

1 INTRODUCTION

1.1 Background

ERM has been commissioned by the International Finance Corporation (IFC) and Amata Garden Resort Inlay Lake (henceforth known as the “Client”) to conduct an IFC Performance Standard 6 (PS6) Gap Analysis, and Biodiversity and Ecosystem Services Impact Assessment on the proposed expansion of Amata Garden Resort Inlay Lake.

This report has been prepared to provide:

- An assessment and presentation of the extent of modified and/or natural habitat within the Area of Interest (AOI) and Project Area, particularly areas that are selected for future clearing and development;
- A clear statement on the presence or absence of biodiversity values, their location, status and condition, and as far as possible, information on key areas or resources that support the values;
- An assessment of the occurrence or likely occurrence of Critical Habitat values, if any; and
- An application of the mitigation hierarchy to recommend suitable management and monitoring measures required for compliance with IFC PS6 requirements.

1.2 International Finance Corporation Performance Standards

The International Finance Corporation (IFC) Performance Standards (PS) establish a range of social and environmental obligations to be met by recipients of financing who apply the IFC PS as their environment and social standards. Governance of the Performance Standards is the responsibility of the IFC. There are eight IFC Performance Standards of which Performance Standard 6 (PS6) is relevant to this biodiversity assessment.

IFC PS6 defines the parameters of biodiversity and ecosystem services which will be considered when assessing the Project against the IFC Performance Standards. This includes the identification and consideration of biodiversity values that include habitat values, threatened species, ecosystem services, protected areas and invasive species. PS6 outlines the objective of no net loss of biodiversity in natural and modified habitats and a net gain of biodiversity in Critical Habitats, where feasible. The PS6 also identifies the need to consider use of offsets to compensate for residual impacts to biodiversity as a result of the Project, but only after the mitigation hierarchy has been applied to the fullest extent practicable. Supporting PS 6 is a Guidance Note (GN), which further elaborates on the key principles discussed in PS 6 itself and guidance on application.

2 PROJECT DESCRIPTION

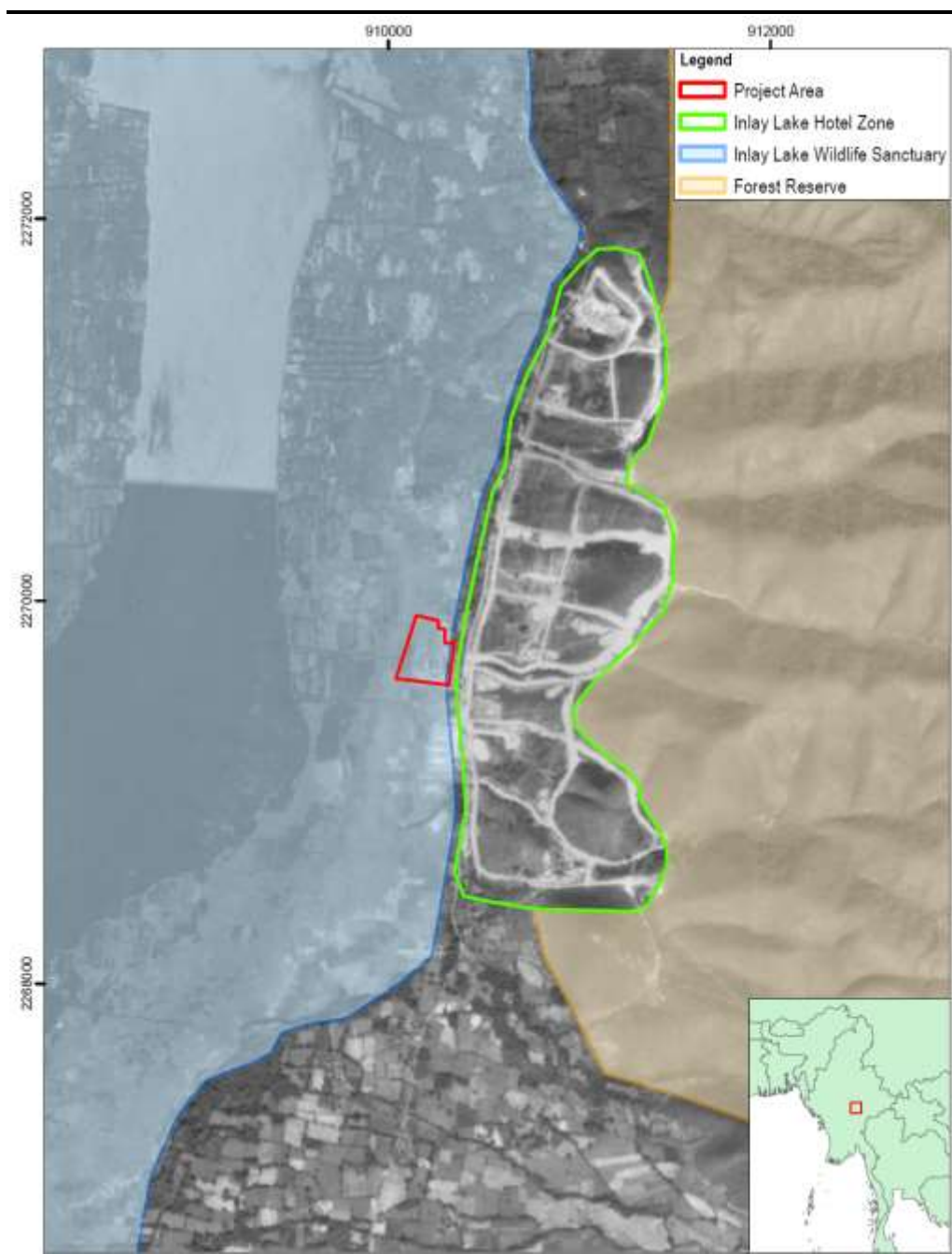
2.1 Location & Site Setting

The Project involves the development of approximately 7.07 ha of land on the eastern shore of Inlay Lake, Plot Number 44, Ingyingone Village within the Taunggyi District of Southern Shan State, Myanmar. The Project lies approximately 20 km south of Nyaungshwe, and is located within Inlay Lake Wildlife Sanctuary, a UNESCO Biosphere Reserve, ASEAN Heritage Park and Important Bird Area (IBA). Inlay Lake Wildlife Sanctuary contains several biodiversity values, including endemic fish species and globally threatened resident and migratory bird species. Further details on the biodiversity values at Inlay Lake can be found in *Chapter 4*.

Immediately west of the Project area lies the Inlay Lake Hotel Zone, a 252 ha plot of land on the hillslopes surrounding Inlay Lake established by the Ministry of Environmental Conservation and Forestry (MoECAF) for future tourism developments. Beyond the Project to the east, lies approximately 650 m of floating gardens. Inlay Lake is accessed from the Project area via a jetty and through a water channel which traverses the floating gardens. Other features found in the vicinity of the Project include rice fields, small villages and other hotel establishments. There are also two forest reserves, the East Inlay Reserve Forest and West Inlay Protected Public Forest, established on the east and west banks of Inlay Lake Wildlife Sanctuary. These forests areas are 139,321 km² and 91,224 km² respectively.

The site setting of the Project is presented in *Figure 2.1*.

Figure 2.1 **Site Setting**



Service Layer Credit: World View 2 Imagery
 Shapefile for Inle Lake Wildlife Sanctuary: Myanmarbiodiversity.org
 East Inlay Forest Reserve is shown

2.2 Project Components

Project components that will be constructed are:

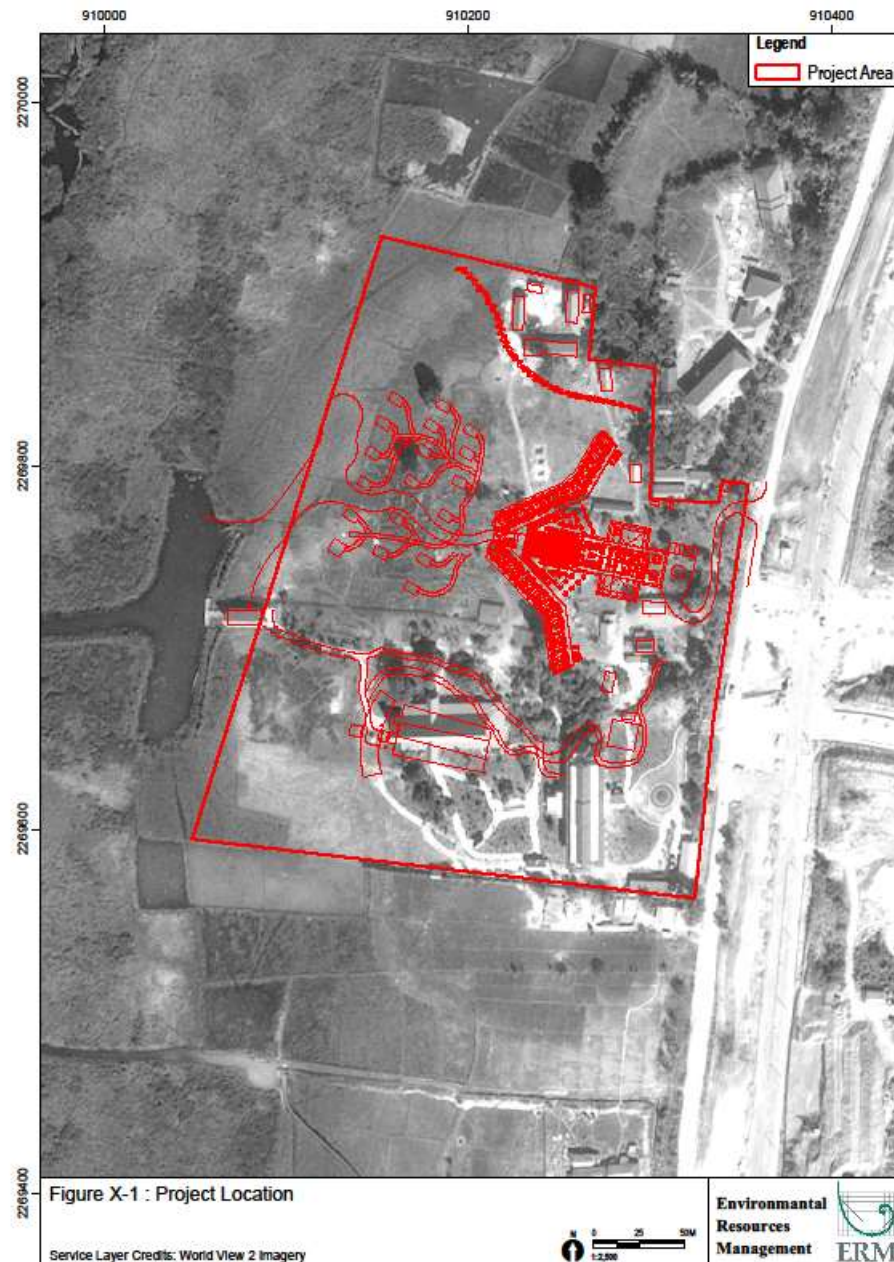
- Twenty (20) one-storey bungalows, constructed on stilts;
- One (1) three-storey building with a capacity of 130 rooms;
- One (1) reception hall;

- One (1) restaurant;
- One (1) gym; and
- One (1) swimming pool.

The Project will be an expansion of Amata Garden Resort Inlay Lake, which currently consists of one (1) three-storey building with 60 rooms, one (1) restaurant, one (1) gift shop, a landscaped garden and a jetty. Project components will be developed north of the existing establishments at Amata Garden Resort Inlay Lake.

These components and their locations in relation to existing properties belonging to Amata Garden Resort Inlay Lake are illustrated in *Figure 2.2*.

Figure 2.1 **Project Components**



The Project will also establish an organic farm on its premises where it plans to cultivate vegetables and spices that will be consumed by high end hotels in the Inlay Lake region. The organic farm will involve local farmers and the Project will be distributing seeds to them. A list of the crop species that will be grown on the farm is being developed.

The proposed plants to be grown in the organic garden include: Seedless Tomato; Eggplant; Lettuce; Cabbage; Cali-flower; Lady finger; Calabash; Beans; Cucumber and Dragon Fruit.

2.3 Environmental Planning Considerations

The Client has commissioned E-Guard Environmental Services to conduct an Initial Environmental Evaluation (IEE) in order to obtain an Environmental Compliance Certificate (ECC) required for operations. A series of Environmental Management Plans is currently being prepared as part of the IEE process and will include an Environmental Management Plan (EMP), a Corporate Social Responsibility (CSR), Monitoring Plan, and Biodiversity Management Plan. At the time of writing, the following planning considerations are understood from the IEE:

- The Project will not encroach onto Inlay Lake, and will maintain a buffer strip of land between it and the water's edge;
- The Project will adopt a policy of zero-waste discharge policy into Inlay Lake;
- Maintenance areas for vehicles, machines and equipment, oil and lubricant storage facility will be on land outside of the resort site;
- Machines, equipment and vehicle maintenance and handling of oil and lubricants to be carried out by trained technicians and experts to minimise risk of spills and leaks to the environment;
- Landscaping at the Project area will be carried out using variety of plants (eg swales of grass, bamboo, hedgerow, trees) to reduce runoff and minimise the risk of sedimentation and waste water seepages into Inlay Lake; and
- Resource conservation practices will be in place once the Project is operational. This will be further elaborated on in *Section 2.1.8*.

2.4 Project Corporate Social Responsibility

The resort has undertaken a number of activities within Ingyingone village and surrounding communities as part of their corporate social responsibility programme. A list of activities undertaken to date is detailed in *Table 2.1*.

Table 2.1 Amata Garden Resort CSR Activities

S/N	Activity	Date
1	Ingyingone Village Plastic and Rubbish Campaign	Feb 2015
2	Food donation: Ingyingone Primary School and Kan Bae Primary School	Jan 2015
3	Food donation: Ingyingone Primary School and Kan Bae Primary School	Nov 2014
4	Food Donation: Ingyingone Primary School	Oct 2014
5	Mai Khoh Village Monastery general maintenance	May 2014
6	Inlay Hotel Zone special cleaning at Phaung Daw Oo Pagoda	Apr 2014
7	Cold drinks donation: Phaung Daw Oo Pagoda water festival	Apr 2014
8	Cold drinks donation: Ah Lo Daw Pauk Pagoda water festival	Apr 2014

S/N	Activity	Date
9	Food and drink donation: Monks and people undertaking meditating at Myittar Mon Old age home	Apr 2014
10	Drinks donation: Phaung Daw Oo Pagoda festival	Oct 2013
11	Drinks donation: Phaung Daw Oo Pagoda festival	Oct 2013

2.5 Construction Phase

2.5.1 Schedule and Resources

Project construction phase has commenced in May 2016 and it is anticipated to span 24 months. Construction activities will be carried out for 8 hours, daily. A labour force of 100 workers will be required to undertake construction activities.

A site walkover conducted in June 2016 observed that work had commenced on the 20 bungalows. A channel traversing the bungalow site is also being dug and potentially connects to Inlay Lake. Materials are stockpiled in a sheltered shed to the back of the construction area, on the eastern side of the Project boundary.

2.5.2 Equipment & Materials

Construction equipment that will be used includes a crane, concrete mixer, and welding equipment. The Project will source timber, cement, bricks, sand, river shingle and plywood from local producers. Viva boards, decking sheets and steel will also be required for construction of Project components. Materials will be transported to and from the site on trucks.

2.5.3 Waste Management

The types of construction waste generated by the Project and their associated management measures are detailed in *Table 2.2*.

Table 2.2 Waste Types Generated and Management Measures

Waste Categories	Waste Types	Management
Vegetation (from site clearance activities)	Softer vegetation (ie leaves, shoots)	Composted on site for reuse during the landscaping phase
	Woody vegetation (ie tree trunks, branches)	stockpiled and removed from site by a licensed waste contractor
General Waste	Food waste, glasses, tins, bottles, packaging material, paper, stationery, damaged/expired appliances/devices etc	collected and segregated into different waste bins collected and sent to dump sites approved by the Nyaungshwe Township Municipality

Waste Categories	Waste Types	Management
Sanitary Waste	-	Temporary toilets will be provided for use on site

2.6 *Operation Phase*

2.6.1 *Operating Hours & Manpower*

The Project will be operational 24 hours a day and employ a maximum of 150 staff. It is anticipated that the Project will be operational for a maximum of 70 years, after which decommissioning activities will be initiated.

2.6.2 *Project Visitation & Trends*

The estimated peak tourist seasons fall within the months of February and November. The Project anticipates up to 1,350 and 1,600 room nights for February and November respectively.

2.6.3 *Utilities*

Water Supply

The Project water source will be obtained via tube wells. Well water will be pumped to an on-site water treatment facility located at the eastern boundary of the hotel compound. Water will be treated to meet the requirements of Nyaungshwe Township Municipality. Treatment media will comprise sand, activated carbon and liquid chlorine. Treated water will be stored in an overhead distribution tank and supplied for non-potable uses. The total estimated water demand during Project operations is an estimated 18,900 litres per day and 5,700,000 litres per year.

Electricity

The Project will obtain electricity from the national grid and will further be supported by two backup generators in the event of emergency power cuts.

Fuel

Fuel and diesel will be required to power the boats, vehicles and generators utilised by the Project. The total estimated demand is 27,300 litres of diesel, 1,900 litres of petrol and 760 litres of lubricant a year.

2.7 *Waste Management*

The types of operational waste generated by the Project and their associated management measures are detailed in *Table 2.3*.

Table 2.3 Waste Types Generated and Management Measures

Waste Categories	Management
Sewage	<p>There will be two ways of managing sewage waste:</p> <ul style="list-style-type: none"> • Conventional septic system where a settling and decomposition chamber will allow sewage solids to separate from liquid and undergo partial decomposition. • Decomposed solid waste will be stored as sludge at the bottom of the tank; • Effluent from the tank will flow by gravity into a subsurface absorption field where it will infiltrate into the soil; • When septic tanks are full, these will be emptied by the Nyaungshwe township municipality. <ul style="list-style-type: none"> • 3-Chamber bio-tank system (for Bungalows) <ul style="list-style-type: none"> • The first chamber will allow for disinfection of sewage using micro-organisms. The second chamber is the sludge sedimentation tank and the last chamber is equipped with an evaporation funnel to store fluids. • Regular monitoring will be carried out on the septic tank and bio-tank systems to ensure that they are not overloaded. • The Project will comply with Nyaungshwe guidelines for proper effluent disposal.
Domestic waste	<ul style="list-style-type: none"> • The Project plans to institute waste segregation and recycling procedures; and • Waste will be collected on a regular basis by the Nyaung Shwe Township Municipality

2.8 Resource Conservation

The Project will adopt resource conservation technologies and practices in its operations. These are listed in *Table 2.4*.

Table 2.4 Resource Conservation Practices Adopted by the Project

Resource Type	Conservation Measures
Electricity	<ul style="list-style-type: none"> • Air conditioning to switch off automatically once a window is opened; • Air conditioning will self-adjust when no presence is detected in the room; • Use of low consumption fluorescent light bulbs; • Lights will switch off automatically when guests are not in the room; and • Outdoor areas will be provided with switch devices to turn off lights during daylight hours.
Water	<ul style="list-style-type: none"> • Water saving flushing devices will be installed; • Low water consumption faucets will be installed;

Resource Type	Conservation Measures
	<ul style="list-style-type: none"> • A reuse towel policy will be encouraged; • Biodegradable soaps will be used; • Treated sewage effluent will be used for irrigation of the grounds; • Residual warm water from the air conditioning system will be used to heat up running water; and • Use of environmentally friendly laundry detergent.

3 ADMINISTRATIVE FRAMEWORK

3.1 Myanmar Legislative Framework

A review of legislation in Myanmar has been undertaken and those applicable to the Project are listed in *Table 3.1*.

Table 3.1 Relevant Legislation in Myanmar

Sector	Relevant Laws
Culture	The Protection and Preservation of Cultural Heritage Region law, 1998 (Revised in 2009 and Supplemented in 2011)
	Antiquities Act, 1957 (Revised 1962)
Forestry, Environment and Natural Resources	The Protection of Wild Life, Wild Plants and Conservation of Natural Areas Law, 1994*
	The Forest Law, 1992*
	The Conservation of Water Resources and Rivers Law, 2006
	The Forest Department Notification No. 583/94* (List of protected wildlife species)
	Environmental Conservation Law, 2012*
	Environmental Conservation Rule, 2014*
	Myanmar Agenda 21
	National Environmental Policy, 1994
	The National Food Law, 1997
	The Traditional Drug Law, 1996
	Environmental Impact Assessment Procedure, 2015
Tourism	The Myanmar Hotel and Tourism Law, 1993
Fisheries, Aquaculture, and Water	The Law Relating to Aquaculture, 1989
	The Conservation of Water Resources and Rivers Law - SPDC Law No. 8/2006
	The Underground Water Act, 1931
Land Use	The Village Act, 1907
Notes 1	
* Elaborated on in greater detail in following sections	

3.1.1 Environmental Impact Assessment Procedure, 2015

Drafted by MoECAP and enacted in 2015, the Environmental Impact Assessment (EIA) Procedures specify requirements for the environmental impact assessment process in Myanmar. Projects are required to undertake an IEE or EIA (or both), develop and implement an EMP in order to receive formal approval for its construction and operation in the form of an ECC. According to the Procedure, developers may be penalised for breaches, violation and performance failure in regard to the IEE, EIA and EMP documents.

3.1.2 *The Environmental Conservation Law, 2012*

The legal mechanism for Environmental, Social and Health Impact Assessments (ESHIA) in Myanmar was put into place in 2012 with the enactment of the Environmental Conservation Law. Under this law, an ESHIA will be required if the proposed project or activity is deemed to cause potentially significant impacts on the environment. Developers are required to ensure emissions of pollutive substances from projects fall below stipulated environmental quality standards by utilising pollution control equipment, undertaking regular monitoring and adopting corrective actions. Developers are also required to manage their waste in an environmentally sound manner and work with relevant government agencies in conserving areas of cultural and natural value.

The Environmental Conservation Law is applicable to projects undertaken by any government department, organisation or person.

3.1.3 *Environmental Conservation Rule, 2014*

These rules detail the environmental policy and implementation framework of the Environmental Conservation Law, 2012. According to these rules, MoECAF, with relevant approval, is authorised to prescribe the amount of liability owing from a person or entity causing environmental damage, and the amounts of contribution to environmental management funds required by those engaged in environmental services and extraction of natural resources.

MoECAF also specifies the types of activities for which EIAs must be conducted. However, even if the nature of the activity does not immediately call for an EIA, an IEE may be ordered to determine whether an EIA is necessary. An EIA should be accompanied with an environmental management plan when submitted to MoECAF for review.

3.1.4 *The Protection of Wildlife, Wild Plants, and Conservation of Natural Areas Law, 1994*

This legislation sets the framework for the implementation of the Myanmar government's policy for wildlife protection and natural areas conservation. It also requires the policy to be carried out in accordance with international conventions to which Myanmar is a signatory/has ratified with respect to the protection and conservation of wildlife, ecosystems and migratory birds.

3.1.5 *The Forest Law, 1992*

This focuses on the adoption of a balanced, sustainable approach towards conservation and development. The Forest Law encourage community forestry and participation in forest management to meet the basic needs of rural people. It

prescribes severe punishments for offences that destroy and degrade forest habitats and biodiversity (eg fire, infestation and occurrence of plant disease).

3.2 *International Conventions and Guidelines*

Myanmar is a signatory of the following international conventions in *Table 3.2* that will be relevant to the Project.

Table 3.2 *International Conventions Ratified by Myanmar*

No.	Conventions	Year (Ratified/Accessed/Accepted)
Environment		
1	Plant Protection Agreement for the Southeast Asia and Pacific Region, Rome 1956	1959 (Ratified)
2	Agreement on the Networks of Aquaculture Centres in Asia and the Pacific, Bangkok 1988	1990 (Accession)
3	United Nations Framework Convention on Climate Change (UNFCCC), New York 1992	1994 (Ratification)
4	Convention on Biological Diversity, Rio de Janeiro 1992	1994 (Ratification)
5	The Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris 1972	1994 (Acceptance)
6	International Tropical Timber Agreement (ITTA), Geneva 1994	1996 (Ratification)
7	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought, Paris 1994	1997 (Accession)
8	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington DC 1973; and as amended in Bonn, Germany 1979	1997 (Accession)
9	ASEAN Agreement on Conservation of Nature and Nature Resources, Kuala Lumpur, 1985	1997 (Signatory)
10	Kyoto Protocol to the Convention on Climate Change, Kyoto 1997	2003 (Accession)
11	ASEAN Agreement on Trans-boundary Haze Pollution	2003 (Ratification)
12	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	2004 (Accession)
13	Ramsar Convention on Wetlands of International Importance	2005 (Accession)
14	Establishment of ASEAN Regional Centre for Biodiversity	2005 (Signatory)
15	Declaration on ASEAN Heritage Parks	2003 (Signatory)
16	International Treaty on Plant Genetic Resources for Food and Agriculture, 2001	2004 (Ratification)

3.3 Inlay Lake Management Plans

A series of management plans have been developed by key ministries involved in the administration of Inlay Lake to guide the management of Inlay Lake and conservation of its biodiversity values. These plans, namely the (i) Inlay Lake Conservation 5-Year Plan; (ii) Inlay Lake Long Term Restoration and Conservation Plan Summary; and (iii) Destination Management Plan for the Inlay Lake Region, were reviewed and their summaries provided in *Table 3.3*, *Table 3.4* and *Table 3.5*.

Table 3.3 Inlay Lake Conservation 5-Year Plan (2015-2016 to 2019-2020) Summary

Topics	Content/Recommendations
Document:	Inlay Lake Conservation 5-Year Plan (2015-2016 to 2019-2020)
Author:	Ministry of Environmental Conservation and Forestry
Objectives	<p>The Action Plan aims to ensure a balanced approach between conservation and development of Inlay Lake by targeting to:</p> <ul style="list-style-type: none"> • Conserve and protect Inlay Lake with active participation of local communities and key stakeholders; • Implement remedial measures to reduce environmental degradation and improve the Inlay Lake ecosystem; • Improve socio-economic conditions and protect livelihoods of local communities in the Inlay Lake watershed; • Maintain the cultural values of the communities living in the Inlay Lake area; and • Establish effective long-term monitoring and management systems for evaluating future progress of conservation efforts.
Geographic Focus	<p>The Action Plan focuses on Inlay Lake and its watershed areas, including the Core Area, Buffer Area and Remote Area. Descriptions of these areas are as follows:</p> <ul style="list-style-type: none"> • Core Area: Includes Inlay Lake, Saka Lake and Moe Bywe Reservoir. Covers approximately 30,000 ha. • Buffer Area: Includes Nyaungshwe Township and surrounding paddy fields, natural forests, Taunggyi and other villages in the immediate catchment of Inlay Lake. Covers approximately 114,000 ha. • Remote Area: Includes headwaters of Inlay Lake. Covers approximately 418,000 ha.
Priority Issues	<ol style="list-style-type: none"> 1) Need for an institutional framework for Inlay Lake conservation; 2) Need for baseline data on the nature and social environment at Inlay Lake, and information management systems; 3) Need for reduction of threats to human health to be reduced and improvement of overall living conditions for Inlay Lake residents; 4) Need for environmental awareness to be improved at all levels (ie national, state, local); 5) Recognition that deforestation rates are unsustainable and need for reforestation in the watershed; 6) Recognition that biodiversity conservation and fisheries resource management are critical for sustaining livelihoods; 7) Need for sustainable agricultural practices, in particular reductions in

Topics	Content/Recommendations
Document:	Inlay Lake Conservation 5-Year Plan (2015-2016 to 2019-2020)
Author:	Ministry of Environmental Conservation and Forestry
	the use of chemical fertilisers and pesticides;
	8) Need to control sedimentation and soil erosion rates which are impacting lake health and productivity; and
	9) Need to promote sustainable tourism practices, improve infrastructure, and provide training and capacity building for local people.
Action Plan	<u>Schedule</u>
Implementation	<p>Phase I: Detailed Project Planning, Design and Secure Funding (Jan-Jun'15)</p> <ul style="list-style-type: none"> Activities identified in the Action Plan to be prioritised and classified into primary and secondary activities. Primary activities to be implemented Jan 2016-Jan 2018. Secondary activities to be implemented Jan 2016-Jan 2020. Related activities will be grouped into projects and defined. Technical and financial proposals to be prepared to seek funding. <p>Phase II: Secure Funding and Project Implementation Planning (Apr-Dec'15)</p> <ul style="list-style-type: none"> Funding secured. Contracts negotiated for projects. Negotiations between Inlay Lake Authority, MoECAAF, financial and implementation partners to develop final work plan for each project. <p>Phase III: Implementation of Priority Projects (Jan'16-Mar'20)</p> <ul style="list-style-type: none"> Project implementation, monitoring and evaluation. Engagements with the community, NGO, government departments at the state, district and national levels to be conducted.
Proposed Budget	<p>Total budget: USD 32,332,335</p> <p>Highest budget allocation: USD 5,410,250 (control of sedimentation and soil erosion rates within the watershed)</p> <p>Smallest budget allocation: USD 998,750 (biodiversity conservation and fisheries resource management)</p>
Monitoring and Evaluation	<p>Three indicator categories have been developed for the monitoring and evaluation to aggregate data at different levels:</p> <ul style="list-style-type: none"> Outcome-level indicators: To capture progress in implementing each project. Based on interviews with stakeholders and agencies implementing each Action Plan activity/project. Output-level indicators: To capture progress in priority activities in the Action Plan Impact-level indicators: To capture contributions of Action Plan investments within the context of conservation planning in Myanmar. <p>Monthly, semi-annual, and annual progress reports will be prepared for all Action Plan activities and projects.</p>

Table 3.4 *Inlay Lake Long Term Restoration and Conservation Plan Summary*

Topics	Content/Recommendations
Document:	Inlay Lake Long Term Restoration and Conservation Plan Summary
Author:	UN-Habitat, Ministry of Environmental Conservation and Forestry
Objectives	<p>Provides the framework for long term restoration and conservation activities at Inlay Lake and its watershed. Key principles of the plan involves:</p> <ul style="list-style-type: none"> • Adopting a watershed approach for conservation and sustainable development of the lake and its watershed areas; • Integrating biodiversity conservation as a priority consideration into Developmental Planning to minimise impacts on the ecosystems and species endemism; • Adopting a participatory approach to mobilise local communities within the lake and watershed areas to take ownership of the Plan; • Adopting proactive measures instead of a reactive approach; • Reviving and incorporating indigenous knowledge and traditional practices relating to watershed management and biodiversity conservation that are practical, applicable and cost effective; • Applying knowledge based techniques through research and development; • Conducting effective and regular monitoring and evaluation; and • Developing an institutional framework for the management of the lake.
Issues and Concerns	<ul style="list-style-type: none"> • Catchment degradation resulting in reduced inflow of water into the lake; • Sedimentation in the lake due to deforestation caused by slash and burn shifting cultivation and agricultural encroachment etc; • Deterioration of water quality issues due to fertilizer and pesticide discharge, disposal of waste, oil spillage, siltation, lake burials etc; • Eutrophication due to improper waste disposal, excessive macrophyte growth etc; • Unsustainable felling of trees, free fishing in the lake etc resulting in habitat degradation; • Discharge of agricultural waste, pesticides and fertilisers from floating garden agriculture; • Shifting cultivation leading to a significant loss of forest area; • Introduction of exotic species through fishery activities; • Poor economic conditions of lake communities; and • Continued reliance on wood and coal for energy.

Specifically, problems identified according to the three zones at Inlay Lake are as follows:


Core Zone	Buffer Zone	Remote Zone
<ul style="list-style-type: none"> • Recharging of lake. • Human settlement and Solid waste disposal. • Siltation and sedimentation. • Floating gardens. • Ingress of fertilizer 	<ul style="list-style-type: none"> • Illicit cutting of trees. • Fringe area settlements and activities. • Influx of tourists. • Inflow of waste water and sewage. 	<ul style="list-style-type: none"> • Cutting / Pruning of trees and loosening of soil. • Excessive silt flow in running water. • Enlargement of agricultural areas. • Human settlements

Topics	Content/Recommendations
Document: Inlay Lake Long Term Restoration and Conservation Plan Summary	
Author: UN-Habitat, Ministry of Environmental Conservation and Forestry	
	<div>and pesticide.</div> <ul style="list-style-type: none"> Threats to the aquatic life of Lake.
	<div>and other activities.</div> <ul style="list-style-type: none"> Soil erosion due to shifting cultivation.

Long Term Restoration and Conservation Plan	<p>1) Ensuring maximum water level in the lake</p> <ul style="list-style-type: none"> Plug data gaps through generation and collection of primary data Short Term measures: De-silting of waterways and dredging at stream mouths and marsh areas of the four perennial streams Medium and Long Term measures: Remove all defunct floating gardens, removal of at least 5% of existing gardens on an annual basis <p>2) Water quality improvement and management measures</p> <ul style="list-style-type: none"> Adopt more sustainable agricultural practices (eg organic farming, vermiculture); The Agriculture Department to be more involved in agriculture education in Inlay Lake. <p>3) Ozonisation of water</p> <ul style="list-style-type: none"> A detailed study should be carried out prior to implementation. <p>4) Community based solid waste management system</p> <ul style="list-style-type: none"> Provide low cost sanitation in peripheral villages; Construction of township wastewater/sewage treatment plants; Installation of community based toilets. <p>5) Catchment conservation and watershed management</p> <ul style="list-style-type: none"> Adoption of planning measures that consider the whole watershed; Delineation of areas into workable units (ie Micro watersheds) and preparing ground cover restoration, soil conservation and water conservation measures according to these management units. Ground cover restoration must take into consideration species selection and planting patterns. <p>6) Alternatives to shifting cultivation</p> <ul style="list-style-type: none"> Identify and grow perennial and seasonal crops compatible with the environment and soil conditions; Permanently structure the land to enable growth of above mentioned crops; Utilise sustainable methods (ie multiple cropping, mulching and recycling) <p>7) Provide more sustainable energy sources</p> <ul style="list-style-type: none"> Promote adoption of energy efficient cook stoves; Waste to Energy projects for households living on the periphery of the lake; Install a mini run-off river hydro plant to augment energy needs. <p>8) Conserve biodiversity</p> <ul style="list-style-type: none"> Collect more data on threatened/rare species and monitor species diversity, abundance and habitat use at Inlay Lake; Manage growth and distribution of aquatic vegetation in the lake; Control weed infestation at the lake; Conservation of endemic fish species through release of fingerlings, and eradication of cage culture of non-native species.
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Topics	Content/Recommendations
Document:	Inlay Lake Long Term Restoration and Conservation Plan Summary
Author:	UN-Habitat, Ministry of Environmental Conservation and Forestry
	<p>9) Infrastructure strengthening and Promoting ecotourism</p> <ul style="list-style-type: none"> • Establish equal sharing benefits arrangements • Skills upgrading. <p>10) Enforcement</p> <ul style="list-style-type: none"> • Upgrade status of Sanctuary Warden's office to enhance enforcement success; • Promulgation of a law for the protection of wetlands; • Preparation of an ecotourism plan according to set guidelines;

Table 3.5 *Destination Management Plan for the Inlay Lake Region Summary*

Topics	Content/Recommendations
Document:	Destination Management Plan for the Inlay Lake Region (2014-2019)
Author:	Ministry of Hotels and Tourism
Objectives	<ul style="list-style-type: none"> • To assess the current status and performance of the visitor economy of the Inlay Lake Region; • To identify opportunities to sustainably develop tourism within the Region, and set directions and priorities for growth for the period of 2014 – 2019; • To provide the framework for the coordination of key stakeholders and resources required to deliver the Plan; and • To provide a framework to create a Destination Management Organisation (DMO) for the region.
Inlay Lake Hotel Zone	<ul style="list-style-type: none"> • 252 ha to the east of Inlay Lake, established in 2012 by MoECAF; • 87 plots available within the hotel zone, 3 under development at time of writing (2014)
<p style="text-align: center;">Inlay Lake Hotel Zone Master Plan</p> 	
	<ul style="list-style-type: none"> • Electricity: From existing coal-fired thermal power station at Kalaw and Hydroelectric Station at Naung Kar. • Access: Via existing village access road linking Nyaungshwe and the hotel zone. A four-lane road will be constructed at the hotel zone. • Compensation: Paid to farmers within the hotel zone based on cultivated area and type of crops, corresponding to three years of projected production.
Tourism Benefits to	<p>1) Employment and Associated Benefits</p> <ul style="list-style-type: none"> • Employment of local communities within the tourism industry; and

Topics		Content/Recommendations
Document: Destination Management Plan for the Inlay Lake Region (2014-2019)		
Author: Ministry of Hotels and Tourism		
Inlay Lake Communities	<ul style="list-style-type: none"> Free meals and accommodation for locals working at hotels. Large locally owned hotels appear to offer staff more benefits and participate more in community development initiatives. <p>2) Support of Local Crafts and Produce</p> <ul style="list-style-type: none"> Much of Inlay Lake region agricultural produce used in local restaurants; and Local artisans benefit from sale of traditional handicrafts to tourists. 	
Estimated Value of Tourism in Inlay Lake Region	Accommodation: \$ 8 million Meals and Drinks: \$ 6 million Activities: \$ 6 million Handicrafts: \$ 6 million Fee Revenue: \$ 6 million Total: \$ 23.5 million	
Visitation	Arrival	Peak/Off-Peak Months
	2009/2010 – 20,000	-
	2013/2014 – 110,000	Peak months - November to February Approximately 16,000 people/month Off-Peak months June to September Approximately 4,000 people/month
Key Environmental Threats at Inlay Lake	<ul style="list-style-type: none"> Reduction of open water due to floating gardens (Loss of 32.4% surface area from 1936 – 2000); Declining native water plant communities and fish stocks, and over-harvesting of key aquatic plants thereby threatening food chains in the lake; Increasing bacterial pollution due to poor sanitation; Shading of water column and lake by water hyacinth and floating gardens; Increasing nutrient levels in water due to human waste and use of chemical fertilisers; Increasing siltation from deltas into littoral zones of the lake; Land use change and forest degradation in erosion hotspots causing sedimentation in deltas and marshes; Loss of fringing marshes due to conversion to floating gardens; Loss of native fish (Nga-Phein) due to over-fishing; Disturbance of fish nursery areas and bird feeding zones caused by fishing activities, boat traffic and noise; Increasing biomass of introduced species (e.g. Tilapia, Common Carp) and danger of hybridisation with native fish; and Impacts of increasing boat traffic. 	
Key Environmental Threats posed by Tourism	<p>1) Transport</p> <ul style="list-style-type: none"> Approximately 30,000 boats used on Inlay Lake and Samkar Lake. Approximately 6,000 used for tourism leading to high boat traffic and increased risk of pollution from boat activities. <p>2) Water</p> <ul style="list-style-type: none"> High water demand from tourists will require pressures on water availability. Potential impacts on the water table. Presently lack of water during dry season in hill areas. Increased demand may exacerbate negative impacts. More advanced wastewater management 	

Topics	Content/Recommendations
Document:	Destination Management Plan for the Inlay Lake Region (2014-2019)
Author:	Ministry of Hotels and Tourism
	systems required.
	3) Electricity
	<ul style="list-style-type: none"> Sourced from Kalaw coal-fired thermal power station facility. Burns with high sulphur content, contributing to region's haze. Increasing carbon emissions.
	4) Solid Waste Management
	<ul style="list-style-type: none"> Much of waste generated is disposed in landfills or via small scale burning.
Key Issues facing Tourism Development	<ul style="list-style-type: none"> Lack of integrated planning between government departments and consideration of physical, legal, promotional, financial, economic, market, management, social and environmental aspects; Increasing tourism arrivals and uneven distribution of tourists leading to unequal benefits throughout the Inlay Lake Region; Inadequate rubbish management and pollution from increased number of tourists and human settlement in and around the lake; Inadequate medical and emergency facilities; Potential oversupply of hotel rooms as tourism growth stabilises; and Lack of tourism technical skills and lack of awareness on sustainability both environmental and business
Inlay Lake Region Strategic Directions	<p>Strategy 1: Planning, Management, Sustainable Development & Heritage Conservation</p> <ul style="list-style-type: none"> Set up a Destination Management Organisation Zonation of Inlay Lake Region to better manage tourism: Urban Zone, Inlay Lake Hotel Zone, General Tourism Zone, Water Zone, Biodiversity Conservation Zone and Emerging Zone Management Plan for Nyaungshwe and Kalaw Set up system to forecast tourism growth and overhaul of the Inlay Zone entrance fee System to review tourism investment and proposals Site-specific heritage management plans Support to religious sites and buildings to manage visitors Development of sustainable management practices in tourism developments Operate the Inlay Lake Hotel Zone within existing legal framework Develop and implement a boat traffic management plan <p>Strategy 2: Infrastructure Development</p> <ul style="list-style-type: none"> Create a regional transport plan and improve provision of regional bus services Improve infrastructure for electricity and water supply and communication technology <p>Strategy 3: Human Resource Development</p> <ul style="list-style-type: none"> Risk assessment and incident planning Training Develop an Inlay Lake Region Technical and Vocational Education and Training (TVET) School and a mobile TVET unit Sponsorship for Inlay Lake Region residents to receive managerial level training Training for regional government departmental managers on destination

Topics	Content/Recommendations
Document:	Destination Management Plan for the Inlay Lake Region (2014-2019)
Author:	Ministry of Hotels and Tourism

management

- Support provision of communications technology

Strategy 4: Marketing and Promotion

- Develop an Inlay Region Brand
- Develop an Inlay Region Marketing Plan
- Develop an Inlay Lake Region Website
- Provide marketing support to private sector and attractions
- Develop an Inlay Lake Region tourism map and booklet
- Upgrade design of Inlay Lake Zone fee ticket

Strategy 5: Business Development & Support

- Establish an Inlay Region Business Forum
- Support provision of entrepreneurial training
- Support development of Micro and Small to Medium Sized Enterprises (MSMEs)

Strategy 6: Community Empowerment

- Encourage implementation of Myanmar Responsible Tourism (RT) Strategy and Community Involvement in Tourism (CIT) Policy
- Establish localised community tourism committees
- Provide training for tourism and gender awareness
- Set up a Land Use Forum
- Implement language improvement programmes in communities

Strategy 7: Environmental Management

- Establish an Environmental Task Force to tackle immediate issues
- Develop Inlay Lake factsheets
- Provide options for green technologies
- Implement environmental education programmes in schools
- Establish community environmental action teams
- Investigate the introduction of fuel-efficient stoves or improve firewood management
- Removal of plastic packaging from the Inlay Lake Region
- Conduct a local knowledge and beliefs study

Strategy 8: Product Development – Improving the Visitor Experience

- Set up a Tourism Information and Heritage Centre in Nyaungshwe
- Develop and implement an Interpretation Plan
- Development of fair trade handicrafts and sustainable development of artisans
- Maximise local value chain and seek value-added products
- Investigate development of mountain biking routes
- Upgrade museum in Nyaungshwe
- Set up a Heritage Rail Museum

Strategy 9: Improving the Trekking Industry

- Set up a Trekking Operator Forum and a Trekking Information Centre in Kalaw
- Improve trekking operator standards and implementation of guidelines
- Development of differentiated trekking products
- Food preparation training programme for communities
- Develop practical standards for accommodation providers and basic

Topics	Content/Recommendations
Document:	Destination Management Plan for the Inlay Lake Region (2014-2019)
Author:	Ministry of Hotels and Tourism
	<p>infrastructure assistance</p> <ul style="list-style-type: none"> • Provide trekking and tourism training for existing guides and local communities • Implement a Trekker's Charter

4 BIODIVERSITY VALUES

4.1 Desktop Assessment

An assessment of the biodiversity values was undertaken through a desktop assessment and direct field observations. The desktop assessment focused on existing studies of the study area and on-line information.

The following existing studies were reviewed as part of the assessment:

- Management plans, including:
 - Destination Management Plan for the Inlay Lake Region;
 - Inlay Lake Conservation 5-Year Plan (2015-2020); and
 - Long Term Restoration and Conservation Plan for Inlay Lake.
- Amata Garden Resort Hotel Initial Environmental Examination (IEE) Report;
- NGO webpages and databases including those belonging to the World Wildlife Fund (WWF); Alliance for Zero Extinction (AZE); BirdLife International; Wildlife Conservation Society (WCS), Biodiversity and Nature Conservation Association Myanmar (BANCA), and Myanmar Alliance for Conservation¹;
- Scientific journals documenting survey findings at Inlay Lake; and
- Species descriptions from the IUCN Red List of Threatened Species (www.iucnredlist.org).

Stakeholder consultation also generated important sources of information that were incorporated into the biodiversity baseline. The outcomes of the stakeholder consultation can be found in *Section 1.3*.

4.2 Global EcoRegions

Inlay Lake Wildlife Sanctuary is located within one (1) WWF Ecoregion type: the Northern Indochina Subtropical Moist Forests. This EcoRegion type covers an area of approximately 43,693,100 ha and is classified as a vulnerable EcoRegion type by WWF. Threats to biodiversity in this EcoRegion originate from land clearance for cultivation and logging; and subsistence hunting. With respect to Freshwater Ecoregions, Inlay Lake is classified as a Small Lake Ecosystem.

¹ MyanmarBiodiversity.org is an online platform consolidating the experience and coordinating the activities of an Alliance for Conservation including the Leona M. and Harry E. Helmsley Charitable Trust, WCS, Oikos, The New York Botanical Garden and the Turtle Survival Alliance.

4.3 Key Biodiversity Areas

Key Biodiversity Areas (KBA) are places of international importance for the conservation of biodiversity through protected areas and other governance mechanisms. KBAs are typically sites where there is a regular occurrence of significant numbers of one or more globally threatened species, restricted-range species and/or congregatory species. KBAs include Important Bird Areas (IBA), Alliance for Zero Extinction (AZE), Important Plant Areas (IPA) and Important Sites for Freshwater Biodiversity.

As of 2016, there are a total of 132 KBAs in Myanmar, including 6 ASEAN Heritage Parks, 1 RAMSAR site, 53 IBAs and 3 AZE sites². The locations of these KBAs are presented in *Figure 4.1*.

Inlay Lake is classified as an Important Bird Area (IBA) by BirdLife International³. The Lake meets IBA Criteria for A1 Globally threatened species; A4i Site known or thought to hold, on a regular basis, >1% of a biogeographic population of a congregatory waterbird species; and A4iii Site known or thought to hold, on a regular basis, > 20,000 waterbirds or >10,000 pairs of seabirds of one or more species.

4.4 Protected Areas

As of 2015, there are a total of 39 Protected Areas (PA) in Myanmar covering an area of 38,906 km².

Based on Myanmar's NBSAP for 2015 to 2020, there are plans to establish 9 more PAs in three phases from 2020 to 2021. With the addition of these 9 proposed PAs, the total area under protected in Myanmar will reach 52,932 km², representing a coverage of 7.82 % of the country's total land area⁴.

Details of PAs within a 200 km radius of the Project Area can be found in *Table 4.2*.

Inlay Lake Wildlife Sanctuary, which is an ASEAN Heritage Park and listed as a UNESCO World Network of Biosphere Reserve. The Reserve is listed as an IUCN Category IV reserve and.

² Myanmar Key Biodiversity Areas. Retrieved from Myanmar Biodiversity at <https://myanmarbiodiversity.org/key-biodiversity-areas/>

³ BirdLife International (2016) Important Bird and Biodiversity Area factsheet: Inle Lake. Downloaded from <http://www.birdlife.org> on 24/06/2016

⁴ Republic of the Union of Myanmar, National Biodiversity Strategy and Action Plan 2015-2020 (Oct, 2015) Retrieved from <https://www.cbd.int/doc/world/mm/mm-nbsap-v2-en.pdf>

Table 4.2 Protected Areas in Myanmar within 200km of the Project Area

Name	National Designation	Year Established	Location and Coordinates	Area (km ²)	Key Species Protected
Inlay Lake Bird Sanctuary (Wetland)	Wildlife Sanctuary	1985	Shan State, 20°10'N, 97°02'E	642	Wetland and Migratory Birds
Taunggyi Bird Sanctuary	Bird Sanctuary	1930	Shan State 20°45'N, 97°04'E	16	Avifauna
Panlaung-Pyadalun Cave Wildlife Sanctuary	Wildlife Sanctuary	1999	Shan State 21°10'N, 96°30'E	334	Elephant, Tiger, Leopard, Gaur, Banteng, Golden Cat, Clouded Leopard, Serow, Gibbon

4.5 Candidate Species of Conservation Significance

The following species of conservation significance exist within the Northern Indochina Subtropical Moist Forests EcoRegion. Endemic Species are listed in Table 4.3. Species classified as Critically Endangered, Data Deficient, Endangered or Vulnerable on the IUCN Red List are shown in Table 4.4.

Table 4.3 Endemic Species with the Northern Indochina Subtropical Moist Forest EcoRegion

Scientific Name	Common Name	IUCN Red List Category
Mammal		
<i>Muntiacus puhoatensis</i>	Puhoat Muntjac	DD
Amphibian		
<i>Amolops tuberodepressus</i>	-	VU
<i>Ichthyophis laosensis</i>	Upper Laos Caecilian	DD
<i>Ingerana liui</i>	Menglun Eastern Frog	VU
<i>Kalophrynus menglienicus</i>	Menglien Rainy Frog	DD
<i>Leptolalax bourreti</i>	Bourret's Asian Toad	DD
<i>Leptolalax ventripunctatus</i>	-	DD
<i>Oreolalax granulosus</i>	-	VU
<i>Rhacophorus duboisi</i>	-	DD
<i>Theloderma bicolor</i>	Chapa Bug-eyed Frog	EN
<i>Xenophrys wuliangshanensis</i>	Wuliangshan Horned Toad	DD

Note: These endemic species are found within the broader EcoRegion and may not be represented within the Area of Influence.

Table 4.4 *Critically Endangered, Endangered and Vulnerable Species within the Northern Indochina Subtropical Moist Forest EcoRegion*

Scientific Name	Common Name	Endemicity	IUCN RedList Category
Amphibian			
<i>Amolops tuberodepressus</i>	-	Yes	VU
<i>Ingerana liui</i>	Menglun Eastern Frog	Yes	VU
<i>Leptolalax alpinus</i>		No	EN
<i>Oreolalax granulosus</i>	-	Yes	VU
<i>Oreolalax jingdongensis</i>	Jingdong Lazy Toad	No	VU
<i>Theloderma bicolor</i>	Chapa Bug-eyed Frog	Yes	EN
Reptiles			
<i>Cuora galbinifrons</i>	Indochinese Box Turtle	No	CR
<i>Cuora trifasciata</i>	Chinese Three-striped Box Turtle	No	CR
<i>Geoemyda spengleri</i>	Chinese Black-breasted Leaf Turtle	No	EN
<i>Indotestudo elongata</i>	Elongate Tortoise	No	EN
<i>Manouria impressa</i>	-	No	VU
<i>Mauremys mutica</i>	-	No	EN
<i>Ophiophagus hannah</i>	King Cobra	No	VU
<i>Palea steindachneri</i>	Wattleneck Softshell	No	EN
<i>Pelodiscus sinensis</i>	Chinese Softshell	No	VU
<i>Platysternon megacephalum</i>	Bighead Turtle	No	EN
<i>Sacalia bealei</i>	Beal's Eyed Turtle	No	EN
Bird			
<i>Aceros nipalensis</i>	Rufous-necked Hornbill	No	VU
<i>Anas formosa</i>	Baikal Teal	No	VU
<i>Aquila clanga</i>	Greater Spotted Eagle	No	VU
<i>Aquila heliaca</i>	Imperial Eagle	No	VU
<i>Ardea insignis</i>	White-bellied Heron	No	CR
<i>Aythya baeri</i>	Baer's Pochard	No	EN
<i>Columba punicea</i>	Pale-capped Pigeon	No	VU
<i>Emberiza aureola</i>	Yellow-breasted Bunting	No	VU
<i>Falco naumanni</i>	Lesser Kestrel	No	VU
<i>Gallinago nemoricola</i>	Wood Snipe	No	VU
<i>Grus nigricollis</i>	Black-necked Crane	No	VU
<i>Gyps bengalensis</i>	White-rumped Vulture	No	CR
<i>Lophophorus lhuysii</i>	Chinese Monal	No	VU
<i>Lophophorus sclateri</i>	Sclater's Monal	No	VU
<i>Mergus squamatus</i>	Scaly-sided Merganser	No	EN
<i>Mulleripicus</i>	Great Slaty Woodpecker	No	VU

Scientific Name	Common Name	Endemicity	IUCN RedList Category
<i>pulverulentus</i>			
<i>Numenius madagascariensis</i>	Far Eastern Curlew	No	VU
<i>Pavo muticus</i>	Green Peafowl	No	EN
<i>Pitta nympha</i>	Fairy Pitta	No	VU
<i>Sarcogyps calvus</i>	Red-headed Vulture	No	CR
<i>Sitta formosa</i>	Beautiful Nuthatch	No	VU
<i>Sitta magna</i>	Giant Nuthatch	No	VU
<i>Tragopan blythii</i>	Blyth's Tragopan	No	VU
<i>Turdus feae</i>	Grey-sided Thrush	No	VU

Mammal			
<i>Ailurus fulgens</i>	Red Panda	No	VU
<i>Arctictis binturong</i>	Binturong	No	VU
<i>Axis porcinus</i>	Hog Deer	No	EN
<i>Bos javanicus</i>	Banteng	No	EN
<i>Budorcas taxicolor</i>	Takin	No	VU
<i>Chrotogale owstoni</i>	Owston's Palm Civet	No	VU
<i>Cuon alpinus</i>	Dhole	No	EN
<i>Elephas maximus</i>	Asiatic Elephant	No	EN
<i>Hadromys humei</i>	Manipur Bush Rat	No	EN
<i>Hapalomys delacouri</i>	Delacour's Marmoset Rat	No	VU
<i>Helarctos malayanus</i>	Sun Bear	No	VU
<i>Hylobates lar</i>	White-handed Gibbon	No	EN
<i>Lutrogale perspicillata</i>	Smooth-coated Otter	No	VU
<i>Macaca arctoides</i>	Stump-tailed Macaque	No	VU
<i>Macaca leonina</i>	-	No	VU
<i>Manis javanica</i>	Malayan Pangolin	No	EN
<i>Manis pentadactyla</i>	Chinese Pangolin	No	EN
<i>Moschus berezovskii</i>	Chinese Forest Musk Deer	No	EN
<i>Moschus chrysogaster</i>	Alpine Musk Deer	No	EN
<i>Naemorhedus baileyi</i>	Red Goral	No	VU
<i>Naemorhedus griseus</i>	-	No	VU
<i>Neofelis nebulosa</i>	Clouded Leopard	No	VU
<i>Nomascus concolor</i>	Crested Gibbon	No	CR
<i>Nomascus hainanus</i>	-	No	CR
<i>Nomascus leucogenys</i>	White-cheeked Gibbon	No	CR
<i>Nomascus siki</i>	-	No	EN
<i>Nycticebus bengalensis</i>	-	No	VU
<i>Nycticebus pygmaeus</i>	Pygmy Slow Loris	No	VU
<i>Panthera tigris</i>	Tiger	No	EN
<i>Pardofelis marmorata</i>	Marbled Cat	No	VU
<i>Petinomys setosus</i>	Temminck's Flying Squirrel	No	VU

Scientific Name	Common Name	Endemicity	IUCN RedList Category
<i>Prionailurus viverrinus</i>	Fishing Cat	No	EN
<i>Pseudoryx nghetinhensis</i>	-	No	CR
<i>Pygathrix nemaeus</i>	Douc Langur	No	EN
<i>Rhinopithecus avunculus</i>	Tonkin Snub-nosed Monkey	No	CR
<i>Rusa unicolor</i>	Sambar	No	VU
<i>Trachypithecus delacouri</i>	-	No	CR
<i>Trachypithecus francoisi</i>	François's Leaf Monkey	No	EN
<i>Trachypithecus hatinhensis</i>	-	No	EN
<i>Trachypithecus phayrei</i>	Phayre's Leaf Monkey	No	EN
<i>Trachypithecus shortridgei</i>	-	No	EN
<i>Ursus thibetanus</i>	Asiatic Black Bear	No	VU
<i>Viverra zibetha</i>	Large-spotted Civet	No	VU
<i>Note: These threatened species are found within the broader EcoRegion and may not be represented within the Area of Influence.</i>			

4.6 Invasive Species

Invasive species are non-native species to a particular ecosystem and whose introduction and spread causes, or are likely to cause, socio-cultural, economic or environmental harm or harm to human health. These species become naturalized in their introduced range, and often reproduce in large numbers spread over a large area. This can result in competition and damage to native species⁵.

Invasive species have the capacity to exacerbate their role in ecosystem degradation through combination threats by habitat change, climate change, over-exploitation of ecosystem resources and pollution. These further enhance their threat to biodiversity and the human condition⁶.

According to the Global Invasive Species Database (GISD)⁷ and WWF, a total of 32 species have been identified as invasive species in Myanmar. A checklist of invasive species is provided in *Table 4.5*. Based on further information review, invasive species known to be present within Inlay Lake have been indicated in the table with an asterisk.

⁵ Food and Agriculture Organisation of the United Nations (2016) Invasive Species: Impacts on Forests and Forestry. Retrieved from <http://www.fao.org/forestry/aliens/en/>

⁶ Emerton L and Howard G (2008) A Toolkit for the Economic Analysis of Invasive Species. Global Invasive Species Programme, Nairobi. Retrieved from http://www.issg.org/pdf/publications/GISP/Guidelines_Toolkits_BestPractice/Emerton&Howard_2008_EN.pdf

⁷ Global Invasive Species Database (2016). Retrieved from <http://www.iucngisd.org/gisd/>

Table 4.5 Invasive Species identified within Myanmar

S/N	Scientific Name	Common Name
Bacteria and Viruses		
1	Banana bunchy top virus (BBTV)	-
2	<i>Yersinia pestis</i>	-
Coral		
3	<i>Tubastraea coccinea</i>	Orange Cup Coral
Plants & Algae		
4	<i>Acacia auriculiformis</i> ⁺	Acacia
5	<i>Acacia longifolia</i>	-
6	<i>Acacia mangium</i>	-
7	<i>Adenanthera pavonina</i>	-
8	<i>Ageratum conyzoides</i> ⁺	Goat Weed
9	<i>Alternanthera philoxeroides</i>	-
10	<i>Cardamine flexuosa</i>	Wavy Bittercress
11	<i>Chromolaena odorata</i>	Siam Weed, Bitter Bush
12	<i>Eichhornia crassipes</i> *	Water Hyacinth
13	<i>Eichhornia crus-galli</i> ⁺	Barnyard Grass
14	<i>Hyptis suaveolens</i> ⁺	Bush Tea
15	<i>Imperata cylindrica</i>	Blady Grass
16	<i>Lantana camara</i> ⁺	Lantana
17	<i>Leucaena leucocephala</i>	-
18	<i>Limnocharis flava</i>	-
19	<i>Loranthus pulverulentus</i> ⁺	Mistletoe
20	<i>Mikania micrantha</i> ⁺	Mile-a-Minute
21	<i>Mimosa diplotricha</i> ⁺	Giant Sensitive Plant
22	<i>Mimosa pigra</i> ⁺	Giant Sensitive Plant
23	<i>Paspalum conjugatum</i> ⁺	Buffalo Grass
24	<i>Pennisetum spp.</i> ⁺	Mission Grass
25	<i>Prosopis juliflora</i> ⁺	Mesquite
26	<i>Sorghum halepense</i> ⁺	Johnson Grass
27	<i>Ziziphus mauritiana</i>	Chinese Date
28	<i>Acanthophora spicifera</i>	-
Insects		
29	<i>Aedes aegypti</i>	Yellow Fever Mosquito
30	<i>Brontispa longissima</i>	Coconut Leaf Beetle
31	<i>Matanastria grisea</i> ⁺	Gypsy Moth
32	<i>Paratrechina longicornis</i>	Longhorn Crazy Ant
33	<i>Solenopsis geminata</i>	Tropical fire Ant
34	<i>Tapinoma melanocephalum</i>	Ghost Ant
35	<i>Trogoderma granarium</i>	Khapra Beetle
Invertebrates		
36	<i>Achatina fulica</i> ⁺	Giant African Snail
37	<i>Pomacea canaliculata</i> * ⁺	Golden Apple Snail

S/N	Scientific Name	Common Name
38	<i>Teredo</i> spp. ⁺	Shipworm
39	<i>Varroa jacobsoii</i> ⁺	Parasitic Bee Mite
Fish		
40	<i>Clarias gariepinus</i> *	African Sharptooth Catfish
41	<i>Ctenopharyngodon idella</i> *	Grass Carp
42	<i>Cyprinus carpio</i> *	European Carp
43	<i>Gambusia affinis</i>	Mosquito Fish
44	<i>Hypophthalmichthys nobilis</i>	Bighead Carp
45	<i>Oreochromis aureus</i> *	Tilapia
46	<i>Poecilia reticulata</i>	Guppy
47	<i>Labeo rohita</i> *	Rohu
Reptile		
48	<i>Hemidactylus frenatus</i>	Common House Gecko
Mammal		
49	<i>Rattus exulans</i>	Polynesian Rat/Pacific Rat
Notes:		
* Species known to be present at Inlay Lake		
⁺ Additionally sourced from Myanmar NBSAP 2015-2020		

4.7 Inlay Lake Wildlife Sanctuary

In 1985, Inlay Lake together with Saga Lake and Moby Reservoir to its south, were gazetted as the Inlay Lake Wildlife Sanctuary (*Figure 4.4*). Inlay Lake Wildlife Sanctuary was designated as an ASEAN Heritage Park in 2003⁸. The area under legislative protection is an estimated 642 km². The wildlife sanctuary has been identified as a KBA; an IBA by BirdLife International in 2004⁹; and a potential Ramsar site.

Inlay Lake Wildlife Sanctuary is an IUCN Category IV Protected Area and requires active management to maintain, conserve and restore species and habitats¹⁰. Two fishing free zones within Inlay Lake have also been established. The closest PAs to Inlay Lake Wildlife Sanctuary are Taunggyi Bird Sanctuary and Panlaung Pyadalin Cave Wildlife Sanctuary, an estimated 15 km northeast and 53 km northwest respectively. Taunggyi Bird Sanctuary is approximately 16.0 km² and an IUCN Category IV Protected Area; Panlaung Pyadalin Cave Wildlife Sanctuary approximately 334 km² and an IUCN Category IV Protected Area. These features, including the East Inlay Reserve Forest and West Inlay Protected Public Forest, are presented in *Figure 4.4*.

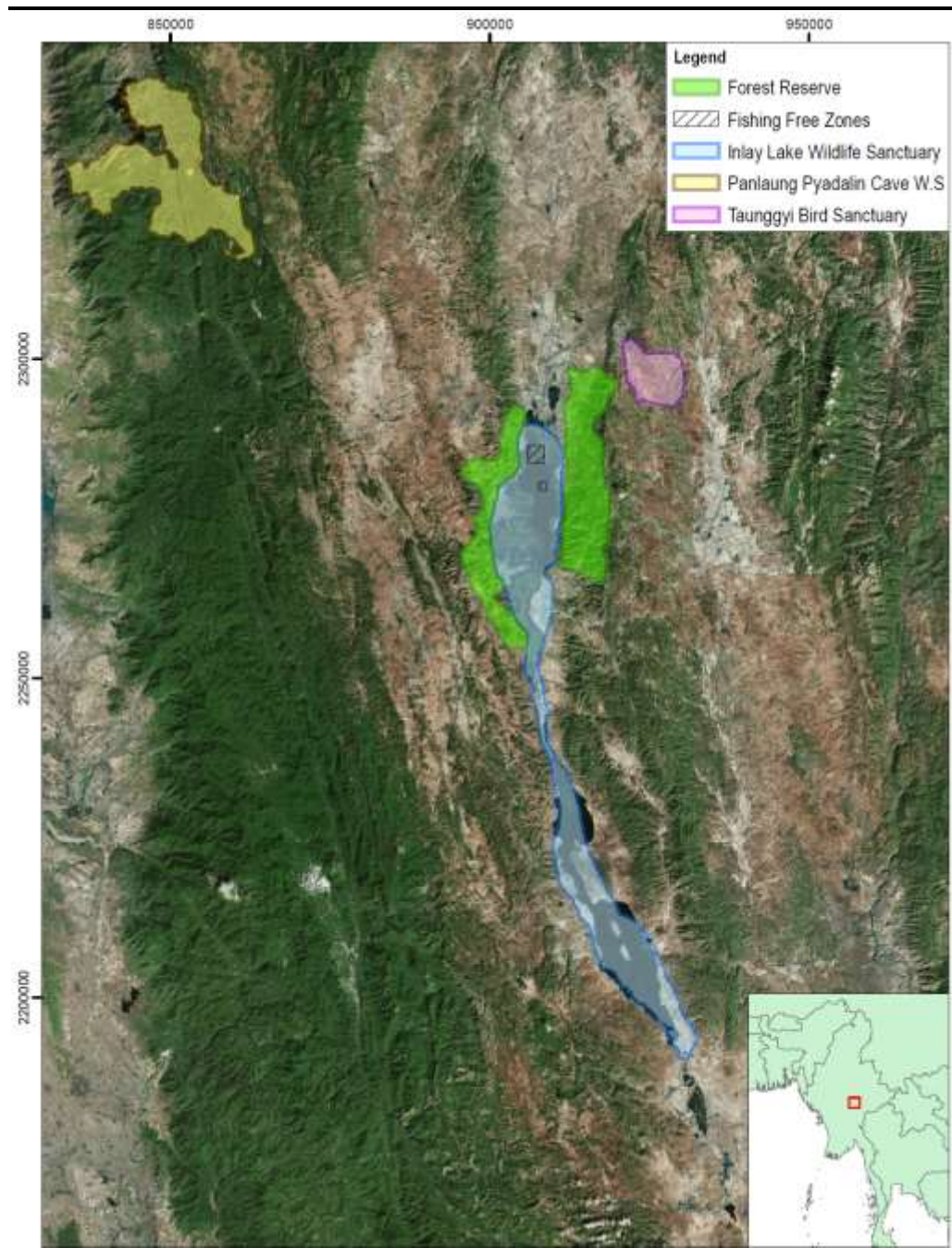
⁸ UNESCO Biosphere Reserves – Inlay Lake.

Retrieved from <http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/asia-and-the-pacific/myanmar/inlay-lake/>

⁹ BirdLife International. Important Bird and Biodiversity Areas, MM026 – Inle Lake. Retrieved from <http://www.birdlife.org/datazone/sitefactsheet.php?id=16278>

¹⁰ IUCN Protected Areas – Category IV: Habitat/Species Management Area. Retrieved from <http://www.iucn.org/theme/protected-areas/about/protected-area-categories/category-iv-habitatspecies-management-area>

Figure 4.4 *Biodiversity Features at and around Inlay Lake Wildlife Sanctuary*



Service Layer Credit: *World View 2 Imagery*

GIS Layer for Inle Lake Wildlife Sanctuary, Taunggyi, Panlaung Pyadalin Cave: *Myanmarbiodiversity.org*

Inlay Lake is located along two major migratory flyways in the region: the East Asia-Australasian Flyway for birds migrating from Siberia to Australia, and the Central Asian Flyway¹¹. It therefore serves as an important resource for wintering birds as the lake's freshwater habitats offer productive feeding grounds and suitable resting

11 Australian Government Department of the Environment. Migratory Shorebirds of the East Asian-Australasian Flyway – Country Accounts. Retrieved from Central-South Asian Flyway

areas¹². IBA trigger species and trigger species group for Inle Lake are detailed in Table 4.6.

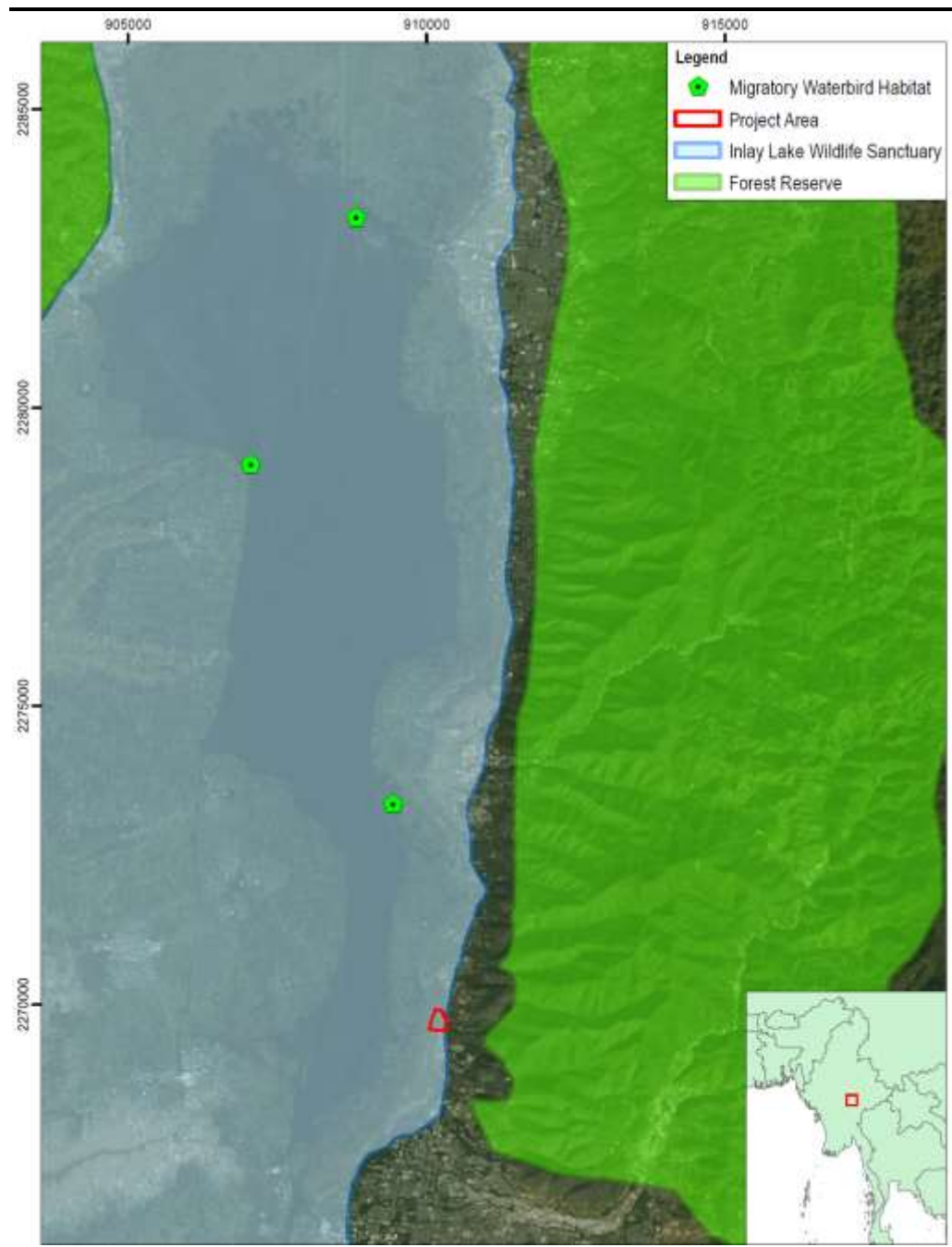
Table 4.6 Inlay Lake IBA Trigger Species

Scientific Name	Common Name	IBA Criteria Triggered ^(Note 1)	IUCN RedList Category
<i>Aythya baeri</i>	Baer's Pochard	A1, A4i	CR
<i>Dendrocygna javanica</i>	Lesser Whistling Duck	A4i	LC
<i>Gyps bengalensis</i>	White-rumped Vulture	A1	CR
<i>Clanga clanga</i>	Greater Spotted Eagle	A1	VU
<i>Antigone antigone</i>	Sarus Crane	A1	VU
<i>Rynchops albicollis</i>	Indian Skimmer	A1	VU
Species group: Waterbirds		A4iii	-
Notes:			
(1) IBA Criteria:			
<ul style="list-style-type: none"> A1: The site is known or thought to regularly hold significant numbers of a globally threatened species (ie CR, EN, VU on IUCN RedList) A4i: The site is known or thought to hold, on a regular basis, > 1% of a biogeographic population of a congregatory water bird species A4iii: The site is known or thought to hold, on a regular basis, > 20,000 waterbirds or > 10,000 pairs or seabirds of one or more species 			

An area of approximately 10.4 km² on the northern fringe of Inlay Lake has been demarcated as a Bird Preservation Area. An estimated 25,000 to 30,000 birds comprising 270 species congregate at this zone during wintering months. Through engagements with BANCA representatives, it is understood that there are three (3) areas containing key habitats for migratory and resident waterbirds at Inlay Lake Wildlife Sanctuary. The locations of these areas in relation to the Project are presented in Figure 4.5. The distance of the Project to the closest waterbird habitat is approximately 3.5 km.

¹² Convention on the Conservation of Migratory Species of Wild Animals. (2005) National Reports – Myanmar Country Report. Retrieved from http://www.cms.int/sites/default/files/document/inf_04_14_Myanmar_0.pdf

Figure 4.5 *Waterbird Habitats at Inlay Lake in Relation to the Project*



Service Layer Credit: *World View 2 Imagery*

GIS Layer for Inle Lake Wildlife Sanctuary: *Myanmarbiodiversity.org*

In 2015, Inlay Lake was designated as a UNESCO Biosphere Reserve under UNESCO's World Network of Biosphere Reserves. The total area of Inlay Lake Biosphere Reserve is approximately 4,900 km², composing of 20 km² of core area, 1,260 km² of buffer zone and 3620 km² of transition area¹³. Administrative authorities for the reserve comprise MOECF and Ministry of Agriculture and Irrigation.

¹³ UNESCO Biosphere Reserves – Inlay Lake.

The forests surrounding Inlay Lake can be classified according to their elevation:

- Hill areas around 1,200 m: comprising a range of pine forests, dry Dipterocarp forests (*Indaing* forests), pine forests mixed with hill deciduous forests, and in areas 4,000 feet and above, a mixture of hill forests, pine forests and grassland can be found. Slash and burn cultivation practices in these areas have caused the dominant plant species to be elephant grass (*Saccharum spontaneum*); and
- Hill areas around 900 m: these areas are covered mostly by moist upper mixed deciduous forests, dry upper mixed deciduous forests and Dipterocarp forests.

Botanical surveys conducted by Yangon University from 1957 to 1959 have recorded an estimated 64 species of fern and fern allies; 12 species of gymnosperms; 292 species of monocot angiosperms and 1,320 species of dicot angiosperms. 217 species of orchids have also been recorded from the area to date¹⁴.

4.8 Site Visit

ERM undertook a site visit to the Project Area from 6 June 2016 to 9 June 2016. The site visit included stakeholder meetings in Yangon and Nyaungshwe, walkovers of the Project area, Inlay Hotel Zone, and a visit to Inlay Lake to gain familiarity with the environmental context of the Project.

A brief summary of site visit activities is provided in *Table 4.7*.

Table 4.7 *Summary of Site Visit*

Date	Activity	Activity Summary
6 June	Consultation with E-Guard	An understanding of the project assessment and IEE procedure was obtained. It was understood that E-Guard had obtained comments from relevant government agencies and were in the process of addressing these. It is noted that E-Guard had received queries on how a Payment for Ecosystem Services assessment could be conducted. No social surveys were conducted as part of the IEE as these are not required. E-Guard is pending data that will feed into the cumulative impact assessment for the IEE.
	Consultation with BANCA*	It was understood that soil erosion is a key problem at Inlay Lake.

Retrieved from <http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/asia-and-the-pacific/myanmar/inlay-lake/>

¹⁴ UN-Habitat & Ministry of Environmental Conservation and Forestry (2014) Inle Lake Long Term Restoration and Conservation Plan

Date	Activity	Activity Summary
7 June	Consultation with MIID*	It was understood that the use of chemical fertilisers and pesticides (associated with floating gardens on the lake), sewage discharges, oil/diesel spills from boats and erosion were key problems at Inlay Lake. Provided insights into the increase in visitor numbers at Inlay Lake.
8 June	Consultation with Inlay Lake Wildlife Sanctuary Park Warden Office*	Provided ERM with species checklists of fauna and flora at Inlay Lake. Shared with ERM the environmental issues of Inlay Lake which echoed comments from BANCA and MIID. ERM also learned that the Department is keen to broaden knowledge of PES within the community.
	Consultation with Inle Speaks, Partnership for Change*	ERM understands that Inle Speaks' work has a strong focus on vocational training for local people to facilitate their employment within the tourism industry. The NGO is largely supportive of the tourism industry but commented on the need environmental sustainability measures for the industry.
	Site Inspection of Project Area	ERM visited the northern side of the Project Area where the 20 bungalows are currently being built. ERM noted potential environmental sensitivities and concerns at the site and advised on potential issues Amata may wish to look out for (eg. crop species selected for the organic garden) ERM also visited the Inlay Hotel Zone to gain a context of the development scale, size and potential environmental impacts.
	Consultation with Myanmar Forest Association*	The stakeholder shared that the tourism industry needs to work harder on complying with environmentally friendly practices. ERM also understands from this engagement that a management framework and better coordination is required between various government departments. This is a similar concern voiced by several stakeholders engaged.
* More details can be found in <i>Annex 1.0 Stakeholder Responses</i>		

4.9 Stakeholder Consultation

Stakeholders were consulted to glean more information about the biodiversity at Inlay Lake, threats to biodiversity, and their perceptions on the existing conditions and trends relating to ecosystem services, natural resource management and habitats present at Inlay Lake. Stakeholders were also asked to provide their views on the perception of opportunities and threats posed by the tourism industry in Inlay Lake.

The stakeholder engagement undertaken to date includes:

- Biodiversity and Conservation Association, Myanmar (BANCA);
- Myanmar Institute for Integrated Development (MIID);
- Myanmar Forest Association (MFA);
- Ministry of Natural Resources and Environmental Conservation, Nature and Wildlife Conservation Division, Inlay Lake Wildlife Sanctuary Park Warden Office;
- Inle Speaks, Partnership for Change; and
- United Nations Development Programme (UNDP).

The results of the stakeholder consultation exercise can be found in *Annex 1.0*.

5 METHODOLOGY AND APPROACH

5.1 Threatened Species

Threatened species are identified in PS6 as those listed on the IUCN Red List of Threatened Species and where relevant species are afforded equivalent conservation protection nationally. The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on flora and fauna that have been evaluated using the IUCN Red List categories and criteria. The criteria identify three categories of threatened species:

- Critically Endangered (CR);
- Endangered (EN); and
- Vulnerable (VU).
- Five additional categories of plants and animals are included in the IUCN Red List including;
- Extinct;
- Extinct in the Wild;
- Near Threatened (NT);
- Least Concern (LC);
- Those for which data is insufficient Data Deficient (DD); and
- Those which have not been evaluated (NE).

Species categorized as CR, EN and VU are considered to be at a heightened risk of extinction and are awarded an elevated level of consideration under the IFC Performance Standards.

Where species have not yet been evaluated by IUCN the Myanmar protection status has been considered. Species listed as Protected under Myanmar *Forest Department Notification No. 583/94 (List of protected wildlife species)* (and not evaluated by IUCN) are also considered 'threatened species' for the purposes of this assessment.

5.2 Modified and Natural Habitats

IFC PS6 divides habitats into Modified, Natural and a subset, where relevant, being Critical Habitats. The IFC PS Guidance Note requires the Project area to be delineated in terms of Natural Habitat and Modified Habitat. Modified Habitat are "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". Natural habitat is: "areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological function and species composition".

5.3 *Critical Habitat*

One of the key provisions of IFC PS6 is the identification of 'Critical Habitat' that defines Critical Habitats as areas with: "high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes".

Critical Habitat may not be limited to pristine or highly biodiverse areas but rather may include both Modified Habitat and Natural Habitats across the broader landscape that supports the biodiversity values that trigger the Critical Habitat criterion. Critical Habitats can therefore be a subset of both Modified Habitat and Natural Habitat.

5.4 *Methodology*

5.4.1 *Approach*

In accordance with IFC PS1 and PS6 the assessment process aims to predict and assess the Project's potential adverse impacts and risks to biodiversity values, in quantitative terms where possible. The objectives of the biodiversity impact assessment are to identify and quantify the potential project impacts; design measures to avoid, minimise or mitigate potential adverse impacts; and identify likely residual impacts. To achieve this; a six step process was undertaken:

1. Screening to determine if the Project may pose a risk to biodiversity and in particular which the biodiversity features require study;
2. Scoping to determine which direct and indirect biological impacts are likely to be significant in order to determine the focus issues of the impact assessment (*Section 6.1*);
3. Information on the likely biodiversity values of the Project's area of influence and describe the relevant biodiversity conditions likely to occur. This includes identifying modified and natural habitat areas and determining the presence of critical habitat in accordance with IFC PS6 definition (*Section 7.5 & 7.6*);
4. Impact Analysis assesses the extent and complexity of potential adverse impacts considering the two parameters of habitat area (spatially) and threatened species individually (*Section 8*);
5. Mitigation Measures are developed to avoid and minimise potential adverse impacts to biodiversity with a priority given to impacts on features with significant biodiversity values (*Section 9*); and
6. Residual Impacts are determined and in the event significant residual impacts occur biodiversity offsets are considered (*Section 9*).

In relation to baseline results, only initial baseline information has been derived from existing data available on the Project Area and Area of Influence. Further baseline studies may be required to further define the biodiversity values of the Project.

5.4.2 *Impact Assessment Methods*

The significance of the impacts has been evaluated using a standardised approach based on ERM's Impact Assessment Standard. This Standard has been determined based on the requirements of IFC PS6. It is based on the relationship between the magnitude of impact and nature of receptor (sensitivity). Impacts to biodiversity are often discussed in terms of impacts to habitats and impacts to individual species or species groups. As such, significance criteria are defined for both habitats and species. The Project impacts identified have been assessed for their significance according to the criteria provided in *Table 5.3* (for habitat areas) and

Table 5.4 (for specific species groups).

Table 5.3 Habitat Impact Assessment – Significance Criteria

Habitat Sensitivity/Value		Magnitude of Effect			
		Negligible	Small	Medium	Large
Low	Habitats with no or local designation/recognition; habitats of significance for species of Least Concern; habitats which are common and widespread within the region.	Negligible	Negligible	Minor	Moderate
Medium	Habitats within nationally designated or recognised areas; habitats of significant importance to globally Vulnerable, Near Threatened or Data Deficient species; habitats of significant importance for nationally restricted range species; habitats supporting nationally significant concentrations of migratory species and/or congregatory species; nationally threatened or unique ecosystems.	Negligible	Minor	Moderate	Major
High	Habitats within internationally designated or recognised areas; habitats of importance to globally Critically Endangered or Endangered species; habitats of importance to endemic and/or globally restricted-range species; habitats supporting globally significant concentrations of migratory species and/or congregatory species; highly threatened and/or unique ecosystems, areas associated with key evolutionary species.	Negligible	Moderate	Major	Critical
Magnitude of Effect Definition					
Negligible	Effect is within the normal range of variation				
Small	Affects a small area of habitat, but without the loss of viability/function of the habitat				
Medium	Affects a sufficient proportion of the habitat that the viability/function of part of the habitat or the entire habitat is reduced, but does not threaten the long-term viability of the habitat or species dependent on it.				
Large	Affects the entire habitat or a significant proportion of the habitat to the extent that the viability/function of the entire habitat is reduced and the long-term viability of the habitat and the species dependent on it are threatened.				

Table 5.4 Species Impact Assessment – Significance Criteria

Species Sensitivity/Value		Magnitude of Effect			
		Negligible	Small	Medium	Large
Low	Species which are included on the IUCN Red List of Threatened Species as Least Concern (LC) (IUCN 2011).	Not significant	Not significant	Minor	Moderate
Medium	Species included on the IUCN Red List of Threatened Species as Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD) (IUCN 2011). Species protected under national legislation. Nationally restricted range species. Nationally important number of migratory or congregatory species.	Not significant	Minor	Moderate	Major
High	Species included on the IUCN Red List of Threatened Species as Critically Endangered (CR) or Endangered (EN) (IUCN 2011). Species having a globally Restricted Range (i.e. plants endemic to a site or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km ² . Internationally important numbers of migratory or congregatory species. Key evolutionary species.	Not significant	Moderate	Major	Critical
Magnitude of Effect Definition					
Negligible	Effect is within the normal range of variation.				
Small	Affects a small proportion of a population, but does not substantially affect other species dependent on it, or the populations of the species itself				
Medium	Affects a sufficient proportion of a species population that it may bring about a substantial change in abundance and /or reduction in distribution over one or more generations, but does not threaten the long term viability of that population or any population dependent on it.				
Large	Affects an entire population or species at sufficient scale to cause a substantial decline in abundance and/or change in distribution beyond with natural recruitment (reproduction, immigration from unaffected areas) may not return that population or species, or any population or species dependent upon it, to its former level within several generations, or when there is no possibility of recovery.				

6 SCREENING AND SCOPING

6.1 Overview

This Section documents the scoping of potential Project impacts on biodiversity values in accordance with the requirements of IFC PS6. It considers the nature of impacts as a result of project activities and the threats to biodiversity values related to those activities.

Table 6.1 broadly defines the types of threats to biodiversity values that have potential to occur as a result of a project. These threats to biodiversity are derived from IFC PS6 and relate to the activities that are likely to occur during construction and post construction phases.

Table 6.1 Threats to biodiversity values

Term	Description
Loss of habitat	Permanent loss of habitat or species due to permanent or temporary site activities.
Disturbance or displacement of individuals	Disturbance to, or displacement/exclusion of a species from foraging habitat due to construction activities, and operational and maintenance activities.
Barrier creation	Creation of barriers to the movements of animals, including mammals, reptiles and amphibians and invertebrates and plants with limited powers of dispersal.
Fragmentation	Fragmentation of habitat, or permanent /temporary severance of wildlife corridors between isolated habitats of importance for biodiversity.
Edge effects	Impacts that occur when a habitat is exposed to a different adjacent habitat type or structure. These impacts can include increased risk of parasitism or disease, increased risk of predation, adverse microclimate conditions (including drying out and subsequent fire risk), and competition from invasive species
Degradation of habitat	Disturbance or damage to adjacent habitat and species caused by changes in microclimate, vulnerability to predation and invasion and overall changes in conditions that can lead to a change in the community and its values for flora and fauna. This can include increased exposure to noise, light and dust.
Impacts by invasive species	Introduction or spreading of alien species during the construction works.
Light impacts	Impacts from light sources on surrounding habitats causing disturbance and displacement and changes in behaviour
Transition of habitats	Creation of new habitats and introduction of species as a result of reinstatement works, habitat enhancement proposals and landscaping.
Pollution or toxicity	Contamination of the environment that has a direct or indirect impact on a species either through exposure to harmful substances.
Mortality – vehicle strike	Mortality of individual fauna species as a result of vehicle or machinery strike or falling debris during clearing activities.
Mortality – hunting and poaching	Mortality to individual fauna species as a result of worker influx and hunting/poaching of extant fauna

6.2 *Key Project Activities/Aspects*

The nature of impacts to biodiversity can be broadly described in terms of direct and indirect impacts, and permanent and temporary impacts. *Table 6.2* considers the construction and operation of each component of the Project and which threats to biodiversity categories may apply. The outcomes of this table are then refined to identify the key potential impacts to biodiversity as a result of the Project that are assessed as part of the impact analysis (*Section 7*).

Table 6.2 Screening of Project Activities and Threats to Biodiversity

Activity/Aspect	Loss of habitat	Disturbance or displacement of individuals	Barrier creation	Fragmentation	Edge effects	Degradation of habitat	Light impacts	Impacts by invasive species	Transition of habitats	Pollution or toxicity	Mortality – vehicle strike	Mortality – hunting and poaching
Project Construction Aspects												
Land clearing	X	X	X	X	X	X		X	X	X		
Land excavation		X	X			X		X				
Installation of utilities (Power, water and wastewater)	X	X	X	X	X	X		X	X	X		
Delivery of materials		X									X	
Material storage			X	X								
Installation of foundations	X	X	X	X	X	X		X	X	X		
Construction of buildings	X	X	X	X	X	X				X		
Use of construction equipment		X								X	X	
Landscaping			X	X	X				X			
Management of waste (construction)	X	X	X	X	X	X		X	X			
Workforce												X
General Operation Activities												
Visitation	X	X				X	X	X		X	X	
Management of waste (operation)						X				X	X	
Wastewater management	X	X			X	X		X		X	X	
Management and upkeep of buildings					X		X					
Organic garden upkeep								X	X			
Landscaping upkeep								X	X	X	X	

7.1 Biodiversity Values

7.1.1 Data Collection

As mentioned in *Table 4.7 Summary of Site Visit*, the Inlay Lake Wildlife Sanctuary Park Warden Office had provided ERM with species checklists of fauna and flora at Inlay Lake. The checklists covered mammals, birds, fish, butterfly, amphibian, reptile, trees, bamboo and orchid species at Inlay Lake. The lists were reviewed and a few additional species from the UN-Habitat Inlay Lake Long Term Restoration Plan were included to generate a species database for the broader Inlay Lake region. This species database is provided in *Annex 2.0*.

ERM conducted a site inspection of the Project Area and the adjacent Inlay Lake Hotel zone to develop an understanding of the habitat types and conditions present.

7.1.2 Screening for Priority Species

Conservation statuses for all species within the database were derived from the IUCN Red List of Threatened Species. Species that were listed as NT, VU, EN or CR on IUCN were then taken forward for the assessment. The profiles for these species were researched from available scientific literature and IUCN species pages to understand information surrounding their dietary and habitat preferences, how these changed according to stages of their life cycles, migratory information etc.

These species profiles were assessed against the habitat types present at the Project area and vicinity, and against potential impacts from the construction of the hotel development. This exercise identified species that were potentially present at the Project area (based on potential species-habitat associations), and species groupings that would potentially be affected by Project activities. The accompanying species database provides further information on the screened species used in this assessment.

Species screened “in” as part of this assessment included:

- Migratory species (birds);
- IUCN Red List Critically Endangered (CR); Endangered (EN) and Vulnerable species; and
- Endemic species.

Species screened “out” of this assessment included:

- Fish species (given no aquatic developments are likely to occur);
- Least Concern (LC), Near Threatened (NT) or species not yet assessed; and
- Species unlikely to occur within habitats found in the Project Area or Project Area of Influence.

7.2 Limitations of Data

It should be noted that there are limitations to species database developed, with gaps arising from:

- Uncertainty surrounding how species checklists were compiled. It is unclear if survey methods adopted and effort spent are consistent, and if the list is based from desktop reviews, anecdotal evidence, or observations.
- Uncertainty surrounding the date of species checklists. It is unclear when the species checklists were compiled or if any of the species recorded are still present in the area.
- Spatial information is lacking from the dataset. The species checklists cover the broader area of Inlay Lake and the exact locations of species, in particular priority species are not known.
- The data may not represent species that occur within the Area of Influence or Project Area. Habitat surrogates have been used to determine the likelihood that the species would be present.

7.3 Screened Threatened Species

Threatened Species have been identified within the Area of Influence and Project Area based on historic records as determined from the background assessment. These species have been screened to determine their likely presence within the Project Area based on the habitat available within the Project Area. Flora species have not been confirmed within the Project Area and hence further survey is recommended prior to this impact assessment being finalized. Critical Habitat candidate species are highlighted in *Table 7.1* below.

Table 7.1 Threatened Species Relevant for this Impact Analysis

Species Grouping	Scientific Name	Common Name	IUCN Status	Likely Presence in Project Area
Ground-dwelling mammals adapted to human settlement	<i>Manis pentadactyla</i>	Chinese Pangolin	CR	Unlikely
	<i>Viverra zibetha</i>	Large Indian Civet	NT	Possible
Ground-dwelling mammals dependent on riparian habitats	<i>Lutra lutra</i>	Common Otter	NT	Possible
Turtles dependent on riparian habitats	<i>Nilssonina formosa</i>	Burmese Peacock Softshell	EN	Possible
Migratory birds	104 species of migratory birds have been recorded for Inlay Lake, 48 of which are wetland dependent			Possible
Birds dependent on riparian habitats	<i>Aythya ferina</i>	Common Pochard	VU	Possible
	<i>Aythya baeri</i>	Baer's Pochard	CR	Possible
	<i>Rynchops albicollis</i>	Indian Skimmer	EN	Possible
Birds dependent on riparian habitats and	<i>Emberiza aureola</i>	Yellow-breasted Bunting	EN	Possible





Species Grouping	Scientific Name	Common Name	IUCN Status	Likely Presence in Project Area
adjacent dry land	<i>Grus antigone sharpii</i>	Eastern Sarus Crane	VU	Possible
<i>Critical Habitat Candidate Species</i>				




A full database of species recorded from Inlay Lake is additionally provided in *Annex 2.0*. Habitat notes for threatened species are detailed within *Annex 2.0*.

7.4 *Land Class Distribution within the Project Area and Area of Influence*

A mapping exercise using satellite imagery (May 2016) was undertaken to determine the land class distribution across the Area of Influence and Project Area. This assessment was also compared to photographs taken during the field visit. The Land Class types observed are outlined in *Table 7.2* below.

Table 7.2 *Definitions of Land Classes within the Area of Influence and Project Area*

Land Class	Description	Photograph
Floating agriculture	Agricultural areas on open water. Market garden trellising, growing crops of tomatoes and other vegetables.	 Floating Agriculture mid-view Terrestrial Agriculture fore-view
Terrestrial agriculture	Agricultural areas on land, including rice paddies and market gardens along the lake edge and foreshores.	
Aquatic emergent vegetation	Emergent reeds in open water near to the lake foreshore. Reeds are free standing and in contiguous patches interspersed with human made channels.	
Open water	Open water of the Lake Inlay surface. Some floating vegetation is present (including Water Hyacinth).	
Scrubland	Vacant land cleared of natural vegetation but not currently used. Some remnant trees and vegetation patches present that are exotic or native in origin.	

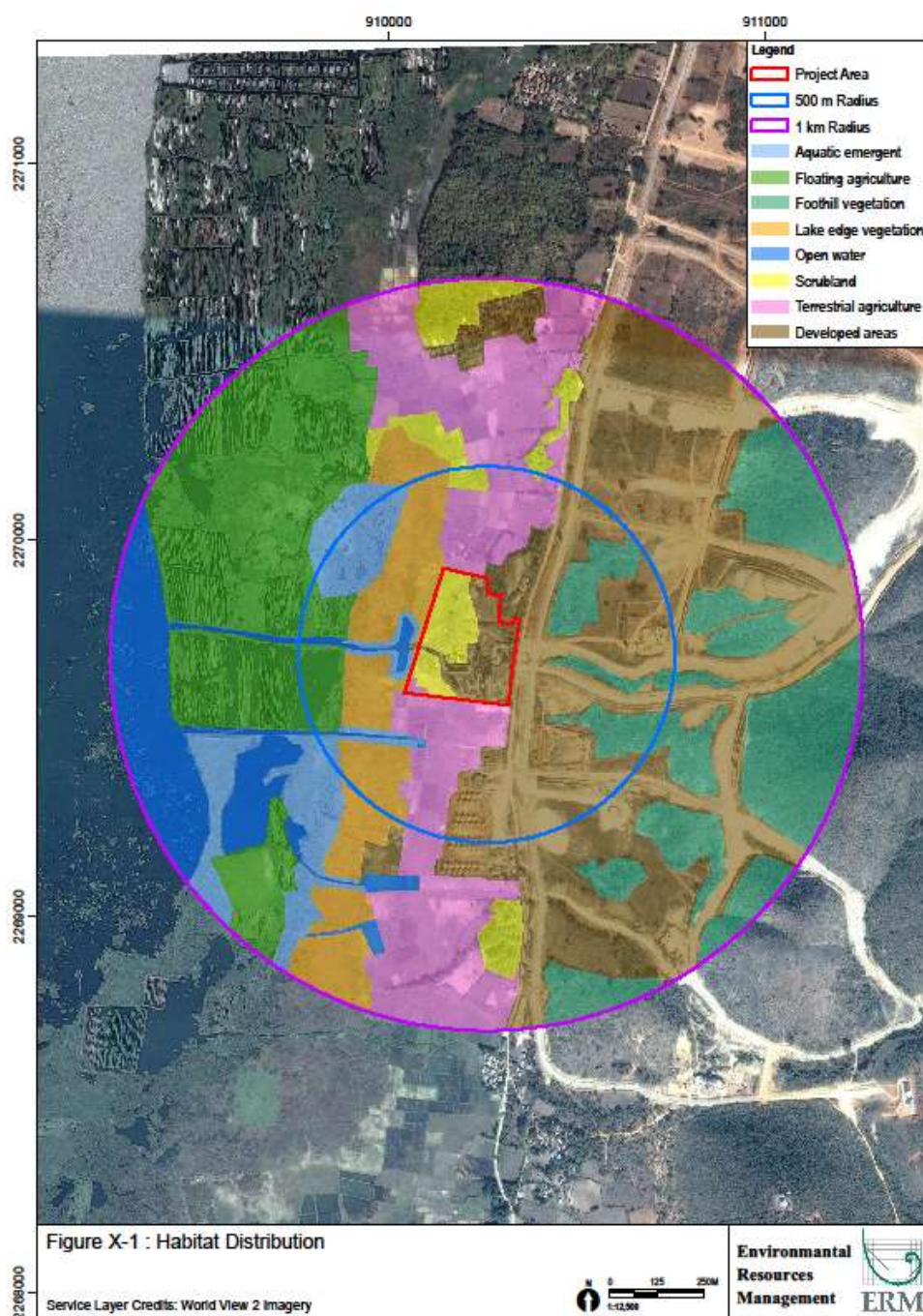
Land Class	Description	Photograph
Developed areas	Areas developed for human use, including resorts, roads, settlements and other built up areas. Also includes areas that have been recently cleared of vegetation. Does not include agricultural areas.	
Foothill vegetation	Vegetation on the lower slopes of hills consisting of disturbed and undisturbed trees and shrubs primarily of native origin.	
Lake edge vegetation	Terrestrial vegetation along the lake edge, including emergent vegetation. Contains a mix of native and non-native species.	

The results of the mapping exercise are shown in *Figure 7.1* below. The distribution of the land classes and areas are shown in *Table 7.3* below. The largest area of land class within the Area of Influence is Developed Areas, Foothill Vegetation and Terrestrial Agriculture. The Project Area is dominated by Scrubland and Developed Areas.

Table 7.3 Area of classes represented within the Area of Influence and Project area

Land class / Vegetation type	Extent within Project area of influence (m ²)	Extent within Project area (m ²)
Floating agriculture	517,897	0
Terrestrial agriculture	449,068	1786
Aquatic emergent vegetation	172,802	0
Open water	203,493	0
Scrubland	120,770	32,439
Developed areas	1,035,951	38,418
Foothill vegetation	425,210	0
Lake edge vegetation	215,680	1834
Total	3,140,871	74,477

Figure 7.1: Land Class Distribution in the Project Area and Area of Influence



Service Layer Credit: *World View 2 Imagery*

7.5 *Natural and Modified Habitat*

To identify and map Natural and Modified Habitats, ERM has used the IFC PS6 Guidance Note to define the habitat types within the Project Area and Area of Influence.

For the purposes of this study the definitions provided by the IFC (2012a) are used as outlined below.

“Modified habitats are 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 components.”

“Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area’s primary functions and species composition.”

For both of these habitat types, it clearly states in IFC PS6 Guidance Note 6 (IFCb, 2012), that there are no metrics available to identify what constitutes Modified or Natural Habitat. ERM classified the Land Class types based on their degree of “naturalness”, taking into account the level of human disturbance, the distribution of native and non-native species. The land classes classified as Natural and Modified Habitats are shown in *Table 7.4* below. The spatial distribution of Natural and Modified Habitat within the Project Area and Area of Influence is shown in *Figure 7.2*.

Table 7.4 Natural and Modified Habitat Classification of Land Classes

Land class / Vegetation type	Natural or Modified Habitat	Rationale
Floating agriculture	Modified Habitat	Contains a large proportion of vegetation that is non-native in origin.
Terrestrial agriculture	Modified Habitat	Contains a large proportion of vegetation that is non-native in origin.
Aquatic emergent vegetation	Natural Habitat	Contains species of predominately native vegetation in origin.
Open water	Natural Habitat	Contains species of predominately native vegetation in origin (some areas containing water hyacinth would be considered as modified habitat).
Scrubland	Modified Habitat	Contains a large proportion of vegetation that is non-native in origin.
Developed areas	Modified Habitat	Contains a large proportion of vegetation that is non-native in origin.
Foothill vegetation	Natural Habitat	Contains species of predominately native vegetation in origin.
Lake edge vegetation	Natural Habitat	Contains species of predominately native vegetation in origin (Some agricultural plantings exist along the water’s edge and would be considered modified habitat).

The outcomes of the natural habitat and modified habitat mapping analysis for the Project Area and Project Area of Influence (AoI) is shown in *Table 7.2* below.

Table 7.2 Natural and Modified Habitat within the Project area and Area of Influence

	Area of Influence (ha)		Project footprint (ha)	
	M ²	%	M ²	%
Natural Habitat	640,890	20.4	1834	2.5
Modified Habitat	2,296,487	73.1	72,642	97.5
Waterbody	203,493	6.5	0	0
Total	3,140,870	100	74,476	100

Figure 7.2: Natural Habitat and Modified Habitat distribution in the Project Area and Area of Influence



Service Layer Credit: *World View 2 Imagery*

7.6 Critical Habitat Screening Assessment

A preliminary Critical Habitat screening assessment is outlined below based on the species identified as possible to occur within the Area of Influence. Critical Habitat is a sub-set of Modified and Natural Habitats and is defined in PS6 (IFC, 2012a) as:

“Critical Habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregator species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.”

Determination of Critical Habitat

Determination of Critical Habitat is a process that usually follows determination as to whether the habitat area in question is Natural or Modified. Natural Habitats are generally of higher biodiversity value than Modified Habitats, although both can still support species that trigger Critical Habitat (as regularly happens in man-made wetland habitats which support large assemblages of migratory birds).

Critical Habitat is defined as habitat which supports species or assemblages of species that fulfil the five criteria as set out in *Section 2.5.1* provided in detail within IFC PS6 (IFC, 2012a, IFC 2012b).

For IFC PS6 Criterion 1-3 (1 - Critically Endangered and Endangered Species; 2 - Endemic or Restricted Range Species; and 3 - Migratory or Congregatory species) a tiered system is used whereby Critical Habitat of the highest importance is Tier 1 and Critical Habitat of slightly lower importance is classed as Tier 2 (see *Table 2.2* for further details).

The determination of Critical Habitat is also not completely limited to Criteria 1-5 and other recognised high biodiversity values may also qualify for Critical Habitat designation which is carried out on a case by case basis.

Examples may include but not be limited to:

- Areas of high scientific value;
- Concentrations of Vulnerable species (under the IUCN Red List of Threatened Species) where there is uncertainty regarding their listing; and
- Landscape and ecological processes (eg water catchment areas, areas which prevent flooding or fire).

IFC PS6 also contains requirements for Critical Habitat in ‘Legally Protected and Internationally Recognised Areas’. It is stated in PS6 (IFC, 2012b) that the following sites are included in the definition of such areas:

“In general, internationally and/or nationally recognised areas of high biodiversity value will likely qualify as critical habitats; examples include the following:

- *“The majority of Key Biodiversity Areas (KBAs), which encompass inter alia, Ramsar Sites, Important Bird Areas (IBA), Important Plant Areas (IPA) and Alliance for Zero Extinction Sites (AZE).”*

The term ‘*recognised area*’ is explicitly used instead of ‘*designated*’ so that it can be clear that the area does not have to be protected but must be internationally or nationally recognised for its biodiversity value.

Criterion for Critical Habitat

Critical Habitat criteria as defined in PS6 Guidance Note 6 (GN6) Paragraphs GN69 – GN97 (*IFC 2012b*), and shown in *Table 2.2*. This table provides detail of the qualifying requirements for Criteria 1-3 while details of the likely qualifying interests are given for Criterion 4 and 5 which will be defined based on research and expert opinion (as will those for Criteria 1-3 where data is lacking). The criteria listed in *Table 2.2* have been used to complete this assessment and it should be noted that this has been only done on a preliminary basis as previously stated.

Table 7.3 Critical Habitat Criteria

Criteria	Tier 1 ⁽¹⁾	Tier 2 ⁽¹⁾
Criterion 1: Critically Endangered (CR) / Endangered (EN) species:	<p>a) Habitat required to sustain $\geq 10\%$ of the global population of a CR or EN species /sub /species and where there known regular occurrences of the species and where habitat could be considered a discrete management unit for the species.</p> <p>b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.</p>	<p>c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally- important concentrations of Red-listed EN species where that habitat could be considered as a discrete management unit for the species/subspecies.</p> <p>d) Habitat of significant importance to CR/EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.</p> <p>e) As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.</p>
Criterion 2: Habitat of significant importance to endemic and/or restricted-range species;	a) Habitat known to sustain $\geq 95\%$ of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species.	b) Habitat known to sustain $\geq 1\%$ but $< 95\%$ of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment.
Criterion 3: Habitat supporting globally significant concentrations of migratory species and/or congregatory species;	(a) Habitat known to sustain, on a cyclical or otherwise regular basis, $\geq 95\%$ of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species.	<p>(b) Habitat known to sustain, on a cyclical or otherwise regular basis, $\geq 1\%$ but $< 95\%$ of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment.</p> <p>(c) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance.</p> <p>(d) For species with large but clumped distributions, a provisional threshold is set at $\geq 5\%$ of the global population for both terrestrial and marine species.</p> <p>(e) Source sites that contribute $\geq 1\%$ of the global population of recruits.</p>
Criterion 4: Highly threatened and/or unique ecosystems; and/or	<p>Criterion 4 has no tiered system although recent publication (<i>Keith et al</i>, 2013) may introduce this. This criterion must include one of the following</p> <p>a) the ecosystem is at risk of significantly decreasing in area or quality;</p> <p>b) has a small spatial extent; and /or</p>	

Criteria	Tier 1 ⁽¹⁾	Tier 2 ⁽¹⁾
	c) contains unique assemblages of species including assemblages or concentrations of biome-restricted species. Highly threatened or unique ecosystems are defined by a combination of factors which may include long-term trend, rarity, ecological condition, and threat.	
Criterion 5: Areas associated with key evolutionary processes	The criterion is defined by: a) the physical features of a landscape that might be associated with particular evolutionary processes; and/or b) subpopulations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history. The latter includes evolutionarily significant units and evolutionarily distinct and globally endangered species.	

Note: ⁽¹⁾ No Tier system is in place for Criterion 4 and Criterion 5.

It should be noted that the IFC defines an endemic species as one that has ≥95% of its global range inside the country or region of analysis. Restricted range species include, for plants, those listed as part of national legislation, and for terrestrial vertebrates, species which have an extent of occurrence of 50,000km.

Critical Habitat Triggers

The five criteria are ‘triggers’ in that if an area of habitat meets any one of the criteria then it is considered to be Critical Habitat, irrespective of any other criterion (*TBC, 2012*). Hence Critical Habitat can be determined through a single criterion or where a habitat area holds biodiversity meeting all five criteria. This approach is generally more cautious but is used more widely in conservation (*McDonald-Madden et al, 2009*). Critical Habitat criteria therefore have two distinctive characteristics. First, components of biodiversity are essentially assigned to only two levels of conservation significance, those that trigger Critical Habitat and those that do not (Tier considerations being secondary to this primary Critical Habitat determination). Second, each criterion is applied separately, not in combination, meaning that the scores are not cumulative (*TBC, 2012*).

Critical Habitat Screening Assessment

Based on the Critical Habitat criteria and the results of the biodiversity values summary assessment, *Table 7.4* assesses the potential for Critical Habitat to exist within the Project Area and Area of Influence.

Table 7.4 Critical Habitat Screening Assessment

Scientific Name	Common Name	IUCN	CH Criteria	Rationale	Likely Critical Habitat?
<i>All Migratory Birds found within Inlay Lake</i>	-	-	Criterion 3, Tiers 1 & 2	<p>Inlay Lake plays host to 104 migratory bird species. Forty eight (48) of these species are wetland dependent and are classed as winter migratory. They utilise the East Asia/Australasia Flyway¹⁵ which extends from Arctic Russia and North America to the southern limits of Australia and New Zealand. It encompasses large parts of East Asia, all of Southeast Asia and includes eastern India and the Andaman and Nicobar Islands. Inlay Lake is a resting location during the migratory route. Records indicate that migratory birds use Inlay Lake and its surrounds during this period. On occasion, migratory birds are likely to utilize parts of the Area of Influence.</p> <p>It is considered that Inlay Lake itself could constitute a Discrete Management Unit for these species and is likely to be habitat known to sustain, on a cyclical or otherwise regular basis, $\geq 1\%$ but $< 95\%$ of the global population of a migratory or congregatory species at any point of the species' lifecycle (Criterion 3, Tier 2). However, the Area of Influence and Project Area are unlikely to meet this definition.</p> <p>Note that some migratory birds are considered individually below given their CR and EN status.</p>	Inlay Lake – Yes Project Area and Area of Influence - No
<i>Manis pentadactyla</i>	Chinese Pangolin	CR	Criterion 1, Tiers 1 & 2	<p>This species is listed as Critically Endangered A2d+3d+4d due to high levels of poaching for meat and scales, both targeted and untargeted, across its range. Although this species has been used locally across its range historically, which continues today, much poaching is now for international trade. The species is plausibly widespread in northern Myanmar, although there are few records and its exact distribution is not well known¹⁶. It is not considered that the habitat within the Area of Influence and Project Area is required to sustain $\geq 10\%$ of the global population. It is also unlikely that the habitat of the Area of Influence and Project Area supports regular occurrence of a single individual of the species.</p>	No

¹⁵ BirdLife International Fact sheet on the East Asia/Australasia Flyway http://www.birdlife.org/datazone/userfiles/file/sowb/flyways/8_EastAsia_Australasia_NEW.pdf

¹⁶ IUCN Red List Species Profile for the Chinese Pangolin <http://www.iucnredlist.org/details/12764/0>

Scientific Name	Common Name	IUCN	CH Criteria	Rationale	Likely Critical Habitat?
<i>Nilssonnia formosa</i>	Burmese Peacock Softshell Tortoise	EN	Criterion 1, Tiers 1 & 2	Traded in some numbers in the East Asian food trade; uncommon to rare in the wild; not known to inhabit effectively protected areas; and life history is particularly sensitive to exploitation of adults ¹⁷ . It is not considered that the habitat within the Area of Influence and Project Area is required to sustain ≥ 10 % of the global population. It is also unlikely that the habitat of the Area of Influence and Project Area supports regular occurrence of a single individual of the species.	No
<i>Aythya baeri</i>	Baer's Pochard	CR	Criterion 1, Tiers 1 & 2	This species is classified as Critically Endangered as it is apparently undergoing an extremely rapid population decline, as measured by numbers on both the breeding and wintering grounds. It is now absent or occurs in extremely reduced numbers over the majority of its former breeding and wintering grounds and is common nowhere. It is thought that hunting and wetland destruction are the key reasons for its decline ¹⁸ . Species primary wintering locations are in China, India and Bangladesh. The species is known to winter in Myanmar, however has not been recently surveyed. Historic records exist for Inlay Lake. It is not considered that the habitat within the Area of Influence and Project Area is required to sustain ≥ 10 % of the global population. It is also unlikely that the habitat of the Area of Influence and Project Area supports regular occurrence of a single individual of the species.	No
<i>Rynchops albicollis</i>	Indian Skimmer	EN	Criterion 1, Tiers 1 & 2	This species is listed as VU because its population is undergoing a rapid decline as a result of widespread degradation and disturbance of lowland rivers and lakes. The species is confined to Pakistan and India, north of c.16°N, Bangladesh, where a large proportion of the population winters, principally in the Padma-Meghna delta, and Myanmar. There are very few recent records from Myanmar. Its population is estimated at 6,000-10,000 mature individuals ¹⁹ . It is not considered that the habitat within the Area of Influence and Project Area is required to sustain ≥ 10 % of the global population. It is also unlikely that the habitat	No

¹⁷ IUCN Red List Species Profile for the Burmese Peacock Softshell Tortoise <http://www.iucnredlist.org/details/14765/>

¹⁸ BirdLife International Species Profile <http://www.birdlife.org/datazone/speciesfactsheet.php?id=478>

¹⁹ Birdlife International Species Profile <http://www.birdlife.org/datazone/speciesfactsheet.php?id=3206>

Scientific Name	Common Name	IUCN	CH Criteria	Rationale	Likely Critical Habitat?
<i>Emberiza aureola</i>	Yellow-breasted Bunting	EN	Criterion 1, Tiers 1 & 2	<p>of the Area of Influence and Project Area supports regular occurrence of a single individual of the species.</p> <p>This species is listed as Endangered, despite its high abundance locally, because of compelling evidence that it is undergoing a very rapid population decline owing mainly to trapping in its non-breeding range. The species winters in a relatively small region in South and South-East Asia, which includes eastern Nepal, north-eastern India, Bangladesh, Myanmar, southern China, Cambodia, Laos, Vietnam and Thailand²⁰. It is also unlikely that the habitat of the Area of Influence and Project Area supports regular occurrence of a single individual of the species.</p>	No

²⁰ BirdLife International Species Profile <http://www.birdlife.org/datazone/species/factsheet/22720966>

8.1 Overview

The scoping and screening of potential project impacts identified a number of Project aspects and activities that have potential to biodiversity values (shown in *Table 6.2*). While the potential impacts relate to a combination of Project aspects/activities and biodiversity threats, they can be summarised into a number of key potential impacts according to the biodiversity threat type. These impacts can relate to habitat areas, specific species or both.

Table 8. summarizes the key potential impacts that are further investigated in terms of significance. *Section 8.2* provides general discussion and background for each of these potential impacts and the significance of each is evaluated in *Table 8.5*. Acknowledging the conservation significant species known or with potential to occur in the Project area of influence and that different species respond differently to impact, **Error! Reference source not found.** considers the significance of these potential impacts as they relate to conservation significant species.

Table 8.1 Potential Impact Summary

Potential Impact
<ul style="list-style-type: none"> • Permanent and temporary loss of habitat (terrestrial and aquatic) including transition of habitats from one habitat type to another • Disturbance and displacement of resident species due to noise, light, dust or vibration • Creation of a barrier to fauna movement, including terrestrial and aquatic species • Edge effects • Degradation of habitat as a result of introduction of, and competition with invasive species • Degradation of habitat in the event of release of hazardous substances or pollution • Mortality as a result of vehicle/machinery strike • Mortality (hunting and poaching) as a result of worker influx and improved community access

The Project footprint and adjacent areas contains native biodiversity and conservation significant values. Baseline information identified a diversity of flora and fauna species, and ecosystems, including species listed on the IUCN Red List of threatened species, endemic species, migratory species and species with elevated protection under legislation in Myanmar.

The nature of each of the potential impacts has been described detail in *Section 8.2* below in order to inform an assessment of significance for either habitat areas or specific species where relevant.

8.2 Discussion of Impacts

This section elaborates on the nature of impacts to biodiversity values at it relates to the characteristics of the Project area as determined by assessing the impacts of the

Project Description (*Chapter 2*). The information has been used to inform the evaluation of the significance of the impact (*Section 8.3*).

8.2.1 *Loss of Habitat*

As described in *Section 7 Priority Biodiversity Values Summary* identified the land class types within the Project footprint and the Project area of influence.

8.2.2 *Disturbance and Displacement of Fauna*

Noise, light and vibration disturbances have the potential to influence breeding, roosting or foraging behavior of native fauna. During the construction phase (temporary) of the Project it is expected that noise will be the primary disturbance of this nature. Vegetation clearing, excavation, movement of materials, drilling and general construction activities will introduce noise sources to areas not currently exposed to these disturbances. In addition there will be vibration associated with drilling activities.

During operation (permanent) there will be a certain level of noise disturbance associated with infrastructure and visitation. It is expected that the noise experienced will be localized. Similarly, it is likely that hotel areas such as pathways will have some lighting installed for safe operation.

The consequences of these influences are dependent on the extent of disturbance but in extreme cases these factors can influence local populations. For example if breeding and communication is inhibited influencing lifecycle, or, if individuals are displaced from noisy areas and home ranges are reduced.

Excessive noise can impede fauna communication and deter the use of habitats nearby. Similarly, introducing light sources has the potential to deter foraging and dispersal activities of nocturnal species.

The proposed construction schedule for the Project commenced in May 2016 and it is anticipated to span 24 months. It should be noted however that the noise, light and vibration disturbances will not be continuous for this period, or focused on any one specific location for the total time. Key disturbance activities are likely to relate to construction activities.

8.2.3 *Barrier to Terrestrial Fauna Movement*

The Project area lies between habitat areas known for biodiversity values. The Project will introduce a number of barrier types to the movement of terrestrial fauna. The introduction of access paths will introduce barriers to movement for some fauna may not readily cross given potential vulnerability to predation and mortality. These barrier impacts are likely to be permanent and mainly associated with the construction of bungalows near the edge of Inlay Lake. Most other Project components are discrete areas that may be navigated around by fauna.

8.2.4 *Edge Effects*

Edge effects are an indirect impact of land clearing during construction and throughout operation. Where vegetation clearing occurs, adjacent vegetation and habitats can be exposed to changes in noise, light (natural or artificial), dust, humidity and temperature factors as well as increased competition from predators and invasive species. The impact of edge effects to habitat value and has been widely recognized as a contributor to habitat degradation and impacts to biodiversity. In extreme cases the effects have potential to alter the habitat characteristics of the ecotone and influence suitability for native flora and fauna (including threatened species). Clearing of vegetation for the Project will create 'new' edges in areas that have not previously been disturbed.

8.2.5 *Degradation of Adjacent Habitats*

During construction, land preparation has the potential to generate dust which may settle on vegetation adjacent to the construction area (including from access roads). Excessive dust deposition on flora may act to suppress growth through limiting photosynthesis and the dusted foliage may also become unpalatable to foraging fauna. The construction activities will be temporary and dust generation is likely to be localised to active work areas. Rainfall will generally remove dust from foliage.

8.2.6 *Runoff*

Land preparation will expose earth areas to be vulnerable to erosion (wind and/or runoff) until infrastructure construction or replanting is completed to stabilise the surface. The Project is adjacent to Inlay Lake which is a sensitive receptor. Erosive processes transport and deposit sediment to downstream/downslope habitats (both aquatic and terrestrial). This indirect impact has potential to degrade downstream habitat areas or change habitat characteristics, and as such influencing suitability for native flora and fauna communities.

8.2.7 *Release of Contaminants*

Accidental release or spill of these materials can be toxic to flora and fauna locally and downstream if substances are released into the aquatic environment. Overland flows from the construction area have potential to carry contaminants towards Inlay Lake. Construction activities such as refueling, storage and other activities that require oil and hazardous substances to be used, are undertaken at risk of accidental release.

8.2.8 *Invasive Species*

Invasive species (flora and fauna) have the potential to be introduced or spread throughout the Project area through increased movement of people, vehicles, machinery, vegetation and soil. An increase in the prevalence of weeds or other pests

has the potential to reduce the quality of habitat for some native flora and fauna, including conservation significant species. Invasive flora species can rapidly germinate in disturbed areas whereby affecting the ability of native vegetation communities to re-establish. Invasive animals also have the potential to be introduced or increased in abundance. These animals may adversely impact native fauna as a result of increased competition for resources, predation or habitat degradation.

Vehicle movement and activities which introduce a risk of invasion will be focused along access road and construction areas. The increase in human activity and movement across the landscape also is a consideration as well as the potential movement of weed seed and aquatic invasive species as a result of runoff.

8.2.9 Fauna Mortality

Vehicle/Machinery Strike

Fauna mortality can occur during most construction activities (e.g. vegetation clearing, excavation, vehicle movement) in the event individuals are struck by vehicles and machinery. Animals that are unable to disperse during clearing activities are vulnerable to being injured or destroyed through interaction with machinery or falling debris.

It is likely that most individuals will disperse from construction activity locations into adjacent habitats as a result of noise and other disturbance however some less mobile species may experience a localised reduction in abundance during this period, such as amphibians, reptiles and small mammals.

Hunting and Poaching

With greater human activity in the region and increased access points to the habitats, there is a risk of increased hunting and poaching activities leading to fauna mortality.

8.3 Impact Significance Evaluation Prior to Mitigation

The significance of the impacts to biodiversity values has been undertaken using the matrix criteria described in *Section 5. Table 8.5* and **Error! Reference source not found.** provide the assessment in terms of habitat areas and species respectively. These tables are used to assess the significance of the sources of impact described, drawing on the results of the field survey and consultation.

Table 8.5 Assessment of Impacts to Habitats Prior to Mitigation

Impact	Summary	Comment	Sensitivity	Magnitude	Significance
Loss of terrestrial habitat	Loss of habitat within the Project.	<p>97.5% of the Project area is considered to be modified habitat. In the context of the surrounding area, the habitats are representative of the landscape and not considered unique. A diversity of flora and fauna species is likely to exist within these habitats and as such the loss of habitat will reduce availability locally for local populations. The habitat may however be visited by migratory birds on occasion.</p> <p>The Project Area is located within the Inlay Lake Wildlife Sanctuary, which is on a tentative list as an ASEAN Heritage Park and listed as a UNESCO World Network of Biosphere Reserve (Sensitivity High). The impact is likely to affect a small area of habitat, but without the loss of viability/function of the habitat (Magnitude Small). The significance of impact is therefore Moderate prior to mitigation.</p>	High	Small	Moderate
Temporary disturbance to fauna behaviours	Disturbance and displacement of resident fauna due to noise, light and/or vibration as a result of construction activities	<p>Noise disturbances will occur throughout the Project area, including areas of adjacent natural habitat not currently exposed to this type of disturbance. Although temporary, the construction schedule is relatively lengthy from start to finish (2 years) and may span multiple breeding for some species. It is expected however that the noise and vibration disturbance is unlikely to occur at all locations simultaneously and will be localised. The impact is likely to affect a small area of habitat, but without the loss of viability/function of the habitat (Magnitude Small). The significance of impact is therefore Moderate prior to mitigation.</p>	High	Small	Moderate

Impact	Summary	Comment	Sensitivity	Magnitude	Significance
Permanent disturbance to fauna behaviours	Disturbance and displacement of resident fauna due to noise and light as a result of the operation facilities	Noise and light disturbances have the potential to influence fauna breeding, roosting or foraging behaviour. The consequences of these influences are dependent on the extent of disturbance but in extreme cases these factors can influence local and neighbouring populations. Excessive noise can impede fauna communication and deter the use of habitats nearby. Similarly, introducing light sources has the potential to deter foraging and dispersal activities of nocturnal species. The requirement for temporary lighting and noise generating machinery will occur during the construction phase. Permanent lighting will be installed during the operational phase. This impact will be localised around pathways and buildings. The impact is likely to affect a small area of habitat, but without the loss of viability/function of the habitat (Magnitude Small). The significance of impact is therefore Moderate prior to mitigation.	High	Small	Negligible
Edge effects Result of any land clearing	The construction and operation phases associated with the Project will generate newly disturbed edges around the margins of the project area.	Edge effects are an indirect impact of land clearing. Where vegetation clearing occurs, adjacent vegetation and habitats are exposed to increased noise, light, dust and wind environment as well as increased competition from predators and invasive species. The impact is likely to affect a small area of habitat, but without the loss of viability/function of the habitat (Magnitude Small). The significance of impact is therefore Moderate prior to mitigation.	High	Small	Moderate
Degradation of habitat Land clearing for all Project components Vehicle movements General construction activities	Dust	The potential for dust will be experienced across the whole Project area, including areas adjacent to habitat for threatened species. The magnitude of the impact will be limited to areas directly adjacent to the generation of dust. The impact is likely to affect a small area of habitat, but without the loss of viability/function of the habitat (Magnitude Small). The significance of impact is therefore Moderate prior to mitigation.	High	Small	Moderate

Impact	Summary	Comment	Sensitivity	Magnitude	Significance
Excavation works, Spoil disposal	Runoff	The potential for runoff will be experienced across the whole Project area, including areas adjacent to habitat for threatened species. It is expected that higher risk areas for runoff and erosion will relate to areas in close proximity to waterways. The impact is likely to affect a small area of habitat, but without the loss of viability/function of the habitat (Magnitude Small). The significance of impact is therefore Moderate prior to mitigation.	High	Small	Moderate
	Release of contaminants	The potential for release of contaminants will be associated with areas where vehicles and machinery area utilised, where chemicals are stored and where vehicles are refuelled, including areas adjacent to habitat for threatened species (Sensitivity High). It is expected that higher risk areas for contaminant release will be in proximity to Inlay Lake. The magnitude of the impact will be limited to areas directly adjacent to any accidental spill unless the contaminant reaches a waterway.	High	Small	Moderate
	Invasive species	The potential for introduction and spread of invasive species will be associated with areas where vehicles and machinery movement occurs including areas adjacent to habitat for threatened species. The magnitude of the impact will be limited to areas directly adjacent disturbed land areas. The impact is likely to affect a small area of habitat, but without the loss of viability/function of the habitat (Magnitude Small). The significance of impact is therefore Moderate prior to mitigation.	High	Small	Moderate
Fauna mortality Land clearing for all Project components Vehicle movements Introduction of a workforce Maintenance of	Vehicle strike	Fauna mortality can occur during most construction activities It is likely that most individuals will disperse from clearing locations into adjacent habitats however individuals some lower mobility species not be able to readily evacuate. The species in the area include threatened species. The impact is likely to affect a small area of habitat, but without the loss of viability/function of the habitat (Magnitude Small). The significance of impact is therefore Moderate prior to mitigation.	High	Small	Moderate

Impact	Summary	Comment	Sensitivity	Magnitude	Significance
access roads	Hunting and poaching	Hunting and poaching of native fauna species is known to currently occur in the Project area and for many threatened species known to occur hunting and poaching are cited as key threats (Sensitivity High). Project activities, including construction and operation will result in increased human activity as well as increased access points to the area (Magnitude Medium).	High	Small	Moderate

The mitigation hierarchy aims to minimize impacts on biodiversity and should be applied sequentially to: avoid, minimize and where residual impacts remain compensate/offset.

IFC Performance Standard 1 (IFC, 2012a) highlights that options to 'minimize' are variable and include abate, rectify, repair and/or restore.

9.1 **Construction Phase**

Disturbance to habitat in modified and natural habitat areas during construction has the potential to impact the local and downstream biodiversity as well as impacts to conservation significant species habitats. Mitigation measures can be implemented to manage the disturbance during construction such that biodiversity values are not significantly impacted or impacts are reduced by the application of the mitigation hierarchy (avoid, minimize, mitigate and compensate through offsets).

Management measures specific to managing the natural environment will be incorporated into Project specific Construction management plans. These general environmental management measures will assist in reducing the potential for degradation of habitat, behavior disturbance, fauna mortality and edge for native species.

In addition to the general measures for the management of potential impacts to the natural environment, measures specific to managing potential impacts to conservation significant values are also considered. The proposed mitigation measures during the construction phase are outlined in *Table 9.1* below.

Table 9.6 Mitigation and Management Measures, Construction Phase

Nature of Impact	Overview of Measures
Loss of habitat	<ul style="list-style-type: none"> • The design and layout plan will be prepared to minimise tree cutting and Protected Area disturbance where possible. The Project owner shall be directly responsible for dissemination to its staff and workers of all rules, regulations and information concerning these restrictions, as well as the measures that can expected if any staff or worker or other person associated with the Project violate rules and regulations; • Strict rules against tree cutting or habitat damage outside the approved construction areas and against wildlife hunting and poaching will be imposed on all project staff, workers, and all contractors and personnel engaged in or associated with the Project, with penalties levied for anyone caught carrying and using fire arms, or using animal snares and traps; • The planned clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing; • Project will utilise or upgrade existing roads where possible to minimise unnecessary clearing requirements; • Construction Contractor, will schedule and implement routine inspection

Nature of Impact	Overview of Measures
	<p>program throughout construction period to monitor clearing extent;</p> <ul style="list-style-type: none"> • In natural habitat areas to be cleared, microhabitat features such as hollow logs will be relocated to adjacent natural habitat areas rather than being destroyed where possible. • Use of the access road should be restricted to construction vehicles only.
Disturbance to fauna behaviour	<ul style="list-style-type: none"> • Construction vehicles and machinery will be maintained in accordance with industry standard to minimise unnecessary noise generation; • For construction areas requiring night-time lighting, lights will be used only where necessary and will be directed toward the subject area and away from habitat areas (mainly Inlay Lake and its foreshore) where possible; • In key habitat areas known to support conservation significant populations (migratory birds), monitoring will be undertaken periodically to detect if fauna are being deterred as a result of noise and/or vibration, especially during the migratory season (November to March). Adaptive approaches may need to be considered if populations begin to vacate the habitat, for example break periods in schedules or periodic changes in location of activities (cycling) rather than continuous noise in one location for an extended period; • Commitment will be made to raise awareness of the construction work force and make arrangements for restriction of poaching.
Barrier to movement and habitat fragmentation	<ul style="list-style-type: none"> • The Project shall implement landscaping and re-vegetation after completion of construction in suitable areas to limit edge effects and vulnerability to weed and invasive species proliferation; • Sediment and erosion control measures should be designed and maintained for all disturbed soil surfaces, including the road and spoil piles and disturbed areas adjacent to Inlay Lake; • Throughout construction any road kill or fauna crossing sightings will be reported to the Project owner representative in the event a corridor pathways hotspot is identified. Data analysis throughout the construction period should inform implementation of additional measures (such as go slow areas) if required;
Edge effects	<ul style="list-style-type: none"> • Dust suppression techniques will be utilised during construction, to control the dispersion of dust created by clearing lands and construction activities. These measures can include using covered saws or watering exposed soil that may generate dust; • The Project shall implement landscaping and re-vegetation after completion of construction using native species where possible; • To avoid/minimize releasing sediment load into Inlay Lake, erosion control measures will be implemented and maintained e.g. using silt fence and temporary re-vegetation to minimize sediment transport; and • Invasive species management measures should be implemented to avoid introduction of weeds to natural and modified habitat areas.
Degradation of habitat	<ul style="list-style-type: none"> • Construction and domestic waste will be appropriately stored and disposed of to avoid attracting native and alien species to the construction and camp areas; • For areas in direct runoff path to a watercourse, sediment and erosion control devices will be installed and maintained until vegetation replanting can occur to stabilise disturbed soil surfaces; • Oil, chemical and solid waste will be stored, and handled and disposed of by appropriately licenced waste management contractors; • Invasive species management measures should be implemented to avoid introduction of weeds to natural and modified habitat areas. These include cleaning machinery and vehicles before and after they leave site; • Construction materials and chemicals will be appropriately secured to avoid accidental release to the natural environment (wind and water erosion).

Nature of Impact	Overview of Measures
Fauna mortality	<ul style="list-style-type: none"> Commitment will be made to raise awareness of values of natural habitat areas to construction work force and arrangements will be made for restriction of poaching and forest product collection; Access restriction should be applied to project facilities for non-construction vehicles; Hunting wild animals will be strictly prohibited to apply for all staff; and Fishing and using of illegal fishing gear anywhere along Inlay Lake will be prohibited.

9.2 Operation Phase

Impacts relating to the operation phase are generally associated with noise and disturbances associated with visitation and operation of the resort facilities. Mitigation measures can be implemented to manage the disturbance during operation such that biodiversity values are not significantly impacted or impacts are reduced by the application of the mitigation hierarchy (avoid, minimise, mitigate and compensate).

Management measures specific to managing the natural environment are outlined in *Table 9.2* below.

Table 9.7 Mitigation and Management Measures, Operation Phase

Nature of Impact	Overview of Measures
Disturbance to fauna behaviour	<ul style="list-style-type: none"> All lighting is to be directed away from Inlay Lake and its foreshore; Visitors will be discouraged from entering areas of natural habitat; Operational vehicles will be maintained in accordance with industry standard to minimise unnecessary noise generation; Access to facilities, including the access road should be restricted to operational vehicles only; For operational areas requiring night-time lighting, lights will be used only where necessary and will be directed toward the subject area and away from habitat areas where possible; Commitment will be made to raise awareness of the operator work force regarding flora and fauna values and make arrangements for restriction of poaching.
Degradation of habitat	<ul style="list-style-type: none"> Non-invasive species are to be used in all landscaping and in the organic garden and plantings (see Myanmar invasive species list at <i>Table 4.5</i>); Minimal use of fertilisers is to be used in landscaping and the organic garden; There will be no direct discharge of wastewater into Inlay Lake; All sewage treatment infrastructure is to be regularly maintained. No discharge from sewage is to be allowed into Inlay Lake; Domestic waste and litter will be appropriately stored and disposed of to avoid attracting native and alien species to the operation areas; Oil, chemical and solid waste will be stored, and handled and disposed of by appropriately licenced waste management contractors.
Fauna mortality	<ul style="list-style-type: none"> Commitment will be made to raise awareness of values of natural habitat areas to operator work force and arrangements will be made for restriction of poaching and forest product collection; Access to project areas, including the access road should be restricted to

Nature of Impact	Overview of Measures
	<ul style="list-style-type: none"> operational vehicles only; Hunting wild animals will be strictly prohibited to apply for all staff and visitors; and Fishing and using of illegal fishing gear anywhere along the edges of Inlay Lake will be prohibited.

9.3 Significance of Residual Impact

Mitigation and management approaches have been considered to avoid, minimize and mitigate potential impacts to biodiversity as a result of Project activities. In general, many of the indirect impacts to biodiversity values can be minimized, such as behavioral disturbances, degradation of habitats, edge effects and barriers to terrestrial fauna movement. The next step of the mitigation hierarchy necessitates consideration of biodiversity offsets for residual impacts. *Table 9.3* outlines the assessment of significance of impacts post mitigation.

Table 9.3 Assessment of Impacts to Habitats Post Mitigation

Impact	Pre-Mitigation Significance	Rationale for impact significance reduction	Post-Mitigation Significance
Loss of terrestrial habitat	Moderate	The application of mitigation measures to reduce impacts on terrestrial habitats will result in a Negligible impact to habitats within the Project Area and Area of Influence. The habitats are considered to be Modified Habitats and are wide ranging. The mitigation measures will reduce the impacts to species that are present within the Project Area. The impact effect is therefore considered to be within the normal range of variation.	Not Significant
Temporary disturbance to fauna behaviours	Moderate	The application of mitigation measures to reduce impacts from the disturbance of fauna behaviours during construction and operation will reduce the overall magnitude of effect to Not Significant. Measures will be taken to reduce the overall impact, especially from noise and vibration and lighting during construction and operation. The impact effect is therefore considered to be within the normal range of variation.	Not Significant

Impact	Pre-Mitigation Significance	Rationale for impact significance reduction	Post-Mitigation Significance
Permanent disturbance to fauna behaviours	Negligible	The application of mitigation measures to reduce impacts from the permanent disturbance of fauna behaviours during construction and operation will reduce the overall magnitude of effect to Not Significant. Management of activities on the site, including visitation will reduce the overall impact. The impact effect is therefore considered to be within the normal range of variation.	Not Significant
Edge effects <ul style="list-style-type: none"> Result of any land clearing 	Moderate	The application of mitigation measures to reduce impacts from Edge effects during construction and operation will reduce the overall magnitude of effect to Not Significant. Measures will be taken to reduce the overall impact, from clearing activities through landscaping construction and operation. The impact effect is therefore considered to be within the normal range of variation.	Not Significant
Degradation of habitat <ul style="list-style-type: none"> Land clearing for all Project components Vehicle movements General construction activities Excavation works Spoil disposal 	Moderate	The application of mitigation measures to reduce impacts from the degradation of habitat during construction and operation will reduce the overall magnitude of effect to Not Significant. Measures will be taken to manage land clearing and vehicle and machinery use during construction and operation. The impact effect is therefore considered to be within the normal range of variation.	Not Significant
Fauna mortality <ul style="list-style-type: none"> Land clearing for all Project components Vehicle movements Introduction of a workforce Maintenance of access roads 		The application of mitigation measures to reduce impacts fauna mortality during construction and operation will reduce the overall magnitude of effect to Not Significant. Measures will be taken to reduce the overall impact, especially hunting and poaching by staff and visitors. The impact effect is therefore considered to be within the normal range of variation.	Not Significant

