BIODIVERSITY ACTION PLAN

	NAME	POSITION	SIGNATURE	DATE
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Contents

1. INTRODUCTION

This document is the Biodiversity Action Plan (BAP) for the Tasiast gold mine in Mauritania, operated by Tasiast Mauritanie Limited S.A. (TMLSA), a wholly-owned subsidiary of Kinross Gold Corporation. The overall purpose of this BAP is to outline the actions for stakeholder engagement by the mine to effectively communicate the findings of past and ongoing biodiversity studies on interactions between the mine and the nearby Banc d'Arguin National Park (PNBA). TMLSA will monitor the effectiveness of the BAP through the Biodiversity Monitoring and Evaluation Plan (BMEP) as provided in this document.

1.1 Document Structure

The document below has the following structure:

1) **Introduction:** Outlines the objectives; description of the Tasiast mine; and existing lender and policy requirements.
2) **Biodiversity context**: Overview of biodiversity of Tasiast and the PNBA, summarizing information which is presented in full in the EIAs and an ecohydrology report.
3) **Managing Impacts to Biodiversity**: Summary of on-site management and reference to relevant detailed documentation; the past and on-going assessments of risks off-site; and a description of additional actions being implemented concerning stakeholder engagement.
4) **Timeline and Action Plan:** Matrix of activities to implement the BAP.
5) **Biodiversity Monitoring and Evaluation**: Summary of the Tasiast approach to monitoring biodiversity and the specific actions being taken in the BMEP to monitor effectiveness of the BAP.

1.2 Objective

The overall objective of this BAP is to guide implementation of a program to engage with key stakeholders on biodiversity-related issues outside the mine site. The BAP aims to adequately engage and involve key stakeholders on biodiversity related issues, to understand their concerns, and provide relevant assessment and monitoring information in a way that is suitable to address their concerns. The effectiveness of the BAP is then assessed through the BMEP. As such this BAP differs slightly from BAPs prepared for other large-scale developments (e.g. the Oyu Tolgoi mine in Mongolia) in that it largely focusses on stakeholder engagement, rather than the application of on-the-ground mitigation or biodiversity conservation measures which are instead addressed through the Biodiversity Resource Management Plan.

1.3 Project Description

The Tasiast gold mine is located in north-west Mauritania in the western Sahara Desert, approximately 60 km east of PNBA, a UNESCO World Heritage Site (WHS) and Ramsar Site (Figure 1). The mine began operations in 2007 and was acquired in 2010 by Kinross Gold Corporation (Kinross) from Red Back Mining. The operational mine area (hereafter referred to as the area 'within the fence line') covers an area of approximately 12,300 ha. Of this, the total area of currently occupied by mine activities is approximately 2,500 ha while expansion covering another 1,300 ha is expected over the life of the mine. This consists of the pits, mill, rock waste dumps, tailings facilities, offices and residential areas, an airstrip and other mine infrastructure as shown in Figure 2. A 60 km access road leads to the mine from national highway N2.

Figure 1: Location of PNBA and Tasiast mine in Mauritania

On commissioning, the mine had a predicted life of ten years at a nominal milling rate of 3,200 tonnes per day (t/day). In 2011-2012 as a consequence of identifying further gold resources through its continuing exploration within the mining license area, TMLSA completed several environmental assessments and permitting to increase the milling rate. With recent construction efforts, the current milling rate is approximately 15,000 t/day with a life of mine until 2034.

Water for mine operations is supplied through 44 operational abstraction wells (*Sondage* wellfield) located 60 km to the west of the mine site and 25 km to the east of the coast, 5 km east of the eastern boundary of the PNBA. The wells are oriented north-to south over a distance of approximately 20 km, producing only saline water, which is transmitted to the mine site via a pumping station and three

pipelines that run parallel to the mine access road (Figure 3). Power to the wells and pumping station is provided from the mine via a 33 kV distribution line which runs alongside the access road.

The aquifer was selected to provide the mine water supply due to its highly saline nature and its location being >80 m below ground level, meaning that it was neither of use as a potential water supply for local communities nor provides baseflow to any surface drainages or ecosystems. Current water extraction rates are 13,000 – 15,000 m^3/day, with permitting authorizing up to 30,000 m^3/day.

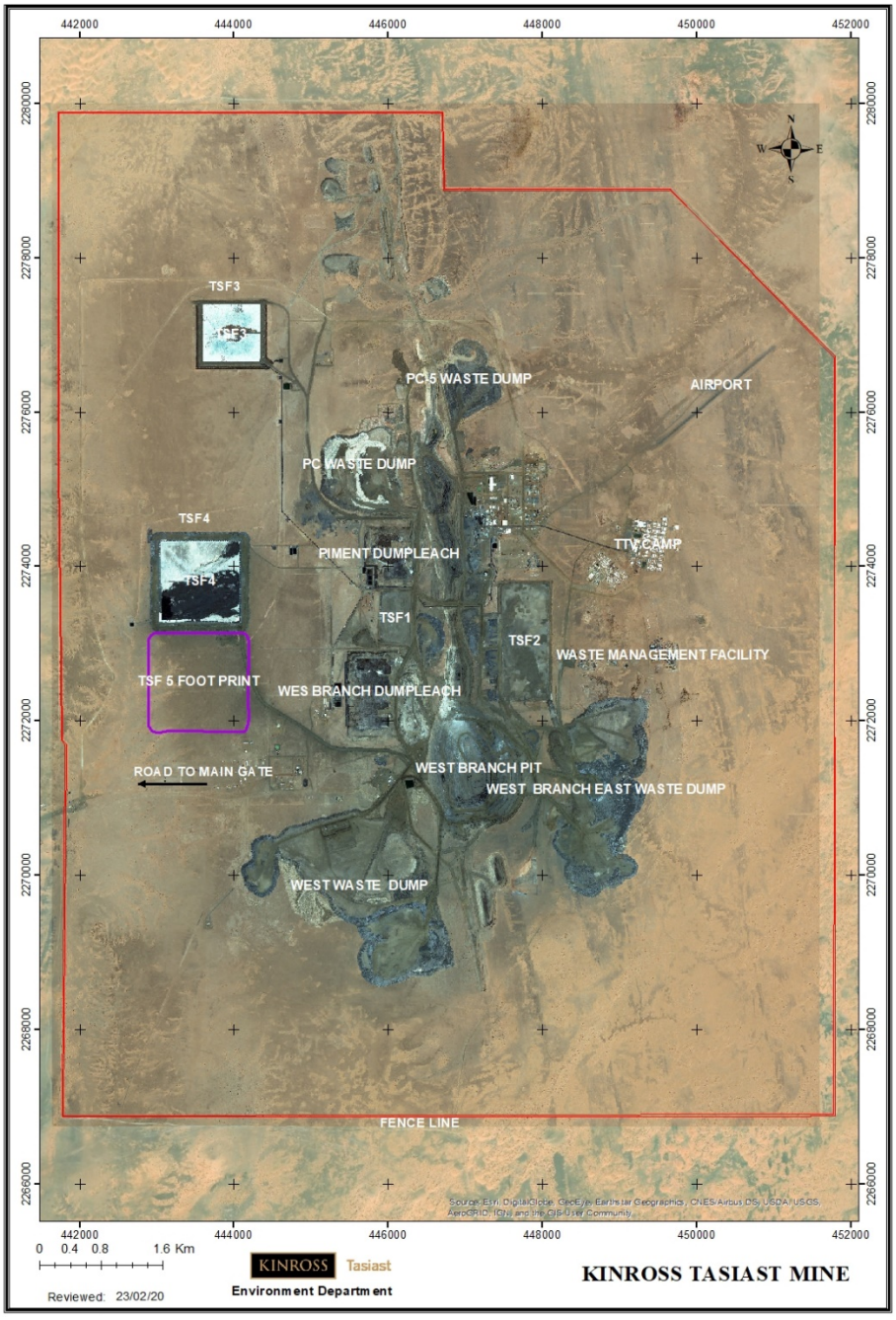

Figure 2: Tasiast mine site infrastructure

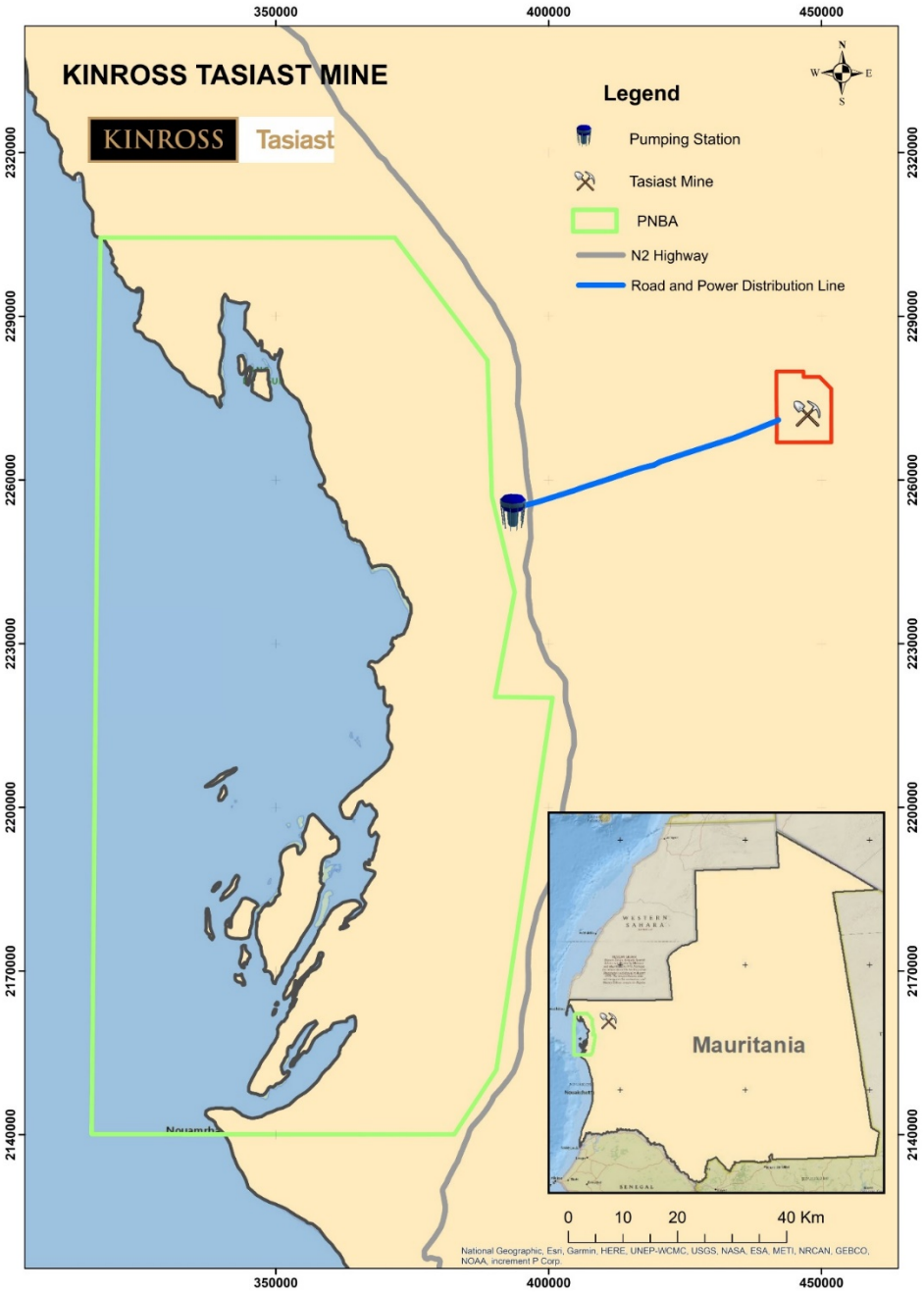

Figure 3: Tasiast mine location in relation to PNBA

1.4 Lender Requirements

TMLSA has secured financing from the International Finance Corporation (IFC) and Export Development Canada (EDC), and thus is required to align with the IFC Performance Standard requirements, including PS6 on biodiversity conservation and sustainable management of living natural resources (IFC 2012). For Tasiast these requirements include:

- Evaluating impacts to biodiversity and applying the mitigation hierarchy to achieve No Net Loss, where feasible, for Natural Habitat;
- Managing impacts to priority ecosystem services which the mine impacts, or depends upon; and

- Managing the introduction and spread of invasive alien species.

Additionally, the Environmental and Social Action Plan (ESAP)[1] for the TMLSA financing also requires a Biodiversity Action Plan (BAP) and Biodiversity Monitoring and Evaluation Plan (BMEP) which is the basis of this document.

1.5 Corporate Framework & Policies

This BAP is part of the Tasiast mine Environmental Management System (EMS), where it is subsidiary to the Tasiast Biological Resources Management Plan (BMRP). The BRMP is defined by Kinross Standard 10.10 on Biological resources.

Other related Standards include: Standard 1.1 Environmental Policy; Standard 1.4 on Environmental Reporting; Standard 1.2 Communication and Consultation; and Standard 12.1 Environmental Monitoring.

The Tasiast EMS ensures that the mine complies with the Kinross corporate Safety and Sustainability Policy (2019). The Safety and Sustainability Policy outlines the main principles of Kinross corporate responsibility:

- Do no harm – including "*Environment: We protect the environment by proactively managing the environmental risks associated with our operations, protecting air and water quality, optimizing consumption of water and energy, protecting biodiversity and ensuring robust plans are in place for emergency prevention, preparedness, and response*."
- Making a positive contribution.
- Acting ethically and transparently.
- Continuous improvement.

At a corporate level the policy is overseen by the Safety and Sustainability Department. While at the Tasiast mine the EMS is the responsibility of the Health, Safety and Environment Department.

[1] The ESAP is a set of conditions regarding the management of environmental and social risk with the mine needs to meet as part of the financial agreement with lenders

2. BIODIVERSITY CONTEXT

2.1 Tasiast mine

The mine site is located in the North Saharan steppe and woodlands ecoregion (Ecoregion reference number PA1321), which extends over much of northern Africa (Olson *et al.* 2001). The natural landscape around the mine consists of dunes with sparse perennial vegetation, gravel plains (ergs) and ephemeral water courses (wadi). The majority of the area within the fence line now comprises of mine infrastructure, and disturbed areas as a result of mine activities. Much of the area within the fence line meets the IFC PS6 definition of Modified Habitat[2]. Some patches of Natural Habitat (*sensu* PS6) which retains most elements of the expected native biodiversity, remain around the fringes of the mine site (URS 2012; SRK consulting 2016).

The main habitat types as identified in a 2018 biodiversity study (FFMES 2018) at Tasiast are listed below.

Natural Habitat types:

"Accumulation type A" habitat: Vegetation where sand accumulates without creating dunes. This is typically either flat land supporting a few tree stems and sparse tufts of grass and some forbs, or, drainage lines where vegetation presence (including trees, forbs and herbs as well as grass) has allowed some sand to accumulate. The soil surface is sandy and soft, and may contain clay. Areas of this habitat area distributed through the area, including along drainage lines.

"Accumulation type B" habitat: Noticeable dunes in active form (changing with wind) where some vegetation is noted, although this is restricted to sand adapted species of grass and some forbs. The soil surface is sandy and soft, without clay. The most notable area of dunes is in the south-east of the mine area.

"Ablation habitat": Wind swept and sand scoured mineral formation where only the surface pebbles and small rocks are noted with minimal accumulation of sand and hardly any vegetation except for a few forbs able to germinate after a rainfall event. The surface often represents an indurated horizon. This habitat is widespread throughout the mine area.

Modified Habitat are areas which have undergone anthropogenic disturbance, and no longer retain natural assemblages of species or ecosystem processes. At Tasiast this includes

- Mine pits, waste rock dumps, heap leach facilities, tailings storage facilities (TSF).
- Roads, parking areas and other storage yards.
- Buildings, including the processing plant, offices and accommodation plants.
- Lay-down areas.
- Landing strip.

[2] PS6 Paragraph 11 "*areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition*"

Modified Habitat areas do retain some biodiversity, including isolated trees and cultivated vegetation which are used by wildlife, but they do not represent natural desert ecosystems.

2.2 Banc d'Arguin National Park and World Heritage Site

PNBA covers 1,200,000 ha of desert, sand dunes, coastal swamps, offshore islands, intertidal shallow waters, and marine systems which extend 50 km offshore. The area was designated as Ramsar site in 1982, and inscribed as a World Heritage Site in 1989 for its Outstanding Universal Value (see more details in TBC 2019a). The small Cap Blanc Integral Reserve, a nature reserve at the tip of Cap Blanc isolated about 35km west of the PNBA close to Nouadhibou, is managed in conjunction with the PNBA.

PNBA is one of the most important areas for biodiversity conservation in West Africa. It supports a high number of nesting bird colonies, as well as the largest congregation of wading birds reported anywhere in the world during the northern winter season (BirdLife International 2019). It includes the most northerly mangroves on the West African coast, and is of regional importance for marine fauna. The high productivity of the area is due to a combination of cold water upwellings, shallow warm water and the input of nutrient rich Saharan dust (Wolff *et al.* 1993; Carlier *et al.* 2015). A detailed review of PNBA's biodiversity features is found in the ecohydrology report provided in Appendix B.

Management activities currently focus on the monitoring and control of fishing activities, where small-scale artisanal fishing by local community members using non-motorized vessels is allowed, but industrial fishing is prohibited. Management actions are defined in 5-yearly management plans (PNBA 2009, 2015) with the PNBA financed from central government funds and supplemented by contributions from a conservation trust fund (BACoMAB; https://bacomab.org/).

While EIAs and the a recent ecohydrology study (Appendix B) show that the Tasiast mine is not considered a threat to the integrity of the PNBA and its OUV, the following are noted as threats (Osipova *et al.* 2017):

- Unsustainable and illegal fishing, including fishing for sharks and rays for the export of shark fin.
- Artisanal / illegal mining and processing. This mainly takes place outside of the park, but processing in the town of Chami is close to, and upstream of the park. Methods to extract gold use mercury, which is not controlled or disposed of appropriately. The risk of pollution is extremely high.
- Un-coordinated infrastructure development.
- Plastic pollution.
- Overgrazing. Grazing of goats, camels and cattle is un-regulated in the PNBA.
- Potential for future oil spills should offshore oil production begin.

3. MANAGING IMPACTS TO BIODIVERSITY

This section provides an overview of potential biodiversity related risks and impacts related to the mine. Impacts and risks are described, and actions to address them are outlined. Additional detail on implementation on mitigation measures at the mine is in the BRMP, further detail on implementation of additional measures is proved in Section 4 of this BAP.

Management actions are presented separately for 'on-site' and 'off-site'. On-site refers to impacts and risks at the mine site within the fence line. Off-site refers to risks or impacts outside the fence line, including perceived impacts to the wider landscape (especially PNBA) and any potential impact to biodiversity from areas under direct Kinross management (access road, transmission line, Sondage well heads).

3.1 On-site Impacts and Management

The mine EIAs (URS 2012; SRK consulting 2016) identified potential impacts to biodiversity from the expansion project. These include:

- Direct habitat loss and fragmentation from mine infrastructure. Habitats have been lost under the mine footprint and associate infrastructure. Additional planned impacts are expected from the mine expansion project, and on-going mine activities including expansion of the pits and waste rock dumps, and construction of additional TSF. The total area of direct impacts is currently approximately 2,500 hectares while another 1,300 hectares is expected with expansion of mine pits, waste rock dumps and tailings facilities.
- Disturbance and degradation of habitats from visual, noise, and vibration impacts from mine operations. Remaining habitats are degraded due to the presence of the mine and associated activities.
- Changes in surface water drainage patterns which will affect vegetation which grows along water courses and the wildlife associated with it.
- Individual mortality due to interaction with vehicles, or contact with cyanide containing solutions

The EIAs conclude that there will be no significant residual impacts to the desert ecosystems present at the mine site after application of appropriate mitigation measures. The habitat that will be disturbed is extremely widespread, occurring through the majority of Mauritania and through northern Africa to Egypt. The ecosystems in and around the exploitation lease area represent parts of a relatively intact ecoregion covering over 1.5 million km^2. Given the scale of the ecosystem, the scale of habitat loss is not significant.

Mitigation measures followed at the Tasiast mine to reduce impacts to low significance are:

<u>Avoidance:</u>

- Where feasible new land disturbance (e.g. TSF, or rock piles) are on Modified Habitat;
- Birds are discouraged from accessing areas where they might be exposed to toxic chemicals;
- Killing, interfering with or keeping of animals as pets is strictly prohibited;
- Potential invasive alien species will not be introduced to the mine site, and introduction of any plants (e.g. for rehabilitation and restoration) will be subject to a risk assessment to identify the potential for introduction of invasive alien species (IAS);

- No mine related infrastructure is developed in Protected Areas, or other areas identified as of global importance (e.g. Key Biodiversity Areas, World Heritage Sites, Ramsar sites); and
- Water for mine operations will be abstracted from a saline aquifer outside Banc D'Arguin National Park.

Minimization:

- Vehicle speed limits are applied on the mine site to minimize risk of road kill.
- All employees/contractors receive environmental awareness training during induction to address native wildlife, sensitivity to various kinds of impacts, information about national legislation in relation to fauna and flora.
- Off-road driving is restricted as far as practical to reduce degradation of Natural Habitats;
- Potential IAS already present on the site will be identified, and measures developed to prevent their spread beyond their current distribution.

Restoration:

- The presence of the fence surrounding the mine property and exclusion of domestic animals (e.g. goats and camels) is promoting the natural regeneration of vegetation.
- All non-essential roads are closed to traffic to minimize disturbance to wildlife, and allow for natural regeneration;
- Opportunities for encouraging the natural restoration of the site during operations, and after closure are outlined in the report "Complement study on the terrestrial biodiversity of Tasiast exploitation permit Tasiast mine site - rehabilitation plan for exploitation end complementary suggestions". These opportunities will be reviewed and implemented where practicable, including: preservation existing wadis and drainage lines, and maintaining large Natural Habitat areas, particularly in the north and west of the exploitation lease area.
- Treated domestic waste water is being used to create and artificial 'oasis'. Vegetation will provide wildlife habitat, and potentially encourage birds away from large water-bearing facilities.

All these actions are on-going and will continue through the lifetime of the mine. Additional restoration activities will be included in the decommissioning plan prior to mine closure.

Responsibility for implementation and monitoring of mitigation measures lies with the head of the Health, Safety & Environment Department.

3.2 Offsite Risks

A major concern of the World Heritage Commission was that EIAs for the mine expansion had not adequately evaluated potential impacts on the Outstanding Universal Value of the PNBA and the possible impact on biodiversity from water abstraction. The potential for project impacts from water abstraction were assessed in the EIAs and investigated in detail in a recent ecohydrology study (Appendix B). The evaluation concluded there are no plausible impact pathways for impacts from water abstraction, and therefore **no impact to the Outstanding Universal Value of PNBA** from the Tasiast mine during its forecast operational life (to 2034) (TBC 2019). The study was an in-depth review of:

i) the area hydrological characterization and identification of biodiversity features that contribute to the OUV (ecological receptors),

ii) the links between these biodiversity values and the aquifer, and

iii) identification of impacts from water abstraction on the aquifer.

It included a site visit and consultations with key stakeholders. Hydrological modelling indicated that the drawdown of the aquifer is limited in extent and does not impact water in the surface layers which are used by vegetation. In addition, the model showed that there is no impact of the drawdown on the hydrological dynamics of coastal sabkhas (the only feature thought to have any physical ties to the ground water).

A recent groundwater model supplemented with an assessment of the coastal groundwater system also confirmed that abstraction of groundwater at a rate of 30,000 m^3/day (the maximum permitted rate) does not influence the groundwater system along the ecologically important coast of the PNBA (Project's current water extraction rates are 13,000–15,000 m^3/day.).

An additional off-site risk identified by the IFC during the financing process was the power distribution lines that run alongside the mine access road to the Sondage abstraction wellfield. While the installation was approved by the Ministry of Environment and Sustainable Development of Mauritania, the IFC requested a more rigorous risk assessment for bird mortality. Powerlines are known to be a source of bird mortality globally due to both collision and electrocution (Bernadino et al. 2018). Several birds that contribute to the OUV of the PNBA are susceptible to powerlines, these being Greater Flamingo, Great White Pelican, Eurasian Spoonbill and Nubian Bustard. An assessment will identify which, if any, species are at greatest risk of collision or electrocution.

3.3 Biodiversity Engagement with the PNBA

The Tasiast EIAs and the recent ecohydrology study have demonstrated that the Tasiast mine and related infrastructure do not have an impact on the PNBA or its OUV. However, a perception that the mine is having impacts on the PNBA can present genuine risks to the operation of the mine and Kinross more widely. Potential risks include: requests for unnecessary studies which draw resources away from genuine issues; increased regulation; or negative publicity against Tasiast, Kinross, the Park and other partners.

Pro-active engagement with stakeholders and development of a collaborative approach to understanding and addressing their issues concerning Tasiast and the PNBA will go a long way to managing this risk. In response to this risk, since 2017 Tasiast has increased engagement and consultation with the PNBA. Much of this engagement has been to provide information to the PNBA on the Tasiast operation, including specific discussions on the Sondage wellfield and the noted ecohydrology study. However, it has also provided an opportunity for Tasiast to better understand the Outstanding Universal Value of the PNBA, through meetings and visits to the PNBA. A summary of the engagement with the PNBA since 2017 is provided in Appendix C.

In early 2019 the concept of a technical committee was discussed with the PNBA to facilitate this collaboration and engagement. As the discussions evolved it was decided there would be two committees, a technical committee and a steering committee. The roles of these two committees are as follows:

- The Steering Committee meets quarterly to; examine the projects submitted by the Technical Committee, discuss the ongoing collaborative activities, and assess new needs and decide on new directions and developments to implement.

- The Technical Committee meets quarterly and is responsible for developing annual action plans and project proposals of scientific and socio-economic vocation. It shall carry out any work requested by the Steering Committee. It may, if necessary, call on experts to assist in carrying out specific projects.

On November 19, 2019, a formal agreement was signed between PNBA and TMLSA to undertake actions in areas of common interest for the protection of the OUV of the PNBA and the implementation of socio-economic activities. The full text of this agreement is provided in Appendix D.

4. TIMELINE AND ACTION PLAN

Short / medium term priority actions for the implementation of this BAP is provided in the table below.

No.	Action	Task	Staff Responsible	Timeline	KPI	Status
1	***Managing perceived impacts***					
1.1	Approach PNBA to agree to the establishment of a collaborative arrangement		HSE Manager* Biodiversity Specialist Community Relations Government Relations	Feb. 2019	Meeting held to discuss a collaborative agreement	**Meeting held Feb. 19, 2019** Decision made to proceed with agreement.
1.2	Agree membership of steering and technical committees			Jul. 2019	Membership agreed	Names of committee members submitted by both parties: - July 7, 2019 – Tasiast - July 23, 2019 – PNBA
1.3	Develop terms of reference (ToR) for steering and technical committees			Sept. 2019	ToR developed	**Meeting held Sept. 17, 2019** ToR reviewed and decision to include details in a formal signed agreement between the parties.
1.4	Formal memorandum of agreement for cooperation established between PNBA and Tasiast with mechanism for steering and technical committees defined.			Nov. 2019	Agreement in place	**Meeting Nov. 22, 2019** Formal agreement signed by both parties.
1.5	Convene a meeting to present findings of the ecohydrological study and discuss approach to responding to WHC concerns			Nov. 2019	Meeting completed. Ecohydrology report discussed PNBA response to WHC discussed.	**Meeting Oct. 14, 2019** Reviewed ecohydrology report **Meeting Nov. 22, 2019** Reviewed answers to PNBA questions on the report

					Generally discussed PNBA response to WHC
1.6	Continued regular meetings to identify issues and address actions of common interest for the protection of the OUV of the PNBA		Nov. 2019 to Dec. 2023	Meetings completed as per agreed schedule.	
2	***Powerline species mortality risk assessment***				
2.1	Develop a scope of work for the risk assessment	Biodiversity Specialist* Consultant HSE Manager	Jan. 2020	Scope developed	Scope of work received (TBC to Tasiast)
2.2	Complete risk assessment		Feb. 2020 To Mar. 2020	Risk Assessment completed High-risk species identified	
2.3	Develop protocol for carcass survey		Feb. 2020	Protocols prepared	
2.4	Baseline live bird & carcass surveys		Mar. 2020 To Apr. 2020 (spring migration)	Surveys carried out per the protocol	
2.5	Develop species-specific thresholds for corrective actions based on the risk assessment and baseline surveys		Apr. 2020	Thresholds established	
2.6	Implement carcass surveys per protocol		From Mar. 2020	Surveys carried out per the protocol	
2.7	Should the risk be considered significant, mitigation measures to be developed		TBD	Mitigation applied to address risk (if identified)	

** Primarily responsible*

5. BIODIVERSITY MONITORING AND EVALUATION

5.1 Existing Monitoring Programs

Groundwater

Tasiast has an extensive monitoring program for water level and quality in the aquifer, and neighboring freshwater aquifers that has been in operation since 2006. As show in Figure 4, the monitoring locations include:

- 31 observation wells which monitor the near-field effect of abstraction on the saline aquifer including the propagation of drawdown effects away from the Sondage in all directions.
- 4 regional ("REG") observation wells installed to the north and south of the Sondage, to monitor changes in the aquifer closer to the freshwater Wad Chebka and Chami abstractions.
- Monitoring of "community wells" located to the north and south of the Sondage wellfield area within the defined freshwater areas.

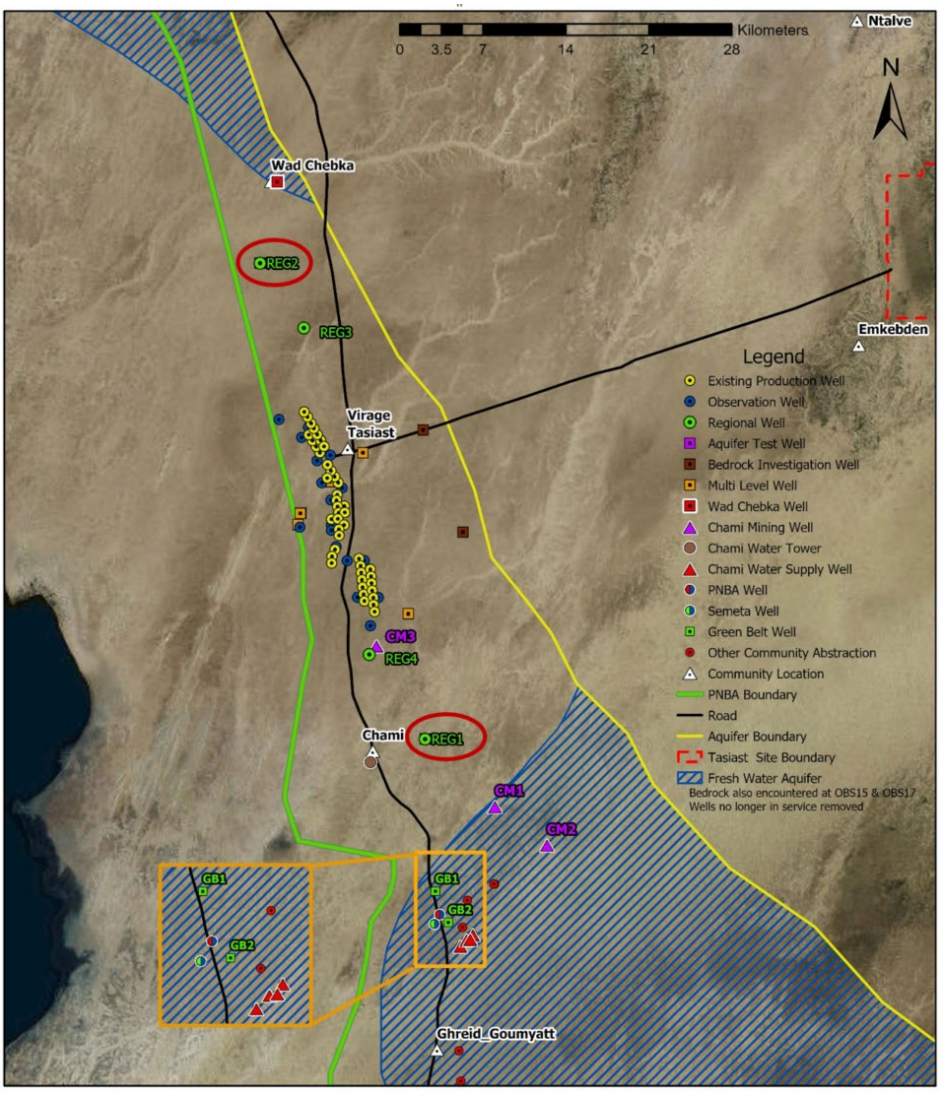

Figure 4: Groundwater monitoring of the Sondage wellfield abstraction

This extensive monitoring program obtains water level, water chemistry and abstraction quantities on a quarterly basis. The results of this monitoring are reviewed and assessed against permit conditions and any observable trends in the data.

On an annual basis the performance of the Sondage and the results of the monitoring program are presented to the government of Mauritania through the National Center for Water Resources (CNRE). This review includes outputs from the groundwater model and predictive scenarios to evaluate the current and future performance of the Sondage.

To date there have been no significant changes in groundwater levels in the regional observation wells with observations aligning well with the groundwater model. The groundwater model predicts the permit conditions for drawdown at REG1 and REG2 will not be exceeded over the life of the permit and fresh water will not be drawn into the Sondage wellfield from Wad Chebka and Chami zones.

As previously noted, the ecohydrology assessment concluded there are no plausible impact pathways for impacts from water abstraction, and therefore no impact to the Outstanding Universal Value of PNBA from the Tasiast mine during its forecast operational life. Tasiast will continue to monitor the groundwater in and around the Sondage and compare to the result from the ecohydrology assessment to ensure its conclusion remains valid.

Air Quality

Tasiast has an extensive air quality program in place with monitoring stations measuring carbon monoxide (CO), Sulphur dioxide (SO2), Nitrogen oxides (NO2, NO, and NOX) and particulates (PM10). These emissions are generated from activities such as internal combustion engines of fixed and mobile equipment, road dust from vehicle movement, blasting operations, and other activities.

Except for PM10 all ambient air quality parameters are below the WHO guidelines. The PM10 results are above WHO guideline levels across the Tasiast including the background station near the north fence. Given the natural weather conditions in the desert it is difficult to measure a difference between ambient air and operations.

To reduce particular levels, dust control measures undertaken include regular water application to roads and use of a dust suppressant in some locations. At the processing operations, a sprinkler system is in use at the crusher loading bay and conveyer belts while water trucks are used at the run of mine (ROM) pads where ore is stockpiled prior to feeding to the crusher.

Past EIAs have indicated there would be no off-site impacts, including to the PNBA, from emissions at Tasiast. However, should the engagement with PNBA indicate additional technical study is needed such work would take place in collaboration with the park.

Biodiversity Surveys

Biodiversity surveys have been conducted in February 2011 (with reporting published in 2012 – see URS, 2012), July/August 2015 (see BETRA, 2015), and April 2018 (FFMES, 2018). These surveys have included botanical sampling for species presence, phytosociology as well as tree abundance. General faunal surveys aimed at reptiles, amphibians and invertebrates have also been conducted including live trapping through deployment of pit fall traps. Mammal surveys have also been performed including live trapping and deployment of camera traps. Finally, avifauna surveys have been performed including during the peak of the South to North breeding migration passage of Palearctic bird species.

To date 92 species of bird (mainly migratory), 12 species of mammal, 11 species of reptile and 71 plant species have been recorded during baseline surveys. Additional species are expected but have not yet been documented in surveys. To date no IUCN Red List species have been recorded as resident species at Tasiast. Egyptian Vulture and European Turtle Dove have been reported on passage.

TMLSA has and will continue to perform surveys to monitor the presence and abundance of biodiversity at the mine. In 2020 a Biodiversity Specialist was hired and will work closely with our biodiversity consultants to conduct this monitoring at Tasiast. The Biodiversity Specialist will also be a member of the PNBA / Tasiast technical committee where proposals for additional biodiversity studies near the PNBA may be proposed.

Cyanide Management

Operational controls have been implemented at the mine to protect birds and other wildlife from the adverse effects of cyanide process solutions. These include; treating tailings from ore processing to below 50 mg/L WAD cyanide, netting solution ponds where WAD cyanide exceeds 50 mg/L, minimizing ponding of solution on heap pads and netting areas where ponding of 50 mg/L WAD cyanide solution exists. The 50 mg/L WAD cyanide level is considered as being protective of wildlife according to International Cyanide Management Code. Monitoring and inspections are conducted daily to ensure these operational controls are effective.

An independent third-party audits' TMLSA for compliance to the International Cyanide Management Code. The audit is conducted in accordance with the *International Cyanide Management Code Mining Operations Verification Protocol*; *Guidance for Recertification Audits for the International Cyanide Management Code*; and using standard and accepted practices for health, safety and environmental audits. Specific elements audited regarding mitigation of wildlife impacts are provided in the table below:

4.1(2)	Does the operation have plans or procedures that identify the assumptions and parameters on which the facility design was based and any applicable regulatory requirements (e.g., freeboard required for safe pond and impoundment operation; the cyanide concentrations in tailings on which the facility's wildlife protection measures were based) as necessary to prevent or control cyanide releases and exposures consistent with applicable requirements?
4.4(1)	Has the operation implemented measures (i.e., fencing, filling in collection ditches with gravel, and covering or netting solution in ponds and impoundments) to restrict access by wildlife and livestock to all open waters where WAD cyanide exceeds 50 mg/l?
4.4(2)	Can the operation demonstrate that the cyanide concentration in open water in TSFs, leach facilities and solution ponds does not exceed 50 mg/l WAD cyanide?
4.4(3)	Is maintaining a WAD cyanide concentration of 50 mg/l or less in open water effective in preventing significant wildlife mortality?
4.4(4)	Does the operation apply leach solutions in a manner designed to avoid significant ponding on the heap surface and limit overspray of solution off the heap liner?
4.6(1)	Does the operation implement specific water management or other measures to manage seepage to protect the beneficial use(s) of ground water beneath and/or immediately down gradient of the operation?
4.6(2)	Are WAD cyanide concentrations (or other species of cyanide for which there is a numerical standard established by the applicable jurisdiction) in groundwater at

	compliance points below or down gradient of the facility at or below levels that are protective of identified beneficial uses of the groundwater?
4.6(4)	If seepage from the operation has caused cyanide concentrations of ground water to rise above levels protective of beneficial use, is the operation engaged in remedial activity to prevent further degradation and restore beneficial use?
4.9(6)	Does the operation inspect for and record wildlife mortalities related to contact with and ingestion of cyanide solutions

Auditors present findings to the International Cyanide Management Institute (ICMI) and report whether the operation is in Full Compliance, Substantial Compliance, or Not in Compliance. TMLSA was certified in Full Compliance on January 24, 2017. A recertification audit was conducted in November 2019, with the auditors reporting Full Compliance. The results are being reviewed by the ICMI as part of the recertification process.

Tasiast also continues to engage in a community outreach program including a cyanide education program with communities along the sodium cyanide road transportation route. This education includes recognition of cyanide transportation vehicles and actions to be taken in the event of cyanide incident or accident. Should the engagement with the PNBA indicate value in providing this information to the technical advisors or scientific council of the PNBA it will be provided.

5.2 Biodiversity Monitoring and Evaluation Plan (BMEP)

This framework Biodiversity Monitoring and Evaluation Plan (BMEP) covers monitoring of risk related to the PNBA and its OUV, and other potential off-site risks. On-site biodiversity monitoring is addressed by the BRMP and elements of the monitoring are described in Section 5.1.

The monitoring program is based on the Pressure-State-Response framework: State being the status of the receptors, the Pressure being the threats on these receptors and the Response the actions of the Project to reduce these threats. This conceptual approach highlights the link between project actions, its impacts and the status of priority ecological receptors, and thus facilitates an adaptive management approach.

One element of this monitoring plan is a risk assessment for bird mortality along the power lines (Pressure). This assessment will consider whether there are at risk species potentially present and their numbers along with the design of the power lines. The potential significance, and species specific thresholds for corrective actions, will be determined based on the findings of this risk assessment and subsequently updates will be made to the BMEP.

The second element of the BMEP is the documenting of PNBA consultations (Response). As previously noted, Tasiast has established a memorandum of agreement with the PNBA as managed through technical and steering committees. If additional actions are recommended as a result of these discussions further monitoring measures may be added to this BMEP to demonstrate their effectiveness.

Aligning with Kinross' commitment to continual improvement the monitoring results will inform adaptive management. Should there be any indication that measures are not as effective as anticipated, mitigation measures will be reviewed, and changed where possible.

Monitoring Feature	Impact	Pressure / State / Response	Detailed description	Monitoring frequency	Indicator	Threshold - Orange	Threshold - Red
Transmission Line	Bird Mortality	Pressure	Complete a risk assessment to determine what, if any, species may be at risk. Key factors to consider are which at risk species are potentially present, the numbers of any at risk species present, and the design of power lines. Pending the findings of the risk assessment, complete a baseline survey of carcasses along power lines. Surveys would involve driving the whole of the transmission line between the power plant and Sondage pumping station, and from pumping station to Sondage well-heads. Surveyors will search for bird carcasses from collisions either side of the line. Recording species, reason for death and estimate age of carcass and sex (if possible). If ID not possible, take multiple photos and collect feathers / wing for ID by experts.	To de determined based on findings of risk assessment and baselines.	Number of individual carcasses from at risk species recorded.	To be determined pending the findings of the risk assessment.	To be determined pending the findings of the risk assessment.
Stakeholder Consultation	Reputational Risk	Response	Document meetings with stakeholders and progress with any follow up actions. Share meeting minutes with meeting participants, EHS department, and Tasiast stakeholder engagement lead	As needed	Meetings completed		

6. DOCUMENTATION

6.1 Document Library

This document shall be stored in the Environmental Management System. This document shall be maintained in MS word (editable) and PDF Adobe formats. Printed copies shall be deemed an uncontrolled document.

6.2 Validity

This document shall be valid through the entire life of the mine until a revised version have been provided and approved by the HSE Manager.

6.3 History of Changes

Any proposed amendment to this document shall be provided to the HSE Manager for approval. Proposed amendments to this procedure shall follow the site document control protocol.

Supervisors shall issue and discuss the new/amended procedure, with their subordinates at a department meeting at the earliest convenience. Supervisors shall establish and maintain an attendance register as well as the minutes of communication meeting for future reference.

Reason for Change - Index	
A. As a result of incidents	B. As a result of audit findings
C. New / changes in governance documents	D. Changes in legislation
E Changes in technology	F. Changes in machinery/equipment
G Results of risk assessments	H. Change in training requirements
I. New document format	J. Change due to spelling or grammatical error
K. To integrate a special instruction into the document control system	

Date of code	Revised Item (Paragraph number)	Changes Made	Reason Code	Name of reviewer
20/03/2020	All paragraphs	New document.	C	Glen Hein

6.4 Record Control

Identification	Reference number	Responsible for maintenance	Location of storage area	Retention period	Method of disposal
Documents and the control of documents	TAS-ENV-PRO-018	HSE Manager	Environment Department	Life of mine	Electronic – archive

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APPENDIX B – ECOHYDROLOGY ASSESSMENT

Evaluation of potential impacts to the Outstanding Universal Value of Banc d'Arguin World Heritage Site from water abstraction for the Tasiast gold mine, Mauritania

THE BIODIVERSITY CONSULTANCY

Report date: June 2019

Images: Unless otherwise stated images are copyright of The Biodiversity Consultancy. Front cover image: Pump houses and power lines at the Tasiast Sondage wellfield, June 2019.

Report development: *Lead investigator* – Edward Pollard. *Project management* – Dr. Genevieve Campbell. *Technical support* – Dr. David Wilson, Vineet Katariya, Mohamed Ahmet Sidi Cheikh, Dr. Adeline Serckx. *Director oversight* – Dr. Malcolm Starkey.

Acknowledgements: Thanks are extended to Kinross and Tasiast mine for their support and input: Ed Opitz (Vice President, Safety and Sustainability at Kinross Gold Corporation), Brahim M'Bareck (vice president of Tasiast Mauritanie Limited SA (TMLSA)), Glen Hein (HSE manager of TMLSA), Mohamedou Sidi Mohamed (Environmental superintendent), and Devin Harbke (Environmental superintendent). Section 4 on the hydrological characterisation was developed in collaboration with Geoff Beale and Mark Boland of Piteau Associates.

Recommended citation: TBC (2019). *Evaluation of potential impacts to the Outstanding Universal Value of Banc d'Arguin World Heritage Site from water abstraction for the Tasiast gold mine, Mauritania.* Unpublished report to Kinross Gold by The Biodiversity Consultancy Ltd, Cambridge, UK.

Executive Summary

This report presents an evaluation of potential impacts to the Outstanding Universal Value (OUV) of the Parc National Banc d'Arguin (PNBA), Mauritania from water abstraction at the Tasiast gold mine Sondage wellfield. The wellfield is located 5 km from the border of the PNBA and draws water from a 40m deep saline aquifer that extends under the PNBA. UNESCO has expressed concerns that the potential impacts from the abstraction have not been adequately evaluated. The findings of this report supplement impact assessments which have been completed by Tasiast, and the approach is aligned with impact assessment principles for World Heritage Areas (IUCN 2013).

The evaluation concludes that there are no plausible impact pathways for impacts from water abstraction, and therefore **no impact to the Outstanding Universal Value of PNBA** from the Tasiast mine during its forecast operational life (to 2034)**.**

To complete the analysis a list of key ecological receptors was identified. These represent the biodiversity features and ecosystem functions which represent the OUV. A total of 68 receptors were identified based on expert input, the PNBA management plan, UNESCO inscription, Ramsar information sheet, and Important Bird Area description.

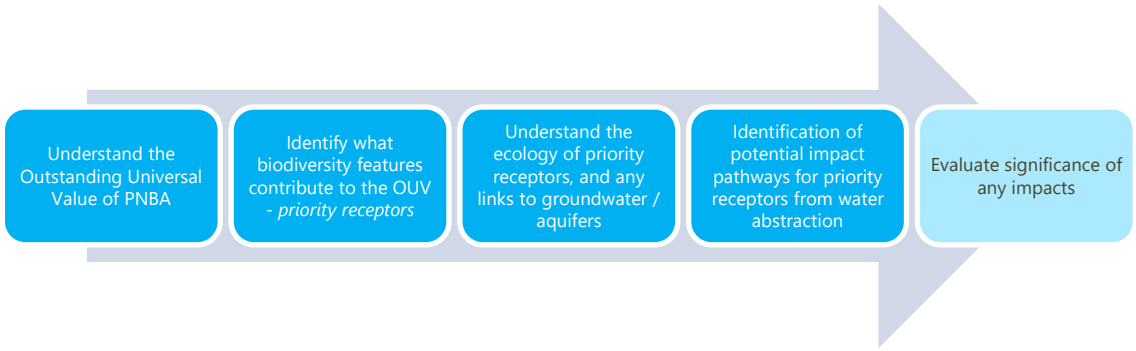

Figure 1: Overview of assessment process

The evaluation primarily takes an ecological approach to determining whether any impact pathways exist (Figure 1). The approach is to determine whether receptors are dependent on groundwater for their persistence. If any parts of the OUV do use the groundwater, then a further evaluation is carried out to establish whether changes in the water table based on the hydrological model will have any impact on the feature, and whether this impact is significant. This primarily ecological approach separates the evaluation of potential impacts from any future variation or changes in the hydrological model.

Secondarily, the evaluation reviews whether the changes in the groundwater system will take place in locations in the PNBA which are essential for the maintenance of the OUV, i.e. does the

potential zone of hydrological change intersect with areas of the PNBA which are fundamental to the OUV. This provides additional supporting evidence for impacts, or lack thereof.

Hydrological modelling indicates that the drawdown of the aquifer is relatively limited in extent, and does not impact on water in the surface layers which are used by vegetation. In addition, the model shows that there is no impact of the drawdown on the hydrological dynamics of coastal sabkhas (the only feature thought to have any physical ties to the ground water).

The available monitoring data, scientific literature, and other information reviewed in this evaluation demonstrate that none of the receptors are ecologically dependent on the saline aquifer from which Tasiast is abstracting water.

THE BIODIVERSITY CONSULTANCY

Table of contents

1 Introduction

1.1 Scope and objectives

This report evaluates whether there are likely to be any potential impacts on the Outstanding Universal Value (OUV) of Banc d'Arguin National Park/World Heritage Site (PNBA), from water abstraction from the Tasiast gold mine Sondage[1] wells. The wellfield is located 5 km from the border of the PNBA and draws water from a 40m deep saline aquifer that extends under the PNBA. The PNBA is located in the north west of Mauritania, with the mine site approximately 60 km inland from the PNBA border (Figure 2).

The study has been commissioned by Tasiast Mauritanie LTD SA at the request of the International Finance Corporation (IFC) and Export Development Canada (EDC). As part of potential financing agreement from lenders, Tasiast has been asked to investigate potential impacts to the PNBA. This request has been prompted by the UNESCO 2018 State of Conservation report for PNBA. The report notes:

"Concerning the EAS for the extension of the Tasiast gold mine, dated March 2012, no evaluation on the impact on the OUV of the property has been undertaken, even although the property is located at 65 km from the mining site and less than 5 km from the pumping field that provides the water needs for the exploitation and drinking water for the mine. This EAS therefore does not represent an adequate information base to take decisions concerning the extension of the mine and it is recommended that the Committee request the State Party to revise it, before taking any decision on the project, to evaluate the impacts on the OUV of the property, in conformity with the IUCN Advice Note on World Heritage and environmental evaluation."

On the basis of this finding the World Heritage Committee decision 42 COM 7B.98 includes:

"7. Takes into account the location of the pumping fields for the Tasiast mine less than 5 km from the boundary of the property and the fact that the EIA for the mine extension project did not include any evaluation of the impacts on the OUV of the property, further requests the State Party to revise this EIA to evaluate the impacts of the projects on the OUV of the property, prior to any possibly irreversible decisions taken, in conformity with Paragraph 172 of the Operational Guidelines and with the IUCN World Heritage Advice Notice and Environmental Evaluation;"[2]

[1] "Sondage" is typically a generic term for bore wells used for water abstraction. For this report however use of the term follows Tasiast documentation (including Environmental Impact Assessment) and refers only to the wellfield used to abstract water for mine usage (see section 2.1 for more detail).

[2] Paragraph 172 of the Operational Guidelines states "*The World Heritage Committee invites the States Parties to the Convention to inform the Committee, through the Secretariat, of their intention to undertake or to authorize in an area protected under the Convention major restorations or new constructions which may affect the outstanding universal value of the property. Notice should be given as soon as possible (for instance, before drafting basic documents for specific projects) and before making any decisions that would be difficult to*

Thus, the objectives of the study, as defined by the scope of work are:

- To provide an understanding of the relationships and interaction between ecological receptors and potential hydrological stressors;
- To evaluate potential impacts on ecological receptors of the water abstraction on the PNBA; and
- To identify knowledge potential gaps and if necessary, future monitoring needs.

The purpose of this report is to consider the groundwater extraction from the Sondage from an ecological point of view, to confirm or reject the conclusion in the 2011 EIA that the ecology and habitats of the PNBA are not dependent on groundwater.

The findings are intended to support the PNBA in responding to the UNESCO State of Conservation findings.

reverse, so that the Committee may assist in seeking appropriate solutions to ensure that the outstanding universal value of the property is fully preserved".

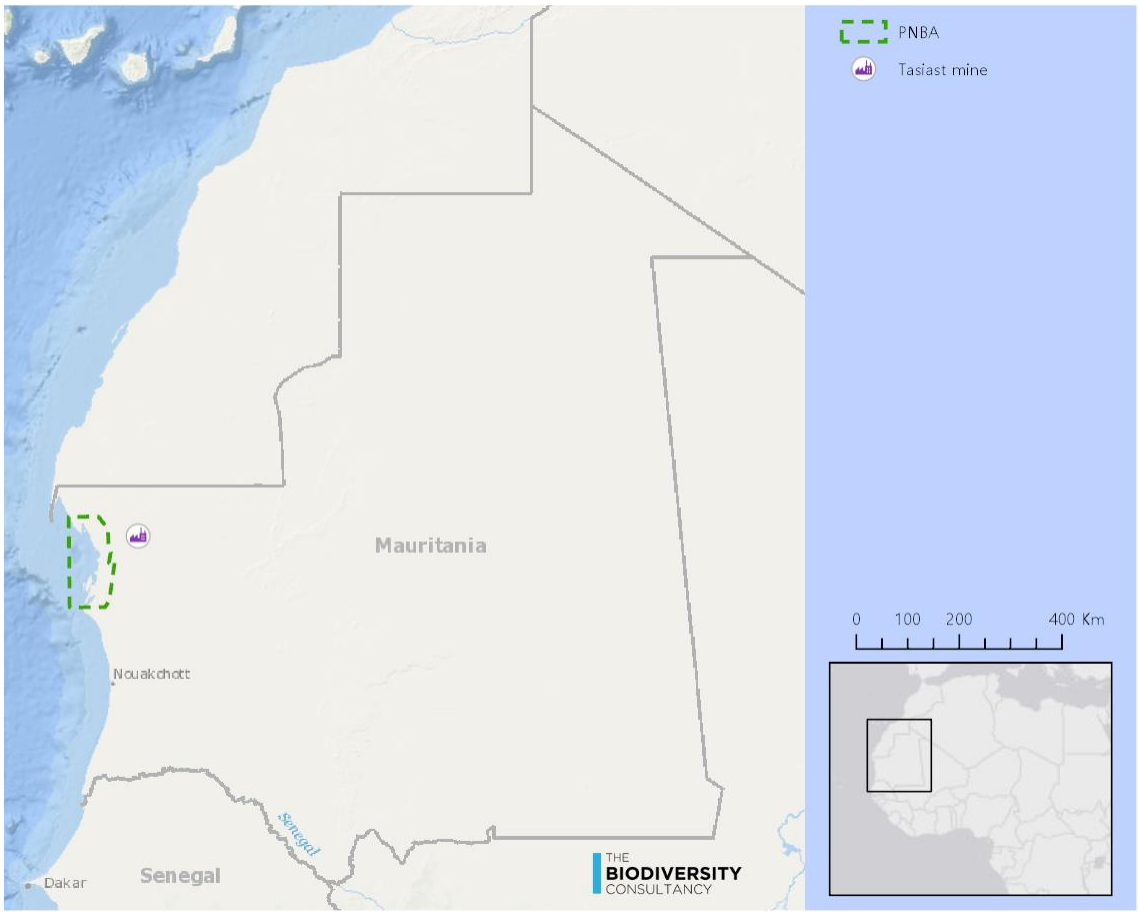

Figure 2: Location of PNBA and Tasiast mine in Mauritania

1.1.1 Geographic scope

The primary area of interest for the study is the entire PNBA. The overall objective of the study is to evaluate whether Tasiast water abstraction activities are having or likely to have any impact on the OUV of the PNBA. As the entire park is deemed to have OUV then it is appropriate to investigate the entire area. While the study evaluates the entire PNBA, this does not imply that water abstraction is having an impact on the whole (or any part) of the PNBA.

In addition, to understand the hydrology of the PNBA, and the aquifer from which Tasiast is drawing water, a secondary area of interest includes the major water catchments in the wider landscape which drain into the PNBA (Figure 3).

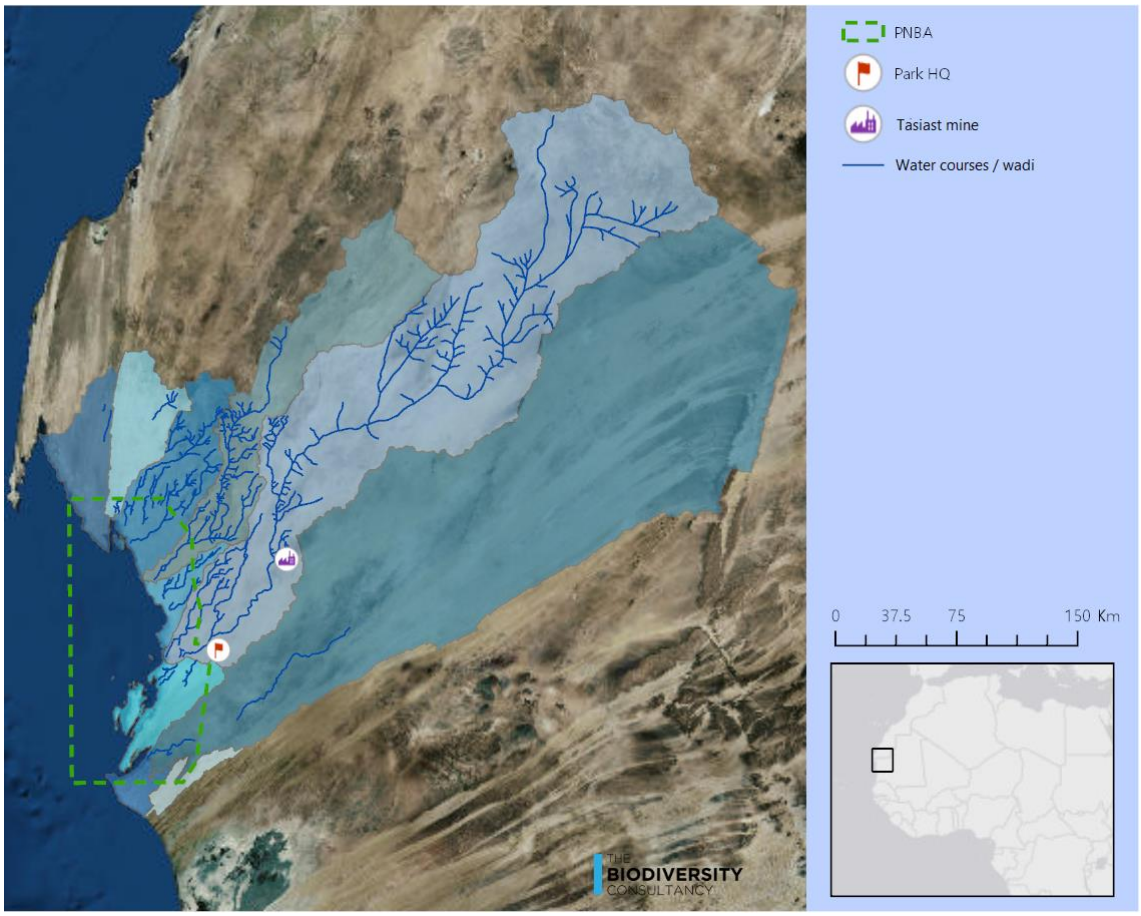

Figure 3: Study area for the evaluation of potential impacts from water abstraction (blue polygons represent different water catchments)

1.1.2 Temporal scope

The temporal scope of the study covers the period of time over which the Tasiast mine intends to abstract water from the aquifer. This is the period over for which the hydrological model has been developed (see section 4.4): January 2017 to December 2034.

1.2 Report structure

The overall structure of this report is summarised in Figure 4. The report introduces the context to the study, with a description of the Tasiast mine, the PNBA, a summary of the hydrology and Sondage water abstraction. The study then outlines the methodology used to evaluate what constitutes the OUV and whether there might be any potential impacts from water abstraction. Finally, next steps for how these findings may be used to respond to the World Heritage Committee concerns are provided.

Introduction	•Objectives and scope of the study
Project area	•Summary of the Tasiast mine project, water abstration site, and PNBA
Assessment methodology	•Description of the methods used to identify ecological receptors and determine whether there is any impact from the Sondage
Hydrological charecterisation	•Summary of the hydrology of the study area, and the water abstraction model.
Findings	•Presentation of study findings, including ecology of the PNBA, identification of ecological receptors,and determination of any potential impact pathways
Alignment with IUCN guidelines	•Demonstation of how this study relates to the IUCN guidelines on impact assessments in World Heritage sites
Next steps	•Recommended future actions.

Figure 4: Report overview

2 Project area

2.1 Tasiast mining Project

The Tasiast Gold Mine (the Mine) is an operational gold mine, situated in north eastern Mauritania.

Operations at the Mine commenced in July 2007, initially under the ownership of Rio Narcea Gold Mines and subsequently, following acquisition, under Red Back Mining Inc. Kinross Gold Corporation (Kinross) completed the acquisition of the Mine on September 17, 2010 as part of its combination with Red Back Mining Inc. Tasiast Mauritanie Limited SA (TMLSA), a wholly owned subsidiary of Kinross, is the operator of the Mine.

On commissioning, the Mine had a predicted life of ten years, at a nominal milling rate of 3,200 tonnes per day (t/day). Over the years a number of expansions were permitted, bringing operations to a milling rate of approximately 9,000 t/day.

In 2011-2012, as a consequence of identifying further gold resources through its continuing exploration within the mining licence area (MLA), TMLSA completed environmental assessments and permitting to increase the milling rate to 70,000 – 80,000 t/day.

Part of the 2011 environmental assessment included an increase in groundwater extraction from 17,000 m^3/day to 30,000 m^3/day. That assessment concluded that the ecology and habitats of the PNBA are not dependent on groundwater; that the water table lies well below the surface within the PNBA and there is no hydraulic interconnectivity between the borefield aquifer and the PNBA; and that therefore there would be no impact on the PNBA from abstraction of water from the Sondage.

Initially, TMLSA anticipated that a seawater extraction system would be needed to support the full 70,000 – 80,000 t/day operation. Later, it was determined that a much smaller expansion would be more economical, which would not require a seawater extraction system and which could be supplied by the existing Sondage at the permitted abstraction rate of up to 30,000 m^3/day, without a further increase in water extraction rates. The hydrological assessment assumes abstraction rates at 30,000 m3/day, although current daily average abstraction rates are 13,000 to 15,000 m3/day.

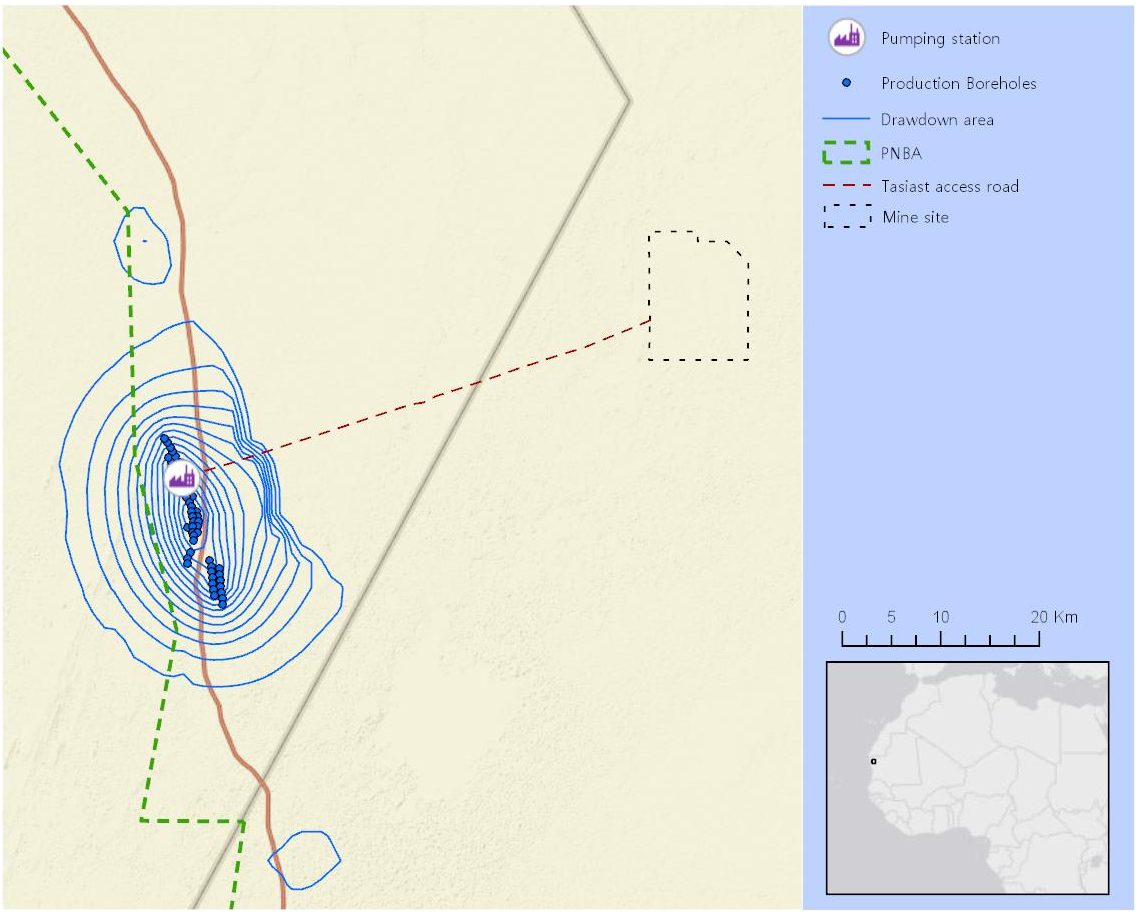

Figure 5: Tasiast mine location, production wells and modelled maximum potential drawdown of the aquifer by 2034.

2.1.1 Sondage wellfield

Water for mine operations is supplied from the Sondage wellfield which is located 60 km to the west of the mine site and 25 km to the east of the coast, 5 km east of the eastern boundary of the PNBA. The aquifer was selected as the mine water supply due to the fact that it is a highly saline water body, present at depths of >80m below ground level, and was therefore neither of use as a potential water supply for local communities nor provides baseflow to any surface drainages or ecosystems.

The wellfield currently comprises 44 operational abstraction wells, oriented approximately north-south over a distance of about ~20km (Figure 5). The wellfield produces only saline water, which is transmitted the 60km to the mine site via a pumping station and three pipelines which run parallel to the main access road (Figure 6).

Figure 6: Sondage pumping station

Groundwater modelling has confirmed that the Sondage can be operated at the permitted 30,000 m^3/day for the projected life of mine (through 2034), without impacting community wells located to the north and south of the Sondage. Recently, the groundwater modelling has been supplemented with an assessment of the coastal groundwater system, which confirms that abstraction of groundwater at a rate of 30,000 m^3/day does not influence the groundwater system along the ecologically important coast of the PNBA. Current water extraction rates are c. 13,000 – 15,000 m3/day.

2.2 Banc d'Arguin National Park

PNBA is located in the north-west of Mauritania where the Sahara meets the Atlantic. It covers 1,200,000 ha of desert, coast, offshore islands, intertidal and marine systems (extending 50 km offshore). The small Cap Blanc Integral Reserve, a nature reserve at the tip of Cap Blanc isolated about 35km west of the PNBA, is managed in conjunction with the PNBA.

The combination of cold water upwellings, shallow warm water and the input of nutrient rich Saharan dust results in a highly productive system (Wolff *et al.* 1993b; Carlier *et al.* 2015). During the northern winter the park hosts the largest congregation of wading birds reported anywhere in the world (BirdLife International 2019). The area also has significant nesting bird colonies, the most northerly mangroves on the West African coast, and is of regional importance for marine fauna. PNBA is therefore one of the most important areas for biodiversity conservation in West Africa.

The PNBA was originally declared in 1976 under decree 74 176/P/G. The status was re-confirmed in 2000 (with small boundary changes) by law 24-2000. It was designated a Ramsar site in 1982, and inscribed as a World Heritage Site in 1989.

The PNBA headquarters is located south of the settlement of Chami, on the main national road N2. Additional management posts are located in Iwik and Nouamghar, with smaller outposts in three other locations along the coast. Management activities currently focus on the monitoring and control of fishing activities, where small-scale artisanal fishing by local community member using non-motorised vessels is allowed, but industrial fishing is prohibited. Management actions are defined in 5-yearly management plans (PNBA 2009, 2015) and the PNBA is financed from central government funds, supplemented by contributions from a conservation trust fund (BACoMAB; https://bacomab.org/).

Figure 7: Banc D'Arguin National Park, where the Sarah meets the Atlantic. (Cap Al Zeis)

2.2.1 World Heritage Site

The PNBA was inscribed as a World Heritage Site in 1989, the first in Mauritania. It is a Natural World Heritage Site, and the World Heritage Centre presents the site's Outstanding Universal Value as:

The Banc d'Arguin is one of the most important zones in the world for nesting birds and Palearctic migratory waders. Located along the Atlantic coast, this Park is formed of sand dunes, areas of coastal swamps, small islands and shallow coastal waters. The austerity of the desert and the biodiversity of the marine area results in a land and seascape of exceptional contrasting natural value.

Criterion (ix): *Banc d'Arguin National Park is an ecosystem rich in biodiversity of nutrients and organic matter due to the vast expanse of marshes covered with seagrass beds, and an important windblown sediment addition from the continent and the result of the permanent upwelling of the*

Cap Blanc. This wealth ensures the maintenance of a marine and coastal environment sufficiently rich and diverse to support important communities of fish, birds and marine mammals.

Criterion (x): *Banc d'Arguin National Park comprises the most important habitat of the Western Atlantic for nesting birds of west Africa and the Palearctic migratory waders. The vast expanses of marshes provide shelter to more than two million limicolous migrant birds from northern Europe, Siberia and Greenland. The nesting bird population is also remarkable in terms of diversity and number: between 25,000 and 40,000 pairs belonging to 15 bird species. The shallows and island area is also the centre of intense biological activity: there are 45 fish species, 11 species of shellfish and several species of molluscs. The property also contains several species of marine turtles, notably the green sea turtle (*Chelonia mydas*) on the IUCN Red List of Threatened Species. Among the mammals, there are still some remnant populations of Dorcas gazelle (*Gazella dorcas*). The bottlenose dolphin and the Atlantic hump-backed dolphin are frequently sighted in the property.*

2.2.2 Current and potential threats to PNBA

The following list of threats to PNBA does not represent an exhaustive evaluation, but is based on first-hand observations during a site visit in June 2019, PNBA documentation (primarily the management plan) and other literature (notably Osipova *et al.* 2017, and the UNESCO state of conservation reports):

- Unsustainable and illegal fishing, including fishing for sharks and rays for the export of shark fin. Local residents are allowed to fish using non-motorised vessels, but industrial fishing is not allowed in the PNBA: despite this ban, industrial fishing does continue.
- Artisanal / illegal mining and processing. This mainly takes place outside of the park, but processing in the town of Chami is close to, and upstream of the park. Methods to extract gold use mercury which is not controlled or disposed of appropriately. The risk of pollution is extremely high.
- Un-coordinated infrastructure development. For example, the building of a sealed road to Nouamghar was carried out without an EIA, and little coordination with PNBA, and the town of Chami has grown dramatically in recent years with no evaluation of potential impacts to the park, or on fresh water supplies.
- Plastic pollution. Plastics are washed ashore along the entire coast, and plastics are blown in from the N2 road, and other settlements. Tourists and other users of the park leave plastic waste throughout the terrestrial portions.
- Overgrazing. Grazing of goats, camels and cattle is un-regulated in the PNBA. At present, grazing levels in most parts appear to be relatively low, however evidence of over-grazing was observed in some parts (including Wad Chebkha 20 km north of the abstraction wells).
- Potential for future oil spills. Seismic exploration activities are currently (2019) being carried out offshore from the PNBA. The success of exploration activities is not yet certain, but should oil exploitation begin there will be an oil spill risk. Ocean currents mean that oil from uncontained offshore spills is highly likely to move into PNBA with potentially severe impacts to coastal and marine ecosystems.

2.3 Climate

The climate of northern Mauritania is classified as an arid-desert climate (Koppen climate classification) with annual high temperatures of 45 ºC between May-August and minimums of 10 ºC in December-January. Temperatures at the coast are moderated by marine currents, with mean temperatures in Nouadhibou ranging from 20-26 ºC. The NE continental trade winds ("Harmattan"), generated by the North African anticyclone cell, blow constantly offshore from the Sahara in a WSW direction and are responsible for high evaporation rates and significant aeolian transport of sediment. The northward movement of the inter-tropical convergence brings humid air into the southernmost region of the country for up to 3 months, however these conditions only exist in the central region, where the Sondage and PNBA are located, for 1-2 weeks.

Rainfall in the north of the country is extremely infrequent, although most rainfall usually occurs from July to September. Up to 50% of annual rainfall may occur as a single event at a given location, with these storms generating flows in wadis, which in turn may quickly dissipate or pond. The mean monthly rainfall at the 13 stations around the PNBA ranges from 1.5 – 8mm, with the maximum monthly values ranging from 20mm-350mm.

Potential evaporation ranges from 2,000-2,500 mm/year at the coastal sites of Nouadhibou and Nouakchott, to over 4,500mm/a at the inland site of Atar. Average annual potential evaporation is therefore 1 to 2 orders of magnitude greater than maximum annual rainfall.

3 Assessment methodology

The outline process to determining the likelihood of impacts to the OUV of PNBA from water abstraction by the Tasiast mine is shown in Figure 8.

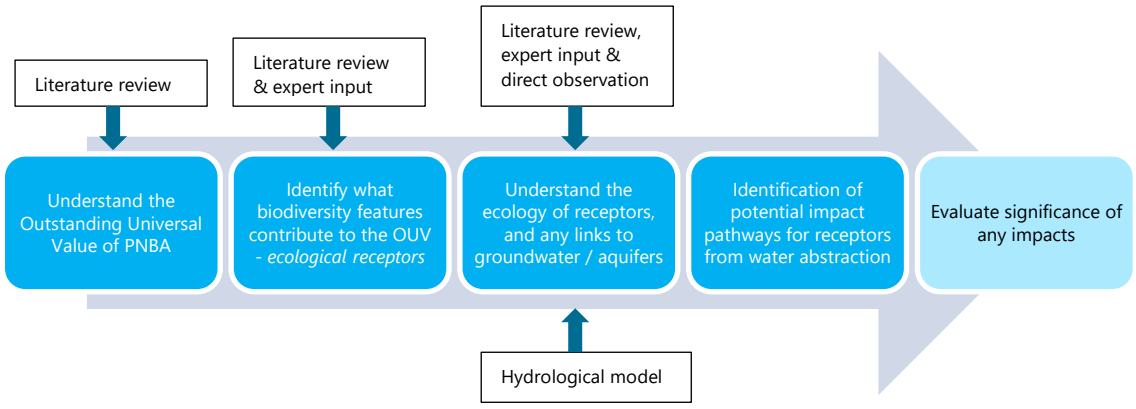

Figure 8: Overview of assessment process

The evaluation primarily takes an ecological approach to determining whether any impact pathways exist. The approach is to determine what biodiversity features represent the OUV, and then to understand whether they are dependent on groundwater for their persistence. Should any biodiversity features which contribute to the OUV use the groundwater a further evaluation

of impacts is carried out. This evaluation is to establish whether changes in the water table caused by water abstraction at the Sondage wellfield will impact on the feature, and if this impact is significant. Understanding of the changes in the water table is based on the Project's hydrological model (see section 4), and determination of potential impact pathways based on stakeholder input and literature review.

The main determinant of impact pathways is therefore the ecology of the features (i.e. do the features rely on ground water) and not the inputs to, or outcomes of the hydrological model. This primarily ecological approach is applied so that evaluation of potential impacts is less sensitive to any errors in, or future changes, to the hydrological model.

Secondarily, the evaluation reviews whether the changes in the water will take place in areas which are essential for the maintenance of the OUV, i.e. does the potential zone of hydrological change intersect with locations in PNBA which are fundamental to the OUV. This, thus provides additional supporting evidence for impacts, or lack thereof.

3.1 Identification of priority ecological receptors

The description of the OUV for the PNBA provides little specificity as to which biodiversity led to the designation of World Heritage Status. Examples of biodiversity features and ecological processes are listed (presented in section 2.2.1), but this description does not allow for the identification of biodiversity features which might experience negative impacts from water abstraction, i.e. ecological receptors.

For this study, other information sources were reviewed to identify which biodiversity features are of global importance in the PNBA, and thus represent receptors for potential impacts from water abstraction. Ideally sources which have followed systematic approaches are used[3]. In addition to the WHS inscription, four main sources have been used:

1. PNBA Important Bird Area / Key Biodiversity Area qualifying features;
2. Ramsar site qualifying features;
3. PNBA management plan; and
4. Stakeholder input (see section 3.4) and published literature (see references).

From these sources a long list of features was compiled (Table 2).

[3] Systematic approaches follow pre-defined objective criteria to identify sites of global importance for biodiversity conservation, for example the Ramsar Criteria, and the KBA standard.

3.2 Determination of priority biodiversity potentially impacted by groundwater change

A risk-based approach is followed to identify if any ecological receptors are priority biodiversity features for further consideration (Figure 9).

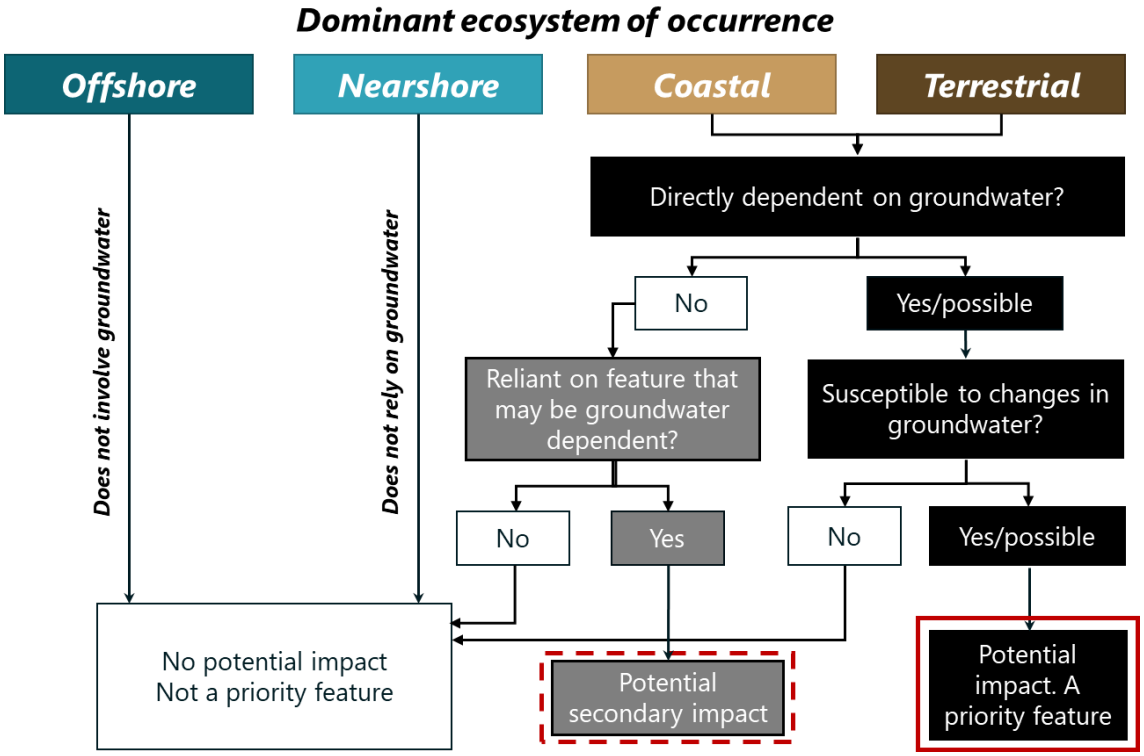

Figure 9. Decision logic to identify priority biodiversity for consideration of potential impacts.

This approach acknowledges that biodiversity will be differentially impacted by any change in groundwater, based on their ecological or behavioural attributes:

- Offshore or nearshore species and habitats are not priority features for this assessment, as reliance on the marine (saltwater) environment precluded any level of dependence on groundwater flows.
- Coastal or terrestrial species or habitats are priority features for evaluating impact significance if:
    - there is a known or likely dependence on groundwater; and
    - a change in groundwater could have negative impact to the feature
- Coastal and terrestrial species with no *direct* dependency, might be priority features if they are reliant on ecosystems or species which are themselves directly dependent. They would thus face potential *secondary* impacts, and may require an evaluation of potential impact significance
- Coastal and terrestrial species which are not directly or secondarily reliant on groundwater, and for which no effect from groundwater change is likely, are not considered as priority features for this assessment.

PNBA is a well-studied site, with multiple peer-reviewed articles and PhD studies investigating the ecology and ecosystem dynamics of the area. These mainly focus on the marine and coastal ecosystems, bird congregations (e.g. feeding ecology and niche separation), and trophic interactions. Relevant literature is cited and included in the reference list. This wealth of knowledge provides a high degree of certainty over the findings.

3.3 Site visit

A site visit was completed in late May – early June 2019. The visit had two main objectives:

1. Consult with PNBA management to understand their perceptions of the important features of PNBA, and discuss the ecology of the PNBA, and

2. Have first-hand review of the state of the environment in the PNBA, including understanding the distribution of features which contribute to the OUV of PNBA, and direct evaluation of the area above the hydrological 'drawdown cone'

The site visit itinerary is presented in Figure 10, and a map of route followed in Figure 11.

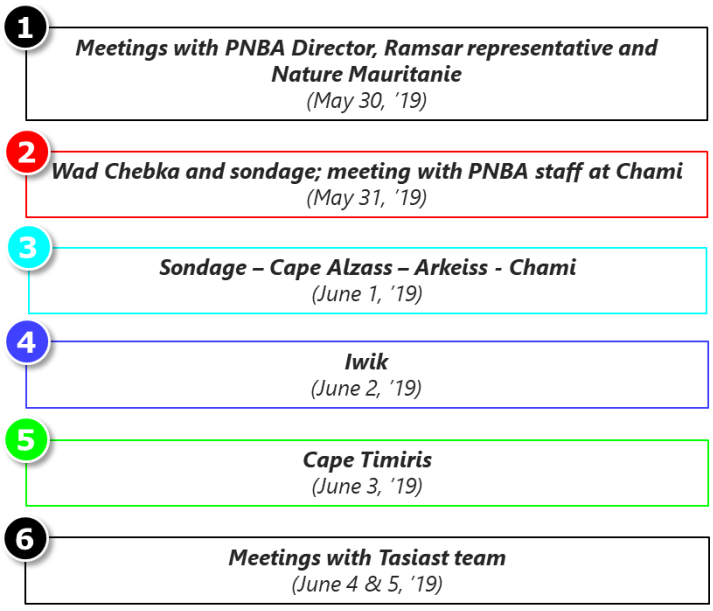

Figure 10: Site visit itinerary

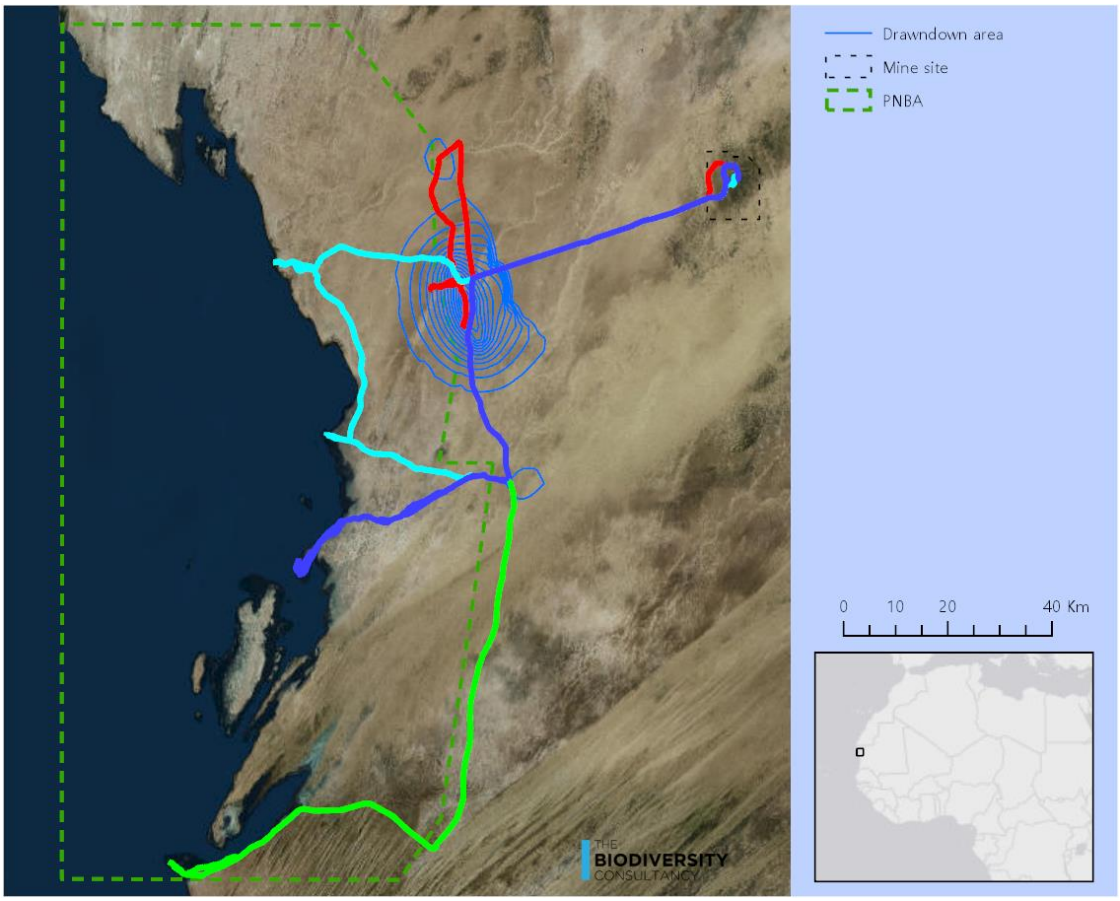

Figure 11: Tracks of site visit to PNBA

3.4 Stakeholder consultation

Stakeholder consultation took place in Nouakchott and at the PNBA headquarters in Chami. The main objectives of the consultation were to consult with stakeholders who are knowledgeable about the park and its ecology. This information helps determine what features constitute the OUV, and what their ecological requirements are. Key lines of enquiry included:

- What are the most important features (e.g. species or habitats) of PNBA? And why?
- What information exists on their status in the Park, and can it be shared with to support the analysis?
- Are there any features which might be particularly sensitive to changes in the water table?
- Are there any areas of the PNBA recommended to visit to get a good understanding of the Park and its ecosystem dynamics?

Meetings were held with:

- The director of PNBA and his staff;
- Ramsar representative for Mauritania; and

- President of Nature Mauritanie, the BirdLife International partner in Mauritania, and a major nature conservation civil-society organisation in Mauritania.

Full details of stakeholder consultation and responses are listed in Table 1.

Table 1: Key Input from Stakeholders

Institution	Name	Input
Parc National du Banc d'Arguin (PNBA)	Maitre Aly Ould Mohamed Salem, (Director of PNBA)	• The PNBA is of international importance for migratory birds, and fisheries. • The ecosystem service valuation of the park shows how important the area if to the economy of Mauritania. • The most important ecosystems are the seagrass, mangroves, mudflats and shallow waters. • The whole ecosystem is connected however and dependent on deep water upwellings, and onshore breezes providing nutrient inputs. • Wadis are important maintaining occasional fresh water inputs
	Cheibany Ould Senhoury (Adviser of the Director)	
	Abdoullah Ould Maaloum, (Adviser of the Director)	
	Hama Ould Cheikh Mohamed ElHafedh, (GIS department at the observatory of PNBA)	
Ramsar Secretariat	Mohamed El Hacen Khouna, (Director of Protected Areas and Coasts at the Ministry of Environment)	• A key aspect is to review links of freshwater and marine systems, and whether freshwater is essential to the maintenance of the coast and marine ecosystems.
Nature Mauritanie	Yelli Diawara (President)	• The site is of global importance for migratory birds. • The most important sites are the offshore nesting islands, seagrass and mudflats. • The whole system is interconnected and any interruption may have un-foreseen impacts. For example, disruption to surface water flow in wadis may impact on nearshore systems. • Recommended a monitoring system to look at potential changes to surface vegetation.

4 Hydrological characterisation

This section provides a summary of the hydrological characteristics of the Sondage area. The findings of the hydrological modelling of the potential impact of water abstraction are also presented with an interpretation of implications for biodiversity at the surface.

4.1 Sondage aquifer

The Sondage wellfield produces saline groundwater from a series of sand layers. These sand layers form an aquifer unit which is about 5-10 m in thickness, and occurs at a depth of about 80 m below ground level (mbgl) in the area of the wellfield. The aquifer unit is overlain by interbedded low permeability sands, silts and clays. These overlying sediments form a semi-confining layer to the aquifer unit.

The entire sedimentary sequence dips to the west and is present at a progressively greater depth westwards under the Banc d'Arguin national park (PNBA) and is underlain by crystalline basement rocks. Figure 12 shows a west-east cross section across the Sondage wellfield, illustrating the westward thickening of the sedimentary sequence as demonstrated by the geological logging of the monitoring network boreholes.

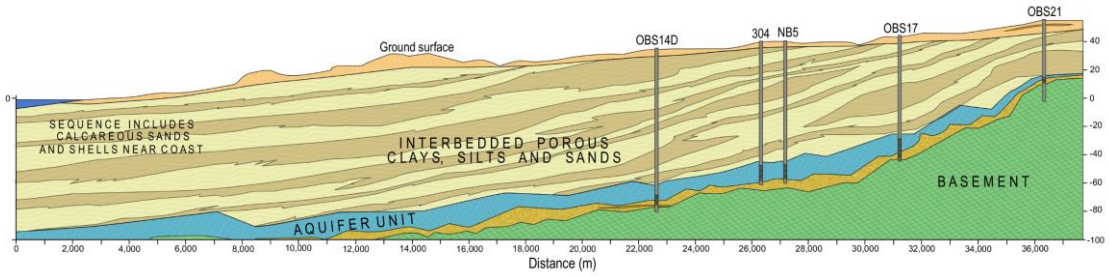

Figure 12: Schematic geological cross section showing the westward thickening of the Continental Terminal aquifer sequence from the Sondage wellfield towards the coast (numbers refer to wells) (image courtesy of Piteau Associates)

Although they dip to the west, the thickness of overlaying sediment layers remains relatively consistent in the area immediately west of the Sondage. They become considerably thinner to the east.

The water table in the Sondage area is approximately 36-46 mbgl, meaning that the lower 25-35 m of sediments to the base of the aquifer are saturated, but with the saturated thickness increasing significantly to the west because the interlayered sediments dip more steeply to the west than the water table.

The water abstracted from the Sondage wellfield is saline, with the total dissolved solids (TDS) in the pipelines to site being between 15,900 mg/l in the and 21,200 mg/l, depending on the pipeline. TDS concentrations reported from wells located in the coastal plain, west of the Sondage, range from about 100,000 to 140,000 mg/L (compared to a seawater TDS

concentration of about 25,000 mg/L). These data illustrate the effect of the evapo-concentration that occurs within the coastal plain (sabkha) zones, resulting in salinity values that are significantly higher than those measured at the Sondage.

Freshwater recharge varies depending on catchment area, with increased groundwater recharge occurring in larger catchments which have greater potential to be influenced by rainfall events, and longer sections of wadi where flows can concentrate and infiltrate to ground. The catchment areas defined to the east of the Sondage wellfield (which thus are the source of any potential recharege) are small compared to the catchments to the north and south (Figure 3). Surface observations indicate little evidence of continuous overland surface water flow in response to the occasional high rainfall events (Piteau Associates *in litt* 2019). These surface observations, coupled with the saline nature of the groundwater, suggests there is little active recharge to the aquifer system.

Unlike typical groundwater systems globally the water table elevations at the Sondage and surrounding area (including Chami and Wad Chebkha) are below sea level. Therefore, the ocean will act as a recharge boundary, rather than a zone of discharge, as occurs in the majority of coastal groundwater systems. This type of aquifer is not unusual at the Atlantic coasts of Mauritania and Senegal, and examples include the Trarza aquifer (part of the Continental Terminal Aquifer) in Mauritania, which supplies drinking water to Nouakchott from the Idrini wellfield (Aranyossy & Ndiaye 1993; Lacroix & Séméga 2005; Mohamed *et al.* 2014).

4.2 Surface drainage

Groundwater recharge in arid to semi-arid climates occurs via infiltration from ephemeral streams (known as wadis in Arabic) that flow in response to occasional high intensity rainfall events. A review of the role of wadi systems in the recharge of groundwater aquifer systems is presented in a UNESCO International Hydrological Programme publication (Wheater & Al-Weshah 2002). Typically, in high rainfall events, water flow runs off into the wadi systems where it pools and infiltrates the surface layers, slowly draining down (Figure 13). This infiltration reduces the flood volume as it moves downstream within the central area of the wadi, and there is some indication that water flow rarely, if ever, now reaches the sea in the PNBA (M Bolland pers comm June 2019).

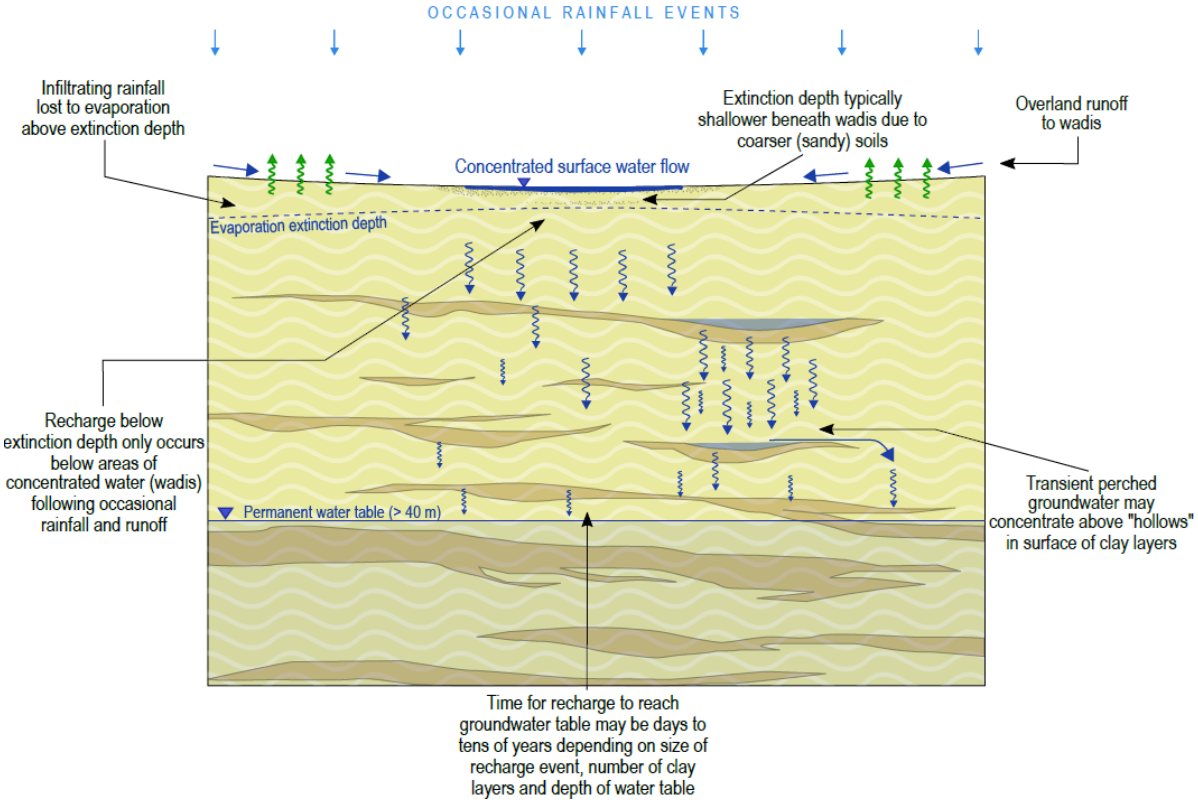

Figure 13: Schematic representation of recharge mechanisms in wadi catchment areas (image courtesy of Piteau Associates).

This model is supported by observations around the Tasiast site following rainfall events up to 100 mm. Runoff is observed to be high and, where surface ponding in depressions did not occur, much of the water migrates quickly to the main wadi systems. Therefore, there is good potential for recharge to the groundwater below the main wadi systems. However, in most cases, shallow infiltration will not become recharge to the deep groundwater system, but instead will be held temporarily in shallow storage prior to evapotranspiration. This temporary shallow storage is sufficient to sustain surface vegetation adjacent to the main wadi channels (Figure 14).

Figure 14: Capparis decidua *in the lower reaches of Wad Chebkha, PNBA*

4.3 Sabkha hydrology

The term sabkha is used to refer to an area of extensive, barren, salt-encrusted mudflats (Figure 15) (Yechieli & Wood 2002). Coastal sabkhas are supratidal, being periodically covered by marine, and potentially also continental (wadi), floodwaters. Coastal sabkhas will pass seaward into an assemblage of marine sediments, while non-marine sediments such as wind-blown sands will be present on the landward side.

Figure 15: Sabkha surface showing salt crystal crust

Given the general offshore direction of the trade winds emanating from the Sahara it is likely that flooding of this zone occurs infrequently in Mauritania. The supratidal zone of sabkhas is where most of the evaporitic mineral deposition will occur.

Aleman *et al.* (2014) provides a detailed description of the Golf d'Arguin, from Cap Blanc in the north to Cap Temeris in the south, and thus incorporating the entire coastline of the PNBA. The offshore basin is separated by "shoals", into an inner shallow basin and an outer part that extends to the 20m isobath. The western margin of the shallow basin corresponds to the western boundary of the PNBA. The shallow water depth in the inner basin, generates a low energy environment, which is fringed by sandy beaches and sand flats. The coastal sabkhas develop in the upper intertidal to supratidal zone of this low-energy, flat lying arid coastline, and result from the periodic inundation of these zones during periods of high tide, coupled with extremely high evaporation rates.

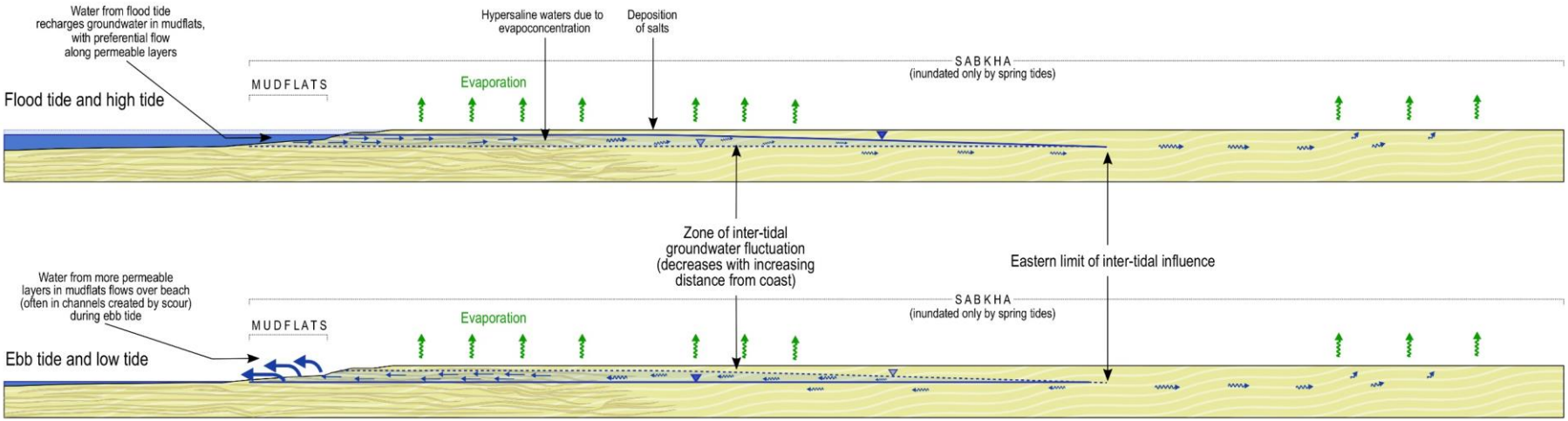

Figure 16: Schematic cross section of the interaction of tidal flooding and sea water intrusion in the coastal plain of the PNBA (image courtesy of Piteau Associates).

Coastal drawdown is therefore self-regulating, controlled by evaporative flux and sea water ingress. Evaporation from the coastal plain becomes the dominant driver within the local water balance, with the upward flux from the sabkha/coastal flats eventually balancing the inflow rate (Figure 16). The coastal model predicts potential evaporative flux of over 700,000 m^3/day, which is 50 times greater than the current pumping rate from the Sondage.

4.4 Effect of water abstraction on the Sondage aquifer

A hydrological model has been developed to run a series of predictive future simulations on potential changes to the aquifer and water table from water abstraction[4]. The model includes a precautionary simulation based on the Sondage wellfield abstracting at the maximum permitted rate of 30,000 m^3/d through to the end of 2034. Figure 16 shows a west-east section that illustrates the conceptual hydrogeological model. The model simultaneously simulated an increasing abstraction from the community wells at both Chami and Wad Chebkha, to reflect the potential for population growth in both communities, coupled with a period of no groundwater recharge occurring during the entire simulation period. The extent of the drawdown generated at the end of 2034 for this precautionary case is shown in Figure 18.

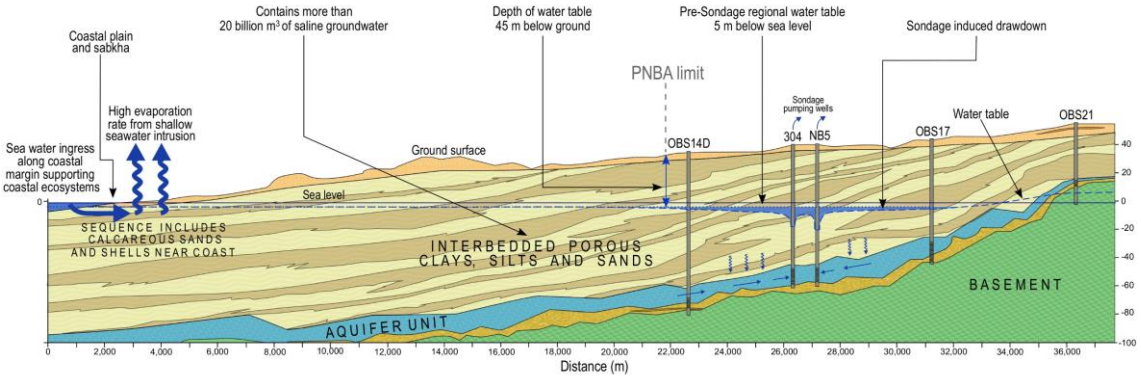

Figure 17: Conceptual cross section of the hydrostratigraphic units and flow mechanisms controlling groundwater elevations in the Sondage and PNBA area (wells labelled 'OBS' are observation wells for monitoring water level and chemistry) (image courtesy of Piteau Associates).

Along the eastern boundary of the PNBA the most precautionary model predicts that the water table will fall from 38.5 mbgl at present to 42.6 mbgl (in 2034). The simulated drop in the water table decreases going to the west (beneath the PNBA) and does not extend within 12 km of the coastal plain. For all simulated cases, the model shows no potential impacts on the "fresh" water zones to the north and south of the Sondage.

[4] The model has been prepared by Piteau Associates UK LTD., Shrewsbury, UK based on data from national network of wells, and data collected from the Sondage to date. This model and its findings has been verified by the lenders' independent engineer, and TBC has relied on that verification in this report.

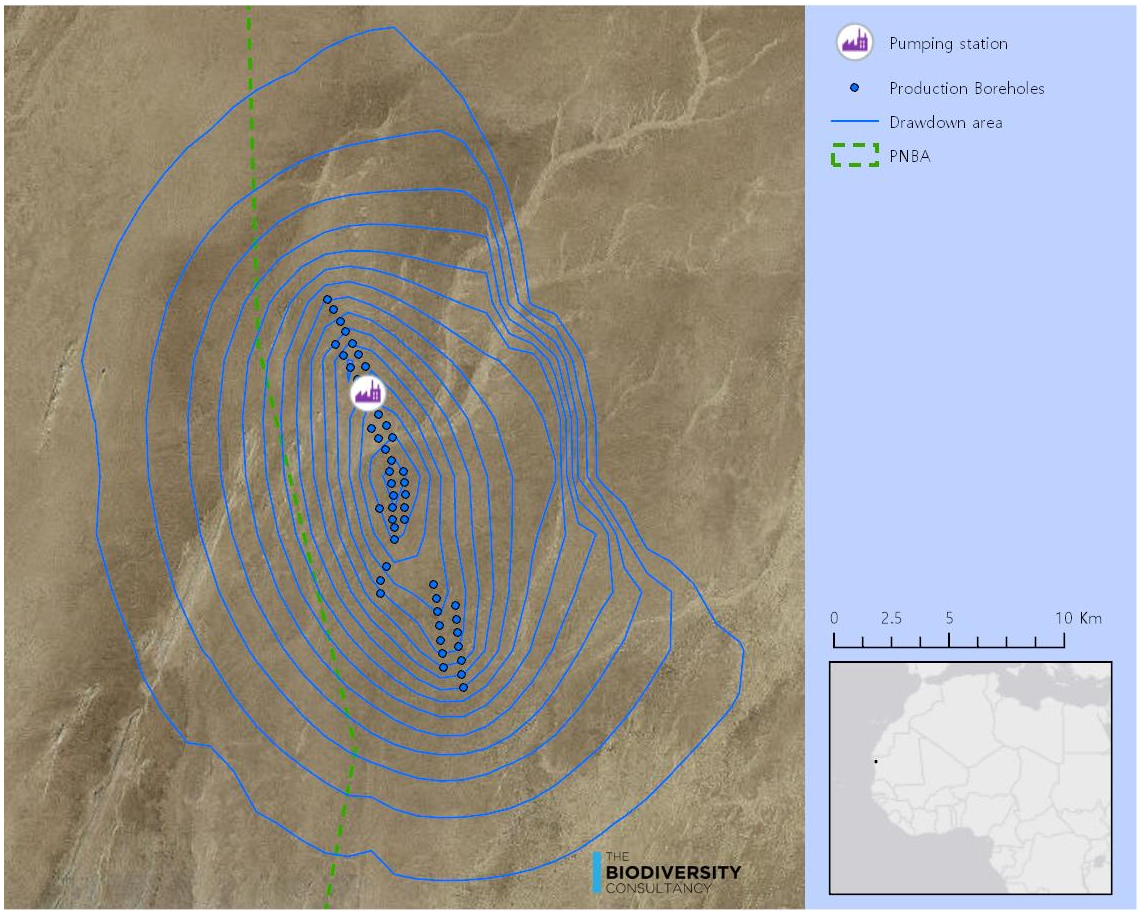

Figure 18: Modelled drawdown area from Tasiast abstraction (each concentric line represents 0.25 m drawdown with the deepest drawdown in the centre)

4.5 Summary on changes to the water table in PNBA

The water table at the PNBA boundary nearest the abstraction wells is at about 45 mbgl, and saline. The aquifer from which water is being abstracted is at a depth of around 80 mbgl. At maximum abstraction levels the hydrological modelling predicts that the water table will become approximately 4 m deeper at the wellfield, and a maximum of 2 m deeper at the PNBA boundary. Changes in the aquifer are anticipated to taper to approximately 10 km under the PNBA. Changes in the water table are not predicted to have any impact on water draining through surface layers in wadis after rainfall events or at any other time. Evaporation in the sabkhas is such a strong force, drawing recharge water from the sea, that it is not feasible that pumping from the aquifer will have any impact.

5 Ecological findings

This section presents the findings of the ecological assessment, including an introduction to the ecology and global significance of the PNBA (section 5.1). Section 5.2.1 documents the ecological features which represent the OUV of the PNBA. Section 5.2.2 presents the evaluation

of potential impacts to the ecological receptors to identify if there are any potential negative impacts from water abstraction on the OUV.

5.1 Ecology of the PNBA

The PNBA consists of approximately half marine and half terrestrial ecosystems. Marine ecosystems include extensive seagrass beds and intertidal mudflats, shallow nearshore waters and some pelagic areas in the western section (Figure 19).

The seagrass areas are dominated by *Cymodocea nodosa* and *Zostera noltii*, with *Halodule wrightii* also present, and cover over 700 km^2 of the PNBA (Araujo & Campredon 2016; Littaye & Cheikh 2018). Seagrass beds are important habitat for juvenile fish species, on which many of the species which constitute the PNBA's OUV (e.g. birds) feed, and an irreplaceable habitat for both immature and adult green turtles (Araujo & Campredon 2016), and likely other turtle species.

Most of the marine area is shallow, (<10 m depth), and with tides of 1-2 m, this means that vast intertidal mudflat areas become exposed twice daily and provide ideal foraging grounds for huge numbers of over-wintering Palearctic waders and other shorebirds (Lourenço *et al.* 2016).

Islands within the PNBA are important breeding areas for colonial seabirds (e.g., terns, spoonbill, pelicans, cormorants) (El-Hacen *et al.* 2013; BirdLife International 2019), as well as providing high tide roosts for shorebirds. Tidra, the largest island at 30 km long, also has a population of Dorcas Gazelle (*Gazella dorcas*) (Araujo & Campredon 2016). Small patches of Black Mangrove (*Avecinia germinans*) persist, most notably at Cap Temeris which represent the northerly limit of mangroves along the African Atlantic coast (Dahdouh-Guebas & Koedam 2001). Cordgrass, *Sparina maritima* on the other hand reaches its southern limit in the PNBA. The area therefore represents the boundary between the Afrotropical biogeographical realm in the south and the Palearctic in the north.

The coastline is a mix of sandy beaches, sabkhas, bays and rocky capes. Turtle breeding on sandy beaches is only rarely recorded (Araujo & Campredon 2016) and it's likely the PNBA is not an important nesting area for any turtle species. Sabkhas, or salt flats, occur along much of the PNBA coast, and are caused by deposits of silt, clay or sand in shallow depressions, in arid areas where evaporation is high and with limited freshwater (either through rainfall or flows). These are reported to flood only on exceptional high tides (PNBA staff *pers. comm.* May 2019).

Sea cliffs between Cap Blanc and Guerguerat in Western Sahara, to the north-west of the PNBA, hold one of the most important global populations of Mediterranean Monk Seal (*Monachus monachus*). The species is not known to pup in the PNBA, but regularly forages in the offshore zone and particularly the Cap Blanc reserve.

Inland, there is a mosaic of sandy and rocky dune systems, and isolated sandstone areas. Vegetation cover is sparse in these ecosystems, with some grasses in higher areas and tamarisk (*Tamarix sengalensis*) and acacias (locally reported as *Acacia raddiana*, but also classified as *Vachellia tortilis*), and other shrubs in swales and ephemeral water courses (wadis). These areas

provide habitat for a range of terrestrial species, including all those listed as terrestrial in Table 2. The terrestrial portion of the PNBA lies predominately in the Atlantic Coastal Desert ecoregion (PA1304) which runs as strip approximately 50km wide along the coast. The park also includes the ecotone with the North Saharan steppe and woodlands ecoregion (PA1321) which extends far into the African interior (Olson *et al.* 2001).

5.1.1 Ramsar Site

The Ramsar Site was designated in 1982 and encompasses the entire PNBA (Ramsar 1999). The site qualifies under several Ramsar criteria (McInnes *et al.* 2017):

- *Criterion 1: Representative example of a wetland type* – based on the scale and diversity of wetland habitats in PNBA
- *Criterion 2: Vulnerable, endangered, or critically endangered species or threatened ecological communities* – primarily due to the Green Turtle, Monk Seal, cetaceans, rays and sharks.
- *Criterion 5: It regularly supports 20,000 or more waterbirds* – wintering Palearctic waders.
- *Criterion 6: It Regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.* – more than 20 species are reported to exceed the threshold (Table 2).
- *Criterion 8: Internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.* – the seagrass bed and nearshore waters are important fish spawning grounds.

Species and communities that qualify the PNBA as a Ramsar site under these criteria are listed in Table 2

5.1.2 Key Biodiversity Area

Key Biodiversity Areas include Important Bird Areas (IBAs), and the PNBA was assessed as an IBA in 2001 (IBA code MRU07) (BirdLife International 2019), and meets criteria:

- *A1: Significant numbers of globally threatened species* - Nubian Bustard
- *A3: Significant component of biome restricted species* - representing the Saharan biome *and;*
- *A4: Significant congregations of birds. ("known or thought to hold congregations of ≥1% of the global population of one or more species on a regular or predictable basis")*[5].

Further detail is found in the Birdlife IBA factsheet for Banc d'Arguin.

[5] The IBA was also designated for Criterion A4iii: congregations of over 20,000 birds, however this Criterion is no longer used by BirdLife, and is not part of the Key Biodiversity Area standard (IUCN 2016) which has superseded the IBA criteria.

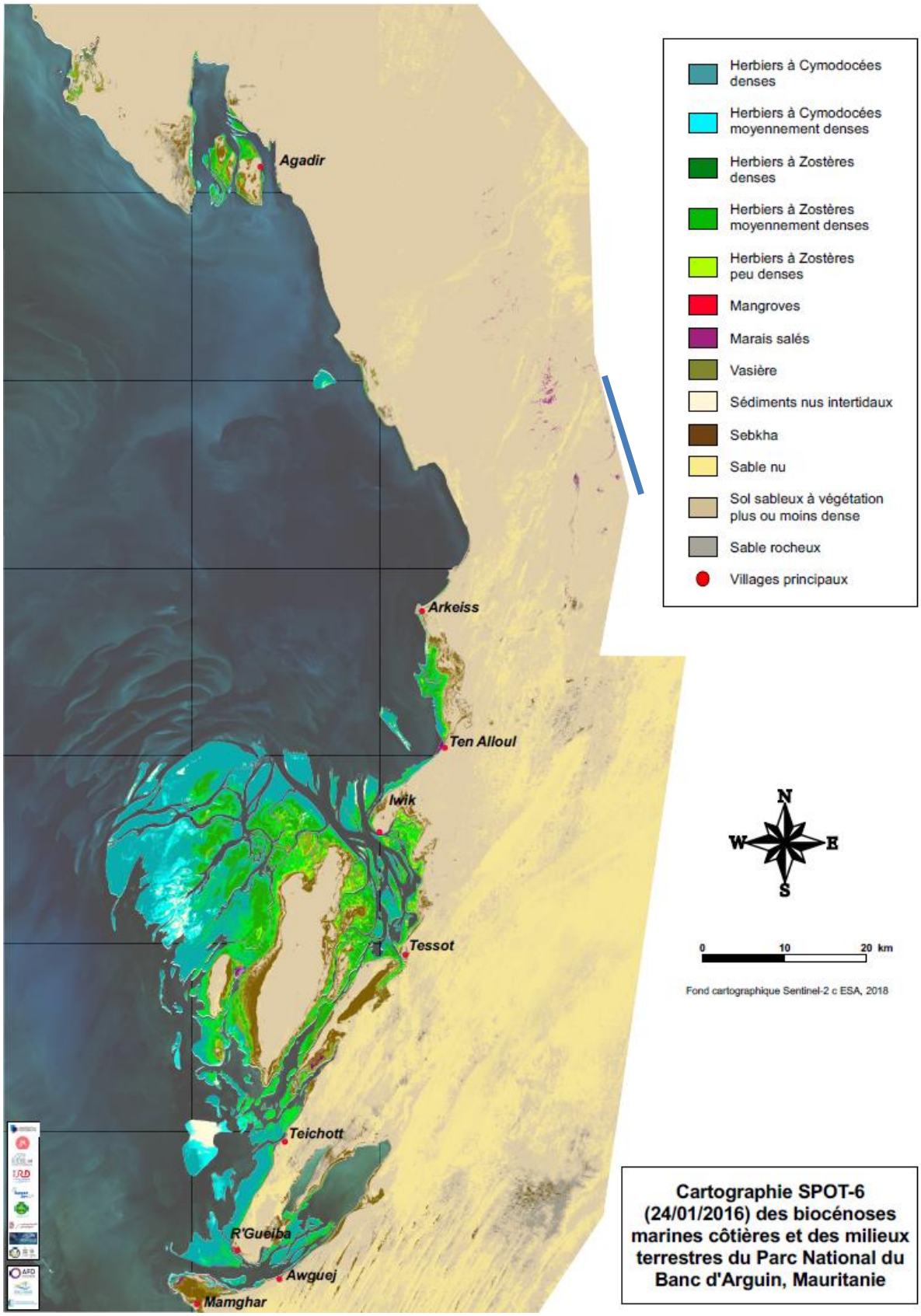

Figure 19: Ecosystems of PNBA. Approximate location of the Sondage is added as the blue line (map courtesy of PNBA 2018)

5.2 Determination of potential impacts

5.2.1 Ecological receptors

Table 2 below summarises the most important biodiversity features of the PNBA based on the literature review and stakeholder consultation. These are the ecological receptors which constitute the OUV for the PNBA for which potential impact pathways are investigated. The table provides a summary of the information used in the assessment of potential impact pathways: a brief summary of the status and distribution of the features in PNBA, the ecosystem and main habitat used by the features. To simplify the analysis and presentation of the results the features are grouped, where possible, based on their ecology, and similarity in potential impact pathways. For example, five cetaceans and one seal are all grouped as 'Marine Mammals' because they all inhabit the open water areas of the PNBA, have similar ecological needs and thus any potential impacts to the six species are likely be the same. This allocation of each feature to a groups is included in Table 2 column headed "Receptor group".

Table 2: Ecological receptors which contribute to the Outstanding Universal Value (OUV) of Parc National Banc d'Arguin

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Ecosystem processes						
Inter-connectivity of marine and terrestrial systems	n/e	Interaction of marine upwellings, circulation of currents through the bay, and input of nutrients from the land, which contribute to the high ecological richness of the PNBA and support the large numbers of fish and birds which visit the area.	All	All	Ecosystem process	PNBA management plan, UNESCO WHS inscription, and stakeholder perception
Ecosystems						
Wadis	n/e	Wadis are ephemeral water courses which have flowing water during extreme rain events. Several major wadi systems cross the PNBA, mostly in a North-east to South-west alignment. Vegetation found along wadis includes *Acacia radianna*, *Balanites aegyptiaca*, *Capparis decidua* and perennial grasses. Near the coast (> 5km) *Tamarix senegalensis* is found as scattered individual trees in the wadi systems.	Desert	Terrestrial	Wadi	PNBA management plan, UNESCO WHS inscription, and stakeholder perception, KBA description
Sabkha	n/e	Salt-pans formed in low-laying areas. Saline water is drawn up from ground water evaporative forces (and re-charged from the sea). Evaporation leaves a salt crust which is mostly too saline for complex life. Coastal sabkhas are intermittently flooded by high tides. At these flood times they are used by wading birds and Greater Flamingo. Distributed along the coastal strip.	Coastal fringes	Coastal	Sabkha	PNBA management plan, UNESCO WHS inscription,

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Intertidal mudflats	n/e	The mudflats comprise of areas of fine sediments that are repeatedly covered and exposed with tidal flows. Mudflats are a highly productive ecosystem with a high biomass of invertebrates (Wolff *et al.* 1993a) which are food source for a range of birds (Lourenço *et al.* 2016) (see below) and as a nursery ground for many fish species. Large areas of intertidal mudflats occur in the PNBA, especially around Iwik, Tidra and Cape Temeris.	Nearshore	Coastal	Intertidal mudflats	PNBA management plan, UNESCO WHS inscription, and stakeholder perception, KBA description
Mangrove	n/e	Mangroves occur worldwide in the intertidal zones of the tropics and subtropics, and are adapted to cope with long periods of salt water immersion. Mangroves form dense ecosystems, which are used by a large range of other species for feeding, shelter and nesting. There are groves of *Avecinia germinans* (see below) at Cape Temeris and Arkeis (Dahdouh-Guebas & Koedam 2001).	Coastal fringes	Coastal	Mangrove	PNBA management plan, UNESCO WHS inscription, and stakeholder perception, KBA description
Seagrass	n/e	Seagrasses are a group of plants adapted to permanent inundation in shallow marine environments. They can form dense beds in sandy or muddy substrates, and are used by a range of species for feeding or shelter. Extensive beds of two species, *Zostera noltii* and *Cymodocea nodosa*, occur in the PNBA. The most extensive areas are around Tidra island in the southern half of the PNBA (Littaye & Cheikh 2018).	Nearshore	Coastal	Seagrass beds	PNBA management plan, UNESCO WHS inscription, and stakeholder perception, KBA description
Plants						
Avicennia germinans (a mangrove)	LC	The most widespread tropical mangrove species, which grows in the intertidal region of sheltered tropical and sub-tropical coasts. This species provides critical habitat to a range of other species, as shelter, foraging habitat for larval fish, or nesting areas for waterbirds. The PNBA contains groves at Cape Temeris and Arkeis, which are the northernmost populations within Africa (Dahdouh-Guebas & Koedam 2001).	Coastal fringes	Coastal	Mangrove	Ramsar remarkable flora

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Small cordgrass *Spartina maritima*	n/e	A widely distributed, predominately Mediterranean, perennial species that grows in tidal mudflats. The species can form dense populations and is a dominant species in saltmarsh development. The PNBA contains the southernmost population of this species (PNBA 2015).	Coastal fringes	Coastal	*Spartina*	UNESCO WHS inscription
Acacia raddiana	n/e	A desert-adapted species reaching 4-7 m in height and which have an estimated life span of >50 years. Individuals occur sparsely in wadis and dry watercourses across northern Africa and the Middle East (the species is synonymous with *Vachellia tortilis* in some literature). Occurs in wadis throughout the PNBA, especially Wad Chebkha	Desert	Terrestrial	Wadi	UNESCO WHS inscription, Ramsar
Invertebrates						
Mollusc species (multiple)		A variety of species (over 35 taxa have been identified to date) occur in the benthos within intertidal mudflats and seagrass beds (Wijnsma *et al.* 1999)	Coast, and offshore	Marine & coastal	Intertidal mudflats	UNESCO WHS inscription
Fish						
Flathead Mullet *Mugil cephalus*	LC	Widespread in shallow coastal tropical to warm-temperate areas, where it occurs in nearshore pelagic habitats. It is mainly diurnal, feeding on larval zooplankton, micro-algae and benthic organisms. Breeding occurs in estuaries from May to September, with juveniles remain for up to three years. While known to be seasonally present no detailed information available on the current status of this species within the PNBA.	Offshore waters	Marine	Fish	PNBA Management Plan
African Wedgefish *Rhynchobatos luebberti*	EN	Occurs along the coast from Mauritania south to Angola, where it is restricted to inshore coastal habitats. Feeds on small bony fish and invertebrates in soft mud or sandy sea floor areas. The species is confirmed as present; however, no detailed information is available on the current status of this species within the PNBA.	Nearshore	Marine	Fish	Ramsar Criterion 2

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Inshore fish species (multiple)		The World Heritage inscription mentions 45 species present, but no further information on which these species are, or their status in the PNBA has been found during this assessment. .	Nearshore waters	Marine	Fish	WHS Criterion X
Reptiles						
Green Turtle *Chelonia mydas*	EN	A widespread marine species that feeds on seagrass and algae. Female return to the same beaches where they hatched to lay eggs, however no nesting beaches are known from the PNBA. Likely to be a frequent non-nesting visitor to seagrass beds in the PNBA.	Marine, seagrass	Marine & coastal	Green and Leatherback Turtles	WHS Criterion x, Ramsar Criterion 2
Leatherback Turtle *Dermochelis coriacea*	VU	A widespread marine species that mainly feeds in the open ocean on jellyfish and other soft-bodied invertebrates. Not known to nest in PNBA. Current status in the PNBA is not known.	Marine, seagrass	Marine and coastal	Green and Leatherback Turtles	Ramsar Criterion 2
Loggerhead Turtle *Caretta caretta*	VU	A widespread marine species that mainly feeds on benthic shellfish, sea urchins and jellyfish. Not known to nest in PNBA. No information available on the current status of this species within the PNBA.	Marine	Marine	Other marine turtles	PNBA Management Plan
Hawksbill Turtle *Eretmochelys imbricata*	CR	A widespread marine species that feeds on algae, sponges, crustaceans and sea urchins. Female return to the same beaches where they hatched to lay eggs, however no nesting beaches are known from the PNBA. No information available on the current status of this species within the PNBA.	Marine	Marine	Other marine turtles	PNBA Management Plan
Mammals						
Harbour Porpoise *Phocoena phocoena*	LC	Found in cold temperate to sub-polar continental shelf waters of the Northern Hemisphere, where they eat a wide variety of fish and cephalopods. Frequently observed near the coast within the PNBA (PNBA 2009), and a likely resident species, but no population assessment undertaken.	Marine	Marine	Marine mammals	Ramsar remarkable fauna

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Long-finned Pilot Whale *Globicephala melas*	LC	Found primarily along the continental slope and oceanic areas of temperate and sub-polar waters. They primarily feed on cephalopods, but will also take a range of fish species. The species is confirmed as present; however, no detailed information is available on the current status of this species within the PNBA.	Marine	Marine	Marine mammals	Ramsar remarkable fauna
Short-finned Pilot Whale *Globicephala macrorynchus*	LC	Found in deep offshore areas of warm temperate to tropical waters, where they may be nomadic or resident, and where they feed on a range of fish and cephalopods. The species is confirmed as present; however, no detailed information is available on the current status of this species within the PNBA.	Marine	Marine	Marine mammals	Ramsar remarkable fauna
Mediterranean Monk Seal *Monachus monachus*	EN	A resident species around known breeding sites, with breeding spread over c. six months with a peak in October. Individuals forage for bony fishes, cephalopods, and crustaceans in coastal waters up to the edge of the continental shelf. One population of c. 220 individuals is at Cap Blanc, the southernmost population of this species. Individuals of this population likely forage within the main PNBA area.	rocky coast / marine	Marine	Marine mammals	Ramsar Criterion 2
Common Bottlenose Dolphin *Tursiops truncatus*	LC	A globally-distributed species inhabiting both inshore and offshore water. Groups are largely resident and forage for a wide range of fish and cephalopods in open water, estuaries and shallow coastal areas. The species is confirmed as present; however, no detailed information is available on the current status of this species within the PNBA.	Marine	Marine	Marine mammals	WHA Criterion x
Atlantic Hump-backed Dolphin *Sousa teuszii*	CR	Occurs in nearshore waters of western Africa, from Western Sahara to Angola. Likely resident in shallow (<30 m) waters, where it forages for a range fish species. Regularly occurs in the PNBA, but current status unknown.	Marine	Marine	Marine mammals	WHA Criterion x

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Striped Hyena *Hyaena hyaena*	NT	Widely distributed through northern Africa and the Middle East, where they are resident in open habitat or light thorn bush country in arid to semi-arid environments. Reportedly extirpated from the PNBA.	Desert	Terrestrial	Terrestrial mammals	Ramsar remarkable fauna, PNBA Management Plan
Fennec Fox *Vulpes zerda*	LC	Widespread resident in sandy deserts and semi-deserts of northern Africa, where pairs forage for a range invertebrates and small vertebrates. Likely to be resident in low numbers throughout suitable habitat in the PNBA.	Desert	Terrestrial	Terrestrial mammals	Ramsar remarkable fauna, PNBA Management Plan
Rüppell's Fox *Vulpes rueppellii*	LC	Widespread resident in sandy deserts and semi-deserts of northern Africa and the Middle East, where pairs occur in open and stony habitats often with sparse vegetation cover. Feeds on a range of invertebrates and small vertebrates. Likely to be resident in low numbers throughout suitable habitat in the PNBA.	Desert	Terrestrial	Terrestrial mammals	Ramsar remarkable fauna, PNBA Management Plan
Golden Jackal *Canis aureus*	LC	Widespread across the Mediterranean, north Africa the Middle East and Asia, where pairs or groups are resident in a range of habitats. Resident in low numbers in the PNBA.	Desert	Terrestrial	Terrestrial mammals	Ramsar remarkable fauna, PNBA Management Plan
Dorcas Gazelle *Gazella dorcas*	VU	Inhabits a wide range of arid and semi-arid habitats, especially sparsely vegetated rocky plains, in northern Africa. Feed on a range of plants, and do not need to drink. There is a resident population of about 80 individuals on Tidra island	Desert	Terrestrial	Dorcas Gazelle	WHA Criterion x, PNBA Management Plan
Birds						
Nubian Bustard *Neotis nuba*	NT	A large terrestrial bird that is resident at low densities in areas with at least some vegetation. Solitary, except when males congregate at leks during the breeding season. Feeds on mainly invertebrates, but will also eat seeds and fruit when available. No information available on the current status of this species within the PNBA.	Desert	Terrestrial	Desert birds	KBA A1, A3

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Greater Flamingo *Phoenicopterus roseus*	LC	The species inhabits shallow saline lagoons or lakes, coastal areas and estuaries, where it feeds on a range of crustaceans, mollusks and small marine aquatic species. Nesting is in dense colonies on mudflats or bare islands. The PNBA is one of the most important breeding (with at least 15,000 pairs) and wintering sites (with 96,073 individuals in 2017) for Greater Flamingo in West Africa (El-Hacen 2018).	Intertidal mudflats, islands, sabkhas	Coastal	Greater Flamingo	KBA A4i
Eurasian Spoonbill *Platalea leucorodia*	LC	The PNBA has a resident endemic sub-species, *P. leucorodia balsaci*, (El-Hacen *et al.* 2013) while the Palearctic migrant sub-species *P. l. leucorodia* is also present between September and March. Nesting is colonial, and occurs on the ground on islands. It forages for a range of aquatic invertebrates in shallow mudflats and estuaries. 1,610 breeding pairs of the endemic sub-species were estimated in 2001. 9,074 individuals (both sub-species) were counted in January / February 2017 (El-Hacen 2018).	Intertidal mudflats, islands, sabkhas	Coastal	Mauritanian Spoonbill	KBA A4i
Little Egret *Egretta garzetta*	LC	A resident species, with populations boosted with Palearctic and Afrotropical migrants. Forages in shallow waters and on tidal mudflats for small fish, invertebrates and crustaceans. 3,670 individuals were counted in January / February 2017[6]	Intertidal mudflats, islands, sabkhas	Coastal	Fish eating birds	KBA A4i
Western Reef-heron *Egretta gularis*	LC	A resident species that breeds solitarily or in small colonies on the ground or rocky ledges. Forages on rocky or sandy shores and reefs for a range of fish, crustaceans and molluscs. 3,670 individuals were counted in January / February 2017[5]	Intertidal mudflats, islands,	Coastal	Fish eating birds	KBA A4i

[6] This count is a combination of Little Egret *E. garzetta* and Western Reef Heron *E. gularis*, as the two were not separated in the field.

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Mauritanian Grey Heron *Ardea cinerea monicae*	LC	The PNBA has a resident population of the restricted-range sub-species, *A. c. monicae*, which may be boosted by Palearctic migrants between June and December. May breed colonially on cliffs or the ground, and forages for fish and other invertebrates and small vertebrates in shallow waters and surrounding areas. 3,302 individuals were counted in January / February 2017 (no separation was made between sub-species (El-Hacen 2018).	Intertidal mudflats, seagrass, islands,	Coastal	Fish eating birds	Stakeholder interest
Great White Pelican *Pelecanus onocrotalus*	LC	A resident species, with populations boosted by Afrotropical migrants in the non-breeding period (which varies annually). Nests on the ground on islands, and forages for medium-sized fish in a variety of coastal marine habitats. Most recently, 7,959 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats, seagrass, islands,	Coastal	Fish eating birds	KBA A4i
Long-tailed Cormorant *Microcarbo africanus*	LC	A resident species which forages in coastal areas for a range of fish species. Nests on rocky outcrops on islands, and also directly on sandy areas if rocky areas or vegetation is not available. 2.938 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats, islands, sabkhas	Coastal	Fish eating birds	KBA A4i
Great Cormorant *Phalacrocorax carbo*	LC	A resident species, with the population boosted by Palearctic migrants between October and February. Nests on rocky cliffs or islets, and forages in surrounding shallow estuaries, coastal areas and lagoons for a variety of fish species. Most recently, 14,504 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats, islands, sabkhas	Coastal	Fish eating birds	KBA A4i
Eurasian Oystercatcher *Haematopus ostralegus*	NT	A Palearctic migrant, generally present in the PNBA between October and April. Foraging on intertidal mudflats or rocky areas for bivalves, crustaceans, molluscs and gastropods. 7,198 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats, islands,	Coastal	Wading birds	KBA A4i

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Kentish Plover *Charadrius alexandrinus*	LC	A Palearctic migrant, generally present in the PNBA between October and March. Feeds on worms and other invertebrates on intertidal mudflat areas. 9,792 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats,	Coastal	Wading birds	KBA A4i
Grey Plover *Pluvialis squatarola*	LC	A Palearctic migrant, generally present in the PNBA between September and April. Feeds on worms and other invertebrates on intertidal mudflat areas. 29,531 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats,	Coastal	Wading birds	KBA A4i
Common Ringed Plover *Charadrius hiaticula*	LC	A Palearctic migrant, generally present in the PNBA between September and April. Feeds on worms and other invertebrates on intertidal mudflat areas. 77,091 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i
Whimbrel *Numenius phaeopus*	LC	A Palearctic migrant, generally present in the PNBA between September and April. Feeds on crustaceans, molluscs and large polychaetes in intertidal mudflat areas. 27,992 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i
Eurasian Curlew *Numenius arquata*	NT	A Palearctic migrant, generally present in the PNBA between September and March. Feeds on crustaceans, molluscs and large polychaetes in intertidal mudflat areas. 5,731 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i
Bar-tailed Godwit *Limosa lapponica*	NT	A Palearctic migrant, generally present in the PNBA between September and April. Feeds on a range of crustaceans, molluscs and invertebrates in intertidal mudflat areas. 251,246 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i
Ruddy Turnstone *Arenaria interpres*	LC	A Palearctic migrant, generally present in the PNBA between September and April. Feeds on a range of insects, crustaceans and molluscs in intertidal mudflat areas. 8,238 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Red Knot *Calidris canutus*	NT	A Palearctic migrant, generally present in the PNBA between September and May. Feeds on a range of insects, crustaceans and molluscs in intertidal mudflat areas. 200,867 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i
Curlew Sandpiper *Calidris ferruginea*	NT	A Palearctic migrant, generally present in the PNBA between August and May. Feeds on a range of polychaetes, crustaceans and molluscs in intertidal mudflat areas. 45,174 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i
Sanderling *Calidris alba*	LC	A Palearctic migrant, generally present in the PNBA between September and May. Feeds on a range of polychaetes, crustaceans and molluscs in intertidal mudflat areas. 41,125 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i
Dunlin *Calidris alpina*	LC	A Palearctic migrant, generally present in the PNBA between August and March. Primarily feeds on a range of polychaete worms and small gastropods in intertidal mudflat areas. 850,650 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i
Little Stint *Calidris minuta*	LC	A Palearctic migrant, generally present in the PNBA between September and May. Feeds on a wide range of invertebrates in intertidal mudflat areas. 14,050 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i
Common Greenshank *Tringa nebularia*	LC	A Palearctic migrant, generally present in the PNBA between September and March. Feeds on a wide range of invertebrates and larvae, crustaceans and molluscs in intertidal mudflat areas. 7,261 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Common Redshank *Tringa totanus*	LC	A Palearctic migrant, generally present in the PNBA between September and March. Feeds on a wide range of invertebrates and larvae, crustaceans and molluscs in intertidal mudflat areas. 58,890 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats	Coastal	Wading birds	KBA A4i
Gull-billed Tern *Sterna nilotica*	LC	A resident species, with the population boosted by paleartic and Afrotropical migrants. Forages over a wide range of habitats, including saltpans, coastal lagoons and mudflats, where it feeds on a wide range of insects and small vertebrates. Most recently, 443 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats, islands,	Coastal	Fish eating birds	KBA A4i
Slender-billed Gull *Larus genei*	LC	A resident species, with the population boosted by paleartic migrants between August and February. Forages in shallow coastal areas, where it feeds on a wide range of fish and marine invertebrates. Most recently, 5,176 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats, islands, sabkhas	Coastal	Fish eating birds	KBA A4i
Lesser Black-backed Gull *Larus fuscus*	LC	A resident species, with the population boosted by paleartic migrants between August and March. Forages at sea, in shallow coastal areas and terrestrially, where it feeds on a wide range of fish, invertebrates and opportunistically other species. 6,240 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats, islands, sabkhas	Coastal	Fish eating birds	KBA A4i
Caspian Tern *Hydroprogne caspia*	LC	A resident species, with the population boosted by paleartic migrants between August and March. Forages in shallow coastal areas for primarily small fish. Most recently, 4,573 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats, islands, sabkhas	Coastal	Fish eating birds	KBA A4i

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Common Tern *Sterna hirundo*	LC	A Palearctic migrant, generally present between September and February. Forages at shallow coastal areas, estuaries and wetlands, where it feeds on small fish. 40 breeding pairs were reported in the justification for listing the PNBA as a KBA. Not recorded during surveys in January / February 2017 (El-Hacen 2018).	Intertidal mudflats, islands,	Coastal	Fish eating birds	KBA A4i
Sandwich Tern *Thalasseus sandvicensis*	LC	A Palearctic migrant, generally present between October and February. Forages at shallow coastal areas, estuaries and wetlands, where it feeds on small fish. 1,244 individuals in 2017 (El-Hacen 2018)	Intertidal mudflats, islands,	Coastal	Fish eating birds	KBA A4i
Royal Tern *Thalasseus maxima*	LC	A resident species, with the population boosted by paleartic and Afrotropical migrants. Forages at shallow coastal areas, estuaries and wetlands, where it feeds on small fish. Most recently, 914 individuals were counted in January / February 2017 (El-Hacen 2018)	Intertidal mudflats, islands,	Coastal	Fish eating birds	KBA A4i
Pharaoh Eagle-owl *Bubo ascalaphus*	LC	A large, nocturnal species that roosts on cliffs or rocky outcrops in arid areas, and forages in surrounding areas for a range of small terrestrial species. Pairs are likely to be resident in suitable habitat in the PNBA.	Desert	Terrestrial	Desert birds	KBA A3
Dunn's Lark *Eremalauda dunni*	LC	A small, terrestrial species that occurs in desert and semi-desert areas with sparse vegetation, where it feeds on seeds, grasses and small insects. Likely to be resident in low numbers throughout suitable habitat in the PNBA.	Desert	Terrestrial	Desert birds	KBA A3
Greater Hoopoe-lark *Alaemon alaudipes*	LC	A terrestrial species that occurs in desert and open wadi areas, where pairs feeds on seeds and small insects. Likely to be resident in low numbers throughout suitable habitat in the PNBA.	Desert	Terrestrial	Desert birds	KBA A3
Bar-tailed Lark *Ammomanes cinctura*	LC	A small, terrestrial species that occurs in desert and semi-desert areas with sparse vegetation, where it feeds on seeds, grasses and small insects. Likely to be resident in low numbers throughout suitable habitat in the PNBA.	Desert	Terrestrial	Desert birds	KBA A3

Ecological receptor	IUCN status	Description and status in PNBA	Habitat	Ecosystem	Receptor group	Source
Desert Lark *Ammomanes deserti*	LC	A small, terrestrial species that occurs in desert and semi-desert areas with sparse vegetation, where it feeds on seeds, grasses and small insects. Likely to be resident in low numbers throughout suitable habitat in the PNBA.	Desert	Terrestrial	Desert birds	KBA A3
Pale Rock Martin *Ptyonoprogne obsoleta*	LC	A congregatory species occurring wherever there are cliffs, ravines or (sometimes) ruins or other human-made structure. Feeds on flying insects., Likely to be resident at suitable habitat throughout the PNBA	Desert	Terrestrial	Desert birds	KBA A3
White-crowned Wheatear *Oenanthe leucopyga*	LC	A species of true desert, especially in rocky areas, where it feeds on a variety of small insects. Likely to be resident in low numbers throughout suitable habitat in the PNBA.	Desert	Terrestrial	Desert birds	KBA A3
Desert sparrow *Passer simplex*	LC	A small species that occurs in desert and semi-desert areas with sparse vegetation, where it feeds on seeds, grasses and small insects. Likely to be resident in low numbers throughout suitable habitat in the PNBA.	Desert	Terrestrial	Desert birds	KBA A3
Trumpeter Finch *Bucanetes githagineus*	LC	A small species that occurs in desert and semi-desert areas with sparse vegetation, where it feeds on seeds, grasses and small insects. Likely to be resident in low numbers throughout suitable habitat in the PNBA.	Desert	Terrestrial	Desert birds	KBA A3
A4iii Species group - waterbirds	-	2,500,000-4,999,999 individuals in winter	Intertidal mudflats, islands	Coastal	Included with several of the above categories	KBA A4iii
	-	50,000-99,999 individuals breeding	Intertidal mudflats, islands	Coastal	Included with several of the above categories	KBA A4iii

5.2.2 Evaluation of links between aquifer and ecological receptors

As a result of the literature review, expert consultation and TBC judgement the evaluation determines that there are **no ecological links between the aquifer and the ecological receptors** presented in Table 2, and thus **no potential for impacts to the OUV from water abstraction**. The findings for each receptor group are presented below.

Ecosystem Process.

The ecosystem processes which represent the OUV are all at the surface. The systems are mainly reliant on marine upwellings, currents and tidal flows to bring nutrients into the bays. These are supplemented by dust blown by onshore winds (Wolff *et al.* 1993b; Carlier *et al.* 2015). Water in the saline aquifer does not have role in these dynamics and thus changes in the aquifer will not impact on the ecosystem processes.

The receptor is not directly or indirectly dependent on saline groundwater, and **no impacts from water abstraction** are predicted.

Wadi

Wadis are ephemeral streams and rivers. They flood after large rainfall events. The vegetation found along the wadis is dependent on moisture retained in the surface layers (Shrestha *et al.* 2003; Sher *et al.* 2010; PNBA 2015) (also see section 4.2). The vegetation, which in turn supports reptiles, mammals and birds, does not utilize the deep, saline aquifer. Thus, although several wadis flow over the drawdown area, any changes in the water table will not have any impact on surface vegetation.

One potential exception in *Tamarix senegalensis* which is found in wadis close to the coast. *Tamarix* are salt tolerant, but this species can reach aquifers no deeper than 3-4 m (Tropical Plants Database 2019): this is the depth of the saline aquifer at the coast in the PNBA. According to the hydrological model (section 4.4) Water abstraction at the Sondage will not have any impact on the aquifers in the coastal strip and the depth of the aquifer will not change. Thus, the drawdown will not have any impact on *Tamarix sengalensis* individuals.

The receptor is not directly or indirectly ecologically dependent on saline groundwater, and **no impacts from water abstraction** are predicted.

Figure 20: Wad Chebka

Sabkha

Salt water is drawn to the surface in sabkhas from the water table. They are therefore physically connected to the saline ground water (Yechieli & Wood 2002). The hydrological model (section 4.3) however indicates seawater recharges the aquifer though offshore intrusion and extreme tidal events, rather than from the interior. Additionally, evapotranspiration at the sabkhas far exceeds any potential draw from the Sondage wells. The abstraction will not therefore impact on the natural dynamics of the sakhas.

Some wading birds, and flamingos may use sabkhas for foraging. Local expertise, and direct observations (June 2019) indicate that this only happens when the sabkhas flood during exceptional high tides and surges. Thus, the ecological importance of sabkhas is linked to tides, and not the aquifer. The lack of influence of the Sondage on sabkha dynamics (section 4.3) means that changes in the ground water in the drawdown area approximately 30 km from the closest sabkhas will have no impact on this receptor.

The receptor is not directly or indirectly ecologically dependent on saline groundwater, and **no impacts from water abstraction** are predicted.

Figure 21: A coastal sabkha

Intertidal mudflats

The value of the mudflats for foraging birds and as habitat for benthic fauna relates to tidal flow, and inputs from offshore upwellings and desert dust. There is no identifiable ecological link to the water table (Wolff *et al.* 1993b, 1993a; Wijnsma *et al.* 1999; Fouw 2016) (see also section 4.4), and thus no impacts from water abstraction.

The receptor is not directly or indirectly ecologically dependent on saline groundwater, and **no impacts from water abstraction** are predicted.

Figure 22: Crabs on intertidal mud

Mangrove thickets

Mangroves are located in isolated patches at Arkeiss and Cap Temeris. The maintenance of mangroves is determined by tidal flows, and not related to the groundwater (Dahdouh-Guebas & Koedam 2001). The nearest mangrove to the bore field is approximately 60 km away, and the significant mangrove stands at Cap Temeris are over 120 km away. None of the mangrove stands are known to draw water from the water table (PNBA *pers comm*), and none are located above the Sondage aquifer (E Pollard *pers obs*). There are thus no conceivable impact pathways for mangroves from water abstraction at the Sondage.

The receptor is not directly or indirectly ecologically dependent on groundwater, and **no impacts from water abstraction** are predicted.

Figure 23: Avecinia germinans *at Cap Temiris*

Seagrass beds

Seagrass beds are dependent on tidal flow, and clear water. The root systems do not penetrate more than 20cm into the substrate and there is no link to the aquifer. The most extensive and important seagrass beds are around Tidra island at least 60 km from the drawdown (Duarte *et al.* 1998; Hemminga 1998; El-Hacen 2018; El-Hacen *et al.* 2018; Littaye & Cheikh 2018).

The receptor is not directly or indirectly ecologically dependent on groundwater, and thus, **no impacts from water abstraction** are predicted**.**

Figure 24: Seagrass at low tide

Spartina

Spartina grows at the tidal limits. It does not depend on ground water. The nearest area of *Spartina* are at least 40 km from the bore field (PNBA 2015). There are no conceivable impact pathways for *Spartina* and water abstraction.

The receptor is not directly or indirectly ecologically dependent on groundwater, and thus **no impacts from water abstraction** are predicted.

Fish

All fish are marine species found in the water body, or seabed. They are dependent on marine systems and not the ground water. There are thus **no impacts to fish from water abstraction** at the Sondage.

Green and Leatherback Turtles

Green and Leatherback turtles forage in seagrass and over mudflats (PNBA 2015). As shown above these ecosystems have no ecological link to the saline aquifer. There are thus **no impacts to turtles from water abstraction** at the Sondage.

Other marine turtles

Other marine turtles use the open water (PNBA 2015). There is no physical or ecological link between the aquifer and open water. There are thus **no impacts to turtles from water abstraction** at the Sondage.

Marine mammals

Marine mammals use the open water (PNBA 2015). There is no physical or ecological link between the aquifer and open water. There are thus **no impacts to marine mammals from water abstraction** at the Sondage.

Terrestrial mammals

Terrestrial mammals use a wide variety of habitats in the PNBA but wadis are considered the most important sites due to the presence of vegetation (PNBA 2015). As demonstrated earlier in this section the maintenance of wadi vegetation is not dependent on the saline aquifer, and therefore no impacts from water abstraction at the Sondage.

The receptor is not directly or indirectly ecologically dependent on saline groundwater, and thus **no impacts from water abstraction** are predicted**.**

Dorcas Gazelle

Dorcas Gazelle are confined to Tidra island (PNBA 2015. The vegetation on the island (used for food and shelter) is not known to be directly linked to any aquifer. This site is at least 60 km from the bore field. There are thus identifiable impact pathways for gazelle from water abstraction at the Sondage.

The receptor is not directly or indirectly ecologically dependent on saline groundwater, and thus **no impacts from water abstraction.**

Greater Flamingo

Flamingos feed in open water on mudflats and occasionally sabkha. The food sources in the open water do not use ground water (PNBA 2015). The nearest nesting colonies are reported to be at least 50 km from the bore field, on offshore islands. There are thus identifiable impact pathways for flamingos from water abstraction at the Sondage.

The receptor is not directly or indirectly ecologically dependent on saline groundwater, and thus **no impacts from water abstraction** are predicted**.**

Figure 25: Greater Flamingo foraging in a tidal inlet at Cap Temeris

Mauritanian Spoonbill

Spoonbills feed in open water on mudflats and occasionally sabkha (El-Hacen *et al.* 2013). The food sources in the open water do not use ground water (PNBA 2015). The nearest nesting colonies are reported to be at least 50 km from the bore field, on offshore islands. There are thus identifiable impact pathways for spoonbills from water abstraction at the Sondage.

The receptor is not directly or indirectly ecologically dependent on saline groundwater, and thus **no impacts from water abstraction** are predicted**.**

Figure 26: Mauritanian Spoonbill at Iwik

Fish-eating birds

Terns, gulls, herons and pelicans feed on fish in open sea water (Veen *et al.* 2018). As documented above there is no link between open water and fisheries with the aquifer. There are thus **no impacts to piscivorous birds** from water abstraction at the Sondage.

Figure 27: Great White Pelicans at Arkeis

Wading birds

Wading birds use mudflats for foraging (Zwarts *et al.* 1990; Lourenço *et al.* 2016; BirdLife International 2019). As documented above there is no link between mudflat productivity and the ground water. There are thus **no impacts to wading birds** from water abstraction at the Sondage.

Desert birds

Desert birds are found throughout the PNBA (PNBA 2015; BirdLife International 2019), but there is no link between the ecological needs of these species and the saline aquifer. There are thus **no impacts to desert birds** from water abstraction at the Sondage.

5.3 Ecosystem services

The services provided to society by the biodiversity and physical environment of PNBA are extremely important to local residents, as well as the economy of Mauritania. Ecosystem services are not part of the OUV of the PNBA World Heritage Site, are therefore not or particular relevance to this investigation. Given their importance however it is instructive to briefly review links between ecosystem services and ground water.

A 2018 study evaluated the ecosystem services provided by PNBA (PNBA 2018). The study identified the main ecosystem services, and estimates a quantified value for the services. The two most important ecosystem services of the PNBA are carbon sequestration in the seagrass bed,

and marine fisheries (both local artisanal fishing and also the contribution that PNBA makes to industrial fishing in Mauritanian waters). Additional services were from tourism (bird watching and sport fishing), nurseries for commercially important fish, and bioremediation. The total estimated annual value of services provided by the PNBA is over 8 billion Euros (with fisheries in the wider Mauritanian EEZ being valued at 3 billion Euros, and carbon sequestration at approximately 3.25 billion).

In terms of economic benefits from the PNBA, the most significant of the ecological receptors identified above are:

- Seagrass beds (for carbon sequestration and as nurseries and birdwatching sites)
- Marine ecosystems (for fisheries);
- Mangroves and saltmarshes for fish nurseries; and
- Mudflats for birdwatching sites and bioremediation.

As outlined above (section 5.2.2) no impacts to these ecosystems from water abstraction are predicted. Thus, there are **no anticipated impacts to priority ecosystem services from water abstraction at the Sondage.**

5.4 Overall findings

In summary a review of literature, expert consultation and hydrological model indicates that:

1. None of the ecological features which represent the OUV of the PNBA are directly or indirectly dependent on groundwater.

2. *Acacia radianna* uses water retained in the surface and is not tolerant of saline conditions (such as the saline water table in the Sondage) (Sher *et al.* 2010)[7].

3. The area above the drawdown is, compared to elsewhere in PNBA, relatively devoid of vegetation. Much of the area is bare, gravel plains (Figure 28).

4. Coastal sabkhas are maintained by evaporation or saline water drawn up from the water table, recharged from the sea. Evaporation leaves a salt crust on the surface, inhospitable to most complex life. Sabkha are only of ecological importance during extreme high tides when they flood and provide a temporary feeding area for wading birds and Greater Flamingo. This occasional utilization of sabkha by birds is not ecologically dependant on groundwater, but on high tides (Sidi Cheikh, and PNBA staff pers comm. May 2019). In addition, the hydrological model shows that the drawdown does not extend to the coast, and that the evaporative draw at sabkhas far exceeds the draw from the Sondage wells. Thus, the water abstraction is not having any impact on the hydrology of the sabkhas.

5. At maximum abstraction levels the hydrological modelling predicts that the water table will become approximately 4 m deeper at the wellfield, i.e. down to nearly 43 mbgl, and a maximum of 2 m deeper at the PNBA boundary. Changes in the aquifer are anticipated to taper to approximately 10 km under the PNBA.

6. While water (predominantly seawater) contained within the coastal sediments may seep back out of aquifers into mudflats and seagrass beds when sea level drops at low tide, the shallow waters at the coast that may feed such seeps are 4-6 m above the groundwater levels in the regional water table, and therefore are not connected in any way with the regional aquifers. Further, there is no indication that the productivity and ecological importance of the mudflats or seagrass systems is maintained by this seepage. The systems are maintained by tidal influx and the movement of nutrients through the bay, and deposition from onshore winds (Hemminga 1998; Carlier *et al.* 2015; Araujo & Campredon 2016; Fouw 2016; Littaye & Cheikh 2018).

[7] Sher et al 2010 reviewed the ecological requirements of *A. radianna* and a *Tamarix* species in Isreal and concluded "We found that *Tamarix* used deep water from aquifers while *Acacia* trees used an alternate source, most likely surface water. Spatial segregation of *Tamarix* and *Acacia* occurs at the large spatial scale but not at the small scale, perhaps because of the high tolerance of *Tamarix* species for salinity and the low tolerance of Acacia species for saline conditions" (our emphasis)

7. The most important areas of all of the main species and communities which contribute to the OUV are far from the drawdown area, including seagrass, mudflats, mangroves, important nesting islands, and Dorcas Gazelle (Dahdouh-Guebas & Koedam 2001; El-Hacen *et al.* 2013; PNBA 2015; Fouw 2016; Lourenço *et al.* 2016). There is no underground water flow between the Sondage and the aquifers below the priority areas. Any change to the Sondage aquifer from water abstraction will not influence the aquifers underlaying any of the areas important for the globally significant biodiversity.

8. Priority ecosystem services from the PNBA include subsistence fisheries in inshore waters, and commercial fisheries throughout Mauritanian waters, carbon sequestration at the seagrass beds, and tourism revenues from birdwatchers and sport fishing. The ecosystems which maintain these services are not impacted by water abstraction activities at the Sondage.

Figure 28: Gravel plains between the wellfield and PNBA boundary.

The overall finding of this study is that there are no identified plausible impact pathways for impacts to any priority receptor of the PNBA OUV from water abstraction by Tasiast in the saline aquifer. Consequently, there are also no potential impacts on any of the broader elements (e.g. a rich and diverse marine and coastal environment, waterbird congregations, wetlands) which comprise the OUV of the PNBA.

Therefore, there is no potential impact on the OUV of the PNBA from current or planned water abstraction by Tasiast.

6 Alignment with IUCN guidelines

The IUCN has prepared guidelines for carrying out Environmental Impact Assessments (EIA) for developments which may impact on World Heritage Sites (IUCN 2013). These guidelines are to ensure potential adverse impacts are identified and managed accordingly. This study supports the existing EIA for the mine expansion, providing additional evidence to support statements contained in the EIA. It is therefore instructive to review how this study might help meet the eight IA Principles. This is summarised in Table 3.

Table 3: How this evaluation supports alignment with IUCN World Heritage impact assessment principles

IUCN World Heritage Impact Assessment Principles	Alignment of this evaluation
Principle 1: All proposals that may adversely affect a natural World Heritage Site must undergo a rigorous Environmental Assessment early on in the decision-making process, whether they are located within or outside its boundaries.	The mine has been the subject of several environmental assessments, that had previously concluded that there is no hydraulic connection between the PNBA and the mine's dewatering wells, and therefore no impact; this study confirms that assessment in a scientifically robust manner.
Principle 2: Experts with World Heritage, protected area and biodiversity knowledge must be closely involved in the assessment process in order to identify the issues that will need to be assessed.	TBC has extensive expertise with World Heritage, protected areas and biodiversity. TBC has carried out similar studies for World Heritage Sites potentially impacted by industrial developments in West Africa, East Africa, and the Middle East. PNBA authorities were also extensively consulted.
Principle 3: The likely environmental and social impacts of the development proposal on the site's Outstanding Universal Value must be assessed, including direct, indirect and cumulative effects.	This evaluation investigates potential impacts from the Sondage wells (section 3), with the aim of addressing concerns from UNESCO raised in the 2018 State of Conservation report.
Principle 4: Reasonable alternatives to the proposal must be identified and assessed with the aim of recommending the most sustainable option to decision-makers.	The findings of this evaluation demonstrate that alternative options are not necessary as no impacts are found from the water abstraction (section 5.4).
Principle 5: Mitigation measures should be identified in line with the mitigation hierarchy, which requires first avoiding potential negative impacts and secondly	No additional measures are required as no impacts have been identified. The mine is fully avoiding any impacts

IUCN World Heritage Impact Assessment Principles	Alignment of this evaluation
reducing unavoidable residual impacts through mitigation measures.	from its water abstraction, and has applied the Mitigation Hierarchy appropriately (section 5.4).
Principle 6: A separate chapter on World Heritage must be included in the Environmental Assessment.	In lieu of a chapter in the EIS this report is focused on potential impacts to the World Heritage Site from water abstraction and acts as a supplement to the existing EIAs.
Principle 7: The assessment must be publicly disclosed and subject to thorough public consultation at different stages.	This evaluation, or its main findings, will be disclosed by lenders, and the main findings will be shared with key stakeholders.
Principle 8: An Environmental Management Plan must be proposed, implemented and independently audited.	No impacts from water abstraction are predicted and thus no EMP is necessary (section 5.4).

7 Next steps

The follow actions are recommended for the Tasiast mine:

- Share findings of this study with PNBA management. The UNESCO national authority will prepare a response to UNESCO decisions in December 2019. These findings can be used by the PNBA to support the position that the water abstraction is not impacting on the OUV.
- Collaborate with PNBA on the development and implementation of a terrestrial monitoring program. Working with PNBA will increase support for the programme and trust in the findings of this study and the monitoring programme.
- As part of Tasiast's position as a leading corporate citizen in Mauritania, evaluate options for supporting the long-term management of the park. This could, potentially, include contributions to the BACoMAB trust fund.

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APPENDIX C – PNBA ENGAGEMENT & CONSULTATION

Date	Organizer	Discussion
Nov. 10, 2017	TMLSA	TMLSA donated equipment to the PNBA to facilitate coastal cleanup of waste debris (e.g. plastic) and community waste management. The PNBA Director had noted: "*the significant aid provided by Tasiast to contribute to the sanitation campaign. It also helped us reinforce our links and to discuss the possible ways of building a strategic partnership between PNBA and Tasiast.*"
Nov. 23 to 25, 2017	PNBA	TMLSA participated in a workshop hosted by the PNBA regarding their State of Conservation Report by the State Party. The PNBA discussed their upcoming response to WHC which stated the following with respect to Tasiast: *"The phase 2 extension and the Tamaya project have been the subject of EIAs which have been transmitted to the World Heritage Center. In all cases, the environmental management plans are scrupulously and rigorously followed with regard to their implementation by the Minister for the Environment and Sustainable Development (MEDD)"*
Nov. 5 to7, 2018	TMLSA	PNBA technical advisor and head of department participated in a TMLSA led workshop regarding the groundwater model for the Sondage abstraction bore field. PNBA advisors asked questions regarding the model. They had noted the model shows groundwater drawdown extending under the PNBA boundaries and requested a thorough study to determine impacts on the park.
Feb. 19, 2019	TMLSA / PNBA	TMLSA organized a meeting with PNBA where agreement was made to establish a technical committee as a means of further collaboration.
Feb. 24 to 25, 2019	TMLSA / PNBA	A team of Community Relations and Environment specialist from TMLSA was provided a two-day tour of the PNBA including Cap Timiris, Tidra, and Iwik. Examples of the OUV of the PNBA were provided while discussions also took place with members of the communities located in the PNBA.
May 7, 2019	TMLSA	A meeting was held with PNBA to request access to the PNBA and their technical advisors when conducting the field component of the ecohydrological study led by The Biodiversity Consultancy (TBC). As agreed by both parties, TMLSA would share the outcome of the study with the PNBA and inform other government stakeholders once complete. Further both parties agreed to provide names of representatives for the Technical Committee between TMLSA and PNBA.

Date	Organizer	Discussion
May 30 to June 5, 2019	TMLSA / TBC / PNBA	TBC presented and solicited feedback on the workplan for the ecohydrological study with the PNBA and other stakeholders (Nature Mauritanie, RAMSAR). Surveys were then conducted of the Sondage and PNBA including the coastal sabkhas and the coast near Iwik. The results of this field work provided input into the ecohydrological assessment being conducted by TBC and Piteau Associates (hydrological component).
Sept. 17, 2019	TMLSA / PNBA	The parties met to review terms of reference for the committee and to finalize dates for presenting the results of the studies being undertaken. The Technical Committee would meet to discuss technical areas of collaboration between TMLSA and PNBA and make recommendations to the Steering Committee for decision.
Oct. 14, 2019	TMLSA / PNBA	The parties met to discuss the results of biodiversity and hydrogeological studies (ecohydrological assessment). Presentations were provided by both TBC and Piteau Associates. Following the presentations, the PNBA posed questions regarding the hydrological model and observed results. In response to questions it was stated that the ecological receptors of the PNBA are not impacted by the Sondage Operations. Currently approximately 0.5 metre drop in water level occurs at the park boundary and that none of the ecological receptors can interact with saline groundwater located 45 metres below the ground. PNBA thanked TMLSA and their consultants for presenting the results of the studies and noted they had sent the reports to their scientific council and would provide comments to TMLSA. A meeting would be planned for November to discuss TMLSA responses to the comments.
Nov. 22, 2019	TMLSA / PNBA	The purpose of the meeting was to formally establish the partnership between PNBA and TMLSA through this first meeting of the Steering Committee. During this meeting the Memorandum of Cooperation Agreement was signed by both parties. Discussions also took place on the TMLSA response to PNBA comments on the ecohydrological assessment. The PNBA General Director stated his satisfaction with the answers to their questions and affirmed cooperation agreement will make it possible to answer the various questions that may be raised in the future. The parties agreed that the Technical Committee would meet in the new year to review the PNBAs five-year action plan and how both parties can collaborate together on work.

APPENDIX D – MEMORANDUM OF AGREEMENT BETWEEN TMLSA & PNBA

Accord - Cadre

Entre d'une part,

Le Parc National du Banc d'Arguin, ci-après désigné par « PNBA », Etablissement Public à caractère Administratif, placé sous la tutelle du Ministère Secrétariat Général du Gouvernement, ayant son siège à Chami et représenté par son Directeur, Maître Aly Mohamed Salem,

Et d'autre part,

Tasiast Mauritanie Limited S.A., société d'exploitation de la mine d'or de Tasiast, ci-après désignée par «TMLSA », ayant son siège à Nouakchott, représenté par son Directeur Général, Monsieur David Hendriks.

Considérant :

Que le PNBA est la plus grande aire marine protégée d'Afrique de l'Ouest (12000 km²) qui possède une Valeur Universelle Exceptionnelle (VUE) qui a prévalu à son classement comme site du patrimoine mondial depuis 1989, site RAMSAR en 1986 et Don à la Terre en 2001. Reconnu pour sa biodiversité d'importance mondiale aussi bien terrestre que maritime et de ses vastes étendues de prairies d'herbiers marins (environ 1000 Km²), il est l'une des zones humides les plus étendues, les plus productives et les plus riches en Afrique de l'Ouest.

La richesse biologique du PNBA est le fruit d'interactions entre les différentes composantes de cet écosystème notamment les herbiers, les oiseaux, le benthos, les poissons mais aussi grâce à la combinaison d'un ensemble de conditions hydro-physiques, climatiques et morphologiques particulières.

Des études récentes montrent la grande utilité du PNBA pour les ressources halieutiques mauritaniennes et quantifie sa contribution à la régénération des ressources maritime à 23%. Le territoire du PNBA est soumis aux effets du changement climatique.

Les missions du PNBA selon la loi spécifique (2000/024) sont la conservation des écosystèmes et de la biodiversité du Parc National du Banc d'Arguin et le développement harmonieux et durable de la population résidente dans le Parc.

Par ailleurs, le PNBA est soumis àun suivi réactif de la part du Comité du Patrimoine Mondial de l'UNESCO depuis 2014 suite au développement de menaces dans et autour du bien.

La société TMLSA est située à environ 60 km des limites EST du PNBA, avec un champ de captage de l'eau souterraine (autorisé jusqu'à 30000m3/jour) en bordure EST immédiate du PNBA.

Que la société TMLSA a pour objectif, entre autres, de développer l'exploitation de l'or au niveau de la mine de Tasiast et de prospecter l'élargissement à d'autres projets tout en respectant l'environnement et les procédures réglementaires applicables en Mauritanie. TMLSA vise à minimiser les impacts potentiels de ses opérations afin de préserver les ressources naturelles.

Les deux parties ont convenu de ce qui suit :

Article 1. Objet et domaines de collaboration

1.1 L'objet de cet accord-cadre est de définir les conditions et les formes générales de collaboration entre les deux parties.

1.2 Dans le cadre de leurs mandats respectifs, le PNBA et TMLSA ont décidé d'entreprendre des actions dans les domaines d'intérêts communs pour la protection de la VUE du PNBA et la mise en œuvre d'activités socio-économiques. Cette collaboration concernera entre autres les aspects suivants :

- L'établissement de relations partenariales ;
- L'appui du PNBA pour la mise en œuvre d'un système de suivi et de partage des connaissances scientifiques ;
- L'appui du PNBA pour la mise en œuvre des projets d'appui à la population résidente au PNBA ;
- Le renforcement des capacités du personnel du PNBA sur des thématiques diverses d'importantes pour la conservation de la biodiversité et des écosystèmes marins et terrestres.

1.3 Les deux parties s'engagent, par ailleurs, à développer un cadre de partage, de diffusion et de publications des informations et d'assurer des échanges réguliers et une concertation soutenue sur les thématiques d'intérêt commun.

Article 2. Instances de coordination

Pour répondre à l'objet du présent accord-cadre, il est créé un Comité de pilotage appuyé par un Comité technique, tels que définis ci-dessous :

2.1 Le Comité de pilotage est constitué des deux (2) représentants provenant des deux institutions qui sont désignés par chaque partie respective. Ce comité se réunit une fois par trimestre. Le Comité de pilotage examine les projets soumis, le rapport et le bilan des activités de collaboration en cours, évalue les besoins nouveaux et décide de nouvelles orientations et développements à mettre en œuvre. Ce comité est présidé alternativement par l'un des directeurs des deux parties. Ces réunions font l'objet d'un procès-verbal diffusé à chacune des deux parties.

2.2 Le Comité technique est composé de représentants des deux parties, dont la désignation est laissée à la discrétion de chacune des parties, et se réunie une fois par trimestre. Le Comité technique est chargé d'élaborer des plans d'action annuels et des propositions de projets de nature scientifique et à vocation socio-économique. Il effectue tout travail demandé par le Comité de pilotage. Il peut, au besoin, faire appel à des experts pour aider à la réalisation de projets spécifiques.

Article 3. Modalités de mise en œuvre de l'accord-cadre

La mise en œuvre des actions retenues se fera sous forme de protocoles spécifiques annuels pris sur le fondement du présent accord-cadre. Les protocoles spécifiques annuels feront expressément référence au présent accord-cadre et définiront notamment les moyens à mettre en œuvre par chacune des parties pour la réalisation des activités envisagées et les conditions de diffusion et de valorisation des résultats.

Article 4. Durée et résiliation

La durée du présent accord-cadre est de **CINQ ANS (5 ans)** à compter de sa date de signature, qui pourra être renouvelé d'un commun accord des parties. Cet accord-cadre peut être résilié par l'une des parties après notification écrite préalable de trois (3) mois adressée à l'autre partie. En cas de résiliation, les partenaires conviendront des modalités de poursuite ou non des protocoles de collaboration spécifiques annuels en vigueur et conclus en référence au présent accord-cadre.

Article 5. Diffusion de l'accord-cadre

Les départements et/ou services administratifs de chaque partie sont chargés chacun en ce qui le concerne de la diffusion du présent accord-cadre.

Article 6. Conformité à la loi applicable et aux dispositions anti-corruption

6.1 Les parties s'engagent à se conformer à toutes les lois en vigueur en Mauritanie et garantissent que toutes les personnes agissant en son nom se conformeront aux lois de la Mauritanie dans la cadre de cet accord-cadre et tout protocole d'entente spécifique annuel.

6.2 Le PNBA doit veiller à ce que l'ensemble de ses représentants agissant conformément aux termes du présent accord-cadre adoptent une conduite entièrement éthique tout au long de leur mission, et ce dans le strict respect des prescriptions légales, réglementaires en vigueur et des conventions internationales régulièrement ratifiées par la Mauritanie, en particulier la Convention des Nations Unies contre la corruption du 25 octobre 2005, tel que mis à jour subséquemment.

6.3 Sans restreindre la portée de ce qui précède, le PNBA prendra toutes les mesures nécessaires afin de s'assurer que ses représentants s'abstiennent de solliciter, directement ou indirectement, de façon explicite ou implicite ou d'exercer une quelconque influence tendant à recevoir de TMLSA ou de ses agents, des paiements, des prêts, des services, des divertissements, des voyages ou des cadeaux, quelles qu'en soient la nature et la valeur.

6.4 Afin d'assurer la conformité aux exigences des lois anti-corruption applicables, TMLSA peut être enjointe de fournir des factures ou autre preuves relatives aux autorités pertinentes ou *per diem* rendus et/ou payés et le PNBA accepte de collaborer avec TMLSA pour ces fins.

6.5 TMLSA ne peut en aucun cas être tenue, en vertu de cet accord-cadre, de prendre toute mesure ou d'omettre de prendre toute mesure, si elle estime, de bonne foi, que cela l'amènerait ou amènerait toute autre société affiliée, à contrevenir aux lois en vigueur, aux lois anti-corruption, ou à prendre part à une activité qui confinerait à toute geste de corruption.

Article 7. Modification

Aucun accord, aucune forme d'engagement modifiant les conditions du présent accord-cadre ne doit être contraignante pour chaque partie à moins que cet accord ne soit établi par écrit et signé par les représentants dûment autorisés de chaque partie.

Article 8. Non-confidentialité

Pour assurer la transparence des relations entre les parties, le présent accord-cadre n'est pas réputé confidentiel et son contenu peut être divulgué en tout ou partie selon toute obligation de divulgation ainsi que d'autres obligations ou des demandes, que celles-ci se fondent sur une loi ou autrement, s'appliquant à chacune des parties ou que celles-ci reçoivent.

Article 9. Notifications

Toutes les notifications ou communications entre les parties concernant le présent accord-cadre devront être adressées à l'adresse mentionnée ci-dessus ou à toute autre adresse transmise par écrite au moins dix (10) jours au préalable.

Article 10. Loi applicable et différends

10.1 Le présent accord-cadre sera régi par et interprété conformément au droit mauritanien.

10.2 Advenant tout différend ou litige entre les parties qui découle de l'interprétation ou de l'application de toute disposition de cet accord-cadre, la partie signalant qu'un tel différend ou litige existe doit en aviser par écrit et fournir les détails pertinents. Les parties doivent ensuite négocier de bonne foi afin d'en arriver à une entente à l'amiable.

10.3 A défaut d'une entente à l'amiable dans les 30 jours suivant la date de réception de l'avis écrit ci-dessus, le différend ou litige doit être soumis à l'arbitrage conformément aux règles de la Cour d'Arbitrage de la Chambre de Commerce Internationale et le lieu de l'arbitrage aura lieu à Nouakchott. La décision de l'arbitre unique ou, selon le cas, celle de la majorité des arbitres, est finale et sans appel de tout autre tribunal. Tous les frais afférents à l'arbitrage doivent être assumés par la partie perdante. Chaque partie s'engage irrévocablement, sans condition ni réserve, par les présentes à exécuter toute sentence arbitrale rendue à son encontre, conformément à ses modalités, en entier, volontairement et sans délai, et renonce par les présentes à renoncer à la compétence de la cour à l'égard de toute sentence rendue et de son exécution.

Fait en deux copies originales à Nouakchott le 19 Novembre 2019

Directeur du PNBA
Maître Aly Mohamed Salem

Directeur Général de TMLSA
David Hendriks

Framework Agreement

Between, on one hand,

The Banc d'Arguin National Park, hereinafter referred to as "PNBA", a public administrative institution placed under the authority of the ministry general secretariat of government, based in Chami and represented by the General Manager Mr. Aly Mohamed Salem,

And, on the other hand,

Tasiast Mauritanie Limited S. A., a gold mining company, hereinafter referred to as "TMLSA", having its registered office in Nouakchott and represented by General Manager, Mr. David Hendriks.

Whereas:

The PNBA is the largest marine protected area in West Africa (12,000 km^2) which has an Outstanding Universal Value (OUV) that has been classified as a World Heritage site since 1989, RAMSAR site in 1986 and as Gift to the Earth in 2001. The PNBA has been recognized for the global importance of its land and sea biodiversity as well as its extended grassland of seagrass meadows (approximately 1000 km^2), it is one of the largest, richest and most productive wetlands in West Africa.

The biological richness of the PNBA is not only the result of interactions between the various components of this ecosystem including grasslands, birds, benthos and fish, but also through a combination of specific hydro-physical, climatic and morphological conditions.

Recent studies show the great usefulness of the PNBA for Mauritanian fishery resources and quantify its contribution to the regeneration of maritime resources at 23%. The PNBA territory is subject to the effects of climate change.

The missions of the PNBA according to the specific law (2000/024) are the conservation of the ecosystems and biodiversity of the Banc d'Arguin National Park as well as a harmonious and sustainable development for the resident population in the park.

Moreover, the PNBA is subject to a reactive monitoring by UNESCO commission since 2014 because of the development of threats in and around the park.

TMLSA is located approximately 60 km from the eastern limits of the PNBA boundary, with a saline groundwater abstraction field (permitted to 30 000 m^3/day) on the eastern edge of the PNBA.

TMLSA's objectives include the development of its gold mining operations at the Tasiast mine as well as the exploration programs for the expansion to other projects while respecting the environment and in accordance to the regulatory procedures applicable in Mauritania. TMLSA aims also to minimize the potential impacts of its operations in order to preserve the natural resources.

The two parties have agreed to the following:

Article 1. Purpose and areas of collaboration

1.1 The purpose of this framework agreement is to define the terms and general forms of cooperation between the two parties.

1.2 Within the framework of their respective mandates, the PNBA and TMLSA have decided to undertake actions in areas of common interest for the protection of the OUV of the PNBA and the implementation of socio-economic activities. This cooperation will include the following aspects:

- Establishment of partnership relations;

- Implementation of a monitoring system and sharing of scientific knowledge;

- Implementation of projects to support the resident population in the PNBA;

- Capacity building for PNBA staff on a variety of issues of importance for the conservation of biodiversity and marine and terrestrial ecosystems;

1.3 the two parties also undertake to develop a framework for the sharing, dissemination and publication of information and to ensure regular exchanges and sustained consultation on themes of common interest.

Article 2. Forum for coordination

In order to fulfil the purpose of this framework agreement, a steering committee shall be established supported by a technical committee, as defined below:

2.1 The Steering Committee shall consist of two (2) representatives from the two institutions designated by each respective party. The committee shall meet quarterly. It examines the submitted projects, the reports and the assessment of ongoing collaborative activities, assesses new needs and decides on new directions and developments to implement. The committee shall be alternately chaired by one of the two parties' managers'. Minutes of these meetings shall be circulated to each of the two parties.

2.2 The Technical Committee shall be composed of representatives of both parties at the discretion of each party and shall meet quarterly. This committee is responsible for developing annual action plans and project proposals of scientific and socio-economic vocation. It shall carry out any work requested by the Steering Committee. It may, if necessary, call on experts to assist in carrying out specific projects.

Article 3. Implementation condition of the framework agreement

The implementation of the actions selected will take the form of annual specific protocols adopted on the basis of this framework agreement. The specific annual protocols shall clearly refer to this framework agreement and shall particularly define the means to be implemented by each of the

parties for carrying out the activities envisaged and the conditions for disseminating and making use of the results.

Article 4. Duration, termination

The duration of this framework agreement shall be five years (5 years) from the date of its signature, which may be renewed by mutual agreement of the parties. This framework agreement may be terminated by either party upon three (3) months ' prior written notice to the other party. In the event of termination, the partners shall agree on the modalities of continuation or not of the specific annual cooperation protocols in force and concluded in reference to this framework agreement.

Article 5. Dissemination of the framework agreement

The administrative departments and/or services of each party shall be responsible for the dissemination of this framework agreement.

Article 6. Compliance with applicable law and anti-corruption provisions

6.1 The parties undertake to comply with all laws in force in Mauritania and guarantee that all persons acting on its behalf will comply with the laws of Mauritania under this framework agreement and any annual specific memorandum of understanding.

6.2 The PNBA must ensure that all its representatives working in accordance with the terms of this framework agreement conduct themselves in a completely ethical throughout their mission, and this in strict compliance with the legal requirements, regulations and international conventions regularly ratified by Mauritania, in particular the United Nations Convention against corruption of October 25, 2005, as updated subsequently.

6.3 Without limiting the generality of the foregoing, PNBA will take all necessary steps to ensure that its representatives do not solicit, directly or indirectly, explicitly or implicitly, or exert any influence whatsoever, with the intention of receiving from TMLSA or its agents, payments, loans, services, entertainment, travel or gifts of any kind or value.

6.4 In order to ensure compliance with the requirements of applicable anti-corruption laws, TMLSA may be required to provide invoices or other evidence relating to relevant or per diem authorities rendered and/or paid, and the PNBA agrees to cooperate with TMLSA for these purposes.

6.5 Under no circumstances shall TMLSA be required under this framework agreement to take any action or to fail to take any action if it believes, in good faith, that it would cause the company or any other affiliate to contravene existing laws, anti-corruption laws, or engage in any activity that would be tantamount to any act of corruption.

Article 7. Modification

No agreement or commitment modifying the terms and conditions of this framework agreement shall be binding on each party unless such agreement is in writing and signed by the duly authorized representatives of each party.

Article 8. Non-confidentiality

In order to ensure transparency in the relations between the parties, this framework agreement shall not be deemed confidential and its contents may be disclosed in whole or in part in accordance with any obligation to disclose as well as other obligations or requests, whether based on a law or otherwise, applicable to or received by each of the parties.

Article 9. Notification

All notifications or communications between the parties concerning this framework agreement shall be addressed to the above-mentioned address or to any other address transmitted in writing at least ten (10) days in advance.

Article 10. Applicable law and disputes

10.1 This framework agreement shall be governed by and interpreted in accordance with Mauritanian law.

10.2 In the event of any dispute between the parties arising out of the interpretation or application of any provision of this framework agreement, the party indicating that such dispute exists shall notify in writing and provide relevant details. The parties must then negotiate in good faith to reach an amicable agreement.

10.3 In the absence of an amicable agreement within 30 days from the date of receipt of the above written notice, the dispute shall be submitted to arbitration in accordance with the rules of the Court of Arbitration of the International Chamber of Commerce and the place of arbitration shall be held in Nouakchott. The decision of the sole arbitrator or, as the case may be, the majority of the arbitrators, shall be final and without appeal to any other tribunal. All costs of the arbitration shall be borne by the losing party. Each party hereby irrevocably and unconditionally undertakes to execute any arbitral award made against it, in accordance with its terms, in its entirety, voluntarily and without delay, and hereby renounces the jurisdiction of the court with respect to any award made and its execution.

Made in two original copies in Nouakchott on November 19 2019.

PNBA General Manager	**TMLSA General Manager**
Maître Aly Mohamed Salem	David Hendriks