

A management plan for Spaans Lagoen

Aruba

November 2017



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Background and context

This management plan is one of the outputs of a two-day participative management planning exercise led by Dr. Lawrence Jones-Walters of Wageningen Environmental Research (Alterra) for the staff of the Arikok National Park and invited stakeholders held at the University of Aruba 3-4 April 2017. It therefore represents a combination of Park, stakeholder and expert views, experience and knowledge of the key issues in and around the Spaans Lagoen and their potential solutions. Spaans Lagoen is a Ramsar site Ramsar Site and became an extension to the Park in February 2017. The provision of a management plan is therefore a critical element in the future protection, management and restoration of the site as one of the key elements within the natural heritage of Aruba.

This document is intended as a reference point for staff at the Arikok National Park, key stakeholders and potential funders in order to assist their planning and thinking in relation to the management of the Spaans Lagoen and its status as a Ramsar site, and in relation to the wider management of the Park itself. It focuses on the critical management issues for the short and medium term and will guide the management of Spaans Lagoen for the next ten years. After the end of the ten year period, a review of the management plan will take place and a new management plan will be produced.



Participants¹ in the management planning process on an excursion to the Spaans Lagoen, here pictured at the abandoned gold mill that overlooks the site (April 2017).

¹ See Annex 1 for a full list of participants and organisations represented

1. Origins, biological interest and socio-ecological importance of Spaans Lagoen

Ramsar site Spanish Lagoon, or in Papiamentu and Dutch ‘Spaans Lagoen’, is located about 10 kilometres southeast of the town of Oranjestad, on the southwest coast of Aruba. It is likely to have been formed some 4-6,000 years ago when a huge cavern in the porous, karstic stone which forms much of the south side of the island collapsed leaving a basin which then filled with sea water. The cavern would have been formed by the constant erosion of underground freshwater streams and rivers, particularly during the rainy seasons. After the collapse the seasonal rivers and streams would have brought fresh water and silt over-ground into the lagoon, slowly filling it up until it reached something like its current profile. At the same time mangrove would have formed around the fringes of the lagoon and it would have colonised with a range of other typical species, including corals, sponges, fish, crustaceans and bird life. Many of these are still present within the lagoon and can be seen there today.

It covers an area of 70 hectares and borders the most southern tip of Parke Nacional Arikok. It is the island’s most significant coastal lagoon. It is fringed by tidal mudflats and well-developed mangroves and has a narrow coastal inlet about 2 kilometres long and 200-500 metres (650-1,650 feet) wide. Spaans Lagoen represents one of the largest natural inland bays in the Caribbean. Its shores are still bordered with mangroves and, of particular importance for maintaining the biological diversity in the biogeographic region, it is an important nursery site for many species of reef fish and crustaceans. The area is a breeding site for many species of migratory and non-migratory bird species (Derix et al. 2013) and it supports a range of wintering and foraging wetland birds.



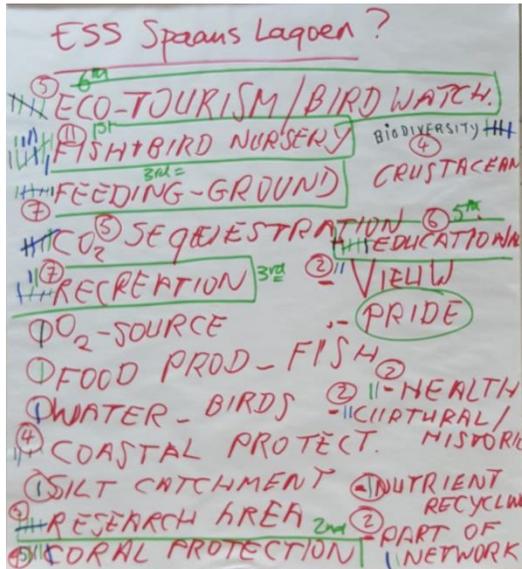
Spaans Lagoen viewed from the old gold mill. The shallow waters of the lagoon and the fringing mangroves can be seen in the middle distance, together with the fringing cactus thorn scrub (Lawrence Jones-Walters, April 2017)

The diversity of habitats in Spaans Lagoen support a great variety of ecological communities with several globally threatened species. It was designated as a Ramsar site in 1980 because of its importance as a feeding and breeding area for water birds and as a nursery area for a variety of fish species and crustaceans. The Ramsar status means that it has international importance for its wildlife interest and, in the context of the Dutch Caribbean islands, is one of the most valuable sites within the region. Because of its importance it is now included within the boundary of the Arikok national Park.

Ecosystem services are the direct and indirect contributions of ecosystems to human well-being and they, directly or indirectly, support our survival and quality of life. They can be categorized in four main types:

- **Provisioning services** are the products obtained from ecosystems such as food, fresh water, wood, fibre, genetic resources and medicines.
- **Regulating services** are defined as the benefits obtained from the regulation of ecosystem processes such as climate regulation, natural hazard regulation, water purification and waste management, pollination or pest control.
- **Habitat services** highlight the importance of ecosystems to provide habitat for migratory species and to maintain the viability of gene-pools.
- **Cultural services** include non-material benefits that people obtain from ecosystems such as spiritual enrichment, intellectual development, recreation and aesthetic values.

Like many natural and semi-natural ecosystems, Spaans Lagoen provides a number of ecosystem services that are vitally important for the economy and social well-being of the island. They include provisioning in the form of harvestable products such as food (fish) and regulating functions such as carbon sequestration (the capture and long-term storage of carbon dioxide) and water management (the mangroves slow the passage of water and the lagoon collects silt that would otherwise deposit itself on the coral reefs in the bay beyond, mangroves also serve a coastal defence function). Important cultural services that directly affect people and which are provided by the lagoon include ecotourism, birdwatching and the pleasure derived from informal recreation and hiking. Habitat or supporting services that are needed to maintain other services, and which include genetic diversity and maintenance of animal life cycles include the role the lagoon plays as an important breeding ground for birds, fish, crustaceans and a range of other animals. Many of these fish go on to populate the reefs and provide a source of food for commercial and recreational fishing.



A list of ecosystem services generated and prioritised by participants in the management planning process, April 2017.

Management is a critical issue for Ramsar sites in general and specifically for the Spaans Lagoen whose fragile ecosystems have the potential to suffer impacts from a number of different human activities and natural events. This management plan for the site is therefore important as it sets out a list of the most important/critical management issues and provides a number of short to medium term actions for addressing them.

Note: The Ramsar Information Sheet (RIS) for Spaans Lagoen contains specific information in relation to the species and habitats found within the site and references to numerous other sources of information. Further useful information is available from baseline studies carried out by the contractors who have constructed the new bridge across the mouth of the lagoon during 2016-17.

2. A Vision for Spaans Lagoen

The medium to long-term vision for Spaans Lagoen was generated by the participants to the management planning process in April 2017. It reads as follows:

The biodiversity, landscape and cultural heritage of Spaans Lagoen will be maintained, restored, enhanced and managed now and in the future for the benefit of the communities of Aruba and for the broader international environment. Spaans Lagoen will provide a regional and national example for the conservation, management and restoration of an internationally important wetland area.

The group work from which the overarching vision was derived.

An area that is protected and contains a sustainable + productive biodiversity for the benefit of the broader environment and the people of Aruba

To Realize A UNIQUE AND Sustainable wetland where Biodiversity is maintained with guided small scale ~~tourism~~ recreation

- Upscale - limited - VISITORS
- Special TOURISM trails
 - geology
 - ARUBAN HISTORY/ARCHAEOLOGY
 - Gold Mill (cultural historical)

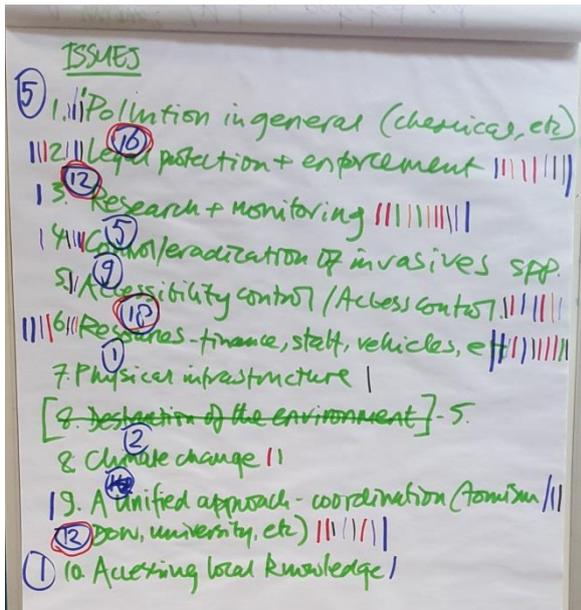
Being an local, Regional & International. example for conservation & Restoration of a resilient ecosystem where there is an optimal balance between the ecosystem services and conscious anthropogenic uses "Smart & Sustainable."

The spanish began:
A beautiful nature reserve sustaining biodiversity and life.
Where cultural heritage and balanced development provide a unique and wonderful experience for visitors and nature lovers alike.

Restored Rain
FOSTER BIODIVERSITY
UNIQUE SPOT/EXPERIENCE
MAKES US PROUD
BALANCED/Relaxed
MAJESTIC

3. Critical management issues for Spaans Lagoen

As part of the planning process a list of critical management issues were generated and prioritised in relation to achieving the vision. The issues are listed in the table below. They were combined with a further list of critical management issues provided within the 'Critical Management Issues' report that had previously been prepared by Wageningen Environmental Research (Jones-Walters, L., November 2016 mission report). As far as possible, duplication has been avoided in the final list and similar issues have been combined (thus, for example, pollution and climate change are included within habitat management and restoration as the responses to these issues are largely via actions that relate to the management and/or restoration of the site).



10 issues generated and prioritised by participants in the management planning process, April 2017.

The following table sets out and summarises the key management issues for Spaans Lagoen. In the detailed of the management plan that follows they are elaborated in the form of management objectives, described, their impacts are listed and actions are provided. These are prioritised and set out in the form of a short term management action plan at the end of the document.

#	Issue (combined and summarised to provide a manageable list)	Priority	Summary Description
1	Habitat and species management and restoration	7	Habitat and species management is one of the critical requirements for the protection and maintenance of Spaans Lagoen. It includes specific management related to the typical (and rare) habitats and species that are found on the site. It also addresses issues such as flood and water management, pollution and climate change (which were identified by the group as separate priorities, 9 and 10 respectively, but which are included here because they relate directly to site management).
2	Public access and recreation (and physical infrastructure)	5	Also a management related topic but identified as having sufficient priority to be treated as a separate issue. The solutions to the problem of formal and informal recreation are found within the area of habitat and species management and restoration, but also within the general topic of communication

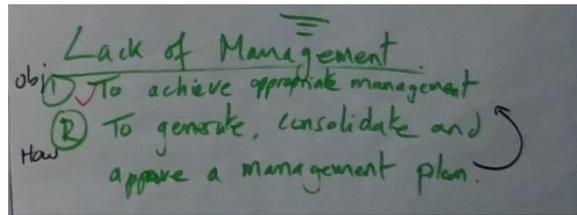
#	Issue (combined and summarised to provide a manageable list)	Priority	Summary Description
			and the creation of physical infrastructure (which was originally given a separate heading as an issue by the group).
3	Specific/Alien invasive species management	8	Because certain species have such a significant impact on the lagoon, they are included within a separate issue rather than within general habitat and species management.
4	Legal protection and enforcement	2	Whilst legal protection and enforcement are together wider issues that involve a range of stakeholders beyond the scope of the national Park (e.g. decision and policymakers within other ministries, the police, etc.) it was seen as the second highest priority by the management planning working group. The actions that can be delivered, which may include better and wider communication, signage on site, etc. should certainly therefore be considered within this management plan. This topic includes the issue 'built and other development'.
5	Research and monitoring	4	Research and monitoring provides an important basis for effective decision-making about management, communication and a range of other actions. It is particularly important for restoration work in order to establish the success or otherwise of work that has been carried out, and should be standard issue to be considered in relation to the opening/closure of new and existing trails and other means of formal or informal access.
6	Communication	12	The successful delivery of solutions to many of the above issues will require effective communication. It is therefore important that this topic is given separate consideration within the management plan. Issues listed by the group and included under this heading are 'A unified approach' which is about bringing together the key stakeholders in order to gain joint ownership for the development and delivery of actions and solutions, and 'Accessing local knowledge' which is largely driven by communication with key local actors.
7	Resources	1	Specifically, resources are required in terms of finance, staff, vehicles, etc. in order to carry out the day-to-day management of the site and to deliver specific-special tasks. This document and its associated action plan should be viewed as a bidding document for resources in that it is based on a joint agreement about needs and priorities for the present and future protection and management of Spaans Lagoen.

4. Objectives and management actions

Following the work carried out by the group to derive an overarching vision for the site and the development of a list of issues, objectives were generated in relation to the key issues. These objectives provide the basis for deriving solutions and actions. The following section therefore sets out the objectives linked to solving each of the issues, in relation to achieving the long term vision. The key areas for action are listed under each objective, described with their impacts and actions are provided. The prioritised actions provide the basis for the short term action plan.

4.1 Habitat and species management and restoration

Objective: To secure the long term protection and maintenance of species and habitats through achieving and applying the appropriate management to the site and its surroundings.



4.1.1 Habitat and species management

Issue	Description	Impact	Potential action
Mangrove management	In general the mangroves can be allowed to develop through natural processes. However, there will be circumstances where they need active management: - when the creation of new waterways or areas of open water is beneficial for ecosystem and its associated wildlife; - when the mangroves encroach too far into existing watercourses or areas of open water (and in relation to the newly constructed bridge) and may need to be cut back and controlled.	The impact of mangrove management should be either positive for ecosystem and its associated wildlife or, if it is a requirement of the bridge maintenance or the maintenance of essential watercourses, it should have neutral impact. The creation of new watercourses and/or areas of open water will provide habitat diversity, increased potential for the movement of fish and other wildlife through the site. Cutting back of mangroves for essential maintenance should be carried out to avoid dieback and/or death of the mangrove trees themselves thereby reducing impact to a minimum.	Areas that suggest a potential for creation of new watercourses and/or areas of open water are included within the mangrove restoration plan. The work will require a cautious approach, avoiding excessive disturbance to local wildlife (e.g. avoiding breeding/spawning season as far as possible, etc.). Once created there will be a minimal requirement for cutting back the encroaching mangroves on a 3-5 year basis. Essential maintenance should also be carried out only when necessary and to avoid excessive disturbance to local wildlife. These requirements are also included within the mangrove restoration plan.
Flood management	Flooding, either as a result of extreme weather events or as part of the normal weather (e.g. rainy season), is a	The chief impact of increased flooding and/or the movement of an increased volume of	There is little that can be done in relation to changing weather patterns themselves. However, restricting the creation of new dirt tracks and

	<p>natural part of the ecological processes that take place within the lagoon. However, changing weather patterns indicate that there will be more extreme weather events in the future and their impact is increased by factors such as the creation of dirt tracks and roads, hard standings and other structures that allow the water to run off the land more quickly into watercourses.</p>	<p>water through the 'roois' (dry river beds) and into the site are likely to be that more silt is taken into the lagoon and the reefs beyond.</p>	<p>reducing the area of land that is converted and cleared for agriculture will reduce the speed of water flow and therefore the erosion and transport of silt. The provision of silt traps, located within strategic parts of the northern part of the lagoon may help to limit the impact of siltation. The silt traps are likely to require ongoing maintenance; thus, every 2-3 years they may require emptying using earthmoving machinery.</p>
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4.1.2 Habitat restoration

Compensation for the loss of mangrove habitat was implemented in April 2017 following extensive discussion and negotiation between DOW, ODINSA (the contractor) and Alterra. Subject to discussion and agreement with local experts and stakeholders this has been carried out (relatively quickly and without great financial expense) at the northern end of the lagoon by creating graded (deep and shallow) scrapes, providing open water habitat for the recolonization/ restoration of mangrove and the provision of feeding habitat for birds (and possible spawning areas for fish).

Issue	Description	Impact	Potential action
Mangrove restoration	<p>The need to restore mangrove has been linked to the loss of mangrove habitat because of bridge construction over the mouth of the lagoon.</p>	<p>The provision of a greater area of mangrove habitat through restoration will provide increased bird breeding habitat, fish spawning areas and other benefits to the biodiversity of the site. It is however important to avoid reducing the area of existing bird feeding grounds; the waders and other species use a number of areas of open silt/sand habitat for feeding and foraging and, if the mangrove restoration is inappropriately located, there is a danger that a proportion of this habitat will be lost.</p>	<p>Linked to the mitigation of the impact of the bridge construction, a plan has been developed for the implementation of mangrove restoration in the northern part of the lagoon (to the south of the Frenchman's pass). These works were implemented in April 2017 (see photomontage below). Important further actions for the short – medium term include: - biological monitoring to establish the colonization (or otherwise) of the restored area and to support decisions in relation to future management actions</p>

			<p>and in order to establish impacts (positive or negative) on the existing fauna and flora of the lagoon. (see also Monitoring section below);</p> <ul style="list-style-type: none"> - the organisation of volunteer action to plant mangroves within the restored area; - the ongoing maintenance of the restored area, e.g. to replace any failed mangrove shoots, to take any remedial action that might be required as a result of unexpected events (e.g. extreme weather events, etc).
	<p>In addition there is</p> <ol style="list-style-type: none"> 1) evidence of some impact to the existing mangrove through the (increased) siltation of the lagoon and 2) from aerial photographs it is possible to see where channels ran through the mangrove, now closed under sense canopy. 	<p>Further bird breeding habitat, fish spawning areas and other benefits to the biodiversity of the site could be created in the area to the east of the current restoration site. It offers the potential for the implementation of a similar approach.</p>	<p>A 'snaking' channel with a shallow profile could be dug between the current open water and the culverts under the Frenchman's Pass in the area illustrated below.</p>
		<p>The previous water course can be seen on the aerial photograph – marked by the yellow arrow. This suggests a potential route for a channel to be reopened in the mangrove; creating increased structural diversity in the vegetation and water courses and providing habitat for fish and bird breeding and feeding. The watercourse will assist in the overall monitoring and management of the site and, if used within strict guidelines, could allow for managed access by wildlife tourists.</p>	<p>The clearance of mangrove within the area of the previous channel.</p>

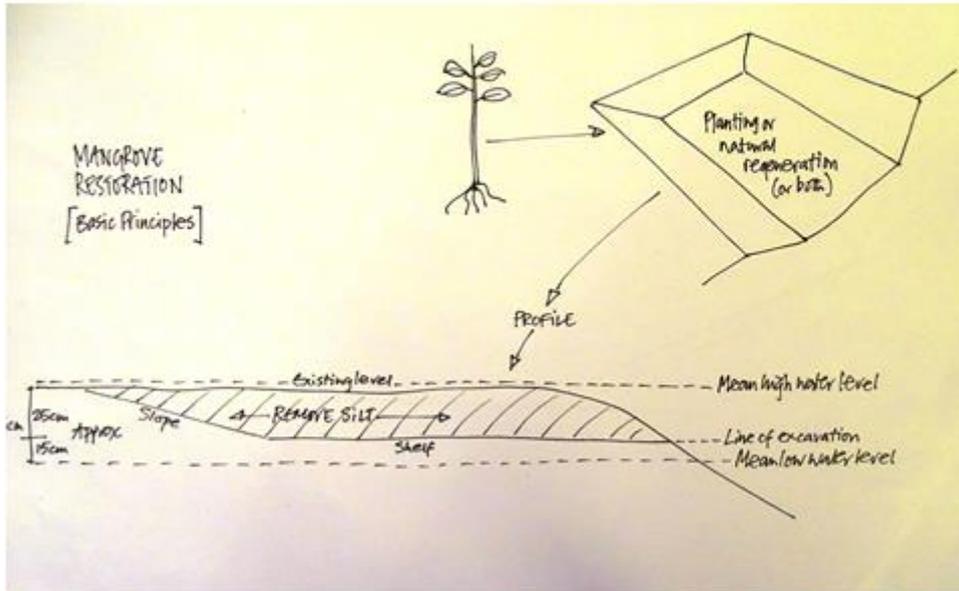


The lagoon prior to restoration work.

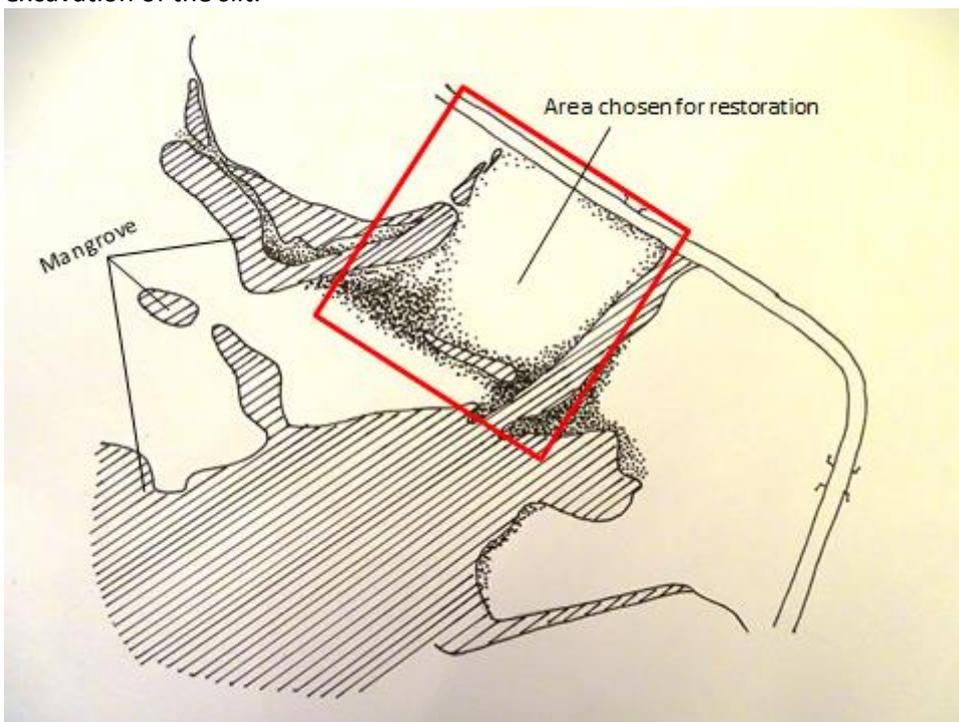


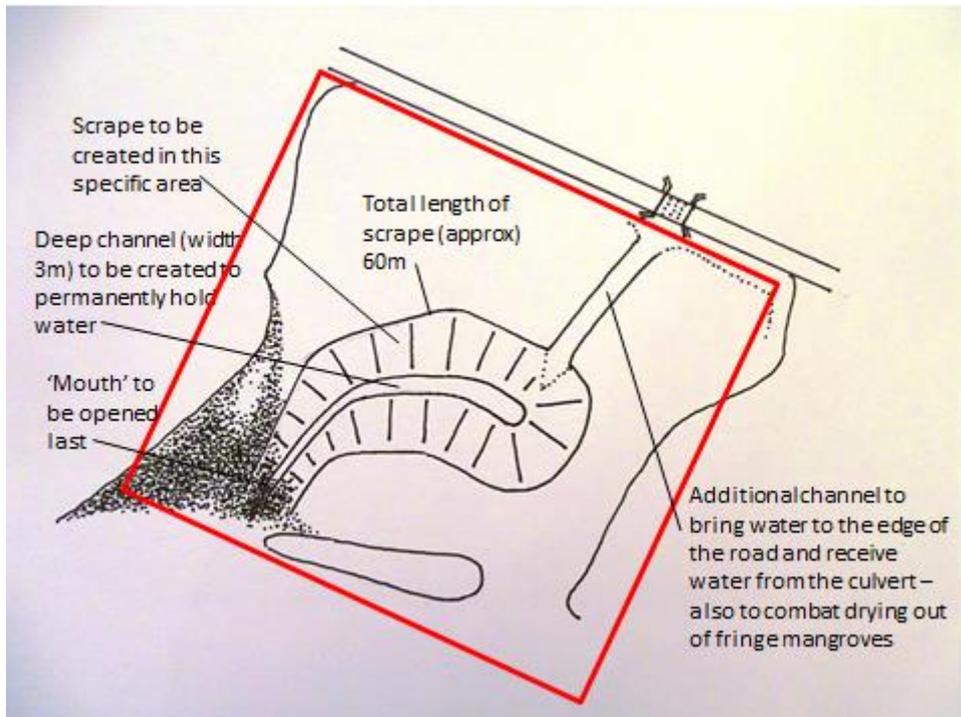
Natural regeneration of mangrove during the rainy season (November 2016). This illustrates the potential for natural regeneration if the circumstances are right and gives positive encouragement for the work planned. The specific size and location of the scrapes will be determined in the coming months together with local ecological experts.

General restoration principles

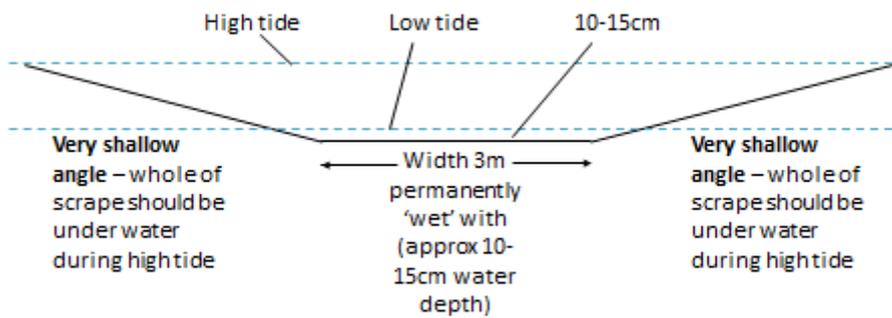


The following illustrations show the area proposed for the restoration and the basic design for the excavation of the silt.



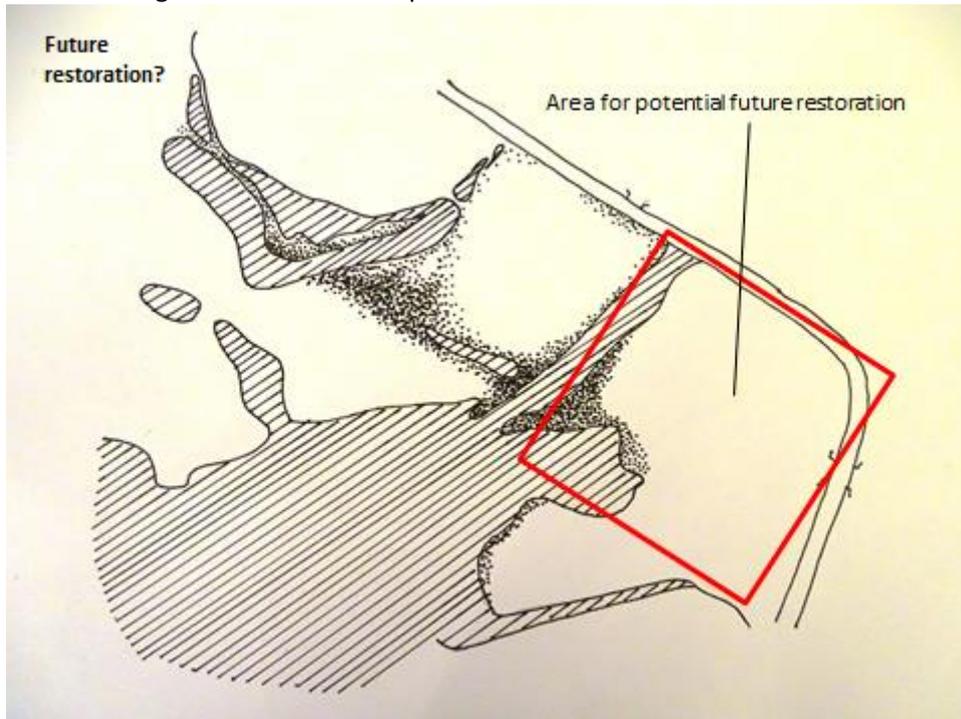


Profile



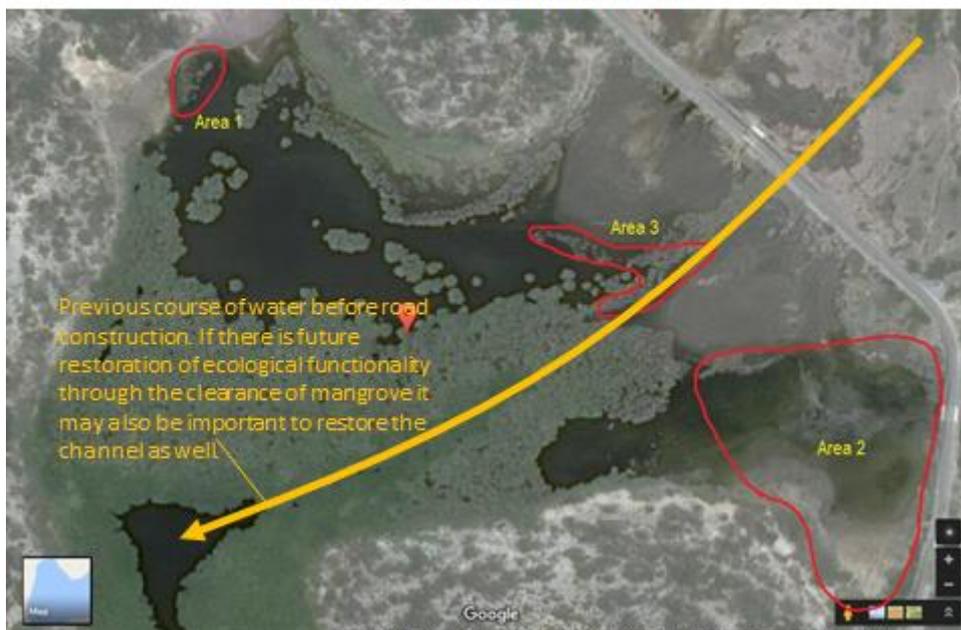


The following slides illustrate the potential areas for future restoration.



The area to the east of the current restoration area offers the potential for the implementation of a similar approach. A 'snaking' channel with a shallow profile could be dug between the current open water and the culverts under the Frenchman's Pass.

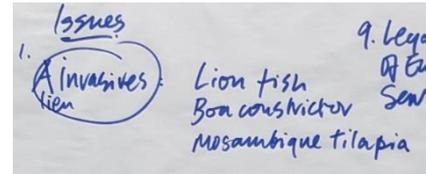
Future restoration?



The previous water course can be seen on the aerial photograph above – marked by the yellow arrow. This suggests a potential route for a channel to be reopened in the mangrove; creating increased structural diversity in the vegetation and water courses and providing habitat for fish and bird breeding and feeding. The watercourse will assist in the overall monitoring and management of the site and, if used within strict guidelines, could allow for managed access by wildlife tourists.

4.2 Specific/Alien invasive species management

Objective: To reduce and, if possible, eradicate those alien invasive species that impact most on Spaans Lagoen.



Recent studies have recorded 211 alien invasive species in the Dutch Caribbean, ranging from lionfish to boa constrictors, iguanas, plants and insects. These include 27 introduced marine species, 65 introduced terrestrial plants, 72 introduced terrestrial and freshwater animals and 47 introduced agricultural pests and diseases and this grows longer by the year (Dutch Caribbean Nature Alliance, <http://www.dcnanature.org/invasive-alien-species-strategy/>).

Issue	Description	Impact	Potential action
Alien Invasive Species	Boa Constrictor (<i>Boa constrictor</i>)	<p>The first five wild <i>B. constrictor</i> were documented on the island in 1999, and in 2000 the government of Aruba established a program whereby any <i>B. constrictor</i> found was collected, recorded, and euthanized. Despite these efforts a reproductively successful population had been established by 2005 (Quick et al., 2005). All size classes have been reported, from neonates to adults approaching 3 m total length, as well as gravid females (Quick et al., 2005). Ongoing research is determining the ecological impacts of this invasion, and initial dietary data suggest that <i>B. constrictor</i> snakes on the island eat various kinds of foods (Quick et al., 2005). There is concern that <i>B. constrictor</i> could directly compete with the endemic Aruba Island Rattlesnake (<i>Crotalus unicolor</i>), and there is already evidence of impact on populations of native wildlife, and even the possibility of preying upon domestic animals (Quick et al., 2005; van Buurt, 2011).</p> <p>The chief impact of this introduced snake species in the lagoon, where it is frequently encountered, is on breeding birds, in particular through eating eggs (and occasionally brooding adults). It is relatively indiscriminate and will</p>	<p>Removal and destruction of snakes from the lagoon by experts. This will only have a temporary (short-medium) effect as any snakes removed will be quickly replaced by others which arrive from the surrounding habitat. However the regular removal of snakes will have a positive effect on bird breeding and should therefore be carried out as a priority action.</p> <p>Clearly, the wider campaign for the removal and destruction of snakes from Aruba as a whole should be a long-term objective and the 2000 Government initiative could be restarted/ given fresh momentum.</p>

		target both tree and ground nesting species. See also Bushar et al (2015).	
	Mozambique tilapia (<i>Oreochromis mossambicus</i>)	The Mozambique tilapia (<i>Oreochromis mossambicus</i>) is a tilapiine cichlid fish native to southern Africa. It is a popular fish for aquaculture. It often lives up to a decade in its native habitats. Due to human introductions, it is now found in many tropical and subtropical habitats around the globe, where it can become an invasive species because of its robust nature. The Mozambique tilapia is an invasive species in many parts of the world, having escaped from aquaculture or been deliberately introduced to control mosquitoes. It has been nominated by the Invasive Species Specialist Group (ISSG) as one of the 100 worst invasive species in the world. It can harm native fish populations through competition for food and nesting space, as well as by directly consuming small fish. Due to their robust nature, Mozambique tilapias often over-colonize the habitat around them, eventually becoming the most abundant species in a particular area. When over-crowding happens and resources get scarce, adults will sometimes cannibalize the young for more nutrients. According to the ODINSA report on the ichthyofauna of the lagoon (INVEMAR, 2017) they were the most abundant/ dominant species in the lagoon so given the above this is significant cause for concern.	Electrofishing was an effective way to remove adults from a population during a project in Australia, but the removal was met with questionable success because the number of juveniles greatly increased as the adult numbers decreased (Thuesen et al. 2011). Discussion with experts in Alterra/ Wageningen Environmental Research and Animal Sciences Group suggests that 'targeted fishing' may be an effective way of reducing the numbers to the extent that they become less impacting on native species.
	Lionfish (<i>Pterois volitans</i> and <i>Pterois miles</i>)	According to the Dutch Caribbean Nature Alliance the recent arrival of the lionfish (<i>Pterois volitans</i> and <i>Pterois miles</i>) in the waters of the Dutch Caribbean has been a harsh reminder of just how rapid and extensive the damage caused by an alien invasive species can be.	If the lionfish appears in the lagoon then electrofishing (together with Tilapia) and targeted fishing would be suitable actions for its control.

		<p>Since their arrival (on Bonaire in 2009, so likely to be similar for Aruba) lionfish have become firmly established and they now pose a significant threat to the island's native reef and fish populations. However, the ODINSA report on the ichthyofauna of the lagoon showed no evidence of this species. It may therefore not have (yet) entered the lagoon from the nearby reefs – where it has been recorded.</p>	
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Note that the Dutch Caribbean Nature Alliance makes recommendations for the development of an invasive alien species strategy for Caribbean Netherlands (<http://www.dcnanature.org/invasive-alien-species-strategy/> and see also Smith et al, 2014). The key principles of the strategy are based on:

1. **Prevention**

- Develop and adopt guiding legal lists for action (**Black List, Alert List, Watch List**) enumerating the species for which border control is essential. T
- Install **effective border controls**
- Establish a special **Invasive Species Management Team** to coordinate data collection, evaluate information and initiate control and management
- Define **responsibilities and mandates**
- Create **public awareness** of the dangers of alien invasive species
- Regulate **access to property**, both public and private, to allow control officers legal access for pest control

2. **Early detection and eradication**

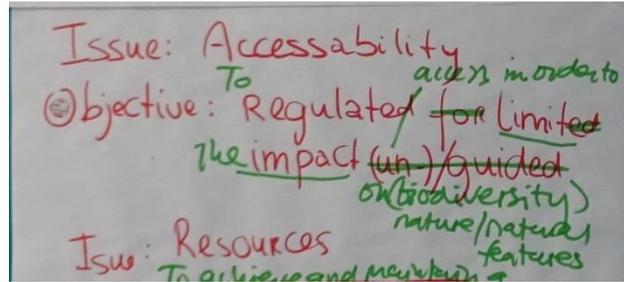
- Establish an **early warning system**
- Develop **actions plans** that describe the successive steps and decisions
- Ensure **public support**.
- Make **rapid surveys** to help experts decide what action(s) to take

3. **Implement control and management**

- Make **risk assessments** before deciding on the control method
- Improve **legal framework**
- Create an **information system** that will help report new discoveries as well as maintain and update critical information
- Create a **platform for cooperation**, ensuring participation of all relevant stakeholders.
- **Monitor** invasive species, focusing on the islands' borders to prevent the introduction of new species.

4.3 Public access and recreation (and physical infrastructure)

Objective: To regulate and manage the access to the lagoon in order to limit the impact on nature/ natural resources



Issue	Description	Impact	Potential action
Casual recreation	There are a number of points where the general public can enter the site for informal/semi-formal recreation. 1) A small informal car park at the north western end of the Frenchman's Pass. 2) The ruin of the gold mining facilities on the western side of the site; 3) Along the Frenchman's Pass. 4) The trail which runs along the west side of the site. At least two of these (2 and 4) are likely to be used by tourists in a semi-formal way.	Disturbance, in particular to feeding, roosting and breeding birds.	Provide signage to inform people of the interest of the site at the key entrance points and advice them of the appropriate behaviour (e.g. avoid littering, no hunting/shooting, restrictions to/management of fishing, etc.). See also the proposals for generic communication actions listed below.
Off-roading	When the tide is out and the conditions are dry it is possible to drive vehicles across both the northern and southern mudflats the lagoon, that may be reached by simply driving off the Frenchman's Pass. In addition, the small informal car park at the north western end of the Frenchman's Pass also provides access to the Western sand/mudflats which are attractive to four-wheel-drive vehicles as they spoil heaps from the gold extraction provide contours, dips and humps. The direct access from the car park has been closed off by DOW using a line of boulders; however, during	Disturbance, in particular to feeding, roosting and breeding birds. Direct damage to, for example, the breeding burrows of the Aruban Burrowing Owl; impacts on vegetation including the potential to damage the regenerating mangrove that can be found on the water's edge.	The signage referred to above should also contain messages for potential off-roaders. Clear signage should be provided along the line of the boulders in order to discourage off-roaders from moving them and/or entering the site. The perpetrators need to be caught in the act through policing activities by Park and other official authorities. Once apprehended suitable action needs to be taken. Thus, active policing of the site is a management recommendation. The larger areas to the north and south of the Frenchman's pass would also benefit from interpretative signage that can include messages for a

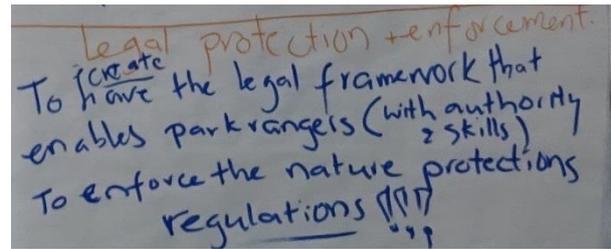
	the November 2016 visit it was clear that these had been levered to one side in order to allow vehicular access.		range of potential users, including off roaders. These should be located at the most likely entry points for these activities.
Paddle boarding and other organised recreation	At least one tour company takes groups on paddle boarding expeditions into the heart of Spaans Lagoen.	Disturbance, in particular to feeding, roosting and breeding birds.	Direct contact with the tour operators in order to discuss best practice with them; this could include direct monitoring of activities in order to establish the precise level of impact on birds and other species.
Fishing	Fishing is a regular activity carried out within the lagoon itself; it also takes place frequently (on an organised basis) along the channel that connects the lagoon to the sea.	Disturbance, in particular to feeding, roosting and breeding birds. Disruption of breeding and other activities by fish and (potentially) marine reptiles, e.g. turtles.	Involvement of the stakeholders (fishermen) in joint problem-solving with a view to managing the current activities to reduce the impact to a minimum.
Hunting	There is evidence to suggest that hunting takes place within the proposed Ramsar boundary of Spaans Lagoen. Clearly this is a highly disruptive and unwelcome activity.	Mortality of and disturbance to, in particular, feeding, roosting and breeding birds.	The perpetrators need to be caught in the act through policing activities by Park and other official authorities. Once apprehended suitable action needs to be taken. Thus, active policing of the site is a management recommendation. The proposed sign boarding and other communication media (above and below) should be targeted at a range of activities including hunting and hunters.

Generic actions: as well as the specific actions listed above there are a number of generic actions, largely related to communication, which could be carried out in order to improve the situation in relation to public access and recreation within Spaans Lagoen. These might include:

- Design and publication of a short information leaflet/flyer about *Responsible Practice within the Spaans Lagoen* that could be made available within hotel lobbies, the national Park office itself, circulated to tour operators.
- The development of a generic approach/communication media for use with tour operators and hotels in order to promote responsible practice in relation to all of the natural areas within the island, including the national Park itself.

4.4 Legal protection and enforcement

Objective: To utilise and/or create the legal framework that enables park rangers to enforce the nature protection regulations.



4.4.1 General Legal protection and enforcement

Issue	Description	Impact	Potential action
General enforcement/ implementation of nature protection regulations	<p>Whilst there is a legal framework for the protection of nature on Aruba it is not always consistently or effectively enforced.</p> <p>The lagoon is also a Ramsar site with international status as a protected area. This requires that certain obligations are met at Government level in relation to this status.</p>	<p>If activities are not regulated there is a danger of direct and indirect damage to the nature and other cultural heritage within the site. Typically this can involve direct loss of land area through agricultural improvement or building, disturbance to (e.g.) breeding and feeding birds through inappropriate recreational or other activities, or general illegal activities taking place within the boundary of the site.</p>	<p>A programme of education and training for key government officials and stakeholders in the content and content of the regulations would raise their profile as instruments for use and implementation.</p> <p>Park staff and the island police could participate in a joint training exercise to discuss and agree 'rules of engagement' for the actual on site implementation of the regulations (e.g. how and when to impose fines, prevent activities taking place, etc.).</p> <p>Simple and concise material could be prepared to communicate the key content of the regulations and their implementation, for use with government officials, police and key stakeholders.</p> <p>A number of specific actions are also listed/ covered in the sections below on 'Built and other development' and above in 'Public access and recreation (and physical infrastructure)'.</p>

4.4.2 Built and other development

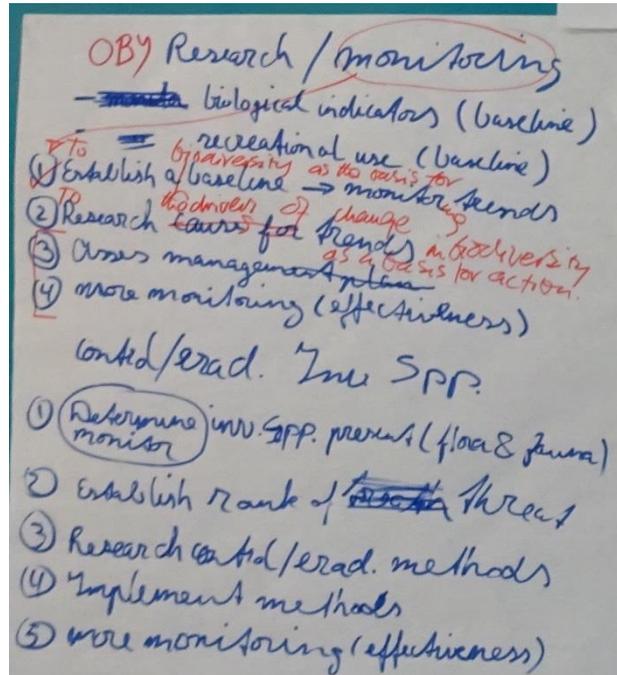
Issue	Description	Impact	Potential action
Existing domestic property	The site boundary currently includes a number of domestic properties. Whilst some are purely residential others appear to be farmhouses; in all cases the occupiers are carrying out activities around the properties that have the potential for impacting on the nature interest of the site.	The greatest impacts relate to actions (such as tipping, construction of temporary or permanent buildings, tracks and car parking areas) in and around the main property.	In the short term it is advised that informal contact should be made with the owners and occupiers of domestic property in order to open communication and provide a platform for discussion over the appropriate management of the land around their properties and to make them aware of the need to avoid potentially damaging actions. Rubbish and waste, and authorised temporary or permanent buildings should as far as possible be removed. Longer term actions could follow the overarching policy applied within the National Park itself, which is to buyout property owners altogether.
New buildings	The construction of new domestic properties and other permanent or temporary buildings is an occasional problem.	Impacts include direct damage and removal of habitat, disturbance to and destruction of species, impeding of water courses and the construction of associated road and other infrastructure in order to service the new buildings/ properties.	The planning process should avoid licensing any new construction. Any illegal construction should be penalised and removed.
Clearance for agricultural use	Clearance of land for growing range of crops/ providing grazing for domestic animals is an ongoing activity on the island. Recently land has been cleared within at least one of the main arroyos and on an area	Clearance results in the removal of scrub and cactus. Associated impacts therefore include direct damage and removal of habitat, disturbance to and destruction of species, impeding of and changes to water courses that to	Any applications for changing land use should be the subject of consultation with the relevant Ministry department and the National Park authority. The potential impacts can be judged, and potentially mitigated for, prior to any

	<p>of land adjacent to the old gold mine/factory.</p>	<p>gather can create the potential for increased erosion and siltation within the lagoon habitats themselves.</p>	<p>clearance taking place. If the impacts are considered to be too great then the development should be prevented. Unlicensed agricultural clearance should be reversed.</p>
<p>Roads and infrastructure</p>	<p>The Frenchman's Pass is the main transport infrastructure impacting on the site. It runs from east to west across the northern end of the lagoon and has created a barrier which fragments the site into two major parts. Two blocks of culverts allow the passage of water into the northern part of the site at high tide and to the southern part of the site during the rainy season.</p> <p>Existing domestic properties are serviced by dirt roads, some of them recently improved and widened; and the construction of new buildings and clearance for agricultural use are often associated with the construction of new roads and infrastructure (e.g. the provision of power lines, water supplies, etc). There are presently a number of dirt tracks within the site and one which runs up the line of Rooij Taki.</p>	<p>The Frenchman's Pass creates a barrier for the movement of fauna such as land crabs which may often be seen as roadkill. It also prevents the general free movement of water and associated fish and other marine life. The culverts have provided some mitigation for these impacts and fish can clearly pass through them when water levels are high (e.g. during the rainy season).</p> <p>The current dirt tracks which lead to existing domestic properties are likely to be a major source of silt during the rainy season and have no doubt contributed to the overall siltation of the lagoon.</p>	<p>Regular maintenance of the culverts under Frenchman's pass is essential for their long-term functionality. The road is an important connection between other transport links and it is therefore important to establish the most effective means of mitigation over time. The fact that the part of the site that lies to the north of the road regularly floods and, during the rainy season, is completely inundated is encouraging and suggests that it's ecological function will be at least partly preserved (and this part of the site is regularly used by wading birds and herons when it is under water). Crab migration is usually seasonal and, when there is an increased movement of crabs across the road, it might be helpful to provide signage to warn traffic to avoid them (or permanent signs can be placed on the side of the road).</p> <p>The provision of silt traps, located within strategic parts of the northern part of the lagoon may help to limit the impact of siltation. The silt traps are likely to require ongoing maintenance; thus, every 2-3 years they may require</p>

			emptying using earthmoving machinery.
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4.5 Research and monitoring

Objective: To establish a programme of research and monitoring to support the long term management and protection of the Spaans Lagoen Ramsar site and protected area.

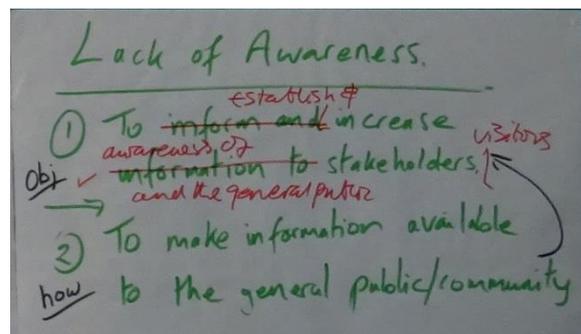
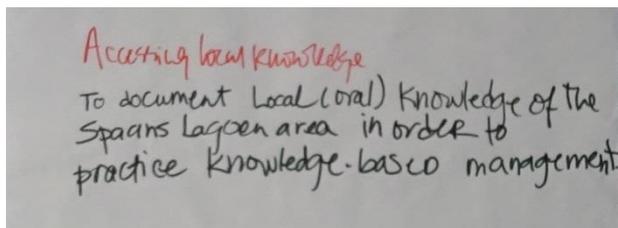


Issue	Description	Impact	Potential action
Research	The availability of basic data and information relating to the natural processes, species and habitats is an important component in supporting the decisions and actions that lead to the sustainable short-medium- and long-term protection and management of the site. Furthermore, specific studies targeted on individual species, groups of species or aspects of the habitats found within and around the site can provide valuable additional information for the fine tuning of management and can assist in the prioritisation of actions.	Improved 1) selection and prioritisation of management and other actions and 2) more effective and accurate decision-making in relation to the delivery and implementation of policy and practical work on site	A number of actions are suggested: 1) Desk study to review and collate relevant existing published and other information (note that data and information has been collated through a number of research projects that have been focused on the island and its associated wildlife interest, specifically via the development of this management plan and as a result of the writing process for the preparation of the Ramsar Information Sheet for the site). 2) A desk study to review the potential impacts of environmental change on the site; leading to action and further research but focusing specifically on the

			<p>impacts of climate change, more frequent and more extreme weather events (also related to climate change and leading to physical effects such as siltation and erosion)</p> <p>2) Gap analysis of the above desk studies in order to identify specific areas for future research, data collection and information provision.</p> <p>3) Based on 1 and 2 above, the development of a research agenda to identify and prioritise specific areas within which research is required in order to support better decision-making in relation to the protection and management of specific species and habitats, the control (for example) of the identified alien invasive species and the management of activities such as fishing and tourist-based recreation.</p> <p>4) The inclusion of specific research elements within the prioritised short term action plan if and as appropriate.</p>
Monitoring	Monitoring allows policy/ decision makers and managers to review and understand the impact of their actions and, on the basis of that review, to continue, stop, change and/or modify their actions in order to maintain or improve the results that they have achieved. Monitoring is particularly important in order to demonstrate success in relation to	Improved 1) selection and prioritisation of future management and other actions and 2) decision-making in relation to maintaining or changing the delivery and implementation of policy and practical work on site and 3) funding potential	Monitoring actions include: 1) Monitoring of the recently completed restoration work; specifically use of the area by birds and fish and the appearance of regenerating mangrove. 2) Bird monitoring; breeding, migrating and feeding bird species and numbers

	<p>funding; and can therefore contribute to future efforts to secure funds and the identification of future priorities for funding.</p>		<p>3) Fish monitoring; presence-absence recording, breeding/spawning</p> <p>4) Monitoring (leading to specific controlling actions) of alien invasive species: boa constrictor, and lion fish.</p> <p>5) Monitoring of physical and other environmental effects associated with the impacts of climate change, extreme weather events, increased siltation and/or erosion, etc.</p>
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4.6 Communication



Objective: To improve the current and future management and protection of Spaans lagoen by raising general public and key stakeholder awareness of the importance and value of the site and engaging them in specific activities

Issue	Description	Impact	Potential action
Stakeholder involvement	<p>Spaans Lagoen is a site that is widely used by a range of stakeholders such as the local community, fishermen, tourism operators, those seeking cultural and natural heritage and wildlife enthusiasts. Beyond the actual use of the site another group of stakeholders within government, the national Park and NGOs is involved in policy for</p>	<p>The current impacts (described above in, for example, the section on legal protection and enforcement) are direct and indirect and in both cases result in the loss and/or deterioration of the wildlife interest of the site. Such deterioration does not only affect the internationally recognised value of the wildlife but has a knock-on effect on local communities who use the site for informal</p>	<p>Identify the key stakeholders.</p> <p>Development of a programme to engage the key stakeholders in one on one and small-group/ focus group meetings with the specific purpose of providing them with 1) increased awareness of the issues around the site 2) an opportunity to input their views and opinions on the present and future protection and</p>

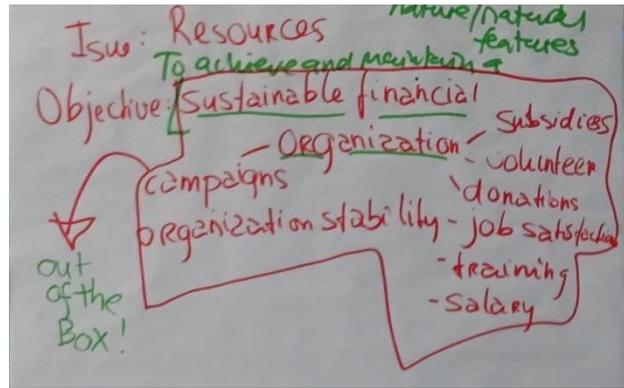
	<p>the protection and management of the site, the actual management of the site and the delivery of regulation and financial support. It is widely known that the involvement of key stakeholders in setting objectives for specific areas or issues, leads to greater ownership for the solutions and the likelihood of a commitment to their delivery either in relation to policy or practice. Stakeholder involvement should therefore be a significant part of the future protection and management of the site and is an activity that can be driven and taking forward by the Park.</p>	<p>recreation, fishermen who will lose spawning grounds and a range of others.</p>	<p>management of the site 3) a common, agreed vision for the site 4) ownership of the solutions and 5) a commitment to being part of their delivery.</p> <p>Leaflets targeted specifically at individual stakeholders/ stakeholder groups in order to raise their awareness of the issues and the potential opportunities for them in becoming more engaged in the future protection and management of the site.</p>
<p>Awareness raising</p>	<p>Many of the activities and potentially damaging operations that take place in and around the boundary of the site are likely to be carried out because of a lack of awareness. This low awareness relates to a number of factors including 1) the wildlife interest and its sensitivity to a range of impacts 2) the legal protection for the site and 3) the importance of the site at both national and regional level, including its international designation as a Ramsar site.</p>	<p>The impact of a lack of awareness are largely the same as those described above. With an increased understanding and awareness of the issues and other factors surrounding the site, people are likely to change their behaviour in order to reduce the impact of their activities. They continue to carry out those activities they can no longer claim that they were unaware making regulation and/or prosecution a more straightforward process.</p>	<p>Awareness raising can form part of an organised campaign under the general heading of 'communication'. A range of media and activities can be used to increase awareness.</p> <p>1) General leaflets explaining the interest and importance of the site, giving advice on how to avoid damaging the site and how to get the most out of a visit in terms of exploring the cultural and natural interest.</p> <p>2) Mentioned above - leaflets targeted specifically at individual stakeholders/ stakeholder groups in order to raise their awareness of</p>

			<p>the issues and the potential opportunities for them in becoming more engaged in the future protection and management of the site. Specific, priority target groups could include:</p> <ul style="list-style-type: none"> • Tour operators • Hotels • Government officials • Fishermen • Those owning properties within and just outside the site boundaries <p>3) A series of short YouTube videos to support the above, providing explanations of the interest and importance of the site, giving advice on how to avoid damaging the site and how to get the most out of a visit in terms of exploring the cultural and natural interest. Updates could include highlighting the arrival of migratory bird species to the site, particular other events and activities taking place on the site (such as community involvement in the mangrove restoration).</p> <p>4) the organisation of a range of events on the site that could include:</p> <ul style="list-style-type: none"> • Community involvement in mangrove planting/restoration • Guided tours to see the cultural and natural interest, targeted at the local community (but also worth considering for government officials and politicians, hotel
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			<p>and tour operators, fishermen, etc.)</p> <p>5) Set up a Facebook page and a Twitter account whose objectives are specifically to provide positive messages about the site and people's involvement in the site.</p> <p>6) Publish a newsletter to keep people informed and, in particular to promote success stories in relation to the site and its management.</p> <p>7) Develop an application for people to identify and/or record species that we see on the site.</p>
<p>Accessing local knowledge</p>	<p>A significant part of the heritage of Spaans Lagoen is provided by the wealth of local knowledge that people have about the past history and management of the site.</p>	<p>Such information can provide insights into how the site became what it is now in terms of the built, but also the natural heritage that it contains. For example, fishermen may be able to describe how the structure of the mangroves has changed over time (and there are already many stories to tell about the construction of the various bridges across the mouth of the lagoon and their impacts on the fish and other wildlife).</p>	<p>In conjunction with the University of Aruba, develop a programme for conducting video interviews of members of the local community, particularly those who have a long experience of living and working in and around the site.</p> <p>Subject to the agreement of the interviewees, consider making a short documentary movie/ movies in which local people are seen talking about the site in the past and present.</p>

4.7 Resources

Objective: To ensure sufficient and sustainable resources for the present and future management and protection of the site



Issue	Description	Impact	Potential action
Acquisition of sufficient and sustainable resources	All of the above activities require financial, staff and other resources in order to ensure their effective implementation and delivery. Spaans Lagoen has only recently been added to the Arikok national Park and there is therefore, presently, no specific budget allocated for delivering actions to ensure the present and future protection and management of the site.	Insufficient resources will result in less, limited or no action for the present and future protection and management of the site (which may potentially threaten the international and national status).	<p>A number of actions can be proposed:</p> <ol style="list-style-type: none"> 1) The delivery of a prioritised, short term action plan that can be the basis of a bidding document for financial and other resources (see section 5, also available as a separate document). 2) The identification of key government stakeholders (via the communication actions listed above) in relation to engaging them within the process and convincing them of the value for providing funding for specific actions identified within the short term action plan. 3) Together with key NGO/international partners find potential sources of external funding in order to deliver specific projects for the protection and management of the site, the engagement of local communities and stakeholders, etc.

5. Action plan priorities – Short Term Action Plan & Species List

The objectives and their associated action lists are relatively long containing a large number of potential actions. They mostly require funding and it is therefore important to develop a prioritised, short term action plan setting out the things that need to be done and which have the most importance for the coming 6-24 months. This plan can provide the basis for bidding for government and other funding sources (e.g. charitable foundations, EU funding streams such as BEST, etc.). This section has also been prepared as a separate document in order that it can be used more easily as the basis for discussion and negotiation with potential funders.

Additionally, a tentative ‘Species List Spaans Lagoen’ has also been prepared as a separate document, supplementing the management plan and short-term action priorities.

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DNM: Directie Natuur en Milieu

DLVV: Directie Landbouw, Veeteelt, Visserij

DIP: Directie Infrastructuur en Planning

DOW: Dienst Openbare Werken

ATA: Aruba Tourism Authority

CARMABI: Caribbean Marine Biological Institute

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