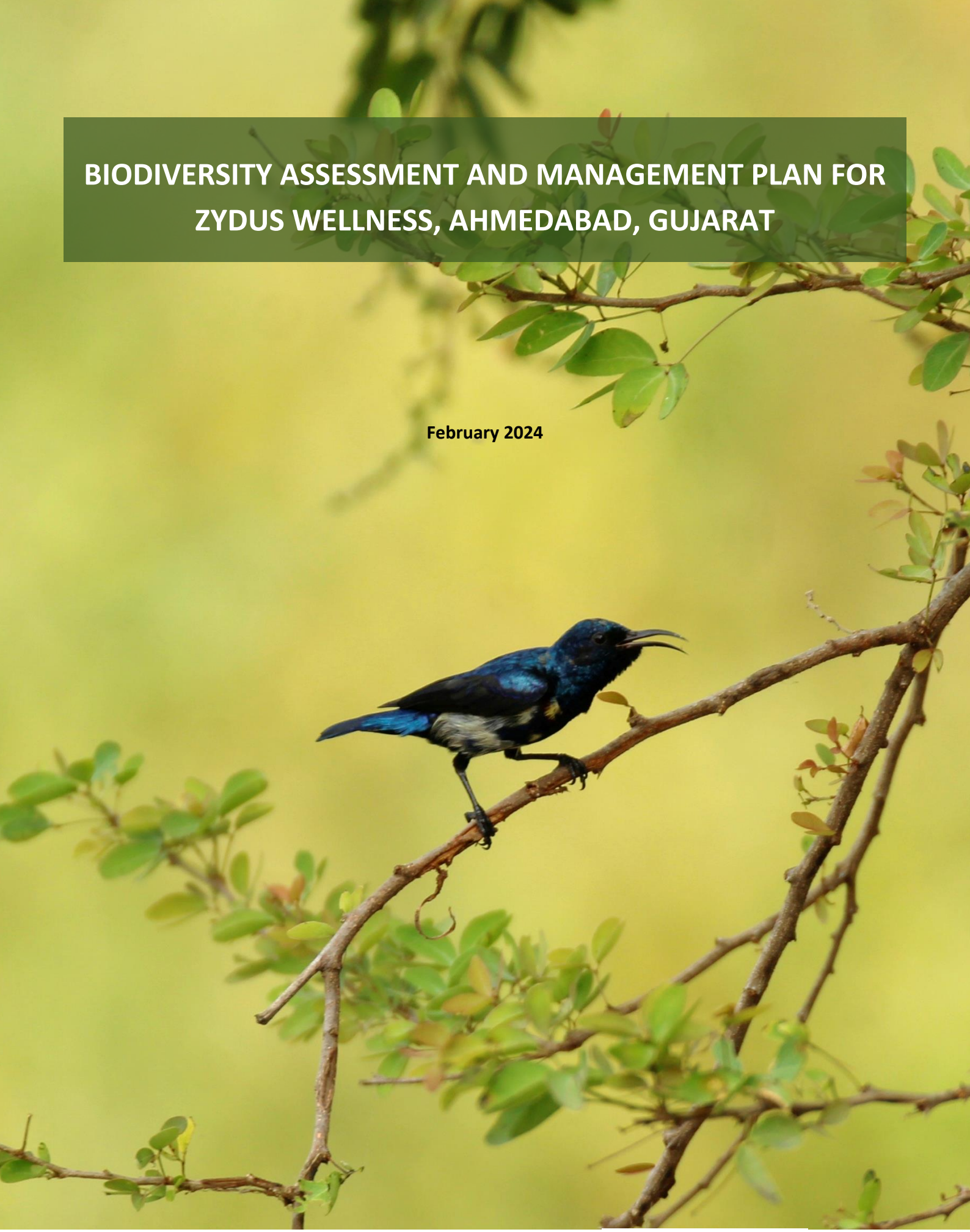
BIODIVERSITY ASSESSMENT AND MANAGEMENT PLAN FOR ZYDUS WELLNESS, AHMEDABAD, GUJARAT

February 2024



SUBMITTED TO:

Zydus Wellness, Ahmedabad

Zydus Wellness

SUBMITTED BY:

Terracon Ecotech Private Limited

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TERRACON
Nature-based Solutions

Table of Contents

1 INTRODUCTION

1.1 Zydus Wellness

Zydus Wellness Products Ltd. is a global leader among consumer wellness companies with health and holistic well-being defining the core of its values. With the launch of India's first zero calorie replacement of sugar, called Sugar Free, in 1988, Zydus Wellness began its journey as is India's leading consumer Wellness Company.Additionally, they manufacture a variety of other innovative, industry leading products like Ghee, Tomato ketchup, Complan, Glucon-D & Everyuth, etc. Headquartered in Ahmedabad, Zydus Wellness enjoys a pan-India marketing presence through a distribution network comprising.

The Company is committed towards environmental responsibility and sustainability. This environmental policy outlines our commitment to minimize our environmental impact and fostering a culture of sustainability within their organization. They also focus on biodiversity protection, energy management, waste disposal, environmental awareness, reducing natural resource consumption and abiding to the environmental laws.

1.2 Business and Biodiversity

Biodiversity, which includes ecosystems, species, and genetic diversity, is critical to the health and stability of the Earth's natural systems. According to the Convention on Biological Diversity, Biodiversity is defined as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems". Its significance is multifaceted, providing critical ecological functions such as pollination, nutrient cycling, and climate regulation while also supporting global food security through various crops and livestock breeds. Furthermore, biodiversity has an inherent value, revitalizing both human existence, culture and spirituality.

Businesses activities lead to both direct and indirect impacts on biodiversity and nature's contributions to people, playing a vital role in shaping the health of natural ecosystems. Business operations like manufacturing, production, urban development, mining, agriculture, etc. can result in lost or degraded habitats, overharvesting of species, and pollution, which can directly threaten biodiversity and disturb ecological balance. Indirect influences of business on biodiversity are mediated through socioeconomical and governance frameworks, where policies favouring commercial growth can weaken conservation efforts. Incentivizing or subsidizing unsustainable practices, further aggravates these impacts by land use changes and resource depletion. By adopting sustainable practices and biodiversity considerations in their operations and decision-making processes, businesses can contribute to the preservation of ecosystems and the sustainable provision of nature's contributions to people.

1.3 Scope of Work

- Identification of all floral and faunal species by qualified taxonomist/botanist/zoologist within core and buffer areas (baseline study).
- Segregation of identified species in Schedule-I, II, III and IV classes with special emphasis on cataloguing taxa which are facing risk of extinction (red list), endangered, vulnerable, threatened & rare species
- Impacts on species of high conservation significance (highly threatened species) existing within the habitats of project area with recommendations for conservation measures to be adopted.
- Identification of exotic species and plan for eradication/de weeding.
- Direct impact of loss of forest and non-forest land on habitats and associated biodiversity.
- Impact on water resources and wetland ecosystems.
- Effects of dust and noise pollution on habitat quality of available faunal groups.
- Measures to avoid/reduce the impacts on biodiversity and associated ecosystem services during the life of the business operations.
- Suggested list of native floral species which need to be planted while taking up afforestation activities to offset loss of biodiversity or carbon emissions.
- Measures for long term neutralization of the impacts on biodiversity and nature's contributions to people.

1.4 Legislative and Policy Requirements

1.4.1 The Kunming Montreal Biodiversity Framework

The framework identifies gaps in the Aichi target and is built around a theory of change which recognizes that urgent policy action globally, regionally, and nationally is required to transform economic, social and financial models so that the trends that have exacerbated biodiversity loss will stabilize in the next 10 years (by 2030) and allow for the recovery of natural ecosystems in the following 20 years, with net improvements by 2050 to achieve the Convention's vision of "living in harmony with nature by 2050".

The framework theory assumes that transformative actions are taken to:

- put in place tools and solutions for implementation and mainstreaming
- reduce the threats to biodiversity
- ensure sustainable use of biodiversity to meet people's needs

The draft Framework comprises 21 targets and 10 'milestones' proposed for 2030, en route to 'living in harmony with nature' by 2050. The targets are proposed with the aim to achieve above mentioned objectives. No national targets have been set yet under the post-2020 - Global Biodiversity Framework.

1.4.2 India's Biodiversity Targets

India's Biodiversity underpins ecosystem functions and services that are of great human value. In order to sustain the nature-dependent livelihood of the country, the Government of India has developed National Policy and Macrolevel Action Strategy on Biodiversity in 1999 in accordance with the Convention of Biodiversity (CBD). India has prepared 12 National Biodiversity Targets (NBTs) using the Strategic Plan for Biodiversity (SP) 2011-2020 for Biodiversity as the broad framework (Error! Reference source not found.).

Figure 1 India's National Biodiversity Targets

1.4.3 The Wildlife (Protection) Amendment Act, 2022

The Indian Parliament passed the Wildlife (Protection) Act in 1972 for the safeguard and protection of the wildlife in the country. This act has been revised and amended in the year 2022. The Wild Life (Protection) Amendment Act, 2022, categorizes the wildlife of India into four different schedules, two of which are for animals, third for plants and fourth for the regulation of international trade in endangered species, which are mentioned below in the table. These schedules are rendered varying degrees of protection, with animals falling under Schedule I and Schedule II being accorded maximum protection. Description of each Schedule is detailed below in the table.

Table 1 Wild Life (Protection) Amendment Act, 2022

Schedule	Description
Schedule I	• Provided absolute protection - offences under these are prescribed the highest penalties
Schedule II	• Protected, penalties lower than that of Schedule I
Schedule III	• Plants which are prohibited from cultivation and planting
Schedule IV	• Regulation of international trade in endangered species of wild fauna and flora

Thus, schedule I is the most essential from a conservation point of view. Whereas animals under schedule II are also accorded high protection, and their trade is prohibited. To implement conservation measures, it is necessary to know whether any of the species listed on these schedules are present in each area, as well as their population status and threats.

1.4.4 The Biological Diversity Act, 2002

This Act provides conservation of biological diversity, and mechanism for equitable sharing of benefits arising out of the use of traditional biological resources and knowledge

The Act prescribes that "any person or corporation or organization of foreign origin needs to procure prior permission from the National Biodiversity Authority (NBA) to obtain any biological resource or knowledge associated with a biological resource found in India, either for research or commercial utilization"

If a person, violates the regulatory provisions he will be punishable with imprisonment for a term extending up to five years, or with fine which may extend up to 10 lakh rupees and where the damage caused exceeds 10 lakh rupees such fine may commensurate with the damage caused, or with both.

- Any offence under this Act is non-bailable and cognizable.

1.4.5 The Taskforce on Nature Based Financial Disclosures (TNFD)

TNFD refers to the Task Force on Nature-related Financial Disclosures. It's an initiative that resembles the Task Force on Climate-related Financial Disclosures (TCFD). The TNFD aims to develop a framework that companies and financial institutions can use to evaluate and reveal their dependencies and impacts on nature. The objective of TNFD is to assist corporations and financial institutions in identifying and managing risks related to biodiversity loss and ecosystem degradation. Additionally, it aims to leverage opportunities associated with nature-positive activities. This framework can assist investors, lenders, and insurers in making well-informed decisions about their investments and lending practices concerning nature-related risks and opportunities.

The Task Force on Nature-related Financial Disclosures (TNFD) has set forth some primary goals, which include:

1. **Enhanced understanding:** To increase awareness and understanding among financial institutions, corporations, investors, and other stakeholders regarding the significance of nature-related risks and opportunities in financial decision-making.
2. **Improved risk management:** To provide a standardized framework for identifying, assessing, and managing nature-related risks within financial institutions and corporations' operations, supply chains, and investment portfolios.
3. **Disclosure standardization:** To develop consistent and comparable metrics, methodologies, and disclosures for nature-related risks and opportunities, which will be similar to the Task Force on Climate-related Financial Disclosures (TCFD), to facilitate transparency and decision-making.
4. **Integration into Financial Decision-Making:** To promote the integration of nature-related considerations into mainstream financial decision-making processes, including investment, lending, insurance, and corporate strategy.
5. **Encouraging Nature-positive Investments:** To stimulate investment in nature-positive activities and projects that contribute to biodiversity conservation, ecosystem restoration, and sustainable land use practices.
6. **Resilient Financial Systems:** To strengthen the resilience of financial systems and economies by addressing nature-related risks and dependencies, thereby reducing vulnerability to shocks and disruptions associated with biodiversity loss and ecosystem degradation.
7. **Contributing to Global Goals:** To support the achievement of global sustainability goals, such as the United Nations Sustainable Development Goals (SDGs) and the objectives of the Convention on Biological Diversity (CBD), by aligning financial flows with environmentally sustainable outcomes. Overall, the TNFD aims to bring about a shift towards a more sustainable and resilient financial system that recognizes and values nature's contributions to economic prosperity and human well-being.

1.4.6 Business Responsibility and Sustainability Reporting

BRSR stands for Business Responsibility and Sustainability Reporting. This term is often used in the context of corporate reporting requirements related to sustainability and social responsibility. BRSR frameworks typically outline guidelines for companies to disclose their performance and impacts on various environmental, social, and governance (ESG) factors. It entails the systematic disclosure of a company's performance and impacts across environmental, social, and governance (ESG) dimensions. Below is a brief overview of BRSR:

1. **Scope:** BRSR encompasses an extensive range of factors, including environmental stewardship, social responsibility, ethical governance practices, employee welfare, community engagement, human rights, and more.
2. **Purpose:** The primary objective of BRSR is to provide stakeholders, such as investors, customers, employees, regulators, and communities, with transparent and reliable information about a company's non-financial performance. This enables stakeholders to evaluate a company's sustainability practices, assess its long-term viability, and make informed decisions. Several countries and regulatory bodies have introduced guidelines or mandatory reporting requirements for BRSR to institutionalize sustainability reporting and ensure consistency and comparability of disclosures across companies.
3. **Standards and frameworks:** Various international standards and frameworks exist to guide BRSR, such as the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), the Task Force on Climate-related Financial Disclosures (TCFD), and others. These frameworks provide principles, indicators, and guidelines for companies to structure their sustainability disclosures. Integration with Financial Reporting: BRSR is increasingly being integrated with financial reporting to provide a comprehensive view of a company's overall performance and value creation. Integrated reporting frameworks, such as the International Integrated Reporting Council (IIRC) framework, aim to merge financial and non-financial information into a single, cohesive report.
4. **Stakeholder engagement:** Effective BRSR involves engaging with stakeholders to identify material issues, set targets, and establish meaningful performance indicators. Companies often conduct stakeholder consultations and engage in dialogue to understand stakeholder expectations and concerns.
5. **Benefits:** Adopting robust BRSR practices offers several benefits, including improved risk management, enhanced reputation and brand value, access to capital, increased stakeholder trust and loyalty, and a competitive advantage in attracting talent and customers.

1.4.7 Dow Jones Sustainability Index

The Dow Jones Sustainability Indices (DJSI) are a family of indices containing one main DJSI World global index, along with various geographic region-based indexes such as: Europe, Nordic, North America and Asia Pacific, operated through a strategic partnership between S&P Dow Jones Indices and RobecoSAM (Sustainable Asset Management). DJSI evaluates the performance of numerous public companies based on their sustainable practices.

1. **Scope:** It has well defined general as well as specific sustainability criteria for each of the 60 industry types defined as per the Industry Classification Benchmark (ICB).
2. **Stakeholder engagement:** To be listed in the DJSI, the long-term economic, environmental, and social performance of a company is assessed based on its sustainable practices in issues such as corporate governance, risk management, branding, climate

change mitigation, supply chain standards and labour management. The companies not operating in a sustainable manner are usually rejected from the Index.

3. **Benefits:** Established in 2012 by the merger of S&P Indices and Dow Jones Indexes, they are the pioneer sustainability benchmarks having a global relevance and have become a standard reference in sustainability investing for capitalists and companies.

DJSI holds industries to keep a check on the biodiversity at its operational unit with consideration of the risks associated with the operations and proposes to take action accordingly.

2 STUDY AREA

The biodiversity assessment was carried out at the Ahmedabad manufacturing facility of Zydus Wellness. It is one of the 4 main manufacturing facilities of Zydus wellness, along with Sikkim, Aligarh. This facility manufactures products such as Glucon-D, Nutralite, etc. This facility is located in the Changodar industrial area, which is on the outskirts of Ahmedabad. This area has multiple industrial units falling within various industrial sectors.

For the purpose of this study, the core area was considered as the main facility of Zydus Wellness and the buffer area comprised of the surrounding 2km area. The entire study area comprised largely of modified land dominated by industries. One waterbody was noted to the east of the facility which was considerably degraded due to waste disposal and industrial discharge Other landuse categories were agricultural lands and scrublands, which were dominated by invasive species. As such the entire region showed considerable signs of anthropogenic influence and modification.

Figure 2: Map of the study area

3 APPROACH AND METHODOLOGY

3.1 Bioidversity Assessment

Biodiversity assessment is the collection of baseline data on the ecosystem and biodiversity present at a given location and their interactions with each other. This includes both off-site and on-site studies where data was collected.

For onfield assessment, Stratified Random Sampling method was used wherein the study area was divided into different strata based on their land use pattern, and randomly sampling points were selected for the study.

Following methodology was used for flora and fauna assessment:

	Habit/ Taxa	Method
Flora Survey	Trees	• 10 m circular plot (List Count Method)
	Shrubs and Climbers	• 5 m concentric circle (List Count Method)
	Herbs	• 1 m x 1 m quadrat
Fauna Survey	Avifauna	• Point Center Count • Aquatic: Total Count
	Herpetofauna	• Visual Encounter • Opportunistic sighting
	Mammals	• Direct Sighting (Visual Encounter) • Indirect sightings (droppings, scat, other tracts and signs)
	Other insects and Arachnids	• Opportunistic sighting

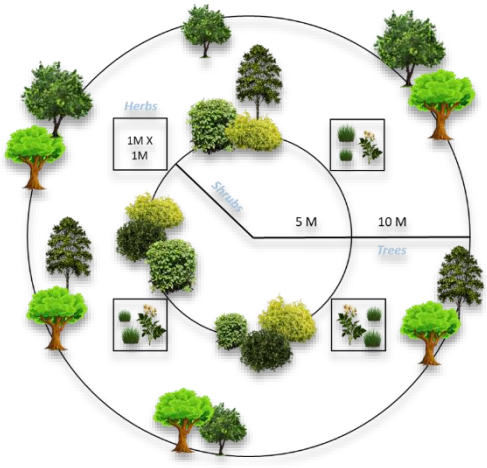

Figure 4 Flora assessment methodology

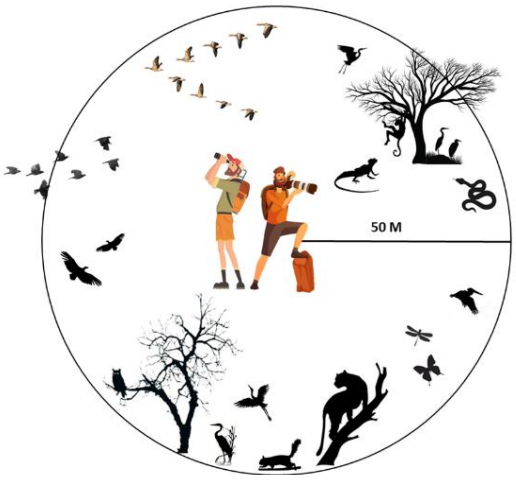

Figure 4 Fauna assessment methodology

The species were analysed for different attributes such as Simpson's diversity index and Shannon and Weiner diversity index; conservation status of the species as per IUCN and WPA, 2022. Also, the bird species were assessed for their residential and migratory status.

For latest scientific names of flora, website (https://www.ipni.org/) was referred. Global Invasive Species Database (GISD) and data from Invasive Species Compendium – Commonwealth Agricultural Bureaux International (ISC-CABI) were referred to assess indigenous status and invasiveness of floral species.

Tools such as Google Earth Pro, Arch GIS, GPS Essentials, and NatureNotes (Application developed by Terracon for data collection) were used for the study.

3.2 Dependency and Impact Assesment

An Ecosystem Services Review tool was used to idendity priority ecosystem services. Ecosystem Services Review is a tool developed by the World Resources Institute (WRI), World Business Council for Sustainable Development (WBCSD), and Meridian Institute. It helps industries to identify their dependencies and impacts on biodiversity and ecosystem services. The output of the exercise is a better understanding of risks and dependencies as well as strategic action plans for consideration of ecosystem services in the future activities of the industries. It is a tool for corporate strategy development and can augment existing environmental management systems. A predefined tool was used to carry out the exercise, which included rigorous discussions with the client.

Figure 5 Ecosystem services review methodology

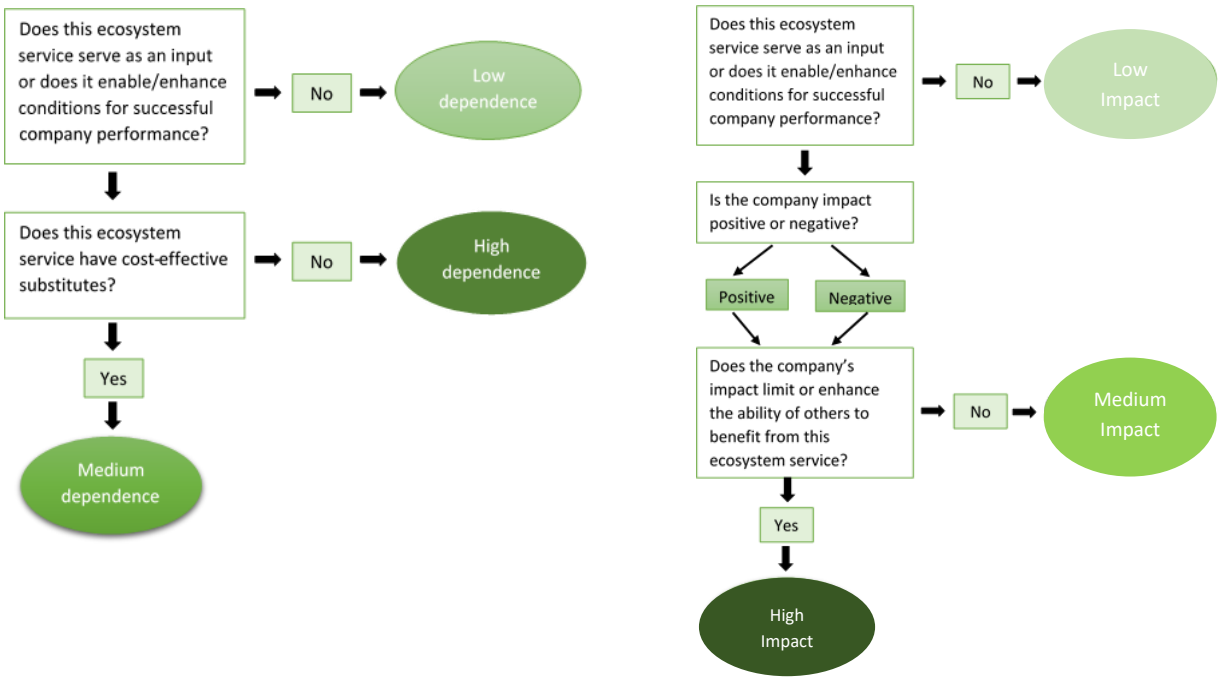

Figure 6 Method to Identify Priority Ecosystem Services

4 BIODIVERSITY OBSERVATION AND ANALYSIS

4.1 Habitats

The study area is significantly altered, with agriculture serving as the most frequently observed habitat, followed by rural settlements, residential colonies, and various industries. Natural and artificial wetlands and ponds are also present. Other natural habitats such as scrublands and open vegetation, also contributing to the land use diversity. The observed floral and faunal composition varied across these habitats, each reflecting unique characteristics.

4.2 Flora Observations

The core area exhibited mixed plantation of native and exotic trees in the greenbelt such as, Ceylon Ironwood (*Manilkara hexandra*), Queen of the night (*Nyctanthes arbo-tristis*), Arjun (*Terminalia arjuna*), Pongam Tree (*Pongamia pinnata*), and Weeping Bottlebrush (*Callistemon viminalis*), Flame Tree (*Delonix regia*), Royal bottle palm (*Roystonea regia*), respectively. Fruit trees such as Margosa Tree (*Azadirachta indica*), Coconut (*Cocos nucifera*), Jamun (*Syzygium cumini*), and Indian Almond (*Terminalia catappa*) were also observed. Flowering of Sweet Tamarind (*Pithecellobium dulce*) and fruiting of Spanish Cherry (*Mimusops elengi*) were also observed on these trees.

The sidewalk edges of the walkway were covered with the avenue trees such as Mast Tree (*Polyalthia longifolia*), followed by Whistling Pine (*Casuarina equisetifolia*), and Weeping Bottle-brush (*Callistemon viminalis*). Few individuals of Lanceleaf Buttonwood (*Conocarpus lancifolius*) were also planted in the greenbelt zone. The boundary walls of the plant comprised trees of Pink trumpet tree (*Tabebuia rosea*), Carribean trumpet tree (*Tabebuia aurea*), and Royal bottle palm (*Roystonea regia*). Single individual of Desert Fan Palm (*Washingtonia filifera*) was also planted as a focal tree-point in the lawn garden. Trees of Ornamental Weeping fig (*Ficus Panda*) were trimmed and the potters of the same included in the lawn garden.

In the buffer area, permanent vegetation around wetlands, both natural and artificial, was dominated by tree species such as Jamun (*Syzygium cumini*), Arjun (*Terminalia arjuna*), and Banyan (*Ficus benghalensis*). Woody trees, including Margosa (*Azadirachta indica*), Indian Siris (*Albizia lebbeck*), and Indian Ash (*Lannea coromandelica*), were observed along the boundaries of agricultural fields. Around human habitation, species such as the Lanceleaf Buttonwood (*Conocarpus lancifolius*), Copperpod (*Peltophorum pterocarpum*), Sacred Fig (*Ficus religiosa*), Indian Bael (*Aegle marmelos*), and Tamarind (*Tamarindus indica*).

The prominent shrub species Sky flower (*Duranta erecta*), and Devil's backbone (*Euphorbia tithymaloides*), were observed to be planted in open lawn spaces of greenbelts and along the

sidewalk edges. Flowering species such as the Red Ixora (*Ixora coccinea*) and Oleander (*Nerium oleander*) were planted for the aesthetic purposes. In the buffer area, shrub vegetation, such as Crown Flower (*Calotropis gigantea*) and Indian Mallow (*Abutilon indicum*), was found at the margins of croplands. In scrublands prominent shrubs included Rubber Bush (*Calotropis procera*), alongside dry grasses and herbaceous species like Mauritian Grass (*Apluda mutica*), Swollen Finger Grass (*Chloris barbata*), Tridax Daisy (*Tridax procumbens*), and Little Ironweed (*Cyanthillium cinereum*). Around human habitations, ornamental shrubs and herbs like Cordyline (*Dracaena angustifolia*), Oleander (*Nerium oleander*), and Periwinkle (*Catharanthus roseus*) for aesthetic purposes were observed. However, the spread of invasive species like Carrot Grass (*Parthenium hysterophorus*) was evident in these settlements.

Scanty herbaceous vegetation was observed throughout the greenbelt of core area. Only mats of Moss-rose purslane (*Portulaca grandiflora*) were planted. Whereas the lawn was covered with the Carpet Grass (*Paspalum vaginatum*), and Lawn Grass (*Cynodon dactylon*). Other herbaceous vegetaion within the lawn garden included Red Ginger (*Alpinia purpurata*), Periwinkle (*Catharanthus roseus*), Giant Crinum Lily (*Crinum asiaticum*), Banana (*Musa paradisiaca*). Potters of Carruthers' False-face (*Pseuderanthemum carruthersii*) were also observed. herbaceous species like Mauritian Grass (*Apluda mutica*), Swollen Finger Grass (*Chloris barbata*), Tridax Daisy (*Tridax procumbens*), and Little Ironweed (*Cyanthillium cinereum*).

Climbers were observed only in the core area. Climber such as Golden Pothos (*Epipremnum aureum*) was planted near the entrance of the admin building, and behind to the same Royal Jasmine (*Jasminum grandiflorum*) was planted.

Table 2: Summary of Findings (Flora)

Sr. No.	Habit	Number of Species	
		Core	Buffer
1	Trees	26	45
2	Shrubs	06	15
3	Herbs	13	37
4	Climbers	03	15

4.2.1 Trees

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
1	*Aegle marmelos*	Indian Bael	Rutaceae	Native	NT	-		+
2	*Albizia lebbeck*	Indian Siris	Fabaceae	Native	LC	-		+
3	*Annona squamosa*	Custard Apple	Annonaceae	Exotic	LC	-		+
4	*Azadirachta indica*	Margosa Tree	Meliaceae	Native	LC	-	+	+
5	*Callistemon viminalis*	Weeping Bottle-brush	Myrtaceae	Exotic	-	-	+	+
6	*Casuarina equisetifolia*	Whistling-pine	Casuarinaceae	Native	LC	-	+	+
7	*Cocos nucifera*	Coconut	Arecaceae	Exotic	-	-	+	+
8	*Conocarpus lancifolius*	Lanceleaf Buttonwood	Combretaceae	Exotic	VU	Invasive	+	+
9	*Cordia dichotoma*	Indian cherry	Boraginaceae	Native	LC	-		+
10	*Cordia subcordata*	Beach cordia	Boraginaceae	Native	LC	-		+
11	*Delonix regia*	Flame tree	Fabaceae	Exotic	LC	-	+	+
12	*Ficus benghalensis*	Banyan tree	Moraceae	Native	-	-		+
13	*Ficus panda*	Ornamental Weeping fig tree	Moraceae	Exotic			+	+
14	*Ficus religiosa*	Sacred fig tree	Moraceae	Native	-	-		+
15	*Lannea coromandelica*	Indian ash tree	Anacardiaceae	Native	LC	-		+
16	*Leucaena leucocephala*	Wild tamarind, River tamarind	Fabaceae	Exotic	-	Invasive		+
17	*Madhuca longifolia*	Indian butter tree	Sapotaceae	Native	-	-		+
18	*Mangifera indica*	Mango	Anacardiaceae	Native	DD	-		+
19	*Manilkara hexandra*	Ceylon Ironwood	Sapotaceae	Native	-	-	+	+
20	*Manilkara zapota*	Sapodilla plum	Sapotaceae	Native	LC	-	+	+
21	*Mimusops elengi*	Spanish cherry	Sapotaceae	Native	LC	-	+	+
22	*Moringa oleifera*	Drumstick tree	Moringaceae	Native	LC	-		+
23	*Nyctanthes arbo-tristis*	Queen of the night	Oleaceae	Native	-	-	+	+
24	*Peltophorum pterocarpum*	Copperpod	Fabaceae	Exotic	-	-	+	+
25	*Phoenix dactylifera*	Date Palm	Arecaceae	Exotic	-	-		+
26	*Pithecellobium dulce*	Sweet tamarind	Fabaceae	Exotic	LC	-	+	+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
27	*Platycladus orientalis*	Oriental thuja	Cupressaceae	Exotic	NT	-	+	+
28	*Plumeria alba*	White frangipani	Apocynaceae	Exotic	-	-	+	+
29	*Polyalthia longifolia*	Mast tree	Annonaceae	Native	-	-	+	+
30	*Pongamia pinnata*	Pongam tree	Fabaceae	Native	LC	-	+	+
31	*Prosopis cineraria*	Indian Mesquite	Fabaceae	Native	-	-		+
32	*Prosopis juliflora*	Algaroba	Fabaceae	Exotic	-	Invasive		+
33	*Psidium guajava*	Guava	Myrtaceae	Exotic	-	Invasive		+
34	*Punica granatum*	Pomegranate	Lythraceae	Exotic	LC	-	+	+
35	*Roystonea regia*	Royal bottle palm	Arecaceae	Exotic	LC	-	+	+
36	*Salvadora persica*	Toothbrush tree	Salvadoraceae	Native	LC	-		+
37	*Syzygium cumini*	Jamun	Myrtaceae	Native	LC	-	+	+
38	*Tabebuia aurea*	Carribean trumpet tree	Bignoniaceae	Exotic	-	-	+	+
39	*Tabebuia rosea*	Pink trumpet tree	Bignoniaceae	Exotic	LC	-	+	+
40	*Tamarindus indica*	Tamarind	Fabaceae	Exotic	LC	-		+
41	*Terminalia arjuna*	Arjun	Combretaceae	Native	-	-	+	+
42	*Terminalia catappa*	Indian almond	Combretaceae	Native	LC	-	+	+
43	*Vachellia nilotica*	Babool	Fabaceae	Native	LC	-		+
44	*Washingtonia filifera*	Desert Fan Palm	Arecaceae	Exotic			+	+
45	*Ziziphus mauritiana*	Indian Jujube	Rhamnaceae	Native	LC	-	+	+

Note:
LC: Least Concern; EN: Endangered; DD: Data Deficient; VU: Vulnerable

4.2.2 Shrubs

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
1	*Abutilon indicum*	Indian Mallow	Malvaceae	Native	-	-		+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
2	*Calotropis gigantea*	Crown Flower	Apocynaceae	Native	-	-		+
3	*Calotropis procera*	Rubber bush	Apocynaceae	Native	-	-		+
4	*Carica papaya*	Papaya	Caricaceae	Exotic	-	-	+	+
5	*Clerodendrum phlomidis*	Arni	Lamiaceae	Native	LC	-		+
6	*Dracaena angustifolia*	Cordyline	Asparagaceae	Native	LC	-	+	+
7	*Duranta erecta*	Sky flower	Verbenaceae	Exotic	LC	-	+	+
8	*Euphorbia tithymaloides*	Devil's backbone	Euphorbiaceae	Exotic	LC	-	+	+
9	*Ipomoea carnea*	Bush morning glory	Convolvulaceae	Exotic	-	Invasive		+
10	*Ixora coccinea*	Red ixora	Rubiaceae	Native	-	-	+	+
11	*Lantana camara*	Lantana	Verbenaceae	Exotic	-	Invasive		+
12	*Nerium oleander*	Oleander	Apocynaceae	Native	LC	-	+	+
13	*Phyllanthus reticulatus*	Black-Honey Shrub	Phyllanthaceae	Native	LC	-		+
14	*Senna occidentalis*	Coffee Senna	Fabaceae	Exotic	LC	-		+
15	*Ziziphus oenoplia*	Wild Jujube	Rhamnaceae	Native	-	-		+
Note: LC: Least Concern								

4.2.3 Climbers

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
1	*Ampelocissus latifolia*	Wild Grape	Vitaceae	Native	-	-		+
2	*Causonis trifolia*	Bush Grape	Vitaceae	Native	-	-		+
3	*Clitoria ternatea*	Butterfly Pea	Leguminosae	Natve	-	-		+
4	*Coccinia grandis*	Ivy gourd	Cucurbitaceae	Natve	-	-		+
5	*Cocculus hirsutus*	Broom Creeper	Menispermaceae	Native	-	-		+
6	*Cuscuta reflexa*	Giant Dodder	Convolvulaceae	Exotic	-	-		+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
7	*Epipremnum aureum*	Money Plant / Golden pothos	Araceae	Exotic	-	-	+	+
8	*Ipomoea aquatica*	Water morning glory	Convolvulaceae	Native	LC	-		+
9	*Ipomoea cairica*	Railway Creeper	Convolvulaceae	Native	-	-	+	+
10	*Ipomoea obscura*	Pan bel	Convolvulaceae	Native	-	-		+
11	*Ipomoea triloba*	Little Bell Morning Glory	Convolvulaceae	Exotic	-	-		+
12	*Jasminum grandiflorum*	Royal Jasmine	Oleaceae	Exotic	-	-	+	+
13	*Luffa acutangula*	Ribbed gourd	Cucurbitaceae	Native	-	-		+
14	*Momordica charantia*	Bitter-melon	Cucurbitaceae	Native	-	-		+
15	*Pergularia daemia*	Pergularia	Asclepiadaceae	Native	LC	-		+
Note: LC: Least Concern								

4.2.4 Herbs

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
1	*Acalypha indica*	Indian Copperleaf	Euphorbiaceae	Native	-	-		+
2	*Achyranthes aspera*	Prickly Chaff Flower	Amaranthaceae	Native	-	-		+
3	*Alpinia purpurata*	Red Ginger	Zingiberaceae	Exotic	-	-	+	+
4	*Apluda mutica*	Mauritian Grass	Poaceae	Native	-	-		+
5	*Bambusa bambos*	Indian Thorny Bamboo	Poaceae	Native	-	-		+
6	*Blumea axillaris*	Soft Blumea	Compositae	Native	-	-		+
7	*Catharanthus roseus*	Periwinkle	Apocynaceae	Exotic	-	-	+	+
8	*Chloris barbata*	Swollen fingergrass	Poaceae	Native	-	-		+
9	*Chrysopogon zizanioides*	Golden Beardgrass	Poaceae	Native	-	-		+
10	*Crinum asiaticum*	Giant Crinum Lily	Amaryllidaceae	Native	-	-	+	+
11	*Cyanthillium cinereum*	Little ironweed	Compositae	Native	-	-		+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
12	*Cynodon dactylon*	Bermuda/ Lawn Grass	Poaceae	Native	-	-	+	+
13	*Dendrocalamus strictus*	Male Bamboo	Poaceae	Native	-	-		+
14	*Dichanthium annulatum*	Kleberg's Bluestem	Poaceae	Native	-	-		+
15	*Dicliptera paniculata*	Panicled Foldwing	Acanthaceae	Native	-	-		+
16	*Digera muricata*	False Amaranth	Amaranthaceae	Native	-	-		+
17	*Eclipta alba*	False Daisy	Compositae	Exotic	LC	-	+	+
18	*Eragrostis tenella*	Japanese Lovegrass	Poaceae	Native	-	-		+
19	*Mesosphaerum suaveolens*	American Mint	Lamiaceae	Exotic	-	-		+
20	*Musa paradisiaca*	Banana	Musaceae	Exotic	-	-	+	+
21	*Ocimum tenuiflorum*	Holy basil	Lamiaceae	Native	-	-	+	+
22	*Oryza sativa*	Asian Rice	Poaceae	Exotic	-	-		+
23	*Parthenium hysterophorus*	Carrot Grass	Compositae	Exotic	-	Invasive		+
24	*Paspalum conjugatum*	Carabao grass	Poaceae	Exotic	LC	-		+
25	*Paspalum scrobiculatum*	Creepin Paspalum	Poaceae	Native	LC	-	+	+
26	*Paspalum vaginatum*	Carpet Grass	Poaceae	Exotic	-	-	+	+
27	*Phyllanthus urinaria*	Chamber Bitter	Phyllanthaceae	Native	-	-		+
28	*Portulaca grandiflora*	Moss-rose purslane	Portulacaceae	Exotic	-	-	+	+
29	*Portulaca oleracea*	Purslane	Portulacaceae	Exotic	LC	-	+	+
30	*Pseuderanthemum carruthersii*	Carruthers' False-face	Acanthaceae	Exotic	-	-	+	+
31	*Sida acuta*	Common Wireweed	Malvaceae	Native	-	-		+
32	*Tephrosia purpurea*	Purple tephrosia	Fabaceae	Native	-	-		+
33	*Tridax procumbens*	Tridax Daisy	Compositae	Exotic	-	-	+	+
34	*Triticum aestivum*	Wheat	Poaceae	Native	-	-		+
35	*Typha latifolia*	Broadleaf Reedmace	Typhaceae	Exotic	LC	-		+
36	*Urena lobata*	Caesarweed	Malvaceae	Native	LC	-		+
37	*Xanthium strumarium*	Common Cocklebur	Compositae	Native	-	-		+
Note:								

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
LC: Least Concern								

4.3 Fauna Observations

Considering the modified nature of the study area, most species observed were generalist species that are observed around heavily modified habitats. The species richness was enhanced considerably due to the presence of migratory birds which were prominent in the study area.

In the core area, the species commonly observed were Red-vented bulbul (*Pycnonotus cafer*), Purple Sunbird (*Cinnyris asiaticus*), White-eared bulbul (*Pycnonotus leucotis*), House sparrow (*Passer domesticus*), House crow (*Corvus splendens*), Common Myna (*Acridotheres tristis*), Common Tailorbird (*Orthotomus sutorius*), Western Koel (*Eudynamys scolopaceus*) These species were spotted all across the lawn and the green belt area of the plant premises. A flock of Jungle Babblers (*Argya striata*) was observed towards the west boundary of the plant, which is adjoining a marginally vegetated plot. Black kites (*Milvus migrans*), were observed in flight around the core area. An abandoned nest of a Black kite on the chimney was also pointed out by the plant representative. Among migratory species, terrestrial migrants observed were Weestern Yellow wagtail (*Motacilla flava*), Lesser Whitethroat (*Curruca curruca*). Majority of migratory birds were observed in the buffer area, around wetlands and agricultural fields. Prominent migratory species were Little ringed Plover (*Charadrius dubius*), Demoiselle Cranes (*Grus grus*), Sarus Crane (*Grus antigone*), Isabelline Shrike (*Lanius isabellinus*), Long-tailed Shrike (*Lanius schach*), Siberian stonechat (*Saxicola maurus*), Common Greenshank (*Tringa nebularia*), Rosy Starling (*Pastor roseus*). It should be noted however that most of the habitats in the buffer area, including wetlands were in a severely degraded condition due to the presence of industries and associated issues such as waste discharge and waste disposal.

Only 4 species of butterflies were observed during the study. Out of these the Plain tiger (*Danaus chrysippus*) and the Gram Blue (*Euchrysops cnejus*) were observed in the plant premises around the lawn. In the buffer area, the Little Orange Tip (*Colotis etrida*) and the Large Salmon Arab (*Colotis fausta*) were observed in the scrubland area. The lack of diversity of butterflies can be attributed to the high level of disturbance in the form of industrial activities.

The only mammals directly observed in the core area were the Five-striped Palm Squirrel (*Funambulus pennantii*) and the Northern Plains Grey Langur (*Semnopethicus entellus*). It was confirmed from the representatives of the plant that a troupe of Langurs frequently moves around the plant premises.

In the buffer area, secondary evidence of the presence of Wild boar (*Sus scrofa*) was spotted in the form of excreta. Their presence was also confirmed during and interaction with locals person in the area who also noted the existence of Golden Jackal (*Canis aureus*). The Indian

Grey Mongoose (*Herpestes edwardsii*) was spotted in the scrubland habitat and is the only Schedule – I mammal species observed.

No herpetofauna was directly observed during the survey. This could be due to the physiology of reptiles, which are cold blooded. During the winter season, the reptiles often have subdued activity patterns and bask in sunlight to absorb external heat. However, the presence of snakes was confirmed by the plant representatives. They informed about the presence of snakes within the plant premises. However no conflict was reported.

Table 3: Summary of Findings (Fauna)

Sr. No.	Habit	Number of Species	
		Core	Buffer
1	Birds	16	82
2	Butterfly	2	2
3	Mammals	2	2
4	Herpetofauna	1	0

4.3.1 Birds

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	MIGRATORY STATUS(BIRDS)	WPA SCHEDULE, 2022	CORE AREA	BUFFER AREA
1	*Acrocephalus agricola*	Paddyfield Warbler	Acrocephalidae	LC	W	II		+
2	*Iduna caligata*	Booted Warbler	Acrocephalidae	LC	W	II		+
3	*Eremopterix griseus*	Ashy-crowned Sparrow-lark	Alaudidae	LC	R	II		+
4	*Ceryle rudis*	Pied Kingfisher	Alcedinidae	LC	R	II		+
5	*Anas poecilorhyncha*	Indian Spot-billed Duck	Anatidae	LC	R	II		+
6	*Apus affinis*	Little Swift	Apodidae	LC	R	II		+
7	*Cypsiurus balasiensis*	Asian Palm-swift	Apodidae	LC	R	II		+
8	*Ardea alba*	Great White Egret	Ardeidae	LC	R	II		+
9	*Ardea intermedia*	Intermediate Egret	Ardeidae	LC	R	II		+
10	*Ardea purpurea*	Purple Heron	Ardeidae	LC	R	II		+
11	*Egretta garzetta*	Little Egret	Ardeidae	LC	R	II		+
12	*Charadrius dubius*	Little Ringed Plover	Charadriidae	LC	R & W	II		+
13	*Vanellus indicus*	Red-wattled Lapwing	Charadriidae	LC	R	II		+
14	*Prinia inornata*	Plain Prinia	Cisticolidae	LC	R	II		+
15	*Prinia socialis*	Ashy Prinia	Cisticolidae	LC	R	II		+
16	*Dendrocitta vagabunda*	Rufous Treepie	Corvidae	LC	R	II		+
17	*Centropus sinensis*	Greater Coucal	Cuculidae	LC	-	II		+
18	*Euodice malabarica*	Indian Silverbill	Estrildidae	LC	R	II		+
19	*Lonchura punctulata*	Scaly-breasted Munia	Estrildidae	LC	R	II		+
20	*Grus antigone*	Sarus Crane	Gruidae	VU	R	I		+
21	*Grus grus*	Common Crane	Gruidae	LC	W	I		+
22	*Hirundo rustica*	Barn Swallow	Hirundinidae	LC	W	II		+
23	*Ptyonoprogne concolor*	Dusky Crag Martin	Hirundinidae	LC	R	II		+
24	*Lanius isabellinus*	Isabelline Shrike	Laniidae	LC	W	II		+
25	*Lanius schach*	Long-tailed Shrike	Laniidae	LC	W	II		+
26	*Lanius vittatus*	Bay-backed Shrike	Laniidae	LC	R	II		+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	MIGRATORY STATUS(BIRDS)	WPA SCHEDULE, 2022	CORE AREA	BUFFER AREA
27	*Sterna aurantia*	River Tern	Laridae	VU	R	I		+
28	*Argya caudata*	Common Babbler	Leiothrichidae	LC	R	II		+
29	*Psilopogon haemacephalus*	Coppersmith Barbet	Megalaimidae	LC	R	II		+
30	*Anthus trivialis*	Tree Pipit	Motacillidae	LC	W	II		+
31	*Motacilla alba*	White Wagtail	Motacillidae	LC	W	II		+
32	*Motacilla citreola*	Citrine Wagtail	Motacillidae	LC	W	II		+
33	*Copsychus saularis*	Oriental Magpie-robin	Muscicapidae	LC	R	II		+
34	*Cyanecula svecica*	Bluethroat	Muscicapidae	LC	W	II		+
35	*Saxicola maurus*	Siberian Stonechat	Muscicapidae	-	W	II		+
36	*Saxicoloides fulicatus*	Indian robin	Muscicapidae	LC	R	II		+
37	*Gymnoris xanthocollis*	Chestnut-shouldered Bush-sparrow	Passeridae	LC	R	II		+
38	*Microcarbo niger*	Little Cormorant	Phalacrocoracidae	LC	R	II		+
39	*Phalacrocorax fuscicollis*	Indian Cormorant	Phalacrocoracidae	LC	R	II		+
40	*Francolinus pondicerianus*	Grey Francolin	Phasianidae	LC	R	II		+
41	*Phylloscopus nitidus*	Green Warbler	Phylloscopidae	LC	-	II		+
42	*Ploceus benghalensis*	Black-breasted Weaver	Ploceidae	LC	R	II		+
43	*Ploceus manyar*	Streaked Weaver	Ploceidae	LC	-	II		+
44	*Ploceus philippinus*	Baya Weaver	Ploceidae	LC	R	II		+
45	*Alexandrinus krameri*	Rose-ringed Parakeet	Psittaculidae	LC	R	II		+
46	*Pycnonotus jocosus*	Red-whiskered Bulbul	Pycnonotidae	LC	-	II		
47	*Amaurornis akool*	Brown Crake	Rallidae	LC	R	II		+
48	*Amaurornis phoenicurus*	White-breasted Waterhen	Rallidae	LC	R	II		+
49	*Fulica atra*	Common Coot	Rallidae	LC	R & W	II		+
50	*Porphyrio porphyrio*	Purple Swamphen	Rallidae	LC	R	II		+
51	*Actitis hypoleucos*	Common Sandpiper	Scolopacidae	LC	W	II		+
52	*Tringa nebularia*	Common Greenshank	Scolopacidae	LC	W	I		+
53	*Acridotheres ginginianus*	Bank Myna	Sturnidae	LC	R	II		+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	MIGRATORY STATUS(BIRDS)	WPA SCHEDULE, 2022	CORE AREA	BUFFER AREA
54	*Pastor roseus*	Rosy Starling	Sturnidae	LC	W	II		+
55	*Sturnia pagodarum*	Brahminy Starling	Sturnidae	LC	R	II		+
56	*Platalea leucorodia*	Eurasian Spoonbill	Threskiornithidae	LC	R	I		+
57	*Pseudibis papillosa*	Red-naped Ibis	Threskiornithidae	LC	R	II		+
58	*Threskiornis melanocephalus*	Black-headed Ibis	Threskiornithidae	NT	R	II		+
59	*Acrocephalus agricola*	Paddyfield Warbler	Acrocephalidae	LC	W	II		+
60	*Iduna caligata*	Booted Warbler	Acrocephalidae	LC	W	II		+
61	*Eremopterix griseus*	Ashy-crowned Sparrow-lark	Alaudidae	LC	R	II		+
62	*Ceryle rudis*	Pied Kingfisher	Alcedinidae	LC	R	II		+
63	*Anas poecilorhyncha*	Indian Spot-billed Duck	Anatidae	LC	R	II		+
64	*Apus affinis*	Little Swift	Apodidae	LC	R	II		+
65	*Cypsiurus balasiensis*	Asian Palm-swift	Apodidae	LC	R	II		+
66	*Ardea alba*	Great White Egret	Ardeidae	LC	R	II		+
67	*Ardea intermedia*	Intermediate Egret	Ardeidae	LC	R	II		+
68	*Ardea purpurea*	Purple Heron	Ardeidae	LC	R	II		+
69	*Egretta garzetta*	Little Egret	Ardeidae	LC	R	II		+
70	*Charadrius dubius*	Little Ringed Plover	Charadriidae	LC	R & W	II		+
71	*Vanellus indicus*	Red-wattled Lapwing	Charadriidae	LC	R	II		+
72	*Prinia inornata*	Plain Prinia	Cisticolidae	LC	R	II		+
73	*Prinia socialis*	Ashy Prinia	Cisticolidae	LC	R	II		+
74	*Dendrocitta vagabunda*	Rufous Treepie	Corvidae	LC	R	II		+
75	*Centropus sinensis*	Greater Coucal	Cuculidae	LC	-	II		+
76	*Euodice malabarica*	Indian Silverbill	Estrildidae	LC	R	II		+
77	*Lonchura punctulata*	Scaly-breasted Munia	Estrildidae	LC	R	II		+
78	*Grus antigone*	Sarus Crane	Gruidae	VU	R	I		+
79	*Grus grus*	Common Crane	Gruidae	LC	W	I		+
80	*Hirundo rustica*	Barn Swallow	Hirundinidae	LC	W	II		+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	MIGRATORY STATUS(BIRDS)	WPA SCHEDULE, 2022	CORE AREA	BUFFER AREA
Note: I, II: Schedules of Wildlife Protection (Amendment) Act, 2022 LC: Least Concern; VU: Vulnerable NT: Near Threatened R: Resident; W: Winter Migrant								

4.3.2 Butterflies

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	MIGRATORY STATUS(BIRDS)	WPA SCHEDULE, 2022	CORE AREA	BUFFER AREA
1	*Colotis etrida*	Little Orange-tip	Pieridae	-	-	-		+
2	*Colotis fausta*	Large Salmon Arab	Pieridae	LC	-	-		+
3	*Danaus chrysippus*	Plain Tiger	Nymphalidae	LC	-	-	+	
4	*Euchrysops cnejus*	Gram Blue	Lycaenidae	-	-	II	+	
Note: II: Schedule of Wildlife Protection (Amendment) Act, 2022 LC: Least Concern								

4.3.3 Mammals

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	MIGRATORY STATUS(BIRDS)	WPA SCHEDULE, 2022	CORE AREA	BUFFER AREA
1	*Herpestes edwardsii*	Indian Grey Mongoose	Herpestidae	LC	-	I		+
2	*Funambulus pennantii*	Five-striped Palm Squirrel	Sciuridae	LC	-	-	+	
3	*Semnopethicus entellus*	Northern Plains Grey Langur	Herpestidae	LC	-	II		+
Note: I, II: Schedules of Wildlife Protection (Amendment) Act, 2022 LC: Least Concern								

4.4 Quantitative Assessment

4.4.1 Shannon-Wiener Diversity Index

One tool for assessing the species diversity in a community is the Shannon Diversity Index, also known as the Shannon-Wiener Index. This index, represented by the letter H, is computed as follows: H = -Σpi * ln(pi). The diversity of species in a given community increases with a greater value of H. The diversity decreases as the value of H decreases. A community with only one species is indicated by a value of H = 0.

Shannon-Wiener Diversity Index falls between 0 and 5.

4.4.1.1 Flora

Shannon-Wiener diversity index value for the flora is depicted below:

Table 4: Shannon-Wiener diversity Index (Flora)

	Sampling point	Latitude	Longitude	Trees	Shrubs	Climbers	Herbs
CORE	D1 P1 C	22.916285	72.435440	1.055	0.598	0.693	0.562
	D1 P2 C	22.916473	72.435196	1.561	0.673	0.637	1.128
	D1 P3 C	22.916473	72.434799	1.887	0.500	0.611	1.241
BUFFER	D2 P1 B	22.916302	72.442017	1.295	1.224	1.199	1.002
	D2 P2 B	22.925154	72.422218	1.561	0.637	1.471	1.628
	D2 P3 B	22.894356	72.432838	0.530	1.011	0.683	0.849
	D2 P4 B	22.924051	72.457420	0.868	0.736	0.974	1.854
	D2 P5 B	22.920300	72.413383	0.693	0.637	0.474	0.264
	D2 P6 B	22.936005	72.441406	0.377	1.242	0.693	0.838

4.4.1.2 Fauna

Shannon-Wiener diversity index value for the fauna is depicted below:

Table 5: Shannon-Wiener diversity Index (Fauna)

	Sampling point	Latitude	Longitude	Birds
CORE	D1 P1 C	22.916285	72.435440	1.65
	D1 P2 C	22.916473	72.435196	1.39
	D1 P3 C	22.916473	72.434799	1.47
BUFF	D2 P1 B	22.916302	72.442017	1.68

	D2 P2 B	22.925154	72.422218	1.35
	D2 P3 B	22.894356	72.432838	1.56
	D2 P4 B	22.924051	72.457420	1.60
	D2 P5 B	22.920300	72.413383	2.14
	D2 P6 B	22.936005	72.441406	1.93

4.4.2 Simpson's Diversity Index

Simpson's Biodiversity Index considers the dominance of species in a community. It is based on the probability that two individuals randomly selected from the community belong to the same species. A community dominated by one or two species is less diverse than one in which several different species have a similar abundance.

As species richness and evenness increase, the value of the indices also increases. The index ranges from 0 to 1, where:

D = 0 indicates minimum diversity, where a single species dominates the entire community (maximum dominance).

D = 1 indicates infinite diversity, meaning all species are equally abundant (perfect evenness).

4.4.2.1 Flora

Table 6: Simpson's diversity Index (Flora)

	Sampling point	Latitude	Longitude	Trees	Shrubs	Climbers	Herbs
CORE	D1 P1 C	22.916285	72.435440	0.800	0.476	0.667	0.429
	D1 P2 C	22.916473	72.435196	0.933	0.533	0.667	0.624
	D1 P3 C	22.916473	72.434799	0.933	0.343	0.467	0.653
BUFFER	D2 P1 B	22.916302	72.442017	0.709	0.721	0.712	0.631
	D2 P2 B	22.925154	72.422218	0.933	0.667	0.822	0.698
	D2 P3 B	22.894356	72.432838	0.366	0.733	0.571	0.523
	D2 P4 B	22.924051	72.457420	0.600	0.433	0.679	0.859
	D2 P5 B	22.920300	72.413383	1.000	0.667	0.327	0.142
	D2 P6 B	22.936005	72.441406	0.250	0.727	0.667	0.447

4.4.2.2 Fauna

Table 7: Simpson's diversity Index (Fauna)

	Sampling point	Latitude	Longitude	Birds
CORE	D1 P1 C	22.916285	72.435440	0.28
	D1 P2 C	22.916473	72.435196	0.33
	D1 P3 C	22.916473	72.434799	0.23
BUFFER	D2 P1 B	22.916302	72.442017	0.29
	D2 P2 B	22.925154	72.422218	0.37
	D2 P3 B	22.894356	72.432838	0.15
	D2 P4 B	22.924051	72.457420	0.38
	D2 P5 B	22.920300	72.413383	0.09
	D2 P6 B	22.936005	72.441406	0.24

The number of species and individuals observed of other taxa were too low to be considered for diversity indices.

5 BIODIVERSITY IMPACT AND DEPENDENCIES

5.1 Inventory of Impacts and Dependencies

Table 8 Dependency and Impact Matrix of Ecosystem Services

Company: Zydus Wellness Limited, Ahmedabad **Assessment scope:** Company operations **Product:** Fast-moving Consumer Goods		***Company DEPENDENCE on ecosystem services***			***Company IMPACT on ecosystem services***			
Ecosystem services	**Definitions**	1.Does this ecosystem service serve as an input or does it enable/ enhance conditions for successful company performance? If "no" skip to question 3	Does this ecosystem service have service have cost-effective substitutes?	Comments or s upporting information	3. Does the company affect the quantity or quality of this ecosystem service? *If "no" skip to the next ecosystem service*	4. Is the company's impact positive or negative? - Positive: The company increases the quantity or quality of this ecosystem service - Negative: The company decreasesthe quantity or quality of this ecosystem service	5. Does the company's impact limit or enhance the ability of others to benefit from this ecosystem service?	**Comments or supporting information**
PROVISIONAL SERVICES								
Biomass fuel	Biological material derived from living or recently living organisms–both plant and animal–that serves as a source of energy.	Y	Y	Brickets are used as fuel in the operation. These are produced using natural agricultural waste and hence is an efficent solution to reducing dependency on non-conventional sources.	N			
Freshwater	Inland bodies of water, groundwater, rainwater, and surface waters for household, industrial, and agricultural uses.	Y	N	The plant relies on water drawn from the Narmada River canal for its operations. The unit also has a Zero-water discharge policy and hence the used water is recycled and further reused within the plant.	N			
REGULATING SERVICES								
Maintenance of air quality	Influence ecosystems have on air quality by emitting chemicals to the atmosphere (i.e., serving as a “source”) or extracting chemicals from the atmosphere (i.e., serving as a “sink”).	Y	Y	The company operates within the permissible limits of pollution. However residual emissions are let out in the surrounding area	N			All the activities in the operations are undertaken within the permissible limit
Global climate regulation	Influence ecosystems have on the global climate by emitting greenhouse gases or aerosols to the atmosphere or by absorbing greenhouse gases or aerosols from the atmosphere.	Y	N	The company emits several green house gases andcurrently it is planning to become a carbon neutral operation. The dependency of the company is high on this service as it is a requirement for the regulatory and reputational purpose.	N			

Company: Zydus Wellness Limited, Ahmedabad **Assessment scope:** Company operations **Product:** Fast-moving Consumer Goods		***Company DEPENDENCE on ecosystem services***			***Company IMPACT on ecosystem services***			
Ecosystem services	**Definitions**	1.Does this ecosystem service serve as an input or does it enable/ enhance conditions for successful company performance? If "no" skip to question 3	Does this ecosystem service have service have cost-effective substitutes?	Comments or s upporting information	3. Does the company affect the quantity or quality of this ecosystem service? *If "no" skip to the next ecosystem service*	4. Is the company's impact positive or negative? - Positive: The company increases the quantity or quality of this ecosystem service - Negative: The company decreasesthe quantity or quality of this ecosystem service	5. Does the company's impact limit or enhance the ability of others to benefit from this ecosystem service?	**Comments or supporting information**
Regional/local climate regulation	Influence ecosystems have on local or regional temperature, precipitation, and other climatic factors.	Y	N	Ideal climatic conditions are vital for the company's functions across the value chain. Ahmedabad is vulnerable to climate anomalies such as heat waves and flooding through unseasonal rains and cloudbursts.	N			
Regulation of water timing and flows	Influence ecosystems have on the timing and magnitude of water runoff, flooding, and aquifer recharge, particularly in terms of the water storage potential of the ecosystem or landscape.	Y	N	In absence of flood control meaures, extreme rainfall can lead to flooding and prevent the movement of raw material and manpower. It can also lead to erosion and poor road conditions, water built up, surface runoff and damage to infrastructure in extreme situations	N			
CULTURAL SERVICES								
Ethical and spiritual values	Spiritual, religious, aesthetic, intrinsic, “existence,” or other values people attach to ecosystems, landscapes, or species.	Y	?		Y	+	N	The company has a temple within the plant premises which employees revere and worship

The study highlights that the operation is highly dependent on freshwater for its operation. Additionally, it is also dependendt on other regulating services relate to climate, air quality and water timing and flows.

Table 9 Summary of Priority Ecosystem Services

Ecosystem services		Dependency	Impact
Provisioning			
1	Biomass fuel	○	
2	Freshwater	●	
Regulating			
3	Maintenance of air quality	●	
4	Global climate regulation	●	
5	Regional/local climate regulation	●	
6	Regulation of water timing and flows	●	
7	Pollination		○, +/-
Cultural			
8	Ethical and spiritual		+
Key ● **High** + **Positive impact** ○ **Medium** - **Negative impact** **Low** ? **Don't know**			

5.2 Inventory of Biodiversity Impacts

Based on the operations of the plant, it was determined that the overall biodiversity footprint and impact of the plant is minor. The most significant direct impact was the presence of invasive species planted in the greenbelt of the plant premises.

Impacts	Type of Impact	Description of the Impact
Impact 1	Direct	Utilization of water resources may increase demand and may lead to its depletion
Impact 2	Direct	Presence of invasive species in the plant area may lead to its dispersal in other parts replacing the native flora of the site and surrounding
Impact 3	Direct	Impact on faunal species due to noise generated during operation
Impact 4	Indirect	Disposal of debris in plant areas may provide hideouts for snakes leading to more encounters with humans

6 BIODIVERSITY MANAGEMENT PLAN

6.1 Objective

The Biodiversity Management Plan (BMP) aims to reduce the impact of the operation process on the biodiversity of the study area to achieve 'No-net Loss'. Following objectives needs to be adopted to sustain the biodiversity of the area in association with the operation:

- Education, awareness, and involvement of stakeholders in the protection of biodiversity
- Conservation and enhancement of the habitat
- Increase Biodiversity Value of the Site
- Reduce Threats on the Biodiversity
- Maintain a database and reporting biodiversity related measures in public domain

6.2 Path to No-net Loss

A mitigation hierarchy (Avoidance-Minimisation-Restoration-Biodiversity Offset). Conservation initiatives and actions that aid in the process of species conservation and enhancing the habitat can contribute towards achieving No-net Loss.

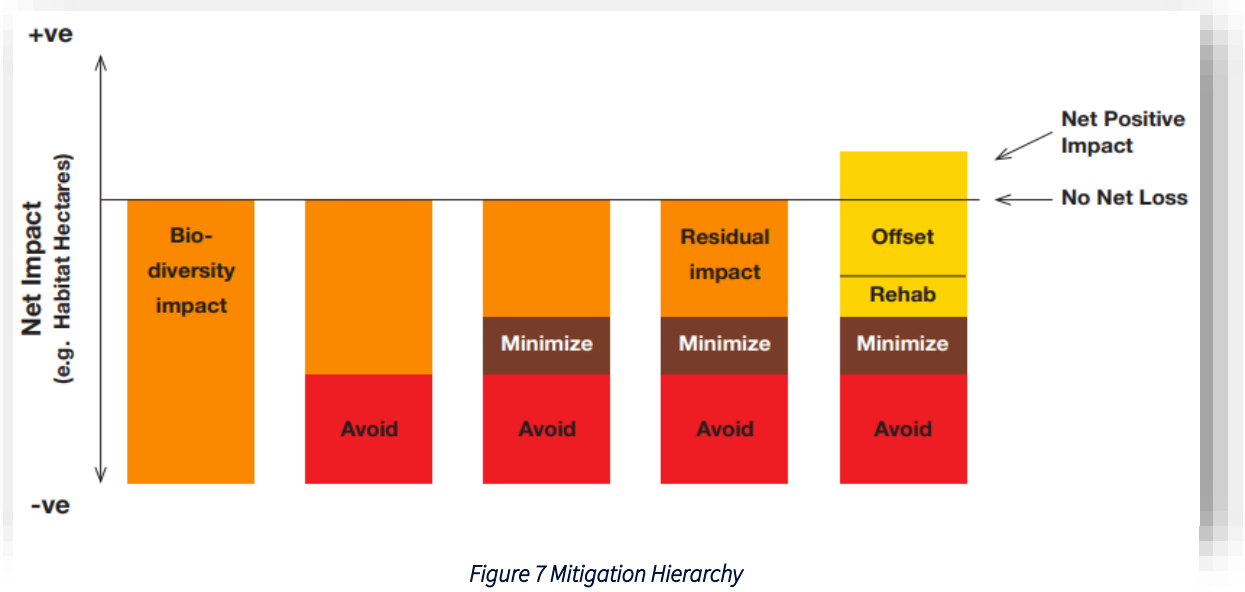

Figure 7 Mitigation Hierarchy

Based on the biodiversity risk of each impact a mitigation category has been assigned to the impacts and based on the it, strategies and action plans have been suggested in below sections.

Table 10 Correlation between the impacts and mitigation hierarchy

Impacts	Description of the Impact	Mitigation Hierarchy
Impact 1	Utilization of water resources may increase demand and may lead to its depletion	**Minimization**
Impact 2	Presence of invasive species in the plant area may lead to its dispersal in other parts replacing the native flora of the site and surrounding	**Minimization + Restoration**
Impact 3	Impact on faunal species due to noise generated during operation	**Minimization**
Impact 4	Disposal of debris in plant areas may provide hideouts for snakes leading to more encounters with humans	**Avoidance**

6.3 Strategies and Action Plans

6.3.1 Biodiversity Management System

Concept/Requirement

A comprehensive Biodiversity Management System can be established on group level to oversee the preservation of biodiversity both within the plant as well as its surrounding habitats. This system should consist of members with diverse expertise in Biodiversity and Environmental Management. Additionally, the creation of this system should be accompanied by a well-designed training program that encompasses the necessary tasks and functions for its effective operation.

The BMS should have protocols for data collection, compilation, and evaluation, and maintaining a consistent database. On unit level a Biodiversity Champion should be engaged for taking ownership and responsibility for biodiversity, facilitated by foundational knowledge gained through various training and awareness programs.

Role of Biodiversity Management System

The Biodiversity Champion will undertake the following responsibilities:

- Overseeing the successful execution of the Biodiversity Action Plan
- Tracking the advancement of the Biodiversity Action Plan's implementation
- Conducting biodiversity awareness sessions for employees and colleagues
- Establishing an accessible information-sharing platform
- Managing, executing, and overseeing the 'Biodiversity Protocols and Procedures' outlined below.

Significance	• Active participation of employees and locals in conservation of habitats and species • Providing opportunities to talent driven individuals

6.3.2 Enhancing Education and Awareness related to Biodiversity

6.3.2.1 Awareness about Biodiversity

Preserving biodiversity of an area necessitates the participation of every segment of the community. Building awareness about the local biodiversity, wildlife population dynamics, and the human-induced threats they face is vital to engage communities actively in conservation efforts.

The percentage of the employees sensitised on biodiversity and ecosystem services during reporting period should be indicated. The following formula can be used for calculation.

$$Percentage\ of\ employees\ sensitized\ on\ biodiversity = \frac{Total\ number\ of\ employees\ sensitized}{Total\ Employees} \times 100$$

Based on the qualification and managerial level, the employees can be divided into different groups and accordingly the sessions can be arranged.

6.3.2.2 Capacity Building Sessions

Concept/ Requirement

To conserve biodiversity effectively, it's crucial to first understand and recognize its significance. Often, the richness of flora and fauna compositions in our surroundings goes unnoticed until a situation demands attention. Therefore, raising awareness among both employees and citizens about local biodiversity and its vital role in human well-being is essential for its preservation.

Implementation Measures

- One of the ways through which awareness can be achieved is by conducting capacity building sessions, wherein the employees and local stakeholders are directly or through indirect means like photographs are introduced to the local biodiversity. This can be done through following techniques:
- Conducting introductory workshops that will showcase interesting images of habitats and existing biodiversity.
- Celebrating a yearly “Biodiversity Festival” that will closely involve practitioners, NGOs, students, locals, and talent driven individuals. Through the festival, biodiversity of the region can be showcased with present state, impacts, mitigation efforts taken by the operation towards conservation.
- Identifying talented individuals and involve them in conservation and monitoring efforts.
- Support and encourage improved training and professional development for teachers, employees and others involved in building awareness about biodiversity.
- Conducting Nature trails in the different habitats and biodiverse regions in the study area.

Significance	• Active participation of employees and locals in conservation of habitats and species • Providing opportunities to talent driven individuals

6.3.2.3 Installation of Biodiversity Information Posters in the Study area

Concept/ Requirement

Posters and signage carrying information of the existing biodiversity in the core, as well as the study area, will take the work of capacity building sessions a step further, regularly exposing the residents to their biodiversity. Along with displaying specific important species found in the study area, these signage boards will also hold information on the importance of the dominant natural habitat of the study area especially the forest species. Impact of human activities on scrublands and their species and measures to reduce this impact and conserve the habitat will be displayed on these installations. Installation of graphical signages in the local languages along with awareness sessions for the residents in their surroundings is essential for the purpose of awareness.

Figure 8 Representative image of information boards

Significance	Biodiversity Awareness among employees and locals regarding local biodiversity and contribution in their conservation

6.3.2.4 Celebration of 25 Wildlife and Environmental days

Concept/ Requirement

International organizations and agencies dedicated some days in the year to various biodiversity and various elements of the environment. These days aim to create awareness and encourage public action for conservation.

Organizing events to celebrate these days sustainably supports the aim of generating awareness about the environment, biodiversity and its conservation. The celebration can be marked by the conduction of talks by experts on the theme of the day, organization of relevant activities like nature trails, competitions and drives to create protect or clean habitats, etc. The employees, students and residents of the unit should be informed of these events and their participation should be encouraged and rewarded. CSR-driven initiatives like awards and scholarships to the most sustainable and environmentally aware village/community in the study area and students actively participating in events organized to create awareness and conserve the biodiversity of the region.

Date	Days related to Biodiversity/ Environment
2nd February	World Wetland Day
14th March	International Day of Action for Rivers
20th March	World Sparrow Day
22nd April	Earth Day
22nd May	World Biodiversity Day
5th June	World Environment Day
1st July to 7th July	Van Mahotsava Saptah
23rd September	World River Day
1st October to 7th October	Wildlife Week
3rd October	World Habitat Day
12th October	World Migratory Bird Day
21st November	World Fisheries Day
5th December	World Soil Day

Significance	Awareness among employees and locals regarding local biodiversity and contribution in their conservation

6.3.2.5 Integration of QR Code/ Label for the Awareness and Management of Tree Species in the Plant Area

Concept/ Requirement

With the rapid advancement of technology, the integration of innovative tools such as Quick Response (QR) codes offers a promising avenue to enhance educational experiences,

particularly in the study of diverse tree species. This initiative aims to explore the potential of using QR codes to provide comprehensive information about various trees located within the core area of

QR codes have already proven to be an efficient method for tracking and managing assets in large-scale operations across multiple sectors. In the context of a plant manufacturing unit, QR coding of trees can significantly contribute to enhancing sustainability, improving the management of green cover, and promoting environmental responsibility. In India, where biodiversity preservation is a growing concern, this technology can play a crucial role in protecting and monitoring native tree species within industrial premises.

The use of QR codes for environmental education and biodiversity conservation is gaining traction in India. For instance, New Delhi Municipal Corporation has installed QR codes on almost 4,000 trees in in Major Gardens, Avenues, Markets and NDMC Schools to highlight their ecological, medicinal, and religious significance (Daily Excelsior), through India's first ecology based environmental consultancy – Terracon Ecotech Private Limited.

Implementation Measures

Steps for Implementing Tree QR Coding:

1. **Inventory & Mapping**
   - Start by identifying and mapping all trees within the premises.
   - This process should include recording the GPS coordinates of each tree, along with data on its species, age, and current health status.
2. **Selection of QR Code Technology**
   - Choose a QR code platform that supports integration with a centralized database and offers data analytics capabilities.
   - The platform should be user-friendly, secure, and scalable to meet future requirements.
3. **Tree Labelling:**
   - Generate and print durable QR code labels.
   - Ensure the labels are weather-resistant and designed to withstand harsh environmental conditions.
   - Attach the QR codes to trees using non-invasive, tree-friendly materials.
4. **Database Development:**
   - Create a centralized online database to store detailed information on each tree, such as growth metrics, species, health logs, and any maintenance or interventions (e.g., pruning or disease treatment).
5. **Integration with Environmental Reports**
   - Incorporate the collected tree data into regular environmental reports for stakeholders, including governmental bodies, local NGOs, and corporate sustainability teams.
6. **Continuous Monitoring & Maintenance:**

- Establish a periodic review process to monitor tree health and ensure that the QR code system is updated regularly to reflect any changes.

Draft design for tree label with QR code

The following image illustrates a sample draft design of a tree label featuring a QR code:

Figure 9: Draft design for tree label with QR code (Representative Picture)

Information to be displayed upon scanning the QR Code:

- Botanical Name
- Common Name (English and Local)
- General description of the plant including their biogeographical region, habit, IUCN status, and its special characters & phenology
- Ecological Significance (5-6 lines)
- Medicinal Uses (5-6 lines)

6.3.3 Enhancement of Greenbelt through inclusion of Native Species

Concept/ Requirement

The existing greenbelt within the premises of Zydus Wellness, Ahmedabad, demonstrates a significant deficiency in regional native flora species. The trees in this area show increased vulnerability to dust accumulation, a condition exacerbated by the proximity of the core area

to highways and surrounding industrial zones, leading to prominent dust deposition across the greenbelt.

The impact of dust settling was particularly evident in the soil and greenbelt near the boundary walls. Additionally, waterlogging issues were observed in the greenbelt adjacent to the security checkpoint, caused by excessive discharge of treated water into the greenbelt and open lawns. This prolonged saturation of the soil has severely compromised its quality and health. Consequently, certain tree species, including Spanish Cherry/Bakul (*Mimusops elengi*) and Flame Tree (*Delonix regia*), were found in a dead or deteriorated state due to waterlogged conditions. The combination of dust deposition and poor drainage has significantly affected the vitality of the greenbelt plantation.

The greenbelt near the boundary walls and open lawn towards operational unit were mostly sparse vegetation of exotic-ornamental trees, shrubs and herbs. Composition of exotic tree species were observed in a significant number.

The exotic floral species do not support the local / regional faunal diversity and change the ecology of their habitats as well as it affects the growth of native plant diversity. Therefore, to enhance the existing green cover, more plantations of native plant species is being recommended along open spaces / side-walk edges in lawns and peripheral boundaries of core zone. Therefore, in order to attract the native faunal diversity and to maintain the original characteristics of their habitat, it is recommended to increase the green cover in the core zone by planting regional native plant species.

Implementation Measures

Particulars	Details
Diverse Native Flora Collections	• Continuously expand and diversify the plant collections to showcase a wide range of botanical specimens, including RET (rare endangered threatened plants), common native species, and plants with cultural and ethnobotanical significance. Use striking name boards for each species
Maintain Data Fidelity	• Cross-verify the scientific names and common names of all the species under cultivation by referring to proper scientific websites;(https://indiabiodiversity.org), http://www.flowersofindia.net), (https://bsi.gov.in) etc. • The same can be verified by consultation with the local forest department
Long-Term Maintenance and Sustainability	• LTM involves the periodic maintenance of the health of flora species and garden premises to maintain its sustainability • Practice sensible and environmentally friendly measures like; organic gardening, composting and using drip irrigation systems, thus maintaining the soil microbiota health and utilizing less water resources
Conservation Initiatives	• Practice plant conservation initiatives, such as ethnomedicinal seed banking, Rare Endangered and Threatened (RET) plant propagation, and native endangered species conservation

The list of native species ideal for enhancing the greenbelt are given below:

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	VEGETATION TYPE
Trees					
1	*Aegle marmelos*	Stone apple (Bael)	Rutaceae	NT	Evergreen
2	*Albizia lebbeck*	Indian Siris	Fabaceae	–	Partially Deciduous
3	*Albizia procera*	White Siris	Fabaceae	LC	Partially Deciduous
4	*Alstonia scholaris*	Scholars tree	Apocynaceae	LC	Evergreen
5	*Artocarpus heterophyllus*	Jackfruit tree	Moraceae	–	Evergreen
6	*Azadirachta indica*	Margosa/ Neem tree	Meliaceae	LC	Evergreen
7	*Bauhinia purpurea*	Purple Orchid tree	Fabaceae	LC	Deciduous
8	*Bauhinia racemosa*	Bidi Leaf Tree	Fabaceae	–	Deciduous
9	*Bauhinia variegata*	Orchid Tree	Fabaceae	LC	Deciduous
10	*Bergera koenigii*	Curry Leaf Tree	Rutaceae	LC	Partially Deciduous
11	*Bombax ceiba*	Red Silk Cotton Tree	Malvaceae	LC	Deciduous
12	*Borassus flabellifer*	Taad	Arecaceae	–	Evergreen
13	*Bridelia retusa*	Spinous Kino Tree	Phyllanthaceae	LC	Deciduous
14	*Buchanania cochinchinensis*	Lanzan	Anacardiaceae	–	Deciduous
15	*Butea monosperma*	Flame of the Forest	Fabaceae	–	Deciduous
16	*Calophylum inophyllum*	Alexandrian Laurel	Calophyllaceae	LC	Deciduous
17	*Caryota urens*	Fishtail Palm	Arecaceae	LC	Evergreen
18	*Cassia fistula*	Golden Shower Tree	Fabaceae	–	Deciduous
19	*Dalbergia sissoo*	Indian rosewood	Fabaceae	LC	Evergreen
20	*Ficus amplissima*	Bat-ficus tree	Moraceae	LC	Deciduous
21	*Ficus benghalensis*	Banyan tree	Moraceae	–	Evergreen
22	*Ficus benjamina*	Weeping Fig	Moraceae	LC	Evergreen
23	*Ficus racemosa*	Cluster Fig	Moraceae	–	Deciduous
24	*Ficus religiosa*	Sacred Fig	Moraceae	–	Evergreen
25	*Ficus semicordata*	Dumur	Moraceae	LC	Deciduous
26	*Ficus virens*	White Fig	Moraceae	LC	Evergreen
27	*Gmelina arborea*	Shivan tree	Lamiaceae	–	Evergreen
28	*Holoptelea integrifolia*	Indian Elm	Ulmaceae	–	Evergreen

29	*Lagerstroemia speciosa*	Pride of India	Lythraceae	–	Deciduous
30	*Lannea coromandelica*	Indian ash tree	Anacardiaceae	LC	Deciduous
31	*Madhuca longifolia*	Indian Butter Tree / Mahua	Sapotaceae	–	Deciduous
32	*Mangifera indica*	Mango	Anacardiaceae	DD	Evergreen
33	*Mimusops elengi*	Bakul tree	Sapotaceae	LC	Evergreen
34	*Mitragyna parviflora*	True Kadamb	Rubiaceae	–	Deciduous
35	*Moringa oleifera*	Drumstick tree	Moringaceae	–	Deciduous
36	*Neolamarckia cadamba*	Kadamba	Rubiaceae	–	Evergreen
37	*Pongamia pinnata*	Indian beech tree / Karanj	Fabaceae	LC	Evergreen
38	*Putranjiva roxburghii*	Lucky Bean Tree	Putranjivaceae	LC	Evergreen
39	*Saraca asoca*	Sita Ashoka	Fabaceae	VU	Evergreen
40	*Streblus asper*	Sandpaper Tree	Moraceae	LC	Evergreen
41	*Syzygium cumini*	Java Plum	Myrtaceae	LC	Evergreen
42	*Tectona grandis*	Teak	Lamiaceae	–	Deciduous
43	*Terminalia bellirica*	Beach almond	Combretaceae	LC	Deciduous
44	*Terminalia catappa*	Jungli Badam tree	Combretaceae	LC	Deciduous
45	*Terminalia chebula*	Chebulic myrobalan	Combretaceae	LC	Deciduous
46	*Thespesia populnea*	Indian Tulip Tree	Malvaceae	LC	Evergreen
47	*Vachellia nilotica*	Babool	Fabaceae	LC	Deciduous
48	*Ziziphus mauritiana*	Indian Jujube	Rhamnaceae	LC	Deciduous
Shrubs					
1	*Abelmoschus manihot*	Bele	Malvaceae	DD	Partially Deciduous
2	*Abutilon persicum*	Persian Mallow	Malvaceae	–	Partially Deciduous
3	*Barleria prionitis*	Porcupine flower	Acanthaceae	–	Evergreen
4	*Bauhinia acuminata*	Dwarf white bauhinia	Fabaceae	–	Partially Deciduous
5	*Breynia retusa*	Cup Saucer Plant	Phyllanthaceae	LC	Evergreen
6	*Calotropis gigantea*	Crown Flower	Apocynaceae	–	Evergreen
7	*Calotropis procera*	Rubber Bush	Apocynaceae	–	Evergreen
8	*Capparis zeylanica*	Ceylon Caper	Capparaceae	–	Evergreen
9	*Carrisa carandas*	Karonda	Apocynaceae	–	Evergreen
10	*Citrus x limon*	Lemon	Rutaceae	–	Evergreen
11	*Clerodendrum laevifolium*	Bridal Veil	Verbenaceae	–	Evergreen
12	*Colebrookea oppositifolia*	Indian squirrel tail	Lamiaceae	LC	Evergreen

13	*Ixora coccinea*	Jungle geranium	Rubiaceae	–	Evergreen
14	*Jasminum grandiflorum*	Royal Jasmine	Oleaceae	–	Evergreen
15	*Leucas stelligera*	Starry Leucas	Lamiaceae	–	Evergreen
16	*Murraya paniculata*	Kamini	Rutaceae	–	Evergreen
17	*Nerium oleander*	Nerium	Apocynaceae	–	Evergreen
18	*Pavetta indica*	Indian Pavetta	Rubiaceae	–	Evergreen
19	*Phyllanthus reticulatus*	Black-Honey Shrub	Phyllanthaceae	–	Evergreen
20	*Tabernaemontana alternifolia*	Crape jasmine	Apocynaceae	–	Evergreen
21	*Tabernaemontana divaricata*	Pinwheel flower	Apocynaceae	–	Evergreen
22	*Vitex negundo*	Five Leaved Chaste	Lamiaceae	LC	Evergreen
23	*Volkameria inermis*	Glory Bower	Verbenaceae	–	Evergreen
Climbers					
1	*Ampelocissus latifolia*	Wild Grape	Vitaceae	–	Evergreen
2	*Ancistrocladus heyneanus*	Kardal	Ancistrocladaceae	–	Evergreen
3	*Asparagus racemosus*	Buttermilk root	Asparagaceae	–	Evergreen
4	*Cajanus scarabaeoides*	Showy Pegionpea	Fabaceae	LC	Evergreen
5	*Celastrus paniculatus*	Black Oil Plant	Celastraceae	–	Evergreen
6	*Cissampelos pareira*	Velvet Leaf	Menispermaceae	–	Evergreen
7	*Clematis gouriana*	Indian Clematis	Ranunculaceae	–	Evergreen
8	*Clematis hedysarifolia*	Burman Clematis	Ranunculaceae	–	Evergreen
9	*Cocculus hirsutus*	Broom Creeper	Menispermaceae	–	Evergreen
10	*Cocculus hirsutus*	Broom Creeper	Menispermaceae	–	Evergreen
11	*Combretum indicum*	Rangoon Creeper	Combretaceae	–	Evergreen
12	*Dioscorea bulbifera*	Air yam	Dioscoreaceae	–	Evergreen
13	*Dioscorea oppositifolia*	Cinnamon Vine	Dioscoreaceae	–	Evergreen
14	*Diploclisia glaucescens*	Glaucous Diploclisia	Menispermaceae	–	Evergreen
15	*Diplocyclos palmatus*	Lollipop Climber	Cucurbitaceae	–	Evergreen
16	*Gouania leptostachya*	Slender Spiked Gouania	Rhamnaceae	–	Evergreen
17	*Hemidesmus indicus*	Indian Sarsaparilla	Apocynaceae	–	Evergreen
18	*Hiptage benghalensis*	Madhavi Lata	Malpighiaceae	LC	Evergreen

19	*Jasminum malabaricum*	Malabar Jasmine	Oleaceae	–	Evergreen
20	*Luffa aegyptiaca*	Sponge Gourd	Cucurbitaceae	–	Evergreen
21	*Mussaenda glabrata*	Dhobi Tree	Rubiaceae	–	Evergreen
22	*Reissantia grahamii*	Ding hou	Celastraceae	–	Evergreen
23	*Smilax zeylanica*	Kumarika	Smilacaceae	–	Evergreen
24	*Smythea bombaiensis*	Bombay Smythea	Rhamnaceae	–	Evergreen
25	*Thunbergia coccinea*	Scarlet Clock Vine	Acanthaceae	–	Evergreen
26	*Thunbergia mysorensis*	Mysore Trumpet Vine	Acanthaceae	–	Evergreen
27	*Thunbergia laevis*	Sweet Clock Vine	Acanthaceae	–	Evergreen
28	*Tinospora cordifolia*	Heart-leaved moonseed	Menispermaceae	–	Evergreen
29	*Vincetoxicum fasciculatum*	Brown-Flowered Ipecac	Apocynaceae	–	Evergreen
30	*Bauhinia vahlii*	Maloo Creeper	Fabaceae	–	Evergreen
31	*Combretum indicum*	Rangoon Creeper	Combretaceae	–	Evergreen
32	*Getonia floribunda*	Paper Flower Climber	Combretaceae	–	Evergreen
Herbs & Grasses					
1	*Asystasia dalzelliana*	Violet Asystasia	Acanthaceae	–	Evergreen
2	*Bacopa monnieri*	Brahmi	Plantaginaceae	LC	Evergreen
3	*Begonia crenata*	Common Begonia	Begoniaceae	–	Evergreen
4	*Canna indica*	Indian Shot	Cannaceae	–	Evergreen
5	*Centella asiatica*	Indian Pennywort	Apiaceae	LC	Evergreen
6	*Chlorophytum glaucum*	Scaly-Stem Chlorophytum	Asparagaceae	–	Evergreen
7	*Cleome gynandra*	Wild Spider Flower	Cleomaceae	–	Evergreen
8	*Cleome viscosa*	Asian Spider Flower	Cleomaceae	–	Evergreen
9	*Crinum latifolium*	Milk and Wine Lily	Amaryllidaceae	–	Evergreen
10	*Curculigo orchioides*	Golden Eye Grass	Hypoxidaceae	–	Evergreen
11	*Hellenia speciosa*	Spiral Ginger	Costaceae	–	Evergreen
12	*Impatiens balsamina*	Garden Balsam	Balsaminaceae	–	Evergreen
13	*Impatiens minor*	Lesser Balsam	Balsaminaceae	–	Evergreen

14	*Justicia adhatoda*	Malabar Nut	Acanthaceae	–	Evergreen
15	*Leea setuligera*	Bristly Leea	Vitaceae	–	Evergreen
16	*Linum mysorense*	Mysore Flax	Linaceae	–	Evergreen
17	*Musa paradisiaca*	Banana	Musaceae	–	Evergreen
18	*Neuracanthus sphaerostachyus*	Pin Cushion Plant	Acanthaceae	–	Evergreen
19	*Ruellia prostata*	Wild petunia	Acanthaceae	–	Evergreen
20	*Sida rhombifolia*	Jelly Leaf	Malvaceae	–	Evergreen
21	*Withania somnifera*	Ashwagandha	Solanaceae	–	Evergreen
22	*Arundo donax*	Giant Reed	Poaceae	–	Evergreen
23	*Bambusa bambos*	Indian Thorny Bamboo	Poaceae	–	Evergreen
24	*Bothriochloa bladhii*	Purple plume grass	Poaceae	–	Evergreen
25	*Cenchrus ciliaris*	Buffel Grass	Poaceae	–	Evergreen
26	*Chloris barbata*	Swollen Finger Grass	Poaceae	–	Evergreen
27	*Chrysopogon aciculatus*	Golden Beardgrass	Poaceae	–	Evergreen
28	*Cynodon dactylon*	Common Lawn Grass	Poaceae	–	Evergreen
29	*Dichanthium annulatum*	Kleberg's Bluestem	Poaceae	–	Evergreen
30	*Digitaria abludens*	Stalked Crabgrass	Poaceae	–	Evergreen
31	*Digitaria ciliaris*	Wild Crabgrass	Poaceae	–	Evergreen
32	*Eleusine indica*	Indian goosegrass	Poaceae	–	Evergreen
33	*Eragrostis ciliaris*	Gophertail Lovegrass	Poaceae	–	Evergreen
34	*Heteropogon contortus*	Black Speargrass	Poaceae	–	Evergreen
35	*Imperata cylindrica*	Cogon Grass	Poaceae	–	Evergreen

6.3.3.1 Additional Measures for Greenbelt Enhancement

Installation of Water Hose System for Greenbelt Management Near Boundary Walls

Water hoses are specially designed pipes with strategically placed water outlets at regular intervals. This system allows for even and controlled water distribution directly to plant roots, promoting healthy growth and reducing water wastage.

In areas where manual watering along dividers and peripheral greenbelt zones is challenging or infrequent, implementing a water hose system offers a reliable alternative. Alternatively, a drip irrigation system can be considered for enhanced efficiency, providing slow, targeted watering that minimizes evaporation and runoff.

Greenbelt Layout

- **Staggered or Zigzag Planting for Greenbelt:** Staggered or zigzag planting between upper-layer trees is a critical strategy for developing a dense, resilient, and ecologically balanced greenbelt. This technique contrasts with linear or row planting by arranging plants in alternating patterns to create a more natural and layered vegetation structure.

Significance/Advantages	Details
Enhanced Density and Thicket Formation	- Staggered planting fills gaps between trees, forming a denser vegetative cover. - A thicket-like structure increases wind-breaking capacity, reducing the direct impact of dust and pollution entering the premises. - Improves noise attenuation by creating a multi-layered buffer that traps sound waves more effectively.
Increased Habitat Diversity	- Zigzag arrangements create microhabitats by varying plant spacing and layering, attracting birds, pollinators, and other wildlife to support local biodiversity. - Shrubs and ground cover in staggered gaps provide shelter, nesting spaces, and food for smaller fauna.
Reduction of Monoculture Risks	- Linear planting can lead to monoculture-like patterns susceptible to pests and diseases. - Staggered planting reduces pest and disease spread by increasing air circulation and breaking direct plant-to-plant contact.
Enhanced Aesthetic Appeal	- Staggered arrangements mimic natural forest patterns, creating a visually appealing landscape with varied plant heights, textures, and foliage density. - Provides a sense of depth and variation, avoiding the monotonous appearance of straight rows.

Improve Soil Fertility

Soil fertility refers to the soil's ability to support healthy plant growth by providing essential nutrients and maintaining favourable chemical, physical, and biological properties.

In the greenbelt areas, soil compaction was observed, along with fine dust accumulation that has further degraded soil quality. Consequently, the ground vegetation in the greenbelt surrounding the core zone was found to be in poor condition. Additionally, overwatering using hose pipes and sprinklers in the lawn garden was noted. This excessive water application not only loosens the soil structure, making it unstable for tree roots, but also leads to foul odors and creates conditions detrimental to beneficial soil microorganisms. Overwatering negatively affects nitrogen-fixing bacteria that are vital for nitrogen fixation in leguminous plants, thereby reducing soil fertility and overall plant health.

Recommendations

- **Implement Efficient Water Management**:

  i. Regulate the use of treated water in greenbelts and lawns to avoid overwatering.
  ii. Consider adopting drip irrigation or other controlled water distribution systems to maintain optimal soil moisture levels.

- **Improve Soil Fertility**:

  i. **Incorporate Organic Matter**: Add compost, organic manure, and well-decomposed plant matter to enrich soil structure and nutrient availability.
  ii. **Apply Nitrogen-Based Fertilizers**: Use nitrogen-rich fertilizers sparingly to boost soil productivity, ensuring compatibility with native plant requirements.
  iii. **Amend Compacted Soil**: Use aeration techniques or organic soil conditioners to alleviate compaction and promote healthy root penetration.

Significance	• Conservation of native biodiversity • Promoting habitat heterogeneity

6.3.4 Invasive Species Management

Concept/Requirement

An invasive species refers to a non-native plant introduced intentionally or unintentionally to a new region, where it spreads rapidly and poses substantial ecological, economic, or health-related challenges. Lacking natural predators or competitors, these species often outcompete native flora, leading to biodiversity loss and ecosystem disruption. According to a recent report in the Journal of Applied Ecology, approximately 66% of India's natural ecosystems are

threatened by invasive species. This conclusion is drawn from a comprehensive national survey covering 158,000 plots across 358,000 square kilometers of wildlands. The report highlights the spread of 11 high-risk invasive plant species, including Common Lantana (*Lantana camara*) and Subabool (*Leucaena leucocephala*), which have established themselves in 20 states across the country

According to the **IPBES global assessment of invasive species**, the following key points have been highlighted. (IPBES 2023)

- Invasive alien species have contributed solely or alongside other drivers of change to 60 per cent of recorded global animal and plant extinctions while invasive alien species are the only driver attributed to 16 per cent of documented global extinction
- People and nature are threatened by invasive species all over the world.
- Invasive alien species cause dramatic and often, irreversible changes to biodiversity and ecosystems, resulting in adverse and complex outcomes across all regions of Earth, including local and global species extinctions.
- The economy, food security, water security and human health are profoundly and negatively affected by invasive alien species.
- Human activities are largely responsible for the transport, introduction, establishment and spread of alien invasive species.
- The recovery of ecosystem functions and nature's contributions to people can be achieved through adaptive management, including ecosystem restoration in terrestrial and closed water systems.
- Preventing and controlling invasive alien species can strengthen the effectiveness of policies designed to respond to other threats to biodiversity and contribute to achieving several Sustainable Development Goal.

Implementation Measures

The list of invasive species recorded during the study are as follows

Table 11: List of Invasive Species observed in the Study area

SN.	Scientific Name	Common Name	Family	IUCN Status	Location
		Trees			
1	*Conocarpus lancifolius*	Lanceleaf Buttonwood	Combretaceae	VU	Core & Buffer
2	*Leucaena leucocephala*	River Tamarind/ Subabool	Fabaceae	–	Buffer
3	*Prosopis juliflora*	Algaroba	Algaroba		Buffer
4	*Psidium guajava*	Guava	Myrtaceae	LC	Buffer
		Shrubs			
1	*Ipomoea carnea*	Bush Morning Glory	Convolvulaceae	–	Buffer
2	*Lantana camara*	Common Lantana	Verbenaceae	–	Buffer
		Herbs & Grasses			
1	*Parthenium hysterophorus*	Carrot Grass	Compositae	–	Buffer

The first step requirement in management of any species is mapping its location in the Core area.

Lanceleaf Buttonwood (*Conocarpus lancifolius*) being the most invasive species observed in the study area, prioritising its management is an important aspect.

There are few locations in the core area with young plantation of Lanceleaf Buttonwood, it is recommended to remove the individuals of this species phase-wise by dividing the area into different section and after cutting replacing the location with native species. New propagations can be uprooted directly.

The population of any obnoxious weed can be easily managed through manually uprooting it from the site.

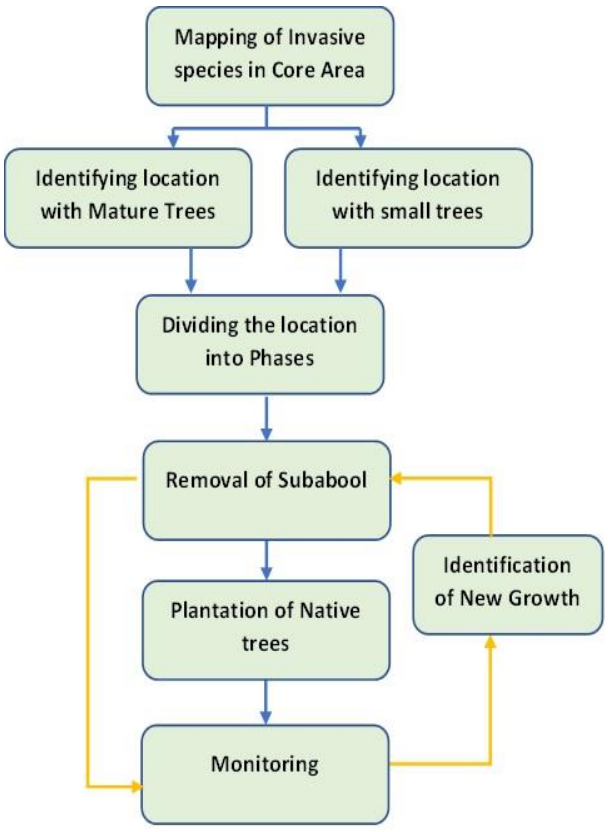

Figure 10: Invasive Species Management

Disposal of the species is also important as it might flourish again. Hence, it is recommended to clear the ground after cutting the species. The wood can be used as fuel in the plant itself or given to locals. Also, regular monitoring and population trend observation is required to ensure maintenance of this population and devising management plans if the need occurs.

Additionally, public awareness campaigns and stricter regulations on the import and planting of exotic species can help prevent future invasions.

Table 12. Management plan for invasive species

SN.	Species Name	Observed at locations	Mechanism of spread	Reproduction mechanism	Methods of removal	Methods of disposal	Representative Photo
1	Lanceleaf Buttonwood (*Conocarpus lancifolius*)	Core area and urban landscapes in buffer zones.	Seeds dispersed by water and wind.	Self-fertile; produces seeds continuously under favourable conditions, ensuring propagation even in isolation.	1. Manual removal or uprooting before seeds mature.	1. Shred plant parts thoroughly. 2. Allow parts to sun-dry for 15–20 days. 3. Compost or spread dried material in plantation areas as mulch.	
2	River Tamarind/ Subabool (*Leucaena leucocephala*)	Drylands, and Human Habitation in Buffer Area	Mammals, Ground insects, water.	Has ability to Self-fertile (promoting seed production even on isolated individuals). Flowering and seeding continually throughout the year as long as moisture permits combined with self-fertility promotes abundant pod and seed set.	1. Mechanical Uproot the plants before it sets fruit.	1. Shredding of all parts. 2. Sun drying for 15 to 20 days. 3. Spreading in plantation site.	
3	Algaroba (*Prosopis juliflora*)	Drylands, Scrublands, roadside degraded lands in Buffer Area	Seeds dispersed by animals (livestock and wildlife), water, and wind.	Highly prolific seed producer: seeds remain viable in the soil for extended periods. Can regenerate from cut stumps and roots, promoting persistence.	1. Mechanical or manual uprooting, ensuring complete removal of roots to prevent regrowth.	1. Shred or chop plant parts. 2. Sun-dry for 20–30 days. 3. Use dried material as biofuel, mulch, or compost. Avoid leaving seeds in accessible areas to prevent further spread.	

SN.	Species Name	Observed at locations	Mechanism of spread	Reproduction mechanism	Methods of removal	Methods of disposal	Representative Photo
4	*Guava* (*Psidium guajava*)	Human Habitation in Buffer Area	Dispersal of seeds through the frugivorous birds and mammals	Seeds and vegetative.	1. Mechanical - Uproot the plants before it sets fruit. 2. Burn the plant.	1. It is recommended to remove the existing individuals and make sure not to adopt these species for future plantation purposes. 2. Uprooting of plant at nonflowering stage. 3. Shredding of all parts. 4. Sun drying for 15 to 20 days. 5. Spreading in plantation site.	
5	Bush Morning Glory (*Ipomoea carnea*)	Wetlands, riverbanks, agricultural fields, roadside areas of Buffer Zone.	Seeds dispersed by water, wind, and animals. Also spreads vegetatively through stem fragments.	Produces numerous seeds that germinate rapidly in moist conditions. Can regenerate from stem fragments, making it difficult to control.	Mechanical removal by uprooting the entire plant, including roots and stem fragments, to prevent regrowth.	1. Collect and shred all plant parts. 2. Sun-dry for 15–20 days to neutralize regrowth potential. 3. Compost or burn dried material carefully. Avoid dumping in wet areas.	
6	Wild Sage (*Lantana camara*)	Open vegetation, Scrublands, Croplands, Wetlands, and Human Habitation in Buffer Area	Birds and Mammals (Sheep, Goats, Cattles)	Seeds and vegetative.	1. Mechanical - Uproot the plants before it sets fruit.	1. Cut the stems and sun dry them for 15 days or 1 month. 2. use them as fence material or craft. 3. Species shows the allelopathic effect. Hence shredding of parts and mixing in soil is not recommended.	
7	Carrot Grass (*Parthenium hysterophorus*)	Open land, scrublands in Buffer Area	1. Seeds are dispersed on the hairs of animals and attached to clothes and agricultural machinery. 2. Seeds are dispersed by wind and water	Seeds and vegetative.	1. Mechanical - Uproot the plants before it sets fruit.	1. Uprooting of plant at nonflowering stage. 2. Shredding of all parts. 2. Sun drying for 15 to 20 days. 3. Spreading in plantation site.	

6.3.5 Creating Habitat for Pollinators

Concept/Requirement

Butterflies are essential to the ecosystem, characterised by a co-evolutionary relationship with plants that underscores their interdependence. Their taxonomy is well-established, and their biology and life history are thoroughly understood. Research has quantified their physiological tolerances—including habitat preferences, temperature, and light requirements—correlating these factors with changes in ecosystem conditions, thus making butterflies effective indicators for assessing ecosystem health. In addition to pollination, butterflies serve as a food source for various organisms, assist in pest control, and contribute to other vital ecological functions. An increase in butterfly populations can have a positive impact on associated species, ultimately enhancing overall species diversity and abundance.

However, it is worth noting that the operational core manufacturing unit premises of Zydus Wellness in Ahmedabad are predominantly characterized by introduced plant species rather than native flora. This composition may limit the complete ecological benefits typically associated with native species in promoting biodiversity and ecosystem stability.

Implementation Measures

Since the core unit features a single open lawn area near the entry gate with a mix of native and exotic plant species, a small section of this space can be thoughtfully designated for a butterfly garden. Careful planning and implementation are essential to ensure its success. When developing the butterfly garden, special attention should be given to the strategic arrangement of nectar and larval host plants. Larval host plants should be placed in locations with minimal human disturbance to support optimal growth and habitat conditions. Over time, butterflies will be attracted to the flowering plants for nectar and may use the host plants for egg-laying, depending on the species present.

The following detailed plan of action can be undertaken to develop a butterfly garden:

Steps	Description
Site Selection	• Preferred locations to establish a butterfly garden within the core area of the Zydus Wellness plant are the lawn behind the parking area.
	• This area can be potentially utilised to accommodate various native plants and eventually attract butterflies.
Planning	• A variety of nectar-rich flowers, and host plants to support all stages of the butterfly lifecycle has been provided below this table.
Soil Preparation	• Features such as rocks, logs, or shallow puddles for basking and puddling can also be incorporated under the locations mentioned in the site selection.
	• Remove any weeds or invasive plants that may compete with butterfly-friendly vegetation.

Steps	Description
Planting of host plants	• Incorporate region-specific larval host plants for caterpillars to feed on.
Maintenance	• Water newly planted areas regularly, especially during dry spells, to establish healthy vegetation.
	• Mulch around plants to retain moisture, suppress weeds, and provide organic matter as it decomposes.
	• Monitor for pests and diseases, opting for natural or organic control methods to minimize harm to butterflies and other beneficial insects.
Monitoring and Evaluation	• Regularly observe the garden to track butterfly activity and species diversity.
	• Keep records of plant performance, noting any successes or challenges encountered.
	• Solicit feedback from visitors and volunteers to identify areas for improvement and future expansion.

The list of butterfly host and nectar plants are given below, which were observed in the core and buffer area

SN.	Common Name	Scientific Name	Larval Host Plant	Nectar Secreting Plant
1	Plain Tiger Butterfly	*Danaus chrysippus*	1. *Calotropis procera* 2. *Calotropis gigantea* 3. *Asclepias curassavica* 4. *Pergularia daemia* 5. *Oxystelma esculentum* 6. *Asclepias curassavica*	1. *Ixora coccinea* 2. *Catharanthus roseus* 3. *Asparagus racemosus* 4. *Combretum indicum* 5. *Volkameria inermis*
2	Gram Blue Butterfly	*Euchrysops cnejus*	1. *Butea monosperma* 2. *Lablab purpureus* 3. *Canavalia gladiola* 4. *Vigna radiata* 5. *Pergularia daemia*	
3	Little Orange-tip	*Colotis etrida*	1. *Capparis decidua* 2. *Capparis Spinosa* 3. *Maerua oblongifolia* 4. *Salvadora persica* 5. *Cadaba fruticose*	
4	Large Salmon Arab	*Colotis fausta*		

The comprehensive checklist of butterfly host and nectar plants designed for a pollinator garden is represented below:

SN.	Scientific Name	Common Name	Family	IUCN Status	Host Plant	Nectar Plant
Trees						
1	*Aegle marmelos*	Stone apple (Bael)	Rutaceae	NT	✓	✓
2	*Artocarpus heterophyllus*	Jackfruit tree	Moraceae	–	✓	
3	*Bauhinia purpurea*	Purple Orchid tree	Fabaceae	LC		✓
4	*Bauhinia racemosa*	Bidi Leaf Tree	Fabaceae	–		✓
5	*Bergera koenigii*	Curry Leaf Tree	Rutaceae	LC	✓	
6	*Butea monosperma*	Flame of the Forest	Fabaceae	–		✓
7	*Calophylum inophyllum*	Alexandrian Laurel	Calophyllaceae	LC		✓
8	*Cassia fistula*	Golden Shower Tree	Fabaceae	–	✓	✓
9	*Lagerstroemia speciosa*	Pride of India	Lythraceae	–		✓
10	*Saraca asoca*	Sita Ashoka	Fabaceae	VU		✓
11	*Vachellia nilotica*	Babool	Fabaceae	LC	✓	
12	*Ziziphus mauritiana*	Indian Jujube	Rhamnaceae	LC	✓	
Shrubs						
1	*Barleria prionitis*	Porcupine flower	Acanthaceae	–		✓
2	*Breynia retusa*	Cup Saucer Plant	Phyllanthaceae	LC	✓	
3	*Calotropis gigantea*	Crown Flower	Apocynaceae	–	✓	
4	*Calotropis procera*	Rubber Bush	Apocynaceae	–	✓	
5	*Capparis zeylanica*	Ceylon Caper	Capparaceae	–		✓
6	*Carrisa carandas*	Karonda	Apocynaceae	–		✓
7	*Citrus x limon*	Lemon	Rutaceae	–	✓	✓
8	*Ixora coccinea*	Jungle Geranium	Rubiaceae	–		✓
9	*Murraya paniculata*	Kamini	Rutaceae	–		✓
10	*Nerium oleander*	Nerium	Apocynaceae	–		✓
11	*Nerium oleander*	Nerium	Apocynaceae	–		✓
12	*Tabernaemontana alternifolia*	Crape Jasmine	Apocynaceae	–		✓
13	*Tabernaemontana divaricata*	Pinwheel Flower	Apocynaceae	–		✓
14	*Vitex negundo*	Five Leaved Chaste	Lamiaceae	LC		✓
15	*Volkameria inermis*	Glory Bower	Verbenaceae	–		✓
Climbers						
1	*Asparagus racemosus*	Buttermilk Root	Asparagaceae	–	✓	
2	*Cajanus scarabaeoides*	Showy Pegionpea	Fabaceae	LC	✓	
3	*Diplocyclos palmatus*	Lollipop Climber	Cucurbitaceae	–		✓

4	*Hemidesmus indicus*	Indian Sarsaparilla	Apocynaceae	–		✓
5	*Hiptage benghalensis*	Madhavi Lata	Malpighiaceae	LC		✓
6	*Jasminum malabaricum*	Malabar Jasmine	Oleaceae	–		✓
7	*Luffa aegyptiaca*	Sponge Gourd	Cucurbitaceae	–	✓	✓
8	*Smilax zeylanica*	Kumarika	Smilacaceae	–	✓	✓
9	*Thunbergia coccinea*	Scarlet Clock Vine	Acanthaceae	–		✓
10	*Thunbergia laevis*	Sweet Clock Vine	Acanthaceae	–		✓
Lianas						
1	*Combretum indicum*	Rangoon Creeper	Combretaceae	–		✓
2	*Getonia floribunda*	Paper Flower Climber	Combretaceae	–		✓
3	*Tinospora cordifolia*	Heart-leaved Moonseed	Menispermaceae	–	✓	
Herbs						
1	*Asystasia dalzelliana*	Violet Asystasia	Acanthaceae	–		✓
2	*Bacopa monnieri*	Brahmi	Plantaginaceae	LC		✓
3	*Begonia crenata*	Common Begonia	Begoniaceae	–		✓
4	*Canna indica*	Indian Shot	Cannaceae	–		✓
5	*Centella asiatica*	Indian Pennywort	Apiaceae	LC		✓
6	*Chlorophytum glaucum*	Scaly-Stem Chlorophytum	Asparagaceae	–	✓	
7	*Cleome gynandra*	Wild Spider Flower	Cleomaceae	–		✓
8	*Cleome viscosa*	Asian Spider Flower	Cleomaceae	–		✓
9	*Crinum latifolium*	Milk and Wine Lily	Amaryllidaceae	–		✓
10	*Curculigo orchioides*	Golden Eye Grass	Hypoxidaceae	–		✓
11	*Hellenia speciosa*	Spiral Ginger	Costaceae	–		✓
12	*Justicia adhatoda*	Malabar Nut	Acanthaceae	–		✓
13	*Linum mysorense*	Mysore Flax	Linaceae	–		✓
14	*Ruellia prostata*	Wild Petunia	Acanthaceae	–		✓
15	*Withania somnifera*	Ashwagandha	Solanaceae	–		✓
Grasses						
1	*Arundo donax*	Giant Reed	Poaceae	–		
2	*Bambusa bambos*	Indian Thorny Bamboo	Poaceae	–	✓	
3	*Bothriochloa bladhii*	Purple Plume Grass	Poaceae	–	✓	
4	*Cenchrus ciliaris*	Buffel Grass	Poaceae	–	✓	
5	*Chloris barbata*	Swollen Finger Grass	Poaceae	–	✓	
6	*Setaria verticillata*	Bristly Foxtail	Poaceae	–	✓	
Note: NT = Near Threatened, VU = Vulnerable, LC = Least Concern						

Significance	• Promoting habitat heterogenicity and natural cycle • Increased habitat for faunal species

6.3.6 Management Plan for Northern Plains Gray Langurs

Concept/Requirement

Northern Plains Gray Langurs (*Semnopithecus entellus*) have been observed within the premises of the Zydus Wellness manufacturing unit in Ahmedabad. As the core zone constitutes a highly altered, modified habitat for this species, it is crucial to implement effective management strategies to mitigate potential human-animal conflicts in the area.

Conservation Measures

Actions to avoid conflicts (Do's)	Actions in Case of Encounter (Don'ts)
• Ensure proper disposal of waste and food scraps to avoid attracting langurs to human-occupied areas. Use langur-proof bins wherever possible. • Record sightings of langurs and their behavioural patterns within and around the premises to identify potential risk areas and times of heightened activity. • Provide training to all staff about langur behaviour, signs of stress or aggression, and appropriate actions to take during encounters. • Grow fruiting and native trees that provide food and shelter. • Observe them from a distance to prevent stress or aggression. • Maintain a list of contact numbers for local wildlife rescuers, forest department personnel, or animal welfare organizations to handle emergency situations effectively.	• Do not approach, provoke, or feed the langurs, as this may lead to aggression or dependency. • Avoid making sudden movements or loud noises that could alarm the langurs. • Observe them from a safe distance, ensuring they have an unobstructed path to leave the area. • If langurs enter any human-occupied zones, contact wildlife rescuers or forest officials for assistance in safely relocating them. • Assign one person to observe the langurs' movements and alert others while maintaining a safe distance.

Actions in Case of Langur-Related Incidents
• **For Aggressive Behaviour or Minor Injuries:**

1. Move away calmly without making direct eye contact or sudden gestures.
2. Wash minor scratches or bites with soap and water immediately. Seek medical attention for potential rabies exposure.

- **For Serious Injuries:**
  1. Call for medical help immediately.
  2. Apply basic first aid to stop bleeding but avoid further contact with the injured area until medical professionals arrive.
  3. Provide information to the attending doctor, such as the time of the incident and the location of the injury.

6.3.7 Additional Strategies

6.3.7.1 Efficient Water Management

Concept

Implementing a comprehensive water management strategy is critical to mitigating the waterlogging observed in the greenbelt at Zydus Wellness, Ahmedabad. Excessive discharge of treated water has compromised soil structure, reduced fertility, and resulted in the deterioration of few tree species, such as Spanish Cherry (*Mimusops elengi*) and Flame Tree (*Delonix regia*). To address these issues, it is recommended to install drainage systems, such as French drains or percolation trenches, and adopt a regulated irrigation system with moisture sensors to optimize water use. Additionally, replanting with native, water-tolerant species will enhance the greenbelt's resilience.

Implementing a comprehensive system for **water drainage, storage, and harvesting** will optimize moisture availability, prevent waterlogging, and enhance soil quality, thus supporting the growth of trees, shrubs, and ground vegetation. This proactive water monitoring system will ensure long-term soil health and prevent future waterlogging.

Implementation Measures

1. Water Drainage Management

Waterlogging was observed near certain sections of the greenbelt, particularly near the security check post, affecting soil structure and tree health.

Recommendation:

- Install **drainage channels and perforated pipes** to direct excess water away from greenbelt areas prone to saturation.
- Ensure **grading and contouring** of the landscape to facilitate natural water flow and prevent pooling.

- **Percolation trenches** or **soak pits** can be developed along the boundaries to enhance groundwater recharge while minimizing surface runoff.

2. Water Storage Systems

Excess treated water was being released into greenbelt and lawn areas without proper regulation, causing soil compaction and anaerobic conditions.

Recommendation:

- Use **storage tanks or cisterns** to collect treated water from the sewage treatment plant (STP) and regulate its controlled use.
- Develop **bio-swales and retention basins** within the greenbelt to capture and store excess runoff. These systems can store water temporarily and release it slowly to prevent over-saturation.

3. Rainwater Harvesting for Greenbelt Irrigation

Excess treated water use leads to soil degradation; rainwater remains underutilized.

Recommendation:

- Install **rainwater harvesting structures**, such as **roof catchment systems and recharge wells**, to capture rainwater and reduce dependency on treated water.
- Integrate **rain gardens** in low-lying areas of the greenbelt to allow natural infiltration and improve soil moisture levels.
- Use **drip irrigation systems** with harvested rainwater to promote efficient watering and minimize evaporation losses.

Significance	• Conservation of Water

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