
<b>El Palomar</b>	0.31
<b>San Camilo</b>	4.64
<b>Total</b>	<b>6.49</b>

According to available data from a 2015 waste composition study, around 75.19% of the waste generated by Market San Camilo was organic waste. Assuming the other markets generate the same amount of organic waste, around 4.8 tons/day of organic waste could be collected separately from the markets only in the District of Arequipa.

Image 6: Market San Camilo in Cercado



There are markets in the other Districts of the Province of Arequipa that could provide a significant amount of organic waste for the project. In particular, two markets have been identified as potential participants for the project due to the large amount of waste they generate:

- **Market El Avelino.** Located in the District of Jose Luis Bustamante y Rivero, it is estimated to generate around 60 tons/day of waste.
- **Market Rio Seco.** Located in the District of Cerro Colorado, it is estimated to generate around 30-40 tons/day of waste.

While a more detailed assessment of the actual amounts produced by these markets (in particular organic waste) should be conducted, given the estimated amounts of waste generated the inclusion of these two markets in the project would be fundamental in order to reach a significant amount of organic waste for the project. However, a coordination work would be necessary between the MPA and the relevant District Municipalities to ensure the participation of these markets.

### **Parks and Green Areas**

The maintenance of green areas generates green waste in the form of grass and branches trimmings. This green waste is fundamental for the composting process to occur.

It is estimated that the maintenance of the green areas in the District of Arequipa generates around 6 tons/day of green waste that could be available for the project. Depending on the expected capacity of the composting plant, a larger amount of green waste will be required for the composting process to be optimal. In this case, work should be conducted to ensure the availability of the green waste from the other Districts of the Province.

In the Cercado, another potential source of green waste is the National University of San Agustín, which has large green areas.

## Other Sources

There are other potential sources of organic waste that could be eventually included in the project.

For instance, the MPA waste transfer station. As mentioned before, it currently receives 85 tons/day of waste from Cercado. If waste was segregated at the station before compacting it, about 25 tons/day of organic waste could be recovered.<sup>7</sup>

Other potential sources that could be explored are slaughterhouse (called *camales*), soup kitchens, anise factories and La Iberica (large chocolate factory based in Arequipa).

In the long-term, the existing source-segregation programs in the Districts could consider the segregation and separate collection of organic waste, providing a significant amount of organic waste for the project.

## 5.4. Compost Market

Another key aspect of the project to be considered is the demand for the compost to be produced at the composting plant.

There are 60 hectares of green areas (170 parks) in Arequipa, however due to the costs the use of compost for maintaining all the green areas is not common, happening once a year and not covering all the green areas. Currently, for green areas maintenance purposes the MPA is using 2.75 ton/year of compost paying 55 soles per 50 kg of compost. Additionally, it uses 250 m<sup>3</sup>/year of cattle manure paying 90 soles/m<sup>3</sup>. The municipality's main compost provider is a local nursery that imports compost from Lima, which often times does not have the adequate quality to be used right away, forcing the municipality to let it mature before it is apt to be applied.

Therefore, the demand of compost for municipal green areas maintenance could be significantly higher, and the composting project presents an opportunity to produce locally and better-quality compost that could be purchased by the municipality at a lower price.

While there is not significant agricultural activity in Arequipa, there are flower producers who currently import fertilizer from Lima. They have been identified as a potential buyer of the compost produced by the project.

It is to be noted that currently there is not regulation or standards for compost certification in Peru. However, there is a proposal being developed at the national level that should be considered.

## 5.5. Relevant Stakeholders

There are different stakeholders that should be involved in the project in order to ensure its success.

---

<sup>7</sup> Considering that organic waste in the Urban Districts of Arequipa represents 58.74% of waste generated and that 50% of the organic waste is efficiently collected from the mixed waste stream received at the transfer station.

1. **MPA Sub-Direction of Environmental Management.** CCAP's primary contact, counterpart and client, responsible for the municipality's solid waste management policies and strategy, and the leading actor for the implementation of the composting project.
2. **MPA Unit of Public Cleaning.** This is the unit responsible for solid waste collection and disposal in the District of Arequipa and will play a key role in the separate collection of organic waste from the municipal markets of the Cercado and its transportation to the composting project.
3. **MPA Unit of Parks and Gardens.** This is the unit responsible for the maintenance of the Cercado's green areas and will play a key role in providing green waste for the composting project.
4. **Municipal Markets.** As the largest generators of readily-available organic waste to be collected separately in Arequipa, they will be a key source of organic waste for the project.
5. **MPA Direction of Tax Management and Direction of Planning, Budgeting and Rationalization.** They are the main municipal authorities responsible for the financial resources and economic development. Their involvement and input will be critical in the development of the financial work plan for the project.
6. **Other District Municipalities.** As the project considers collecting organic waste from other Districts in addition to the Cercado, the municipal governments of the relevant districts will need to be engaged to ensure their buy-in and participation in the project.

## 5.6. Financing

The main objective of the technical assistance is to provide the municipality with a financial work plan for the implementation of the organic waste treatment project. In this regard, a key component to be defined is the financing scheme for the project.

During discussions with representatives of the Direction of Tax Management and the Direction of Planning, Budgeting and Rationalization of the Provincial Municipality of Arequipa, and based on the potential estimated cost of a composting plant, a concession contract or public-private agreement for the construction, operation and maintenance of the composting plant through a competitive public tender was identified as the preferred option by the municipality to finance the project.

Due to the lack of technical capacity, the MPA would prefer to outsource the project to a private company under contract with the municipality following the model of the municipal landfill. However, in this case, a long-term contract would be considered instead of an annual one in order to create regulatory security for the potential companies interested.

A potential purchase agreement of part of the compost produced at a fixed price could be signed between the private operator and the MPA in order to guarantee a stable source of revenue for the project and a stable and economic supply of compost for the municipality to use in green areas maintenance activities. The rest of the compost could be sold by operator at market prices to other potential buyers. This option is preferred over the option of the municipality marketing and selling the compost directly, which would require the creation of a public-private joint venture.

Other potential revenues that could be considered for the financial analysis of the project is the potential credits received for reducing GHG emissions. Additionally, the Ministry of Economy and Finance defined a Social Cost of Carbon for public projects that could be incorporated in the economic and finance analysis the project.

## **6. Next Steps**

As a next step, a high-level pre-feasibility analysis of the project needs to be conducted, including an assessment of the technology, capacity, capital and operational costs, and economic evaluation of the project.

Following this, a risk assessment and action plan associated to the projects' financing and implementation should be conducted, including technical, financial, political, institutional and environmental risks and identifying solutions for addressing those risks.

Finally, a financial work plan will be developed with a focus on structuring a solid business model that makes the project attractive for private companies to invest in building and operating the plant. To this end, the financial work plan could also consider potential additional financing options for the private operator, such as credits or public subsidies, as well as public guarantees addressing potential risks related to the project.

## Appendices

### Appendix I. Relevant national regulation on solid waste in Peru

- Decreto Supremo N.º 012-2009-MINAM. Política Nacional del Ambiente. 23 de mayo de 2009.
- Ley General de Salud N.º 26842. Diario Oficial El Peruano. Lima-Perú. 20 de julio de 1997.
- Código Penal aprobado mediante D. L. N.º 635: Ley que modifica diversos artículos del Código Penal y de Ley General del Ambiente N.º 29263. Diario Oficial El Peruano. Lima-Perú. 2 de octubre de 2008.
- Ley N.º 26631, ley que dicta normas para efectos de formalizar denuncia por infracción de la legislación ambiental.
- Decreto Supremo N.º 003-2013-VIVIENDA. Reglamento para la gestión y manejo de los residuos de las actividades de la construcción y demolición. 8 de febrero de 2013.
- Ley General del Ambiente N.º 28611. Diario Oficial El Peruano. Lima-Perú. 13 de octubre de 2005.
- Ley de Gestión Integral de Residuos Sólidos, D. L. N.º 1278. Diario Oficial El Peruano. Lima. Perú. 23 de diciembre de 2016.
- Ley que Regula la Actividad de los Recicladores N.º 29419. Diario Oficial El Peruano. Lima. Perú. 7 de octubre de 2009.
- Decreto Supremo N.º 005-2010-MINAM del 03-06-2010: Reglamento de la Ley N.º 29419, Ley que Regula la Actividad de los Recicladores.
- Decreto Supremo N.º 001-2012. Reglamento de residuos de aparatos eléctricos y electrónicos. 27 de octubre de 2012.
- Decreto Legislativo N.º 776. Ley de Tributación Municipal. 30 de diciembre de 1993. Ley de Mancomunidades N.º 29341. Diario Oficial El Peruano. Lima-Perú. 4 de abril de 2009.
- Decreto Supremo N.º 046-2010. Reglamento de la Ley de Mancomunidades. Diario Oficial El Peruano. Lima-Perú. 9 de abril de 2010.

### Appendix II. Relevant local regulation on solid waste in Arequipa

- Ley Orgánica de Municipalidades N.º 27972. Diario Oficial El Peruano. Lima-Perú. 26 de mayo de 2003.
- Ley Orgánica de Municipalidades N.º 27972. Diario Oficial El Peruano. Lima-Perú. 26 de mayo de 2003.
- Ordenanza Municipal N.º 947-MPA. Decreto de Alcaldía 011-2013- MPA.
- Ordenanza Municipal N.º 694-2011- MPA, Acuerdo Municipal N.º 094-2011- MRA, Decreto de Alcaldía N.º 003-2012- MPA, Ordenanza Municipal N.º 793-2012 y Ordenanza Municipal N.º 846-2013, de la Municipalidad Provincial de Arequipa.
- Ordenanza Municipal N.º 391, de la Municipalidad Distrital de Santa Rita de Siguan.
- Ordenanza Municipal N.º 838 y Ordenanza Municipal N.º 413-MDASA, de la Municipalidad Distrital de Alto Selva Alegre.
- Ordenanza Municipal N.º 160 y Ordenanza Municipal N.º 951, de la Municipalidad Distrital de Cayma.

- Ordenanza Municipal N.° 409-2016- MDCC, de la Municipalidad Distrital de Cerro Colorado.
- Decreto de Alcaldía N.° 003-2016- MDJH, Ordenanza Municipal N.° 005- 2014-MDJH, Ordenanza Municipal N.° 023-2015-MDJH, de la Municipalidad Distrital de Jacobo Hunter.
- Decreto de Alcaldía N.° 003–2016– MDJLBYR y Ordenanza Municipal N.° 010-2013-MDJLBYR, de la Municipalidad Distrital de José Luis Bustamante y Rivero.
- Ordenanza Municipal N.° 622 y Ordenanza Municipal N.° 012-2013, de la Municipalidad Distrital de Uchumayo.
- Ordenanza Municipal N.° 504 y Ordenanza Municipal N.° 633, de la Municipalidad Distrital de Mariano Melgar.
- Decreto de Alcaldía N.° 007–2012 – MDM, Ordenanza Municipal N.° 186 – MDM, Ordenanza N.° 220 – MDM, Ordenanza Municipal N.° 406, Ordenanza Municipal N.° 133-2011 – MDM y Ordenanza Municipal N.° 158 – MDM, de la Municipalidad Distrital de Miraflores.
- Ordenanza Municipal N.° 012-2016 – MDP y Decreto de Alcaldía N.° 001-2016 – MDP, de la Municipalidad Distrital de Paucarpata.
- Ordenanza Municipal N.° 021-2016 – MDS, Ordenanza Municipal N.° 015-2015 – MDS, Ordenanza Municipal N.° 006- 2016 – MDS, Ordenanza Municipal N.° 001-2016 – MDS, Acuerdo de Concejo Municipal N.° 003-2016 – MDS y Acuerdo de Concejo Municipal N.° 004-2016 – MDS, de la Municipalidad Distrital de Sachaca.
- Decreto de Alcaldía N.° 03-2016 – MDS, de la Municipalidad Distrital de Socabaya.
- Ordenanza Municipal N.° 093 – MDY y Ordenanza Municipal N.° 069 – MDY, de la Municipalidad Distrital de Yanahuara.
- Ordenanza Municipal N.° 009-2016 – MDY y Decreto de Alcaldía N.° 001- 2016 – MDY, de la Municipalidad Distrital de Yura.
- Ordenanza Municipal N.° 08-2014 y Decreto de Alcaldía N.° 01-MDCH-2014, de la Municipalidad Distrital de Characato.
- Ordenanza Municipal N.° 007-2015 – MDS, de la Municipalidad Distrital de Sabandía.