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Nablus– Jenin Highway Project: EA in Relation to Biodiversity in the Corridor Areas Passing through Asira Ash–Shamaliya–Al Badhan (AASAB) and New Um At–Tut (NUAT).

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Jenin-Nablus Highway Project: Environmental Assessment in Relation to Biodiversity (2nd Draft)

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A. Existing Conditions: Baseline data

The project's area is located in the Mediterranean plant geographic territory (M). Since flora and fauna are largely determined by geographic conditions, plant geographic regions, to a certain degree, resemble animal geographic regions in their extent and borders. However, animals are capable of locomotion and this is demonstrated in the often-transient character of zoogeographic borders.

The vegetation that covers the project's area (most of the mountains and hills, and internal plains of Jenin and Nablus) is composed of the principal plant communities that make up the units maquis and forests (cover the central mountain range and hills) which include tree groups such as *Quercus calliprinos* and *Pistacia palaestina* accompanied by *Rhamnus palestinus* and *Sarcopoterium spinosum*, and park forests of *Ceratonia siliqua* and *Pistacia lentiscus* (cover foot of the central mountain range of the area).

Endemic and Endangered plant species present in the study area:

The flora of Palestine includes 149 endemic species (belonging to 30 families) of which 43% are common, 27.5 rare, and 25.6 % very rare. About 50% of the endemics are restricted to the Mediterranean area; some of these endemic species are restricted to single geographical locations. For example *Ferula samariae* is found in a single geographical location in Wadi Al-Badhan north of Nablus. In the West Bank, surveyed endemic species were estimated to be 51, most of them (21%) belong to Compositae. Twelve species of the endemics were found to be very rare. Of these species the following are present in Nablus highlands (*Iris lorteti*, *Phlomis platystigia*). Total number of rare species in the West Bank is 195 of which 57 are found in the Nablus and Jenin highlands. Number of rare species is 40 in Nablus district and 1 in Jenin district, about half of these species are expected to exist in the project area. Names of endangered plant species present in the Jenin and Nablus highlands are listed in Table 1.

Table 1. List of "red plant" in the Nablus and Jenin highlands:

1. <i>Adonis aestivalis</i>	20. <i>Ferula orientalis</i>	39. <i>Mericalpaea ciliata</i>	58. <i>Romulea columnae</i>
2. <i>Allium albotunicatum</i>	21. <i>Gagea villosa</i>	40. <i>Michauxia campanuloides</i>	59. <i>Rosa phoenicia</i>
3. <i>Allium sindjarense</i>	22. <i>Galium canum</i>	41. <i>Neotinea maculata</i>	60. <i>Salvia syriaca</i>
4. <i>Arenaria deflexa</i>	23. <i>Galium chetopodium</i>	42. <i>Nonea melanocarpa</i>	61. <i>Scrophularia heirochuntena</i>
5. <i>Bellevalia longipes</i>	24. <i>Gastrium ventricosum</i>	43. <i>Onosma gigantea</i>	62. <i>Sedum palaestinum</i>
6. <i>Bunium paucifolium</i>	25. <i>Hydrocotyle ranunculoides</i>	44. <i>Ophrys apifera</i>	63. <i>Silene grisea</i>
7. <i>Bupleurum brevicale</i>	26. <i>Hyoscyamus albus</i>	45. <i>Orbanche lavandulacea</i>	64. <i>Silene macrodonta</i>
8. <i>Callipeltis factorovskyi</i>	27. <i>Hypericum hircinum</i>	46. <i>Orbanche palaestina</i>	65. <i>Silene swertiifolia</i>
9. <i>Celtis australis</i>	28. <i>Iberis odorata</i>	47. <i>Orbanche pubescens</i>	66. <i>Sparganium erectum</i>
10. <i>Centaurea sinaica</i>	29. <i>Iris haynei</i>	48. <i>Orchis laxiflora</i>	67. <i>Tetragonolobus requienii</i>
11. <i>Centaurea speciosa</i>	30. <i>Iris lortetii</i>	49. <i>Orchis laxiflora</i>	68. <i>Teucrium montbretii</i>
12. <i>Centaureum erythraea</i>	31. <i>Kickxia judaica</i>	50. <i>Orchis punctulata</i>	69. <i>Teucrium spinosum</i>
13. <i>Cephalaria syriaca</i>	32. <i>Lachnophyllum noeanum</i>	51. <i>Paliurus spina-christi</i>	70. <i>Trigonella spicata</i>
14. <i>Corchorus olitorius</i>	33. <i>Linaria triphylla</i>	52. <i>Phlomis platystegia</i>	71. <i>Tuberaria guttata</i>
15. <i>Crataegus azarolus</i>	34. <i>Lisaea strigosa</i>	53. <i>Phyllitis sagittata</i>	72. <i>Turgenia latifolia</i>
16. <i>Crepis micrantha</i>	35. <i>Lupinus micranthus</i>	54. <i>Phyllitis scolopendrium</i>	73. <i>Typha latifolia</i>
17. <i>Cyperus flavidus</i>	36. <i>Lysimachia dubia</i>	55. <i>Poa trivialis</i>	74. <i>Verbascum galilaeum</i>
18. <i>Daucus gattatus</i>	37. <i>Medicago constricta</i>	56. <i>Populus euphratica</i>	75. <i>Viola modesta</i>
19. <i>Equisetum ramosissimum</i>	38. <i>Melilotus italicus</i>	57. <i>Reichardia intermedia</i>	76. <i>Xeranthemum cylindraceum</i>

Nature reserves and biodiversity rich areas in the study area:

Main natural areas identified as ecologically highly significant (EHSN) and sensitive areas and ecosystems present in the study area that the proposed project will affect include: Planted Pine Forest at Jenin City Southern Entrance; New Um El - Tut (Jn3); Sir-Misiliah; Asseereh El Shamaliyeh-El Badhan (N2); Al-Fara'a East (Jn6). Aqqaba South (Jn5). Classification of these open spaces was carried out in accordance to the following criteria: presence of an exceptional habitat and / or biological communities; richness in biological diversity; presence of a habitat of limited representation; presence of rare and / or endangered species; vulnerability; and distance from human settlements. The identified EHSN are important for the protection of biodiversity and for recreational needs. According to the Oslo Agreement, all of the existing reserves and forests should be protected. This most likely includes all above mentioned nature reserves and rich biodiversity areas.

Wildlife in the Jenin and Nablus districts is limited and sensitive to land use changes. Common mammals species present in these areas include hedgehogs, gazelle, hyaena, rabbits, antelopes, bats, and others. Several species of birds also exist in the area including resident, winter visitors, summer visitors, migrant, or vagrant birds. Some of the listed wild birds include osprey, black francolin, golden eagle, honey buzzard, barn owl, eagle owl, sparrow hawk, and goshawk. More than 40 species of reptiles are expected to exist in the study area and are represented by two orders: Chelonia that includes turtles, and Squamata, which includes lizards and snakes. In addition, thousands of species of insects and other invertebrates exist in the study area.

El-Fara'a East (Jn6)

Location: North-west of Nablus city; coordinates: x= 183, y= 187; approximate size 1000 dunoms; 100-200 m above sea level; annual rainfall: 450-500 mm; ecosystem type: Mediterranean forest; designated natural site of national importance; important biological features of the ecosystem: habitat for endangered species, and for breeding and nesting for several species.

Natural area located about 2 km west of Tammoun village at the periphery of Tammoun Nature Reserve, and about 0.5 km southeast of the Fara'a refugee camp. The area receives the remaining water flow of the Fara'a stream. It represents a transition between Mediterranean territory and the Irano-Turanian territory. Several wild plant species grow here including *Ceratonia siliqua*, *Crataegus aronia*, *Quercus calliprinos*, *Calycotome villosa*, *Retama raetam*, *Pistacia lentiscus*, *Ziziphus spina-christi* and others. This area can be considered as a wetland since it remains wet for a long period of time. It supports several other plant species adapted to such environment. In addition, several wild animal species live in this area which can be attributed to the availability of stream water most of the year.

Aaqaba South (Jn5)

Location: Southeast of Jenin city; coordinates: x= 183, y= 194; area= 2,000 dunoms; altitude: 400-500 above sea level; annual rainfall= 450-500; ecosystem type: Mediterranean forest; designated natural site of national importance; important biological features of the ecosystem: habitat for endangered species, and for breeding and nesting for several species.

Located 0.5 km south of Aqqaba village, about 2 km north -west of Tubas, and 3 km east of Jadida village. Vegetation and wildlife resources are similar to those of New Um-Tut (Jn3). However, *pinus halapensis* seems to dominate the plant cover.

Sir–Misilya (Jenin)

Location: extends east west between Al-Kufair and Misiliah villages, and located north of Sir village and south of Alzababidah; area= 2000-2500 dunums; annual rainfall= 500 mm; altitude: 400–600 m above sea level; ecosystem type: Mediterranean forest; natural site of national importance; important biological features of the ecosystem: habitat for endangered species, and for breeding and nesting for several species.

Vegetation and wildlife resources are similar to those of New Um-Tut (Jn3). However, *Quercus caliprinos*, *Ceratonia siliqua*, *Pistacia lentiscus*, *Pistacia palaestina* seem to dominate the plant cover.

This area needs further investigation since it was not surveyed in the MOPIC study, because it was inaccessible and partly used as a military base when the MOPIC survey had been carried out.

New Um-Tut

Location: south east of Jenin city; coordinates: x= 179, y= 205; area= 7,000 dunums; altitude: 300-400 m above sea level; annual rainfall= 450-500; ecosystem type: Mediterranean forest; designated natural site of national importance; important biological features of the ecosystem: habitat for endangered species, and for breeding and nesting for several species.

Located in the Mediterranean territory West of Um El Tut (south east of Jenin). Its area is about 600 dunoms. *Pinus halapensis*, *Quercus calliprinos*, *Ceratonia siliqua*, *Pistacia lentiscus*, *Phillyrea media*, *Pyrus syriaca*, *Pistacia palaestina*, *Styrax officinalis*, *Crataegus azarolus*, *C. aronia*, and *Laurus nobilis* and grow in this area. Several companion shrubs and semi - shrub plants are also present. In addition several species of wild animals, have been observed here.

Main shrub and semi - shrub companions include *Clematis cirrhosa*, *C. flammula*, *Inula viscosa*, *Tamus communis*, *Prosopis farcta*, *Lonicera etrusca*, *Cistus salviifolius*, *C. creticus*, *Salvia fruticosa*, *Rubia tenuifolia*, *Anagyris foetida*, *Calycotome villosa*, *Smilax aspera*, *Phlomis viscosa*, *Ephedra campyloppda*, and *Ruscus aculeatus*.

Some species of wild mammals also live in this area including: the hyena, *Hyaena hyaena syriaca*, Mountain gazelle, *Gazella gazella*; wolf, *Canis lupus pallipes*; red fox, *Vulpes vulpes palestina*; wild hare, *Lepus capensis syriacus*; wild boar, *Sus scrofa libicus*; hedgehog, *Erinaceus europaeus concolor*; jackal, *Canis aureus lupaster*; Egyptian mongoose, *Herpestes ichneumon ichneumon*; Syrian squirrel, *Sciurus anomalus syriacus*; Porcupine, *Hystrix indica indica*; and badger, *Meles meles canesens*. Certain species of reptiles, rodents, and birds have been observed here.

Planted Pine Forest at Jenin City Southern Entrance

Located near Al-Shuhada triangle close to the southern entrance of Jenin City. It has an area of about 150 dunoms. It is mainly an old pine and cupressus forest that was planted towards the beginning of this century.

Asseereh El Shamaliyeh-Al Badhan

Location: North-east of Nablus city; coordinates: x= 179, y= 185; area= 2,500 dunums; altitude: 400-500 m above sea level; annual rainfall= 500-600; ecosystem type: Mediterranean forest, and wetland; designated natural site of national importance.

Located north east of Nablus. Its area is about 2000 dunoms. Wild plants like *Ceratonia siliqua*, *Pistacia lentiscus*, *Pinus halapensis*, *Q. calliprinos*, *Pyrus syriaca*, *Styrax officinalis*, *Crataegus aronia*, *Prosopis farcta*, *Capparis spinosa*, *Anagyris foetida*, *Calycotome villosa*, *Rhamnus palaestinus*, *Salvia fruticosa* and others grow there. Several streams are present in the area. In addition, several wild animals like hedgehog, wild hare, hyrax, red fox, porcupine and others have been observed there. The lower parts of this area are a freshwater wetland and therefore host many species of aquatic plants, and aquatic birds and other animals. It serves a variety of natural service functions for other ecosystems and for people.

The general nature of the project's impact on ecosystems include deforestation, flooding, changes in hydrologic regimes, facilitation of human access to these areas, vehicle traffic and noise.

B. Environmental Impacts

The significance of likely negative impacts relative to:

Total area of ecosystem type in region and/or country: The project will destroy approximately 700 - 800 dunoms (0.2 - 0.3 %) of nation's remaining Mediterranean forest ecosystem. It will destroy 2.4 - 22 % of the nature reserves and EHSN in the project's area. Destruction and fragmentation of wildlife habitats, and disturbance inflicted on the remaining habitats will be too great. Hunting of birds and animals near the road alignment will also increase.

Cumulative effects and trends for ecosystem: Mediterranean forest ecosystem area is being lost in the country at an annual rate of 1 percent a year; this project and other possible projects in the coming 5 years for the study zone, will involve a total of 7 percent of the remaining area. Note that the area of declared nature reserves 469,000 dunoms in the West Bank constitutes about 5.7 % of the West Bank area.

Construction related impacts

Threatened and endangered species: It is expected that many of the species listed as red plant in the Nablus and Jenin highlands are present in the areas designated as nature reserves located in the study corridors. These species are therefore expected to suffer the greatest impact. Direct impacts include morbidity (injury) and mortality (death) of wild animals from both short-term (construction) impacts and long-term (operational) impacts. Indirect impacts may result from induced development of the area, habitat disturbance and fragmentation, changes in surface water conditions, and disposal of hazardous waste.

Greater impact is expected to be inflicted on biodiversity and landscape in mountain and valleys cut or fill requirements where acquired land may exceed 300 meters of width and 60 meters of height or depth.

Future Conditions without the Project (No Build Alternative):

The No Build alternative would have no impact on terrestrial communities since no

additional right-of-way would be acquired. However, degradation in biodiversity will continue with absence of appropriate conservation laws and regulations and the lack of law enforcement. In the last few years (1996-now) natural areas have been more accessible and therefore have become more vulnerable to destruction by human activity. A large proportion of the vegetation in these areas has been cleared

C. Analysis of Alternatives

Specific negative impacts of the project (i.e., identification of route segments with the most likely negative impacts)

Table 2: Specific negative impacts of the project (identification of route segments with the most likely negative impacts).

Nature Reserve (area in dunoms)	Corridor #	Alternative #	Route segment	Direct impact on Biodiversity (habitat loss area dunoms and %)	Hydrologic Changes
Planted Forest at Jenin City southern entrance Al-Shuhada junction (150)	1	2	H-I	33 [⊗] (22)	Major
New Um-Tut (7000)	1	103	A-B	380** (5.4)	Major
	1	2	C-G	470 [⊗] (6.7)	Major
	1	1	C-D-E	450 [⊗] (6.4)	Major
	4	4	K-L	>170 [⊗] (2.4)	Major
Aqqaba (2000)	1	103,1,3	P-Q	110 [⊗] (5.5)	Medium
	1	2		Negligence	
Sir-Misilya (2000-2500)	4	4	R-S	300 [⊗] (12-15), in addition to high impact on agricultural ecosystems	Major
Asseereh El Shamaliyeh - Al Badhan (2500)	1	103	M-N	170** (6.8)	Major
	1	1,2,3,4	M-O	200 [⊗] (8), in addition to considerable impact on wetland ecosystem in Al-Badan valley to the east	Drastic
El-Fara'a East (Jn6) (1000)	1	1,2,3,4,103	T & U		Medium changes that may indirectly affect this area and its wetland ecosystem.

**Preferred highway build alternative link segments (see Map) with least overall impacts on existing plant and animal communities.

[⊗] Highway link segments with greatest overall impacts on existing plant and animal communities, and / or wetland communities.

The preferred alternative is alternative No. 2 through corridor No. 2. It would provide the least overall impacts on existing plant and animal communities. It is also suggested to modify the alignment near Talfeet to minimize the damage of the biological life and agricultural resources. However, there is a need to develop an appropriate environmental mitigation and monitoring program for impacts of the preferred alternative route.

D. Mitigation Plan

Mitigating measures to minimize harm to existing plant and animal communities, and or wetland communities.

Each potential concern including MOPIC concerns in relation to biodiversity conservation and landscape, identified previously will be addressed as follows (see also Table 3):

Roadkills: in order to prevent crawling animals like snakes and other animals from moving onto the road way were they would be subjected to harm from traffic. Special exclusion devices (i.e., fence or wall) may be constructed along the right-of-way line between the land used for highway purposes and the forest preserve land.

Habitat loss: relative to the total area of potential forest preserve, the amount of habitat loss resulting from the project in the preferred route is large ranging from 5.4 - 6.8 % of the affected areas. The affected areas can be considered to be of higher quality, and this can be partly mitigated by increasing the areas of nature reserves (to compensate for lost parts), reclamation, forestration, and other measures (Table 3).

Direct mortality from construction activities: the construction limits should be fenced using a suitable temporary snake-proof fencing. Competent biologists and skilled personnel should search the area for snakes and other crawling animals immediately before construction activities begin and relocate any animals found out side of the fence. Excavation should not occure on the biodiversity site between October and April of any year. Biologists and skill personnel should be present on the days when initial escavation is carried out. An educational program that includes information about wild plants and animals should begin at the pre-construction meeting between involved parties. Each individual worker should be toled that any animal encountered must not be killed or harmed. They will be informed that a certain wild animals and plants is ligaly protected under the Palestinian Endangered Species Protiction Act.

Hydrologic Changes: Alternative 103, segment M-N is anticipated to change existing hydrological conditions in the vicinity of the Al-Badhan Area. Existing drainage patterns and outfalls will be affected unless a suitable drainage system is construced. The road at this site will cross valleys requiring large fill quantities. Special attention should be paid to the drainage of storm and periodic surface water through the valleys. To increase road permeability and reduce noise impacts on wildlife and hydrologic status in the affected nature reserves, silent asphalt may be used for the rout segments passing through the reserves.

E. Environmental Management and Training

See Table 3.

F. Monitoring Plan

See Table 3.

Table 3. Summary of EIA mitigation measures at New Um-Tut and Asseereh El Shamaliyeh - Al Badan.

Impact	Potential Issues	Mitigation Measures
Vegetation	Loss of rare plant habitats	Transplant mature plants or collect and sow seeds of affected rare plants. Install appropriate controls to minimize erosion until vegetation is established. Monitor at least once during the growing season for two years after transplanting, then again after five years to ensure the plants survived.
	Loss of native habitat	Progressively reclaim pits as new areas are developed. Revegetate closed pits with native grass species. Monitor annually.
	Fragmentation of remaining habitat	Establish passage corridors to allow continuity between various parts of the reserve.
	Other	Seeds should be collected and held in reserve to plant in these areas, should transplanting not be successful. Appropriate erosion controls should be placed on the reclaimed areas, to minimize potential erosion until vegetative ground cover has become established. While the initial goal of reclamation will be to re-establish herbaceous ground cover to control erosion, cleared and affected areas should be re-forested as soon as possible. A vegetation specialist should inspect the transplants at least once during the growing season for two years after transplanting, then again after five years to ensure the plants survive. Should any activities associated with the highway appear to be impacting the slope near these plants, proper mitigation practices should be implemented. Monitoring for general vegetation cover can be co-ordinated with soils monitoring, and should be conducted annually, at a minimum, until vegetation is established. Planting with suitable plants would allow development of an even aged stand similar in habitat quality to the existing stands. Surveys should include an assessment of weed populations on the sites so weed control programs can be initiated quickly if problem areas are detected. Transplant rare species from this area prior to clearing or excavating for 3 years. Ensure transplanting of plants is done by a qualified vegetation specialist. Seed should be collected from the plants prior to transplanting so that seed is available should the host plants not survive transplanting. A qualified vegetation specialist should also do this activity. Arrange for reforestation of reclaimed sites with appropriate plant stock type. Establish minimum setback distances to minimize habitat lost through slumping. After the sites have been reforested with the appropriate stock type, annual visits should be made in the late summer to measure the year's growth and to investigate for pest damage. Restrict human activities in the affected reserves or biodiversity areas including prohibition of digging up plants, cutting trees or shrubs, hunting, agricultural practices, grazing, mining and stone cutting.
Wildlife	Displacement or destruction of breeding or overwintering wildlife species during pit clearing	Conduct clearing activity in late summer or early fall to avoid nesting periods for breeding birds, and critical overwintering period for some animals.
	Loss of wildlife habitat	Clearly mark work site boundaries before clearing begins, and restrict disturbance to this site only. Progressively reclaim sites as new areas are developed. Revegetate sites as soon as possible after work at site ends. Monitor for wildlife at three to four-year intervals after reclamation.
	Fragmentation of habitat	Establish underground passage corridors to allow continuity between various parts of the reserve.
	Barriers to wildlife travel corridors	Confine development to small, previously disturbed area as per five-year plan, thereby avoiding the forest stands along the highway. Develop and reclaim sites sequentially, restoring a tree and a shrub corridor along the highway within 5-10 years.
	Increased traffic mortality	Enforce a speed limit of 30 kph within operating area. Or on leased property access roads.
	Other	Wildlife crossing areas should be posted with wildlife crossing signs to warn drivers of the potential risk in this area. Wildlife reflective posts could also be placed in either side of these crossing areas to help discourage wildlife crossings in traffic during evenings or at night. Recolonization of the reclaimed areas should also be monitored, to ensure the goal of restoring suitable wildlife habitat has been met. Breeding bird and ungulate browse and pellet surveys conducted at three to four year intervals would provide an indication of reclamation success. Alternatively a wildlife observation system, which would record observations and locations of wildlife on the site, could be used to informally monitor use of the area by wildlife species. Traffic may be minimized between 2100 PM and 0700 AM, to allow a quiet period and

		encourage wild life movement during those times. Maintenance of wildlife corrodors through the site. Access should be restored with reclamation of the disturbed areas.
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