Designation date: 24/09/12 Ramsar Site no. 2078

# Information Sheet on Ramsar Wetlands (RIS)

## – 2009-2012 version

Available for download from http://www.ramsar.org/ris/key_ris_index.htm.

*Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).*

**Notes for compilers:**

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.

2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 14, 3rd edition). A 4th edition of the Handbook is in preparation and will be available in 2009.

3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

**1. Name and address of the compiler of this form:**

FOR OFFICE USE ONLY.

DD MM YY

Designation date | Site Reference Number

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**2. Date this sheet was completed/updated:**

04/10/2011

**3. Country:**

India

**4. Name of the Ramsar site:**

The precise name of the designated site in one of the three official languages (English, French or Spanish) of the Convention. Alternative names, including in local language(s), should be given in parentheses after the precise name.

Nalsarovar (Nalsarovar Bird Sanctuary)

**5. Designation of new Ramsar site or update of existing site:**

**This RIS is for** (tick one box only)**:**
**a) Designation of a new Ramsar site** ☑ ; or

**b) Updated information on an existing Ramsar site** ☐

**6. For RIS updates only, changes to the site since its designation or earlier update:**

**a) Site boundary and area**

**The Ramsar site boundary and site area are unchanged:** ☐

or

**If the site boundary has changed:**

i) the boundary has been delineated more accurately ☐ ; or

ii) the boundary has been extended ☐ ; or

iii) the boundary has been restricted** ☐

and/or

**If the site area has changed:**

i) the area has been measured more accurately ☐ ; or

ii) the area has been extended ☐ ; or

iii) the area has been reduced** ☐

** **Important note**: If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

**b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:**

**7. Map of site:**
Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

**a) A map of the site, with clearly delineated boundaries, is included as:**

i**) a hard copy** (required for inclusion of site in the Ramsar List): ☑ ;

ii**) an electronic format** (e.g. a JPEG or ArcView image) ☑ ;

iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** ☐

**b) Describe briefly the type of boundary delineation applied:**
e.g. the boundary is the same as an existing protected area (nature reserve, national park, etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The boundary follows the boundary of the sanctuary. The sanctuary area has been demarcated with boundary cairns at the site.

The legal boundaries of the area are as below.

| | |
|---|---|
| **North** | Shahpur Village in Viramgam Taluka of Ahmedabad District. |
| **South** | Village boundaries of Shiyal in Bavla Taluka of Ahmedabad district. |
| **East** | Village boundaries of Kayla and Vekaria of Viramgam Taluka and Meni and Durgi Villages of Bavla Taluka of Ahmedabad District. |
| **West** | Village boundaries of Digvijaygadh, Panali, Mulbavla, Ranagadh, Bhagvanpur, Jaliayla, and Nani Kathechi in Limbdi taluka of Surendranagar District. |

**8. Geographical coordinates** (latitude/longitude, in degrees and minutes):
Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

Latitude 22°46'33" N

Longitude 72°02'21"E

**9. General location:**
Include in which part of the country and which large administrative region(s) the site lies and the location of the nearest large town.

The area falls within the administrative jurisdiction of Surendranagar and Ahmedabad Districts in the west of India. Ahmedabad is the nearest large town and distance 65 k.m. in the direction of north east.

**10. Elevation:** (in metres: average and/or maximum & minimum)

9.10 m above MSL

**11. Area:** (in hectares):

12,000 ha

The actual water body in normal years is less than the legal area of the sanctuary 12,082 ha (120.82km$^2$).

**12. General overview of the site:**

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Nalsarovar, being a natural lake, is quite different and unique due to its genesis, wherein, despite it being a fresh water lake, salinity level keeps on varying, which also depend upon quantum and pattern of rainfall and the area supports some halophytes also. At Nalsarovar habitat formation is highly dynamic, to the extent that habitats get changed from one to another type within the same year also, due to change in the water level.

The area being a wetland, the habitat preference is to be viewed mainly for waterfowl species. Based on various studies and observations made in the area, nine food types have been identified which are consumed by various bird species found in the area. It supports 210 species of birds including some of the species shown in Red List of IUCN. Thus, Nalsarovar wetland has a unique ecosystem with unique ecological communities having different sub habitats present at one place.

**13. Ramsar Criteria:**

Tick the box under each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11). All Criteria which apply should be ticked.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |

**14. Justification for the application of each Criterion listed in 13 above:**

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

**Criteria 1**

Nalsarovar is the largest natural wetland in the Thar Desert Biogeographic Province and is the largest in 4-B[1] Gujarat-Rajputana Biotic Province as per the bio-geographical classification of the country. No other wetland in the region is as large as Nalsarovar and supports such high population, density and diversity of wildlife**.** The genesis of the wetland is unique with the site being a relict sea that has been converted into a natural lake due to the gradual upheaval of sea bed and siltation of the creek. As a result, the water level, pH, salinity and area under submergence varies not only from year to

[1] Classification system used Biogeographic classification used by Panwar and Rodgers (1988). See section 15.

year but varies within the same season depending upon the quantum and pattern of rainfall. Due to the unique geophysical features the variation occurs among flora and fauna also.

**Criteria 2**

Nalsarovar supports threatened mammals and birds.

| English Name | Scientific Name | IUCN Red List | CITES | CMS | India National Status |
|---|---|---|---|---|---|
| **Mammals** | | | | | |
| Indian Wild Ass | *Equus hemionus* | Endangered | I | II | Endangered |
| **Birds** | | | | | |
| Sarus Crane | *Grus antigone* | Vulnerable | II | II | Vulnerable |
| Dalmatian Pelican | *Pelecanus crispus* | Vulnerable | I | I and II | Vulnerable |
| Marbled Teal | *Marmaronetta angustirostris* | Vulnerable | - | I and II | Vulnerable |
| Sociable Lapwing | *Vanellus gregarius* | Critically Endangered | - | I and II | Critically Endangered |
| Pallas's Fish Eagle | *Haliaeetus leucoryphus* | Vulnerable | II | II | Vulnerable |
| Greater Spotted Eagle | *Aquila clanga* | Vulnerable | II | I and II | Vulnerable |
| Eastern Imperial Eagle | *Aquila heliaca* | Vulnerable | I and II | I and II | Vulnerable |
| Fish | | | | | |
| White Carp | *Cirrhinus cirrhosus* | Vulnerable | | | |
| Wild Common Carp | *Cyprinus carpio* | Vulnerable | | | |

**Criterion 3**

Nalsarovar supports rich biological diversity in the Thar Desert Biogeographic Province It supports 216 species of birds, 13 species of mammals, 11 species of reptiles, 19 species of fish, 76 species of zoo benthos & zooplanktons; besides, rich diversity of other invertebrate fauna as Annexure-E. The area is very rich in its floral diversity as it supports 48 species algae, 1 pteridophyte and 74 species of flowering plants.

**Criterion 4**

Nalsarovar is a wintering home for about 52 species of migratory waterfowl, 53 are resident birds. The wetland is strategically located on a migratory route of south Asia, Siberia, Russia, United Kingdom etc., mainly Central Asian Flyway.

Even in the case of a poor monsoon, the wetland still receives enough water to provide food and water for waterfowl. The globally threatened Sarus Crane (*Grus antigone*) take refuge at this wetland during summer when other water bodies are dry. Globally threatened species such as Marbled Teal

(*Marmaronetta angustirostris*), Sociable Lapwing (*Vanellus gregarius*), and Lesser Flamingo (*Phoenicopterus minor*) use this as a stopover site during migration and on the return flight

The wetland is a lifeline for a satellite population of the endangered Indian Wild Ass (*Equus hemionus khur*) which uses this area in the dry season.

**Criterion 5**

The wetland supports on average 174,128 (see Annex A) waterfowl during winter and about 50,000 waterfowl in summer. The table provides data bird counts from 1992-2008.The results of detailed winter waterfowl census for the last seven years are given in Annexure-A.

| Year | 1992 | 1996 | 2000 | 2002 | 2004 | 2006 | 2008 | 2010 |
|---|---|---|---|---|---|---|---|---|
| Total count | 187,734 | 141,534 | 50,581 | 134,975 | 198,139 | 252,682 | 253,254 | 131,306 |

**Criterion 6**

Nalsarovar supports 1% of the individuals in a population of the following species of waterfowls.

| Scientific Name | English Name | 1% Threshold | Recorded Count | Year/s, periods present |
|---|---|---|---|---|
| **PELICANS** | | | | |
| *Pelecanus onocrotalus* | Great White Pelican | 210 | 3264 | 1992, 1996 |
| **CORMORANTS & DARTERS** | | | | |
| *Phalcrocorax niger* | Little Cormorant | 2,500 | 3264 | 1992, 1996, 2000, 2002, 2004, 2006, 2008 |
| **STORKS** | | | | |
| *Anastomus oscitans* | Openbill Stork | 3,000 | 13,948 | As above |
| **IBISES & SPOONBILLS** | | | | |
| *Plegadis falcinellus* | Glossy Ibis | 250 | 8,205 | As above |
| **FLAMINGOS** | | | | |
| *Phoenicopterus roseus* | Greater Flamingo | 2,400 | 11,146 | As above |
| **GEESE & DUCKS** | | | | |
| *Anser anser* | Greylag Geese | 250 | 6,856 | As above |
| *Anas acuta* | Pintail | 20,000 | 25,927 | As above |
| *Anas crecca* | Common Teal | 4,000 | 36,712 | As above |
| *Anas strepera* | Gadwall | 3,000 | 7,051 | As above |
| *Anas penelope* | Wigeon | 2,500 | 5,171 | As above |
| *Anas querquedula* | Garganey Teal | 3,500 | 25,468 | As above |
| *Anas clypeata* | Shoveller | 7,100 | 19,165 | As above |
| *Sarkidiornis melanotus* | Comb Duck | 250 | 4,532 | As above |
| **RAILS, CRAKES, GALLINULES & COOTS** | | | | |
| *Fulica atra* | Coot | 15,000 | 102,815 | As above |
| **SHOREBIRDS AND WADERS** | | | | |

| | | | | |
|---|---|---|---|---|
| *Limosa limosa* | Blacktailed Godwit | 1,500 | 9,997 | As above |
| *Philomachus pugnax* | Ruff | 1,000 | 2,553 | As above |
| *Himantopus himantopus* | Blackwinged Stilt | 1,700 | 3,904 | As above |

**15. Biogeography** (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

**a) biogeographic region:**

The area is part of

the Thar Desert Biogeographic Province.

**b) biogeographic regionalisation scheme** (include reference citation):

Udwardy M.D.F. 1975, A classification of the biogeographic regions of the world. IUCN occasional paper no. 18; Morges, Switzerland, IUCN.

**16. Physical features of the site:**

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

I. The sanctuary is a relict sea converted into a natural lake due to siltation of the creek and also due to geological movements.

II. Being a natural lake the area under the submergence as well as the depth of water, which at the most is 2.7 metres, depends upon the rainfall. Ultimately the formation of habitats depends upon the quantum and pattern of rainfall in the catchment zone.

III. A major portion of the lake out of about 120 sq. m. of the notified sanctuary area dries up by winter and even in the years of good rainfall, water remains in less than 50% of the area during the winter. The lake almost dries up in the summer.

IV. Water in the lake is potable during monsoon. It is potable in post-monsoon period also during the years of good rainfall. It gradually becomes brackish due to oozing out of salts. Chlorinity and alkalinity rise with the shrinkage in lake area and oozing out of salt, and reaches at its peak during late winter and summer.

V. Formation of habitats in the area is a dynamic process which keeps on altering within the same area round the year.

VI. The process of drying up of the lake is a natural process, which up to certain extent causes distribution of flora, algae, zooplanktons and zoo-benthos etc.

The ecosystem is unique in the sense that it is a natural wetland where depth of water plays a major role in deriving its utility as a waterfowl habitat. As compared to many other areas, here the complexity in terms of interrelationships among various components is quite deferent

The lake is believed to originate from gradual upheaval of a shallow section of the sea connecting the Cambay and Kutch Gulf. The wetland is spread over an area of 120 km$^2$. There are more than 300 islands, 36 of them have sizable area while the rest are very small.

It consists of alluvial plains of the Quaternary era. Soils are salty clay, with organic matter. Nalsarovar is a saltpan with alkaline salt concentrations in the upper layers of clayey medium black soil. The sub soil is highly saline. Rajasthan and Sen *et al* [1982] explains that the process of evaporation of collected water leads to drying of the soil surface with the accumulation of patches of salt. A similar situation exists with Nalsarovar where white salt crusts are found on dried soil throughout the Nal Kantha Region.*Suaeda*, is a typical halophyte, i.e. saline plant, found in these salty patches. The halomorphic soil is typical of Bhal Region.

Nalsarovar is a natural, shallow lake having maximum depth of about 1.5-2.0 meters depending upon rainfall in the catchment. Average rainfall is 580 mm. The area receives water (rainfall) from the northern, eastern and western catchments which drain into small rivers and streams, however in summer, Nalsarovar becomes dry. The total carrying capacity of the wetland is estimated at 66 MCM of water. After flooding, the excess water drains south of the wetland.

Quality of water changes from the monsoon season to summer. In the beginning it is fresh and in summer it becomes saline. pH values measured at 7 different locations of the lake indicates there at the onset of monsoon when rainwater drains in to the area, pH varied between 7.00 to 7.5, indicating neutral character, which raises up to 9.5 in summer. Physical and chemical parameters studies for soil and water are as shown in Annexure-F.

Nalsarovar is a non forest area being a natural lake, the area under submergence varies depending on the rainfall. During years of good rainfall, the total submerged area of the sanctuary can reach 350 sq. km (35,000 ha). However, it has been observed that the average area under submergence in winter and during normal rainfall years, is approximately 60 km$^2$ (6,000 ha) Thus, the actual water body in normal years is less than the legal area of the sanctuary (120.82 km$^2$ 12,082 ha).

Natural and seasonal spread of Nalsarovar wetland is irregular. It is shallow and in most parts, muddy. Formerly an estuary, this area is the result of tectonic uplift, sedimentation and Aeolian infill.

**Climate**

The temperature is higher during the month of April and May. The monthly average temperature ranges from 4.9$^0$C to 45.5$^0$C for the years 1996-2000. The rainfall in the region is generally erratic. The mean annual rainfall is around 700 mm. Number of rainy days in this area is hardly around 15 per year. The yearly rainfall data of adjoining tehsils (blocks of the district) are given in Annexure-C. During winter, wind direction is from north and northeast to south and southwest. This wind comes from the western Himalayan regions. The maximum wind velocity in winter is around 15 km/hour, and it reaches 30-40 km/hour during summer, increasing the rate of evaporation of water in Nalsarovar. During summer, wind direction is from the southwest to the northeast.

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**17. Physical features of the catchment area:**
Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

**Genesis of Nalsarovar**

The catchment area of Nalsarovar is about 3082.5 Sq.km. The water spread reaches up to 300 sq.kmduring a good rainfall year and is about 60 sq.km. in an average rainfall year. During below average rainfall years, the submergence area drops as low as 30 sq.km. However, in the years of scarcity, the submergence area has even reduced up to 15 sq.km. Annual rainfall recorded at Sanand, Viramgam, Bavla and Limbdi during 1996 to 2005 reveals that the rainfall varied from minimum 193 mm in 2002 at Viramgam and a maximum of 1245 mm in 2005 at Limbdi.

The basin of Nalsarovar has gentle slopes running from east to the northwest and northwest to the south. Water (rainwater run-off) enters the wetland from the northern and northwest upland areas of Surendranagar, Ahmedabad and Mehsana Districts. If the rainfall is very heavy, this site receives water from Kachchh, and eventually discharges into the Gulf of Khambhat.

Due to the impervious salt pan, Nalsarovar has a good water retention capacity. Although, the main water source is rain water, the rivers Surendranagar-Bhogavo and Brahmani flow into the wetland. The extent of the wetland area therefore largely depends upon the rainfall received and the rivers Surendranagar-Bhogavo and Brahmani. Inaddition, the Ghoda feeder canal from Mehsana District also feeds Nalsarovar. Therefore, the catchment area of Nalsarovar extends as far as

Mehsana district. Nalsarovar has completely dried up during times of extreme water shortages (1988 and 1992).

The catchment area is over 3000 km$^2$. Prasad *et al* (1997) have developed a 3 stage model for the evolution of Nalsarovar region during the late-Quaternary period. During stage-1 of evolution, spanning over a period of 127-73 ka, a shallow sea linked the Gulf of Kachchh with the Gulf of Khambhat. The sea connection broke up around the beginning of marine isotope stage-4 due to regression of the sea. Subsequently only a land link remained. In stage-2 (73-7 ka), fluvial sediments from the east were episodically deposited in the Nalsarovar region in response to westward migration of depositional front of eastern rivers. In stage-3, due to advance of sedimentation front, tectonics and post glacial sea level rise, the elevation of Nalsarovar came to within a few meters of its present elevation at about 7 ka when it became a closed basin. The mudflats, present to south of Nalsarovar, represent recent sea transgression in the area.

It is probable that the Nal and the lower course of the River "Bhogava", together represent what at no very distant date was an arm of the sea, which possibly at a still earlier time combined with the Rann of Kachchh to isolate 'Kathiawar' from the main land. Hardly any inhabited country can be much lower than the isthmus between the Nal and the Rann. During heavy rain, it is entirely overflowed, changing the peninsula into an island; and it flows into the Nal, and from the Nal finds its way into the Gulf of Cambay.

**Geology, Rock and Soil**

The area is bound to the west by basaltic trap, rocks of the Saurashtra and the northwest by Jura Cretaceous sandstone. The igneous and metamorphic rocks of the Arvallis constitute the extreme northeast. In the immediate east are the Quaternary alluvial plains, occupying the Cambay basin. All these indicate evidence of tectonics in the form of entrenched streams, cliffy sections and fault-controlled on the basis of soil characteristic, the area is divided into 3 litho units from the core obtained as under

a. Horizon -3 [18-45m] clay and silty and with occasional sand lenses and basalt fragment base not reached.
b. Horizon -2 [18-3 m] clayey silts with organic matter and shells of isttium and land snails.

c. The presence of red beds [10-14 m] is indicative of subaerial exposure; presence of gypsum at 4-7 m depth also indicates a period of an arid period.

There are several elevated plateaus (islands) in the basin. They are locally called *'Bets'* meaning 'islands' as they remain above the water surface. Among these, only 37 islands have sizeable plateau area, while the rest are very small. The list of main islands is given in Annexure-B.

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**18. Hydrological values:**

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

The wetland has significant hydrological values. It is the only source of fresh (potable) water for the surrounding villages. The rain water recharges the underground water and also checks its salinity. It also saves the surrounding area from heavy flood and siltation.

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**19. Wetland Types**

**a) presence:**

Circle or underline the applicable codes for the wetland types of the Ramsar "Classification System for Wetland Type" present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

**Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)**
**Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp Ts • U • Va •**
**Vt • W • Xf • Xp • Y • Zg • Zk(b)**

**Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)**

**b) dominance:**

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

Ramsar wetland type R, P, O, Q

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**20. General ecological features:**

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

The Nalsarovar and the surrounding area have a peculiar floral composition. The shallowness of water level and the penetration of sunlight up to bottom of the lake promote growth of algae and the aquatic vegetation. The vegetation including various algae, zooplanktons and benthos makes the area an ideal habitat for water fowls. The biotic and abiotic factors are intrinsically dependent upon each other and biodiversity of the area is dependent upon these all factors.

On the basis of water level and vegetation, 8 habitat types have been identified in this site, out of which at least two types are outside the sanctuary boundary but adjacent to it. These habitat types are as below.

(i) Deep open water habitat

(ii) Shallow open water habitat

(iii) Emergent aquatic vegetation

(iv) Muddy habitat

(v) Shore land and island

(vi) Cultivation in surrounding area

(vii) Follow land is surrounding area

(viii) Wood land habitat

The vegetation types are:

(i) Aquatic emergent vegetation includes *Cyperus* spp., *Phragmites* spp. and *Typha angustifolia*, *Arundo donex*.

The spread of the vegetation depends upon water level and it is controlled by grazing and grass collection. It provides roosting habitat and escape cover to waterfowl.

(ii) Submerged vegetation is mainly aquatic plants. They are *Najas minor, Najas major* spp., *Vallisneria* spp., and *Hydrilla* spp., *Nymphaea stellata*, Y*mphaea pubescens*, *Aponogaton natans*

(iii) Vegetation on islands and shore land:

Islands (bets) like Dhrabala and Panwad have thick vegetation of mostly *Prosopis juliflora*, *Acacia nilotic*, *Salvadora* spp. bushes of *Tamarix* spp and *Zyzyphus* spp. Nearly most of the bets, reed-meadow sedge, a seral stage are due to siltation. Sedge, grass & cattails grow abundantly. *Cyperus bulbosm* (Thek) and *C. rotundas* (Chiyo) are used as food by local people. These plants play an important role in air circulation in the lake, as they are hollow & possess aerenchymous tissues. They help in gaseous exchanges of carbon dioxide and oxygen which are made available to submerged plants.

(iv) Cultivation area: In agricultural areas surrounding the sanctuary, paddy, wheat, gram and cotton are grown. While wasteland on the downstream side and surroundings is almost completely infested by *Prosopis juliflora* (*F: Fabaceae*)

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**21. Noteworthy flora:**

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14, Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

*Phragmites* spp. is important as it provides roosting cover for waterfowl and *Najas* spp. is important as it provides staple food for herbivorous ducks and coots. *Prosopis julifora*, an invasive species do occur sporadically in scattered patches on fringes and on some of the islands. However, its occurrence is more of a positive in nature as it provides roosting and perching sites in the area which is otherwise devoid of any tree species.

The most prevalent among the aquatic floral species are *Typha angustata* (Gha-bajariyu), Bakheda *(Arundo donex)*, Gondro *(Phragmites karka)*, Dilo/Chiyo *(Cyperus rotundus)*, Thek *(Cyperus bulbosus)* Kando *(Cyperus* sp.) etc. Among the algae, Chara, *Najas, Hydrillia* and *Vallisneria* which covers its entire bottom left unoccupied by the weeds, is most prominent. There are 48 algal species mainly of *Cynophyceae, Chlorophyceae, Bacillanophyceae* and *Euglinophyceae* families recorded from Nalsarovar.

The surrounding area has very scanty growth of terrestrial flora. Among the tree species the most abundant are *Salvadora* and *Prosopis*. However, a few trees of *Tamarix* and *Acacia nilotica* are also found. The *Acacia nilotica* trees growing in the adjoining areas of Nal and in the surrounding villages, are preferred by the heronry birds for nesting and breeding.

In all, total 83 flowering species including trees, shrubs, herbs and grasses have been recorded from the region.

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**22. Noteworthy fauna:**

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS*.

The study team of the Zoological Survey of India carried out a detailed biodiversity survey in 2009 and is optimistic of finding species mollusks which are new to science.

**Birds:** Apart from the species mentioned in section 14, the area supports species like Pallid Harrier (*Circus macrourus*), Curlew (*Numenius arquata*), Black Tailed Godwit (*Limosa limosa*), Indian River Tern (*Sterna aurentia*), Painted Stork (*Mycteria leucocephala*), Lesser Flamingo (*Phoeniconaias minor*), Spotted Red Shank (*Tringa erythropus*), Ferruginous Pochard (*Aythya nyroca*) are under near threatened category as per IUCN.

**Fish:** Fish is one of the major components of the wetland ecosystem. It has significant importance in the ecosystem due to its role as (i) source of food for avifauna (ii) a consumer in the food chain. Catla (*Catla catla*) and Rohu (*Labeo rohita*) are the main source of income for the local people. Species like Scampi (*Wallago attu*), which is under near threatened category as per IUCN are found at Nalsarovar.

**Reptiles:** The gazetteer mentions the presence of Common Indian Monitor (*Varanus bengalensis*). Among the water snakes recorded here are the most common fresh water snake Checkered Keelback (*Xenochrophis piscator*)

and the Buffstriped Keelback (*Amphiesma stolata*). Indian Cobra (*Naja naja*) is also present in this region. Certain other species of reptiles like Sand Boa (*Gongylophis colubrinus*), Rat snake (*Ptyas mucosus*), Indian Wolf snake (*Lycodon capucinus*), Indian Python (*Python molurus*) are also common in this region.

**Mammals:** Blackbuck (*Antilope cervicapra*) is also found in the area which is listed under near threatened category by IUCN.

**23. Social and cultural values:**

**a)** Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

The Nalsarovar can be termed as a lifeline for the surrounding villages. It is the main source of drinking water and irrigation to fields. People benefit from fishing for subsistence and commercial purposes. Cattle heavily depend on Nalsarovar wetland for grazing.

Few temples of local deities are situated on the bets (Islands) periphery of the lake. People worship them and consider them as sacred places.

The periphery of the site is inhabited by the "Padhar" Community, a primitive scheduled tribe. The "Padhars" are confined to this area only. The community has unique cultural heritage, rituals and very strong system of customs and justice.

Presently, local people associate the name of the lake with "Nal", the king who was known for his honesty and truthfulness. This seems to be a recently developed folklore. Another meaning of the word "Nal" (Naal) indicates presence of a sea creek. Locally, "Nal" is used for a canal like protrusion of a creek or river. This meaning seems more logical as shown by Prasad *et al* (1997) who attempted to study the evolution pattern of the Nal Lake.

**b)** Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

If Yes, tick the box ☑ and describe this importance under one or more of the following categories:

i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:

ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetla☑

Padhar community which is the only tribe which resides in plains and is listed as one of the primitive tribes, resides in the periphery of the Nalsarovar. Their cultural values are exceptional. Padhars are the aborigines of surrounding area of Nalsarovar. As per the history

about 600-700 years ago, a group of labourers came to the surrounding area of Nalsarovar in search of labour and settled there. They gradually adopted the life of fishing, poaching and using the aquatic vegetation as their food. It is also believed that during the 6th and 7th Century, a woman leader popularly known as 'Hinglaj' settled some of her close servants in 8-12 places around Nalsarovar. Around 40000 Padhars, today also, lead more or less the same way of life, and struggle for their survival.

iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:

iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

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**24. Land tenure/ownership:**

**a) within the Ramsar site:**

The entire area is notified as sanctuary. However the area is not notified as forest under Indian Forest Act. The area is owned by the State Government. The settlement proceedings are yet to be finalized and rights of the people are yet to be inquired into, though most of proceedings have taken place.

**b) in the surrounding area:**

Surrounding area consists of mainly agriculture farms and fallow with some uncultivated land. Farms and fallow land are owned by farmers whereas the uncultivated land (Government land which is not under cultivation and not under private ownership) belongs to the State Government.

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**25. Current land (including water) use:**

**a) within the Ramsar site:**

As it is a notified wildlife sanctuary the site is used only for the purpose of wildlife, habitat conservation.

**b) in the surroundings/catchment:**

The surrounding area is mainly used for the purpose of agriculture, pastureland and settlements. There are few industrial units adjacent to the towns and along the highways.

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**26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:**

**a) within the Ramsar site:**

Withdrawal of water for irrigation and fishing activities are the main factors adversely affecting the ecological character.

**b) in the surrounding area:**

Increase in agriculture without adopting modern irrigation practices puts a lot of pressure on the quantity of water in the wetland. Development of industries without proper effluent treatment plants pose a risk of polluting inflow of water for the wetland.

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**27. Conservation measures taken:**

The staff of the sanctuary regularly patrols the area for preventing poaching. Habitat improvement measures, Eco-tourism activities and Eco-development activities are undertaken. Attempts are also made to reduce people's dependence upon the wetland by providing alternatives.

**a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:**

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

The area was declared a Wildlife Sanctuary under the provisions of Wildlife Protection Act, 1972, since 8/4/1969. Total area is 120.82 km$^2$.

The provisions of conservation of wildlife and its habitat including ban on hunting is being enforced.

**b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):**

Ia ☐; Ib ☐ ; II ☐ ; III ☐ ; IV ☑ ; V ☐ ; VI ☐

**c) Does an officially approved management plan exist; and is it being implemented?:**

A Management plan is prepared and approved. The prescriptions of the management plan are being implemented. Annual Action Plan for conservation of the wetland is also prepared and the works as per the annual Action Plan have already started.

Separate division headed by the Deputy Conservator of Forests has been organized for the management of the wetland.

Presently the 3rd Management Plan of Nalsarovar Bird Sanctuary exists and it is being implemented. It contains 14 Chapters which are (I) Introduction to the Area (II) Natural Resources and Their Attributes (III) History of Management (IV) Objectives of the Management (V) Settlement, Survey and Demarcation (VI) Zonation (VII) Habitat Management (VIII) Development and Management of Peripheral Areas Including Catchment Area (IX) Protection (X) Socio-Economic Development (XI) Wildlife Health and Population Management (XII) Ecological Monitoring and Research (XIII) Education and Training (XIV) Organization.

**d) Describe any other current management practices:** None

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**28. Conservation measures proposed but not yet implemented:**
e.g. management plan in preparation; official proposal as a legally protected area, etc.

Monitoring of water quality of the effluents of the industries is proposed under the Management Plan. Preservation measures of satellite water bodies around the main wetland are also planned. Ban on fishing, restriction of movement of human and cattle etc. within the sanctuary area is announced and suitable follow up measures are being taken.

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**29. Current scientific research and facilities:**
e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

A team of Zoological Survey of India 2009, western region has completed biodiversity surveys and inventory of the wetland. The data and information are being compiled. Specific research studies on the subject of migratory birds, inter and intra species behavior, invertebrate fauna, microorganism and quantitative as well as qualitative monitoring water are proposed and specific studies on zooplankton and phytoplankton has been carried out by the GEER Foundation, Gandhinagar in 1998 and 2007.

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**30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:**
e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

Nature education camps for students are regularly organized. Display boards, and signage giving information about the migrating birds and their routes are available. Interpretation Center and touch –screen information kiosk were developed.

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**31. Current recreation and tourism:**
State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

The basic facilities of eco-tourism have been developed. An average of 75,000 tourists visit the wetland annually.

Facilities like tourist resort, food stalls, seating arrangements, boating, restrooms, tented accommodation, and an Open Air Theater are being developed. The wetland has got tremendous potential for eco-tourism development.

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**32. Jurisdiction:**
Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

Territorial Jurisdiction: Hon. Governor of Gujarat State

Functional Jurisdiction: Department of Revenue And Department of Forests & Environment are having functional jurisdiction over the area. Functional jurisdictions are overlapping.

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**33. Management authority:**
Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Name: Shri Praveen Kumar Arajanbhai Patel
Deputy Conservator of Forests,
Nalsarovar Bird Sanctuary, Wildlife Division,
Near Mamalatdar Office, Sanand – 382110.
District: Ahmedabad, Gujarat State, India.
Phone: 02717-223500

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**34. Bibliographical references:**
Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.


(1) Anonymous (1998) Environment Impact Assessment of Sardar Sarovar Project on Nalsarovar Bird Sanctuary, Gujarat Ecological Education and Research (GEER) Foundation

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(8) Islam, M. Z. and Rahmani, A. R. (2008) *Potential and Existing Ramsar Sites in India.* Indian Bird Conservation Network: Bombay Natural History Society, BirdLife International and Royal Society for the Protection of Birds. Oxford University Press. Pp. 592

(9) Prasad, S., Pandarinath, K. and Gupta, S. K. (1997). Lake Quaternary Evolution of the NAL Region, Gujarat, India. in "Changes in Global Climate due to Natural and Human Activities". S. N. Das and R. S. Thakur (eds). proc. IGBP symp., (1997), Allied Publishers Ltd.

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