



Biodiversity Action Plan to Address  
Biodiversity Impacts of National  
Highway 7, Adjacent to Boundary  
of Pench Tiger Reserve,  
Maharashtra, India

**Oriental Structural Engineers  
Pvt. Ltd. (OSEPL)**

**Final Report**

March 2018

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Oriental Structural Engineers Pvt. Ltd. (OSEPL)

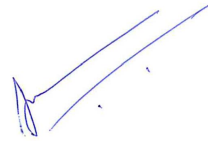
# Biodiversity Action Plan to Address Biodiversity Impacts of National Highway 7, Adjacent to Boundary of Pench Tiger Reserve, Maharashtra, India

March 2018

Reference # 0451847

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Reviewed &  
Approved by: **Arun Venkataraman**



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## ACRONYMS

BAP	Biodiversity Action Plan
BMEP	Biodiversity Monitoring and Evaluation Plan
CA	Compensatory Afforestation
CAP	Compensatory Afforestation Plan
CBD	Convention for Biological Diversity
CHA	Critical Habitat Assessment
CAMPA	Compensatory Afforestation Management and Planning Authority
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DMU	Discrete Management Unit
EMP	Environmental Management Plan
EN	Endangered (as per IUCN Red-List)
ERM	Environment Resource Management
ERP	Emergency Response Plan
ESMS	Environment and Social Management System
ha	Hectares
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
IWPA	Indian Wildlife Protection Act
km	Kilometers
GoI	Government of India
IWPA	Indian Wildlife Protection Act
MFD	Maharashtra Forest Department
MoEFCC	Ministry of Environment, Forests and Climate Change
NNL	No Net Loss
NHAI	National Highways Authority of India
NG	Net Gain
OIT	Oriental Infra Ventures Trust

OSEPL	Oriental Structural Engineers Pvt. Ltd.
PAs	Protected Areas
PS	Performance Standard
SOP	Standard Operating Practice
SPV	Special Purpose Vehicle
WII	Wildlife Institute of India
UNESCO	United Nations Education, Scientific and Cultural Organization
VU	Vulnerable (as per IUCN Red-List)

# 1 INTRODUCTION

## 1.1 PURPOSE OF THE REPORT

This Biodiversity Action Plan (BAP) has been prepared to assist Oriental InvIT (OIT) comply with the requirements of the International Finance Corporation (IFC) Performance Standard (PS) 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources and recommendations made in the Critical Habitat Assessment (CHA) report (ERM, 2018)<sup>1</sup>

A Critical Habitat Screening Study was commissioned for the 117.078 km stretch of the National Highway 7 extending from the Madhya Pradesh/Maharashtra border to Hinganghat in Maharashtra, India. This was conducted to study the part of the highway stretch that lies on the periphery of the buffer zone of the Pench National Park and Tiger Reserve, an important protected area for Tiger (*Panthera tigris*, IUCN version 2018-1, EN, Schedule I, IWPA (1972)) conservation.

The majority of the 117.078 km highway segment is in heavily developed areas including the outskirts of Nagpur City. The exception is the 37.450 km stretch that passes through Reserve Forest land and lies on the periphery of the Buffer Zone of Pench Tiger Reserve.

The Pench Tiger Reserve has been divided by the National Tiger Conservation Authority (NTCA) into a Core and Buffer Zone for conservation purposes. The Core Zone is the key areas where Tiger activity is most prominent and the Buffer Zone has been identified as spillover habitat for the species. Only 22 km of the Project road is on the periphery of the Pench Buffer Zone and the road is located approximately 24 km from the Pench Core Zone. The road also represents the eastern border of the Pench Tiger Reserve and therefore the road abuts the National Park but does not pass through the park boundaries.

PS6 and CHA recommend a number of high level and specific mitigation and management actions to manage biodiversity values. These mitigation and management actions would be implemented along the 37 km long highway segment in Maharashtra and are elaborated in this BAP.

## 1.2 FIELD ASSESSMENT AND CONSULTATIONS

This BAP is guided by field assessments and consultation across 2 phases, undertaken in March and July, 2018.

The first phase was for carrying out during the Critical Habitat Assessment. The second phase was focussed on gathering information that specifically informed the BAP with reference to the merits of maintaining habitat contiguity across the road and the potential offset sites attributes.

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<sup>1</sup> Critical Habitat Screening (CHS) along the Nagpur Bypass Stretch of the National Highway 7.

The details of the activities undertaken are provided in *Annexe A*.

### 1.3

#### *STRUCTURE OF THE REPORT*

The BAP includes the following components:

- Introduction
  - Structure of the BAP
  - Project description and ecological setting
  - Institutional framework: Relevant national and international laws, policies and conventions and guidelines
- OIT Policy Requirements
  - Overview of BAP and Biodiversity policies within OIT's ESMS
  - Relevant company policy requirements:
    - Existing OSEPL environmental policies
    - Biodiversity policy requirements
    - Monitoring and evaluation
    - No poaching and hunting policy requirements
- Impact Summary
  - Habitat Values
  - Species Values
- Mitigation actions
  - Mitigation Actions in Environmental Management Plan; for Pre-construction and Construction
  - Mitigation Actions to Address Barrier Effect of Road
- Biodiversity Offset
  - Potential Offset Definition
  - Compensatory Afforestation Sites as Offset Sites
- Biodiversity Monitoring and Evaluation Plan
- Technical rationale for NNL/NG
- Annexes

### 1.4

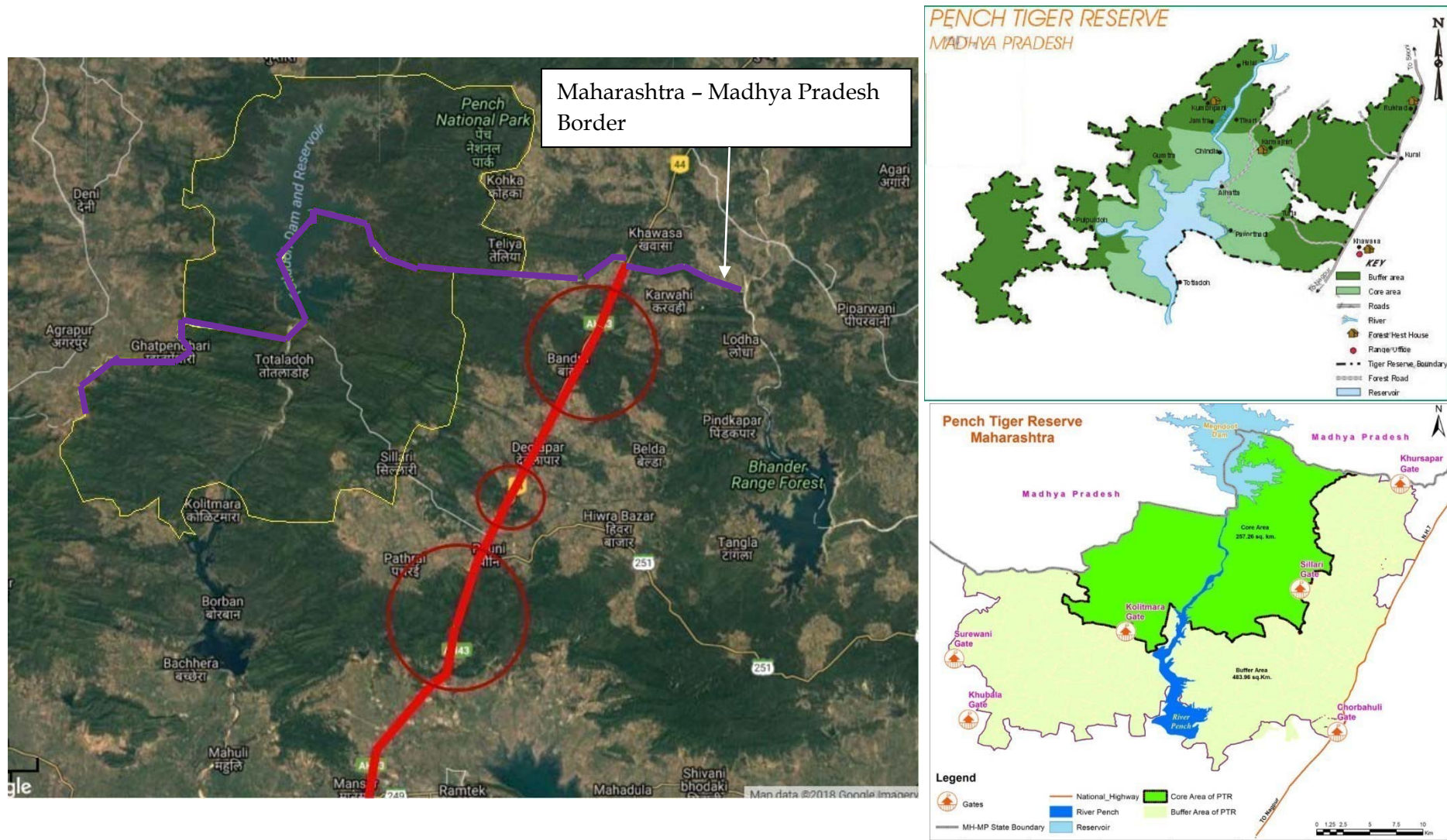
#### *PROJECT DESCRIPTION AND ECOLOGICAL SETTING*

The work undertaken by OSEPL across four highway segments as provided in ERM (2018), include widening and four laning, construction of new stretches and maintenance of existing segments.

The Pench National Park was notified in 1975 and the Tiger Reserve in 1999. The road stretch however has been in existence for over a 100 years and pre-dates the park. The rehabilitation and widening undertaken by OSEPL is to facilitate better connectivity for residents in the area. In doing so, re-establishing forest contiguity for wildlife has been proactively considered, with appropriate mitigations in place. No new roads are being constructed.

The location of the Project road relative to the Pench Core and Buffer Zones is shown in *Figure 1.1*.

Figure 1.1 Project Road Location Relative to the Pench Core and Buffer Zones



Note: Line in bright red shows the NH 7 and the dark circles indicate the points where the road intersects with the Pench Buffer Zone. The purple line shows the state boundary and the yellow line shows the approximate boundary of the core zone divided by Maharashtra and Madhya Pradesh. Individual maps of the Pench National Park Maharashtra (<http://www.mahapenchTiger.com/Map.aspx>) and Madhya Pradesh (<https://www.penchnationalpark.com/pench-map.html>) has also been provided.

#### 1.4.1 *Pench Tiger Reserve*

The Pench Tiger Reserve in Maharashtra and Madhya Pradesh covers a total area of 1920.85 km<sup>2</sup> as shown in *Figure 1.1*. The Tiger Reserve supports approximately 43 mature Tigers (*Panthera tigris*)<sup>(1)</sup> as well as several other large mammals including leopard (*Panthera pardus*), Dhole (*Cuon alpinus*), Jungle Cat (*Felis chaus*), Sloth Bear (*Melursus ursinus*), Chital (*Axis axis*), Sambar (*Cervus unicolor*) and Gaur (*Bos gaurus*).

#### 1.4.2 *Effect of Highway Widening on National Park and Resident Species*

As seen in *Figure 1.1*, there are three patches of the National Highway 7 lying adjacent though outside the Pench Buffer Zone.

In 2015 the Wildlife Institute of India (WII)<sup>2</sup> undertook extensive surveys along the National Highway 7 in collaboration with the National Tiger Conservation NTCA, to determine wildlife dispersal in the area and conducted focused studies on the aforementioned three patches<sup>3</sup>.

The WII survey included an analysis of road kills along the road stretch and determined that the current traffic trends on the road surveyed is at the threshold of deterrence levels for most species. The analysis was supported by anecdotal evidence from the Forest Department on low number of road kills for some species (leopard, chital and jungle cats) and no road kills for gaur Tiger and sloth bear. Therefore, the NH 7 may already be acting as a 'barrier' for movement of these species and the few animals that attempt to cross the highway stretch are at risk of injury or mortality.

##### *Implementation of Mitigation Measures*

WII has, in a conclusion to their survey, recommended specific mitigation measures to increase the openness and connectivity across the Project road. The focus of the mitigation measures has been to construct bridges and underpasses in select areas along the road stretch as determined through primary surveys. Given the mitigation measures proposed in the Project road stretch, it is likely that the pre-existing deterrence levels will reduce allowing for increased crossing of large mammals such as Tigers.

#### 1.4.3 *Pench in a Larger Tiger Landscape*

Pench National Park is part of a larger Tiger conservation landscape that includes Kanha and Tadoba Tiger Reserves. These reserves are considered a single Tiger landscape i.e. Satpuda Maikal Tiger Conservation Landscape

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(1) <http://www.penchTiger.co.in/biodiversity.html>

(2) Proposed Mitigation Measures for Maintaining Habitat Contiguity and Reducing Wild Animal Mortality on NH 6 & 7 in The Central Indian Landscape, Technical Report No. 2015/006, Wildlife Institute of India, MoEFCC, Govt. of India

(WWF 2012) <sup>(1)</sup> to ensure connectivity habitat between the reserves and allow free dispersal of Tigers. The Satpuda Maikal TCL has been presented in *Figure 1.2*.

#### 1.4.4 *Discrete Management Units*

A Discrete Management Unit (DMU) is an area with a clearly demarcated boundary within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas <sup>(2)</sup>.

The Satpura Maikal Landscape can be considered a DMU for Tiger populations. However, because of encroachment and recent trends in Tiger dispersal, 3 sub-populations within the Satpura Maikal Landscape have been identified, of which only the Pench-Kanha-Achanakmar sub-population was considered a DMU, for assessing critical habitats for this project. The linkage between Pench and the other 2 sub-populations is fragile. ERM (2018)<sup>3</sup> concluded that this DMU is critical habitat keeping in mind that it supports a viable population of Tigers that is nationally and globally significant. The project stretch avoids fragmentation of this DMU through well-placed/ designed mitigation structures. These mitigation measures have been discussed in detail further in the report.

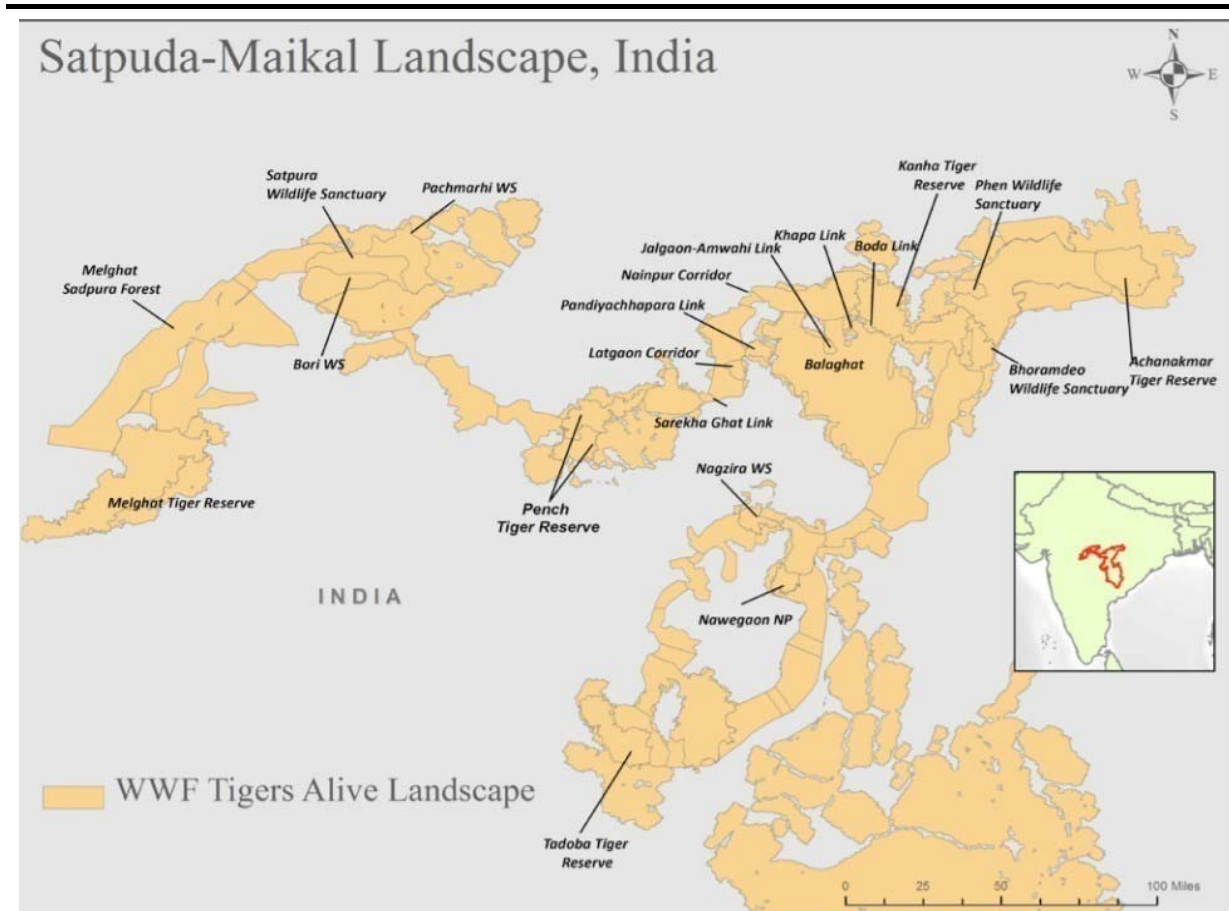
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<sup>(1)</sup> WWF (2012): Tiger Alive Initiative's 12 Tiger Landscapes

<sup>(2)</sup> As defined in paragraph 65 of IGC PS 6 Guidance Note

<sup>(3)</sup> Critical Habitat Screening (CHS) along the Nagpur Bypass Stretch of the National Highway

Figure 1.2 Satpuda Maikal Tiger Conservation Landscape



This section provides a legal and institutional framework for the Project, covering national requirements as well as applicable international treaties and conventions, guidelines and standards. The intent of this section is to lay out the regulatory and non-regulatory performance requirements for all stages of the Project.

**2.1***RELEVANT INTERNATIONAL AGREEMENTS/COMMITMENTS*

India is a party to several international agreements and conventions as provided in *Table 2.1*.

**Table 2.1 Conventions and Agreements that India Signed and Ratified**

Examples of Legally Binding International Conventions and Treaties for Biodiversity Conservation		Relevance for BAP
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1975)	<p>CITES is a multilateral treaty to protect endangered plants and animals. It was drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN). The convention was opened for signature in 1973 and CITES entered into force on 1 July 1975. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species in the wild, and it accords varying degrees of protection to more than 35,000 species of animals and plants. Although the Convention itself does not provide for arbitration or dispute in the case of noncompliance, 36 years of CITES in practice has resulted in several strategies to deal with infractions by Parties. Companies violating provisions of the conventions can be prosecuted by the respective national governments through national legislation that aligns to the provision of the convention.</p> <p>India ratified the convention in 1976.</p>	<p>Several CITES listed species are also protected by the IWPA (1972) and it is the project proponent legal obligation that these species are not impacted by project activities</p>
Convention on Biological Diversity (1992)	<p>CBD is a multilateral treaty. The Convention has three main goals:</p> <ol style="list-style-type: none"> <li>1.Conservation of biological diversity (or biodiversity);</li> <li>2.Sustainable use of its components; and</li> <li>3.Fair and equitable sharing of benefits arising from genetic resources</li> </ol> <p>The Convention opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993.</p> <p>The Convention requires countries to prepare a national biodiversity strategy (or equivalent instrument) and to ensure that this strategy is mainstreamed into the planning and activities of all those sectors whose activities can have an impact (positive and negative) on biodiversity.</p> <p>The convention is highly relevant for companies in the sustainable use of natural resources and conservation of biological diversity in their support for national biodiversity strategies. India signed the convention in 1992 and ratified this in 1994. India submitted its National Biodiversity Strategy and Action Plan in 2002.</p>	<p>As a legal corporate entity in the Indian Union, OIT must demonstrate sustainable use of natural resources especially is ecologically sensitive areas.</p>

Examples of Legally Binding International Conventions and Treaties for Biodiversity Conservation		Relevance for BAP
Convention on the Conservation of Migratory Species of Wild Animals (1979)	<p>The Convention on the Conservation of Migratory Species of Wild Animals aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include over 100 Parties from Africa, Central and South America, Asia, Europe and Oceania. The Convention was signed in 1979 and entered into force in 1983.</p> <p>The convention is relevant for companies in situation where impacts could occur to migratory species covered by the convention.</p> <p>India signed the convention in 1983</p>	<p>Probably only relevant for migratory raptors that may visit the project's area of influence. The client is voluntarily obliged to ensure that species covered in the convention are not impacted by project activities.</p>
World Heritage Convention	<p>India is a member of World Heritage Convention responsible for listing of World Heritage Sites, which include both Cultural and natural sites. The World Heritage Convention is a Convention under the aegis of the United Nations Educational, Scientific and Cultural Organization (UNESCO). Wild Life wing of the Ministry of Environment and Forests is associated with the conservation of the Natural World Heritage sites.</p> <p>Currently, six natural World Heritage Sites have been recognized by UNESCO in India, viz., Nanda Devi National Park, Kaziranga National Park, Manas National Park, Keoladeo National Park, Sundarbans National Park. Apart from these, the Valley of Flowers National Park has also been included in the list of World Heritage Sites as an extension of Nanda Devi National Park.</p> <p>India ratified the convention in 1977.</p>	<p>Only relevant if the Satpuda-Maikal Landscape qualifies for future status as a World Heritage Site. There is no such proposal presently existing.</p>

**2.2 INTERNATIONAL FINANCE CORPORATION PERFORMANCE STANDARD 6: BIODIVERSITY CONSERVATION AND SUSTAINABLE MANAGEMENT OF LIVING NATURAL RESOURCES**

The IFC Performance Standard (PS) 6 has identified specific parameters to evaluate when considering the impacts from a project on biodiversity. The parameters include:

- i. Risk and impact identification process;
- ii. Adaptive management of biological resources;
- iii. Classification of habitat as natural, modified or critical;
- iv. Considerations for projects in legally protected areas;

**2.3 RELEVANT LAWS IN INDIA**

The applicable environmental and ecological legislative framework for the Project in India is provided in

**Table 2.2**

**Table 2.2 Applicable Environmental and Ecological Legislation Framework**

Applicable Indian Legislation/Guidelines					Agency responsible	Remark/status
	Pre-construction	Construction	Operation	Decommissioning		
Forest Conservation Act, 1980 and as amended in 1988 and Forest (Conservation) Rules, 2003 and as amended in 2004	√	√	X	X	State Forest Department	The road construction will involve the diversion of 49.246 ha of Reserve Forest for non-forest purposes. The Project therefore applied for a Stage I and II Forest Clearance from the State Forest Department in Maharashtra and the Ministry of Environment, Forests and Climate Change (MoEFCC). Conditions provided in the forest clearances will need to be followed throughout the project life cycle.

Applicable Indian Legislation/Guidelines					Agency responsible	Remark/status
	Pre-construction	Construction	Operation	Decommissioning		
<b>Environmental Impact Assessment Notification, 2006 and as amended</b>					<p>Ministry of Environment , Forests and Climate Change and Expert Appraisal Committee</p> <p>State Environmental Impact Assessment Authority and State Expert Appraisal Committee.</p>	<p>The road construction will require an Environmental Clearance (EC) from the Expert Appraisal Committee (EAC) under Category 7f of the Schedule because it is an expansion of a National Highway greater than 30 km with additional right of way greater than 20 m ,land acquisition and passing through more than one state. The EC in the case of this project is the responsibility of National Highway Authority of India (NHAI), who obtained the EC for the entire road stretch including sections of the road that are not within the purview of OSEPL.</p> <p>The EC will include an ecology component that identifies the list of species found in a 10 km study area around the road, proximity to protected areas, list of protected species and other species of conservation importance and provide an impact significance for the impact to the above receptors with mitigation measures to reduce the same.</p>
<b>Ecology</b>						
<b>Wildlife (Protection) Act, 1972 and as amended</b>	√	√	√	√	State Forest Department	<p>The Wildlife Protection Act, 1972 allows the designation of Wildlife Sanctuaries and subsequently National Parks by the State Government and National Government respectively. The act also protects several species under the Schedules I to IV of the act (and subsequent amendments).</p> <p>The act also requires the State Governments and Tiger Conservation Authority to create Tiger conservation Plans that protect a Tiger reserve and linkages between protected areas including dispersal habitats and corridors for spill over population of wild animals from the designated core areas of Tiger reserves or</p>

Applicable Indian Legislation/Guidelines	Pre-construction	Construction	Operation	Decommissioning	Agency responsible	Remark/status
<b>Environmental Protection Act (1986) Eco Sensitive Zone (ESZ) (pertains to demarcated area around protected areas) Notifications</b>	√	√	√	√	State Forest Department	<p>from Tiger breeding habitats within a protected area (Section 38- V(3)(b)).</p> <p>Environment Protection Act, 1986 is an Act of the Parliament of India. The purpose of the Act is to implement the decisions of the United Nations Conference on the Human Environments as they relate to the protection and improvement of the human environment and the prevention of hazards to human beings, other living creatures, plants and property. The Act is an “umbrella” legislation designed to provide a framework for central government coordination of the activities of various central and state authorities established under previous laws, such as the Water Act and the Air Act. The Act is relevant for biodiversity conservation as it notifies the designation of ecologically sensitive zones.</p> <p>Eco-sensitive zone notifications provide the following guidelines for activities in ESAs.</p> <ol style="list-style-type: none"> <li>1) Commercial mining prohibited.</li> <li>2) Felling of trees requires appropriate local forest authority permission.</li> <li>3) Saw-mills prohibited.</li> <li>4) Industries causing air, water, soil or noise pollution prohibited.</li> <li>5) Commercial usage of ground water to be as per approved master plan which takes care of habitats and places no restriction on movement of wild animals.</li> <li>6) Hydro-electric projects prohibited.</li> <li>7) Erection of electric cables is regulated to promote underground cabling.</li> <li>8) Rain water harvesting to be actively promoted.</li> </ol>

Applicable Indian Legislation/Guidelines	Pre-construction	Construction	Operation	Decommissioning	Agency responsible	Remark/status
						9) Fencing of premises with permission from appropriate authority. Renewable energy to be actively promoted. 10) Widening of roads with proper EIA and mitigation measures. 11) Introduction of exotic species with permission from appropriate authority. 12) Use or production of any hazardous substances prohibited. 13) Discharge of effluents and solid waste in natural water bodies or terrestrial areas prohibited. 14) Air and vehicular pollution regulated by appropriate local authority. 15) Signboards and hoardings as per master plan. 16) Adoption of green technologies for all activities should be actively promoted.

The Standing Committee of the National Board for Wildlife (NBWL) in its 47<sup>th</sup> meeting (February 2018), required that future linear infrastructure projects such as multiple lane roads, highways, canals and railway lines passing through national parks, wildlife sanctuaries and all other protected areas will need an animal passage plan as part of the project proposal to the NBWL for wildlife clearance.

The minutes of the meeting said while designing infrastructure projects inside protected areas and notified eco-sensitive zones, guidelines of the Wildlife Institute of India (WII) regarding mitigating impacts on wildlife through the construction of overpasses, underpasses, bridges, culverts, fences, installation of wildlife detection system or animal response altering mechanisms, needs to be considered.

Even though wildlife clearance has already been obtained from the NBWL, as the road passes through the Ecologically Sensitive Zone of the Pench Tiger Reserve, the following WII guidelines are relevant for designing the mitigation structures in the project road stretch.

#### **2.4.1 *Guidelines for Linear Infrastructure Intrusions in Natural Areas: Roads and Power-lines***

The guidelines as written by the National Board for Wildlife (NBWL) provides specific criteria for road and power-line projects in protected areas. The guidelines include specifications on what a project proponent needs to achieve before attempting to site a road through a protected area including the use of trained specialists to undertake an impact assessment and a clear analysis of alternatives identifying no other alternate route. The guideline also indicates mitigation measures to be implemented for projects sited in protected areas including, but not limited to use of overbridges and underpasses, restriction of night vehicular movement, enforcement of no off-roading and patrolling.

#### **2.4.2 *Eco-Friendly Measures to Mitigate Impacts of Linear Structures on Wildlife***

The guidance manual details impacts from linear structures (e.g. roads, power lines and rail) on wildlife and protected areas. As part of the manual, typical impacts associated with siting a project in protected areas are identified including direct loss of habitat, habitat degradation, noise, habitat fragmentation, displacement, injury/mortality, barrier effects and human-wildlife conflict. The manual also includes detailed mitigation measures for preventing the above impacts and considers specific criteria such as the specifications of an over-bridge/underpass that needs to be followed.

**3.1 EXISTING ENVIRONMENTAL POLICIES**

OSEPL has an overarching Environmental, Health and Safety (EHS) Policy signed by Director and applicable to the project. Objectives outlined under the policy include obligation of the company with respect to the following:

- Comply with all the applicable environmental laws, regulations and permit.
- Investigate environmental incidents, identify root causes and implement corrective actions.
- Undertake regular reviews of the environmental aspects and impact registers.
- Ensure safe working conditions and health environment for employees.

OSEPL also has an Environmental Management Manual that is applicable to all Special Purpose Vehicle (SPV) subsidiaries and covers the following topics:

- Environment, Health & Safety Policy
- Roles and Responsibility for implementation of Environmental Policy
- Environmental Management System
- Planning
- Environmental Aspects
- Legal and Other Requirements
- Implementation and Operation
- Competence, Training and Awareness
- Documentation
- Emergency Response Plan (ERP)
- Public Communication, Complaints & Grievance Handling Procedure
- Land Acquisition, Resettlement of People, Natural Habitats, Cultural Heritages Policy
- Waste Management Policy
- Public Grievance Handling Policy

Apart from implied compliance to biodiversity laws and regulations through the commitment to comply with applicable environmental laws, regulations and permits, there is no specific mention of any policy commitments to biodiversity conservation

**3.2 BIODIVERSITY POLICY REQUIREMENTS**

The purpose of a Biodiversity Policy is to outline practical steps to assist the OIT to meet obligations required by the IFC Performance Standards. The policy outlines the associated procedures and actions for biodiversity management at OIT projects.

The following commitments shall occur in relation to the management of biodiversity

- Apply the “mitigation hierarchy” to reduce impacts of OIT projects on biodiversity values through assessment of biodiversity risks and subsequent avoidance, minimization, restoration, and, as a last resort, offsetting;
- Prepare Biodiversity Action Plans (BAPs) for all projects in Critical Habitats, as per IFC PS6 definitions, and in other projects where high risk biodiversity contexts exist and as assessed on a case-by-case basis.
- High risk biodiversity contexts may include areas where biodiversity values of importance are found such as habitats of importance to threatened species, (as categorized by the IUCN Red-List), species protected by the Indian Wildlife Protection Act (IWPA) (1972) and of national conservation significance, endemic or restricted range species and significant concentrations of migratory/congregatory species . Biodiversity values of importance can also be nationally Protected Areas as per IWPA (1972) and sites recognized as internationally important for biodiversity conservation (e.g. Key Biodiversity Areas, UNESCO World Heritage Sites, Ramsar Sites).
- Implement a policy of “no-poaching and no-hunting” of IUCN Red List threatened species, legally protected species and CITES listed species for all OIT Staff and contractors;
- Respect the requirements of legally designated protected areas;
- Adopt practices that are practical and easily implementable whilst meeting the objectives of sustainably managing biodiversity; and
- Work with local communities and key stakeholders to restore biodiversity values.

The Policy shall apply to all OIT projects, including new projects, where the triggering conditions are found.

### 3.2.1 *Scope of Policy*

This Policy shall apply to all OIT projects across the project life cycle, including

- Development sites (includes survey and project development phases);
- Operational sites;
- Those on maintenance

Biodiversity management addresses the actions required to reduce the impacts on biodiversity values e.g. biodiversity management; managed land clearance; prevention of water, air and soil pollution; and habitat restoration and progressive rehabilitation.

All OIT contractors and consultants undertaking work for or on behalf of OIT shall comply with this Policy.

### 3.2.2 *Policy Requirements*

Risks to biodiversity values shall be assessed and documented in a Risk Register across the project life cycle for all OIT projects

Biodiversity risks shall be assessed by:

- Developing baseline data on existing and new projects acquired by OIT and continue monitoring regimes on existing sites with respect to biodiversity values within the vicinity of OIT projects that cover:
  - Fauna and flora of terrestrial and aquatic habitats;
  - IUCN Red -List Species, National Conservation List Species and habitats of high biodiversity value;
  - Critical and natural habitats;
  - Linkages with habitat corridors and protected areas;
  - Local communities knowledge of biodiversity values; and
- Determining the likely risk on important biodiversity values posed by new projects based on an assessment of the project's likely impact on biodiversity values. The likely risk to important biodiversity values must be based on the nature and extent of activities undertaken on the site during the project lifecycle; and
- Documenting the likely risks to important biodiversity values in the Risk Register.

### 3.2.3 *Legal and Other Requirements*

Each OIT project shall comply with all applicable laws and other legal requirements and provide proof of such compliance as required.

Where applicable laws and other legal requirements do not require performance at least to the level of this Policy, activities should be carried out consistently with this Policy, taking into consideration any social and cultural sensitivity of communities. Regardless of specific legal requirements, IFC PS6 shall always be applied. In cases, where requirements differ, actions shall be scoped to close gaps as appropriate.

Where an offset is required to compensate for a project's residual impact, legal and financial mechanisms must be put in place to ensure the effective financing and management of the offset for at least as long as the project impacts endure.

### 3.2.4 *Objectives and Targets*

The overall objective is to ensure that either no net loss or net gains in biodiversity values are respectively achieved, in situations where natural habitat or critical habitat respectively are either degraded or converted.

With a focus on continual improvement to avoid and mitigate against residual impacts on biodiversity values, all OIT projects shall:

- Develop site-specific applicable biodiversity objectives and performance targets;
- Review annually all site-specific biodiversity objectives and performance targets; and
- Confirm performance targets are consistent with OIT biodiversity targets, once these are in place.

### 3.2.5 *Operational Control*

#### *Biodiversity Values in New Projects*

The assessment of biodiversity values for all new projects must:

- Apply the mitigation hierarchy, based on the baseline data and risk assessment, to avoid and mitigate against impacts to biodiversity values;
- Consider biodiversity offsets as a last option for delivering no net loss and/or net gains where these are required and where there is a significant residual impact following implementation of other aspects of the mitigation hierarchy;
- Any biodiversity offset related to an OIT project shall have an effective long-term financing mechanism in place;
- Engage the community when assessing biodiversity values

#### *Management of Biodiversity Values at Existing Projects*

As part of the management of biodiversity values, all OIT projects shall:

- Develop management measures for biodiversity values that respond to identified risks and residual impacts;
- Support local, regional, national and international biodiversity management measures where appropriate;
- Integrate the assessment of biodiversity values and biodiversity management into the planning, decision making and reporting processes throughout the project lifecycle;
- Develop processes and procedures to manage unplanned conditions or unexpected impacts to biodiversity;
- Support ongoing research through disseminating biodiversity baseline and monitoring data and promoting practices and experiences in biodiversity assessment and management where appropriate;
- Manage biodiversity values through consultation, constructive relationships and partnerships with subject matter experts, research institutions and NGOs.

#### *Development of Biodiversity Action Plan for OIT projects*

As part of the management of biodiversity values, OIT projects must:

- Develop a Biodiversity Action Plan for sites within Critical Habitat as defined by IFC. BAPs may also be developed in high risk biodiversity contexts, as determined and agreed on a case by case basis. The need for such BAPs will be based on biodiversity baseline data and risk assessment that includes:

- Management measures including-
  - Defining critical habitats, natural habitats, habitat corridors and, where required as a last option to address significant residual impacts, biodiversity offsets;
  - Implementation of weed and pest control programs;
  - Species recovery and habitat restoration;
  - Rehabilitation requirements;
  - Responses to impacts from contamination, soil, water, waste, air and other harmful substances;
  - Other measures necessary to manage biodiversity values.
- Links to social investment plans and/or partnerships with the community;
- Management of people, equipment and infrastructure;
- Assignment of clear accountabilities and responsibilities (resources and roles);
- Competence, training and awareness;
- Communication requirements;
- Legal requirements;
- Monitoring requirements; and
- Documentation, maintenance and retention requirements.

### 3.3

#### *MONITORING AND EVALUATION*

All OIT projects must:

- Review and update the Biodiversity Action Plan on a pre-determined and regular basis. The review and update period should be once every 2 years from first implementation of the BAP, and should occur in October of each second year. Review and update will be led by the Head of EHS for OIT in consultation with biodiversity specialists either in direct employment with OIT or hired as consultants.
- Regularly monitor areas of high biodiversity value within the areas included in the biodiversity action plan (for road projects this will be restricted to the ROW and the compensatory afforestation sites) ; and
- Regularly monitor IUCN Red- List Species and Protected Species as per IWPA (1972) and its amendments with habitats within the area of influence of the site (for road projects this will be restricted to the ROW and the compensatory afforestation sites).
- Regularly monitor and validate management measures as outlined in the Biodiversity Action Plan for biodiversity offsets, protected areas, critical habitats, resilience of habitat restoration and rehabilitation programs based on agreed success criteria within the area of influence of the site;
- Regularly monitor the implementation of the “no-poaching and no-hunting” and “anti-illegal logging” policy;
- Establish data collection and reporting systems to meet both internal and external reporting requirements in relation to biodiversity baseline and monitoring data required for the annual OIT Sustainability Report; and
- Establish a spatial layer of biodiversity baseline and monitoring data and any other relevant data important to biodiversity management.

### 3.4 NO POACHING AND NO HUNTING POLICY REQUIREMENTS

#### 3.4.1 *Policy Requirements*

OIT commits to the following policy for all operations:

All OIT staff and contractors are strictly prohibited from the possession, purchase, trade or collection of wildlife or forest resources that are legally protected under Indian Law, are CITES<sup>1</sup> listed, or classed as threatened by the IUCN Red- List<sup>2</sup>.

The purpose of the policy is to prohibit the collection of wildlife and forest resources by OIT staff.

#### 3.4.2 *Operational Control*

OIT shall implement the following actions in relation to the Policy:

- All staff and contractors must be educated during induction training and on an annual basis regarding OIT “no-poaching and no-hunting” policy;
- A register is to be kept of staff and contractor completion of the training and any refresher training attended;
- All staff and contractors work agreements must contain a clause that states that the staff and contractors agree to comply with OIT “no-poaching and no hunting” policy;
- All OIT properties are to have access control facilities at entrances (the road, toll plaza etc. are not to be construed as OIT Property);
- OIT Posters and signage are to be developed and placed at OIT controlled properties (aimed at OIT staff and contractors) stating the policy, outlining the species prohibited from poaching/hunting; and
- Staff identified to have participated in the possession, purchase, trade or collection of wildlife or forest resources will be dismissed from employment and not re-employed at any later date.

Species targeted for inspections are provided in *Section 5.2*. This list is based on species that were detected on site. There may be other species that may be considered threatened or listed on CITES that may occur on the sites, including plants (orchids). Inspections should identify ANY flora and fauna being transported from the site and subsequent action taken as described above, if they are detected being removed from the site.

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<sup>1</sup> CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

<sup>2</sup> Threatened species are considered to be listed as Critically Endangered, Endangered, Vulnerable, on the IUCN Red- List of Threatened Species.

Impacts from the road construction and operation, fall into the these categories

*Impacts on the Biological Environment (Habitat and Species Values Described Below)*

Construction phase: These include

- Habitat loss and degradation due to construction (habitat degradation also occurs due to impacts on the physical environment described below)
- Poaching and hunting of species and degradation of habitat (e.g. setting of fires) by construction work force
- Invasion of invasive species through transport of construction material , machinery and vehicles

Operation Phase: These include

- Barriers to wildlife dispersal by the road due to deterring factors such traffic volume, noise and other associated human activity
- Mortality of fauna through collision with vehicles
- Invasion of invasive species from traffic and associated human activity.

*Impacts on the Physical Environment*

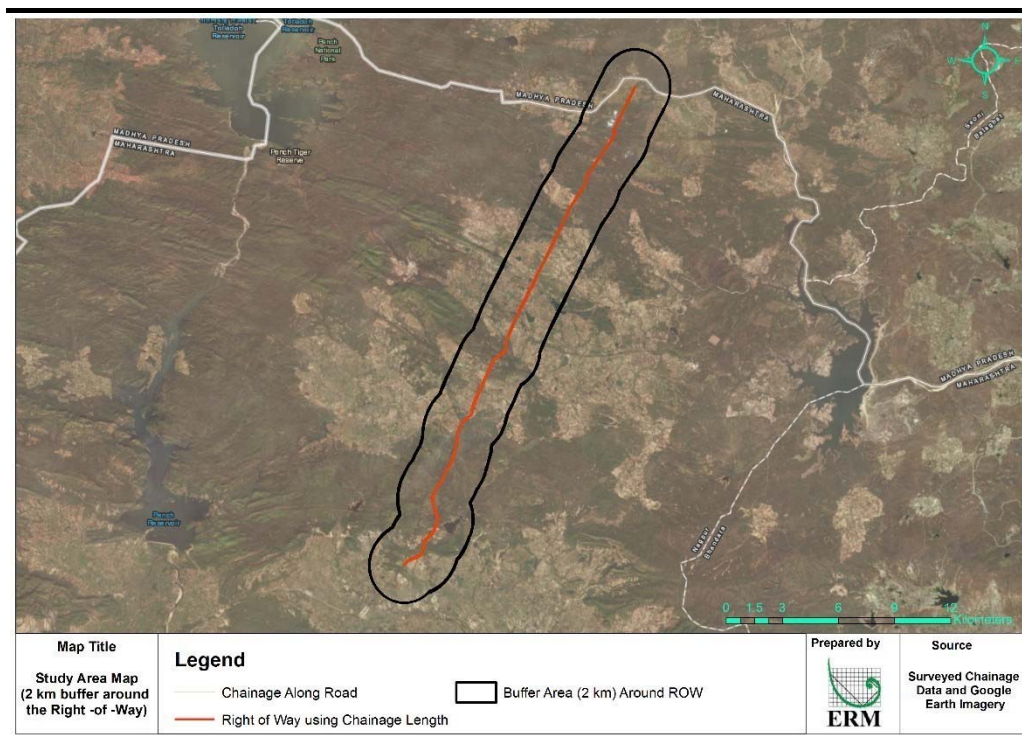
- Impacts to soil through land clearing, excavation for road foundation and shoulders, compacting ground and constructing earthworks. Soil erosion is the major consequence of these activities
- Impacts to surface water quality from run-off from unprotected slopes, spillage and leakage from storage sites and machines, domestic sewage from temporary worker camps
- Impacts to air quality due to increased dust due to earthworks and rock crushing activities, generation of hazardous gases from the asphalt hot mix plant and odour from the compaction of the pavement
- Impacts of noise from machinery such as excavators, bull -dozers, stabilizers, drills, stone crushers, graders, vibratory rollers, concrete mixing plants and screening plants.

#### 4.1

##### HABITAT VALUES

*Figure 4.1* provides the road alignment from Chainage 652 to 689 (37 km). An area of influence of 2 km on either side of the road is delineated. ERM typically uses an area of influence of 2 km for assessing impacts of road construction and operation.

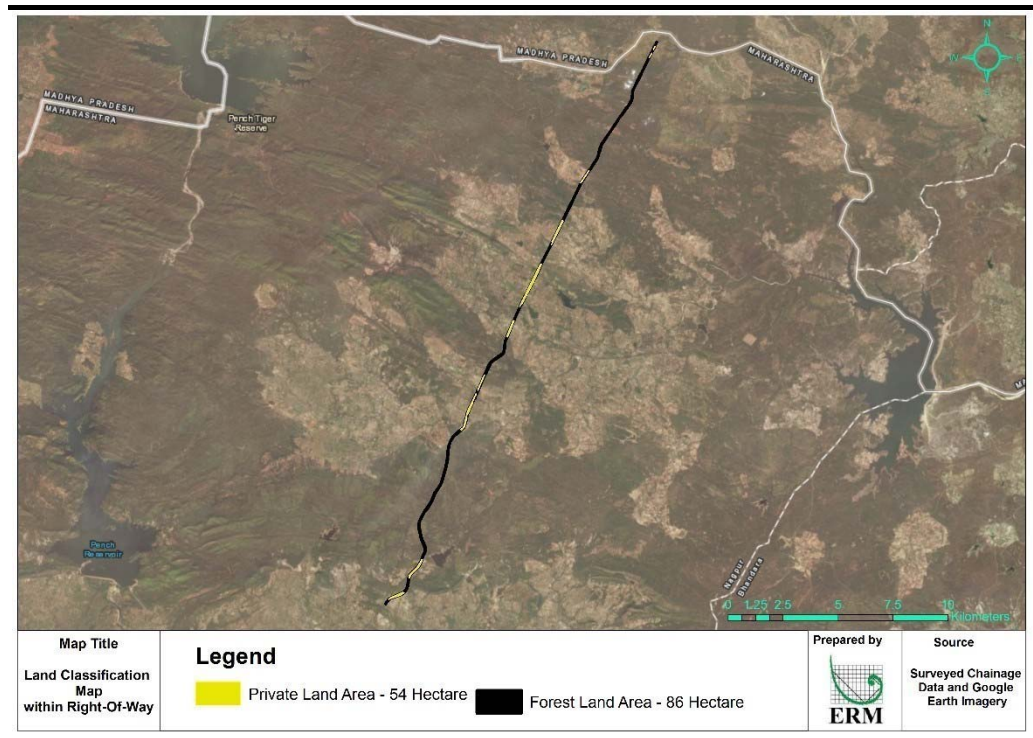
**Figure 4.1 Road Alignment from Chainage 652 to 689.**



To estimate the natural habitat lost due to road widening, we have used RoWs provided by OSEPL at each chainage sub-division, and digitized a polygon of varying width (15-30 m LHS and 15-30 m RHS). Within this polygon we have estimated the area of private (largely agricultural land) and forest land that has been impacted (diverted) by the road widening.

*Figure 5.2* provides this polygon based on the chainage and their sub-divisions and indicates the area of private or forest land impacted within the polygon.

**Figure 4.2 Polygon to Estimate Area of Private and Forest Land Impacted by Road Widening**



A total of 140 ha occurs within the buffer out of which 54 ha was private or agricultural land and 86 ha was forest land or natural habitat. Detailed survey results of the Maharashtra Forest Department (MFD) estimate that 49.246 ha of forest land will be impacted. The reason for this discrepancy (between 86ha vs 49ha) is that while we have estimated the area potentially impacted using a buffer along the provided ROW on either side of the road, the MFDs survey would have considered the precise area which needs to be cleared for highway segment widening and represents a more accurate estimate of direct habitat loss.

Even though there is some habitat loss for the faunal species listed below, in comparison to the extent of forests on either side of the road, habitat loss is relatively insignificant. The percentage natural habitat loss within the state of Maharashtra alone is approximately 0.09 % of the natural habitats immediately adjacent to the ROW (West of ROW: 741.22 km<sup>2</sup> in Pench Tiger Reserve in Maharashtra; East of ROW: 800 km<sup>2</sup>)

Habitat loss is however far more relevant for floral species and the mitigation is addressed below (as part of the compensatory afforestation).

## 4.2 SPECIES VALUES

Significant impacts to species are primarily due to the barrier effect of the road. Impacts can also include mortality through collisions with vehicles and poaching. It should be noted again that these impacts occurred due to past construction of the existing road.

A Critical Habitat Assessment was undertaken for the road and several critical habitat candidate species were identified during the study that could be potentially impacted by the project. The 2 vulture species have not been recorded in the project area but are likely to be found in other parts of the DMU. Similarly the Dhole and the Indian Pangolin have been reported from the core areas of the Pench Tiger Reserve but not from the project area. They are however likely to be present in other parts of the DMU. We therefore surmise that for these species, there are no impacts within the project's area of influence (AoI).

**Table 4.1** *Impacts to CH Triggering Species*

S.N.	Species	Common Name	IUCN Listing (v2018-1)	Key Impacts
1.	<i>Gyps bengalensis</i>	White-rumped Vulture	CR	None in project's AoI
2.	<i>Gyps indicus</i>	Indian Vulture	CR	None in project's area of influence
3.	<i>Panthera tigris</i>	Tiger	EN	Barrier effect of existing road
4.	<i>Cuon alpinus</i>	Dhole	EN	Unlikely to be present in project's area of influence.
5.	<i>Manis crassicaudata</i>	Indian Pangolin	EN	Unlikely to be present in project's area of influence

CR = Critically Endangered and EN = Endangered and

There are also VU species found in the project's area. As per WII (2015) <sup>1</sup>these species occur along the highway segment and are likely to be impacted by the barrier effect of the road. The WII study included an analysis of road kills along the road stretch and determined that the current traffic trends on the road surveyed is at the threshold of deterrence levels for most species. The analysis was supported by anecdotal evidence from the Forest Department on low number of road kills for some species (leopard, chital and jungle cats) and no road kills for gaur Tiger and sloth bear. Therefore, the NH 7 may already be acting as a 'barrier' for movement of these species and the few animals that attempt to cross the highway stretch are at risk of injury or mortality.

WII has in a conclusion to their survey, recommended specific mitigation measures to increase the openness and connectivity along the Project road. The focus of the mitigation measures has been to construct bridges and underpasses in select areas along the road stretch as determined through primary surveys, determination of key microhabitats i.e. seasonal water streams and consultations with the Forest Department and communities. Given the mitigation measures proposed in the Project road stretch, it is likely that the pre-existing deterrence levels will reduce allowing for increased crossing of large mammals such as Tigers

There is also a likely impact from hunting and poaching by workers and staff in both the construction and operation phases, although no such instances

(1) Proposed Mitigation Measures for Maintaining Habitat Contiguity and Reducing Wild Animal Mortality on NH 6 & 7 in The Central Indian Landscape, Technical Report No. 2015/006, Wildlife Institute of India, MoEFCC, Govt. of India

have been reported and going forward, OIT staff and contractors would be required to sign an undertaking to not engage in any such activities. Likely impacts if any, would have to be tracked and managed in future.

These species are listed in *Table 4.2* while likely impacts have already been discussed above.

**Table 4.2** *Impacts to Other Species of Concern*

S.N.	Species	Common Name	IUCN Listing v2017-3)
1.	<i>Panthera pardus</i>	Leopard	VU
2.	<i>Bos gaurus</i>	Gaur	VU
3.	<i>Rusa unicolor</i>	Sambar	VU
4.	<i>Melursus ursinus</i>	Sloth Bear	VU

VU = Vulnerable

Impacts to CH triggering species will need to be mitigated, resulting in net gains to biodiversity values while impacts to other species of conservation concern species will need to be mitigated as part of natural habitat requirements for no net loss of biodiversity values.

## 5 **BIODIVERSITY ACTION PLAN FOR THE HIGHWAY SEGMENT PASSING THROUGH THE FORESTED STRETCH**

### 5.1 **BIODIVERSITY MITIGATION ACTIONS**

*Table 5.1* provides the mitigation actions for the pre-construction of the pre-construction and construction phases.

The construction and pre-construction phase actions have been adapted from the Environmental Management Plan, focussing on those actions relevant for biodiversity conservation. These actions deal with avoidance of ecologically sensitive areas and minimization of construction impacts. As the construction phase is complete, an assessment was carried out to determine how the mitigation actions proposed in the Environment Management Plan (EMP) were complied with. This was based on an ESDD carried out at the request of the client for this highway stretch (Anon, 2019)

The operation phase mitigation actions (*Table 5.2*) address the barrier effect of the road through construction of mitigation structures and their subsequent monitoring and management.

**Table 5.1 Status of Biodiversity Mitigation Actions Recommended for the Pre-construction and Construction Phase**

S. No.	Biodiversity Values	Impacts	Proposed Mitigation	Action as per Mitigation Hierarchy	Responsibility	Reference	Prevailing Status as per ESDD
1.	<u>Natural Habitat</u>	Vegetation clearance within RoW	Compliance to EMP on location of borrow areas, quarries and construction camps based on a sensitivity and constraints mapping	Avoidance	Contractor	Mitigation relevant for Biodiversity as per approved EMP (see <i>Annex B</i> )	All opening of borrow area was done after proper agreement with the owner. However as per the ESDD, there was no borrow area management plan developed.
			Guidelines for vegetation clearance and rehabilitation of site after demobilization.		OIT		Quarry material was obtained from licensed quarries only.
							Construction labour were locals and did not require labour camp. Moreover, the establishment of any labour camp in the forest area was not allowed
							In addition to the above, borrow areas, quarries and conduction labour camps were located on private lands and there was no natural habitat involved.
							See <b>Annex E</b> for locations. land use and agreements entered for all borrow areas, quarries and construction labour camps.

S. No.	Biodiversity Values	Impacts	Proposed Mitigation	Action as per Mitigation Hierarchy	Responsibility	Reference	Prevailing Status as per ESDD
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For both borrow areas and construction camps during demobilization, the ESDD mentions that these will be restored according to site restoration plans but no details or guidelines are provided for restoring vegetation.

The ESDD also mentions that the borrow pits shall be redeveloped as per MoRTH guidelines (Clause 308.3). Spoils shall be overlaid with stockpiled top soil in accordance with compliance requirements with respect to MoEF guidelines. However there are no guidelines for revegetation.

As per the ESDD Avenue and Median planting has been undertaken as per IRC (2014)<sup>1</sup> However this is largely to ensure safety along the highway and improve the aesthetics.

<sup>1</sup> Manual of Specifications & Standards For Four Laning of Highways Through Public Private Partnership. Indian Roads Congress

S. No.	Biodiversity Values	Impacts	Proposed Mitigation	Action as per Mitigation Hierarchy	Responsibility	Reference	Prevailing Status as per ESDD
	<u>Physical Environment</u> Air Water Soil Ambient Noise	Degradation of ambient conditions and likely degradation of natural habitats	As per Environmental Management Plan (EMP)	Minimization	Contractor	Approved (EMP), Oriental Nagpur Bypass Construction Pvt. Ltd.-Nagpur Bypass Project	<u>Air</u> All earthworks were protected in a manner acceptable to the Supervision Consultant to minimize generation of dust.  All vehicles delivering materials to the site were covered to avoid spillage of materials.  Precautions were taken to reduce the level of dust emission from the hot mix plants and the batching plants  <u>Water</u> The project provided storm water management by providing 2 major bridges, 20 minor bridges and 132 culverts.  Silt fencing was provided around stockpiles at the construction sites close to water bodies. The fencing was provided prior to commencement of earthworks and continued

S. No.	Biodiversity Values	Impacts	Proposed Mitigation	Action as per Mitigation Hierarchy	Responsibility	Reference	Prevailing Status as per ESDD
							<p>till the stabilization of the embankment slopes. Construction materials containing fine particles were stored in an enclosure so that sediment-laden water does not drain into nearby watercourses.</p> <p>To look at project specific turbidity and total dissolved solids monitoring was carried out at the following sampling sites</p> <ol style="list-style-type: none"> <li>1. Mansar</li> <li>2. Kandri Kanhan</li> <li>3. NBP Toll Plaza.</li> </ol> <p><u>Soil</u></p> <p>The topsoil from borrow areas, areas of cutting and areas to be permanently covered were stripped to a specified depth of 150 mm and stored in stockpiles. At least 10% of the temporarily acquired area were earmarked for storing topsoil The stockpile was designed such that the</p>

S. No.	Biodiversity Values	Impacts	Proposed Mitigation	Action as per Mitigation Hierarchy	Responsibility	Reference	Prevailing Status as per ESDD
							<p>slope does not exceed 1:2 (vertical to horizontal), and the height of the pile was restricted to 2 m.</p> <p>Stockpiles were not surcharged or otherwise loaded and multiple handling was kept to a minimum to ensure that no compaction occurred. The stockpiles were covered with gunny bags or tarpaulin.</p> <p>Vehicle/machinery and equipment operation, maintenance and refueling was carried out in a manner that spillage of fuels and lubricants does not contaminate the ground.</p>
<u>2.</u>	<u>CR, EN and VU species</u>	Hunting and poaching by contractor workers and staff	Implementation of no hunting and no poaching policy of OIT of wildlife and forest resources protected under IWPA (1972), CITES Appendix I and II and species classified as threatened (CR, EN	Minimization	OIT and contractor		The ESDD does not mention whether a no hunting and poaching policy was complied with

S. No.	Biodiversity Values	Impacts	Proposed Mitigation	Action as per Mitigation Hierarchy	Responsibility	Reference	Prevailing Status as per ESDD
			and VU) under the IUCN Red-List				
3.	<u>Physical environment and CR, EN, VU species</u>	Impacts actually occurring but unpredicted in EIA.	Rapid assessment of occurring but unpredicted impacts to inform mitigation actions to be still carried out such as those described in 1 and 2 e.g. restoration.	Minimization	OIT		Not discussed.

**Table 5.2 Biodiversity Mitigation Actions for Operation Phase**

S. No.	Biodiversity Values	Impacts	Phase	Proposed Mitigation	Action as per Mitigation Hierarchy	Frequency/ Timeline	Responsibility	Reference	Annual Capital /Recurrent Costs (US\$)
1.	Natural Habitat	Vegetation Clearance in ROW, Borrow Areas and Quarries	Construction Phase	1. ROW  A requirement exists for the restoration of natural habitat in the ROW. The ESDD mentions that this will be taken up consequent to the completion of construction but does not provide any guidelines for the restoration.  Restoration of RoW (In forest lands) should be carried out by the	Avoidance and Minimization	Once/Within 3 months after construction	EPC Contractor	Ministry of Road Transport and Highway Guidelines (2013)	As per EMP budget.

S. No.	Biodiversity Values	Impacts	Phase	Proposed Mitigation	Action as per Mitigation Hierarchy	Frequency/ Timeline	Responsibility	Reference	Annual Capital /Recurrent Costs (US\$)
				<p>MFD supported<sup>1</sup> by OIT. Restoration should be carried out using existing guidelines for linear intrusions into natural habitat.</p> <p>The ROW should be restored to species composition and structure as close to adjacent areas within the buffer zone of Pench Tiger Reserve.</p> <p>Species composition should be guided by the species likely found in the ROW provided <i>in Section 6.2.2</i>.</p> <p>2. Borrow Areas.</p> <p>At present no reforestation guidelines are available for habitats impacted by road construction. However the following</p>					

(1) Support requires any technical guidance to MFD on achieving compliance to IFC PS6 both with respect to restoration and monitoring progress of restoration, any reasonable funds required for restoration such as raising of nurseries for indigenous plants, labour costs for restoration and costs for maintenance of restored areas. It is anticipated that the MFD will have some funds under existing habitat restoration programmes for protected areas and any shortfalls should be met by OIT.

S. No.	Biodiversity Values	Impacts	Phase	Proposed Mitigation	Action as per Mitigation Hierarchy	Frequency/ Timeline	Responsibility	Reference	Annual Capital /Recurrent Costs (US\$)
				<p>guidance is available Topsoil is to be stripped and stockpiled in accordance with Clause 301.3.2 of the MoRTH guidelines<sup>1</sup>. Where it is required to replace the topsoil as part of the reinstatement of borrow areas, the topsoil will be replaced and seeded in accordance with Clause 308.3, immediately after the area is no longer required for borrow.</p> <p>Unless the borrow areas were previously grasslands providing grazing to wild herbivores and livestock, the reforestation should follow the same guidelines as those provided for the ROW.</p> <p>3. Quarries</p>					

<sup>(1)</sup> Specifications for Road and Bridge Works (FIFTH REVISION, 2013). Ministry of Road Transport and Highways (MORTH)

S. No.	Biodiversity Values	Impacts	Phase	Proposed Mitigation	Action as per Mitigation Hierarchy	Frequency/ Timeline	Responsibility	Reference	Annual Capital /Recurrent Costs (US\$)
				There are no specific guidelines for quarries and the same guidance provided for the rehabilitation of the ROW and borrow areas should be used.					
2.	Tiger	Barrier effect created by 4-laning of road	Construction / Operation	Construction and maintenance of mitigation structures	Minimization	Continuous/ 2 months prior to operations	Contractor	See <i>Annex C</i>	In EPC Budget
				Signage on roads to enforce no hunting of Tiger prey species with penalties for violations prominently displayed as per IWPA (1971).		Once/One month after construction	OIT HSE team		Capital: 5000
				Speed limit regulations and no stopping zones within 100 m zone of overpasses.					Capital 6000
				Signages to be installed with the permission of concerned authorities.					
				All areas used for dumping construction waste adjacent to the mitigation structures (and falling outside the					In EPC budget

S. No.	Biodiversity Values	Impacts	Phase	Proposed Mitigation	Action as per Mitigation Hierarchy	Frequency/ Timeline	Responsibility	Reference	Annual Capital /Recurrent Costs (US\$)
				<p>RoW) should be cleared and revegetated. The minimum buffer area for this action should be 100 m</p> <p>Strict surveillance of underpasses to ensure that there is no disturbance by cattle graziers, potential poachers of ungulates and other human presence.</p> <p>The surveillance is to be carried out by staff of the Wildlife Division of the Pench National Park, adjacent to the road. OIT should provide funds to ensure that any shortfalls of budgets for training and carrying out surveillance are addressed</p> <p>Ensuring that access to and exits from the underpasses have good vegetation cover and an appropriate tree and shrub species composition found around the ROW (see <i>Section 6.2.2</i>). This will</p>		Weekly/Continuous through project life cycle	MFD		<p>Recurrent: 40,000</p> <p>Recurrent: 20,000</p>

S. No.	Biodiversity Values	Impacts	Phase	Proposed Mitigation	Action as per Mitigation Hierarchy	Frequency/ Timeline	Responsibility	Reference	Annual Capital /Recurrent Costs (US\$)
				<p>allow Tigers to enter and exit underpasses relatively undisturbed from the noise of the highway and create near natural conditions to reduce any hesitancy in crossing.</p> <p>The surveillance should also ensure that proper housekeeping under the underpasses occurs such as the removal of all metallic and non-metallic construction waste. The cleaning should ensure that no waste remains.</p> <p>The cleaning should be carried out with a maximum of 2 staff and a wildlife observer to ensure that there is minimal disturbance to wildlife.</p>					
3.	Vultures:	White-Rumped Indian Vulture	Collision risks from vehicles to low flying birds	Any vultures circling in the vicinity of the road as observed by OIT patrolling staff should be reported to MFD.	Minimization	Continuous through project life cycle and based on information received on carcasses.	OIT HSE team		Capital: 5000 Recurrent: 20,000

S. No.	Biodiversity Values	Impacts	Phase	Proposed Mitigation	Action as per Mitigation Hierarchy	Frequency/ Timeline	Responsibility	Reference	Annual Capital /Recurrent Costs (US\$)
	4. Other CR and EN species	Barrier effect	Operation	As described above for barrier effects	Minimization	Continuous through project life cycle	OIT/MFD	See <i>Section 4.4.</i>	Recurrent: Included for Tiger
	Dhole Pangolin	Hunting and poaching by OIT workers and staff		Implementation of no hunting and no poaching policy of OIT.					
	VU species	Barrier effect	Operation	As described above for barrier effects	Minimization	Continuous through project life cycle	OIT/MFD	See <i>Section 4.4</i>	Recurrent: Included for Tiger
	Leopard Gaur Sambar Sloth Bear	Hunting and poaching by OIT workers and staff		Implementation of no hunting and no poaching policy of OIT					Recurrent: Included for Tiger

*Potential Offset Definition*

As per the survey carried out by the Maharashtra Forest Department, a total of 49.246 ha of forest, was cleared within the Right of Way (Row) for upgrading the highway from 2 lanes to 4 lanes and for associated infrastructure. Section 2 of the Forest Conservation Act (1980) describes restrictions on the de-reservation of forests (reserved) or use of forest land for non-forest purpose and requires that only the MoEFCC, GoI, can accord permission to a user agency for any diversion of forest for non-forest use. The Act also requires the user agency proposing to divert any forests, to support compensatory afforestation within the state where the diversion has occurred, and compensate the State government for the commercial value of the trees to be cleared, as a consequence of the forest diversion.

The commercial and ecological value is the Net Present Value (NPV)<sup>1</sup> and is determined by the State Forest Department. The NPV is based on the forest type and condition. There are 6 forest types with varying NPVs which is ultimately adjusted by the forest condition (very dense, dense and open forests) of the forests being diverted for non- forest.

Once the proposal for forest diversion is approved by the MoEFCC (Stage I clearance), the user agency is requested to deposit the costs of compensatory afforestation and the NPV into the account of the Compensatory Afforestation Management and Planning Authority (CAMPA). The user agency is also requested to obtain all necessary environmental approvals for implementing the project. Once the funds are deposited and the MoEFCC is convinced that all necessary approvals have been obtained, a Stage II clearance is then provided.

Compensatory afforestation shall be done over an equivalent area of non-forest land and the following criteria should be used in the selection.

- As far as possible, the non-forest land for compensatory afforestation should be identified contiguous to or in the proximity of Reserved Forest or Protected Forest to enable the Forest Department to effectively manage the newly planted area.
- In the event that non-forest land of compensatory afforestation is not available in the same district, non-forest land for compensatory afforestation may be identified anywhere else in the State/UT as near as possible to the site of diversion, so as to minimise adverse impact on the micro-ecology of the
- Where non-forest lands are not available or non-forest land is available in less extent to the forest area being diverted, compensatory afforestation may be carried out over degraded forest twice in extent to the area being

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<sup>(1)</sup> Guidelines for diversion of forest land for non-forestry purposes under Forest (Conservation) Act, 1980-Guidelines for collection of Net Present Value (NPV), Ministry of Environment and Forests, February, 2009.

diverted or to the difference between forest land being diverted and available non-forest land, as the case may be.

The state Forest Department which ultimately receives these funds will use the funds to manage the compensatory afforestation lands.

For this project, the Stage I and II clearance were granted in December 2013 and May 2015.

The Stage II approval was contingent on OSEPL depositing the above funds and obtaining

- The Environmental clearance of the MoEFCC
- Approval from the National Board for Wildlife, Government of India, as the project is in the Eco-sensitive Zone of the Pench Tiger Reserve.

The Stage 1 approval requested OSEPL to support compensatory afforestation in degraded forest land, in an area twice the diverted area (~100 ha). The compensatory afforestation will be carried out by the Maharashtra Forest Department (MFD), with the funds provided by OSEPL.

**Table 5.3** provides the location of 4 sites identified by the MFD for the compensatory afforestation (CA). Each site is 25 ha thereby totalling 100 ha.

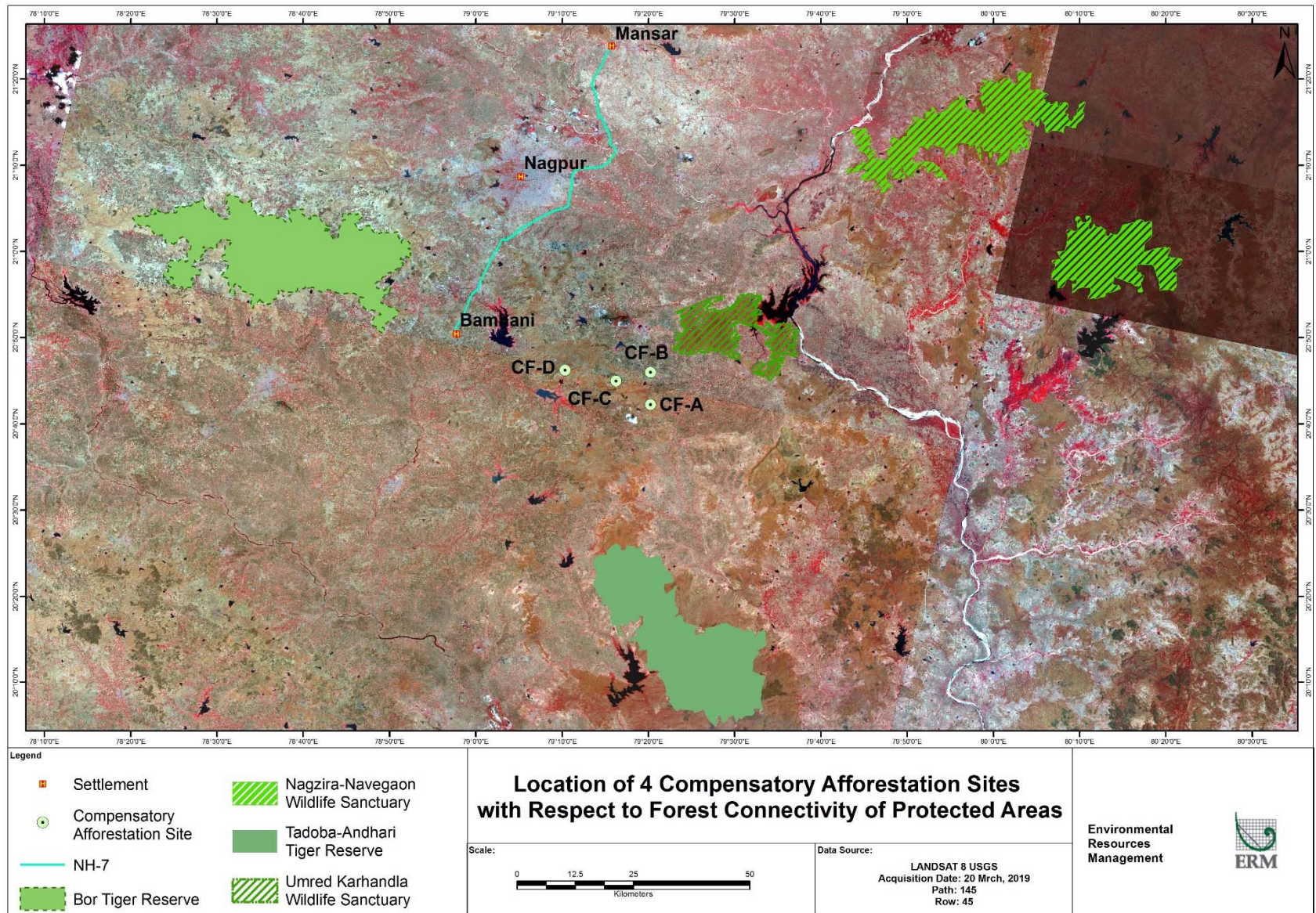
**Table 5.3** *Sites, Area and Locations of Compensatory Afforestation Sites.*

Compartment No. 350(RF) Coupe No. IV,-	25.00 Ha.	N 20° 42' 15" E 79° 20' 15"
Compartment No. 356(RF) Coupe No. A,-	25.00 Ha.	N 20° 46' 00" E 79° 20' 15"
Compartment No. 389(PF) Coupe No. XVI,-	25.00 Ha.	N 20° 45' 00" E 79° 16' 15"
Compartment No. 383(RF) Coupe No. XIV,-	25.00 Ha.	N 20° 46' 15" E 79° 10' 21"
Total Area =	100.00 Ha.	
Range: South Umred,		
Round - Botezari, Umred, Chargaon(Mo). & Nandra		
Beat - Salebhatti, Mangrud, Mandwa & Chikhaldhokda		

**Figure 5.1** provides the location of the 4 sites in relationship to a complex of protected areas and Tiger reserves. Table 5.4 provides the extent of these sites as polygons, plantation details and the forest administrative units these sites fall under.


In the next section these compensatory afforestation sites are assessed for their adequacy as biodiversity offset sites aligned to IFC PS6.

Figure 5.1 Compensatory Afforestation Sites (CF A--D) in Relationship to the Network of PAs



**Table 5.4 Forest Compartment and Division, Plantation and Land Status Details of 4 Compensatory Afforestation Sites**

Compensatory Afforestation Land	Comp. No.	Area (Ha.)	Forest Division	Total Plantation	Land Status
Salebhati Reserve Forest	350	25	Forest Circle -Nagpur Range-South Umred Sub range-Botejhari Forest Village-Salebhati	27775 Saplings (3m X 3m spacing )	Degraded Forest
					
Mandwa Protected Forest	389	25	Forest Circle -Nagpur Range-South Umred Sub range-Chargaon Muglai Forest Village-Mandwa	27775 Saplings (3m X 3m spacing )	Degraded Forest
					
Mangrol Reserve Forest	356	25	Forest Circle -Nagpur Range-South Umred Sub range-Mangrol Forest Village-Mangrol	27775 Saplings (3m X 3m spacing )	Degraded Forest
					
Chikhaldhokra Reserve Forest	382	25	Forest Circle -Nagpur Range-South Umred Sub range-Forest Village-Chikhaldhokra	27775 Saplings (3m X 3m spacing)	Degraded Forest

Compensatory Afforestation Land	Comp. No.	Area (Ha.)	Forest Division	Total Plantation	Land Status
-					

## 5.2.2

### *Compensatory Afforestation Sites as Offset Sites*

*Annex D* provides attributes of the compensatory site in terms of its floral and faunal value. Comparing the biodiversity values of the impacted area and the compensatory afforestation sites, allows assessment of these sites as potential offset sites

#### *Floral Values*

The forests cleared within the highway segment's RoW, mostly comprise Group 5; sub group 5A Southern Tropical Dry Deciduous with Dry Teak bearing Forest<sup>1</sup>. Mixed forest species other than Teak (*Tectona grandis*) are *Cassia fistula*, *Bauhinia racemose*, *Terminalia arjuna*, *Terminalia tomentosa*, *Terminalia belerica*, *Albizia odoratissima*, *Anogeissus latifolia*, *Adina cordifolia*, *Pongamia pinnata*, *Madhuca indica*, *Butea frondosa* etc.

Shrubs within the undercover of the forest and are represented by species of *Adhatoda zeylanica*, *Wrightia tinctoria*, *Grewia hirsuta*, *Lantana camera*, *Carissa arandus*, *Holorrhena antidysentrica* and *Datura metel*.

The vegetation type of the compensatory afforestation sites is Southern Tropical Dry Deciduous forest with dominant species of *Tectona grandis*, *Lannea coromandelica*, *Terminalia tomentosa*, *Butea monosperma*, *Bauchanania lanzan*, *Diospyros malanoxylon*, *Madhuca longifolia* and *Ziziphus mauritiana*.

The existing vegetation at the CA land is degraded forest land with past history of lopping and pruning by the villagers. There are plantation activities presently occurring and these are provided in *Annex D, Table 12.1*.

#### *Faunal Values*

As can be seen from *Annex D, Table 12.2* the mammalian species composition is very similar across the impacted area and the compensatory afforestation sites with the exception of some arid habitat species such as the Striped Hyena and the Four-horned Antelope.

<sup>1</sup> Champion, H. G. and Seth, S. K. (1968). A Revised Survey of Forest Types of India, Govt. of India Press, New Delhi, p. 404

The compensatory afforestation sites) also form part of the Tadoba-Bordharan-Umred Karhandla Tiger corridor. These further connect the Nagzira and Bor Tiger Reserve. As reported by the Range Forest Officer, South Umred Range, this corridor is used by 6 Tigers. The compensatory afforestation site at Chikhaldhokra Reserve Forest currently hosts a female Tiger with two cubs. This area is proposed as part of Muniya Conservation Reserve located in the Umred-Bhivapur Taluk of Nagpur District, Maharashtra. Muniya Conservation Reserve is a potential wildlife corridor (a natural habitat linkage allowing for wildlife movement between two larger forest patches) connecting Bor Tiger Reserve in the Umred-Karhandla Wildlife Sanctuary with Tadoba-Andhari Tiger Reserve. It is spread over 1700 hectares of protected forest and about 710 hectares of reserve forest in the South Umred Range of Nagpur Forest Division, and has regular movement of wildlife, including threatened/near threatened species like Leopards (*Panthera pardus*-IUCN VU v2018.1) and Blackbucks (*Antelope cervicapra*-IUCN LC v2018.1), and historically, the critically endangered Great Indian Bustard (*Ardeotis nigriceps*-IUCN CR v2018.1).

### ***Conclusion***

The CA sites can be considered potential offset sites as they have equivalence (like for like) with the impacted area, with respect to floral and faunal species composition as well as functionally, by providing breeding habitats and habitat contiguity for Tigers. They also satisfy both regulatory and IFC PS6 requirements and with proper habitat rehabilitation planning and protection, are likely to ensure net gain or at least no net loss (see **Section 8**) of floral and faunal values as long term outcomes.

However it is essential that an appropriate baseline be established and monitored to demonstrate net gains, both at the afforestation and at restored areas along the road. Based on this monitoring given high risk of afforestation/restoration failure, corrective actions including additional planting may be required for the MFD to take up.

It is also essential that a stake-holder engagement strategy is developed to ensure that local communities surrounding the CA understand the long term objectives of the CA sites and participate in its long term management.

## **5.3**

### ***MONITORING AND EVALUATION OF MITIGATION ACTIONS***

**Table 5.5** provides the monitoring and evaluation plan for the mitigation actions for the pre-construction and construction phases provided in **Section 6**. Monitoring and evaluation will monitor selected indicators and will indicate whether impacts experienced during the pre-construction, construction were appropriately avoided or minimized in accordance to the EMP.

*Table 5.6* monitors actions with respect to habitat and species values. Here the BMEP will assess whether net gains are achieved for species that are critical habitat triggers and no net loss for natural habitat, including associated species of concern. For Tigers and other species, this would involve monitoring the successful crossing of either resident or transient Tigers or individuals of other species through the mitigation structures. The monitoring protocol suggested will attempt to identify individual Tigers so that resident and transient Tigers can be identified. In the case of unsuccessful crossings, the behaviour of individual Tigers will be analysed, so that corrective action can be taken to facilitate successful crossing.

*Table 5.5: Status of Biodiversity Monitoring and Evaluation Actions for Preconstruction and Construction Phase*

S. No.	Biodiversity Values	Phase	Monitoring Action	Responsibility	Reference	Status of EMP Actions as per ESDD
1.	<u>Physical Environment</u> Air quality Water quality Soil quality Noise Levels	Construction	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the monitoring plan prepared for EMP	Contractor - Engineer	Monitoring plan in EMP	<p>Ambient air quality monitoring was conducted on regular basis to keep a check on air quality and whether this was within acceptable limits. However, sensitive locations were not included in the monitoring.</p> <p>Ground water quality monitoring was conducted on a regular basis to keep a check on compliance with water quality standards</p> <p>Noise levels for construction equipment used in this project (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws was monitored to ensure that these did not exceed 75 dB (A), as specified in the Environment (Protection) Rules, 1986.</p> <p>No soil quality was monitored</p>
2.	Vegetation in Natural Habitat	Construction	<p>Borrow areas, quarries and construction camps are located as per guidelines provided in Annex B.</p> <p>Vegetation clearance will be continuously monitored so that minimal damage or disruption to flora of vegetation occur, only ground level shrubs that impinge of temporary or permanent work will be cleared and there is no damage to trees not identified for felling within the RoW.</p>	<p>Contractor - Engineer</p> <p>Contractor - Engineer</p>	<p>Annex B</p> <p>Annex B</p>	<p>Borrow areas and construction camps were all located &gt; 1000 m from reserved forests. Construction material was only sourced from existing licensed quarries</p> <p>The ESDD does not indicate the results of the monitoring of vegetation clearance in terms of assessing damage to flora and vegetation and whether any trees not earmarked for felling were felled</p> <p>Monitoring should ensure that the natural habitat is restored as completely</p>

S. No.	Biodiversity Values	Phase	Monitoring Action	Responsibility	Reference	Status of EMP Actions as per ESDD
			There are requirements of forest clearance to plant trees within the RoW which will be carried by the MFD supported by OIT,	OIT HSE team		as possible by planting species of trees and shrubs as indicated in <b>Section 6.2.2</b> and similar to baseline conditions.

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**Table 5.6 Biodiversity Monitoring and Evaluation Actions for Operation Phase**

S. No.	Biodiversity Values	Phase	Monitoring Action	Indicator	Frequency/Timeline	Responsibility	Annual Capital/Recurrent Costs (US\$)
1.	Tiger	Operation	<p><b>Routine inspection of planned vegetation cover and species composition in approach areas of underpasses:</b> This is to ensure that adequate vegetation cover and appropriate species composition exist, to allow Tigers to enter and exit the underpasses without hesitation.</p> <p>This is subsequent to the mitigation structures being cleared of all construction material and rehabilitation of topsoil and habitat has occurred</p> <p><b>A long- term system of monitoring Tiger and prey usage of underpasses with video camera traps</b> These should be located at either ends of the underpass. Each video camera should be accompanied by a regular camera on the opposite side so that both sides of the Tigers are captured (for identification of unique Tigers)</p>	<p>Ground cover initially when shrubs and sapling dominate. Canopy cover when trees establish</p> <p>Both shrub cover and canopy cover can be estimated using CANOPEO<sup>1</sup></p> <p>Number of successful and unsuccessful Tiger crossings.</p> <p>Number of unique Tigers crossing</p>	<p>Monthly/Right through project life cycle</p> <p>10 nights a month/ 5 years of project life cycle</p>	<p>OIT HSE team and MFD.</p> <p>OIT HSE team and MFD</p>	<p>Capital: 0 Recurrent: 10,000</p> <p>Capital: 15,000 (4 camera traps per each of 5 underpasses with accessories) Recurrent: 30,000</p>
2.	White-Rumped and Indian Vulture	Operation	Reporting vulture presence and mortality along the highway segment	<p>Number of carcasses detected and removed by MFD</p> <p>Number of incidences of vulture congregation in the vicinity of the road</p>	Continuous through project life cycle whenever there is any information	OIT HSE team	1000

<sup>1</sup>

S. No.	Biodiversity Values	Phase	Monitoring Action	Indicator	Frequency/Timeline	Responsibility	Annual Capital/Recurrent Costs (US\$)
				Number of vultures killed through collisions			
3.	Gaur Sambar Sloth Bear	Operation	As mentioned above. However no attempt will be made to identify individual animals as done for Tigers	Number of successful and unsuccessful species crossings. No attempt to be made to identify individuals	10 nights a month/ 5 years of project life cycle	OIT HSE Team and MFD	Capital: See above  Recurrent: Included for monitoring of Tiger crossings.
4.	All biodiversity values listed in Table 6.2	Operation	Based on monitoring protocols described above, compliance to the objectives of the BAP are being achieved and this needs to be reported.	Indicators provided above.	Annually	OIT HSE Team	Including in monitoring costs provided above.

At present details on the management and monitoring and evaluation of the potential offset sites need to be finalized as the potential offset sites being assessed, are compensatory afforestation sites. The afforestation will be carried out and managed by the MFD as per a Compensatory Afforestation Plan (CAP) that is still to be reviewed. This plan will provide the species to be planted, protocols for planting, monitoring of planting success, time frame and milestones for implementation and organizational responsibilities within the MFD for implementing the CAP. The ultimate objective would be that the CA sites have a species composition and canopy cover similar to the impacted area. The impacted forest area is of low quality or degraded. Restoration at a worse or equivalently degraded site, to a high quality forest under improved management, over an area that is twice the impact area, is considered to net gains in natural habitats.

The CA sites will need to be protected and managed to prevent further degradation. As there are entirely under the control of the MFD, a management plan will need to be adapted from the existing CAP subsequent to discussions and ensuring buy in from the MFD.

*Table 5.7* provides a monitoring and evaluation plan for the offset site which will be finalized once the CAP is adequately reviewed.

A key step in getting this plan implemented is to negotiate an agreement with the MFD for the implementation of the National Tiger Conservation Authority (NTCA) protocol for monitoring Tiger and their prey densities, MStrIPES

In 2010, the National Tiger Conservation Authority (NTCA) along with the Wildlife Institute of India, launched MStrIPES (Monitoring System for Tigers - Intensive Protection and Ecological Status). This vital tool is a patrol-based wildlife monitoring GIS database, designed to assist wildlife protection, monitoring, and management of Protected Areas. Under MStrIPES protocols, forest guards are expected to patrol their beats and record their tracks using a GPS, in addition to recording observations in site-specific data sheets.

The following data is recorded in MStrIPES

1. Carnivore sign encounter: Multiple occupancy surveys in a beat
2. Tiger prey abundance; Distance from transect line on a beat
3. Vegetation: Canopy cover, tree, shrub and herb composition, weed infestation on plots on a transect in a beat
4. Human disturbance Multiple plots of 30m diameter on line transects in a beat
5. Pellet and dung counts: Counts of all dung identified to species in multiple 40m plots on transects.

This data is also supplemented by remotely sensed data to model Tiger occupancy and abundance which include habitat characteristics surrogated by

forest area, vegetation cover, forest patch size, forest core areas, elevation, distance from protected areas and drainage density.

The above data is also supplemented by camera trap based Capture-Mark-Recapture.

Tiger surveys in India are often carried out with participation between the Forest Department, research institutions and NGOs. A prominent NGO working in Maharashtra is the Wildlife Conservation Trust (WCT) <sup>1</sup>. The WCT has focussed on understanding Tiger dispersal between protected areas in Maharashtra and the impacts of linear structures such as roads on this dispersal<sup>2</sup>.

The BMEP for the offset sites would greatly benefit from an association between OIT, MFD and WCT and would comprise the actions provided in *Table 5.7*

The importance of these compensatory afforestation sites for promoting Tiger dispersal between the protected areas would provide ample justification for forging this association

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<sup>1</sup> <https://www.wildlifeconservationtrust.org/>

<sup>2</sup> A Policy Framework for Connectivity Conservation and Smart Green Linear Infrastructure Development in the Central Indian and Eastern Ghats Tiger Landscape. Volume 1 | February, 2018. Wildlife Conservation Trust (WCT), India

**Table 5.7 Biodiversity Monitoring and Evaluation Plan for the Compensatory Afforestation/Offset Sites**

S. No.	Biodiversity Values	PS6 Goal	Monitoring Action	Indicator	Frequency/Timeline	Responsibility	Annual Capital/Recurrent Costs (US\$)
1.	Tiger and prey species and their habitat	Net Gains	Monitoring afforestation of degraded forests through time series analysis of USGS satellite images from baseline values (pre afforestation)	Forest extent, NDVI, canopy cover from MSTRiPES, reduction in human disturbance from MSTRiPES	Once a year/Till complete restoration	OIT	Recurrent: 40,000
			Monitoring of Tiger presence	Camera trap data	Continuous across project life cycle.	OIT&MFD	Capital: 72,000 (6 camera traps for each of the 4 sites)
2.	EN and VU species and their habitat (Dole, Indian Pangolin, Sloth Bear, Sambar)	No net loss	Monitoring of prey species	MSTRiPE data on prey abundance	Continuous across project life cycle.	OITMFD	Recurrent; 10,000
			Monitoring of carnivore presence	Camera trap data			
			Monitoring of prey species	MSTRiPE data on prey abundance			

*Table 7.1* provides details of the impacts on species and habitat values assessed, the mitigation action recommended, residual impacts on species and habitat values anticipated subsequent to mitigation actions, the objectives of the BAP in terms of achieving net gain or no net loss, the mitigation action proposed to achieve net gains or no net loss and the baseline from which net gains or no net loss is assessed.

Mitigation action for net gain is relevant for all diverted forest areas within the RoW as these have been assessed as critical habitat when Tigers are assessed against Criteria 1 Tier 2. Mitigation action for net gain is also relevant for Tigers, as this a critical habitat trigger species.

There is approximately 800 km<sup>2</sup> of natural habitat east of NH7, the Bawanthadi Block, which apart from providing habitat contiguity to the Pench Kanaha Corridor also provides some connectivity to the Nagzira-Nawegaon Tiger Reserve to its east<sup>1</sup>. While much of this habitat is fragmented and degraded, due to the presence of several settlements within, from a review of Google Earth Image (2018), there are some intact patches of good habitat, particularly around the villages of Mangarli and Lawada.

The Pouni Range Office confirmed that the east side of highway segment falls in 3 forest ranges 1. Devlapar Range, 2. Pouni Range 3. Ramtek Range and there is Tiger dispersal from the east side of the highway to the west. Regular animal crossings of large herds of Chital (*Axis axis*) also occurs at Chainage 698 near a temple.

Construction workers at Animal Underpass (Chainage 656+340) confirmed Tigers using the mitigation structures during night to cross the highway segment.

Karwahi village borders the Karwahi Reserve Forest and lies approximately 3.5 east of NH7. Tigers are sighted a maximum of 4-5 and a minimum of 1-2 times per year. Other wild species sighted are Chital, Black buck (*Antelope cervicapra*), Nilgai (*Boselaphus tragocamelus*) and Wild Boar (*Sus scrofa*) are sighted around the village.

Villagers at Navgaon village (Chainage 660+100) confirmed Tiger dispersal in the area. A cattle lifting incident was reported by them. Occasionally Tigers venture into open fields but are mostly confined to forested areas. Other wildlife seen are Chital, Sambar, Wild boar and Nilgai.

From the above stake-holder consultations it seems evident that

<sup>1</sup> <https://www.wildlifeconservationtrust.org/monitoring-Tigers-beyond-Tiger-reserves/>

1. There is viable habitat on the east of NH7 that a small numbers of Tigers are using. These Tigers may have dispersed from the core area of the Pench Tiger Reserve as a consequence of high densities of the Tigers within.
2. Tiger prey species also occur in east of NH7 but perhaps densities are low.
3. Movement of both Tigers and prey species across NH7 does occur and in some cases the existing mitigation structures are used.

Thereby it can be concluded that with the completion of the mitigation structures and the recommended ancillary mitigation actions discussed in *Section 6.1*, Tiger densities may increase east of the road, leading to a net gain of this critical habitat value. This is contingent to adequate protection of prey species and habitats in the Forest Ranges on the east of NH7.

There are other potential critical habitat candidates within the DMU such as the Dhole (EN) and the Indian Pangolin (EN). The former mammals, even though deemed unlikely to be found in the project's area of influence, are still present in the DMU, but are not impacted by the project. The White- Rumped and Indian Vulture (CR) are also very unlikely to be impacted by the highway segment.

In addition, as indicated in *Section 5.2*, there are several VU species that are impacted by the project and mitigation action addressing these impacts will be considered a part of broader efforts for natural habitat and requirements for no net loss as an outcome

**Table 6.1 Achieving Net Gains or No Net Loss through Recommended Mitigation Action**

Species/Habitat Values	Relevant Impacts	Proposed Mitigation Action	Residual Impacts	Outcome Desired NG/NNL	Baseline to Assess NG/NL achievement	Comments on Mitigation Action Proposed to Achieve NG/NNL
<b>Forest diverted within RoW</b>	Forest Clearance	Avoidance where possible  Restoration of forests within ROW  Compensatory afforestation	49.246 ha	NG	Tree species composition and density in un-degraded forest compartment adjacent to the ROW in the buffer zone.	Restoration of natural habitats in ROW to baseline conditions  Compensatory afforestation sites (2X 49.246 =100 ha) as biodiversity offset sites aligned to IFC PS6
<b>Tiger</b>	Barrier Effect	Unobstructed and accessible mitigation structures	Reduction of Tigers crossing widened highway segment despite mitigation structures such as underpasses and bridges.	NG	Frequency of Tigers crossing old 2 lane highway segment	Mitigation Structures will possibly allow a higher Tiger crossing frequency across the highway segment, than the earlier 2 lane highway  Residual impacts will be further addressed in compensatory afforestation sites as biodiversity offset sites aligned to IFC PS6. The sites provide habitats and habitat contiguity for resident and transient Tigers respectively will contribute to improved connectivity that will further compensate for any reduction of crossings caused by the highway segment.
<b>Gaur Sambar Sloth Bear</b>	Barrier Effect	Unobstructed and accessible mitigation structures	Reduction of these species crossing highway segment despite mitigation structures	NNL	Frequency of these species crossing old 2 lane highway segment	Mitigation Structures will possibly allow a similar crossing frequency for these species across the highway segment as compared to the earlier 2 lane highway.  Residual impacts will be further addressed in compensatory afforestation sites as biodiversity offset sites aligned to IFC PS6. The sites provide habitats and improved

Species/Habitat Values	Relevant Impacts	Proposed Mitigation Action	Residual Impacts	Outcome Desired NG/NNL	Baseline to Assess NG/NL achievement	Comments on Mitigation Action Proposed to Achieve NG/NNL
						connectivity for these species and can further address any population level consequences of reduction of crossings caused by the highway segment.
<b>Gaur Sambar</b>	Hunting and poaching by workers and staff during construction and operation phase	No hunting and poaching of OIT policy	Lack of enforcement of policy results in some hunting and poaching of these species by contractors' workers and OIT staff.	NNL	Baseline levels of hunting and poaching by local communities	Residual impacts will be further addressed in compensatory afforestation sites as biodiversity offset sites aligned to IFC PS6. The sites provide habitats and improved connectivity for these species and with protection, can address any residual hunting and poaching by Project SPV staff and workers.

To implement this BAP there are several short and mid term actions required over the next few months to finalize the BAP and ensure organisational support and buy in for its implementation. The actions, time frame for their implementation and roles and responsibilities are provided in Table 7.1 . Time frames of 2 months or less are deemed short term or otherwise mid-term. These short or mid -term actions will enable long term monitoring actions to assess whether the BAP objectives of no net loss or net gain are achieved.

**Table 7.1 Details of Short/Mid Term Actions for Implementation of BAP**

Actions	Time Frame (Months)	Roles and Responsibilities	Means of Verification
<b>Finalization of BAP.</b>			
1. Finalisation of Enforcement Plan for preventing human obstructions of underpasses (See <b>Table 6.2</b> ).	3	OIT and MFD to discuss present resources and capacity existing within the MFD as enforcement is typically a government effort and the MFD is likely to have human resource and capacity to implement this activity. Any gaps to be discussed and additional OIT support required, agreed upon	Enforcement plan finalized with complete comprehension on procedures by MFD with a commitment to utilize its resources and capacity for implementation. Any gaps requiring OIT support identified, and will be addressed by OIT through mutual agreement with the MFD.  MOU signed with MFD
2. Finalisation of Monitoring and Evaluation Plan for usage of underpasses by Tigers and other species of concern (see <b>Table 7.2</b> )	3	OIT and MFD to discuss present resources (such as equipment and skilled human resources) and capacity existing within the MFD as surveying Tigers through camera trapping is typically a government effort and the MFD is likely to have human resources and capacity to implement this activity. Any gaps to be discussed and additional OIT support agreed upon	Monitoring plan finalized with complete comprehension on procedures by MFD with a commitment to utilize its resources and capacity for implementation. Any gaps needing OIT support to be identified, and will be addressed by OIT through mutual agreement with the MFD.  MOU signed with MFD
3. Finalisation of CA Site Protection and Monitoring Plan (as adapted from the CAP). Adaptation should also include monitoring of fauna as discussed in <b>Table 7.3</b>	4	A competent agency to review CAP and adapt it as discussed in <b>Section 7.2</b> to ensure better compliance with PS6. This will need to keep in mind that forest protection and monitoring is typically an activity of the MFD. Any additional actions required for compliance with PS6 to be discussed with the MFD and OIT to provide additional resources for ensuring compliance with PS6.	CA Site Protection and Monitoring Plan finalized with complete comprehension by MFD/WCT of processes and human resource required. Additional resources to ensure compliance to PS6 and to be provided by OIT, mutually agreed upon.  MOU signed with MFD and WCT.

Actions	Time Frame (Months)	Roles and Responsibilities	Means of Verification
<b>Organisational Structure and Buy In.</b>			
1. Buy in into all elements of the BAP with emphasis on the biodiversity policy requirements and mitigation actions	1	A competent agency to run a half day workshop for OSE/OIT to explain the elements of the latest version of BAP, receive and attend to comments and ensure sign off by OIT prior to BAP finalization .	Latest version of BAP signed off by OIT. Document control mechanism should exist for signing off later versions.
2. Organisational structure in place for BAP implementation	6	An organisation chart should be first prepared identifying human resource needs with qualifications specified. This should be prepared by OIT in consultation with a competent agency. The organisation chart should also include ,human resources from the MFD that will need to be supervised/collaborated with	Finalized organisation chart approved by management
3. Implementation of BAP with Budgeting for BAP Actions finalized (see Budget in <b>Table 7.2</b> )	4	OIT to implement BAP in accordance to finalized budget.	Final BAP and budget approved by OIT management

**Table 7.2 Budget for Implementing BAP Actions**

S. No.		Capital Budget (US\$)	Annual Recurrent Budget (US\$)
<b>Mitigation Actions</b>			
1.	Vegetation clearance within RoW	As per budget for EMP implementation	
2.	Degradation of ambient conditions and likely degradation of natural habitats	As per budget for EMP implementation	
3.	Barrier Effect of Road	11,000	,60,000
4.	Collision risks to vultures	5,000	20,000
<b>Biodiversity Monitoring and Evaluation Actions –Mitigation Actions</b>			
1.	Vegetation clearance within RoW	As per budget for EMP implementation	
2.	Degradation of ambient conditions and likely degradation of natural habitats	As per budget for EMP implementation	
3.	Routine inspection of planned vegetation cover and species composition in approach areas of underpasses:	0	10,000
4.	A long- term system of monitoring Tiger and prey usage of underpasses with video camera traps	15,000	30,000
5.	Monitoring vulture presence and mortality along the highway segment	0	1000
5.	A long- term system of monitoring other EN and VU species usage of underpasses with video camera traps	Included above	
<b>Biodiversity Monitoring and Evaluation Actions-Compensatory Afforestation and Offset</b>			
1.	Monitoring gains through afforestation of degraded forests	0	40,000
2.	Monitoring of Tiger and prey species presence	72,000	10,000
3.	Monitoring of other EN and VU species	Included above	
<b>Grand Total</b>		<b>103,000</b>	<b>171,000</b>

***ANNEX A: DETAILS OF SITE VISIT AND DOCUMENT REVIEW***

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**Table A.1 Site Visit and Consultation Details**

Date	Activities Undertaken
<b>Phase I</b>	
6 <sup>th</sup> March, 2018	<ul style="list-style-type: none"> <li>• Site Reconnaissance;</li> <li>• Mapping of Habitat along the project site and understanding of disturbance in the forested section;</li> <li>• Discussion with the Deputy Chief Conservator of Forests, Nagpur to understand presence of endemic, migratory and threatened species and to determine records or approximate numbers; and</li> <li>• Discussion with the Range Forest Officer to determine unofficial Tiger sightings.</li> </ul>
7 <sup>th</sup> March, 2018	<ul style="list-style-type: none"> <li>• Discussion with the Forest Guard office at the Pench National Park entrance to understand Tiger sightings and movement.</li> </ul>
<b>Phase II</b>	
11th July (Pre Lunch) 2018	Reconnaissance Visit to the highway segment
11th July (Post Lunch) 2018	Consultation with the Project Authorities
12 July (Pre Lunch) 2018	Consultation with the Villagers, Visit to Mitigation Structures, Consultation at Manegaon Tek village, Karwahi village, Pauni Range forest office
12th July (Post Lunch) 2018	Consultation with the Range Forest Officer South Umred, Visit to the offset site

### Documentation Review

ERM sent a list of documents required for review to undertake the critical habitat screening and develop the BAP. The documents reviewed for the Project are provided in **Table 9.2**.

**Table A2 Documents Reviewed for Critical Habitat Screening**

S.N.	Document
1.	Forest Working Plan for Nagpur
2.	Deolapar Range Forest Officer letter dated 09.03.2018
3.	WWF Report (2014): Lifeline for Tigers – Status and Conservation of the Kanha-Pench Corridor
4.	Sharma, S. et. al. 2012. Spatial genetic analysis reveals high connectivity of Tiger ( <i>Panthera tigris</i> ) populations in the Satpura-Maikal landscape of Central India. Ecology and Evolution.
5.	Jhala, Y.V. 2011. Status of the Tigers, Co-predators and Prey in India. National Tiger Conservation Authority. Govt. of India, New Delhi and Wildlife Institute of India, Dehradun.
6.	WWF Report (2010): Fragmentation Threat in the Kanha-Pench Corridor – Implications of the Gondia-Jabalpur Railway Line on Corridor Connectivity and Tiger Dispersal
7.	Wildlife Institute of India (2015): Proposed Mitigation Measures for Maintaining Habitat Contiguity and Reducing Wild Animal Mortality on NH 6 and 7 in the Central Indian Landscape.

## Minutes of Phase II Stake-holder Consultations

**Table A.3 Consultation along the East of Highway Segment**

SNo.	Consultation with	Minutes of Consultation
1.	Villagers at Manegaon Tek Village Sri Ganesh Maraskule	The village fall close to MP/Maharashtra Border. As the village is in agricultural land. The respondent confirmed that majority of animals are confined to the forested area. Some species such as Wild Boar, Nilgai, Chital and Sambar are occasionally encountered.
2.	Villagers at Karwahi Village Sri Babulal Parshan Varkade	The village is bordering the Karwahi Reserve Forest. Tiger sighting frequency is 4-5 times/year (maximum) and 1-2 times/year (minimum). Other wild species are commonly sighted such as Chital, Black buck, Sloth Bear, Nilgai, Jungle Cat ( <i>Felis chaus</i> ), Wild Boar, Indian Hare ( <i>Lepus nigrocollis</i> ), Indian Crested Porcupine ( <i>Hystrix indica</i> ), Indian Python ( <i>Python molurus</i> ), Cobra ( <i>Naja sp.</i> ) and Monitor lizard ( <i>Varanus sp.</i> ).
3.	Construction workers at Chainage 654.	The local road construction workers were consulted. It was reported that the Tiger have visited the mitigation structures 3 days ago but did not cross as the construction work was ongoing with presence of humans. Other wild life observed by them are Sloth bear and Chital visiting the construction area.
4.	Sri Bhure (+91-8806992393) Pouni Range Office	Pouni Range office was visited, the Range Officer was not available, Sri Bhure was met. He confirmed that the east side of highway segment falls in 3 forest ranges 1. Devlapar Range, 2. Pouni Range 3. Ramtek Range. He confirmed that the Tiger movement occurs from east side of highway segment to west site. He also confirmed that regular animal crossing such as large herd of Chital and Indian Python occurs at Chainage 698 near temple.
5.	Construction Workers at Animal underpass Chainage 656+340	Construction workers confirmed the Tiger movement using the mitigation structures at under construction stage during night to cross the highway segment. The ground work for bridge was completed and the filling of the flyash and earth material in the wing wall was undertaken.
6.	Villagers at Navagaon near Chainage 660+100	Villagers were consulted about the wildlife movement along the forest stretch between the village and under construction highway segments. The villagers confirmed the Tiger movement in the area. One cattle lifting incident was reported by them. Sometimes the Tiger venture in open field but mostly it follows the forested path. Other wildlife available are Chital, Sloth bear, Leopard, Sambar, Wild Boar and Nilgai.

## ANNEX B: EMP ACTIONS RELATED TO MITIGATING IMPACTS TO BIODIVERSITY VALUES

Sl. No	Activities	Management / Mitigation Measures	Location	Reference
<b>1</b>	<b>Pre-construction activities</b>			
<b>1.2</b>	<b>Identification &amp; Selection of Material Sources</b>			
<b>1.2.1</b>	Borrow Areas	<p>Arrangement for locating the source of supply of material for embankment and sub-grade as well as compliance to environmental requirements as applicable will be implemented.</p> <p><u>No use of any of the locations for borrowing</u> within and upto 1000m either side of Reserve Forest/ Ecologically sensitive areas.</p> <p>Locations identified will be reported to the Engineer. Planning of haul highway segments for accessing borrow materials is duly undertaken. The haul highway segments are routed to avoid agricultural areas.</p>	All Borrow areas	MoRTH. <sup>1</sup> 305.2.2.2
<b>1.2.2</b>	Quarries	The construction materials have been identified from existing licensed quarries Apart from approval of the quality of the quarry materials, the legal status of the quarry Operation is verified, as to whether approval under applicable statute is obtained.	All quarries recommended to be used in the project	MoRTH:111.3
<b>1.4</b>	<b>Setting up construction sites</b>			
<b>1.4.1</b>	Construction Camp Locations-Selection Design & Layout	<p>Location identified will be reported accordingly to the Engineer</p> <p>Construction camps will not be proposed;</p> <p>(i) Within 1000m of locations as described in Section 1.2.1 (Reserve Forest / Ecologically sensitive areas).</p> <p>Locations for stockyards for construction materials will be Identified at least 1000 m from watercourses.</p>	All Construction Workers Camps including areas in immediate vicinity.	Contract
<b>2</b>	<b>Construction Activities</b>			
<b>2.1</b>	<b>Site Clearance</b>			

<sup>1</sup> Specifications for Road and Bridge Works (FIFTH REVISION, 2013). Ministry of Road Transport and Highways (MORTH)

Sl. No	Activities	Management / Mitigation Measures	Location	Reference
2.1.1	Clearing and Grubbing	<p>Vegetation will be removed from the Col before the commencement of Construction.</p> <p>All works will be carried out such that the damage or disruption to flora is minimum.</p> <p>Only ground cover / shrubs that Impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Engineer.</p> <p>Under any circumstances no damage to the trees will be done.</p>	Corridor of Impact	MoRTH 111.15.1, 111.15.4
2.1.4	Non-bituminous construction wastes disposal	<p>Location of disposal sites will be finalized prior to the completion of the earthworks on any particular section of the highway segment conforming to the following:</p> <p>(a) These are not located within designated forest areas as indicated in section 1.2.1</p> <p>(b) The dumping does not Impact natural drainage courses</p> <p>(c) No endangered/rare flora is impacted by such dumping.</p>	Dump site locations	<p>Contract</p> <p>MoRTH: 201.4 &amp; 202.5</p> <p>Section 1.2.1</p>
<b>2.18</b>	<b>Demobilization</b>			
2.18.1	Clearing of Construction Camps & Restoration	<p>Site restoration plans will be prepared for approval by the Engineer. The approved plan will be implemented prior to demobilization.</p> <p>On completion of the works, all temporary structures will be cleared away, all rubbish burnt. excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, to the entire satisfaction of the Engineer.</p> <p>Residual topsoil will be distributed on adjoining/proximate barren/rocky areas as identified by the Engineer in a layer of thickness of 75mm-150mm.</p>	All Construction Workers' Camp	

Sl. No	Activities	Management / Mitigation Measures	Location	Reference
2.18.2	Redevelopment of Borrow Areas	Redevelopment of borrow areas will be taken up in accordance with the plans approved by the Engineer.	At all borrow area locations suggested for the project.	
2.18.3	Tree Plantation and Landscaping	Highway segment landscape plantation, re-vegetation (using approved indigenous species) of highway segment embankments and other slopes. edge treatment of water bodies will be taken up.  Stockpiled topsoil will be utilized for landscaping, incidental spaces etc.	Entire Project Corridor, as per the tree plantation strategy  Entire Project Corridor, as per the landscape plan.	Forest (Conservation) Act, 1980

ANNEX C: DETAILS OF MITIGATION STRUCTURES WITH EXPLANATIONS ON DESIGN  
CONSIDERATIONS

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Chainage Km	Type	Provision	Dimensions (m)		Remarks
			Length	Height	
656+340	Under pass	RCC Structure	750	5	<ul style="list-style-type: none"> <li>- In general, 15 m Vehicular Underpasses are constructed, 30 m Grade separators are constructed as per Indian Roads Congress guidelines</li> <li>- Structures with such large dimensions (100-750m) are unprecedented in the country and have primarily been constructed to ensure that the stretch remains animal-friendly</li> <li>- The structures has been proposed keeping in mind the traffic heterogeneity, daily and annual traffic volumes, and types of animals found near the stretch</li> <li>- Structure provide sufficient openness for multiple species including solitary animals such as tiger and herd-living animals such as chital and wild pig</li> <li>- Construction of the structure would significantly contribute towards mitigation of the 'barrier effect' due to existing traffic on the road and provide open access to the other side of the road</li> </ul>
		Approaches	960		- Longer approaches than the recommended length of 600 m would provide additional safety for the animals crossing the structure
		Animal Guide Walls	100	2	- Construction of guide wall in addition to the approach to the structures ensures usage of the structure by animals

Chainage Km	Type	Provision	Dimensions (m)		Remarks
			Length	Height	
675+800	Under pass	RCC Structure	750	5	<ul style="list-style-type: none"> <li>- Two underpasses of 750 m length are being constructed. In general, 15 m Vehicular Underpasses are constructed, 30 m Grade separators are constructed as per Indian Roads Congress</li> <li>- Construction of the underpasses would significantly contribute towards providing open passage to the animals without any barrier</li> <li>- Post construction of underpass, the black top of the existing road would be removed. This land would get converted into forest cover resulting in better connectivity to the other side of the road for the animals.</li> <li>- Sufficient vegetation would be ensured on both sides without degradation to the forest cover</li> </ul>
		Approaches	700		- Approach remanded by WII was 600 m
		Animal Guide Walls	100		- Ensures usage of the structure by animals
653+872	Minor Bridge	Structure	60	5	<ul style="list-style-type: none"> <li>- 60 m has been constructed compared to 10 m length as per CA</li> <li>- Minor Bridge of width 60 m has been built over a stream with width around 5-6 m providing longer opening. This ensures no obstruction to the wildlife crossing the stretch.</li> <li>- Structure has been modified from wall type to circular pillar type to provide additional space and free access to the other side of the road</li> <li>- Sufficient vegetation would be ensured on both sides without degradation to the forest cover</li> </ul>
		Animal Guide Walls	100	2	- Construction of guide wall in addition to the approach to the structures ensures usage of underpass by animals

Chainage Km	Type	Provision	Dimensions (m)		Remarks
			Length	Height	
659+710	Under pass	RCC Structure	300	5	<ul style="list-style-type: none"> <li>- Structure provide sufficient openness for multiple species including solitary animals such as tiger and herd-living animals such as chital and wild pig</li> <li>- Construction of underpass will lead to net gain of forest cover beneath the structure and unobstructed pathway for the animals to cross the road</li> <li>- In general, 15 m Vehicular Underpasses are constructed, 30 m Grade separators are constructed as per Indian Roads Congress</li> </ul>
		Approaches	1000		- Longer approaches than the recommended length of 600 m would provide additional safety for the animals crossing the structure
		Animal Guide Walls	100	2	- Ensures usage of the structure by animals
654+478	Under pass	RCC Structure	50	5	<ul style="list-style-type: none"> <li>- Construction of the underpasses would significantly contribute towards providing open passage to the animals without any barrier</li> <li>- Post construction of underpass, the black top of the existing road would be removed. This land would get converted into forest cover resulting in better connectivity to the other side of the road for the animals.</li> </ul>
		Approaches	700		- Approach remanded by WII was 600 m
		Animal Guide Walls	100	2	- Ensures usage of the structure by animals
658+130	Minor Bridge	Structure	80	5	<ul style="list-style-type: none"> <li>- 80 m length of the structure being constructed compared to 51 m length as per Concession Agreement</li> <li>- Minor Bridge of width 80 m provides longer opening across the stream. This ensures no obstruction to the wildlife crossing the stretch.</li> <li>- Structure has been modified from wall type to circular pillar type to provide additional space and free access to the other side of the road</li> </ul>

Chainage Km	Type	Provision	Dimensions (m)		Remarks
			Length	Height	
		Animal Guide Walls	100	2	- Ensures usage of the structure by animals
668+165	Minor Bridge	Structure	65	5	- 65 m length of the structure being constructed compared to 27 m length as per Concession Agreement - Minor Bridge of width 65 m provides sufficient opening across the stream for the wildlife crossing the stretch - Structure has been modified from wall type to circular pillar type
		Animal Guide Walls	200		- Ensures usage of the structure by animals
674+000	Under pass	RCC Structure	100	5	- The length of the underpass is much larger than the specification as per Indian Roads Congress - Construction of the structure would significantly contribute towards mitigation of the 'barrier effect' due to existing traffic on the road and provide open access to the other side of the road
		Approaches	600		
		Animal Guide Walls	100		- Ensures usage of the structure by animals
677+593	Minor Bridge	Structure	50	5	- Length of the minor bridge is much larger than the originally planned width of 8 m as per the Concession Agreement - This provides sufficient openness for the animals to cross the road without any barrier
		Animal Guide Walls	500		- Ensures usage of the structure by animals
660+634, 660+903, 661+274	Additional Animal Guide Walls on both sides	Animal Guide Walls	100	2	- In addition to the 9 structures additional guide walls are being constructed to ensure usage of the structures being constructed

677+593	Minor Bridge	Structure	50	5	<ul style="list-style-type: none"> <li>Length of the minor bridge is much larger than the originally planned width of 8 m as per the Concession Agreement</li> <li>This provides sufficient openness for the animals to cross the highway segment without any barrier</li> </ul>
		Animal Guide Walls	500		<ul style="list-style-type: none"> <li>Ensures usage of the structure by animals</li> </ul>
660+634, 660+903, 661+274	Additional Animal Guide Walls on both sides	Animal Guide Walls	100	2	<ul style="list-style-type: none"> <li>In addition to the 9 structures additional guide walls are being constructed to ensure usage of the structures being constructed</li> </ul>
677+593	Minor Bridge	Structure	50	5	<ul style="list-style-type: none"> <li>Length of the minor bridge is much larger than the originally planned width of 8 m as per the Concession Agreement</li> <li>This provides sufficient openness for the animals to cross the highway segment without any barrier</li> </ul>
		Animal Guide Walls	500		<ul style="list-style-type: none"> <li>Ensures usage of the structure by animals</li> </ul>
660+634, 660+903, 661+274	Additional Animal Guide Walls on both sides	Animal Guide Walls	100	2	<ul style="list-style-type: none"> <li>In addition to the 9 structures additional guide walls are being constructed to ensure usage of the structures being constructed</li> </ul>

Figure C.1 Location of Mitigation Structures



ANNEX D: ATTRIBUTES OF THE COMPENSATORY AFFORESTATION  
SITES

## FLORA AND FAUNA OF THE COMPENSATORY AFFORESTATION SITES

The compensatory afforestation (CA) occurred at four locations. Out of the four CA land, 3 plantation areas were visited.

The plantation undertaken are mixed plantations with species given in *Error! Reference source not found.* The plantation is undertaken in degraded forest areas. The general pattern of plantation with spacing of 3m X 3m is followed all through the compensatory plantation lands. A total of 111100 saplings are planted in an area of 100 ha.

**Table D.1** *Tree Species used in plantation*

S No.	Local Name	Scientific Name
1.	Sagaun or Teak	<i>Tectona grandis</i>
2.	Imli	<i>Tamarindus indica</i>
3.	Aomla	<i>Phyllanthus emblica</i>
4.	Bahera	<i>Terminalia bellirica</i>
5.	Shiwan	<i>Gmelina arborea</i>
6.	Jamun	<i>Syzygium cumini</i>
7.	Bahawa	<i>Cassia fistula</i>
8.	Khair	<i>Senegalia catechu</i>
9.	Vat	<i>Ficus benghalensis</i>
10.	Peepal	<i>Ficus religiosa</i>
11.	Anjan	<i>Hardwickia binata</i>
12.	Arjun	<i>Terminalia arjuna</i>
13.	Chichwa	<i>Albizia odoratissima</i>
14.	Neem	<i>Azadirachta indica</i>
15.	Gulmohar	<i>Delonix regia</i>
16.	Sitaphal	<i>Annona reticulate</i>
17.	Ain	<i>Terminalia tomentosa</i>

Consultation with Range Forest Officer South Umred Forest Range Mr. P.S. Tadas (+91-9822444303) revealed presence of wildlife which occasionally visit the compensatory afforestation sites. These are given in *Error! Reference source not found.12.2.*

**Table D.2** *Mammalian Species in Compensatory Afforestation Sites*

SNo.	English Name	Scientific Name	IUCN, v2018.1	IWPA,1982
1.	Tiger	<i>Panthera tigris</i>	Endangered	I
2.	Cheetal	<i>Axis axis</i>	Least Concern	III
3.	Indian Leopard	<i>Panthera pardus</i>	Vulnerable	I
4.	Striped Hyaena	<i>Hyaena hyaena</i>	Near Threatened	III
5.	Wild dog/Dhole	<i>Cuon alpinus</i>	Endangered	II
6.	Jackal	<i>Canis aureus</i>	Least Concern	II
7.	Nilgai	<i>Boselaphus tragocamelus</i>	Least Concern	III
8.	Bengal Fox	<i>Vulpes bengalensis</i>	Least Concern	IV
9.	Sambar	<i>Rusa unicolor</i>	Vulnerable	III
10.	Wild boar	<i>Sus scrofa</i>	Least Concern	III
11.	Sloth bear	<i>Melursus ursinus</i>	Vulnerable	II
12.	Four horned antelope	<i>Tetracerus quadricornis</i>	Vulnerable	I
13.	Common Langur	<i>Semnopithecus entellus</i>	Least Concern	II
14.	Indian Bison-Gaur	<i>Bos gaurus</i>	Vulnerable	I
15.	Barking Deer	<i>Muntiacus muntjak</i>	Least Concern	III

SNo.	English Name	Scientific Name	IUCN, v2018.1	IWPA,1982
16.	Rhesus macaque	<i>Macaca mulatta</i>	Least Concern	II

Figure D.3 Compensatory Afforestation for NH-7



ANNEX E: LOCATIONS OF BORROW AREAS, QUARRIES AND CONSTRUCTION CAMPS WITH  
RESPECT TO NATURAL HABITAT

Table E.1 Location of Borrow Areas, Quarries and Construction Camp with Respect to Natural Habitat.

Map	Associated Facility	Location and Land Use	Verification
<p>The map shows the Nagpur region in Maharashtra, India, with the MP/MH border to the north. Key features include:         <ul style="list-style-type: none"> <li><b>NH-7:</b> A major highway running north-south through Nagpur. It is highlighted in green for widening/lanning (37 km) and in red for maintenance (22.015 km).</li> <li><b>NH-6:</b> A highway running east-west through Nagpur.</li> <li><b>NH-69:</b> A highway running north-south to the west of Nagpur.</li> <li><b>Construction Projects:</b> <ul style="list-style-type: none"> <li><b>WIDENING/4-LANNING OF NH-7:</b> 37 km, from Km. 652 to Km. 689.450 (Forest Land).</li> <li><b>KAMPTEE-KANHAN BYPASS:</b> 21.238 km.</li> <li><b>NAGPUR BYPASS:</b> 21.600 km.</li> <li><b>MAINTENANCE OF NH-7:</b> 22.015 km.</li> </ul> </li> <li><b>Associated Facilities:</b> <ul style="list-style-type: none"> <li><b>Borrow Areas:</b> Vanpavani (1.5 km from highway), Sindewahi (1.0 km from highway), Wadamba (0.5 km from highway).</li> <li><b>Quarries:</b> Salaimendha, Chatrapur.</li> <li><b>Construction Camps:</b> Parseoni (adjacent to highway).</li> </ul> </li> <li><b>Other Landmarks:</b> Kanhan River, MP/MH Border, Jabalpur Madhya Pradesh, Wardha, Chandrapur, Amravati, and Hyderabad directions.</li> </ul> </p>	Borrow Areas	Vanpavani-668 km (1.5 km from highway)/Private Land	No dues letter
		Sindewahi -6664 km (1.0 from highway)/Private Land	Google Earth Image
		Wadamba-661 km (0.5 km from highway)/Private Land)	No dues letter
			Google Earth Image
	Quarries	Salaimendha/Private Land	Permit
	Chatrapur/Private Land	Permit	
Construction Camps	Parseoni-689.5 km (adjacent to highway)	Lease document	



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