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Estate Guyeau

Review of the Spatial Development Plan St. Eustatius

Rho

ADVISEURS VOOR LEEFRUIMTE

Estate Guyeau

St. Eustatius

Review of the Spatial Development Plan St. Eustatius

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Explanation

Chapter 1 Introduction

1.1 Why a review?

On the eastern side of St. Eustatius, flanking the Quill, lies the former plantation of 'Estate Guyeau '. This initiative proposes to develop this land, with an area of approximately 179,000 m2, for tourist and residential purposes. Estate Guyeau will be a high-quality development for villas and a hotel. A development framework has been drawn up for the planning.

The first phase consists of the development of hotel 'Petit Guyeau', a small hotel at the entrance of the estate. There is a separate review of the ROP created for Petit Guyeau. The second phase entails the development of the remainder of Estate Guyeau. In this phase, (holiday) villas and a second hotel are realised.

Based on the current Spatial Development Plan (in Dutch, Ruimtelijk Ontwikkelingsplan; hereinafter referred to as ROP), a nature preserve now spans the area. Development is therefore not entirely possible within this area. To enable the development of Estate Guyeau, a revision of the ROP is necessary.

1.2 Planning area

The planning area is located on the southeast side of the island of St. Eustatius, in the Dutch Caribbean. The area is situated on the road that runs around the east side of the Quill. The Knippenga Resort is located on the southwest side of the planning area. Vacant lots lie on both the west and east sides.

Figure 1.1 Location Estate Guyeau (source: Bing Maps)

Figure 1.2 Location Guyeau Estate (source: Bing Maps)

1.3 Structure

This ROP review consists of an explanation, regulations and a zoning map. The zoning systematics of the ROP are followed. After reviewing, the project area is an integral part of the ROP, where the rules of the ROP apply unless specified otherwise in this review.

1.4 Procedure

This review has its legal basis in the Island Ordinance ''Eilandsverordening ruimtelijke ontwikkelingsplanning Sint Eustatius''. Under this regulation, the island government can review the spatial planning regulations of the Island. The review shall be adopted by the Island Council. The adoption is preceded by a careful procedure where everyone is given the opportunity, at a public hearing, to respond to the preliminary design of the review and to make their objections known.
The review is available for public inspection for 30 days. In this period, each person is given the opportunity to submit an objection. The period of public inspection shall be announced in advance in the regular appearing newspapers and news magazines, which are distributed within the island area.
This review is written in Dutch and has been translated into English. Should there be any differences between the Dutch and English version, the Dutch version prevails.

1.5 Digital and analogue

This ROP review has been composed digitally and is available for digital consultation. The review will be incorporated into the digital ROP. The ROP review will also be available in hard copy (on paper). The hard copy version will be adopted by the Island Council. It is this adopted review plan which is legally binding.

1.6 Legend

This review is structured as follows:

- Chapter 2 describes the development, content of the programme and economic impact of the development
- Chapter 3 explains how the development fits within the current policy framework
- Chapter 4 deals with the aspects of traffic, sustainability, erosion, water, ecology and archaeology
- Chapter 5 explains briefly how this review adjusts or complements the regulation of the Spatial Development Plan

The studies are included as annexes to this review.

Chapter 2 Project Description

2.1 Project content

Current situation

On the northeast side of the island of St. Eustatius lies the former plantation of Estate Guyeau. The site is located about three kilometres east of Oranjestad and the island's international airport. On the south side Estate Guyeau is bordered by a narrow access road. The coastline of the Compagnie Bay forms the northern boundary. The site covers an area of 179,000 m2 with a coastline of 318 metres. It is undeveloped in its current situation.

Figure 2.1: Current situation planning area (source: SECAR)

Figure 2.2: Intended development (source: Estate Guyeau)

The initiative proposes to develop the Estate Guyeau plan here. This means a high-quality resort with villas and hotel rooms. The first phase concerns the hotel, Petit Guyeau, where a separate procedure has been followed. Estate Guyeau is a high-quality development that radiates luxury. Development proposals show a demand for luxurious accommodations in this part of the Caribbean.

2.1.1 Explanation of development

This review concerns the second phase of the development of Estate Guyeau. A phase that provides villas, hotel rooms and support facilities. Furthermore, the terrain will be landscaped. The exact details are not yet known, so this review will form the development framework. However, in view of the landscape structure, it is clear that the buildings will focus mainly on the parts of the site that are more elevated above sea level; towards the coast the buildings are to be more extensive with an emphasis on landscaping.

Villas

In this phase, new villas are realised atop spacious plots ranging from 1,500 m2 to 5,000 m2 and are intended for both permanent residence and rental. The villas are mainly realised on the west side of Estate Guyeau, adjacent to Petit Guyeau.

The villas have a luxurious design and are executed in the Caribbean style. This means that natural materials and sloping roofs are utilised. In terms of construction possibilities, the current spatial development plan prevails. The villas have a maximum building height of 10 m, include up to 2 floors and have a footprint no larger than 500 m².

Hotel

Central to the area of the villas, a hotel complex is realised. As a departure from hotel Petit Guyeau, this complex consists of separate cabins. Each cabin has an area of approximately 65 m2. They are erected in one building floor and covered with a sloping roof. Just as the villas mentioned earlier in this report, these cabins are executed in the Caribbean style. Due to their limited height, the cabins do not obstruct the view of the villas situated on slightly higher ground.

The cabins are luxurious. In addition to a spacious bedroom, they also have their own pantry and separate bathroom. At the front there is a veranda overlooking the sea. As an option, the veranda can open up onto a small pool and a rock garden.

Figure 2.3: Artist impression cabin Petit Guyeau (source: Estate Guyeau)

Supporting facilities

A small-scale pavilion is located centrally within the area and is intended to house supporting functions. The structure can be used not only as a restaurant, but alternatively a convenience store or service centre (launderette) and possible hurricane shelter.

Layout terrain

The site is equipped with access roads and paths. Furthermore, its landscape is inspired by the current natural environment. As indicated earlier, the development of the west side and to the east is becoming more extensive, and the emphasis is on the park-like layout; as much use as possible is made of plants that are already present in and around the area. Approaching the coast, the extensive buildings are erected around a park. With its natural design, the park makes use as much as possible of indigenous plants. This is to reduce the risk of invasive flora and fauna.

Furthermore, water buffers and anti-erosion measures are provided throughout the area. This prevents both the loss of useful rainwater and earth flowing into the sea. These various facilities are integrated into the landscape design.

2.2 Economic factors

The future growth of the island is laid out in the Strategic Development Plan (SDP). The word 'growth' refers to both economic growth (population, tourism, activity) and growth in relation to protecting and maintaining the natural beauty of the island. Ultimately, it is this beauty that also provides a source of income (tourism) to the island.

The tourism sector of the island is expected to grow. At the time the SDP was written up, it was clear that there was a shortage of hotel rooms; the assumption was that the number of hotel rooms would grow from 75 in 2012 to 300 hotel rooms in 2030.

The development of Estate Guyeau will ensure employment not only in the development phase, but also when the site is put into use. As such, it will make an important contribution to the desired economic development of the island. In total, Estate Guyeau will provide employment for approximately 300 employees during and after construction.

Chapter 3 Policy framework

3.1 Strategic Development Plan

3.1.1 Framework assessment

The Spatial Development Plan (in Dutch, Ruimtelijk Ontwikkelingsplan or ROP) is based on the pre-existing situation and the Strategic Development Plan (SDP). The SDP contains the vision on the desired spatial development of St. Eustatius and is leading in the assessments for new spatial initiatives.
In the SDP, St. Eustatius focuses on achieving a higher level of prosperity and liveability, through economic and demographic growth, facilities maintenance and the development of the spatial qualities of St. Eustatius. Cultural identity and a sense of security in a family environment are important building blocks in achieving a higher level of prosperity and quality of life.

3.1.2 Analysis

Increasing the quality of life is at the forefront of the policy within the SDP. One of the ways to improve prosperity for both the island and its inhabitants is economic growth. Economic growth can be stimulated by strengthening the tourism sector.

From an economic standpoint, the most important pillars are the oil terminal and tourism. However, regarding tourism, St. Eustatius can play a much larger role. St. Eustatius has a unique history, a beautiful city, lush landscapes, breathtaking diving possibilities, unique flora and fauna and a strong position between the other Caribbean islands. To attract more tourism, there is a demand for an increased capacity in residences. There is no large hotel situated on the island at this time. Currently, St. Eustatius has five small hotels and a few holiday villas. At least 250 to 300 hotel rooms must be realised in order to put St. Eustatius squarely on the tourist map. With an increase in tourism comes the increased demand for other facilities, such as catering and shops. These create more employment on the island. Here, active marketing of the island as a tourist attraction is an important condition.

According to the SDP, to put St. Eustatius on the map as a tourist destination, a series of developments is needed:

- Expand the hotel capacity to at least 300 rooms;
- Develop Lower Town to increase tourist capacity, including opportunities for the mooring of yachts;
- Develop activities and facilities;
- Redevelop public buildings and other places in the historic centre;
- Stimulate an increase in retirees and build more second homes;
- Improve infrastructure; and
- Improve accessibility by plane.

The unique nature of the island is one of the most important qualities of St. Eustatius. The development of cultivated areas has always taken place in the west of the island, whereas the eastern part of the island offers plentiful nature and an open appearance. The design for Estate Guyeau takes this into account by using sightlines as the starting point for the design.
Around the island lies the protected National Marine Park. This legal protection ensures the preservation of this coral reef.

3.1.3 Conclusion

The trend in development anticipates the need for increasing the accommodation capacity for tourists. This contributes to the objective of making St. Eustatius a more attractive tourist destination. Therefore, development of Petit Guyeau fits within the policy framework of the SDP.

3.2 Spatial Development Plan

The Spatial Development Plan (ROP) provides the spatial framework for both the current situation and new developments.

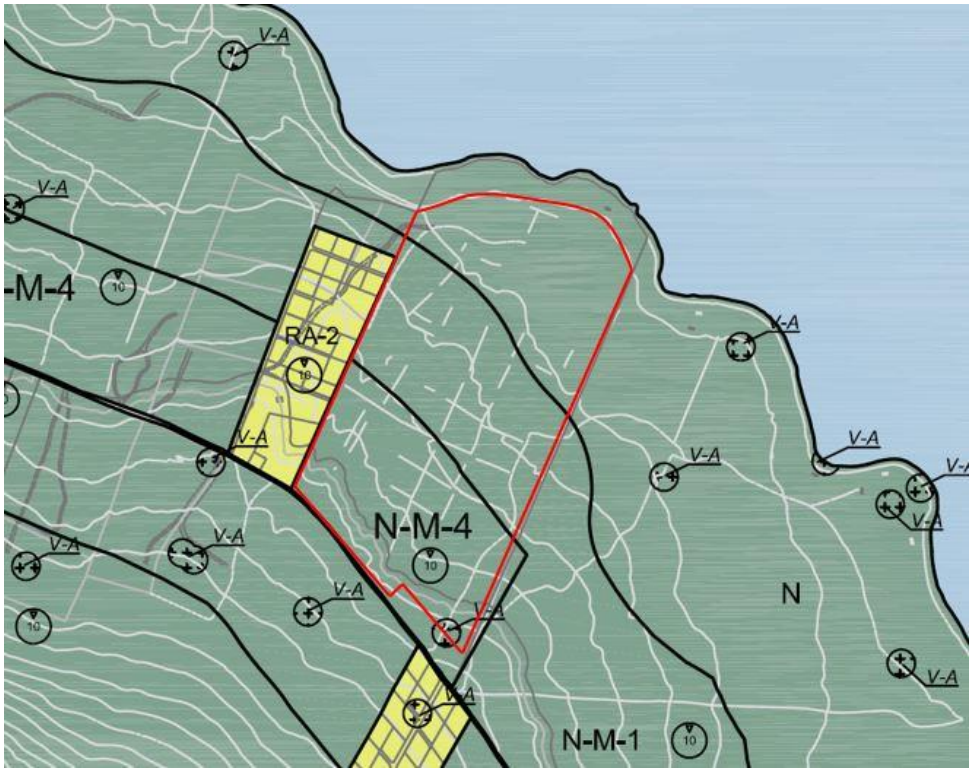

Figure 3.1: Adopted Spatial Development Plan

Based on the ROP, this location has been assigned as 'Nature – Mixed 4', 'Nature – Mixed 1' and 'Nature'. The area is intended for: conservation; restoration; development; and the management of the scenic, natural and ecological advantages. For agricultural activities and dwellings alike.

Homes are permitted within these destinations. A house may have a maximum height of 10 metres, include up to 2 floors (with or without a roof) and may not have a larger surface area than 500 m². For the purpose of Nature – mixed 4, a property must be realised on a plot of at least 3,000 m2. For the purpose of Nature – mixed 1, a house is realised on a plot of at least 16 acres. The permissible building density in the destination Nature – mixed 1 is therefore lower. In both destinations, the houses may not be used for rental as a holiday home. Therefore the ROP must be revised.

These destinations can be changed to other destinations via change permissions. For example, the destination can be changed to enable initiatives with regard to hotels, resorts, recreational apartment complexes, guest houses, bed & breakfasts, residential accommodations and the commercial accommodations that belong to the accommodation facilities. In view of the conditions imposed in this amendment authority, namely that the building density shall not exceed 1 building (not being a separate building in a dwelling or a recreation facility) per 3,000 m², the development cannot be made possible by means of this amendment authority.

3.3 Nature Policy Plan

Nature Policy Plan, Caribbean Netherlands (2013-2017)
The Nature Policy Plan 2013-1017 provides a policy framework for the sound management and sustainable use of nature in the Caribbean Netherlands. Its aim is to ensure that the nature of the Caribbean Islands can be utilised in a sustainable way so that the ecological systems and ecosystem services are maintained. For the management of nature on St. Eustatius, St. Eustatius National Parks (STENAPA) has been appointed. This management organisation is responsible for the preparation and implementation of management plans.

On St. Eustatius, The Quill, Boven National Park and the St. Eustatius National Marine Park are designated as nationally protected areas.

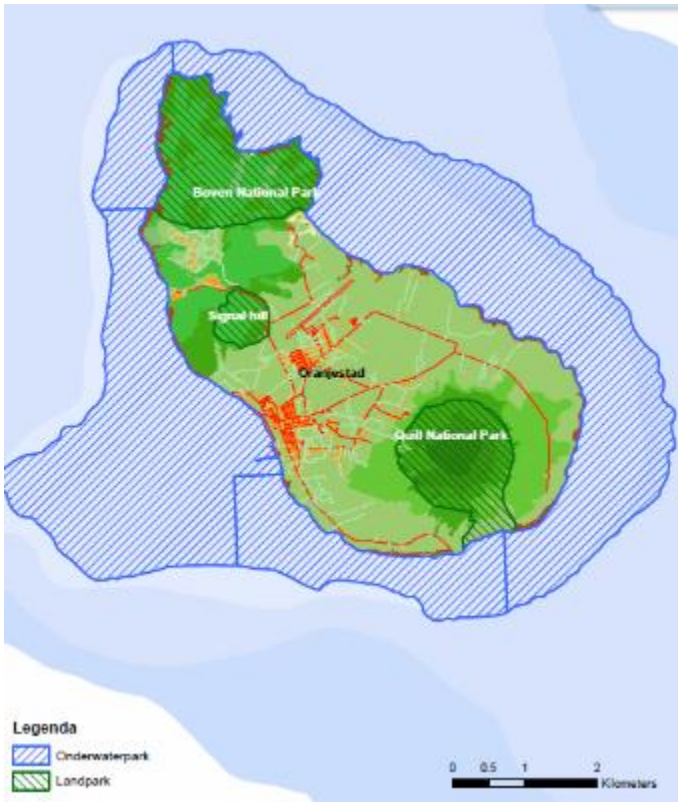

Figure 3.2: Protected areas Sint Eustatius

The planning area is not located within a protected area. Therefore, the Nature Policy Plan does not form an obstacle to the development of Estate Guyeau. However, the planning area is near the underwater park and a land park. Attention is paid to this revision.

Chapter 4 Environmental aspects

4.1 Traffic

The grounds of Estate Guyeau lie on the road to the Botanical Garden. This road connects to the Lodi Weg from Oranjestad and to the Mansionweg from Bay Brow. The area is therefore well connected to the main facility centres and tourist attractions. In the context of this development, the developer will make some improvements to the road so that Estate Guyeau is easily accessible.

The amount of mixed traffic that this plan entails remains difficult to estimate at this moment. One aspect adding to the difficulty has to do with the various transport methods (scooter, car, shuttle bus, etc.) that will be used, while it is yet unclear how the distribution between these methods will take place. However, due to the limited scale of development, the amount of traffic will be low. The current road network is sufficient for this.

An internal traffic access road is provided within the plan area. Throughout the estate, sufficient parking is also realised. In addition, each villa has parking on its own grounds. A central parking solution is provided for the hotel.

4.2 Sustainability

Sustainability sits high on the agenda of St. Eustatius. The Solar Park was opened in November 2017, providing 46% of St. Eustatius' energy needs. Furthermore, the development of the waste recycling and incineration plants contribute to the sustainability of the island. Estate Guyeau also wants to contribute to this.

The first contribution is the facilitation of electric cars. Electric cars provide an efficient and environmentally friendly mode of transport, also given the short distances that are travelled on the island. In this way any nuisance caused by traffic will be limited in part. Electric cars are noiseless and have no polluting exhaust emissions.
Moreover, the dwelling roofs are covered with solar panels in the form of roof tiles. In an environmentally appropriate way, energy is being generated on site.

Sustainable water management is also a starting point for development. Water flowing from the Quill is collected and made suitable for drinking. The wastewater is purified in a private septic tank to grey water, which is used for watering plants. Collecting systems are also installed in the roads so that the maximum amount of water can be collected.

The area is landscaped. Height differences are applied in this context. Regional material that is displaced during development is reused throughout the area.

4.3 Erosion and water

St. Eustatius is located in a hurricane area, which means that the island is subject to heavy and short-term rainfall. Compared to the current situation, the objective is to not increase the amount of water flowing from the site. To this end, area-wide technical measures have been taken into consideration.

In the project area, a water purification plant, among other things, is provided. Rainwater is collected in these tanks and purified into drinking water. This allows part of the rainwater to be collected. In addition, much green is provided in the area where the water can be absorbed into the soil.

During and after construction, measures will be taken to prevent erosion. For example, gabions are buried and the land is terraced, which helps to avoid the creation of large drainage surfaces. This prevents water run-off in heavy rain showers. Moreover, any foreign materials are prevented from entering the Marine Park. See also the paragraph below. In the context of the intended development, advice will be requested from STENAPA.

The previous section describes how sustainable water management is a starting point for development.

4.4 Ecology

The plan area lies between two national parks. To the west of the area, lies Quill Park. The distance to this park is relatively large. Moreover, of course, this park is limited by the difference in height. The development of Estate Guyeau has no negative effects on this park.

To the east of the plan area is the Statia National Marine Park. Estate Guyeau is adjacent to this. This means that the value of this park must be taken into account. As described in section 4.3, measures are taken in the project to combat erosion. Sand, dust and stones that flow into the sea can affect the existing reefs and corals. This kind of erosion is prevented with these measures. Furthermore, the plan is set up in such a way that the density of development towards the coast decreases; a more natural layout of the area is created. In this way any influence on the other park is prevented.

The plan area itself does not form part of a protected nature preserve. However, it is undeveloped in its existing situation. The current vegetation consists of a mix of indigenous and exotic species. Indigenous species, such as iguanas, may be present in the area. To take these values into careful account, an ecological field study has been carried out (BioCarib Research Consultancy, April 2018).

The field study shows that a certain habitat loss for species currently present in the plan area is unavoidable during development. The plan area has had an agricultural use for years; currently it is used for grazing. This is also evident from the limited biodiversity in the area, of which the vegetation consists mainly of bushes.

Nevertheless, there is value in the area along the coast. A number of Red-billed Tropicbirds were observed here (with possible nesting sites on the cliff side). Furthermore, birds and butterflies were found in sub-area 2; native iguanas were already observed in sub-area 3. In view of the current and historical use, the entire area can be regarded as disturbed, which makes it unlikely that it would be suitable for a large population of iguanas or other vulnerable flora or fauna. Loss of habitat for most species currently living in the area can be eased through mitigating measures as described in the field study (with the exception of Red-billed Tropicbirds if the coastline is to be developed). For some species (e.g. Iguana Delicatissima), the attractiveness of the area can even be improved by careful planning and application of specific vegetation.

The advice is to preserve as much vegetation as possible and to introduce native vegetation into the plan. Not only to minimise habitat loss, but also to limit any effects such as erosion.
By taking anti-erosion measures, soil outflow to the sea can be prevented.

4.5 Archaeology

The objective of the Malta Convention is to preserve and protect archaeological values. As a result of this treaty, the preservation of archaeological heritage is taken into account in the context of spatial planning, as with all other interests that play a role in the preparation of the plan. It is known that the cultural heritage of St. Eustatius is one of the richest in the Caribbean (for all periods).

In 2018 SECAR (St. Eustatius Center for Archaeological Research), carried out an archaeological research project for the development of this site. This research reveals the following:

Most of the research area contains little or no archaeological remains, except for all the stone walls. The report recommends keeping these walls on site as they can contribute to the historic character of Estate Guyeau. Moreover, these walls were used to avert water and prevent erosion. The removal of these walls could therefore lead to accelerated erosion of the landscape. Nonetheless, should these walls be removed, it is not necessary to document them. In the development of Estate Guyeau, efforts will be made to preserve and integrate the historic stone walls, unless, after consultation with the Heritage Foundation, this proves impossible.

Archaeological sites are also present in the plan area (see illustration on the next page). Most of these are clustered in a small area near the road. These archaeological remains include a relatively small sugar plantation. This sugar plantation includes an industrial complex, cattle mill, cattle farm, main house, cemetery, undesignated locations and the newly discovered cistern. There are two recommendations for the archaeological remains that are part of this sugar plantation. First, all the sites can be included in the plans and (partially) restored or maintained on site. Second, if inclusion and (partial) restoration is not possible and one (or more) locations have to be destroyed, further research will be carried out in the form of archaeological excavations to maintain the location off site.

Aerial map of Guyeau with the observed archaeological sites

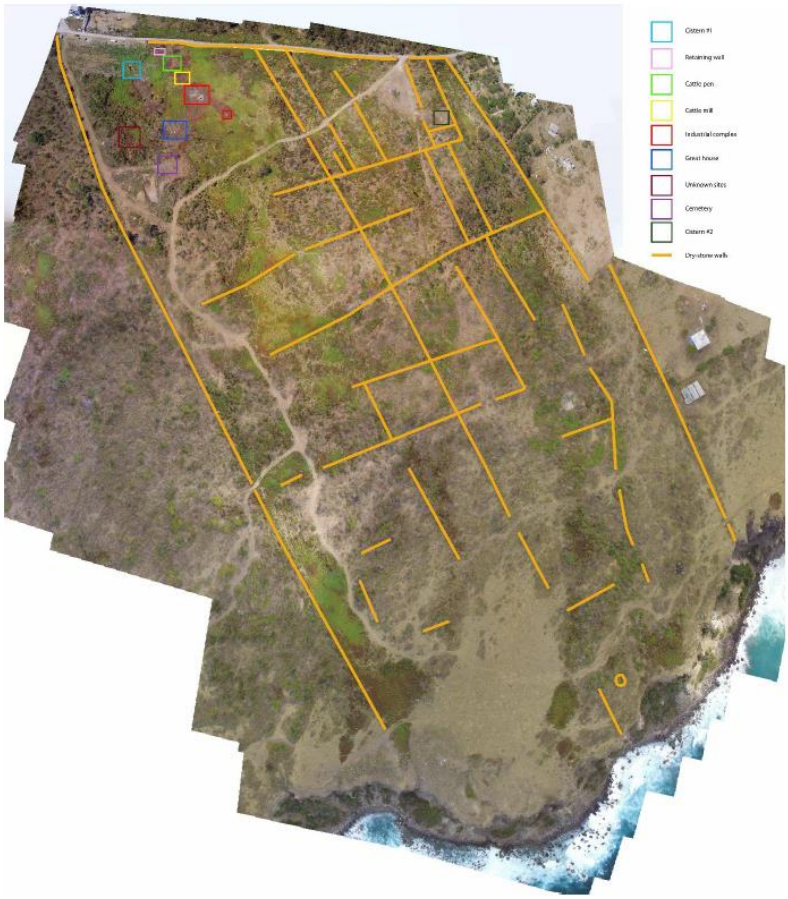

Figure 4.1: Aerial map of Guyeau with the observed archaeological sites (source: SECAR)

Figure 4.2: Aerial map of Guyeau with the observed archaeological sites (source: SECAR)

Chapter 5 Explanation to the regulations

The review adjusts the following components of the Spatial Development Plan:

Zoning map

The project area included in this review is equipped with two new zoning areas, namely:

- Recreation - Guyeau; and
- Nature - Guyeau.

Regulations

In the Spatial Development Plan, two new articles are added:

- Recreation – Guyeau; and
- Nature- Guyeau.

Recreation - Guyeau

Within the article Recreation - Guyeau, the realisation of the villas and of the hotel is made possible. Moreover, the use of the villas is extended. The construction of a villa on a plot of 1,500 m2 is made possible in comparison with the current arrangement in the Nature – Mixed 4 location.

A mooring permit scheme has been included in the location designation. This prevents the loss of landscape, as well as natural and ecological values and qualities. Moreover, this scheme ensures that the required anti-erosion measures are taken.

Nature - Guyeau

The intended park gets the location designation Nature - Guyeau. In fact, the current destination has been taken over. However, the possibility of building has been blocked. Actually, this is to compensate for the densification in the location designation Recreation. This will ensure that the park receives the desired scenic appearance and that the site will not be built up too intensively, especially near the Marine Park.

Appendices to the explanation

- An Archaeological Exploratory Field Investigation of Guyeau, St. Eustatius, Caribbean Netherlands (St. Eustatius Center for Archaeological Research, rapport number 2018-01);
- Rapid Terrestrial Ecological Assessment Guyeau (BioCarib Research Consultancy, April, 2018)

An Archaeological Exploratory Field Investigation of Guyeau, St. Eustatius, Caribbean Netherlands

SECAR *Excavating the Caribbean's "Historical Gem"*

The St. Eustatius Center for Archaeological Research

Fred van Keulen MA

An Archaeological Exploratory Field Investigation of Guyeau, St. Eustatius, Caribbean Netherlands

SECAR archaeological report number 2018-01

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Acknowledgements

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1. Introduction

In January 2018, the St. Eustatius Center for Archaeological Research was asked to conduct an archaeological exploratory field investigation of the entire Guyeau property. The plan is to construct, besides the hotel as described in SECAR report no. 2017-04, several luxurious bungalow villas.

To restate the Monuments Law BES article 1: monuments can be movable and immovable property, which are at least 50 years old and that are perceived of general interest because of their beauty, artistic value, their meaning for science, the history of the country or the value for their people, including archaeological heritage. The definition of archaeological heritage is in this case: buildings, objects or remains that, independently or jointly, and whether or not in the context of the location, indicate human activities that took place in the past, that are older than fifty years (wetten.overheid.nl).

The first step in the archaeological process, the desk-based assessment of the planned area of construction, can be found in SECAR report no. 2017-04 and will not be included in this report again. This report contains the archaeological exploratory field investigations of the remaining property. Exploratory field investigations. performed by an aerial survey and a survey on foot, are conducted to determine the locations of the archaeological heritage in the designated area. In the end, a map with all the encountered archaeological sites of the complete property will be included.

1.1 The reason and objective of this research

The reason for this research is that development is going to take place in the area. The plot of land that is discussed in this research is called Guyeau. Robert Proper plans to construct several luxurious bungalow villas on this plot of land (Fig. 1).

Figure 1: The planned development for the Guyeau property. The area that will be discussed in this report is outlined in red Source: Robert Proper.

The objective of this research is to locate the archaeological remains on the piece of land by using the desk-based assessment of the previous report and by performing a fieldwalking and aerial survey. The

outcome of this research will provide us with an archaeological map that depicts all the sites that have been encountered on the property. Additional drawings will be included of all the individual sites.

1.2 The research area

The planned area for development is a piece of land on the eastern side of St. Eustatius, across the street from Knippenga Estate (Fig. 2). The planned area for construction that is discussed in this report is approximately 700 meters long and 325 meters wide (Fig. 2). This is the complete terrestrial area of the property that is up for development.

Figure 2: The piece of property that is up for the development. The hotel is in the bottom right corner on the northern side of the street. Source: Robert Proper.

2. Exploratory Field Investigation

2.1 Introduction

When the property was inspected for a second time in February, we investigated a different and much larger area than the smaller plot of land discussed in SECAR report no 2017-04. As mentioned in the previous report, the archaeological expectation is "that at least one plantation can be found on the Guyeau property. Furthermore, the map that dates to 1781 shows a slave village on the piece of land that is owned by John Cuvilliers. The archaeological expectation for this property is high in specific places, but most of the property seems to be used as meadow for cattle or for the cultivation of sugar cane" (van Keulen 2017, 14). The slave quarters were not located because there were no remains visible on the surface.

Additional information that has been used to locate archaeological remains on the property came from Dr. Jay B. Haviser's field notes that date to the year 1981 (Haviser 1981). A few sketches have been included in his notes, as can be seen below (Fig. 3 and 4).

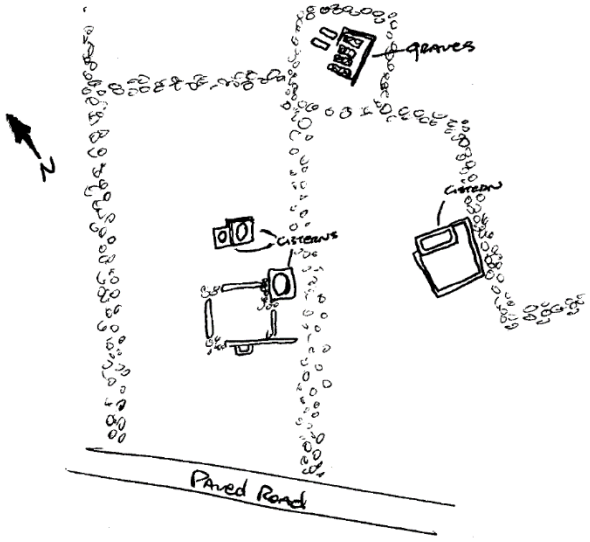


Figure 3: Overview sketch of the rediscovered sites according to Haviser (Source: Haviser 1981, 23).

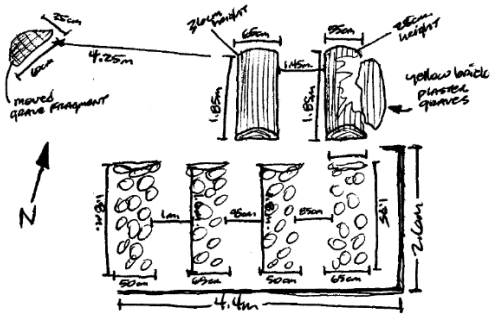


Figure 4: Sketch of the cemetery according to Haviser (Source: Haviser 1981, 20).

Select areas on the property were cleared by Paradise Landscaping (Fig. 5). They used chainsaws, machetes and weedwhackers to remove the vegetation in the area. An archaeologist from SECAR was present three times a day to give instructions, check the progress and to ensure that no archaeological remains were destroyed. During the clearing of the area, more archaeological remains have been observed. A boiling house, molasses vat, cane juice clarifier basin, great house, cemetery,

cistern and several dry-stone walls have been found. Furthermore, a presumable rum distillery, cattle mill and cattle pen have also been encountered.

Figure 5: Part of the cleared area, seen from the stone pile wall near the road (Photo: SECAR Staff).

After the area was cleared, aerial photographs were taken with a DJI Phantom 3 drone that carries a 12-megapixel camera. Combined aerial photographs were used to generate an overview map of the area. Photographs on the surface were taken with a Nikon D5300 digital camera to provide a full visual record of the site.

Additional data from the cistern is collected by using the form described in van Keulen (2018) (see appendix 3). The form includes the geographical location, the overall measurements, the description of its materials and its function. The scale of 0.5 meters and the north arrow were included in all the photographs of the encountered sites.

Surface material was collected by location. The locations that were used are: industrial complex, great house, cistern #2, dry-stone wall between great house and cemetery, cane juice clarifier basin fill and near the retaining wall that is next to the supposed cattle pen. Artifacts are conserved and stored at the SECAR storage facility.

2.2 Results

The aerial and fieldwalking survey resulted in an archaeological map (see appendix 1) that depict multiple dry-stone walls and a relatively small sugar plantation. These walls can be found all over the island and were used to mark borders (also within the property) and to redirect water. In the SECAR report no. 2017-04, the P.F. Martin map from the year 1781 shows the sugar plantation near the road. This location coincides with the findings of this report.

The sugar plantation consists of an industrial complex, a great house, a cemetery, two cisterns and unknown sites. The industrial complex is subdivided into a cattle pen, a cattle mill, a boiling house, a clarifier basin, a molasses vat and a presumable rum distillery. Cattle such as oxen or donkeys were used to drive the mill that crushed the cane to retrieve the juice (Fig. 6). This juice would then flow to the clarifier basin from which it was then ladled into a series of large metal basins called 'coppers' (although usually made of iron). These coppers were heated above a furnace. The coppers are located in multiple furnace basins in the boiling house. Ashes and lime would then be added to the coppers to get the impurities out of the cane juice. These impurities would then be scooped of by perhaps the most important slave of the plantation. After boiling, the obtained sugar syrup would then be transferred to the curing house in which it would be poured into conical clay moulds with nipples at the base. These clay moulds would then be placed on top of pots so that the syrup can drip down into it. Water was poured into the top of the mould for at least a month leaving behind muscovado sugar and molasses (in the pots) (Fig. 7). The molasses too could then be shipped off or distilled into rum. The molasses was usually contained in a molasses vat at the plantation.

Figure 6: Drawing by Jan Veltkamp depicting slaves working on a Statian sugar plantation around 1750. Source: National Maritime Museum, Amsterdam. The rum distillery is indicated with an 'A', the cattle mill with a 'B', the boiling house with a 'C' and the sugar cane with a 'D'.

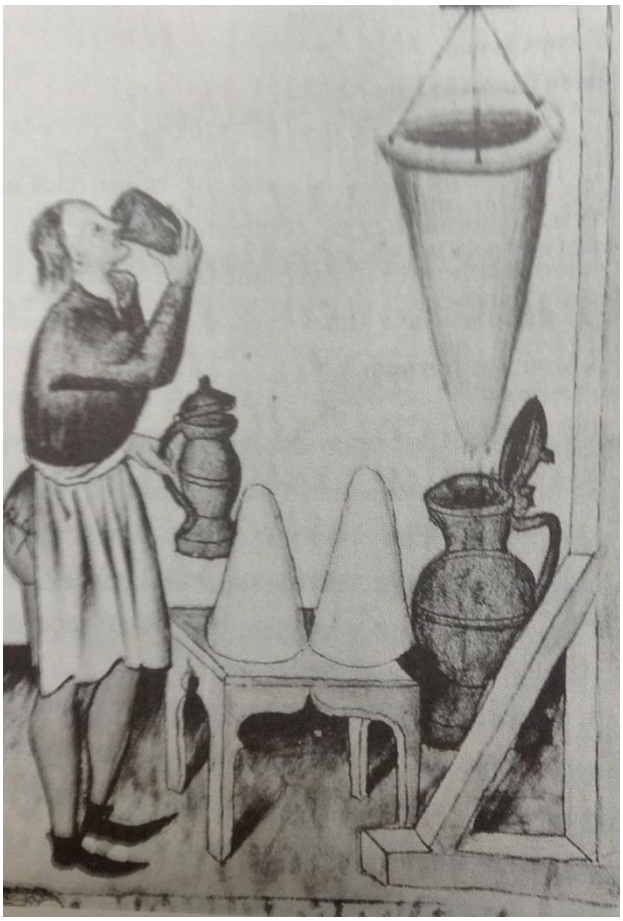


Figure 7: A sugar cone that is dripping molasses and a man drinking it. Source: pulcinellapasta.wordpress.com.

A great house would usually be located upwind from the sugar plantation to avoid its smell, but still within its visibility to keep an eye on the slaves. Often plantation owners or relatives were buried on their own property.

The sugar plantation and all the dry-stone walls are indicted on the archaeological map in appendix 1. The dry-stone walls are indicated by orange lines. The archaeological sites are all depicted with colored boxes. Cistern #1 is light blue, the retaining wall is pink, the cattle pen is green, the cattle mill is yellow, the industrial complex is red, the great house is blue, the unknown sites is brown, the cemetery is purple and cistern #2 is dark green.

Aerial photographs and drawings of every individual site are enclosed in appendix 2. Ground photos were taken of every site to provide a complete visual record of all the sites (Fig. 8 – Fig. 31).

The industrial complex

The industrial complex consists of a molasses vat (Fig. 11), a cane juice clarifier basin (Fig. 13), boiling house(s) (Fig. 10; Fig. 14 – Fig. 17), a presumable rum distillery (Fig. 18), an unknown structure (Fig. 19), a cattle mill (Fig. 20 and 21) and a cattle pen (Fig. 22 and 23). A presumable rum distillery, because it could very well be a retaining wall that keeps the plateau, on which the cattle mill is, from eroding. A rum distillery, however, would explain the large molasses vat on the property (Fig. 11). Still, on other plantations on Statia, a boiling house would be the closest to the cattle mill. Further excavation is needed to determine its true purpose.

Figure 8: Overview of the industrial complex (Photo: SECAR Staff).

Figure 9: Overview of the industrial complex (Photo: SECAR Staff).


Figures 10 and 11: A structure that used to contain a kettle for boiling cane juice and behind it a molasses vat (Photos: SECAR Staff).

Figure 12: Possibly the corner that is missing from the structure that can be seen in figure 6. This corner can be found downhill from the molasses vat in the northwestern direction (Photo: SECAR Staff).

Figure 13: The cane juice clarifier basin that was used to collect the juice after crushing the sugar cane.

Figure 14 (clockwise starting in the top left corner): The boiling house seen from the NNE. Figure 15: The boiling house seen from the SSE. Figure 16: The inside of the furnace. Figure 17: Close-up of the arch of the furnace (Photos: SECAR Staff).

Figure 18: The presumable rum distillery (Photo: SECAR Staff).

Figure 19: Unknown structure northwest of the boiling house (Photo: SECAR Staff).

Figures 20 and 21: Plateau on which the cattle mill used to be (Photos: SECAR Staff).

Figures 22 and 23: Plateau that is surrounded by rocks, presumably a cattle pen (Photos: SECAR Staff).

Retaining wall

Figure 24: Retaining wall and plateau near the road (Photo: SECAR Staff).

The great house

The foundation of the great house (Fig. 25 and 26). There does not seem to be a wall on the southwestern side of the house.

Figure 25: Foundation of the great house (Photo: SECAR Staff).

Figure 26: Foundation of the possible great house (Photo: SECAR Staff).

Unknown sites

These sites can be found to the southeast of the great house (Fig. 27 and 28). A bee's nest was found near these sites, which made it very difficult to clear the area of vegetation.

Figures 27 and 28: Unknown sites (Photo: SECAR Staff).

The cemetery

After rediscovering the cemetery, it was found to be destroyed. The tombstones are no longer there; only yellow bricks can be observed on the surface (Fig. 29 and. 30). The cemetery was probably destroyed when the adjacent area was mechanically cleared prior to the start of this research. Sand has been excavated in this cleared area.

Figure 29: The destroyed cemetery; yellow bricks are scattered around. The great house and a dry-stone wall can be seen in the background (Photo: SECAR Staff).

Figure 30: The cemetery; the top right corner shows the place where sand has been excavated (Photo: SECAR Staff).

The cistern (#2)

Another cistern was found on the property (Fig. 31 – Fig. 35). The first cistern that was found is discussed in the previous report. This cistern is in a much better state with the arch still intact and there is very little rubble inside the basin.

Figure 31: The cistern seen from the west (Photo: SECAR Staff).

Figure 32 (clockwise starting in the top left corner): The cistern seen from the northeast. Figure 33: The cistern seen from the southeast. Figure 34: The cistern seen from the southwest. Figure 35: The cistern seen from the northwest (Photos: SECAR Staff).

The cistern conforms to the typology made by van Keulen (2018) and can be defined as a type 3, subtype d, cistern (Fig. 36). The form that contains all the measurements and descriptions can be found in appendix 3.

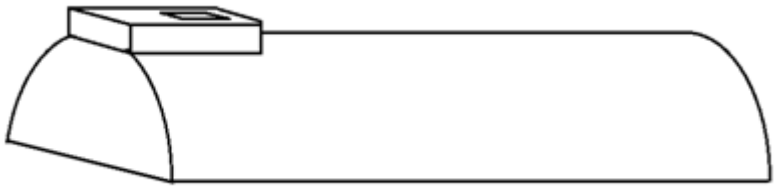


Figure 36: Schematic sketch of the type 3, subtype d, cistern (Source: van Keulen 2018, 55).

A type 3 cistern is a cistern that is 'mostly underground'. This means that the basin is dug into the ground and that part of the cistern (usually the arch) is visible above ground. Type 3, subtype d, is a cistern with an extended elevated opening to the front of the cistern that is usually made of basalt stones. The basin of the cistern, which is rectangular with semicircular round ends, is made of basalt stones that have been plastered for the containment of water. The basin could probably hold up to approximately 15,900 liters of water.

The cistern is one of thirteen cisterns on St. Eustatius that are constructed in this manner. However, the cistern solely consists of hewed basalt stones. A similar cistern can be found behind the Methodist Church in Oranjestad that dates to the year 1883 (van Keulen 2018, 11). This could mean that the cistern was built in a later time-period than the plantation that is already depicted on the map of 1741.

The water catchment was probably on the northern side of the cistern; however, this is not visible anymore. On the other side of the cistern, a water inlet hole is placed high on the arch. This could mean that a building was close that redirected water from its roof into the cistern. After a thorough search, no remains of a building have been observed.

2.2.1 Surface material

Archaeological surface material has been collected and grouped by the locations where they were found. As mentioned before, the locations that were used are: The industrial complex, cane juice clarifier basin fill, the great house, cistern #2, the dry-stone wall between great house and the cemetery and near the retaining wall that is next to the supposed cattle pen.

The industrial complex

The artifacts found at the industrial complex consist of ceramics and glass. The types of ceramics found are polychrome hand painted tin enamel ware and clear salt glazed stoneware (brown, clear and white) (Fig. 37). The types of glass found probably belong to a green wine bottle and dark green case bottle (Fig. 38).


Figure 37 and 38: Archaeological surface material that has been collected at the industrial complex sites (Photo: SECAR Staff).

Cane juice clarifier basin

The artifacts that have been collected at the cane juice clarifier basin within the industrial complex consist of glass, ceramics and metal. This group has been separated due to the high number of artifacts and to provide a better context for the material. The types of glass that have been collected are from a square clear glass bottle and a dark green case bottle (Fig. 39). The type of ceramic collected is a piece of blue hand painted porcelain (Fig. 40). Furthermore, metal artifacts were encountered such as hinge and other metalwork (Fig. 41).



Figure 39, 40 and 41: Archaeological surface material that has been collected from the cane juice clarifier basin (Photo: SECAR Staff).

The great house

The artifacts found at the industrial complex site consist of ceramics and metal. The types of ceramics found at the great house are hand painted porcelain, lead glazed coarse earthenware, shell imprinted

pearlware, slipware, brown salt glazed stoneware and clear glazed coarse earthenware (Fig. 42). In the metal category, hoe fragments have been collected at the great house (Fig. 43).


Figure 42 and 43: Archaeological surface material that has been collected at the great house structure (Photo: SECAR Staff).

Cistern #2

The artifacts that have been found at cistern #2 consist of glass and ceramics. The types of glass that have been collected are part of a dark green wine bottle and a clear bottle or container (Fig. 44). The types of ceramics collected are blue transfer printed pearlware, red bodied tin enamel ware, black transfer printed creamware and a whiteware handle (Fig. 44).

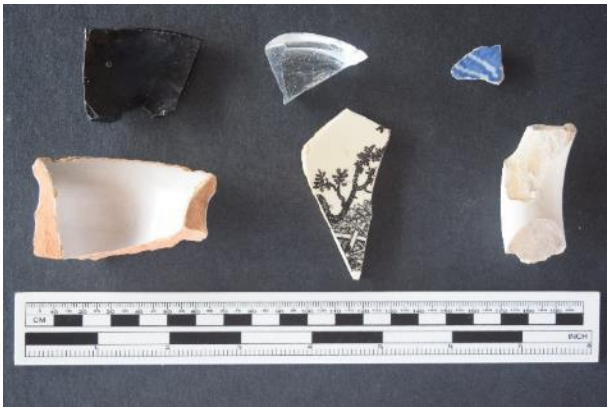


Figure 44: Archaeological surface material that has been collected at cistern #2 (Photo: SECAR Staff).

The dry-stone wall

The artifacts found at the dry-stone wall in between the great house and the cemetery consist of glass and ceramics. The types of glass collected are free blown wine bottles finishes and bases. Also, a dip molded bottle can be seen in the bottom left corner of the top left picture (Fig. 45). The types of ceramics found are polychrome/blue hand painted tin enamel ware (Fig. 46), creamware, Afro-Caribbean ware and brown/clear salt glazed stoneware (Fig. 47).

Figure 45, 45 and 47: Archaeological surface material collected at the dry-stone wall (Photo: SECAR Staff).

Retaining wall

The only artifact found at the retaining wall near the supposed cattle pen was a piece of blue hand painted tin enamel ware (Fig. 48).

Figure 48: Archaeological surface material collected at the retaining wall (Photo: SECAR Staff).

Most of the artifacts that have a small time frame date to the 18th century and beginning of the early 19th century, which coincides with the previous desk-based assessment of the entire property (van Keulen 2017). The table below shows the type ceramics, the number of datable pieces and the time span in which the types of ceramics were produced (Tab. 1). The mean date of the collected ceramics for Guyeau is 1728. The number is lower due to the large time periods in which ceramics were produced.

Table 1: Table of the datable ceramics.

Ceramics type	Ceramics subtype	Number	Date*
Stoneware	Brown salt glazed	3	1650-1775
	White salt glazed	2	1685-1785
	Clear salt glazed	4	1630-1775
Coarse earthenware		1	1490-1900
	Yellow lead glazed	1	1490-1900
Tin enamel ware	Plain	1	1640-1800
	Blue hand painted	9	1630-1790
	Polychrome hand painted	3	1571-1790
Pearlware	Blue shell edged	1	1785-1840
	Blue transfer printed	1	1784-1840
Creamware	Feather edged	1	1765-1810
	Black transfer printed	1	1770-1815
Whiteware	Plain	1	1830-present
Porcelain	Blue hand painted	2	1660-1810
Total		31	

*These date ranges can be found on: www.floridamuseum.ufl.edu.

Most of the material that was found served a domestic use, such as plates, bowls jars and bottles (Tab. 2). Except for the small pieces of porcelain, most of the material do not point to an extremely wealthy plantation. However, one must keep in mind that these collected pieces only represent a small part of the material culture. Therefore, definite conclusions cannot be made.

Table 2: Artifact forms, numbers and their percentage.

Form	Number	Percentage
Bowl	5	10.6%
Plate	13	27.7%
Cup	1	2.1%
Jar	3	6.4%
Tumbler	1	2.1%
Bottle	11	23.4%
Handle	1	2.1%
Hoe	1	2.1%
Hinge	1	2.1%
Unknown	10	21.3%
Total	47	100%

2.3 Recommendations

The largest part of the research area contains little to no archaeological remains, except for all the dry-stone walls. Multiple dry-stone walls are scattered around the property as can be seen on the map in appendix 1. The recommendation for the dry-stone walls is that most of them are best left *in situ*. By doing so these walls can contribute to the historical character of the property. Furthermore, more importantly, many of these walls were used to redirect water to slow down erosion (Gilmore 2004, 68). By removing all these walls, it might lead to an accelerated erosion of the landscape. Nevertheless, when these walls are to be disturbed, no further archaeological information needs to be recovered.

Most of the archaeological sites are clustered in a small area near the road. These archaeological remains comprise a relatively small sugar plantation. This sugar plantation includes: the industrial complex, the cattle mill, the cattle pen, the great house, the cemetery, the unknown sites and the newly discovered cistern. There are two recommendations for the archaeological remains that are part of this sugar plantation. Firstly, all the sites could be incorporated into the plans and (partially) restored or left *in situ* as to amplify the historic character of the property. Secondly, if this is not possible and one (or several) sites are to be destroyed, further research in the form of archaeological excavations is recommended to preserve the site *ex situ.*

Websites

https://pulcinellapasta.wordpress.com/2013/05/09/sugar-and-ingegno/, accessed on 28 March 2018.

http://wetten.overheid.nl/BWBR0028429/2010-10-10, accessed on 19 March 2018.

https://www.floridamuseum.ufl.edu/histarch/gallery_types/type_list.asp, accessed on 28 March 2018.

Bibliography

Gilmore, R.G., 2004. *The archaeology of New World slave societies: a comparative analysis with particular reference to St. Eustatius, Netherlands Antilles*. Ph.D. thesis, Institute of Archaeology, University College London.

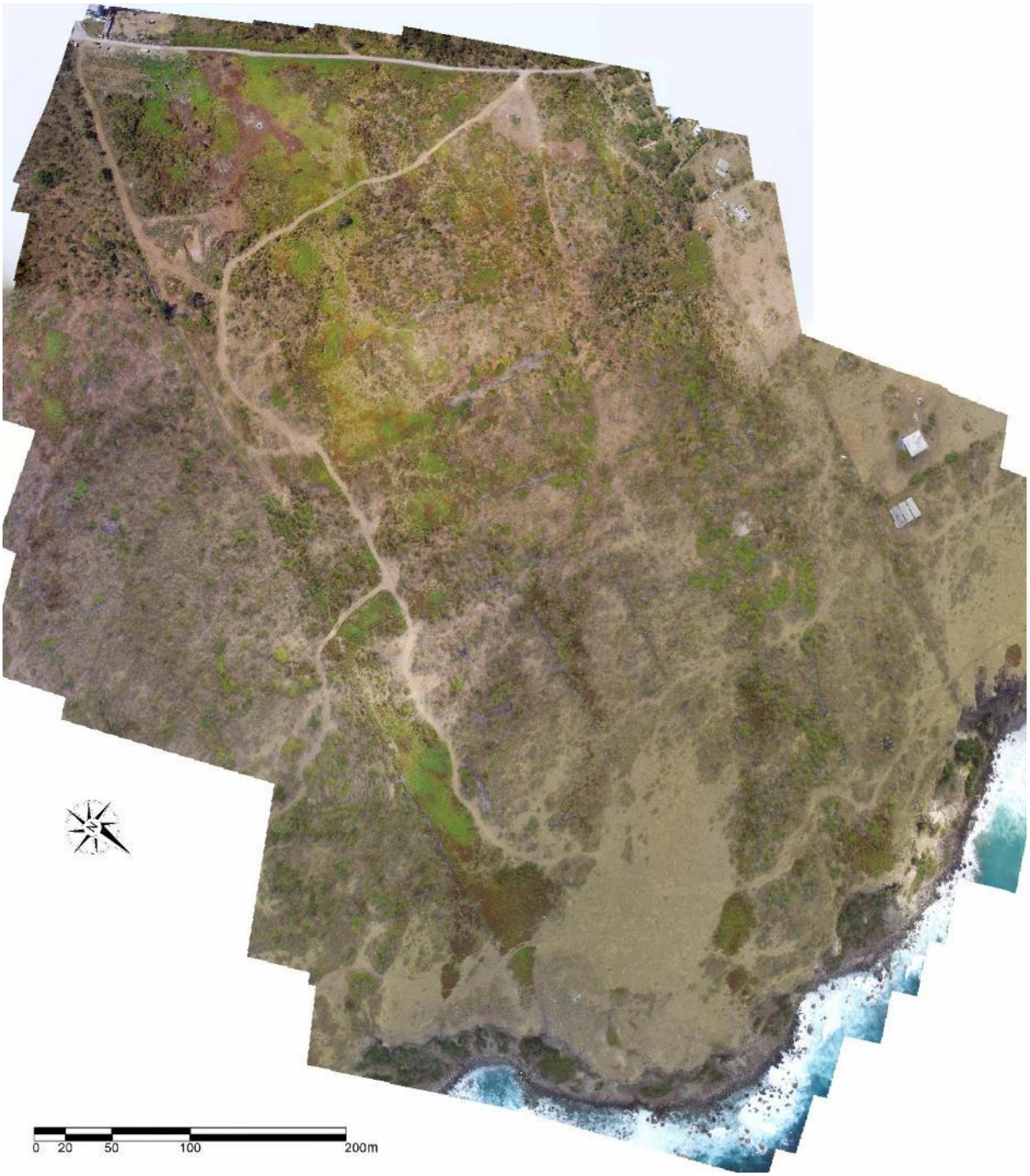
Haviser, J.B., 1981. *Land Survey St. Eustatius: Book 2*. Unpublished field notes on digital file at SECAR, St. Eustatius.

van Keulen, F.J.T., 2017. *An Archaeological Desk-based Assessment and Field Investigation of Guyeau, St. Eustatius, Caribbean Netherlands*. SECAR archaeological report number 2017-04, St. Eustatius.

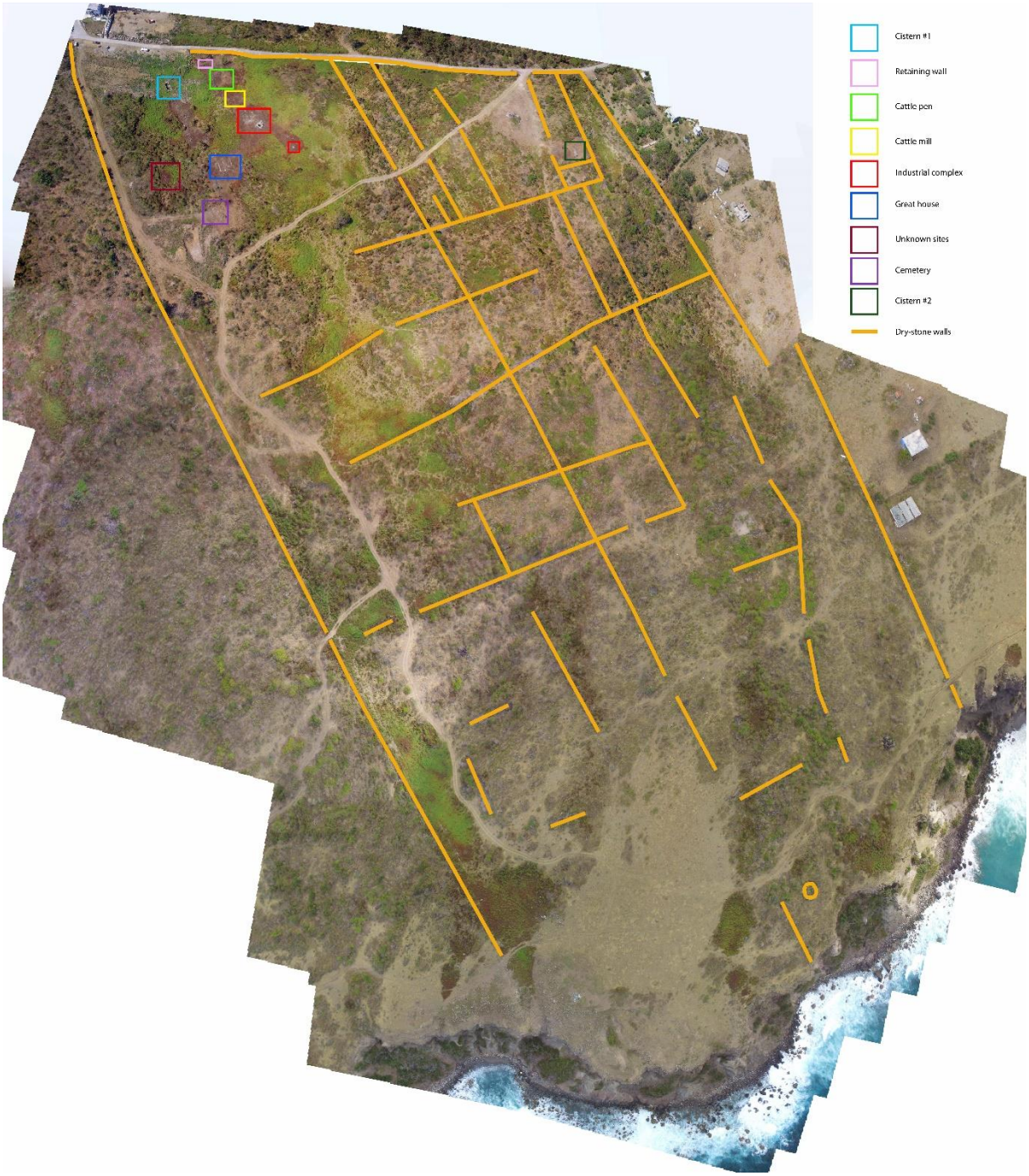
van Keulen, F.J.T., 2018. *The Island without Water: The cisterns of St. Eustatius in the colonial era*. Leiden (unpublished MA thesis University of Leiden).

Appendix 1: Archaeological Map Guyeau

Aerial map of Guyeau



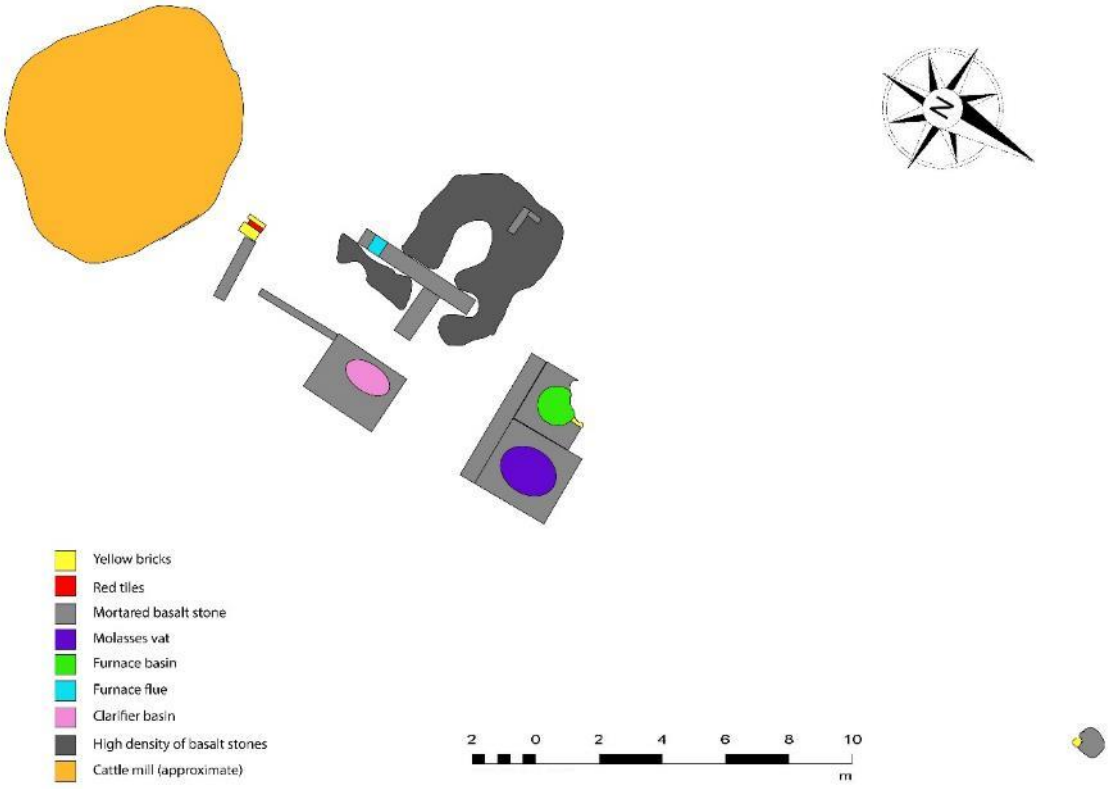
Aerial map of Guyeau with the observed archaeological sites



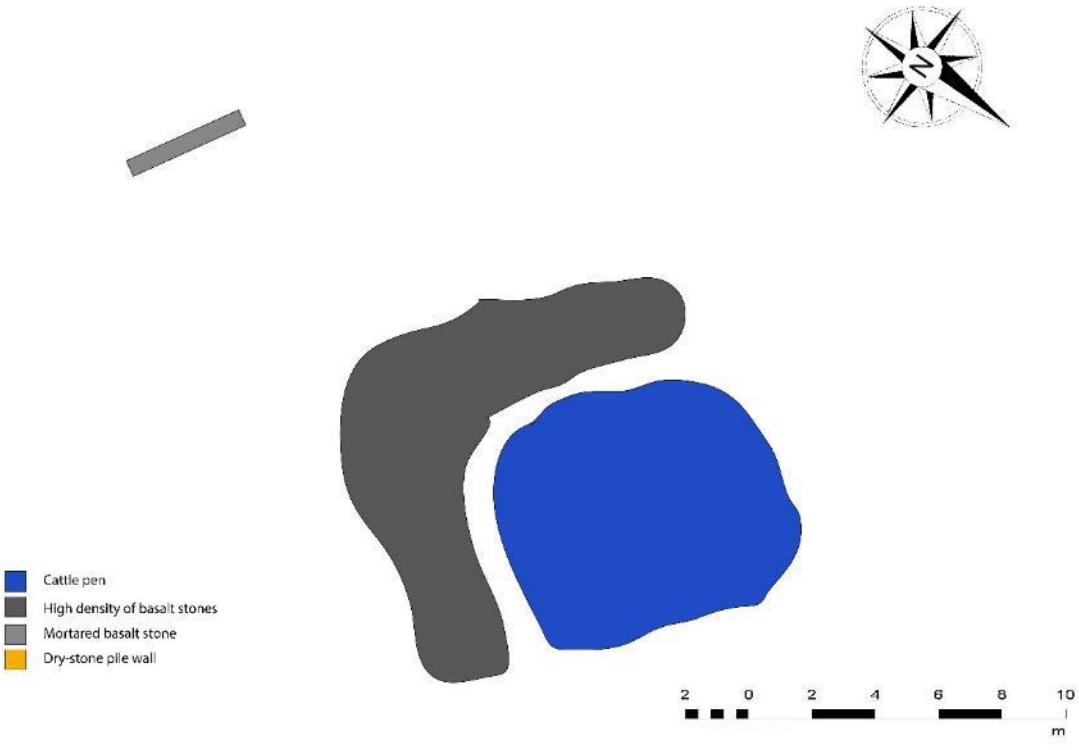
Close-up of the aerial map of Guyeau with the observed archaeological sites

Appendix 2: Aerial Structure Photographs and Drawings

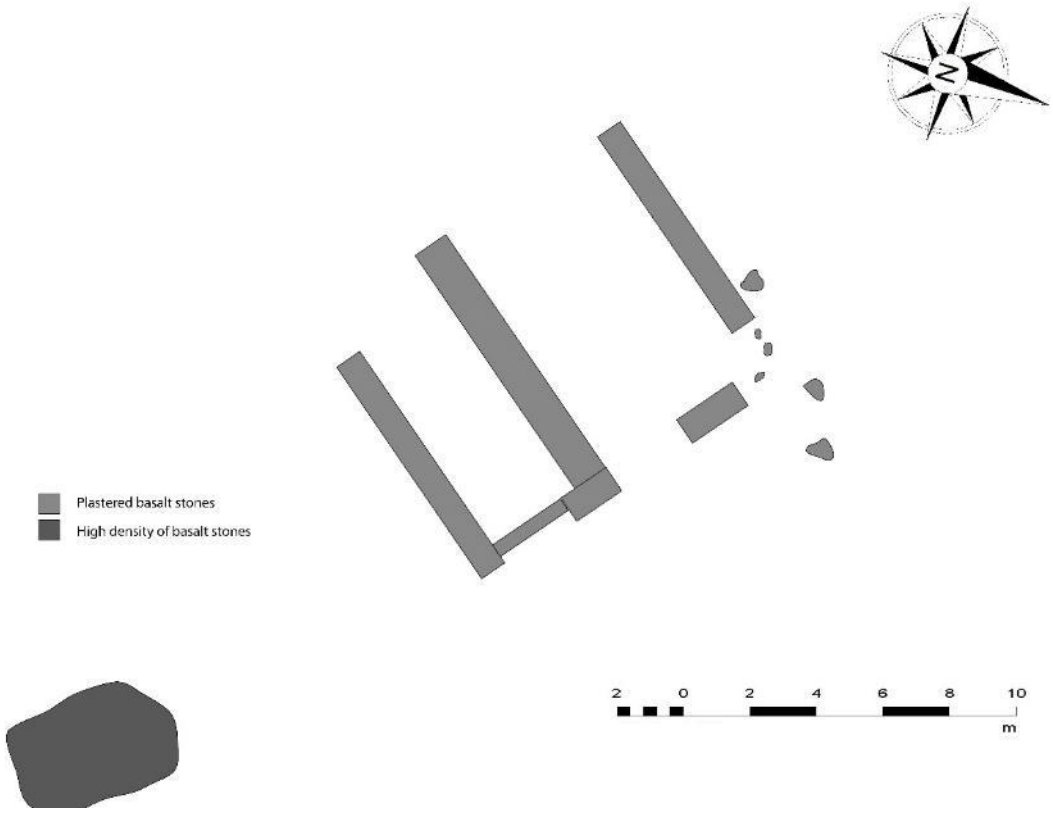
Industrial complex and cattle mill



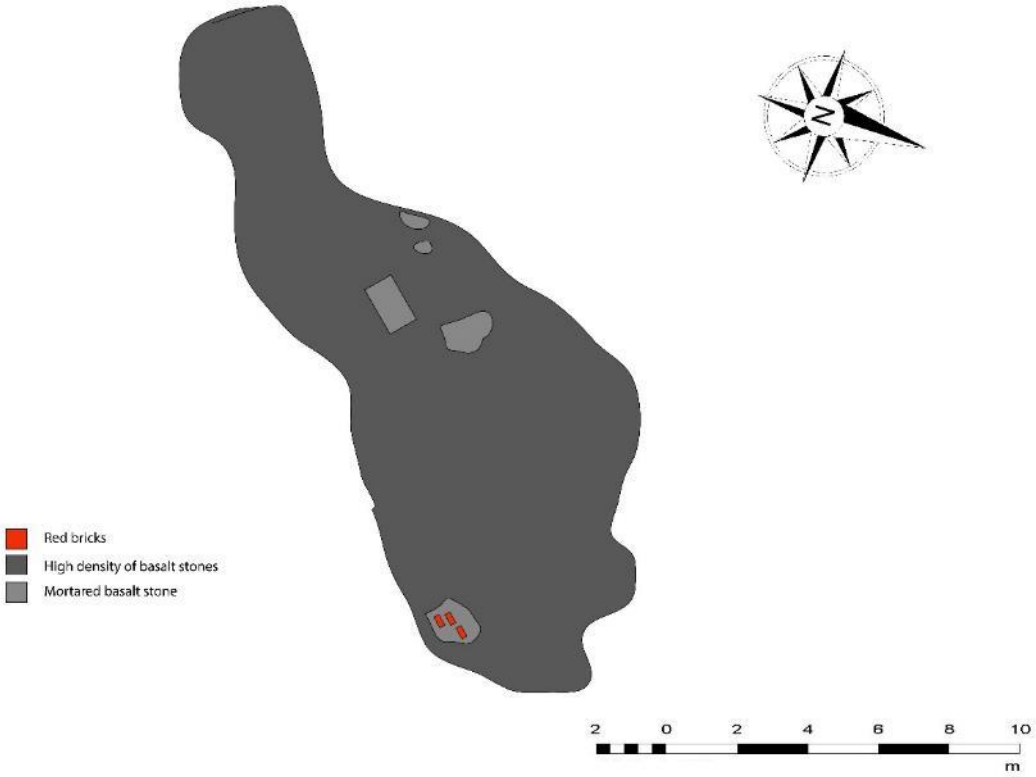
Retaining wall and cattle pen



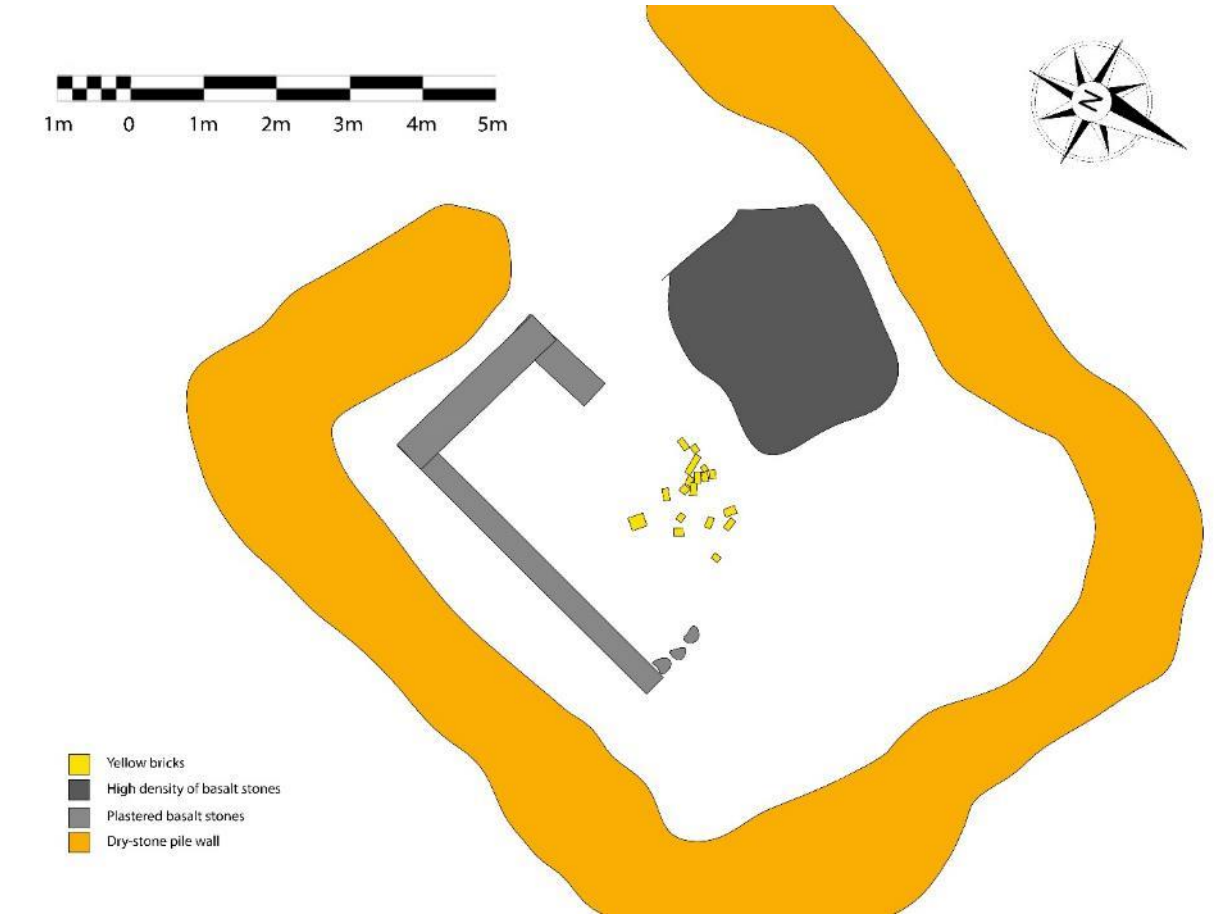
Great house


N
Plastered basalt stones
High density of basalt stones
2 0 2 4 6 8 10
m

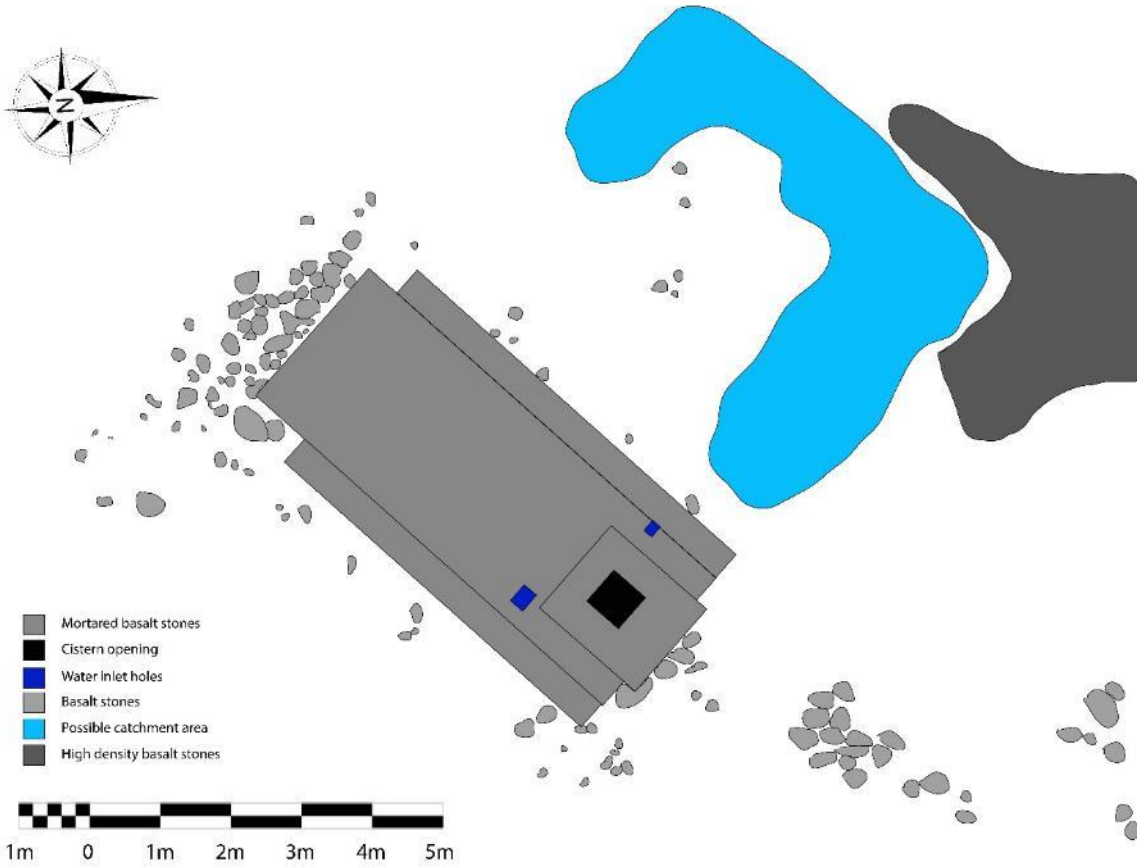
Unknown sites



Cemetery


1m 0 1m 2m 3m 4m 5m
N
Yellow bricks
High density of basalt stones
Plastered basalt stones
Dry-stone pile wall

Cistern #2


N
Mortared basalt stones
Cistern opening
Water inlet holes
Basalt stones
Possible catchment area
High density basalt stones
1m
0
1m
2m
3m
4m
5m

Appendix 3 Cistern Form

Context	
Reference #	#96
Site	Guyeau
Location	Cistern number 2 across the street from Knippenga Estate
GPS-Coordinates	17° 29’ 15.8388” N 62° 57’ 18.5868” W
Photograph number	

Measurements	
Height (complete exterior building)	1.10 m
Height (arch cistern)	1.10 m
Length (exterior)	5.48 m
Width (exterior)	2.79 m
Width (arch cistern)	1.95 m
Width (side or sides of cistern)	0.42 m (N), 0.42 m (S)
Length of arch circumference	2.82 m
Height (opening, outer dimensions)	0.17 m
Length (opening, outer dimensions)	1.38 m
Width (opening, outer dimensions)	1.20 m
Height (opening, inner dimensions)	0.06 m
Length (opening, inner dimensions)	0.44 m
Width (opening, inner dimensions)	0.47 m
Depth (interior until top arch)	3.22 m
Max water level height	2.38 m
Thickness dome	0.14 m
Length (interior)	4.20 m
Width (interior)	1.75 m
Capacity (interior)	15,900 litres
Length water catchment area	Not possible
Width water catchment area	Not possible
Height water catchment area	Not possible
Length yellow bricks	-
Width yellow bricks	-
Thickness yellow bricks	-
Length red bricks	-
Width red bricks	-
Thickness red bricks	-
Water inlet 1 height	0.23 m (N)
Water inlet 1 width	0.12 m (N)
Water inlet 2 height	0.11 m (S)
Water inlet 2 width	0.13 m (S)
Water inlet 3 height	-
Water inlet 3 width	-

Materials	
Type of stone/brick	Basalt stones
Type of lid	-
Sample of mortar taken	-

Description

Exterior shape	Rectangular with an arch on top
Interior shape	Rectangular with semi-circular rounded ends
Shape of opening	Square-like
Presence and number of steps Length, width and height of the stairs. Also, the length of the steps.	Not present

Function	
Status (used/unused)	Unused
Wet/dry	Dry
Condition	Fair. Basin is broken, but overall the cistern is still standing. Some stones are missing
Type of water collection	Catchment and roof?
Method of water extraction	Manual
Type of associated building	Unknown

Comments
This cistern has two water inlet holes. One is located near the ground and the other one is higher on the arch. The latter could have meant that it received water from the roof of a nearby building. However, no signs of any structure were observed.

Rapid Terrestrial Ecological Assessment

Guyeau

BioCarib
Research Consultancy

By
Anna Maitz
BioCarib Research Consultancy
April, 2018

BioCarib
Research Consultancy

Contents

1. Background

BioCarib was commissioned by the landowner and developer Mr. Robert Proper (Statia BV) to perform a rapid terrestrial ecological assessment for the Guyeau property on St Eustatius. A rapid ecological assessment (REA) assesses the flora and fauna inhabiting the area and the likely local environmental impacts of a development on the area and its immediate surroundings.

BioCarib Research Consultancy, located in St Eustatius, is an independent company which provides multidisciplinary research consultancy in all stages of project cycles both in marine and terrestrial areas, including rapid ecological assessments. The rapid ecological assessments cover the aspects as agreed upon prior:

- Ecological landscape values and qualities in the area
- Biodiversity present on the property (protected/non-protected for plants and animals)
- Mitigation strategies by indicating the local consequences of the project for the values, qualities, and species listed.

The primary aim of this assessment is to identify and evaluate habitats of conservation value at the site, however species of note are also included in the evaluation. In order to complete the assessment, existing resources (e.g. historical, scientific and vegetation maps) were used.

2. Purpose of Project

The Guyeau area is approximately 600 x 300 m (18 ha) and is located below Knippenga Estate on the south eastern coast of St Eustatius (Figure 1). Statia BV (the proponent) wishes to develop the area which is currently undeveloped. Guyeau Estate is proposed to be a development with a luxury hotel, residential complex, and a marina with helicopter pad (Figure 1, 2). This report will focus on the terrestrial part of the intended development.

In order to develop the area, it will be necessary to change the current zoning plan for the property. Before changing the zoning plan, however, a rapid ecological assessment must be carried out. Guyeau Estate is not located within any national park boundary and therefore does not fall under St Eustatius National Parks (STENAPA) rules and regulations, except for the proposed marine part of the area, which is located within the St Eustatius National Marine

Park (see Environmental Impacts Assessment for the Proposed Development of a Marina on the East Coast of St Eustatius, 2018).

Figure 1. Boundaries of St Eustatius national parks (dark green lines) (1A) and location of the proposed development of the Guyeau property (1B).

3. Survey Team

Team members were Mrs. Anna Maitz, M.Sc. (Environmental specialist) and assistant researcher, Ms. Hannah Madden, M.Sc. (Terrestrial ecologist). Fieldwork was conducted from 25 February to 4 March 2018.

4. Policy and Legal Context

The main purpose of a rapid ecological assessment is to inform stakeholders of the likely impacts of a proposed development before a decision is made. It provides an opportunity to identify key issues and stakeholders in the early stages of a proposed development so that potentially adverse impacts can be addressed before final approval is granted (Bissets, 1996).

This document provides an overview of potential environmental concerns and should be used within a wider context, taking local laws regarding building guidelines and permitted actions into account. As stated in the Island Legislation section of the St Eustatius legislation handbook: "*It is forbidden to begin, continue, expand or amend environmentally harmful activities (indicated by General Island Resolution, along with exceptions* ***EUX2-Art.4****), or*

*change any of the working methods involved, without a permit from the Executive Committee (to whom notification of changes should be given in advance **EUX2-Art.4**) – except for expansions or changes to an activity or work method that will have no effect or only positive effects on the environment*."

5. Project Description

Guyeau Estate is intended to become a new development that will offer a hotel and homes, as well as a marina for yachts (Figure 2). There are 45 lots in total ranging from 1,500 to 3,000 m^2. The villas will be developed into luxury vacation homes, which, in addition to being permanent homes, will also be available for rental to third parties. Individual buyers can choose to rent their villas through 'petit Guyeau' hotel in order to complement nearby, high quality Knippenga Estate, upon which this new development is based. Guyeau Estate will be a luxury development, ably competing with comparable successful developments on the nearby islands of St. Kitts, Nevis, and St. Barthélemy. One advantage of this development will be the presence of a quality hotel. The hotel, which initially will have 120 rooms, will not only cement St. Eustatius on the tourist map, it will also be valuable for the villas and marina. It is therefore crucial that the hotel is able to meet the demands that the type of tourists staying in similar accommodations on islands close to St. Eustatius are accustomed to. The hotel will consist of around 100 standard rooms and around 20 'short-stay studios'. In addition, a restaurant, brasserie, bar and shops will complement this type of quality development. In addition to the large hotel, a smaller development (petit Guyeau) will be built close to the entrance of the property. This will consist of 12 rooms and four suites, which will form the initial accommodation until the hotel by the sea is built. This can later be turned into staff quarters. All the necessary provisions such as water treatment, generators and laundry service will be situated here. The reception in petit Guyeau shall provide services for Guyeau Estate, such as porter, sales office for the project, and car rental. The marina will be suitable for larger yachts that sail within the region, thus requiring it to be of high quality and comparable with those found on other islands. Standard size will be 60 feet, however there will also be a few places for yachts two or three times that length. The marina accommodation will be integrated into the hotel building and will also include a helipad (Figure 2).

Figure 2. Overview of intended development at the Guyeau property (PVB Achitects, 2017).

6. Site description

Guyeau Estate is located on the lower slopes of the Quill, a dormant strato volcano (Roobol & Smith 2004). On the lower slopes of the Quill turf layers occur; this is referred to as the "Cultuurvlakte" that is built up of volcanic ash, fragments of molten or semi-molten rock, lapilli (rock fragments), and pumice (light-colored, frothy volcanic rock and ash-sized particles). The "Cultuurvlakte" forms the flatter foot plains of the Quill volcano (de Freitas et al 2012). Altitude ranges from 10 m to about 80 m above sea level, averaging 40 m (Augustinus *et al.* 1985), and on the coastal side of the property steep cliffs of 20-45 m elevation are present. The soil type in this area is categorized as 'Statia sandy loam'. The vegetation type, according to Boldingh (1909), is considered to be "Croton vegetation" and is described as a dry, shrubby vegetation of a grayish aspect that is dominated in the Cultuurvlakte. Historically and currently the site is grazed by cattle; previous disturbances include vegetation clearing (mechanical clearing and thinning) and agricultural use.

7. History of Guyeau

St. Eustatius is comprised of three geomorphologic areas; the first is the north-western part of the island known as the Northern Hills which consists of an extinct volcanic landscape; the second area is the dormant Quill volcano located in the southern part of the island; and thirdly the plains between the northern and southern areas are, according to Westerman and Kiel

(1961), known as the “Cultuurvlakte” or agricultural plains, where the proposed Guyeau Estate is located. Historical records show that a plantation was situated in the planned area of development (Figure 3), which is documented on the first known map of St. Eustatius dating back to 1741 (Renkema 2016). The map indicates where plantations in the Guyeau area were once located (potentially no. 42 and 43) (Figure 3). In 1781, when St Eustatius was under English rule, a map was produced showing the plantation at Guyeau in great detail, with the boundary area marked in green as indicated in the map of Figure 4. On the property line of John Cuvilliers (within the area of Guyeau), a slave village is illustrated on the map (Figure 4B).

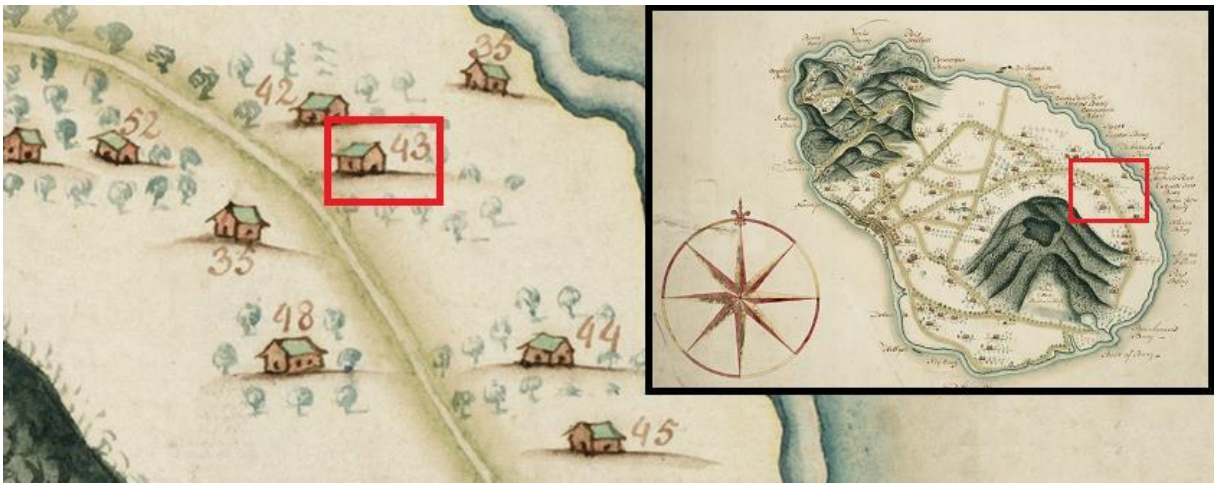


Figure 3. Indicates were plantations on the Guyeau area were once located. Source from SECAR.

At the beginning of the 20th century some plantations in the “Cultuurvlakte” area of St. Eustatius (Boldingh 1909), where the Guyeau property is located, still existed. In 1950, a considerable part of this area was still under cultivation for the production of crops and cattle ranching (Veenenbos 1955). A larger part of this area and parts of the lower slopes of the Quill are still in use today for free-roaming cattle grazing. A more recent map from 1963 shows the Guyeau area in more detail; it also indicates vegetation colorations and former agricultural uses (Figure 4B).

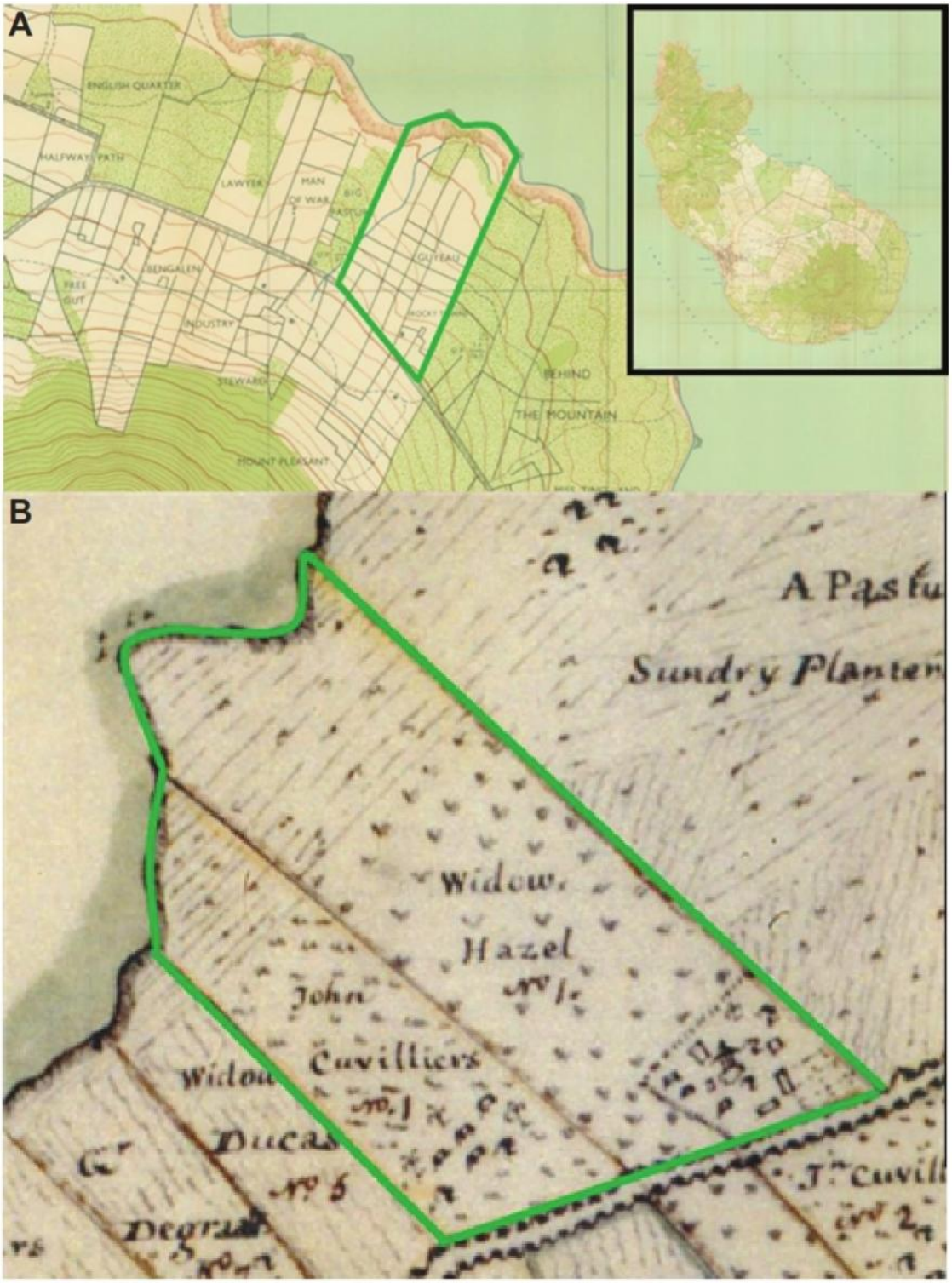


Figure 4. Map by P.F. Martin in 1781 where Guyeau is outlined in green (A), KLM Aerocarto map of 1963. Guyeau is outlined in green (B). Source from SECAR.

8. Climate and Rainfall

The dry season on St Eustatius typically runs from January to April, with the wetter months falling in the second part of the year (Figure 5) (http://seawf.com/rainhist.php). Guyeau Estate

is located in a low-lying area and thus likely to receive less rainfall than the higher elevations of the Quill and Boven mountains.

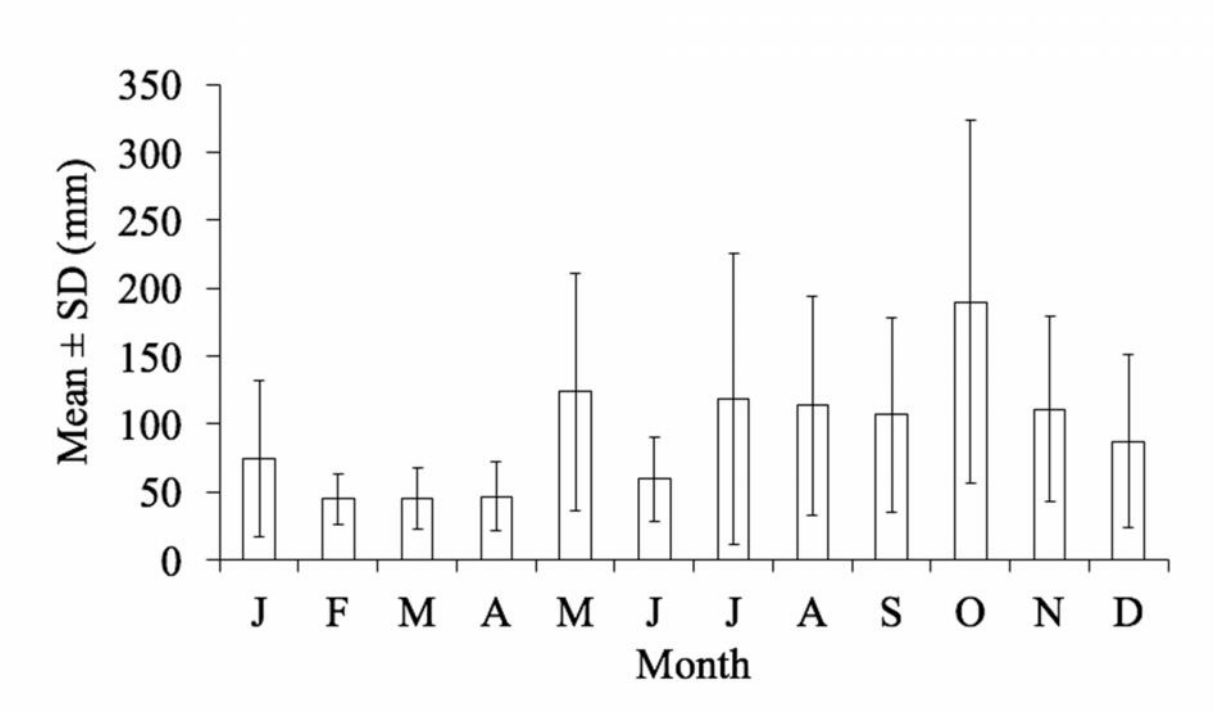


Figure 5. Average monthly rainfall on St. Eustatius. Source www.seawf.com

Annual rainfall data for St. Eustatius from 1981 to 2017 is displayed below (Figure 6) (http://seawf.com/rainhist.php). Decade averages range between 1,132 mm and 1,351 mm. Generally, the climate in the Caribbean is predicted to become drier, in line with rising sea levels and surge and thus increased potential for damage. Tropical cyclone intensity is projected to increase, and the frequency of the most intense storms will increase substantially in some basins. This will give rise to a likely increase in both global mean tropical cyclone maximum wind speed and rainfall intensity (Nurse 2017).

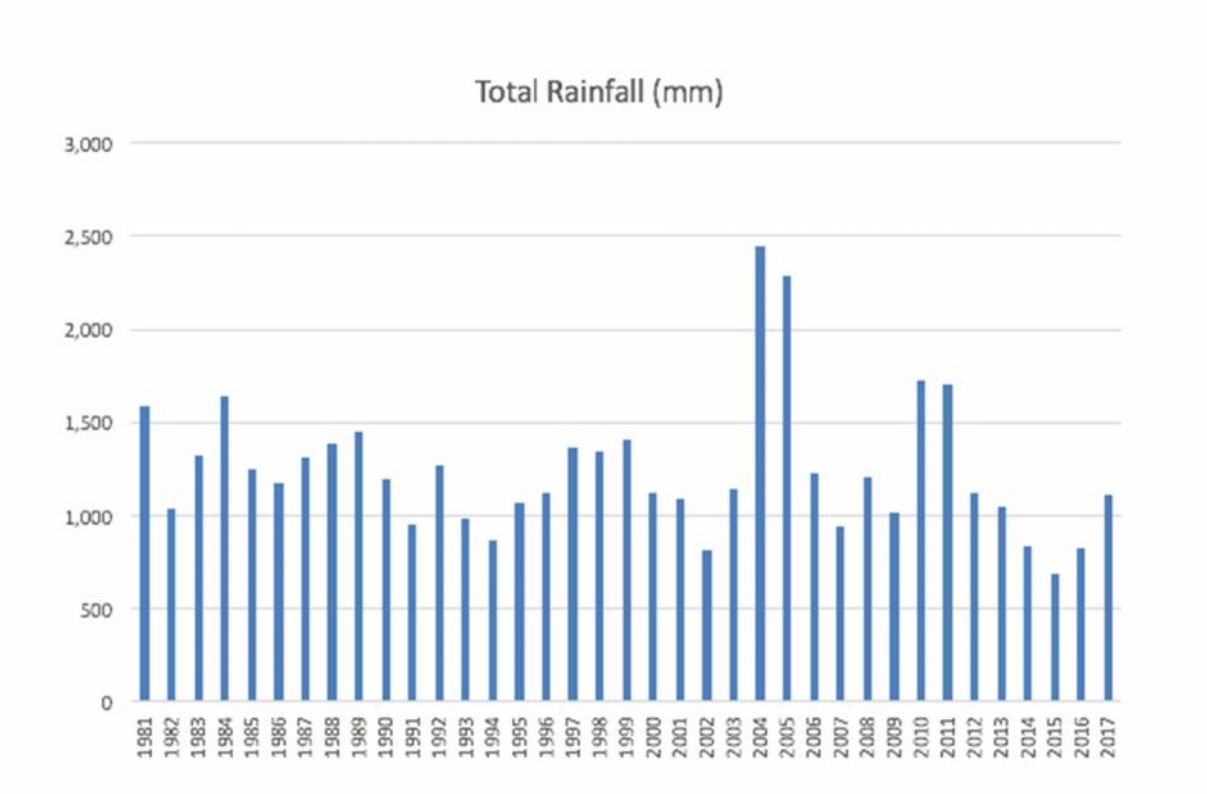


Figure 6. Total annual rainfall on St. Eustatius from 1981 to 2017. Data source www.seawf.com

9. Description of status and protection of species

Of all flora/fauna species occurring on St Eustatius, 51 appear on the International Union for the Conservation of Nature (IUCN) Red List of threatened species as ‘critically endangered (CR), ‘endangered (EN) ‘vulnerable’ (VU), or ‘near threatened’ (NT). IUCN’s Red List is generally recognized as the most extensive and objective global approach to the evaluation of the protection status of plant and animal species. The function of IUCN’s Red list is to identify species that require protection, both locally and internationally. Internationally protected species that occur in more than one country and are under threat globally are protected by international agreements such as CITES (Convention on International Trade in Endangered Species), the Inter-American Convention for the Protection and Conservation of Marine Turtles (IAS), the Convention on the Conservation of Migratory Species (CMS) and the regional SPAW protocol concerning Specially Protected Areas and Wildlife. The species listed in these international agreements must be protected, usually according to specific measures, as stated in the corresponding convention. Tables 2 and 3 contain a list of all the species recorded while conducting transect surveys at Guyeau, with their specific protection status based on the various conventions.

10. Vegetation description of Guyeau

Stoffers (1956) produced the first vegetation map for St. Eustatius, in which 18 vegetation types were described, and since then several different vegetation descriptions have been published by various scientists (de Freitas et al. 2012; Posthouwer, 2016; van Andel et al. 2016). For this report we used the vegetation descriptions provided in of the latest vegetation map by de Freitas et al. (2012) (Figure 7). Guyeau is located in the marked-out area of the map (indicated with a red rectangle) and is according to de Freitas et al. (2012) categorized as a miscellaneous, urban, disturbed area (Figure 7). The area was put into this category of the above-mentioned vegetation map due to the current and former agricultural activities conducted in the area, which included growing crops and grazing roaming animals (e.g. cows, goats, sheep), the latter being the most common agricultural activity in the area. As a result of agricultural activities, as well as the removal of the majority of native vegetation several decades ago and large areas being covered in the invasive vine Coralita (*Antigonon leptopus*), the area is considered by de Freitas et al. (2012) as disturbed.

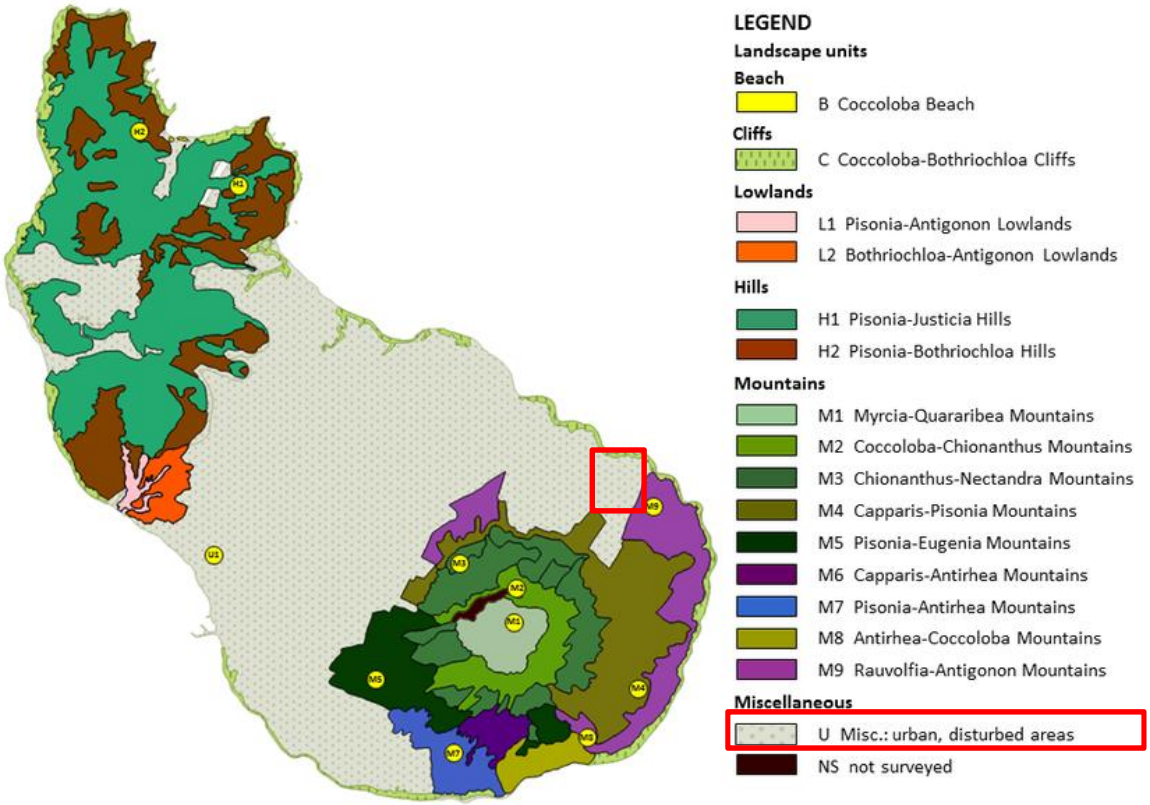


Figure 7. Vegetation map of St Eustatius (Posthouwer, 2016, based on de Freitas et al., 2012).

11. Field work and observations

In the 18 ha Guyeau property, walking transects were conducted from 23 February to 4 March 2018. A total of seven +/- 300 m long by +/- 10 m wide transect surveys were conducted in the area (Figure 8) In addition to the transects crossing the area, a “coastline” (following the cliff), “main road” and “dirt road” transect were conducted, hereafter referred to as transect numbers 1, 6 and 7 respectively. During the transect surveys two team members walked simultaneously, one recording and listing the species of flora observed. The second person recorded fauna through visual and audio observations. All animals seen or heard within close proximity of the transects were recorded. In addition to the listing and recording of flora and fauna species, an estimation of vegetation cover was recorded in each transect in order to build a general picture of the type of cover and average height of the vegetation present. Prior to commencing the walking transects, the BioCarib team marked trees in the historical area before landscapers cleared the site for SECAR. Trees marked were Cherry (*Malpighia emarginata*), Calabash (*Crescentia cujete***)**, Mappoo (*Pisonia subcordata*) and Gum trees (*Bursera simaruba*), which were left in situ by the landscapers.

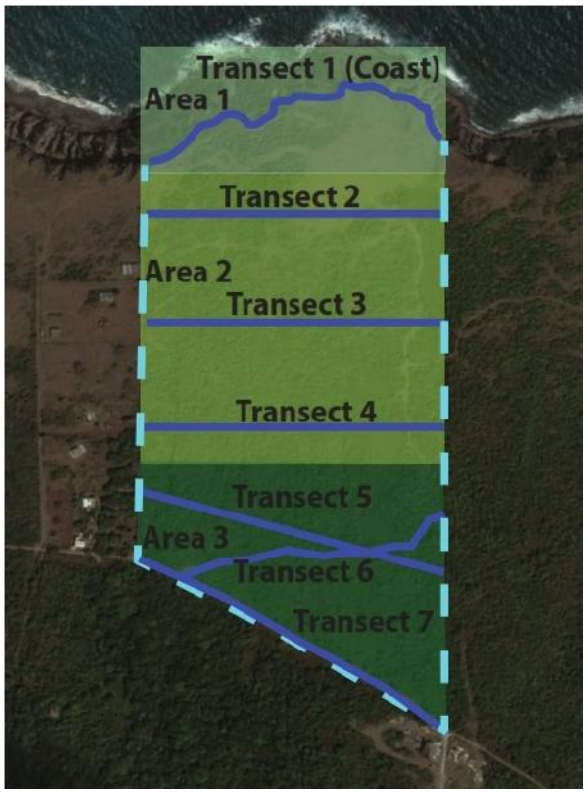


Figure 8. Overview of transect surveys (1-7 indicated in blue) conducted at Guyeau (property line indicated in light blue dotted line) and the different areas (Area 1 = light green, Area 2 = green, Area 3 = dark green).

	Vegetation	Cover %
Area 1	Bare Ground	5
	Grass	85
	Coralita/cleared area	0
	Lower Shrub (<1 m)	7
	Higher Shrub (>1 m)	3
	Woody Shrub (<5 m)	0
	Trees (>5 m)	0
Area 2	Bare Ground	0
	Grass	0
	Coralita/cleared area	5
	Lower Shrub (<1 m)	15
	Higher Shrub (>1 m)	5
	Woody Shrub (<5 m)	73
	Trees (>5 m)	2
Area 3	Bare Ground	0
	Grass	0
	Coralita/cleared area	35
	Lower Shrub (<1 m)	0
	Higher Shrub (>1 m)	30
	Woody Shrub (<5 m)	30
	Trees (>5 m)	5

Table 1. The three different areas at Guyeau and general vegetation cover, indicated in percentage for each area. Examples of some of the vegetation categories are presented in Appendix 1.

12. Description of the Flora and Fauna of the Guyeau property

12.1 General description of the flora and fauna of the three areas

The main vegetation in the coastal area (Area 1) (Figure 8) consisted of grass fields and in some parts bare ground as well as some shrubs (Table 1). The cliff side towards the ocean was partly covered by trees (i.e. Sea grapes) but was mostly exposed rock. In this area Red-billed Tropicbirds were observed flying as well as landing in natural crevices in the cliff face. The peak nesting season of Tropicbirds (Figure 11A) in St Eustatius (Vanderwerf and Young 2014) coincided with the time that fieldwork took place. It is very likely that the tropicbirds observed (in North Eastern part of the cliffs) were nesting in the cliff area. Due to the steep gradient of the cliff, it is not possible to fully observe the entire coast line and cliff. However, sea grape trees were observed at several locations on the sloping cliffs (Figure 11B).

The main vegetation in Area 2 (Figure 8) consisted of different species of shrub, with some smaller areas covered with Coralita as well as a few trees (Table 1). Areas with large boulders were encountered in Area 2 (GPS coordinates N 17,490 57° W 062,953 50°) which had a high activity of birds and butterflies. Monarch butterflies (*Danaus plexippus*) and several Yellow Warblers (*Setophaga petechia*) (Figure 9C) were observed and displayed courting behavior. Bird nests of several species were also observed among the woody shrubs in this area.

The main vegetation in Area 3 (Figure 8, Table 1) consisted of higher, woody shrub with some areas covered by Coralita. There were a low number of trees (consisting mainly of Gum tree, Mappoo, Genip) and several cactus of the species Columnar cactus (*Pilosecereus royenii*) and Cochineal cactus (*Nopalea cochenillifera*) in the area. In Area 3 two areas were cleared from vegetation prior to the current assessment, Petit Guyeau and the boulder formation closes to the main road. These areas were classified in the cover category "Coralita/cleared area" in Table 1. In Area 3, more ground lizards and anoles were encountered as well as different species of doves and pigeons than in the other two areas surveyed (Figure 9B). Although sightings of the Lesser Antillean Iguana (*Iguana delicatissima*) or signs of nesting sites were not documented during surveys, three individuals of this species were observed in 2017 close to the main road (Area 3) (Figure 8) (Tim van Wagensveld, personal observation). According to IUCN's Red List, the Lesser Antillean Iguana is considered endangered (EN) but its status will shift to critically endangered (CR) later this year (van de Burg, in preparation). Although iguanas have been observed in Area 3 previously (year 2017), which is the area of the property containing the highest amount of developed vegetation, the lack of iguana sightings or any signs of nests during fieldwork, combined with the current status of vegetation in the general area, indicates that the property does not contain a significant population of the species.

Figure 9. Cloudless Sulphur (*Phoebis sennae*) butterfly (A). Red-faced ground lizard (*Ameiva erythrocephala*) (B), Yellow Warbler (*Setophaga petechia*) (C), American Kestrel (*Falco sparverius*) (D).

Figure 10. Calabash Tree (*Crescentia cujete*) (A), Gum Tree (*Bursera simaruba*) (B), Columnar Cacti (*Pilosecereus royenii*) (C), Genip Tree (*Melicoccus bijugatus*) (D).

Figure 11. Red-billed tropicbird (*Phaethon aethereus*) (A). Coastline showing Sea Grape trees (*Coccoloba ufivera*) lining the cliff slope (B).

12.2 Flora and fauna species list indicating status of species

Of the approximately 60 species of flora documented during fieldwork, only two (Table 2) (Columnar cactus [*Pilosecereus royenii*] and Cochineal cactus [*Napalea cochenillifera*]) are recorded on the CITES Annex list II (Figure 10C), which means that trading rules apply. However, none of the other flora species recorded in the area are considered endemic, endangered or threatened.

Flora	Common name	Scientific name	IUCN Category	SPAW	CMS	CITES
Grass	Grass	Fam. Poaceae				
	Donna grass	*Bothriochloa pertusa*	Not assessed			
Shrub	Coralita	Antigonon leptopus	Not assessed			
	Pandou	*Jatropha gossypiifolia*	Not assessed			
	Thistle	*Argemone mexicana*	Not assessed			
	Money Bush	*Senna bicapsularis*	LC			
	Tattoo fern	*Pityrogramma calomelanos*	Not assessed			
		Sida cordifolia	Not assessed			
	Castor	Ricinus communis	Not assessed			
		Matalea maritima	Not assessed			
		Samyda dodecandra	Not assessed			
		Sida cordifolia	Not assessed			
	Milkweed	Calotropis procera	Not assessed			

		Heliotropium	
	Eye bright	angiospermum	Not assessed
	Devil's horsewhip	*Achyranthes aspera*	Not assessed
		Fam. Lamiaceae	
	Love vine	*Cuscuta americana*	Not assessed
	Jumbie bead	*Abrus precatorius*	Not assessed
		Quadrella indica	Not assessed
	Periwinkle	*Catharanthus roseus*	Not assessed
		Solanum lanceifolium	Not assessed
	Bahama		
	Nightshade	*Solanum bahamense*	Not assessed
	Wild Lantana	Lantana involucrata	Not assessed
Woody			
Shrub/Trees	Acacia	Vachellia sp.	
		Portulaca oleracea	Not assessed
	Sugar Apple	*Annona squamosa*	Not assessed
	Christmas Tree	Randia aculeata	Not assessed
	Prickly Myrtle	*Volkamerica aculeata*	Not assessed
	Christmas Tree	Randia aculeata	Not assessed
	Fig	Ficus sp.	
		Allophylus racemosus	Not assessed
		Justicia sessilis	Not assessed
		Stigmaphyllon emarginatum	Not assessed
	Prickly Myrtle	*Volkamerica aculeata*	Not assessed
		Croton flavens	Not assessed
		Spermacoce bahamensis	Not assessed
		Herissantia crispa	Not assessed
		Melochia tomentosa	Not assessed
	Genip	Melicoccus bijugatus	Not assessed
	West Indian		
	Cherry	Malpighia emarginata	Not assessed
	Tan Tan	Leucaena leucocephala	Not assessed
	Capparis	*Cynophalla flexuosa*	Not assessed
	Loblolly	*Citharexylum spinosum*	Not assessed
	Calabash	*Crescentia cujete*	Not assessed
	Gum Tree	Bursera simaruba	Not assessed

	Sea Grape	Coccoloba uvifera	Not assessed	
	White Cedar	*Tabebuia heterophylla*	Not assessed	
	Loblolly	*Citharexylum spinosum*	Not assessed	
	Capparis	*Cynophalla flexuosa*	Not assessed	
	Calabash	*Crescentia cujete*	Not assessed	
		Waltheria indica	Not assessed	
	Tamarind	*Tamarindus indica*	LC	
		Datura inoxia	Not assessed	
		Cissus verticillata	Not assessed	
	Mappoo	Pisonia subcordata	Not assessed	
		Malvastrum americanum	Not assessed	
		Sida sp.		
Cacti	Columnar cactus	Pilosecereus royenii	Not assessed	2
		Quadrella cynophallophora	Not assessed	
		Abutilon indicum	Not assessed	
		Bourreria succulenta	Not assessed	
		Tecoma stans	Not assessed	
	Cochineal cactus	*Nopalea cochenillifera*	Data deficient	2
		Fam. Malvaceae	Not assessed	

Table 2. All recorded species of flora and vegetation at Guyeau and their status according to the different annexes. (Based on Nature Policy Plan 2012-2017)

Of the approximately 30 fauna species documented in the survey area, only a few are recorded on the lists mentioned in section 9 (Description of status and protection of species) (Table 3), and one species - the Red-faced ground lizard (*Ameiva erythrocephala*) - is considered Near Threatened (NT) on IUCN's Red list (Figure 9B). The American Kestrel (*Falco sparverius*) (Figure 9D) is recorded in both the CMS and CITES annexes, meaning that this species is migratory and trading rules apply. The monarch butterfly (*Danaus plexippus*) is also a migratory species and the same trading rules apply accordingly. The remaining species are not considered to be endemic, endangered, vulnerable or threatened according to the various lists.

Fauna	Common name	Scientific name	IUCN Category	SPAW	CMS	CITES
Bird	American Kestrel	*Falco sparverius*	LC		2	II
	Red-billed Tropicbird	*Phaethon aethereus*	LC			
	Yellow Warblers	*Setophaga petechia*	LC			
	Caribbean Elaenia	*Eleania martinica*	Not assessed			
	Zenaida Dove	*Zenaida aurita*	LC			
	White-winged Dove	*Zenaida asiatica*	LC			
	Common ground dove	*Columbina passerina*	LC			
	Pearly-eyed Thrasher	*Margarops fuscatus*	LC			
	Gray Kingbird	*Tyrannus dominicensis*	LC			
	Bananaquit	*Coereba flaveola*	LC			
	Black faced grassquit	*Tiaris bicolor*	LC			
	Lesser Antillean Bullfinch	*Loxigilla noctis*	LC			
Butterflies	Little Sulphur	*Eurema lisa*	Not assessed			
	Great Southern White	*Ascia monuste*	Not assessed			
	Cloudless Sulphur	*Phoebis sennae*	Not assessed			
	Gulf Fritillary	*Agraulis vanillae*	Not assessed			
	Miami Blue	*Hemiargus thomasi*	Not assessed			
	Hanno Blue	*Hemiargus hanno*	Not assessed			
	Monarch	*Danaus plexippus*	Not assessed		2	
	Caribbean Duskywing	*Ephyriades arcas*	Not assessed			
	Antillean Hairstreak	*Strymon acis*	Not assessed			
Reptile	Little tree lizard	*Anolis schwartzi*	Not assessed			
	Red faced ground lizard	*Ameiva erythrocephala*	NT			
Insects	Ladybug	*Coccinellidae*				
	Grasshoppers	*Caelifera*				
	Spiders	*Arachnida*				
	Carpenter Bee	*Xylocopa mordax*	Not assessed			
	Dragonfly	*Odonata*				
	Honey Bee	*Apis mellifera*	Not assessed			
	Tarantula hawk wasp	*Pepsis sp.*				
	Assassin Bug	*Reduviidae*				
	Sand wasp	*Stictia signata*	Not assessed			
	Hermit Crab remains	*Anomura*				

Table 3. All recorded species of fauna at Guyeau and their status according to the different annexes (based on the Caribbean Netherlands Nature Policy Plan 2013-2017).

13. Identification and assessment of potential impacts

Floral composition in the area comprises mainly grass, woody shrubs, and small trees, which is typical of the vegetation type described by de Freitas et al, (2012) and Posthouwer (2016). The Guyeau area is heavily impacted by grazing animals and was used as farmland until the 1960s (Ishmael Berkel, personal communication). No endemic or critically endangered species of fauna or flora were documented during transect surveys, (except for observations of the Lesser Antillean Iguana that were recorded in the area previously [2017] and whose status will in the future shift to critically endangered (CR)). Potential specific impacts related to

construction methods and materials for Guyeau Estate are outside the intended scope of this report and will not be assessed.

13.1 Impacts on the terrestrial environment

i. Soil erosion / run-off

Vegetation binds the top soil into the ground and acts as a natural protector soil erosion; when vegetation is cleared the top soil becomes exposed and could potentially be more susceptible to erosion caused by winds and rainfall. During heavy rainfall and/or bad weather, run-off from land during the construction and operational phase could potentially end up in the sea caused by e.g. clearance of vegetation. Run-off can severely impact marine life in the waters below the suggested development site. The size of the area that could potentially be affected depends on several factors including but not limited to soil grain size, quantity of rain, and area exposed. The consequences of sedimentation and increased turbidity include the smothering of corals and other marine organisms, as well as a reduction in photosynthesis due to an increase in water turbidity and the introduction of other chemicals which can make the water murky. In many cases these can lead to a die-off of corals, and in turn affect the many other species that depend on these corals in the affected area. These stressors have also been identified as one of the most important factors threatening reefs on a global scale (Grigg and Dollar, 1990).

ii. Deforestation and bare grounds

Removal of vegetation in its entirety would, in addition to the risk of substantial soil erosion, leave the area susceptible to invasive species (such as Coralita) which can rapidly move into a disturbed area. Moreover, while the diversity of flora species may be relatively low (ca. 60 species) this type of vegetation provides an important nesting/feeding habitat for many native fauna species, such as (migratory) birds, lizards and butterflies (Holway, 1991; Dennis, 2004).

iii. Air pollution

High activity of vehicles during the construction phase would increase dust levels in the area. Dust generated during construction will result from clearing and

earthworks, including trenching, levelling, and construction operations. This means that airborne contaminants, including contaminated particulate matter and volatile compounds, are spread around (by wind) in the surrounding area (the main wind direction will influence the area most affected by air pollution around a construction site). Contaminants spread in the air can travel large distances in a short time. Particles that could be spread include asbestos, gases such as carbon monoxide, carbon dioxide**,** nitrogen oxides and volatile organic compounds (VOCs) (www.environmentalpollutioncenters.org). The occurrence and significance of dust generation will depend upon meteorological and ground conditions at the time and location of activities. However, under normal meteorological conditions, dust impacts will be limited to within several hundred meters of the construction area/s. Dust generation can affect the ability of nearby vegetation to survive and maintain effective evapotranspiration, especially in agricultural areas, and cause a wide range of health problems including respiratory illness, asthma, and bronchitis (www.sustainablebuild.co.uk).

iv. Water pollution

Surface water runoff and surrounding water sources close to a construction site can become polluted with various materials used during the construction phase (e.g. VOCs, paints, glues, diesel, oils, other toxic chemicals, cement). As described under air pollution above, such contaminants can pollute the water and, if brought to the sea, would be toxic to the marine environment and marine organisms.

v. Soil pollution

The soil in and around a construction site may become contaminated due to air transport followed by deposition of construction contaminants (listed under air pollution) as well as water run-off of construction contaminants (listed under water pollution). Soil may constitute a sink for pollutants and some of those may accumulate in the soil and persist over longer periods of time. Polluted soil can harm anyone who treads on the land, plays in the soil or inhales vapours released into the surrounding air. Health issue that can arise from the inhaling of vapours include respiratory problems. Toxic chemicals in the soil can also be ingested through the consumption of foods and vegetables grown in the polluted soil.

vi. Noise pollution

Construction sites inevitably produce noise, mainly from vehicles, heavy equipment and machinery, but also from construction personnel. High noise levels disturb animals and could lead to an imbalance in their natural cycles, as well as reducing their usable habitat.

vii. Loss of habitat

Although the habitat in the intended development site is already disturbed (de Freitas et al, 2012) and the area does not constitute high biodiversity, there is a certain intrinsic and biological value in any habitat. The development in the area would remove habitat for many of the species currently inhabiting the area, and although many mobile species (such as birds) could to some extent "move", the overall habitat type on the island would shrink for these species.

Socio economic impacts

A handful of private residences are situated on the north eastern property line of Guyeau Estate. Consideration during construction should be taken to minimize any unnecessary disturbances for these residences. Trucks carrying concrete and other buildings materials will regularly visit this area during the preparation and construction phase. Building contractors will bring their own vehicles, all of which will contribute to noise pollution. The environmental impacts typically associated with traffic generated during construction projects include:

- Dust from vehicles traveling on un-surfaced roads.
- Noise pollution.
- General damage to the soil surface and flora from off-road driving.
- Potential interference with roads/traffic during construction activities.

14. Recommendations of minimization and mitigation measures

The maximum project impacts are expected to occur during the construction phase, whereas the operational phase carries less concern with respect to generating impacts. A majority of the impacts identified above are also amenable to mitigation**.**

i. Soil erosion / Run-off

Preventing environmental impacts caused by run-off from land into the ocean should be given high priority. Soils can be thought of as a living entity, usually comprising a layered habitat with thickness varying from place to place. Construction activities would result in localized alteration of the soil profile, and soil compaction in the immediate vicinity due to result of vehicle and construction equipment operations. Soil run-off during the construction phase can be mitigated by actions, which include but are not limited to: the scheduling of construction activities so that the exposure of bare soil is minimized as much as possible, sediment control practices and silt fences, which should be installed before construction begins, construction of retaining walls, building of interception channels to prevent heavy rain from washing over exposed soil surface, paving haul roads with concrete, as well as other measures which actively divert water from slopes.

ii. Deforestation and bare grounds

As mentioned in section 8 (Climate and rainfall), the rainy season occurs during the second half of the year, which also coincides with the hurricane season (June to November). To avoid potential loss of topsoil and prevent soil from eroding into the waters below, it is not recommended to leave large areas of bare ground exposed, especially during this time. Preserving this vegetation wherever possible will minimize erosion, maintain ecological functions, and minimize habitat loss to native fauna species. If removal of vegetation is absolutely necessary, one area at a time should be removed in order to minimize the risk of erosion by exposing topsoil. Removed topsoil should also be stored in a manner which will minimize run-off and so it can be reused for landscaping at a later stage.

iii. Air pollution

Air pollution can be minimized by spraying water to dampen down the site, which will minimize the spread of dust. Screens and fine mesh screening at the construction site close to the dust source can also minimize air pollution. Trucks loaded with construction materials that can cause air pollution should be covered and damped down with water to further minimize the spread of dust and other air pollution. Similarly, covering building materials such as cement, sand and other powders at the construction site will further minimize air pollution.

iv. Water pollution

Wastewater generated from construction and related activities such as concreting, plastering, cleaning and polishing, internal decoration etc. should be collected and discharged of properly. Direct discharge of wastewater into bare ground would pollute the soil and affect the quality of the surrounding water body in the area, therefore a suitably designed wastewater collection system should be provided on site to divert all wastewater to a facility. Procedures to handle the accidental spillage of various materials used during the construction phase (e.g. VOCs, paints, glues, diesel, oils, cement, other toxic chemicals) should be created and adhered to in order to minimize water pollution. Other chemical waste and sewage generated during the construction phase should be collected, stored and discarded appropriately.

v. Soil pollution

Potential soil contamination may be associated with waste handling/disposal practices and potential spillage of e.g. gasoline/oil during construction activities. By wasting less and reusing and recycling materials, soil pollution can be reduced. Waste could also be treated, acids and alkaline could for example be neutralized before they are disposed. Biodegradable wastes could be broken down in a controlled environment before being reused or discarded, and other waste generated should be disposed of properly at the recycling plant or the landfill.

vi. Noise pollution

Construction work should be carried out during work hours (7 am to 5 pm) in order to minimize noise and dust disturbance to local residents. Trucks carrying materials

such as gravel or loose dirt should be covered in order to minimize contamination of the area around the site and nearby residences.

vii. Loss of habitat

Through careful planning and the incorporation of native vegetation in the development of the area, habitat loss can be mitigated to a large extent. Such measures can make the area more attractive for some species than the existing habitat currently provides. Focus should be on vulnerable species such as the native iguana, which can thrive in urban garden areas with lush vegetation. By planting new trees and saving certain current vegetation, the area could be made suitable for iguanas and other wildlife. Selection of optimal vegetation for future residents of the area as well as wildlife should be considered in cooperation with local and international experts who have specific knowledge of native species and their habitat requirements. This will create an optimal habitat for all future users of the land.

viii. Construction

Construction companies which incorporate an environmental approach in the planning and construction phases should be considered. Environmentally friendly materials and the incorporation of vegetation in the development of the property, which could retain the organisms currently inhabiting the area, would to a large extent reduce the negative effects of the development (see mitigation of habitat loss). Construction and overall planning should also consider the possible impacts of severe weather. Particularly sensitive facilities, such as waste management, should be constructed so that any damage incurred during severe weather or other incidental leaks of pollutants will be minimal.

ix. Monitoring of mitigation measures

The predicted impacts and the effectiveness of the proposed mitigation measures should be monitored during both the construction and operational phase of the construction.

15. Conclusion

A certain amount of habitat loss for species currently inhabiting the proposed development area is inevitable when developing. The area proposed for development has been used for agricultural purposes for many years and is still used today as grazing pastures. This can be seen from the relatively low level of biodiversity in the area, with vegetation consisting mainly of shrubs on disturbed land. However, there is biological value in the area mainly concentrated to the coastal area where a few Red-billed Tropicbirds were observed (with some possible nesting sites on the cliff side). In addition, larger gatherings of birdlife and butterflies were overserved in small hotspots in Area 2, and native iguanas (*Iguana delicatissima*) have been observed previously in Area 3. The general area is, however, not thought to support a significant population of iguanas or other vulnerable flora or fauna species due to its current and historical use, which is reflected in its current described status (disturbued). Loss of habitat for most species currently inhabiting the area can to a large extent be mitigated through the actions described in previous sections (with the exception of Red-billed Tropicbirds if the coastline is to be developed). For some species (e.g. *Iguana delicatissima*), careful planning and integration of certain vegetation in the development of the property can even improve the attractiveness of the area. It is recommended to retain as much vegetation as possible and integrate native vegetation into the development of the property, not only to minimize habitat loss but also to mitigate impacts such as soil run-off. Other impacts can to a large extent also be mitigated, with the prevention of soil run-off being particularly important in order to protect the marine environment in the area below and around Guyeau Estate.

References

Augustinus. P.G.E.F, Mees. R.P.M, Prins.M.1985. Biotic and abiotic components of the landscapes of Sat. Eustatius (Netherlands Antilles). Publ. Found. Sci. Res. Sur. Neth. Ant., Utrecht,The Netherlands. 116, 104 pp.

Bisset.R. 1996. Environmental Impact Assessment: Issues, Trends and Practice, prepared for the United Nations Environment Programme (UNEP).

Boldingh. 1909.The Flora of the Dutch West Indian Islands St. Eustatius, Saba and St. Martin. E.J. Brill, Leidem (1909)**.**

de Freitas. J.A, Rojer. Nijhof. B.S.J, Debrot. A.O. 2012. A landscape ecological vegetation map of Sint Eustatius (Lesser Antilles). IMARES Wageningen UR report C053/12 –june 2012.

Dennis, R.L., 2004. Butterfly habitats, broad scale biotope affiliations, and structural exploitation of vegetation at finer scales: the matrix revisited. *Ecological Entomology*, *29*(6), pp.744-752.

Holway, D.A., 1991. Nest-site selection and the importance of nest concealment in the Black-throated Blue Warbler. *Condor*, pp.575-581.

Posthouwer.C. 2016. Sustainability of Wild Plant Extraction on the Dutch Caribbean Island Sint Eustatius. Naturalis Biodiversity Center, Leiden University, Darwinweg 4, P.O. Box 9517, 2300 RA Leiden, The Netherlands.

Renkema.W. 2016. Kaarten van de Nederlanse Antilles: Curaçao, Aruba, Bonaire, Saba, SintEustatius en Sint Maarten tot 1900. Leiden and Boston: Brill Hes & De Graaf.
Roobol.M. J, Smith. A.J. 2004.Volcanology of Saba and St. Eustatius, Northern Lesser Antilles.Amsterdam: Koninklijke Nederlandse Akademie Van Wetenschappen, 320 p.

van Andel, T., van der Hoorn, B., Stech, M., Arostegui, S.B. and Miller, J., 2016. A quantitative assessment of the vegetation types on the island of St. Eustatius, Dutch Caribbean. *Global Ecology and Conservation*, *7*, pp.59-69.

Vanderwerf. E.A, Young. L.C. 2014. Breeding biology of red-tailed tropicbirds phaethon rubricauda and response to predator control on O'ahu, Hawai'i. Marine Ornithology 42: 73–76.

Veenenbos. J.S.1995. Aerial photo-interpretation and analysis for soilsurvey and land classification purposes. Vol 12, 1955–1956, Pages 376-381. Photogrammetria.

Westerman, J.H, Kiel.H. 1961. The geology of Saba and St. Eustatius: with notes on the geology of St. Kitts, Nevis, and Montserrat (Lesser Antilles).Utrecht Natuurwetenschappelijke Studiekring voor Suriname en de Nederlandse Antillen.

Protocol, Handbooks, Reports and Websites

Maitz. A. BioCarib. Jan 2018. Environmental Impacts Assessment for the Proposed Development of a Marina on the East Coast of St Eustatius

Environmental pollution center
https://www.environmentalpollutioncenters.org/construction/ accessed 27 MAR

Nature Policy Plan for the Caribbean Netherlands 2013-2017

Legislation Handbook for the National and the Marine Park of St Eustatius: Version 1 July 2008 p1-94. St Eustatius National Park, Dutch Caribbean Nature alliance
SPAW Protocol Adopted at Kingston, Jamaca on 18 January 1990.

St. Eustatius Historical Weather Data. 2018.
(http://seawf.com/rainhist.php, accessed 17 March 2018).

Nurse, L. 2017. Climate Change Impacts and Adaptation for Coastal Transport Infrastructure in Caribbean SIDS

(http://unctad.org/meetings/es/Presentation/LNurse_UWI_JAMWorkshop_p02_en.pdf, accessed 18 March 2018).

Appendix 1

Figure A1. Example of vegetation descriptions; Grass (A), Coralita covered area (B), Lower shrub (C), Higher shrub (D), Trees (E).

Regulations

Review of the regulations of the Spatial Development Plan

I.
This review plan may be cited as ‘Estate Guyeau'.

II.
On the grounds on which this review plan applies, the provisions and regulations of the Spatial Development Plan Sint Eustatius, as adopted on April 29, 2011, shall apply by analogy, provided that:

The following articles are added to the regulations of the Spatial Development Plan:

Article 1 Nature - 1

1.1 Destination description
a. The lands designated as 'Nature' are intended for the preservation, restoration, development and management of landscape, natural and ecological values.
b. Recreational activities in the form of walking, cycling and picnics are allowed.
c. In addition to the aforementioned functions, roads, paths, watercourses, water bodies, water storage facilities and facilities for preventing erosion are also permitted.

1.2 Building regulations
Building on land designated as a 'Nature' destination is subject to a number of regulations. These include:

1.2.1 Buildings
a. A building may:
1. not have a larger area than 50 m²; and
2. not have a greater building height than 4 m.

b. In deviating from the provisions under sub-article a, buildings may be built according to the existing situation, if the heights and areas indicated in this article restrict the existing situation.

1.2.2 Construction work, non-buildings
Only non-building construction may be erected for the management, restoration and development of the landscape, natural and ecological values; these structures must not have a building height higher than 5 m.

1.3 Building permit

1.3.1 Activities

Some activities may not be carried out without a permit from the Executive Council, given the existing landscape, natural and ecological values and qualities and the likelihood of erosion. This includes the following activities:

a. Raising or digging up of the grounds.
b. The application of surface pavements.
c. Carrying out activities that may have consequences for water management.
d. Carrying out activities that can lead to erosion.
e. The construction of roads and paths.
f. The extraction of sand or other minerals.

1.3.2 Conditions

The Executive Council can only grant this permit if the landscape, natural and ecological values of the area have not been affected and if there are no negative effects in the context of water management or erosion.

1.3.3 Routine maintenance

A building permit is not required for the performance of routine maintenance.

Article 2 Recreation-1

2.1 Destination description

a. The grounds labelled as 'Recreation' destinations are intended for hotels, schools, diving schools, restaurants, leisure-friendly apartment complexes, resorts, cafés, snack bars, bars, shops, market places and rental companies for recreational purposes and associated functions.
b. Houses.
c. For the aforementioned functions, 1 business residence is permitted per accommodation and recreation facility.
d. In addition to the aforementioned buildings and functions, the associated facilities are also permitted. These are roads, paths, green areas, play facilities, watercourses, water features, water storage, paved areas, gardens, parking facilities, utilities and facilities for the prevention of erosion.

2.2 Building regulations

Building on land labelled a 'Recreation' destination is subject to a number of regulations. These include:

2.2.1 Buildings

a. A building may:
    1. have an overall height that does not exceed 10 m;
    2. consist of maximum 2 building floors (with or without a roof);
    3. be no larger than 500 m²;
    4. be provided with separate buildings belonging to the dwelling with a total surface area of 50 m²;
    5. be built no less than 3 m from a plot boundary;
    6. be built no less than 3 m from a road;
    7. not be built in a location and manner that obstructs the view from another residential recreation building on the sea; and/or
    8. not be built in a location or manner that would impede public access to a beach.

b. The total surface area of the buildings may not exceed the percentage of the designated area indicated in the 'maximum construction percentage' indication.
c. The total number of dwellings may not exceed 50.
d. The total number of recreational units may not exceed 200.
e. A building for the management, maintenance, restoration and development of the landscape, natural and ecological values or for the benefit of agricultural activities may not have a larger area than 50 m² nor a building height higher than 4 m.

2.2.2 Construction work, non-buildings
a. A boundary and terrain demarcation may have a maximum height of 2 m.
b. A retaining wall may have a maximum building height of 1 m.
c. Any other non-building may have a maximum height of 5 m.

2.3 Further requirements
The Executive Council is authorised to impose further requirements on the location, size and design of a building. The council can do this with a view to the image, quality, values and qualities of the Marine Park and the publicly accessible character of the recreational area.

2.4 Exemption from the building regulations

2.4.1 Exceptions
a. In special cases it is possible to have a building:
    1. with a flat roof;
    2. that is built higher than the indicated building height;
    3. that is closer to a plot boundary, or to build a road that is closer than the indicated distances; and/or
    4. that is built in such a way that the sea view from a residential recreation building is hindered.
b. In some cases, higher retaining walls can be built.

2.4.2 Conditions
Any of these conditions are only possible when the Executive Council grants an exemption. The council can do this if the members believe that:
a. In the exemptions referred to under subsections a, b and c, no material harm will be done to:
    1. the quality of the recreational area;
    2. the environmental situation; and
    3. the usage possibilities or the view of the adjacent grounds.
b. With the exemption under subsection d, no negative consequences of the construction are to be expected, which must be apparent from agreement between the parties involved (the applicant and the person whose unobstructed sea view is lost due to the erection of a residential recreation building).
c. The retaining walls show that they have the correct shape, construction and strength.

The exemption for increasing building height may not lead to an overall height of more than 3 m above the maximum permitted building height.

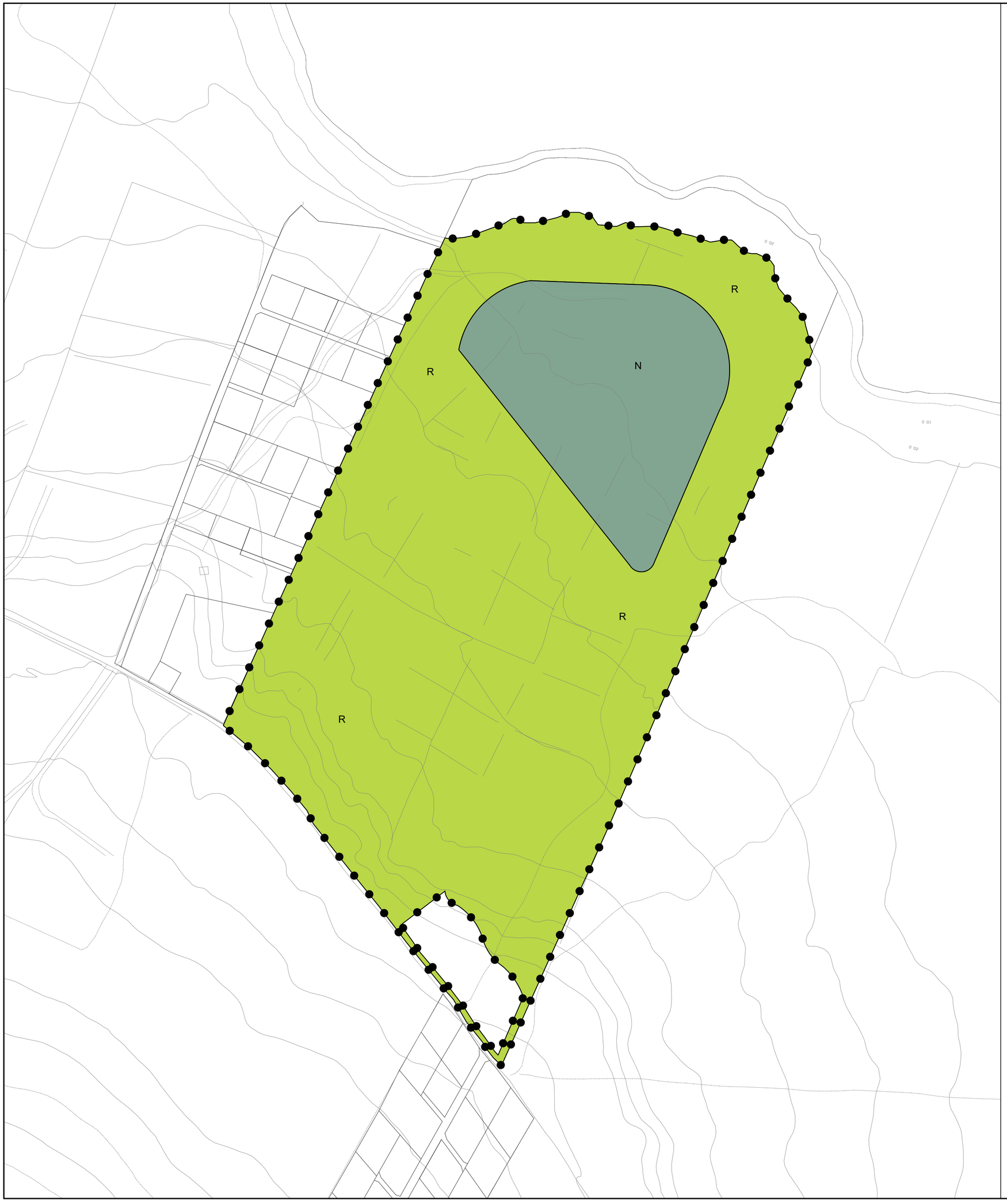
2.5 Building permit

2.5.1 Activities
In view of the known values and qualities and the likelihood of erosion, some activities may not be carried out without a license from the Executive Council. This includes the following activities:
a. Raising or digging up grounds.
b. The application of surface paving.
c. Carrying out work that may have consequences for the water management.
d. Carrying out activities that can lead to erosion.
e. The construction of roads and paths.

2.5.2 Conditions
The Executive Council can only grant a building permit if the natural and ecological values of the Marine Park area will not be affected and there will be no further negative effects in the context of water management or erosion.

2.5.3 Routine maintenance
A building permit is not required for the performance of routine maintenance.

2.6 User instructions
It is prohibited to use the (non)buildings and sites or to allow them to be used if that use is in direct violation of the destination and its regulations. The Executive Council may grant exemption from this prohibition upon request if there is no urgent reason that would limit a most efficient usage thereof.



Spatial development plan area

Boundary

Regulation

N Nature

R Recreation

Sint Eustatius

Estate Guyeau

SPATIAL DEVELOPMENT PLAN

N

project	20171873		
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