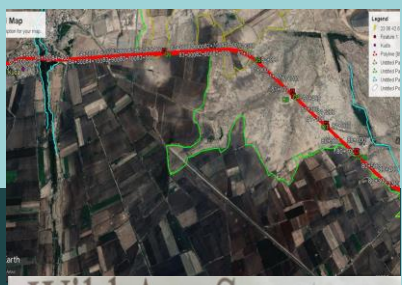
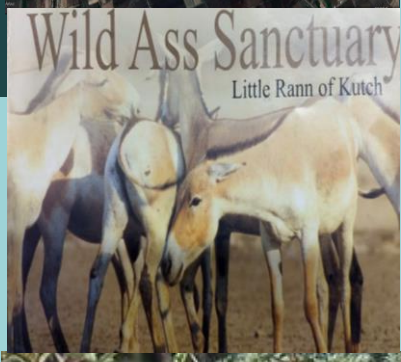
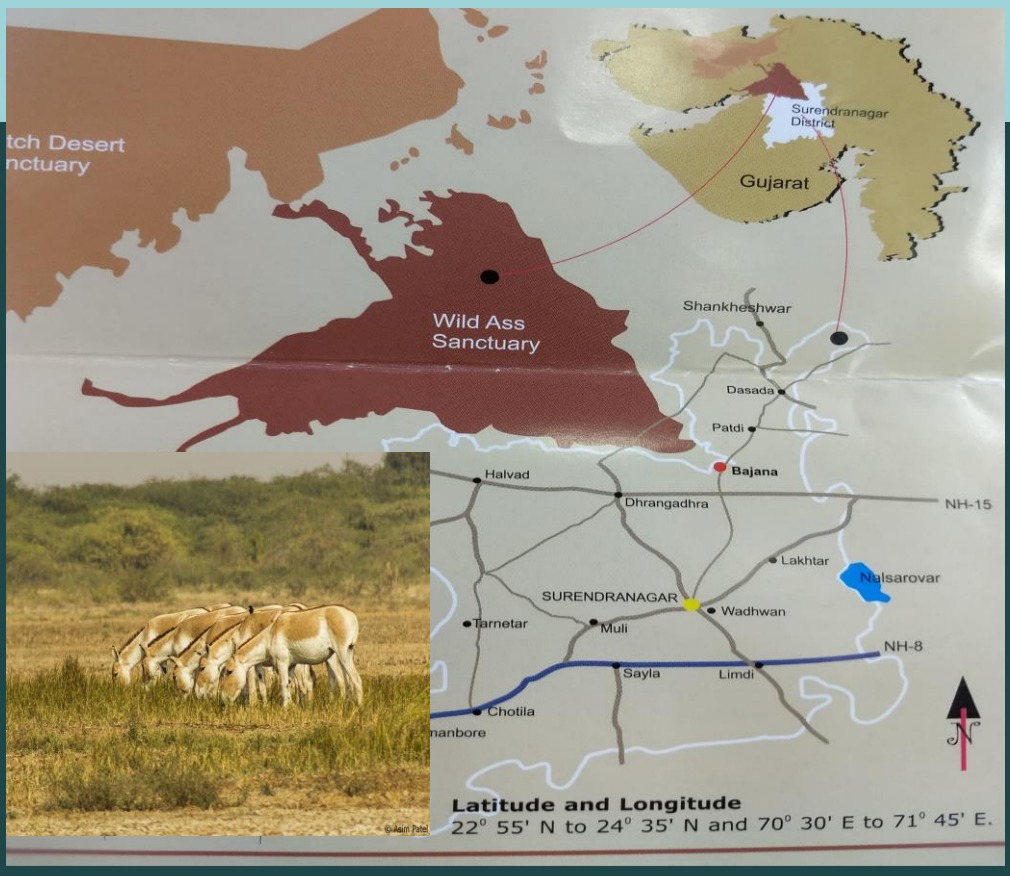
BIODIVERSITY REPORT



Wild Ass Sanctuary



Widening and Strengthening of Dharangadhra-Kuda (up to existing Km 20.0) Section of NH-51 to Two Lane with Paved Shoulder from Ch. 67.106 to Ch. 85.040 in the State of Gujarat(Pkg-2)



January 2018

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1. BIODIVERSITY REPORT (WILD ASS SANCTUARY (WAS) – LITTLE RANN OF KUTCH)

1.1. INTRODUCTION

The Wild Ass sanctuary Preliminary Notification was issued on 12th of January 1973. The government under a notification (under the Wild Animal and Bird Protection Act) has to declare 4840.469 sq. km area (3569.363 km of LRK and 1271.106 sq. km from areas surrounding LRK) as Wild Ass Sanctuary. Through another notification in 1978, another 112.81 sq. km was added to WAS[1].

Wild Ass Sanctuary encompasses an area of 4953.70 sq. km. of the Little Rann of Kachchh and the districts of Surendranagar, Rajkot, Patan, Banaskantha and Kutch. Easily spotted in big groups in the vast span of desert throughout the year, this population of wild ass is the only gene pool of Indian Wild Ass in the entire world and one of the six geographical varieties or sub-species surviving on the earth.

Owing to the uniqueness of the area and the existence of the rare and endangered species such as Dalmatian pelican, lesser flamingo, sarus crane, caracal, desert fox, black cobra etc., the area is being considered to be declared as one of the world heritage sites. Internationally the area is recognized for its natural and geomorphological value and has high biodiversity conservation significance.

With the arrival of monsoon the landscape changes dramatically, when entire sanctuary area is filled with shallow fresh water. This stagnant water offers a vast feeding ground to the famous Kachchh prawns and several other birds, fish and invertebrates.

This sanctuary attracts many internationally threatened birds like houbara bustard, dalmatian pelicans, hawks, harriers and falcons. Many of these birds migrate to this area, which falls on the migratory route of birds coming to Indian subcontinent Large portion of Little Rann of Kachchh has been covered by Prosopis chilensis. The other plants and trees are: Morad, unt morad, theg, dolari, khijdo, kerdo, mithi jar, kheri pilu, akado etc. The Boundary of Wildlife Sanctuary is depicted in Figure 1-1.

The landscape of Little Rann of Kachchh is a proposed Biosphere Reserve which encompass approximately 6500 km² of low saline desert dotted with small patches of uplands of which 4841 km² is famous Indian Wild Ass Sanctuary. This Sanctuary is adobe for last survival population of the Indian Wild Ass (Singh et. Al.,1999).

During monsoon season, several small ephemeral rivers drains their water in low lying area of Sanctuary, at the same time the saline water from the sea through Gulf of Kachchh. This make the part of the sanctuary as vast shallow wetland dotted with number of Island locally called Bet. These wetland recedes during winter and post monsoon season, resulting in dry saline desert. This vast flat terrain interspersed with numerous green patches creates unique habitats for Indian Wild Ass.

It is believed that Little Rann of Kutch was part of sea, rivers like Saraswati, Banas, Rupen and many others used to meet here and used to shed their sediments which got deposited over a period to time to form the Little Rann of Kutch.

[1] WAS: Wild Ass Sanctuary

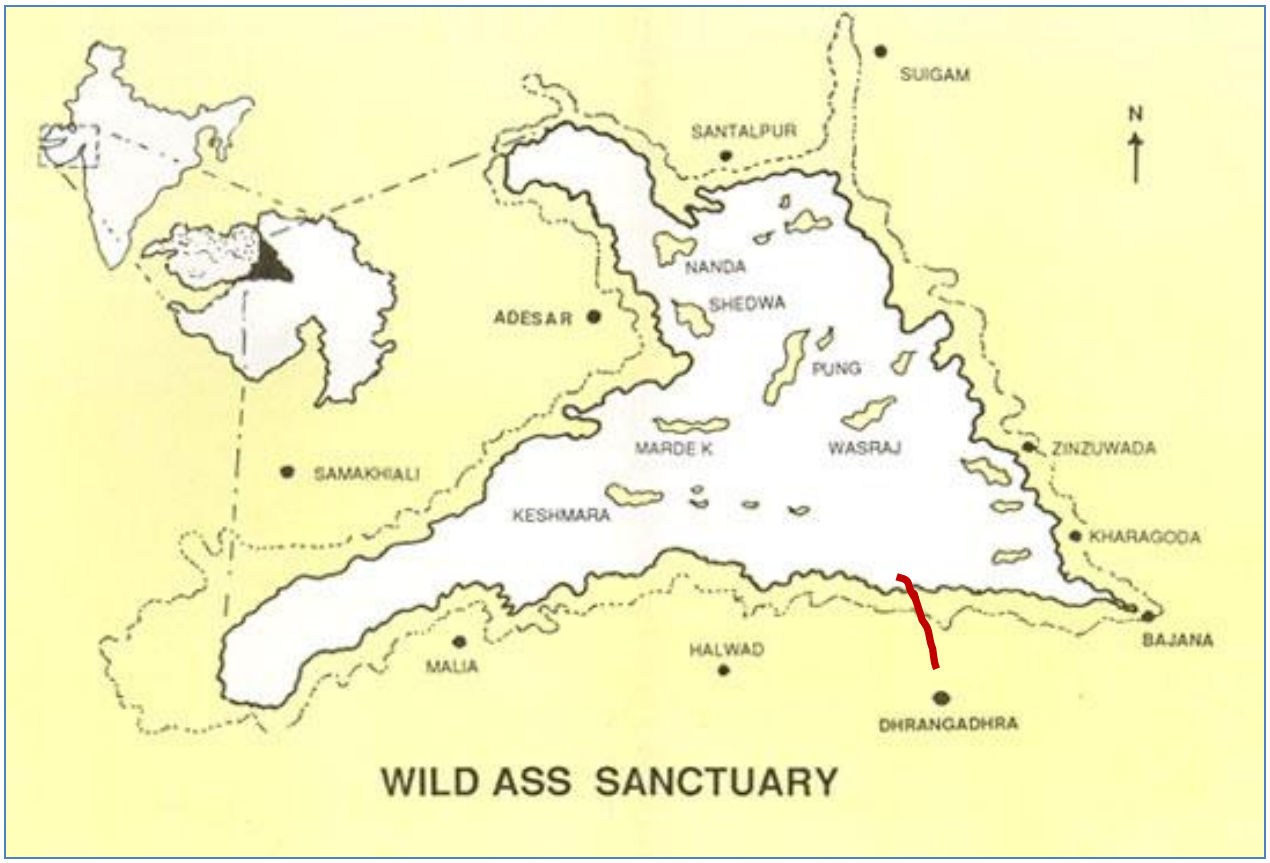


Figure 1-1: Boundary of Wildlife Sanctuary

1.2. BIOGEOGRAPHIC CLASSIFICATION

As per the Biogeographic Zones Classification of India, The Little Rann of Kutch falls in Semi- Arid Zone and 4B – Semi Arid Gujarat Rajputana. Based on Vegetative Classification, the vegetation of Little Rann of Kutch is classified into Rann saline thorn scrub, Salvadora scrub and tropical Euphorbia scrub (degradation stage) (Champion and Seth 1968). Meher-Homji (1972), classified the vegetation of Kutch under the Prosopis cineraria, Capparis decidua, Zizyphus – Salvadora type. Gupta and Saxena (1971) categorized this vegetation as Halophytic scrubland. As per Koppen's Classification the Kutch district falls in the Semi- Arid climatic condition which belongs to the Steppe – Bush type.

Biogeographically, Kutch is classified as desert as per the classification (WII, Dehradun, 1988)

Biogeographic zone	3	The Indian Desert
Biotic province	3A	Kutch desert
Sub divisions	3A (I)	Little Rann salt marsh & islands
	3A(II)	Great Rann salt marsh & islands
	3A(III)	Southern hills

1.3. CLIMATIC CONDITION

Temperature:

The climatic characteristics of area shows transitory phase between the arid and semi humid type in the west and east respectively. The intensity of heat goes on increasing from east to west in the district except in the coastal zones. The region experiences four main seasons namely winter, summer, South-west monsoon and post monsoon seasons. During winter season (December to February) winds are N-NE and rough sea conditions may prevail because of western disturbances characterized by chilly winds from the N-NE due to high pressure zone in the north of Himalayan ranges. Summer season (March to mid-June) is

characterized by high temperature and high humidity with the maximum air temperatures often reaching 40-45°C. Southwest monsoon (mid-June to mid- September) has weak monsoon mainly due to monsoon low centered around more inland part making it a low rainfall area with strong winds with S –SW directions. Post monsoon season (mid-September to November) is a transition period between monsoon and winter when the climate is pleasant with relatively calm periods.

Rainfall:

The area has three rainy month i.e June, to August of which July is the wettest month. About 80% of the rainfalls are received during month of July. The average annual received is 320mm. the total rainy day are less than 15. The average humidity if the year is less than 25%.

Wind:

Strong summer winds, which blow from SW and W and often carry salts from dried salt encrustation of the Ranns towards the land, is also one of the factors contributing salinity to the area.

Soil:

The surface of Little Rann of Kutch exhibits itself in terms of dark brown surface configuration with wide and deep cracks with veneer of salt. Generally in the semi-arid regions of the tropics and sub tropics, there is pre-dominance of deep dark colored clay soil, particularly in the flat topographical areas. Such deep and dark colored clay are called Vertisols.

Dark color of soil is related to either parent material or presence of manganese oxides. The dark brown-black color of the Rann sediment is attributed to the parent material lying in its catchment area of basaltic geological structure. Overall, Aridisol and Entisol orders dominate soil of the Kutch peninsula. The soil of the mainland areas is characterized by varying depth and textures. The soil of this region is moderately calcareous and alkaline.

1.4. FLORA AND FAUNA OF WILDLIFE SANCTUARY

Flora:

In the Rann the vegetation is confined only to the island bets which have a thin layer of soil whereas the Rann terrain is encrusted by evaporated salt and hence there is no vegetation. The natural vegetation of the Kutch area could be classified into two major types:

(1) Halophytic vegetation near sea and

(2) Typical low thorny shrubs i.e, “Xerophytes” in the fringe.

Major types of halophytic plants present in this area are *Cress Cretica, Abeurapa Sp*., and *Chenopodium Sande*. The xerophytes include low and stunted trees of *Acacia Arabica (Babul), Prosopis Spicigera, Prosopis Julifera, salvadora Persica (piludi), Catotropic Gigantis (Akoda), Capparis Aphylla(Kerdo),* etc. The islands (bets) are sparsely covered by *Prosopis Julifora (Gando Bawal), Accacia Nilotica (Desi Bawal), Prosopis Cineraria (Khijdo/Kando), Buteq Frondosa (Khakhro).*

Chloris sp. and *Aeluropus lagopoides* were most dominant grasses while *Chloris* species and *Aeluropus lagopoides* were the most dominant grasses while *Dactyloctenium* species, *Aristida* species, *Eragrostis* species and *Sporobolus* species also showed a high frequency of occurrence.

Prosopis Sp. in Wild Ass Sanctuary

The low lying area in Little Rann having high salt content and clay, *Cyperus* and *Scirpus* species would establish first, this would be followed by *Aeluropus lagopoides* and *Cressa cretica*. *Blumea* and *Echinochloa colonum* would come up in the area having puddles of fresh water. Most of these species are good soil binders and modify the soil for further succession. In fallow land having sandy gravelly soil, *Boerhavia, E.ciliaris and Corchorus* are the first to establish which are gradually replaced by *Aristida*.

Fauna:

The Sanctuary is habitat to about 93 species of invertebrates, including 25 species of zooplanktons, 1 species of annelid, 4 crustaceans, 24 insects, 12 molluscs and 27 spiders. Totally 4 species of amphibians (frogs and toads) and 29 species of reptiles (2 species of turtles, 14 species of lizards, 12 snakes and 1 crocodile) occur.

The mixing of tidal water from the Gulf of Kutch with the freshwater discharged from the rivers takes place in the Little Rann of Kutch, making it an important spawning ground for prawns. Metapenaeus kutchensis is the most dominant and important prawn in the area.

The sanctuary provides an important feeding, breeding and roosting habitat for a large number of birds due to its strategic location on bird migration route and its connection with the dynamic Gulf of Kutch. According to an estimate about 70,000-75,000 birds nests in an area spread over 250 acres. Nine mammalian orders with 33 species/subspecies have been reported from the Sanctuary, including the world's last population of the khur sub-species of the wild ass

Mammals:

The mammalian species reported are Chinkara (Gazella gazelle), Wild Ass (Equus onager), Neelgai or blue Bull, Wild Boar, Indian Wolf, Jackal, Striped Hyna, Desert Hare, Indian Fox, Mongoose, Jungle Cat, Desert Cat, Pangolin, Indian porcupine, Indian hare, etc.

Birds:

The sanctuary is adobe for both the residential and migratory birds, winter migrants are most common. The residential birds species commonly reported are eagle, pale harrier, pelican, heron, spoon bill, great and lesser flamingo, great crested grebe, common crane, indian peafowl, common quail, rock brush quail, little gibis, rock pigeon, laughing dove, green pigeon, little swift, common koel, Indian pond heron, cattle egret, grey heron, great egret, little egret, darter, red wattled lapwing, common sandpiper, common hoopoe, green bee-eater, blue tailed Bee-eater, indian roller, common kingfisher, pied kingfisher, black drongo, etc.

Reptiles:

The reptilian species reported in the Sanctuary area are Crocodile, Monitor Lizard, Patla Gho, Kutch Rock Gecko, Desert Monitor Lizard, Spiny Tailed lizard, Sanda, Flat tailed lizard, Starred tortoise, water turtle etc.

Snakes:

The sanctuary is famous for presence of both the poisonous and non-poisonous snakes species. The commonly poisonous snakes species reported are Black Krait, Black Cobra, Russel Viper, Saw Scaled Viper, Sea Snakes, etc.

The non-poisonous snakes commonly reported are Python, Sand Boa, Rat snakes, Royal snakes, etc.

1.5. SOCIO-ECONOMIC SCENARIO

The Little Rann of Kutch including the Wild Ass Sanctuary area was known for it's traditional salt production and various reference to support this 600 years old activity. During the British era, this activity increases manifolds. The britishers had established railways line, water tanks and even school for the children's of workers engaged there. The income generated was used by the British government to meet the substantial part of military expenses.

At presently the Little Rann of Kutch is inhospitable for human habitation. In the fringe or outskirt of saline low land is habituated by 108 villages having 52600facilies (CESC, 2008). Long the outskirts numerous developmental and infrastructural activities are proliferation. However, many of the local community are still dependent on substance farming and small scale animal husbandry. Some marginal communities till date are engaged in salt extraction and seasonal fishing. In agricultural practices, the major crops are Juwar and Bajra- staple food of the locals as well as patchy cultivation of pulses, oil seeds and cotton.

1.6. PROJECT BACKGROUND

The Govt. of India has acknowledged the importance of better road infrastructure and launched several programs and initiatives to extend and improve India's highway network. Road development is pivotal to sustain the country's economic growth. This is further reflected in the Ministry of Road Transport and Highways (MORTH) Road Development Plan: Vision 2021.

As part of the Govt's initiatives to further road development, the existing section of Junction with NH-47-Limbdi-Surendranagar, Dhrangadhra-Kuda the state of Gujarat has been considered for widening to two lanes with paved shoulders/four lane configuration.

Indian Academy of Highway Engineers (IAHE) has been entrusted with the development of this Project Road and mandated with the preparation of Detailed Project Reports.

1.7. PROJECT DESCRIPTION

The Project corridor that starts from SH-07 junction at Dharangadhra at km 67+106 (Existing km. 1+630) and end at Kuda village at km 85+040 (Existing km. 20+000) which is existing Major District Road.The Project Highway location is shown on Figure 1-2.

The development of the project highway is widening and strengthening of Dharangadhra - Kuda Section of NH-51 to Two Lane with Paved Shoulder from Ch. 67.106 to Ch. 85.040 (L=17.934 km) in the State of Gujarat on EPC Mode.

The Project Highway passes through a number of villages en-route. The important among them are Virendragarh and Kuda.

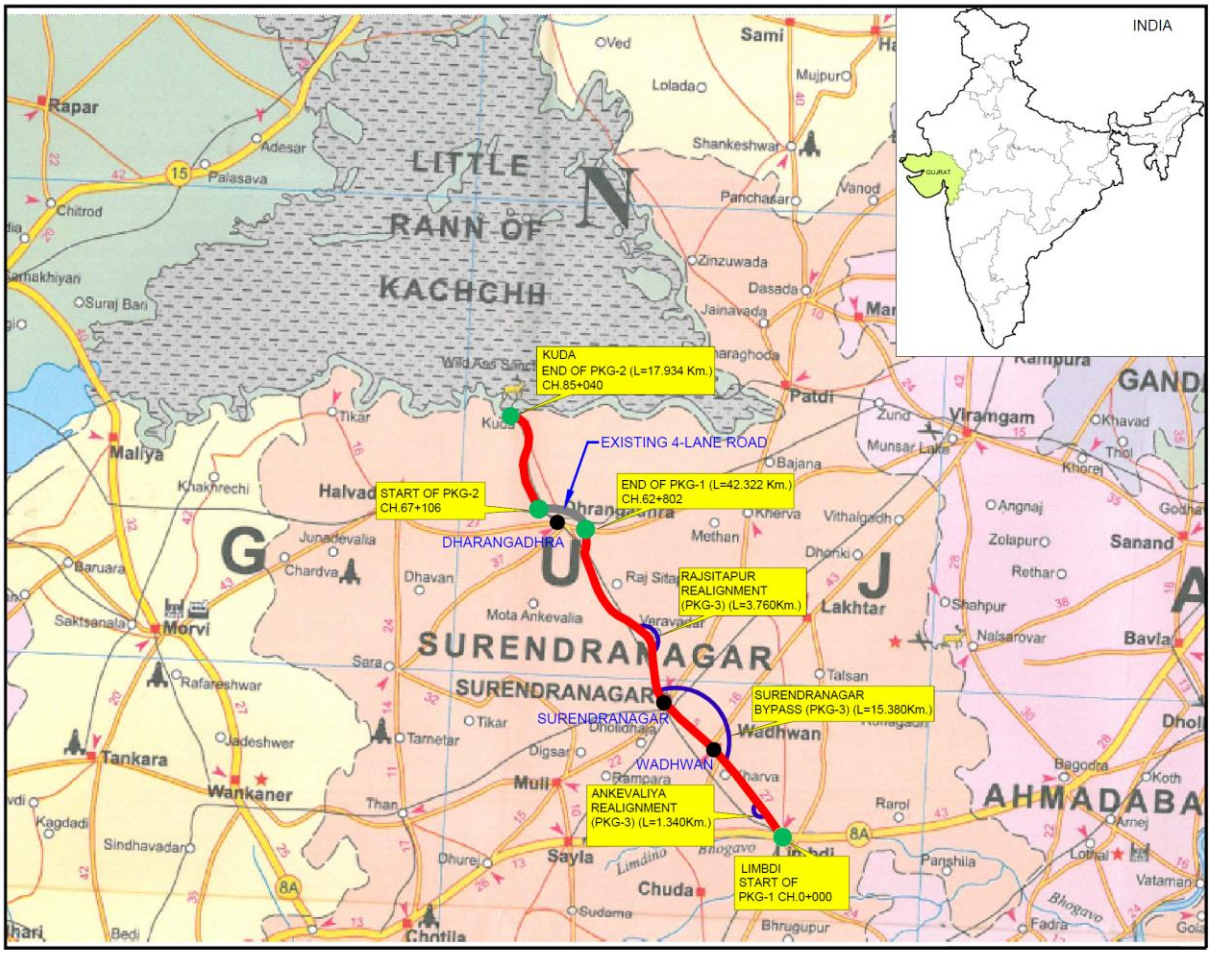


Figure 1-2: Location Map

Table 1-1: The Details of Existing and Proposed Right of Way (ROW)

Sl. No	Design Chainage		Design Length	Width (m)		
	From (m)	From (m)		Full Right of Way Available	Part Width Required(m)	
					LHS	RHS
i) Full Right of Way (full width)						
(a) Stretch	67+106	68+355	1249	24	-	-
	69+235	69+845	610	24	-	-
	70+165	70+865	700	24	-	-
	70+965	72+845	1880	24	-	-
	73+065	73+365	300	24	-	-
	73+515	73+805	290	24	-	-
	73+935	74+675	740	24	-	-
	74+975	75+305	330	24	-	-
	75+505	76+795	1290	24	-	-
	76+875	76+925	50	25	-	-
	77+765	79+465	1700	24	-	-
	79+575	80+185	610	24	-	-
	80+385	82+015	1630	24	-	-
	82+445	84+245	1800	24	-	-

Sl. No	Design Chainage		Design Length	Width (m)		
	From (m)	From (m)		Full Right of Way Available	Part Width Required(m)	
					LHS	RHS
ii) Part Right of Way (part width)						
(a)	68+355	68+705	350	24	3	15
	69+845	70+165	320	24	14	
	70+865	70+965	100	24		8
	72+845	73+065	220	24	4	4
	73+365	73+515	150	24		8
	73+805	73+935	130	24	8	
	74+675	74+975	300	24		11
	75+305	75+505	200	24		3
	76+795	76+875	80	24		2
	76+925	77+135	210	24		4
	79+465	79+575	110	24	6	
	80+185	80+385	200	24		7
	84+245	85+040	795	24		8
iii) Full Right of Way(Realignment)						
(a)	68+705	69+235	880	-	15	15
	77+135	77+765	630		15	15

1.8. DESCRIPTION OF TWO LANING WITH PAVED SHOULDER

Widening and Strengthening Dharangadhra-Kuda (up to existing Km 20.0) Section of NH-51 to Two Lane with Paved Shoulder from Ch. 67.106 to Ch. 85.040 in the State of Gujarat on EPC Mode. The proposed alignment within the sanctuary area will comprise of Main Carriage Way of 7 meters width which is same as the existing road followed by 1.5m paved shoulder on both the side and finally Earthen Shoulder of 2 meters wise. Thus the total width Roadways within Wild Ass Sanctuary is 14 meters.

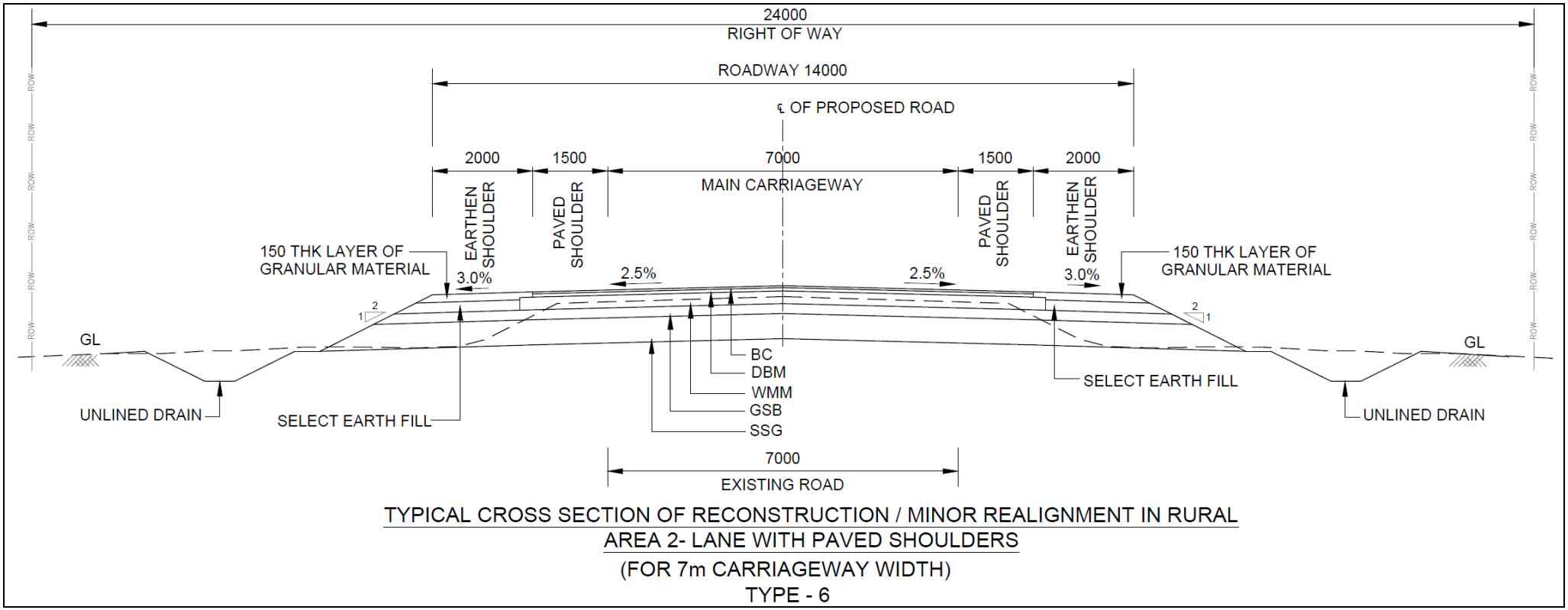


Figure 1-3: Typical Cross Section of Roadways width within Wild Ass Sanctuary

1.9. AREA DESCRIPTION

The proposed project road Dharangadhra-Kuda (Design Chainage Ch. 67.106 to Ch. 85.040) is located in the Surendranagar district, Gujarat. The part of the alignment from Chainage 79+700 to 85+040 traverse through Notified Wild Ass Sanctuary Area (Little Rann of Kutch) , for the Conservation of Indian Wild Ass *(Equus hemionus khur)* under ***"The Indian Wildlife (Protection) Act, 1972".*** This notified area which is falling within the Alignment is notified Protected Forest Under "The Indian Forest Act -1927 and The Forest (Conservation) Act, 1980 with Amendment Made in 1988. The proposed project will involve diversion of 8.252 Ha for Wild Ass Sanctuary land.

1.10. REQUIREMENT OF ROAD IMPROVEMENT

A. WAR ZONE AREA

The proposed project area has witness 1965 War with Pakistan. The Rann of Kutch had been battle field during 1965 war with Pakistan Army. The area due to wetland and water logged had contributed in winning the war and pushing back the enemies. The proposed alignment section is within 200 km (aerial distance) from Indo-Pak Boarder. This road improvement can be used as an alternative by Indian Army during emergency situation or war line situation with Pakistan.

B. CONTRIBUTION TO LOCAL MOVEMENT

The proposed route will improve the connectivity of the locals to the adjoining district. It will shorten the travel time to adjoining districts. It will also help the locals farmers to carry their agricultural products like vegetable to district markets and adjacent area.

1.11. BIODIVERSITY STUDY

A. ZONE OF PRIMARY IMPACT: PRIMARY SURVEY

The detailed study was carried out as an attempt to identify Flora & Fauna, the human wildlife interactions and people's perception dwelling within the Wild Ass Sanctuary. The field survey was carried in two phase, firstly to establish the need of the project within the Sanctuary area based on one to one interaction with the dwellers and their dependence on Sanctuary resource and secondly to established/correlate various species (Flora & Fauna) reported within the existing ROW and project impact zone (500 mts) from project boundary. The survey was also conducted to conform movement of Wild Ass within the project influence area and to records the incidence of animals kill due to vehicles plying on existing road.

1. Initial interaction survey of was carried out in two phases winter season- i.e 4th May 2016 to 7th May 2016.
2. Second survey was carried out in month of October (favorable season) from 23rd October 2017 to 27th October 2017.

Methodology Adopted:

To record the vegetation association in the study area and for vegetation classification and orientation, parallel line transects were laid in the project affected area. In the intensively studies area of the proposed alignment the transects of length varying between 3-4 kms each laid parallel at 250 -500 meters apart.

The species richness, density, abundance and frequency of flora were estimated with the help of 10m x 10m quadrate, with 2 replicate samples at every random selected point. Species richness index was calculated using Margalef's Richness Index (RI), with the following formulae:-

1. Density = $\frac{\text{Total no.of individuals of the species in all the sampling unit (S))}}{\text{(Total number of sampling units studied (Q))}}$

2. Frequency (%) = $\frac{\text{Number of quadrats in which the species occurred X 100}}{}$

Total number of quadrats studied

3. Abundance = Total number of individuals of a species in all quadrats
Total number of quadrats in which the species occurred

4. Margalef's Richness Index (RI) = (S-1)/ In N
Where, S = Total number of species.
N = Total number of individuals

These two interaction and survey involve primary data collection in the Wild Ass Sanctuary (WAS) area gathered through interviews, group meetings, informal discussions, vegetation transects, point & line survey for fauna and direct observation within the ROW (which is unbuilt) and 500 mts on both side of existing roads. One to one interaction with the people were also carried out with respect to animals casualty, hunting by the dwellers in side WAS , animals approaching the settlements during night time, animals poaching by outsiders, domesticated animals preyed by wild scavengers and human – animals conflict etc.

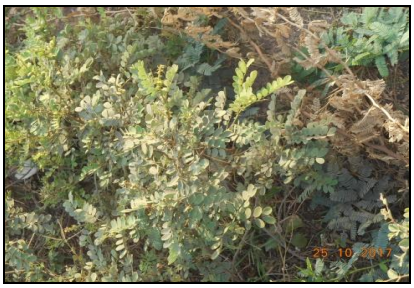
Species of Flora reported by Transect Methods:

To record the flora distribution of shrubs and trees along the proposed alignment, 1 km long transects were placed systematically from Narali village (79+750) within Wild Ass Sanctuary protected area towards end of chainage at Kuda Village (85+040). The vegetation is xerophytic dominated by exotic mesquite. Narali village on the southern fringe of the sanctuary is interspersed with agriculture fields and wasteland. The species of shrubs and trees reported during transects study of the proposed alignment are Prosopis juliflora, Prosopis cineria, Calotropis spp., Zizipus spp., Acacia jacquemontii, Acacia senegal, Acacia nilotica, Capparis decidua, Cassia auriculata, Salvadora oleoides, Maytenus emarginata, Commiphora wightii, Senna auriculata, etc.

Plate -1: Photograph of Species reported within proposed Alignment

Calotropis spp

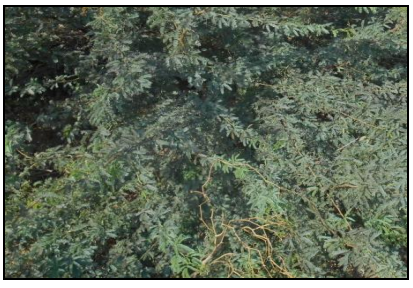
Cassia auriculata



Maytenus emarginata

Azadirachta indica

Capparis decidua



Prosopis juliflora

Acacia jacquemontii

Acacia nilotica

During the primary survey study was conducted for the grasses distribution and growth within the proposed right of way and within 100 mts. During the survey growth of grasses was mainly noticed under the mesquite. The distribution of grasses decreases as the distance from the base increased until it again increases with association with neighboring shrubs. The reasons of presence of grasses under the mesquite are animals grazing the grasses become unfavorable. During the transect survey for distribution of grasses the whole of the alignment was divided into 250 mts stretch with 250 mts stretch gap between to transect line. The species of grasses reported during the primary survey varies according to the soil type, location of water bodies, agricultural habitat and anthropogenic activities. The major portion of the project is wastelands with scattered growth of mesquite. Where water body like ponds, streams and river are noticed, the grass shows extensive growth with variation in species distribution. During primary survey the species of grasses reported in the scrubland within wildlife sanctuary with higher dominance of distribution area *Chloris barbata*, *Dactyloctenium aegyptium*, *Aristida spp., Eragrostis sp, Sporobolus sp, Aeluropus lagopoides, Cressa cretica etc.* The species with less distribution are *Suaeda nudiflora*, *Cyperus sp., Scirpus sp., Echinochloa colonum*, *Cyanodon dactylon*, *Blumea eriantha*, *Eragrostis ciliaris, Corchorus depressus, Suaeda nudiflora, etc.*

Plate 1A: Photograph of Grasses reported in the Proposed Project area

Imperata cylindrica

Cynodon dactylon

Sporobolus indicus

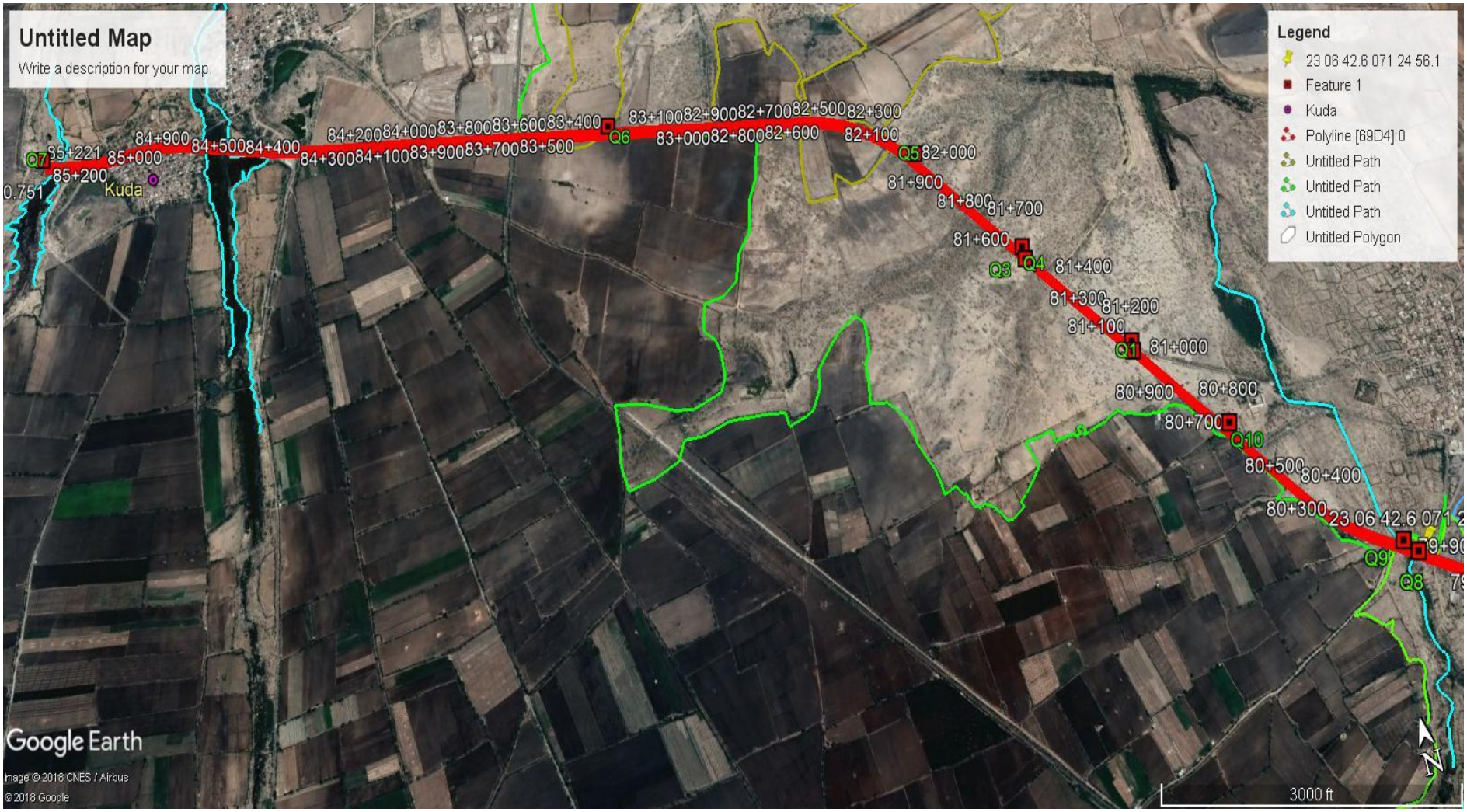
Solanum xanthocarpum

Chloris barbata

Dactyloctenium aegyptium

Species diversity Study by Quadrant Methods:

To study the species richness, density, abundance and frequency of flora within the PROW quadrant was laid of dimension 10m x 10m at random selected locations. The quadrant was laid on both the side of road to have an idea about species richness between two sides. About 11 Quadrant are laid and details of which is discussed in Table 1-2.



Quadrant Location **Sanctuary Boundary** **Proposed Road** **River & Stream**

Figure 1-4: Quadrant Sampling Location along the Prow within the Wild Ass Sanctuary

Table 1-2: Details of Quadrants location along the PROW

S. No	Quadrant Locations Details	Photographs of Quadrant Laid	Species Report
Q1.	**Chainage:** 81+030 Side: LHS **GPS Details:** Lat: 23º07'09.2N Long: 071º24'33.1´´E Elevation: 21m↑ Temperature: 41ºC	 	***Shrubs:*** *Prosopis juliflora, Cassia auriculata, Acacia nilotica, etc.* ***Grasses:*** *Aristida spp, Cynodon dactylon, Dactyloctenium aegyptium, etc.*    

S. No	Quadrant Locations Details	Photographs of Quadrant Laid	Species Report
Q2.	**Chainage:** 81+030 Side: RHS **GPS Details:** Lat: 23º07'09.5N Long: 071º24'33.3´´E Elevation:21m↑ Temperature: 41ºC	 	***Shrubs:*** *Prosopis juliflora, Acacia nilotica, etc.* ***Grasses:*** *Aristida spp, Cynodon dactylon, Eragrostis spp , etc.*    

S. No	Quadrant Locations Details	Photographs of Quadrant Laid	Species Report
Q3	**Chainage:** 81+500 Side: LHS **GPS Details:** Lat: 23º07'21.7N Long: 071º24'24.8´´E Elevation:18m↑ Temperature: 41.5ºC	 	***Shrubs:*** *Prosopis juliflora, Cassia auriculata, Acacia nilotica etc.* ***Grasses:*** *Aristida spp, Cynodon dactylon, Eragrostis spp , Scirpus sp., Eragrostis spp, Chloris barbata etc*    

S. No	Quadrant Locations Details	Photographs of Quadrant Laid	Species Report
Q4	**Chainage:** 81+530 **GPS Details:** Lat: 23º07'35.8N Long: 071º24'15.0´E Elevation:17m↑ Temperature: 42.2ºC	 	***Shrubs:*** *Prosopis juliflora, Acacia nilotica, Prosopis cineria etc.* ***Grasses:*** *Aristida spp, Cynodon dactylon, Imperata cylindrica., Solanum xanthocarpum, Sporobolus indicus, etc*    

S. No	Quadrant Locations Details	Photographs of Quadrant Laid	Species Report
Q5	**Chainage:** 82+030 **GPS Details:** Lat: 23º07'36.4N Long: 071º24'15.6´E Elevation:12m↑ Temperature: 42.8ºC	  	***Shrubs:*** *Prosopis juliflora, Prosopis cineria, Acacia nilotica etc.* ***Grasses:*** *Aristida spp, Cynodon dactylon, Imperata cylindrica., Solanum xanthocarpum, etc.*    

S. No	Quadrant Locations Details	Photographs of Quadrant Laid	Species Report
Q6	**Chainage:** 83+170 **GPS Details:** Lat: 23º07'49.3N Long: 071º23'38.2´E Elevation:17m↑ Temperature: 42.5ºC	 	***Shrubs:*** *Prosopis juliflora, Acacia nilotica Clatropis sp, Cassia auriculata, etc.* ***Grasses:*** *Aristida spp, Cynodon dactylon, Imperata cylindrica., Solanum xanthocarpum, etc.*    

S. No	Quadrant Locations Details	Photographs of Quadrant Laid	Species Report
Q7	**Chainage:** 85+155 **GPS Details:** Lat: 23º08'03.3N Long: 071º22'27.7´´E Elevation:23m↑ Temperature: 41.8ºC	 	***Shrubs:*** *Prosopis juliflora, Prosopis cineria, Zizipus spp., Acacia nilotica Clatropis sp, , etc.*    

S. No	Quadrant Locations Details	Photographs of Quadrant Laid	Species Report
Q8	**Chainage: 79+975** **GPS Details:** Lat: 23º06'42.6N Long: 071º24'56.1´E Elevation:15m↑ Temperature: 41.5ºC	 	***Shrubs:*** *Prosopis juliflora, Acacia nilotica , Prosopis cineria, Clatropis sp, Cassia auriculata, etc.* ***Grasses:*** *Aristida spp, Cynodon dactylon, Imperata cylindrica., Solanum xanthocarpum, Typha latifolia sp. etc.*    

S. No	Quadrant Locations Details	Photographs of Quadrant Laid	Species Report
Q9	**Chainage: 80+040** **GPS Details:** Lat: 23º06'43.9N Long: 071º24'54.5´E Elevation:16m↑ Temperature: 41.5ºC	 	***Shrubs:*** *Prosopis juliflora, Acacia nilotica , Prosopis cineria, Cassia auriculata, etc.* ***Grasses:*** *Aristida spp, Cynodon dactylon, Imperata cylindrica., Solanum xanthocarpum, Typha latifolia,Typha domingensis sp. etc.*    

S. No	Quadrant Locations Details	Photographs of Quadrant Laid	Species Report
Q10	**Chainage: 80+670** **GPS Details:** Lat: 23º06'59.3N Long: 071º24'40.1´E Elevation:21m↑ Temperature: 41.5ºC	 	***Shrubs:*** *Prosopis juliflora, Acacia nilotica , Prosopis cineria, Cassia auriculata, Salvadora oleoides etc.* ***Grasses:*** *Aristida spp, Cynodon dactylon, Imperata cylindrica., Solanum xanthocarpum, Typha domingensis sp. etc.*    

Table 1-3: Species Richness Calculation by Using Quadrant Methods

S.No	Plant Species	1	2	3	4	5	6	7	8	9	10	Total No. Of individual of species	Total No. of Quadrant of Occurrence	No. of Quadrant Studies	Frequency %	Density	Abundance	Richness Index
1	*Prosopis juliflora*	3	6	2	7	5	4	10	9	11	3	60	10	10	100	6	6	
2	*Prosopis cineria*	-	-	-	2	1	-	3	1	3	1	11	6	10	60	1.1	1.83	
3	*Salvadora oleoides*	-	-	-	-	-	-	-	-	-	1	1	1	10	10	0.1	1	
4	*Cassia auriculata*	1	-	3	-	-	3	1	2	3	2	15	7	10	70	0.7	2.14	
5	*Acacia nilotica*	5	1	2	3	7	3	2	2	6	3	34	10	10	100	1.5	3.4	
6	*Zizipus sp.*	-	-	-	-	-	-	2		-	-	2	1	10	20	0.2	2	
7	*Calitropis procera*	-	-	-	-	-	3	2	1	-	-	6	4	10	40	0.6	1.5	
	Total Number											129						

1.12. FAUNA

a. Methodology Adopted

Faunal survey was carried out by point count, call detection, line transect, walk through, etc. The survey was mainly carried out during the dawn (early morning) dusk (evening) as animals are most active during these hours.

Animal's movement, feeding ground, daily route of movement were also studied so as to propose animals underpass, if required. The density and area where it is frequently noticed were also recorded. The nesting patterns of birds, bats and small arboreal mammals were also taken care off.

Secondary information regarding animal's movement outside the Wild Ass Sanctuary near settlement was also noted. In the core zone area number of nest reported on the trees were also recorded. Even study was also targeted to records the avifauna approaching the roads in search of small grain size pebbles, which they consume for proper functioning of their gizzard.

b. The outcome of the study

Mammals

During primary survey the mammalian species directly sighted and recorded based on direct sighting, pug mark and consultation with villagers dwelling in the WAS boundary are given in Table 1-4.

Table 1-4: List of Mammalian Species Reported during Primary Survey

S. No	Common Name	Scientific Name	Survey method	Wild/ Domesticated	Reported Area	IWPA-72 Schedule
1.	Gazelle	*Gazella bennetti*	Interaction with locals	Wild	LRK	I
2.	Indian Wild Ass	*Equus hemionus khur*	Interaction with locals	Wild	Study area	I
3.	Camel	*Camelus bactrianus*	Interaction with Locals	Domesticated	Study area	-

S. No	Common Name	Scientific Name	Survey method	Wild/ Domesticated	Reported Area	IWPA-72 Schedule
4.	Bluebull	Boselaphus tragocamelus	Walk through	Wild	Agricultural Field Study area	
5.	Desert Fox	*Vulpes vulpes pusilla*	Interaction with locals	Wild	Study area	I
6.	Indian Fox	*Vulpes bengalensis*	Interaction with villagers	Wild	Study area	II
7.	Wild Boar	Sus scrofa	Sighted	Wild	River bank	
8.	Small Indian mongoose	*Herpestes javanicus*	Line Transect	Wild	Agricultural Area	II
9.	Sheep	*Ovis aries*	Line transect	Domesticated	Villages	-
10.	Goat	*Carpra*	Point & line	Domesticated	Villages	-
11	Wolf	*Canis lupus*	Interaction with locals	Wild	Study area	I
12.	Indian civet	*Viverricula indica*	Interaction with locals	Wild	Study area	II
	Black buck	*Antilope cervicaprais*	Interaction with locals	Wild	Study area	I

Among the mammals reported during the primary survey goats, sheep, cows are most dominance species in wild as well as domesticated. The villages residing in the Wild Ass Sanctuary boundary are found of animal's husbandry as source of income. The raise large herds of domesticated animals and leave them in the wild to graze LRK grasses, herbs, leavers of small trees as fodder. Due to presence of large number of domesticated mammals the sanctuary is under threat due to over grazing. The villagers during primary interaction also mention that wild animal's approach the villages during the night time in search of food. Wild animals are also reported in the field mainly to graze the farms. Herbaceous wild mammals are commonly reported when fruiting of ground nuts took place. In the recent past no Wild Ass were reported near the villages, sanctuary area and agricultural field along the proposed project.

Avifauna:

To record the avifaunal distribution in the PROW area and in buffer zone of proposed project, survey was carries out at dawn and dusk using various survey methods as discussed previously. Even interaction with DCF (WL) WAS office was also consulted in this regards. Consultations with villagers residing in the WAS area were also carried out. The survey methods adopted for avifaunal study were: The Google image showing the location of Transect & Point Count locations are shown in Figures 5 & 6

1. Point Count Methods: Observer records all the birds seen and heard from a point count station for a set period of time. They record the species sighted or call heard.

2. Transect Method/Walk Through Method: In this method the observer walk through the selected or fixed path (Transect) for appropriate length. And records all the species reported. A transect of 500mts was drawn with intermediate distance of 500 meters between to transect. While walking along transect the observer records all the species reported.

Nest Monitoring: The observer inspects the trees and records the number of nest with species reported. The observer records number of eggs, young's, etc.

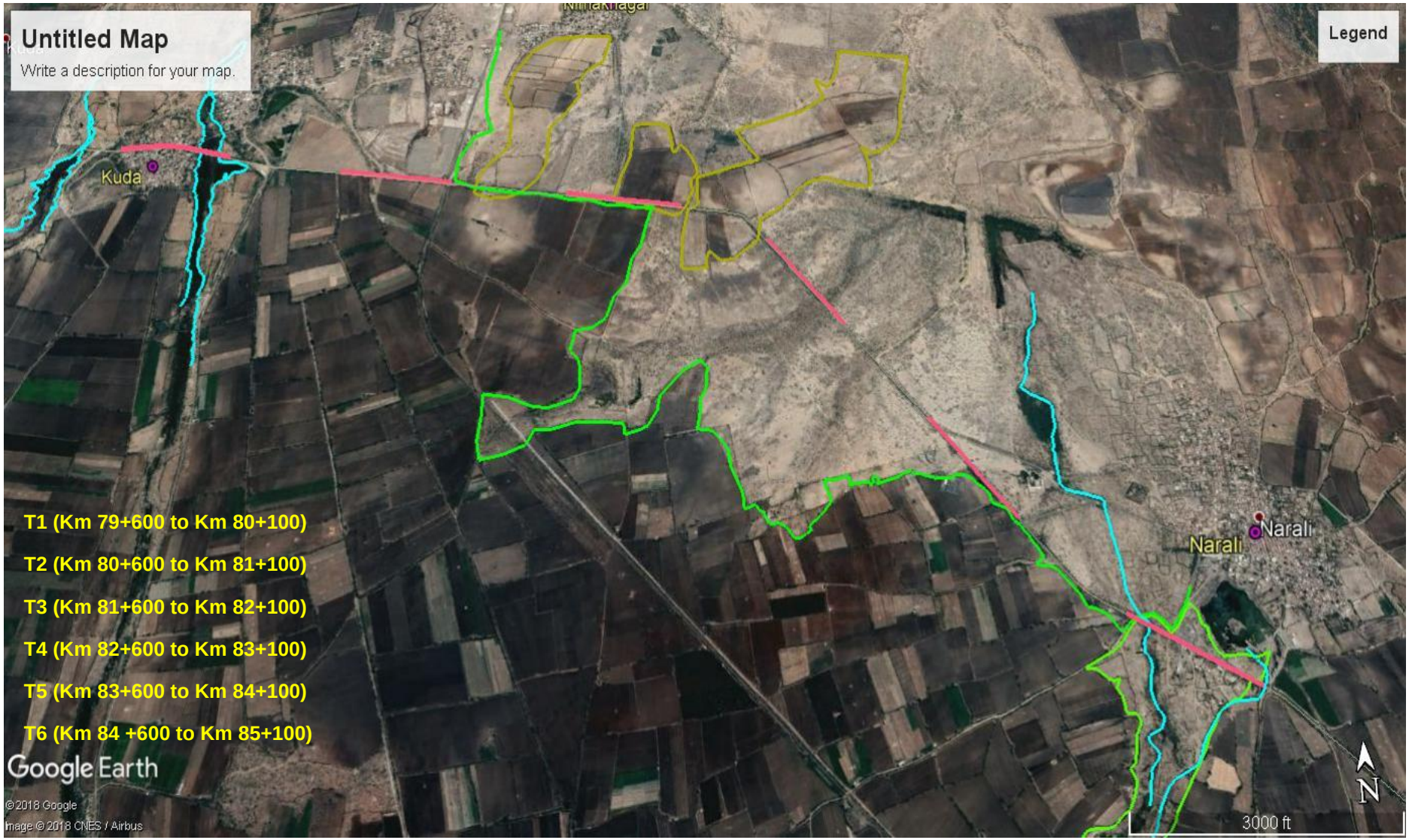


Figure 1-5: Location of Transect Study of Avifauna

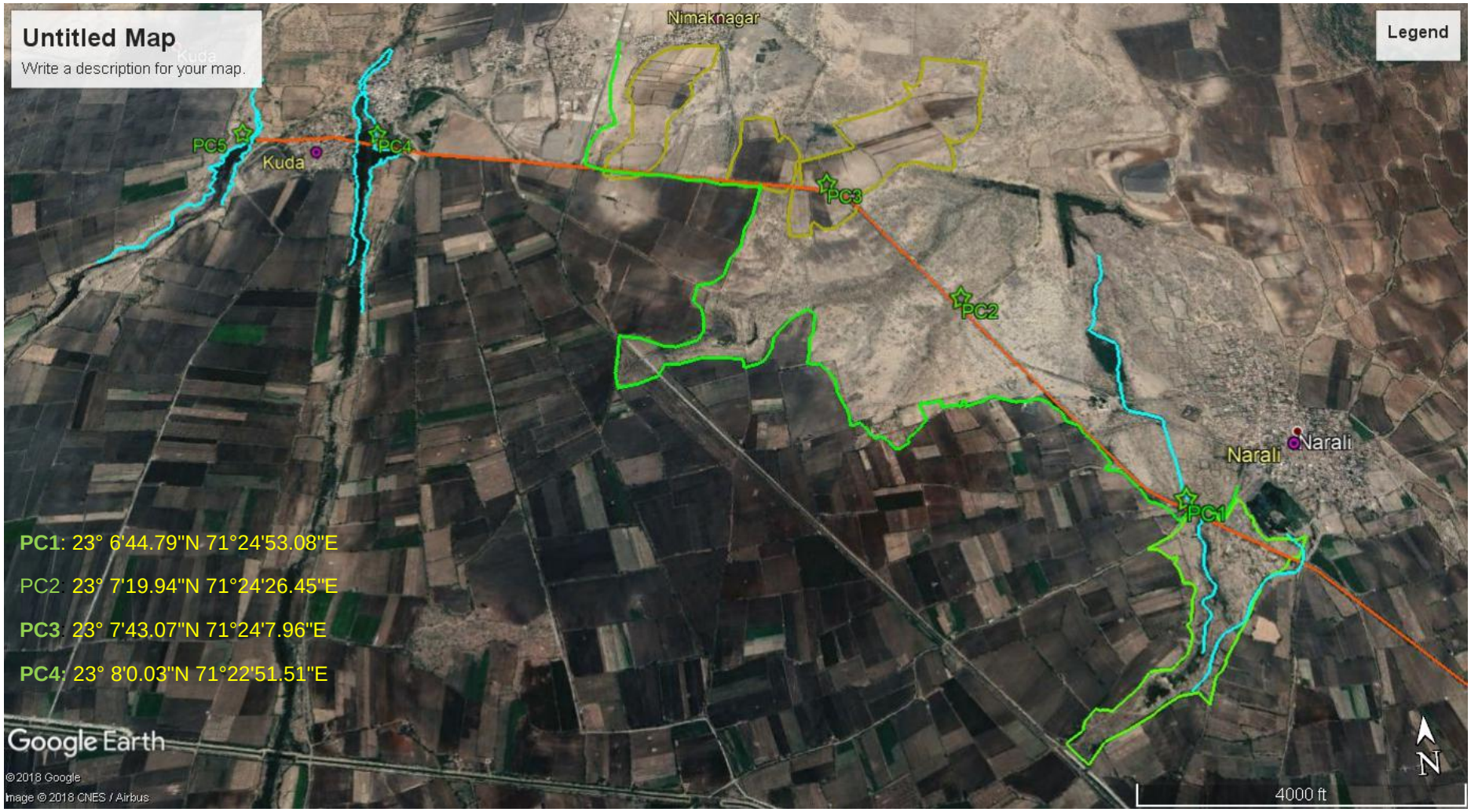


Figure 1-6: Location of Point Count Study Method for Avifauna

Table 1-5: List of Avifauna Reported In study Area

S. No	Common Name	Scientific Name	Study Method	Schedule as per IWPA/IUCN Red Data Book
1.	Common Crow	*Corvus splendens*	Spot/Transect	Sch. –V/ IUCN -LC
2.	Spotted Dove	*Spilopelia chinensis*	Transect	Sch. –IV/IUCN -LC
3.	Sparrow	*Passer domesticus*	Transect	Sch.-IV/IUCN – LC
4.	Ring Dove	*Streptopelia capicola*	Spot Count	Sch.-IV/IUCN LC
5.	Rock Pigeon	*Columba livia*	Spot Count	Sch- IV/IUCN – LC
6.	Pied Myna	*Gracupica contra*	Transect	Sch.- IV/IUCN – LC
7.	Common Myna	*Acridotheres tristis*	Spot Count	Sch.- IV/IUCN – LC
8.	Brahminy Myna	*Sturnia pagodarum*	Transect	Sch.- IV/IUCN – LC
9.	Bank Myna	*Acridotheres ginginianus*	Transect	Sch.- IV/IUCN – LC
10.	Cattle Egret	*Bubulcus ibis*	Transect	Sch.- IV/IUCN – LC
11.	Pond Heron	*Ardeola grayii*	Transect	Sch.- IV/IUCN – LC
12.	Green Bea Eater	*Merops orientalis*	Transect	Sch.- IV/IUCN – LC
13.	Red Wattled Lapwing	*Vanellus indicus*	Transect	Sch.- IV/IUCN – LC
14.	Paddy Finch	*Anthus rufulus*	Transect	Sch.- IV/IUCN – LC
15.	Crested Lark	Galerida cristata	Transect	Sch.- IV/IUCN – LC
16.	Common House martin	*Delichon urbicum*	Transect	Sch.- IV/IUCN – LC
17.	Black Drongo	*Dicrurus macrocercus*	Transect	Sch.- IV/IUCN – LC
18.	Weaver Bird	*Ploceus philippinus*	Spot Count	Sch.- IV/IUCN – LC
19.	Zebra Finch	*Taeniopygia*	Transect	Sch.- IV/IUCN – LC
20.	Red Vented Bulbul	*Pycnonotus jocosus*	Spot Count	Sch.- IV/IUCN – LC
21.	Indian Robin	*Saxicoloides fulicatus*	Spot Count	Sch.- IV/IUCN – LC
22.	Indian Roller	*Coracias benghalensis*	Transect	Sch.- IV/IUCN – LC
23.	Laughing Dove	*Spilopelia senegalensis*	Transect	Sch.- IV/IUCN – LC
24.	Isabellin wheatea	*Oenanthe isabellina*	Transect	Sch.- IV/IUCN – LC
25.	Common Babbler	*Turdoides caudata*	Transect	Sch.- IV/IUCN – LC
26.	Pied king fisher	*Ceryle rudis*	Transect	Sch.- IV/IUCN – LC
27.	Oriental Magpie	*Copsychus saularis*	Transect	Sch.- IV/IUCN – LC
28.	Sand Lark	*Calandrella raytal*	Transect	Sch.- IV/IUCN – LC
29.	Darter	*Anhinga sp.*	Spot Count	-
30.	Laughing Dove	*Spilopelia senegalensis*	Transect	Sch.- IV/IUCN – LC
31.	Tylor Bird	*Orthotomus sutorius*	Transect	Sch.- IV/IUCN – LC
32.	Blue cheeked bee eater	*Merops persicus*	Transect	Sch.- IV/IUCN – LC
33.	Sandpiper	*Limnodromus scolopaceus*	Transect	Sch.- IV/IUCN – LC
34.	Lesser Sand pover	*Charadrius mongolus*	Transect	Sch.- IV/IUCN – LC
35.	Common Wood shrike	*Tephrodornis pondicerianus*	Transect	Sch.- IV/IUCN – LC
36.	Great Egrets	*Ardea alba*	Transect	Sch.- IV/IUCN – LC
37.	Little Egret	*Egretta garzetta*	Transect	Sch.- IV/IUCN – LC
38.	Little stint	*Calidris minuta*	Spot Count	Sch.- IV/IUCN – LC
39.	Paddy field pipet	*Anthus rufulus*	Transect	Sch.- IV/IUCN – LC
40.	Rose ring parakeet	*Psittacula krameri*	Spot Count	Sch.- IV/IUCN – LC
41.	Pallied harrier	*Circus macrourus*	Secondary source	IUCN - NT
42.	Lesser flamingo	*Phoeniconaias minor*	Secondary Source	IUCN – NT
43.	Common Crane	*Grus grus*	Secondary Source	Sch.- IV/IUCN – LC

NT: Near Threatened; LC: Least Concern

PLATE -2: PHOTOGRAPHS OF BIRDS REPORTED DURING STUDY

		
Limnodromus scolopaceus	**Anthus rufulus**	**Oenanthe isabellina**
		
Spilopelia senegalensis	**Apus nipalensis**	**Bubulcus ibis**
		
Ardeola grayii	**Dicrurus macrocercus**	**Merops orientalis**
		
Vanellus indicus	**Platalea leucorodia**	

		
Copsychus saularis	**Egretta garzetta**	**Ardea alba**
		
Sturnia pagodarum	**Psittacula krameri**	**Ceryle rudis**

Reptiles:

During primary survey only garden lizard was reported. Other reptiles were reported based on secondary interaction with the locals and farmers. Lizard like Patla Gho, Kutch Rock Gecko, Desert Monitor Lizard, Spiny Tailed lizard, Sanda, Flat tailed lizard, Starred tortoise, water turtle etc. are noticed. Among snakes species reported are Black Krait, Black Cobra, Russel Viper, Saw Scaled Viper, Sea Snakes, etc. The non-poisonous snakes commonly reported are Python, Sand Boa, Rat snakes, Royal snakes, etc.

1.13. MOVEMENT CORRIDOR OF ANIMALS

No well-established animal movement corridors have been reported. Survey was carried out during day and night time to records the animals crossing at dawn, at dusk and peak hours of day. Interactions with locals in all the villagers were carried out residing near the RoW area. No defined or fixed route was noticed by the locals. They reported that animal's movement is not fixed. Care will be taken that during design and implementation phase, proper animal's underpass is provided in consultation with the DCF WAS office. Sign Board where ever required will be provided. Appropriate speed regulator will be provided to prevent animals' casualty if they approach the roads during night time.

1.14. PROJECT AREA REQUIREMENT

The proposed construction and upgradation of existing road to two lanes with paved shoulder configuration involved diversion of 20.13 Ha, comprising protected forest and Wild Ass Sanctuary Area. Out of the total area about ***8.252 Ha*** of lands belongs to Wild Ass Sanctuary Area, which need diverted for Diversion.

1.15. IMPACT ASSESSMENT STUDY

Based on the baseline study carried out within the WAS area and seeing the magnitude of the project Impact has been identified. To minimize the predicated impacts mitigation measures has been proposed.

1. Impact during Preparation Phase of the project:
2. Impact during Construction Phase of the Project
3. Impact during Operation Phase of the Project.

1. IMPACT DURING PREPARATION PHASE OF THE PROJECT

a. Establishment of Labours Camps

Mostly Local labours will be employed, for semi – skilled and highly skilled labours, labours camps will be established outside the Sanctuary boundary near the settlements.

Mitigation Measure: The location of the labour camps will be far away from the Sanctuary Boundary. It will be identified in consultation with the DCF (WAS) office. No camping even temporary will be allowed within the WAS boundary.

b. Movement of Heavy Vehicles or Machineries

To start the construction work, during planning phase heavy vehicles and machinery will be mobilized to the store yard. This uncontrolled movement within the WAS on existing roads may leads to animals casualty or disturbance due to noise generated during the night time.

Mitigation Measures: During preparation phase, all the heavy vehicles will be moved to the material stack yard by the alternative route available in the study area. If no such routes are available, all care will be taken during the plying, speed limits will be as per park area norms. No night time movement of vehicles will be allowed.

c. Stacking of construction materials

Stacking of construction material during preparation phase, in the project area may leads to animal's ill effect, if it contains hazardous material.

Mitigation Measures: No staking of material will be anticipated within the WAS boundary during preparation and construction phase of the project. Finished material, ready to be used will be brought to the construction site. All the left over material will be carried back to the stack yard during night time.

d. Setting of Hot Mixed Plant

The fumes and debris of hot mixed plant may affect the flora and fauna of the WAS. Animal casualty may be anticipated if they approach the Hot Mix Plant site. Animals may get stick to the hot bituminous if left uncovered.

Mitigation Measures: The location of the hot mixed plant will be as per the guideline for setting of hot mixed plant as mention in the Environment Protection Act 1986. The minimum distance at which it will be located will be 1km from WAS boundary. Permanent/temporary walls will be erected surrounding the hot mixed plant site and stack yards. Guards will be employed which will supervise the stack yard area.

e. Resource identification before start of Work

No raw materials like quarry stones, earth material required for road material, fire woods to fire hot mix plants, fuel woods for labours, herbs or wild vegetables, fruits, seed, nuts will be bought from the locals villagers sourced from the WAS area. Care should be taken that no wild meats consumption are allowed in the labours camps and as working labours. A noticed should be send form the DCF (WAS) as warning in this regards to labour camps, highlighting the punishment under the wildlife (Protection) Act-1972.

2. IMPACT DURING CONSTRUCTION PHASE:

Major impacts anticipated during the construction phase, when cutting, levelling, pressing, filling, eraction of culverts and bridges will be carried out. It will involve increase in plying of vehicles, increase in noise level due to vehicles movement; cutting, pressing, aerial lighting during night time, operation of D.G sets, etc.

Mitigation Measures: All the work will be carried under regulated and controlled condition. No night time work or aerial lighting will be allowed, no night time camping in the DNP area will be allowed, even discard

of food and drinks material which can attract the animals or choke the animals intestine will be allowed in open. The contractor should have van in which the labours will have their food and left over will be discarded at the designated landfill site. The local labours will carry away the leftover food, plastic and other items along with themselves or the contractor should provide dustbins, which will be carried away at the end of work every day.

All the cutting, drilling, blasting if required will be carried in the presence of experts. All the D.G sets operating in the WAS area should have noise enclosure and thickly padded to prevent vibration generated. There should be daily noise monitoring carried out 1 meter distance form D.G sets location. The monthly report of which should be submitted to the DCF office. The speed limits of all the vehicles should be within the Norms as laid down by the DCF Wild Ass Sanctuary. There should be training of all the drivers in this regards and helper should be provided on each vehicles to see if no animals are near the roads or are crossing the roads.

If young once of animals are reported or noticed during excavation of earth, it should be quickly handover to the WAS office or guards available in WAS area. The phone number of all the official of WAS official should be there with supervisor.

The best way of construction should be such that the contractor should hire an individual in consultation with the DCF, who should act as independent supervisor and report daily on phone to the DCF (WAS) through phone. He should be free from any type of interference from the contractor and should be available at the construction site. He should submit independent progress report to the DCF WAS monthly. He should be trained by the DCF office on need to need basis.

3. IMPACT DURING OPERATION PHASE:

The anticipated impact expected during operation phase will be continuous if not mitigated the mitigation are as follows:

a. No Honk signboard should be provided inside the WAS area.

b. No Discard of waste, plastic, food signboard should be provided in the WAS area.

c. Speed limit and speed regulator and speed check instrument should be installed inside the WAS. The Guard at check post should fine such person on over speeding, on regular basis.

d. Green Planation along the RoW should be carried and Budgets of plantation and maintenance be paid by the contractor.

e. Animals crossing hooding should be placed and speed breaker be erected ahead of such locations.

f. No night time plying is allowed until under emergency condition and travelling/tourist coming from different state.