

Developing an Eco-Rating system for Resorts in sensitive natural landscapes of Western Ghats. Case: Tungi Resort, Lonavala.

Submitted in partial fulfilment of the requirements of the degree of
Masters of Architecture in Landscape

by
Paulomi Kanakia

Guided by
Ar. Hrishikesh Phadke

Master of Architecture in Landscape
L.S. Raheja School of Architecture, Mumbai



Bombay Suburban Art & Craft Education Society's
**L S Raheja School of
Architecture**

April, 2020

Dedicated to

my Mother and Father

Shobha and Pravin Kanakia





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Developing an Eco-Rating system for Resorts in sensitive natural landscapes of Western Ghats. Case: Tungi Resort, Lonavala. Submitted in partial fulfilment of the requirements of the degree of Masters of Architecture in Landscape by Paulomi Kanakia Guided by Ar. Hrishikesh Phadke Master of Architecture in Landscape L.S. Raheja School of architecture, Mumbai / MARCH, 2019-2020

DECLARATION

I, **Paulomi Kanakia**, the author of the dissertation titled **Developing an Eco-Rating system for Resorts in sensitive natural landscapes of Western Ghats. Case : Tungi Resort, Lonavala**, hereby declare that this is an independent work of mine, carried out towards partial fulfilment of the requirements for the award of Masters of Architecture in Landscape degree at the L.S Raheja School of Architecture, Mumbai. It contains my own ideas in my own words and has not been taken from the work of others (as from books, articles, essays, dissertations, other media and online); and where others ideas or words have been included, I have adequately cited and referenced the original sources, other texts, or any other source whatsoever are acknowledged and the source cited are identified in the dissertation references.

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Paulomi Kanakia

Date: April, 2020

Place: Mumbai

Signature of Student

C E R T I F I C A T E

This is to certify that the dissertation titled **Developing an Eco-Rating system for Resorts in sensitive natural landscapes of Western Ghats. Case : Tungi Resort, Lonavala** has been submitted by **Paulomi Kanakia** towards partial fulfilment of the requirements for the award of Masters of Architecture in Landscape degree at the L.S Raheja School of Architecture, Mumbai in accordance with the undertaking signed by the student on the previous page.

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Personal narrative



Figure (i): Maldives - year 2009
Source : photographs - Author



Figure (ii): Kandalama - year 2009
Source : photographs - Author

I love to travel. I feel refreshed being close to nature and exploring variety of places, people, culture. I have experienced stays at some amazing Resorts located in beautiful natural landscape settings.

With landscape studies, I began to think, how can one conserve this natural beauty and its ecology, and that's how I started this Research.

Abstract

Hospitality industry contributes to about 9.6% GDP and 8% of total employment in India. This industry is one of the key drivers of growth. Its strong potential is due to **beautiful natural landscapes of India** and **rich Indian cultural heritage**. While making it enjoyable for travellers, it becomes necessary to keep its original form and value intact, alongside securing **culture** and **Economy of local communities**. The increasing number of travellers, is bound to cause more and more use of resources and generation of waste. If there are no mitigation measures for these negative impacts, it leads to **depletion of resources** and **degradation of Ecology**.

Resorts are one such part of hospitality industry, that are self-contained destinations, mostly **in natural landscape settings** like beaches, mountains, lakes, historic or scenic places, for purpose of relaxation and leisure. Hence for Resorts, it becomes even more necessary to protect, restore, preserve, and manage this natural environment and relationship between living organisms within its natural surroundings.

Among the natural landscapes of India, Western Ghats, Himalayas, Indo-Burma region, Sundalands-Nicobar group of islands are the **biodiversity hotspots**. Biodiversity Hotspots have a dire need for ecological conservation through responsible design, construction and management.

Landscape ecology is a science of studying and improving relationships between ecological processes in environment and the ecosystems. All relevant existing Guidelines and Rating systems were found inadequate in relation to ecology; thus Author felt the need to develop an Eco-Rating system to **incentivize Resort owners and management** to adopt **Ecological conservation practices**. This Eco-Rating system is developed with a **greater purpose of Ecological conservation**. Along with ecological benefits, it would bring community, economical, recreational benefits, specifically in and around the **Resorts** situated in **Western Ghats**, thus considers its climate, topography, biodiversity, and its unique ecological conditions.

Need for such a defined ‘System’ is even stronger in wake of Covid-19.

ECOLOGY IS NOT SOMEBODY'S WORK... IT'S EVERYBODY'S WORK
- SADHGURU

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Ar. Shraddha Kakade - Design Manager - IMK Architects.

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A HEALTHY ECOLOGY IS THE BASIS FOR A HEALTHY ECONOMY
- CLAUDINE SCHNEIDER

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ECONOMY WITHOUT ECOLOGY MEANS
MANAGING THE HUMAN - NATURE RELATIONSHIP
WITHOUT KNOWING THE DELICATE BALANCE
BETWEEN HUMANKIND AND THE NATURAL WORLD.
- SATISH KUMAR

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List of abbreviations

HRACC - Hotel and Restaurant Association Classification Committee,
[Ministry of Tourism, Government of India]

FHRAI - The Federation of Hotel & Restaurant Associations of India.

MOEF - Ministry of Environment and Forestry.
[Government of India]

UNESCO - United Nations Educational, Scientific and Cultural Organisation.

WGEEP - Western Ghats Ecology Expert panel
[constituted by MOEF - Government of India]

IGBC - Indian Green Building Council.

GRIHA - Green Rating for Integrated Habitat Assessment.

LEED - Leadership in Energy and Environment.

NZGBC - New Zealand Green Building Council.

STP - Sewage Treatment Plant

MEP - Mechanical, Electrical, Plumbing [consultants]

SQ.M. - Square Meters

CU.M. - Cubic Meters

ERCA – Eco-Rating Certification Authority

EVEN LUXURY CAN CREATE REDUCED ECOLOGICAL FOOTPRINTS,
IF WE CARED ENOUGH TO WORK WITH IT CAREFULLY
– AR SANJAY PRAKASH

1 Introduction

1.1 Aim, Objectives, Scope, Limitations.

Aim: To develop an Eco-Rating system as a tool to incentivize Ecological conservation in Resorts situated in sensitive natural landscapes of Western Ghats.

3 Objectives to develop eco-rating system are:

- 1) To encourage holistic pre-planned approach through well-defined framework and certification of Eco-design for Resorts.
- 2) To incentivize ecological conservation, that promotes strong reasoning cum willingness of Resort owners and management to adopt better ecological practices.
- 3) To create a Region-specific Rating system for Resorts as a tool for ecological conservation in biodiversity Hot Spot - the Western Ghats.

Need for such a defined ‘System’ is even stronger in wake of Covid-19.

Scope: A voluntary eco-rating ‘System’ to serve as an authoritative source, that provides a framework for certification of any Resort situated in sensitive natural landscapes of Western Ghats, for Ecological, Community, Recreational and Economic benefits in and around the Resort.

Need for such a defined ‘System’ is even stronger in wake of Covid-19.

Author believes that in the wake of COVID-19, this System of ERCA (proposed as an independent body) ideally should be considered by Ministry of Environment and Forestry, and to be taken under jurisdiction of WGEEP [Western Ghats Ecology Expert Panel] for policy level consideration and implementation of this defined System, specifically for best results in Resorts.

Limitations: Resorts are a private commercial establishment. Studies or any research around ecological conservation are generally not encouraged in such establishments. All owners do not have that vision and understanding towards ecology. Entry in such Resorts, even for case studies, are possible only if we have the bookings to stay, as guests. Author’s study was done, as a visitor and guest, which was challenging and created certain limitations like no access to official documents, and detail service drawings of Resorts.

2 Background Study

2.1 Hospitality industry

Hospitality means an inviting and welcoming reception and care of guests on their terms with warmth, friendliness, and kindness.

Different **kinds of hotels** are Economic / mid- range hotels, business hotels, family hotels, boutique hotels, luxury / high-end hotels, and Resorts that are beach Resorts, lake Resorts, mountain Resorts that are in natural landscape settings. Hotels / Resorts are informally categorised as deluxe, Luxury, First Class, Superior, Tourist Class, Standard, and Budget Class/Economy.

Resort is a self -contained destination and commercial establishment, intended for full service lodging facility that allows privacy, relaxation, leisure, entertainment and experiences within the premises and are usually located in natural landscape settings like beaches, mountains, scenic or historic places.

Hotel Star Ratings represents condition and quality of guest facilities. Ratings depend on quality of hospitality services offered like food, accommodation / rooms, amenities, pools, spas, fitness centres, sports, recreation, entertainment, condition of facility, quality of service, business practices, access and location. Ratings inform travellers on what facilities to expect. Quality refers to services offered and extends to a holistic experience. Classification to categorise hotels internationally followed, is star Rating from one to five. Greater stars indicate greater luxury. Officially there are no 6 - star or 7- star hotels, but these numbers are used for marketing purpose only. There are no universal criteria / standards for hotel star Ratings. World Hotel Rating (WHR 2009) project, aims to set international classification standards and Rating criteria along the lines of a world star-Rating system, along with sustainable tourism , and protection of worlds natural heritage and culture.

HRACC - Hotel and Restaurant Association Classification Committee, Ministry of Tourism, Government of India : Resorts are approved /classified / reclassified by HRACC, by means of star Rating system which has guidelines that are more oriented

towards services offered to guests. There is only a brief mention of Eco-friendly practices , while there are no defined guidelines for Ecological conservation.

2.2 Chronology of Ecological Conservation

Traces of environment protection in India can be seen from the early times. In the early stages of human history in India, human beings considered the environment as very dominant and that was why, they worshipped different aspects of trees, forest, animals, mountains, rivers etc.

Various aspects of environmental conservation in India were recorded by the foreign travellers like Megasthenes, Pliny, the unknown author Periplus of the Erythraean Sea, Ptolemy, Fa-Hien, Hiuen Tsang, Itsing etc., who came to India at different periods.

3300 - 1300 BCE: In early days, many religious and customary norms governed environmental conservation. It was the dharma of each individual in the society to protect nature. Harappan seals have given rise to the speculation that their belief system centered around zoomorphism. Apart from worshipping a tree, the Harappans were familiar with several methods to control and preserve water for irrigation.

1500 - 1000 BCE: The Vedas deal with the concept of Nature and Life, contained several references on environment conservation, Ecological balance and weather cycle. The idea of worshipping nature does not limit with the reverence to the deities, but they gave due importance and took care of the environment as the nature was important to fulfil their requirements.

In the Vedic texts, the protection of trees and wildlife held a place of special respect. Forests received an important role in Indian civilization and in literature. Forests were not the place of uncivilized groups or wild animals as portrayed in other civilizations. In fact, the ancient forests of India have survived as the sacred groves of modern India.

1000 – 800 BCE: The epics Ramayana (c.1000/900 BCE) and the Mahabharata (c.900/800 BCE) refers to the environment at various places. Thus, the intimate relationship between man and nature is portrayed vividly. In Mahabharata, the Hindu epic describes “Trees with flowers and fruits satisfy this world. Those who donate a tree are given salvation by the same trees in the other world.”

6th – 5th c. B.C: In the age of Gautama Buddha (6th – 5th c. B.C.) there were attempts to create Ecological balance through the religious and philosophical teachings. This can be best seen in the concept of ahimsa (non-violence) in Buddhism and Jainism. They criticized the killing of animals in the name of sacrifice or rituals, and advocated a gentle and non-aggressive attitude towards nature and prudent use of resources.

2nd BCE-3rd BCE: Manusmriti, an ancient legal text condemned cruelty towards animals. According to it, air and water is not a private property but is a public property, therefore no one should pollute air and water. Impure substance is not to be thrown to fire as the smoke rose thereof, may act poisonous. Highest environmental ethics of Manusmriti, is to go for penance after someone commits an environmental sin; a high order of self-punishment entails self-realization.

350-187 BCE: Kautilya's Arthashastra, provides a lot of knowledge about the environment and its conservation. It describes the maintenance of public sanitation and preservation of the environment, forest and wildlife. Even in the affairs of the state, the administration and rulers were lawfully directed to preserve and promote environmental welfare. Arthashastra also revealed that Mauryas designated specific forests to protect supplies of timber, as well as lions and tigers, for skins.

In land unsuitable for agriculture, Arthashastra directs for the measures to be taken to for effective water management with detailed guidelines. In the Mauryan period: certain forests were declared as protected and they were called as "Abhayaranya" like the present day 'Sanctuary'.

268 -232 BCE: Asoka's rule is the foremost example of Ecologically responsible statehood in India's ancient history. The Pillar Edict V of Asoka inscriptions reveal that he had imported and grown herbs suitable for human and animal. He had ponds dug up and shelters erected along the roads at every eight kilometers, and planted banyan trees on the roads to give shade to man and animal. He was concerned about the wildlife and its importance and banned the royal hunting and animal sacrifices. Burning of the forests without purpose was forbidden.

193 BCE–170 BCE: The Kalinga emperor, Kharavela was a great supporter of nature and environment. He extended the canal constructed by Mahapadma Nanda three hundred years ago from Tanasulia to Kalinganagari, his capital city.

The notable feature of the Mughal regime was the growth of interest in natural history. An administrative post “Muhtasibs” were vested with the duty of prevention of pollution. ‘Baburnama’ gives a detailed description of the flora and fauna of India in a very systematic manner.

1st century CE: The Periplus of the Erythraean Sea (c. 1st century CE) and Ptolemy (c.2nd) provides valuable information about various aspects of environment of this period.

375 CE - 415 CE: Fa-Hien, the Chinese Buddhist pilgrim, mentioned about the veterinary hospitals in the capital city, Pataliputra, during the reign of Chandragupta II (c. 375 CE to 415 CE), which was most probably the first veterinary hospital in the world.

350-375 CE: The Allahabad Pillar Inscription mentions that Samudragupta, the mighty Gupta ruler who conquered forest states of central India in 4th century furnishes valuable information about various aspects of the environment during this period.

16th Century: Akbar’s efforts in promoting afforestation in common property resources, management of water bodies, and his disapproval of killing animals are legendary.

17th Century: Jahangir was responsible for laying out some of the finest gardens in Mughal India. He also made it possible to cultivate high altitude trees. During the Mughal period, hunting, especially of the lion and tiger, was restricted to the members of the royal family only. This, in the long run, helped to preserve them.

1700 CE: Bishnoi Movement: Bishnoi is a religious sect found in the Western Thar Desert and northern states of India. It was founded by Guru Maharaj Jambaji in 1485 CE in the Marwar (Jodhpur) desert region of Western Rajasthan, India. It is non-violent community of nature worshippers. This movement was started by sage Sombaji around 1700 CE against deforestation.

Year 1973: Chipko Movement was launched from Gopeshwar in Chamoli district, Uttarakhand in 1973. This movement was to prevent illegal cutting of trees in the Himalayan region (Uttarakhand). Sunderlal Bahuguna and Chandi Prasad Bhatt were leaders of this movement.

Year 1973: Silent Valley Movement was in an area of tropical evergreen forests in Kerala, very rich in biodiversity. Environmentalists and the local people strongly

objected to the hydel power project being set up here in 1973. Under pressure, the government had to declare it the national reserve forests in 1985.

Year 1982: Jungle Bachao Andola: Tribal community of Singhbhum district of Jharkhand (Previously, it was a district of India during the British Raj, part of the Chota Nagpur Division of the Bengal Presidency) agitated against the forest policy of the Government in 1982. Government wanted to replace the natural soil, forests with the high-priced teak.

Year 1983: Appiko Movement: In 1983, on the lines of Chipko Movement, Pandurang Hegde launched a Appiko Movement in Karnataka. Its main objectives were afforestation as well as development, conservation and proper utilization of forests in the best manner. The meaning of “appiko” is to express one's affection for a tree by embracing it.

Year 1985: Narmada Bachao Movement: Environmentalists and the local people started protest against the building of Dams on the Narmada for the production of hydro-electricity since 1985 which was popularly known as Narmada Bachao Aandolan.

Year 1986: Environment (Protection) Act authorizes the central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and /or operation of any industry on environmental grounds.

Year 1980-1990: Tehri dam conflict was by local people, as dam was planned in seismically sensitive zone, and caused submergence of forest areas along with Tehri town.

Year 2002: Biological Diversity Act and Biological Diversity Rules provide for the conservation of biological diversity, sustainable use of its components, and fair and equitable sharing of the benefits arising out of the use of biological resources and its knowledge.

Year 2010: Under the National Green Tribunal Act: For effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto.

2.3 Western Ghats

2.3.1 Overview - Western Ghats

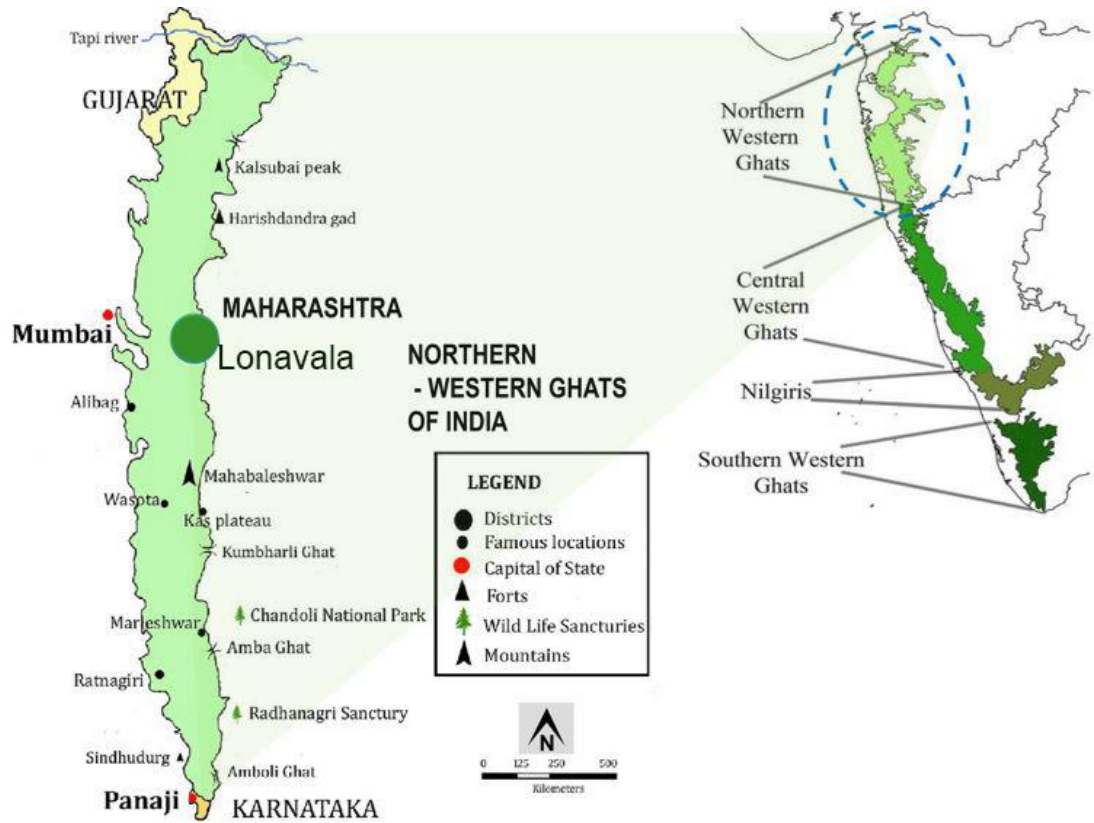


Figure 2.3.1.a: Western Ghats

Sources :

C., Sudhakar Reddy. Assessment and monitoring of long-term forest cover changes (1920–2013) in Western Ghats biodiversity hotspot. 2019 January 2016.

https://www.researchgate.net/publication/292178919_Assessment_and_monitoring_of_long-term_forest_cover_changes_1920-2013_in_Western_Ghats_biodiversity_hotspot. 5 December 2019

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<https://www.quora.com/What-is-the-highest-mountain-peak-of-Western-Ghats-of-India>. 5 December 2019

2.3.2 Tourism in Western Ghats

Western Ghats are declared as biodiversity hotspot and World heritage site by UNESCO , due to its exceptional level of biodiversity and endemism.

The mountain range is home to over 5,000 species of flowering plants, 139 mammal species, 508 bird species and 179 amphibian species which are not found elsewhere in the world.

Hill stations like Ooty, Mahabaleshwar, Lonavala, Khandala, Munnar, Ponmudi, Wayanad are some of the several tourist hotspots in Western Ghats. Mathikettan Shola National Park, Pampadam Shola National Park, Begur Wildlife Sanctuary, Chinnar Wildlife Sanctuary, Thattekad, Phansad Bird Sanctuary and Karnala Bird Sanctuary are some of the wildlife reserves located in the Western Ghats. Kodaikanal, Lovedale, Ranipuram, Mattupetty, Coonoor, Yercaud, Meghmalai, Valparai, Kumily, Thenmala, Sulthan Bathery, Wayanad, Idukki, Vagamon, Nelliampathy, Vythiri, Ponmudi and Chikmagalur are some of the prominent towns located in the mountain range.

Several centres of pilgrimage have traditionally attracted many visitors to the Western Ghats, prominent amongst these being Sabarimalai in Kerala, Madeveshwaramalai in Karnataka and Mahabaleshwar in Maharashtra.

Best known most visited tourist spots are Ooty in the Nilgiris and Thekkady Wildlife Sanctuary in Kerala. Recent decades have seen a boom in building of second holiday homes, tourist Resorts housed in plantations and new hill stations.

2.3.3 Impacts of Tourism in Western Ghats

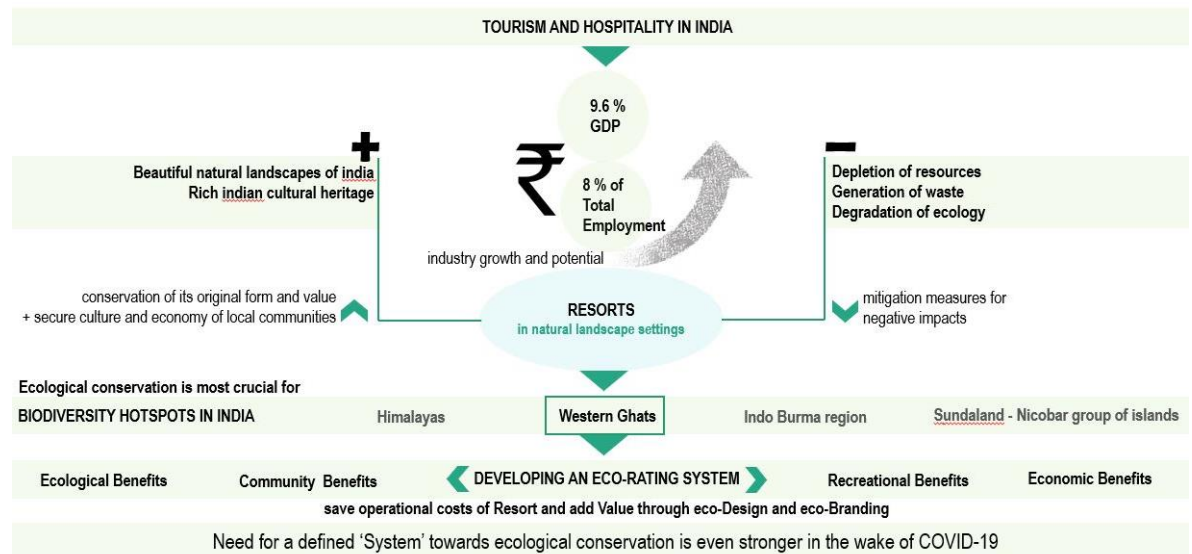
Human habitation and overuse is a major threat to Western Ghat's high level of biodiversity and endemism. Threats due to tourism in Western Ghats, are uncontrolled growth of tourists, intensive water demand, untreated water discharge, increase in waste/garbage causing diseases, change of land use, loss of access to natural areas for villagers, habitat fragmentation, changes in traditional livelihood, labour shortage, impacts of roads, machines, modern technology.

Quality of life of locals has degraded in recent decades with the depletion of natural vegetation and extermination of wild animals.

Western Ghats have been subjected to erosion of 'natural capital' alongside construction and development by humans. This has been imposing excessive damage to its ecology.

3 Research component

3.1 Research Methodology



Flowchart 3.1a : Tourism and Hospitality in india

Source: Author

Eco-Rating system is developed to incentivize Resort owners and management to adopt Ecological conservation practices in a holistic manner. This is a voluntary Eco-rating 'System' to serve as an authoritative source, that provides a framework for certification of any Resort situated in sensitive natural landscapes of Western Ghats, for Ecological, Community, Recreational and economic benefits in and around the Resort. Need for such a defined 'System' is even stronger in wake of Covid-19.

Thesis Title and the Aim is **Developing an Eco-Rating system for Resorts in sensitive natural landscapes of Western Ghats.**

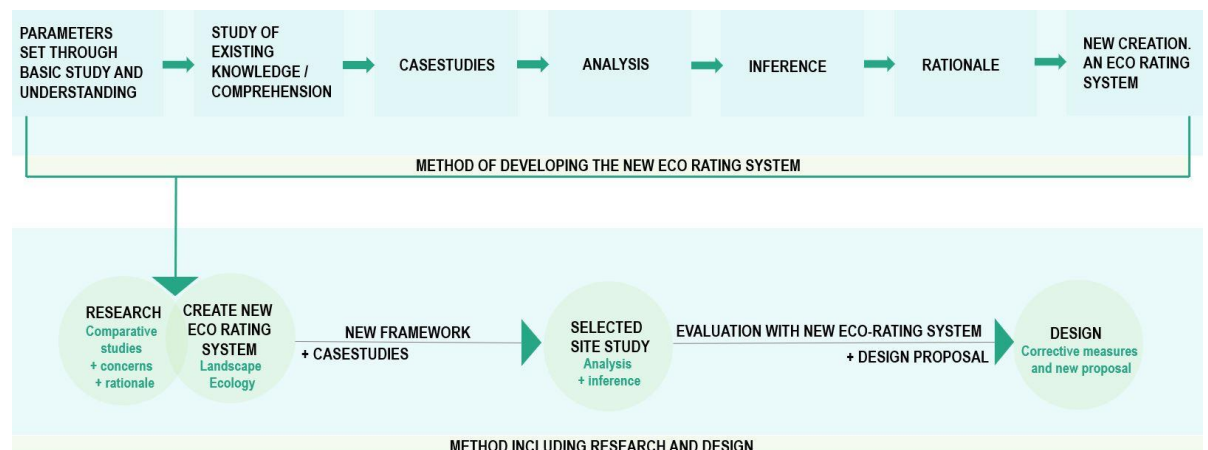


Figure 3.1a : Method towards Research and Design.

Source: Author

As a first step, author listed **parameters** with an ecological perspective, as follows :

1. Predesign stage measures
2. Design stage measures
3. Construction stage measures
4. Soil conservation
5. Rain water harvesting
6. Grey water treatment
7. Black water treatment
8. Solid waste management
9. Conservation of flora and fauna
10. Energy saving and generation
11. Education and awareness
12. Community and culture
13. Excellence or innovation - was also considered later in score process.

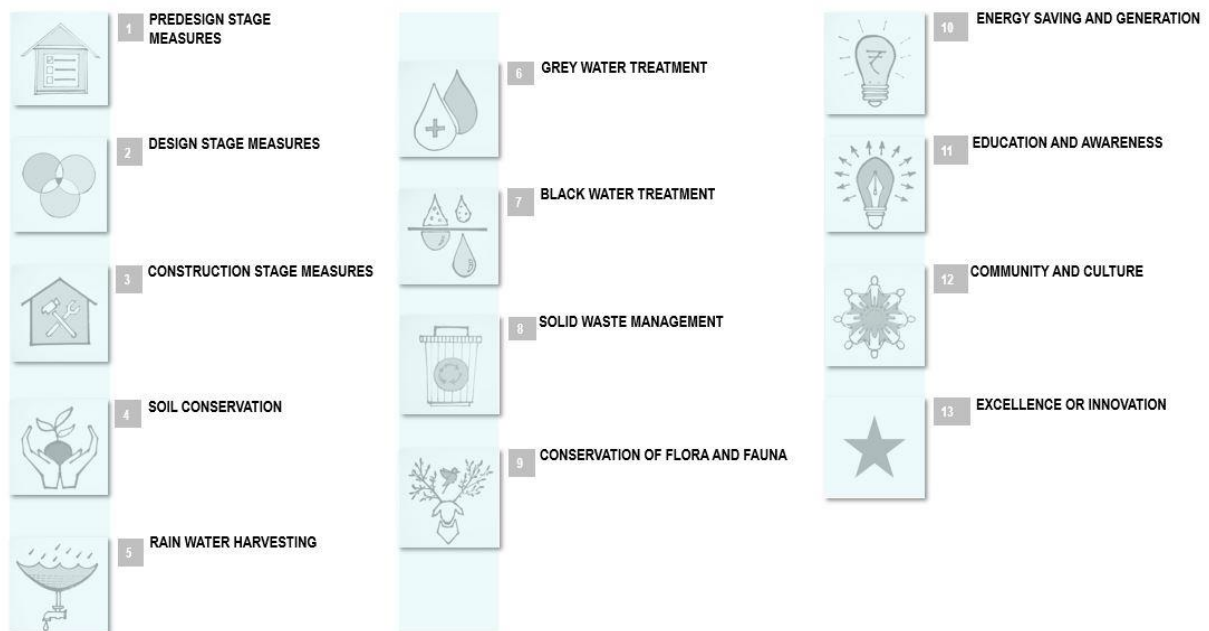


Figure 3.1b : Parameters for study

Source: Author

With above mentioned parameters, author desired to create framework and Rating system for Resorts in Western Ghats. With an ecological perspective, these parameters are included through Author's Academic landscape learnings, readings of various Rating systems, Guidelines, Author's Professional experience of 18 years in Architecture and correlated informal landscape learnings.

To develop this Eco-Rating system along the mentioned parameters, author studied other green Rating systems initially. Author searched through Rating systems like IGBC, LEED, GRIHA, NZGBC, specific to Resorts. These Rating systems were found inadequate for Resorts, thus looked into guidelines for Resorts by various authorities constituted by Government of India, Bhutan green building design guidelines - Bhutan being a country sensitive to environment and with elaborate guidelines. WGEEP -Western Ghats report and other research works and documentation. Comparative study of Rating systems and guidelines for Resort were done first , and then for hotels and other kind of buildings for certain relevant pointers were considered.

The tables given next explains the comparative studies in a better form : (P.T.O)

Comparative study of Rating systems :

RATING SYSTEMS				
CONCERN AUTHORITIES / INSTITUTIONS / CONSULTANCIES	IGBC green Resorts [Nov 2018]	GRIHA [2019]	LEED [2011]	NZGBC [Aug 2016]
RATING SYSTEMS				
REF .	R1	R2	R3	R4
ELABORATE FRAMEWORK FOR ECOLOGICAL CONSERVATION ↓	Indian Green Building Council - Green Resorts Rating systems.	Green Rating for integrated Habitat Assessment.	Leadership in Energy and Environment	NewZealand Green Building Council
FOR RESORTS	GIVEN	X	X	X
ANALYSIS	ONLY IGBC HAS MADE A GREEN RATING SYSTEM FOR RESORTS IN NOV 2018			
PARAMETERS ↓				
PREDESIGN STAGE MEASURES	X	X	X	X
DESIGN STAGE MEASURES	X	X	X	X
CONSTRUCTION STAGE MEASURES	X	X	X	X
SOIL CONSERVATION	X	X	X	X
RAIN WATER HARVESTING	GIVEN	X	X	X
GREY WATER TREATMENT	GIVEN	X	X	X
BLACK WATER TREATMENT	•	X	X	X
SOLID WASTE MANAGEMENT	GIVEN	X	X	X
CONSERVATION OF FLORA AND FAUNA	GIVEN	X	X	X
ENERGY SAVING	ELABORATE	X	X	X
EDUCATION AND AWARENESS	GIVEN	X	X	X
COMMUNITY AND CULTURE	GIVEN	X	X	X
FRAMEWORK FOR REGION - WESTERN GHATS	X	X	X	X
ANALYSIS	ONLY IGBC GREEN RATING FOR RESORTS IS AVAILABLE WHICH LACKS ECOLOGICAL PERSPECTIVE AND IS INADEQUATE FOR ECOLOGICAL CONSERVATION.			
INFERENCE	FRAMEWORK OF ECOLOGICAL CONSERVATION MEASURES ARE NEEDED FOR RESORTS IN WESTERN GHATS THAT CAN BE USED TO FORM AN ECO- RATING SYSTEM TO INCENTIVISE ECOLOGICAL CONSERVATION.			
	X - NO MENTION	• - BRIEF MENTION		
POINTS FROM RATING SYSTEMS OF OTHER BUILDINGS LIKE HOTELS / TOWNSHIPS FOR SAME PARAMETERS	considered by IGBC	GIVEN - not for Resorts	GIVEN - not for Resorts	GIVEN - not for Resorts

Table 3.1b: Comparative study of Rating systems

Source : Author

Comparative study of Guidelines :

GUIDELINES									
CONCERN AUTHORITIES / INSTITUTIONS / CONSULTANCIES	HRACC [Jan 2018]	MOEF [2010]	UNESCO [2009]	WGEEP [2011 Report]	TOURISM POLICY OF MAHARASHTRA [2016]	MAHARASHTRA SHASAN RAJPATRA, [July 1997]	ENVIRONMENT MANAGEMENT PLAN FOR MATHERAN PLATEAU	RESEARCH AND DOCUMENTATION ON WESTERN GHATS	BHUTAN CONSERVATION GUIDELINES [June 2013]
REF NO.	G1	G2	G3	G4	G5	G6	G7	G8	G9
ELABORATE FRAMEWORK FOR ECOLOGICAL CONSERVATION ↓ FOR RESORTS	Hotel and Restaurant Association Classification committee, Ministry of Tourism, Government of India (Approval , Classification and Reclassification of Hotels)	Ministry of Environment and Forestry, Government of India	United Nations Educational, Scientific and Cultural Organization	Western Ghats Ecology Expert Panel- Report 2011- constituted by MOEF - Ministry of Environment and Forestry, Government of India.	Tourism policy of Maharashtra, 2016, Government of Maharashtra	Special Regulations for Development of Tourist Resorts in Hill station areas.	Funded by MMR - Environment improvement society, Prepared by Grassroots Research and consultancy.	OIKOS for ecological services - Research and documentation	Bhutan Green Building Design Guidelines. Ministry of Works and Human Settlement, Royal Government of Bhutan.
	BRIEF MENTION	X	X	X	X	X	BRIEF MENTION	X	GIVEN
ANALYSIS	THERE IS NO ELABORATE FRAMEWORK FOR ECOLOGICAL CONSERVATION IN RESORTS EXCEPT BHUTAN. [IN BHUTAN, RESORTS HAVE TO FOLLOW SAME GUIDELINES AS FOR OTHER BUILDINGS]								
PARAMETERS ↓									
PREDESIGN STAGE MEASURES	X	X	X	X	X	X	X	X	ELABORATE
DESIGN STAGE MEASURES	X	X	X	X	X	•	•	•	ELABORATE
CONSTRUCTION STAGE MEASURES	X	X	X	X	X	X	•	X	ELABORATE
SOIL CONSERVATION	X	X	X	X	X	X	•	•	X
RAIN WATER HARVESTING	•	X	X	X	X	X	X	X	ELABORATE
GREY WATER TREATMENT	•	X	X	X	X	X	X	X	ELABORATE
BLACK WATER TREATMENT	•	X	X	X	X	X	X	X	ELABORATE
SOLID WASTE MANAGEMENT	X	X	X	X	X	X	•	X	ELABORATE
CONSERVATION OF FLORA AND FAUNA	X	X	X	X	X	X	•	•	ELABORATE
ENERGY SAVING	X	X	X	X	X	X	X	X	ELABORATE
EDUCATION AND AWARENESS	X	X	X	X	X	X	X	X	X
COMMUNITY AND CULTURE	X	X	X	X	X	X	X	X	•
FRAMEWORK FOR REGION - WESTERN GHATS	X	X	•	GIVEN	X	X	ELABORATE	•	X
ANALYSIS	THERE IS NO ELABORATE FRAMEWORK FOR ECOLOGICAL CONSERVATION SPECIFIC TO RESORTS EXCEPT BHUTAN. [IN BHUTAN, RESORTS HAVE TO FOLLOW SAME GUIDELINES AS FOR OTHER BUILDINGS]								
AS RATINGS ARE INADEQUATE, GUIDELINES ALSO CAN BE LOOKED AT AS A REFERENCE TO FORM NEW ECO-RATING SYSTEM									
	X - NO MENTION	• - BRIEF MENTION							
POINTS FROM GUIDELINES OF OTHER BUILDINGS LIKE HOTELS / TOWNSHIPS FOR SAME PARAMETERS	X	GIVEN - Have elaborate points for construction stage measures, which can be applicable for Resorts.	X	X	X	X	GIVEN - points specific to western ghats region.	X	Same as for resorts.

Table 3.1c : Comparative study of Guidelines

Source: Author

Relevant study and analysis :

- **No Indian Rating system or guidelines are sufficiently elaborate, holistic or complete in terms of landscape ecology.**
- **Bhutan** green building design guidelines were studied, as its a country sensitive to environment that believes in Gross National Happiness - has **elaborate** guidelines.

- Only **IGBC Green Resorts Rating system [2018]** is for Resorts in which focus is more on resources / energy savings in operational phase, but lacks perspective of landscape ecology - natural systems and processes.
- **WGEEP and UNESCO** has mention of ecological points for **Western Ghats** but it is **not specific to Resorts**.

IGBC			
PARAMETERS			
PREDESIGN STAGE MEASURES	X	very important for ecological conservation NEEDED	▪ FOCUS IS MORE ON ENERGY EFFICIENCY OR SAVING NATURAL RESOURCES.
DESIGN STAGE MEASURES	X		
CONSTRUCTION STAGE MEASURES	X		
SOIL CONSERVATION	X		
RAIN WATER HARVESTING	GIVEN	Can get specific / detailed to avoid loopholes	▪ DOES NOT CONSIDER REGENERATION OF ECOSYSTEMS IN DESIGN.
GREY WATER TREATMENT	GIVEN		
BLACK WATER TREATMENT	*	brief mention	▪ IGBC FOR RESORTS IS A GENERIC SYSTEM FOR ANY REGION.
SOLID WASTE MANAGEMENT	GIVEN	Can get specific / detailed to avoid loopholes	
CONSERVATION OF FLORA AND FAUNA	GIVEN		
ENERGY SAVING	ELABORATE	elaborate	
EDUCATION AND AWARENESS	GIVEN	Can get specific / detailed to avoid loopholes	
COMMUNITY AND CULTURE	GIVEN		
FRAMEWORK FOR REGION - WESTERN GHATS	X	Not specific for any region but generic.	Common for biodiversity hotspot , natural landscapes, urban, rural.

Table 3.1d : Analysis of IGBC rating system.

Source: Author

IGBC green resorts rating system [2018] is inadequate as:

1. **The only system** for Resorts - IGBC Green Resort Rating system [2018] is **generic and structured to be applied on any Resort whether it is a natural landscape, urban, rural, or any biogeographic zone in india, so it doesn't consider specific ecological aspect in its structure.** It is focused more towards resources and energy savings, under the broad spectrum of sustainability.
2. IGBC has emphasis on operational phase while has **inadequate guidelines for predesign, pre-construction, during construction and post construction phases, which is most crucial phase in relation to conservation, ecological processes and ecosystems.**
3. IGBC guidelines are not elaborate enough in some portions and has **loopholes which could lead to escape in its implementation and doesnot serve the purpose of landscape ecology.**

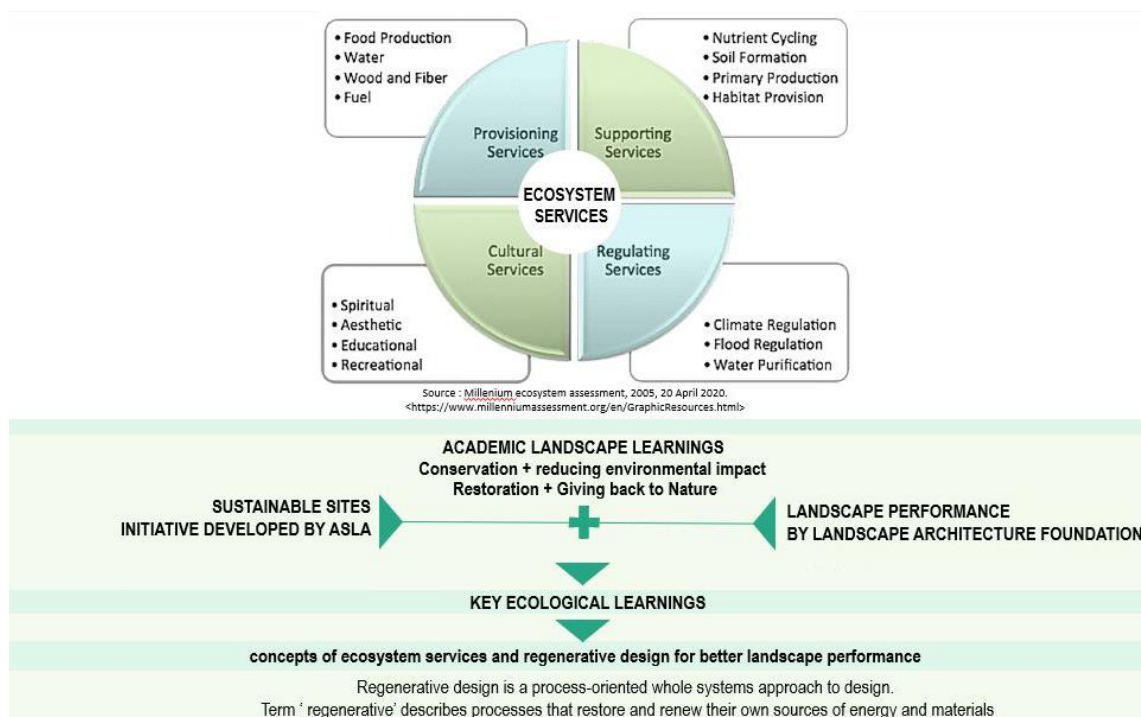


Figure 3.1c: Key ecological learnings

Source: Millenium ecosystem assessment, 2005, 20 April 2020.

<https://www.millenniumassessment.org/en/GraphicResources.html>

SITES. *SITES Rating System*. n.d. 20 April 2020. <<http://www.sustainablesites.org/certification-guide>>.

—. *The sustainable SITES initiative*. n.d. 20 April 2020. <<http://www.sustainablesites.org/resources>>.

Council, U.S. Green Building. *SITES Curriculum*. n.d. 20 April 2020.

<<https://www.usgbc.org/education/sessions/introduction-sites-program-6749989>>.

Foundation, landscape Architecture. *Landscape Performance Series*. n.d. 20 April 2020.

<<https://www.landscapperformance.org/guide-to-evaluate-performance>>.

Simultaneously, Author studied landscape and ecology-oriented documents, that are sustainable sites initiative developed by ASLA, and landscape performance by landscape architecture foundation. Concepts of ecosystem services and regenerative design for better landscape performance are key ecological learnings. Author also studied other Resorts as case studies for further understanding about Ecological conservation practices in Resorts and to choose one to evaluate it based on the new developed Eco-Rating system.

Criteria for Choice of **Resort case studies** are :

- **One International case study** in an environmentally sensitive country **Bhutan** that is located in a biodiversity hotspot.
- Resorts in **Western Ghats**.
- Resorts that are in **Natural landscape settings**.
- Resorts that are well known brand or **famous - most visited** and liked by travellers.

- Resorts with area of **25 acres or more.**
- Resorts that **more or less follow environmental conservation measures.**

Based on above criteria, following Resorts were studied:

- 1. Six senses, Punakha, Bhutan**
- 2. The Macchan Resort, Lonavala, Maharashtra, Western Ghats.**
- 3. Banasura Hill Resort, Kerala, Western Ghats.**
- 4. Wilderness Nature Resort, Goa, Western Ghats.**
- 5. Tungi Resort, Lonavala, Maharashtra, Western Ghats.**

Comparative Study of Rating systems, guidelines, and case studies were used to first form the framework of ecological conservation measures for Resorts and decide scores. Eco-Rating system is developed by comprehension of existing knowledge, analysis, inference, and refining through rationale for each point, along the parameters mentioned earlier. Author's Academic landscape learnings, readings of various Rating systems, Guidelines, Author's Professional experience of 18 years in Architecture and correlated informal landscape learnings, and case studies cumulatively supported the process.

Thus,

Main step 1 was to develop an Eco-Rating system as a tool to incentivize Ecological conservation in Resort situated in sensitive natural landscape settings of Western Ghats.

Next step 2, was using this developed Eco-Rating system, as a tool to evaluate the Resort that seemed to fall short among the selected case studies, and then enhance that Resort towards better solutions and design proposal.

All the case studies which were simultaneously studied along with Rating systems and guidelines, are elaborated in chapter 3.3.

3.2 ERCA and the developed Eco-Rating System.



Figure 3.2 a: An imagination and Umbrella concept.
Source: Author

Three major reasons to create an Eco-rating system for western ghats are as follows:

1. A new Eco-rating system **to consider landscape ecology of Western Ghats for regenerative design to better landscape performance.** Hence this System was to be designed underpinning idea of **‘Reinforce Natural landscapes to Reactivate natural systems’** on any Resort site that includes creation of habitats, reviving of ecosystems, and revitalizing natural self-regulating systems and processes for any Resort site.
2. A new Eco-rating system **to develop an elaborate framework** for predesign, pre-construction, during construction and post **construction phases, which is most crucial phase in relation to conservation, ecological processes and ecosystems.**
3. A new Eco-rating system **to be elaborate and well - defined that considers landscape ecology and regenerative design.** Need for a defined **‘System’ towards landscape ecology at Resorts is even stronger in the wake of COVID-19.**

Reference Rating systems:

- (R1) IGBC (Nov 2018) - Indian Green Building council - Rating for Green Resorts.
- (R2) GRIHA (2019) - Green Rating for Integrated Habitat Assessment.
- (R3) LEED (2011) - Leadership in Energy and environment.
- (R4) NZGBC (Aug 2016) - New Zealand Green Building council

Reference Guidelines:

- (G1) - HRACC (Jan 2018) - Hotel and Restaurant association classification committee, Ministry of Tourism, Government of India. (Approval, classification, and reclassification of Hotels)
- (G2) - MOEF - Ministry of Environment and Forestry, Government of India
- (G3) UNESCO - United Nations Educational, Scientific and Cultural Organisation
- (G4) WGEEP - Western Ghats Ecology Expert panel - Report 2011 - constituted by 2011 - constituted by MOEF - Ministry of Environment and Forestry, Government of India.
- (G5) Tourism Policy Of Maharashtra (2016) , Government of Maharashtra.
- (G6) Maharashtra Shasan Rajpatra (July 1997) - Special regulations for development of Tourist Resorts in hill station areas.

(G7) Environment Management plan for Matheran plateau - Funded by MMR - Environment improvement society - Prepared by Grassroots Research and consultancy.

(G8) Research and Documentation on Western Ghats - OIKOS for Ecological services - Research and Documentation.

(G9) Bhutan Green Building Design Guidelines (June 2013) - Bhutan Green building Design Guidelines - Ministry of works and Human Settlement, Royal Government of Bhutan.

ERCA: Eco-Rating Certification Authority is an independent and third-party certification body for appraisal of Resorts in Western Ghats, to certify on basis of Ecological Rating, with underpinning idea of **‘Reinforce Natural landscapes to Reactivate natural systems’** Reinforce - here means to strengthen the very idea, as well as literally protect, restore, improve, and enhance natural landscapes.

Author believes that in the wake of COVID-19, this System of ERCA ideally should be considered by Ministry Of Environment and Forestry, and to be taken under jurisdiction of WGEEP [Western Ghats Ecology Expert Panel] for policy level consideration and implementation of this defined System specifically for best results in Resorts.

ERCA Frame work for Eco-Rating: is formed for Resorts development in Western Ghats towards a larger purpose of Ecological benefits to region as a whole. It is a guidebook for any individual, companies, consultancies, organization or business establishment that is involved in development of Resort like Resort owners, Architects, Landscape Architects, Site engineers, all service consultants involved in any and every stage of Resort development including operational phase.

Eligibility: Any Resorts situated in Western Ghats are eligible to apply for this Eco-Rating.

Resorts are categorised as:

X Type: Upcoming Resorts.

Y Type: Existing operational Resorts.

X Type and Y Type Resorts shall voluntarily apply for Eco-Rating. X Type Resorts have more advantage due to opportunity of pre-planning to meet requirements of eco-rating system in better ways than the reconsiderations, limitations and later stage implementations by Y Type Resorts.

For Y Type Resorts, appraisal is done considering measures from operational phase and not predesign stage as these Resorts are already in operational phase. Instead, a compensatory clause (R1) is added for Y Type Resorts. These are Resorts that have got completion certificate or are operational prior to 31March,2021. ERCA validity for certification for Y type Resorts remains till 31March,2025. Category of Y type Resorts shall dissolve on 31March,2025, beyond which only single category of Resorts that is upcoming Resorts shall be considered for certification. This validity period till 31March,2025, is given for existing Resorts in operational phase to get enough time for application to ERCA, implement requirements and complete the certification process.

Four Objectives of ERCA Framework are as follows:

1. Ecological benefits for Resorts: Enhancing landscapes Ecologically as these include environment and its relationship with living organisms. Aligning the built with natural Ecosystems. Conserving natural resources, enhance biodiversity and Ecosystems, mitigate negative impacts, protecting natural habitats, encouraging holistic approach to conservation in biodiversity hotspot - the Western Ghats. Underpinning idea ‘**Reinforce Natural landscapes to Reactivate natural systems**’ is most important and hence greatest ecological benefit.

2. Community Benefits in and around Resorts: Controlling all kinds of pollution, creating healthy spaces, connecting humans to nature, improving human health and overall wellbeing, increase awareness and education, preserve culture of place, promoting Economy of local community.

3. Recreational Benefits in Resorts: Conserving unique visual and experiential quality of natural landscapes in particular, and increase outdoor recreational opportunities in these natural landscape settings. Also, these two factors are the main selling point for Resorts.

4. Economic Benefits to Resorts: Conservation measures helps Resort to save operational costs in long run. Resorts use their Eco-friendly approach and vision to advertise themselves and take pride in being a Nature Eco-Resort. Energy savings and generation of energy on site. Optimize use of natural resources on site. Reduce, reuse, recycle of water and waste, better Economic outcomes and co-benefits with local community. Enhancing experiential quality of Resorts in natural landscape settings is directly proportional to Economic benefits.

Four steps of Eco-Rating certification process:

1. E-Registration of the Resort: It shall be done online by filling in the blank spaces, with mandatory details like Name of Resort, details of Resort owners, Area of Resort site, total permissible F.S.I. (Floor space index). Registration process is free on ERCA website.

2. E-Application for certification: Online Application shall be submitted with documentation and design as follows: Submit all legal approvals which are site specific and mandatory. Existing and Proposed Drawings of Site plan, 2 longitudinal site sections and 2 transverse site sections, site plan and these 6 site sections to show all existing natural and manmade elements on site - all architectural floor plans whether existing or proposed of every structure with, minimum 2 elevations and 2 sections of each structure passing through staircase and toilets. Drawings should have signatures of Resort owners, Architect, and Landscape Architect of project. 10 clear site photographs in color to be submitted. A descriptive report of minimum 10 pages on vision and values of Resort owners, municipal rules, descriptions on history, culture and community near site to be submitted. These submissions are for an overview of project, only for application to be considered for appraisal. Application fees shall be paid online of amount as stated in website.

3. Appraisal process: Appraisal process starts on acceptance of E-application. Detailed Documents, Drawings, Reports, Certificates, Photographs, required at every stage shall be submitted with prior intimation to ERCA at stages as mentioned in each points of framework.

Appraisal shall include assessment of Documents, Drawings, Reports, Certificates submitted at every stage, as stated in framework. It shall follow with site inspection and needed monitoring as per dates and decisions of ERCA after formal intimation through email by Resort developers. Appraisal fees shall be paid online of amount as stated in website.

4. Eco-Rating Certification: For both categories X Type Resorts and Y Type Resorts, Certification shall be provided on final decision of ERCA panel. **Certification shall be valid after operational phase of minimum one year (to cover / complete at least 1 cycle of seasons throughout 1 year) in order to monitor satisfactory implementation, smooth working and fulfilment of needed measures as per the framework. However, this certification shall be provisional only, and final certificate will be provided after 3 years, as the natural landscapes, habitats and ecosystems take time to evolve, and the real landscape performance improves once the systemic changes and natural processes are actually sustainable and working on site for a considerable time.** For ‘Y’ type resorts a compensatory clause is mentioned before the framework and scores for operational phase. Complete ERCA fees shall be paid online of amount as stated in website, after which the certificate shall be issued to Resort.

13 ERCA Parameters for Ecological conservation are :

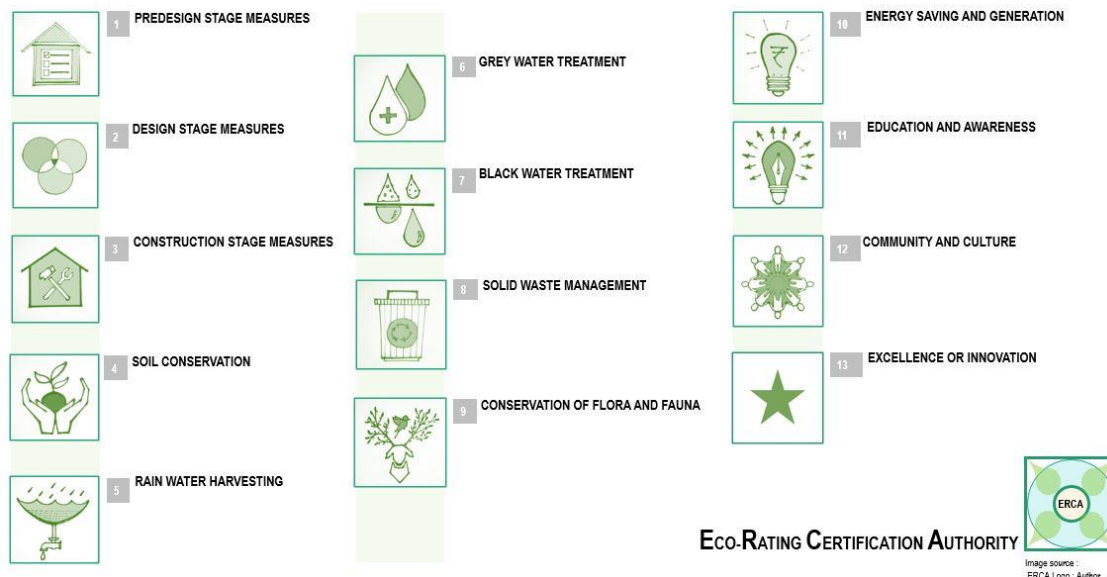


Figure 3.2a : ERCA Parameters
Source: Author

1. Predesign stage measures
2. Design stage measures
3. Construction stage measures
4. Soil conservation
5. Rain water harvesting
6. Grey water treatment
7. Black water treatment
8. Solid waste management
9. Conservation of flora and fauna
10. Energy saving and generation
11. Education and awareness
12. Community and culture
13. Excellence or innovation

With an ecological perspective, these parameters are included through Author's Academic landscape learnings, readings of various Rating systems, Guidelines, Author's Professional experience of 18 years in Architecture and correlated informal landscape learnings. These cover all aspects of Ecological conservation and ERCA objectives.

ERCA Score structure is based on 3 factors:

1. Measures in relation to Ecologically critical elements like soil, water, vegetation, biodiversity, Ecosystems, or measures for holistic approach are primary measures - 2 points.
2. Secondary measure is that which is easy to implement and has comparatively lesser impact on Ecology if not followed. - 1 point.
3. High Economic investment or challenge to execute on site - 2 points for high investment and 2 points for challenge to execute on site.

Difference in weightage is to encourage Resort owners to make investments for benefits in long run, to take up measures that are a challenge to execute and gain higher scores, towards higher overall benefits. Other points are secondary that are easier to implement, and with lesser investments and thus have less weightage in score system. Ecological initiatives beyond the Resort property, and excellence or innovation get the highest scores for encouragement to do better not only within what

is required but beyond their own limits for society and design as a valuable contribution. Elaborate explanation is in detail framework. For all points, whether 1 point, 1- 2points, 1- 4 points, 1-5 points, 1-10 points, the scores between the range, will be as per joint and final decision of ERCA panel.

ERCA Rating structure:

CORE POINTS - 40 (mandatory points and easy to implement points)

3. ECO GROVE - AVERAGE [41-60] – following practices but needs improvement.

2. ECO WOODS - GOOD [61-80] – following almost all practices within the site.

1. ECO FOREST - BEST [81-100] – following practices with innovation, excellent performance and greater contribution to Ecology and society.

Common sub-headings across framework are:

Rationale:

Consultants / sources:

Strategies:

Documentation:

Time span:

Formulas:

Scores:

A) PREDESIGN STAGE MEASURES

A1 :Appointment of collaborative professional team of respective field experts :

Rationale: Ecological conservation is a complex process that aims to protect, restore, manage environment and its relationship with living organisms like plants and animals. A site and landscape work comprises design of buildings, roads, services, natural features, man-made features green areas with hydrology, geology, ground water, soils, slopes, stability, flora, fauna, that varies at every site, due to which the design solutions are site specific. Design needs to sync with nature. Design should follow the very basis of ERCA eco-rating system ‘Reinforce Natural Landscapes to reactivate Natural systems’. Ecological conservation needs perspectives of respective experts, for a holistic design approach. Thus, it is important to have a collaborative

professional team of respective field experts with experience of Ecological conservation work. Ref: (G9)

Consultants: Architect [M.Arch, registered with COA], Landscape design consultancy [with minimum total staff of 50], Environmental consultants, MEP (Mechanical, Electrical and Plumbing) consultants, Rain water harvesting consultants, grey and black water treatment consultants, solid waste management consultants, Horticulturist, solar energy consultants, and an inhouse team to directly coordinate with landscape design consultancy for integrated working and management. Resort inhouse team should have minimum of one Landscape Architect[M.Arch], one junior Architect[B.Arch], one junior Engineer[B.E.civil] only for co-ordination purpose, as a link between Resort owners and consultancies.

Strategies: To interview and appoint respective experts, consultancies, and Resort inhouse team with needed certificates of their education and authenticity in respective fields, and prior experience of having worked on projects with Ecological conservation with preference to those who have worked on Ecological conservation of other Resort projects.

Documentation: Certificates of education and authenticity of all appointed consultants to be submitted to ERCA.

Time span: Submit stated documents to ERCA within a week after acceptance of application to ERCA. This submission marks the starting date for ERCA appraisal process.

Formulas: not applicable here.

Scores: 2 points: choosing the right team members and consultants as enlisted above is a crucial step towards Ecological conservation for leading the project in right direction through their expertise, and a deciding factor towards success of proposed Eco-design, hence considered primary and is a mandatory measure.

A2 : Detail study of all site features and Ecological layers :

Rationale: Site details and its aspects like site access, topography, climate, geology, soils, hydrology, buildings if any, all existing man-made and natural site features like, existing trees, native species, medicinal trees and plants, water channels, water bodies, existing flora, fauna, habitats to be documented and mapped.

This detailed study is necessary at the beginning, for preservation and design decisions towards Ecological conservation, for sync with different factors, instead of an afterthought during operational phase. It is important to have a holistic approach to Ecological conservation including study of municipal rules, history, culture and community around the Resort. Ref: (G9)

Consultants: Architect, Landscape design consultancy, Environmental consultants, Horticulturist, to document in detail the site, its natural site features and Ecological aspects. Documentation to be shared with inhouse team and all other consultants enlisted in A1.

Strategies: Detail documentation and mapping of all site features, Ecological layers, municipal rules, history, culture and community around the Resort.

Documentation: Submit all legal approvals which are site specific and mandatory. Show detail documentation with all site features like site access, topography / contour drawings, climate data, geological and soil reports, hydrological data, buildings if any, map all existing man-made and natural site features like existing trees, water channels, water bodies, existing flora, fauna / habitats, all features even which are not listed here also need to be documented in form of Reports, drawings, maps, photographs, certificates, models. Municipal rules, history, culture, and community around Resort to be included in documentation. Minimum drawing requirements are as submitted with application along with additions of documentation and mapping of all Ecological layers mentioned above.

For the Western Ghats, existing medicinal trees and plants are to be retained on Resort site as per guidelines in WGEEP report Ref: (G4) hence these should be clearly mapped to preserve. (MOEF)

Time span: Submit this documentation at the most within 2 months of starting date of ERCA Appraisal process.

Formulas: not applicable here.

Scores: 2 points: Detail study of all site features and Ecological layers as mentioned above, leads to major decisions towards preservation and is a deciding factor in relation to existing habitats and ecosystems. It directly affects existing natural processes on site, hence considered primary and a mandatory measure.

B) DESIGN STAGE MEASURES

B1 : Holistic Plan and design for preservation of natural features on site :

Rationale: Every site has different natural features like water channels, water bodies, wetlands, existing flora, existing trees, and fauna. Resort is in natural landscape settings, which is its unique inherent quality, it also has its unique biodiversity, that should be preserved to retain its landscape character and to protect existing natural Ecosystems.

Rain water flows into the site and out of site over its natural slopes. Natural slopes of site determine the hydrology, not only of site but also of the region which influences other Ecological factors at macro level like soil, vegetation, depositions and Ecosystems of the region and hence should be preserved to the maximum extent. Built forms and connecting roads in such Resorts is about 20-25% of site area which should not exceed, and remaining 70-75% of site slopes shall be retained. Ref: (G6), (G7), (G8), (G9). Water channels should be retained, its flow or course should not be covered, stopped or changed by any construction or man-made element on site. All existing trees mandatorily have to be retained. In case, it has to be transplanted, a detailed justification should be provided to ERCA, which would be valid and considered on joint decision of ERCA panel.

For the Western Ghats, existing medicinal trees and plants are to be retained on Resort site as per guidelines in WGEEP report (MOEF) Ref: (G4)

Besides, carving out spaces for the built forms and connecting roads, the natural landscape character of place should be retained. Resort in natural landscape settings, is its unique inherent quality. This should not change due to any control, imposition or manicured landscapes by humans. Landscapes should not be beautification oriented but the built should sync and merge with original landscape of site. Design should follow the very basis of ERCA eco-rating system 'Reinforce Natural Landscapes to reactivate Natural systems'. Ref: (G7)

Consultants: Collaborative professional team of respective field experts appointed for Resort project (as mentioned in point A1) should work towards design for preservation of natural features on site.

Strategies: Any design decision from Architect and landscape design consultancy, or any solution from consultants, have to respect conservation of natural site features and plan accordingly.

Documentation: Drawings, Plans and sections, showing all above mentioned natural site features with photographs, mapping of medicinal trees, medicinal plants, existing trees, water channels, water bodies, wetlands, natural slopes, with existing or proposed Resort plan, drawings, sections, details showing the strategic proposal for Resort that explains the Team plan for preservation of natural features on site should be submitted. This shall be strictly checked on site by ERCA and is a mandatory measure.

Time span: Submit this documentation at the most within 2 months of starting date of ERCA Appraisal process.

Formulas: not applicable here.

Scores: 4 points: Preservation of natural features on site becomes primary as it directly impacts Ecological elements like soil, water, vegetation, biodiversity. It is a deciding factor in relation to existing habitats and ecosystems. It directly affects existing natural processes on site, hence considered primary and a mandatory measure. That makes it challenging than otherwise, thus $2+2 = 4$ points.

C) CONSTRUCTION STAGE MEASURES

C1 : Preconstruction measures:

C1.1 : Preservation of existing trees, native or medicinal trees and plants.

Rationale: At pre-construction stage, during process of removal of weeds, utmost care should be taken to not harm existing trees, native or medicinal trees and plants. Native plant species are adapted to environment of the place these belong to and original landscape character. For the Western Ghats, existing medicinal trees and plants are to be retained on Resort site as per guidelines in WGEEP report. Ref: (G4)

Consultants: Landscape design consultants, Horticulturist and civil engineer from appointed team for Resorts should supervise and take care of the same.

Strategies: To clearly map on paper and on site to take care of medicinal trees and plants on site.

Documentation: ERCA monitoring and site inspection shall be done as per documentation of same at stage A2 and B1 – mapping of medicinal species.

Time span: ERCA to be intimated at least 15 days before starting the clearing of site.

Formulas: not applicable here.

Scores: 2 points: Preserving medicinal species is critical as per guidelines in WGEEP report (MOEF) for Western Ghats as an Eco sensitive area and biodiversity hotspot.

C1.2 : Bio fencing the property :

Rationale: Instead of bricks, cement, metal or concrete wall, bio fence is an Eco-friendly compound wall made by growing trees and plants close to each other, and tying wires along it. Bio fencing also acts as protection, physical barrier, visual barrier if needed, sound breaker, wind breaker, provides shade and acts as buffer for dust. Vegetation is main element of bio fence, which enhances Ecology, enriches soil and is part of biodiversity, just like other trees and shrubs. Very importantly, creating a biofence, is creating a habitat in itself and the evolving ecosystem. Ref: (case study: The Macchan, lonawala).

Consultants: Landscape design consultants and Horticulturist from appointed team for Resorts.

Strategies: Bio fencing shall remain not only from preconstruction to postconstruction construction stage but also a permanent fence for Resort when operational. Bio fencing protects site as well as settlements around, from any encroachments and pollution. Consider planting shrubs like Adulasa, Nirgudi, Karwand, sagargota, chillar, murundsheng, kadipatta, dhayati, Rui, baman...Trees like pipar, Umbar, shivan, kalam, etc and bamboo biofence, especially for resorts in Western ghats. (check native plant list in appendix)

Documentation: Submit drawings with key plans, plans, sections, details of plantation and wiring along compound wall with list of species used for bio fence should be submitted.

Time span: Drawings should be submitted at least 15 days before starting construction. Monitoring shall be done in process of ERCA appraisal. 'Y' type Resort projects to consider bio fencing if feasible in operational phase, and shall earn the scores.

Formulas: not applicable here.

Scores: 1 point: Bio fencing is relatively easy to implement, it is creation of habitat and ecosystems along the property wall, so highly recommended.

C1.3: Site to build toilets for labourers and compost pits before Resort construction starts.

Rationale: Site should be in hygienic conditions once construction starts, so provision of toilets for labourers is mandatory. Defecation in open areas should not be allowed, for healthy conditions in and around the site. Compost pits are necessary for waste management during construction. Ref: (G2).

Consultants: Architect to provide drawings for toilets. Landscape design consultancy to provide area and details of compost pits. Site engineer from appointed team, shall execute and supervise during construction.

Strategies: Provision of toilets for labourers and compost pits for waste management.

Documentation: Drawings, plans, 2 sections, 2 elevations of toilets, plumbing drawings and details of compost pits.

Time span: Drawings to be submitted in preconstruction stage before site clearing, ERCA to be intimated once construction of toilets starts on site with tentative dates for inspection.

Formulas: not applicable here.

Scores: 1 point: For hygienic site conditions, and to not affect the healthy patterns and existing environment and ecology on site, it is mandatory to implement.

C2 : During construction measures:

C2.1: Retaining natural features of site during construction.

Rationale: Retaining natural features of site as mentioned in points A1, B1, C1. Same reasoning as explained earlier holds true here. Specifically mentioned as C 2.1 to insist special care for same during construction phase. Roads constructed during construction should be same as those proposed for Resorts, and any extra connectivity is prohibited for Ecological conservation. Any harm or change in natural features, or if any difference found with reference to earlier drawings during site inspection, will lead to loss of scores. Ref: (G2).

Consultants: Landscape design consultants, Horticulturist and civil engineer from appointed team for Resorts should supervise and take care of the same on site.

Strategies: Supervision and special care for preservation of natural features during construction phase.

Documentation: Documentation submitted for A1, B1, C1 shall be considered for check during and post construction.

Time span: ERCA monitoring and site inspection, during construction.

Formulas: not applicable here.

Scores: 2 points: As mentioned in framework points A1, B1, C1, preservation of natural features is a primary factor and important to consider during construction phase also. It directly affects existing ecosystems, and natural processes on site, hence considered primary and a mandatory measure.

C2.2: Preservation of top soil

Rationale: During construction of buildings and connecting paths, there is excavation. In that process, top soil should be preserved and reused for landscaping on same site. Soil composition of any site has minerals, organic matter, clay, rock particles, gases, moisture, and most importantly microorganisms, and hence it is a natural resource that should be reused on same site. Ref: (R1), (R2), (R3), (R4).

Consultants: Landscape design consultants, Horticulturist and civil engineer from appointed team for Resorts should supervise and take care of the same on site.

Strategies: In Western Ghats, due to slopes certain areas have less soil cover due to soil erosion. Top soil could be used in such areas on site and measures to control that soil erosion needs to be considered and followed – as per soil conservation explained ahead in framework.

Documentation: Soil report and analysis.

Time span: ERCA monitoring and site inspection, during construction.

Formulas: not applicable here.

Scores: 2 points: As mentioned in framework points A1, B1, C1, and score structure, preservation of natural features is primary. It directly affects existing ecosystems, and natural processes on site, hence considered primary and a mandatory measure. Soil is a critical Ecological element to consider during construction phase also, and thus is a mandatory point.

C2.3: Lighting on construction site to be solar lighting.

Rationale: Renewable energy from sun to be used for lighting. Since it is dependent on sun for generation, LED lights could be used in rainy season if solar lighting is

found inadequate. Initial cost may seem high but these lights could be in use, even when Resort is in operational phase. Ref: (G2).

Consultants: MEP (Mechanical, Electrical, Plumbing) consultants.

Strategies: Renewable energy from sun which is free to be used for lighting during construction.

Documentation: Submit Lighting layout which should be same as proposed design for resort. Detail drawings, plan, lighting details and specifications of installations.

Time span: ERCA monitoring and site inspection, during construction.

Formulas: scope of MEP consultants to specify distances, heights, light intensities of installations.

Scores: 1 point: Solar lighting is easy to implement with higher installation cost but Economical and beneficial in longer run as it is free renewable energy once installed.

C2.4: Regular PUC check for vehicles and machinery during construction.

Rationale: PUC check is for pollution control, which is necessary for healthy conditions of air, water, soil, and communities around. Vehicles and machinery on site should be regularly checked for harmful gases, chemical, leakage of any kind. Ref: (G2).

Consultants: Site engineer from appointed team, shall keep the check during construction.

Strategies: PUC check - minimum once in six months.

Documentation: PUC certificates to be submitted to ERCA regularly every six months, during construction.

Time span: During construction.

Formulas: not applicable here.

Scores: 1 point: PUC check is easy to implement. Pollution may also affect existing natural systems and biodiversity on site, so it is mandatory.

C3 : Post construction measures :

C3.1: Construction waste to be given to the recyclers

Rationale: Cement bags, Polymer bags, Gypsum, non-biodegradable waste should be handed over to recyclers. Site should not have any construction material left behind on-site post construction to avoid any land pollution. Giving to recyclers

allows recycling or reuse of materials. Ref: (G2). NOTE: Incineration of waste on site or disposal of waste in water body would disqualify the project from being considered for Eco-Rating system.

Consultants: Site engineer from appointed team, shall be responsible to clear the site of waste as stated.

Strategies: Construction waste to be given to the recyclers to avoid land pollution and reuse of materials. Giving to recyclers allows recycling or reuse of materials.

Documentation: Photographs clicked with dates showing site clear of waste should be submitted post construction.

Time span: Post construction - Site should be clear of waste within maximum two weeks. ERCA monitoring and site inspection would follow.

Formulas: not applicable here.

Scores: 1 point: Any pollution is harmful for natural landscapes and natural systems on site. Mandatory to implement.

C3.2: Use of Eco-friendly materials and products for construction :

Rationale: Green pro products, Eco mark products, or any relevant Eco-certifications that certify the materials to be Ecologically harmless should be used. Use of harmful products causes complex environmental issues, incase mixed with air, water or soil. Ref: (R1).

Consultants: Site engineer from appointed team, shall be responsible to use Eco-products and materials.

Strategies: using Eco-friendly materials and products, harmless to Ecology.

Documentation: List of products and materials, with material properties and certifications should be submitted to ERCA.

Time span: List of materials, products and certificates as Eco-friendly materials shall be submitted post construction.

Formulas: not applicable here.

Scores: 1 point: use of Eco-friendly materials protects Ecology from harm, and thus doesnot harm natural processes on site. Mandatory to implement.

COMPENSATORY CLAUSE - 20 scores for ‘Y’ type Resorts.

R1) Research, educational programmes for ecological conservation.

Rationale: For ‘Y’ type Resorts, that are already in operational phase, it is not possible to reinstate or return to the past in predesign, design and construction phase. Hence to compensate for the part of ecological conservation before operational phase, and gain 20 scores for the same, additional ecological conservation measures mentioned here are to be followed. Research, educational and awareness programmes like seminars, workshops, study trips to Resort, through invitations to NGOs, Colleges, Researchers, Students of landscape, environment, ecology and ecological conservation, to be planned and executed. Availability of open spaces, banquet halls, conference spaces at Resorts would be an added advantage for this purpose. It has to be non-profit oriented, with affordable / nominal / subsidized rates or charges but it is not bound by provision of rooms for accommodation. Each seminar should be of minimum 60 participants, and workshops of minimum 30 participants. Educational programmes need to include minimum of 6 completed ecological Seminars / workshops, minimum of 3 completed ecological Student trips and minimum 2 ecological Research works in process (research could get completed after certification).

Resort management could use it, as an opportunity towards promoting their brand in relation to their values towards green practices and consequently add value to their brand.

Sources : NGOs, Colleges, Researchers, Students of landscape, environment, ecology and ecological conservation, shall be invited and involved.

Strategies: Research, educational and awareness programmes like seminars, workshops, study trips to Resort, through invitations to NGOs, Colleges, Researchers, Students, to be planned and executed, that has to be non-profit oriented, with affordable / nominal / subsidized rates or charges.

Documentation: Supporting Documents and photographs to be submitted. One ERCA panel member to be invited to witness the program.

Time span: Documents and photographs to be submitted any time before the end of certification process - 1 year of operational phase [ERCA scrutiny period], or time taken to fulfil all needed requirements of certification, whichever is more. It can continue after getting provisional certificate (1 year). But compensatory clause

should be fulfilled before final certification. In any case it would be before end of validity period for Y type Resorts - 31 March 2025.

Formulas: not applicable here.

Scores: 20 points: 2 points each for every seminar, workshop, research or any academic trips related to ecology and ecological conservation, before certification process - 1 year of operational phase, or time taken to fulfil needed requirements of certification, whichever is more. Creating awareness is a crucial step towards reinforcing natural landscapes and reactivating the natural systems on any site.

For ‘X’ as well as ‘Y’ type Resort, irrespective of scores, ERCA suggestion is to continue with this practice of education voluntarily, even after the final certification.

D) SOIL CONSERVATION

Soil conservation protects erosion and loss of the soil due to harsh weather. Soil conservation is extremely important as it directly supports the flora and fauna, biodiversity, habitats, ecosystems and thus is considered primary. Import of soil is strictly prohibited. Make soil if needed using vermiculture pits - plants grow well in decomposed matter. So combination of a variety of plant based materials like leaf litter, cuttings, cocopeat, agricultural wastes, dung, decomposed wastes can form best growing mix.

D1 : Increasing tree cover by tree plantation on site for soil conservation.

Rationale: Tree cover intercepts rains, besides many other benefits. In Western Ghats, the rainfall is very heavy, annually more than 4000mm, and when it hits the ground, due to the intensity, it washes away the soil even on gentler slopes. In case of tree canopy cover, soil erosion is controlled due to interception of rains by trees and the roots of trees hold the soil. Ref: (R1), (G7), (G8).

Consultants: Landscape design consultancy from appointed team.

Strategies: Planting trees to increase tree cover for interception of rains so that it doesn't hit the ground with high intensity. Blasting of rock on ground to create tree pits for planting trees is strictly prohibited. NOTE: Resort will be disqualified from ERCA certification if any blasting of rock surface done on site.

Documentation: Submit drawings showing new tree plantation, with added percentage of tree cover and list of proposed tree species.

Time span: Drawings, and details to be submitted at stage B1, as mentioned in the point for holistic conservation. ERCA monitoring and supervision shall be on intimation.

Formulas: not applicable here.

Scores: 2 points: Trees are most beneficial for Ecology, most important habitats, for biodiversity and ecosystems. As explained before, soil is an important element of Ecology, that influences other Ecological factors, hence is primary.

D2 : Use Bunds or vegetation to control soil erosion.

Rationale: Soil erosion is more with more water run off. Slow down the surface run off using contour bunds, earthen or stone pitched contour bunds, semi-circular bunds. Western Ghats has deccan trap basalt which is hard, impervious rock, hence trenches for slowing down water, are unsuitable in this region.

Vegetation is another way to control soil erosion. Using plant species that have deeper roots and roots that hold soil reduce soil erosion. Ref: (G7), (G8) Refer list of native species given in appendix. But this species selection should be as per site conditions.

Consultants: Landscape design consultancy from appointed team for Resort.

Strategies: Along with contour bunds, earthen or stone pitched contour bunds, semi-circular bunds as suitable to site, even swales are recommended to avoid random and high water run off and channelizing those to water collection areas / ponds. Control soil erosion using appropriate vegetation. - shrubs / grasses. Species native to Western Ghats, of trees, shrubs, and grasses should be used that has root system which grows deeper, and holds soil, controlling the erosion. Ref: (R1), (G7), (G8).

Documentation: Submit drawings, plans, sections, and details showing proposed earthen / stone bunds and plantation, and list of proposed tree species.

Time span: Drawings with proposal, and details to be submitted at stage B1, as mentioned in the point for holistic conservation. ERCA monitoring and supervision shall be on intimation.

Formulas: not applicable here.

Scores: 2 points: As explained before , soil is an important element of Ecology that influences other Ecological factors, ecosystems and natural processes on site, hence is primary.

D3: Use Organic fertilizers only

Rationale: Organic fertilizers release nutrients in soil, improve soil structure and its ability to hold water. Improve the quality of soil. Chemical fertilizers cause air and water pollution, cause mineral depletion and acidification of soil. Organic fertilizers help to maintain healthy natural patterns in soil and ecology. Overtime organic fertilizers make plants healthy and hence suitable to use.

sources: Organic fertilizers to be made on site, or bought from local community near Resort.

Strategies: Use of organic fertilizers only - panchgavya, vermiculture, leaf mould manure, bone meal, farmyard manure, neem cake , castor cake, pongamia, treated sewage sludge, compost, Ref: (R1), (G9)

Documentation: Submit List of fertilizers

Time span: Mandatory to follow at any stage of project including operational phase.

Formulas: Not applicable here.

Scores: 1 point - Easy to implement and mandatory to follow.

D4 : Use Organic pesticides only

Rationale: Organic pesticides are naturally occurring substances or mixtures that are used to repel pests. Chemical pesticides affect soil quality cause environment pollution with harmful effects on environment as well as living organisms. Organic pesticides help to maintain healthy natural patterns in soil and ecology.

sources: Make Organic pesticides on site/buy from local community near Resort.

Strategies: Neem leaves, neem extract, chrysanthemum extracts, onion -garlic spray, chilli- garlic paste, sitaphal powder, eucalyptus oil, Tobacco spray, panchgavya, or any natural pesticide. Ref: (R1), (G9)

Documentation: Submit List of Pesticides.

Time span: Mandatory to follow at any stage of project including operational phase.

Formulas: Not applicable here.

Scores: 1 point - easy to implement and mandatory to follow.

E) RAIN WATER HARVESTING

E1: Rain water harvesting system on site:

Rationale: Water is one of the most important elements of Ecology. Flora, fauna and human beings depend on water to live. Rain water harvesting is a technique to collect and store rain water at surface or in sub-surface aquifers to be used when needed, so that it is not lost and wasted as surface run-off. To avoid this loss which is more due to the hilly terrain of Western Ghats, rain water harvesting should be practiced. In this basaltic area of Western Ghats, artificial recharge structures are check dams, gully plugs, percolation tanks, nalla bunds, contour bunds, ponds, as per site conditions. Existing dug wells, preferable in this region to be used for artificial recharge, and thus water should be properly filtered to recharge these.

Western Ghats have numerous lakes and ground water which are tapped for drinking water and daily use. Due to the terrain, most Resorts in Western Ghats, fall in upper elevations and should not depend on these common lakes downstream or municipal water supply. Instead of municipal water supply for water consumption and watering landscaped areas, it is a better practice to harvest rain water on site to save energy and costs. Initial costs of construction might seem costly, but site becomes self-regulatory and sustainable once the system is in place. Resorts should harvest rainwater within the site itself, so that there is no loss of rain water due to run off, instead it shall be collected and used as needed, and to be used to recharge ground water. Rain water collection overcomes inadequacies of water. It saves energy and is to be used for watering the landscape at upper level, improve Ecology of the area, which otherwise consumes immense amount of municipal water. Ref: (R1), (G9).

Open well - of a minimum 1m. diameter and 6m. in depth into which rain water may be channelled and allowed to filter for removing silt and floating material. The well shall be provided with ventilating covers.

Consultants: Rain water harvesting consultants from the appointed team

Strategies: use of artificial recharge structures are check dams, gully plugs, percolation tanks, nalla bunds, contour bunds, ponds for rain water collection. Pits and trenches are not advisable in Western Ghats due to the hard deccan trap basalt.

Documentation: Drawings, plans, sections, details explaining the rain water harvesting proposal with calculations of water consumption on site and amount of

water harvested, hydrology of site, proposed swales, ponds, artificial recharge structures, all factors contributing to rain water harvesting shall be explained.

Time span: Drawings with rain water harvesting proposal, and details to be submitted at stage B1, as mentioned in the point for holistic conservation. ERCA monitoring and supervision shall be done on intimation.

Formulas:

Total site area = Z sq.m.

no	particulars	catchment area in sq.m. (a)	runoff coefficient (c)
1.	rooftop area	P	a
2.	green area	Q	b
3.	paved area (parking)	R	c
4.	roads	S	d
5.	dense vegetation	T	e

Average annual rainfall is 750 mm.

Formula for calculating rain water harvest capacity:

runoff volume = surface area x runoff coefficient x rainfall.

runoff volume of rooftop area

$$= P * a * 0.75$$

$$= G \text{ cu.m.}$$

runoff volume of green area

$$= Q * b * 0.75$$

$$= H \text{ cu.m.}$$

runoff volume of paved area

$$= R * c * 0.75$$

$$= I \text{ cu.m.}$$

runoff volume of road area

$$= S * d * 0.75$$

= J cu.m.

runoff volume of dense vegetation (steep slope) area

= T * e * 0.75

= K cu.m.

total runoff volume= G + H+ I + J+ K cu.m.

= M litres

(part of it to be collected in ponds, part of it to be filtered for well recharge)

Scores: 6 points: Water is life and a primary element of Ecology, ecosystems, and natural processes on site. Working out the rain water harvesting on a site, and execution of same needs high investments, as well as is challenging to execute.

E3: Paved area should not exceed 25%. (including roads)

Rationale: Permeable pavings allow water percolation in the ground and hence these should be used. Impermeable pavings have better strength, so those should be planned only in areas of movement of heavy service vehicles. Ref: (R1), (G9).

Consultants: Landscape design consultancy from appointed team.

Strategies: Impermeable pavings in areas of movement of heavy service vehicles, which shall be justified. Maximum paved areas to have permeable pavings.

Documentation: Drawings should indicate paved area, its total percentage, with percentage of permeable and impermeable surfaces, with justification and detail description of material.

Time span: ERCA monitoring and supervision shall be done on intimation.

Formulas: not applicable here.

Scores: 1 point: Easy to implement and mandatory.

F) GREY WATER TREATMENT

F1: 100% Grey water treatment

Rationale: Grey water is the waste water from sinks, bathrooms, kitchens, wash basins. This water should not be contaminated by faecal or urinal matter. Major benefit of grey water treatment on site is that, it can be reused on site , reduce load on city sewerage system, and at the same time support sustainable landscapes with self-regulation on site itself. Materials in grey water contaminates lakes, or soils, if not drained properly. In Western Ghats it is better to treat grey water on site mainly

due to the terrain. Treated Grey water to be used for flushing, and for watering the landscaped areas, to conserve fresh water. Ref: (R1), (G9).

Grey water constitutes only about a tenth of the nitrogen established in black water. There is much more reduced load of pathogens in grey water than the black water. As a result, the processing of the grey water is easier because organic content of grey water decomposes more rapidly than black water. Ref: (R1), (G9)

Consultants: Grey water treatment consultants from appointed team of Resort.

Strategies: Grey water treatment should be done by natural waste water treatment systems to be used for treating waste water like phytoremediation, phytoid, root zone treatment, soil bio technology.

Plant species like *Canna indica* (Indian shot), *Hedychium coronarium* (white ginger lily), the cyperus plant (umbrella plant), *Colocaesia*, banana, or species appropriate to the purpose to be used.

Documentation: Drawings showing filtration process, method, list of plant species with their location, and details to be submitted for Eco-Rating.

Time span: Drawings with proposal, and details to be submitted at stage B1, as mentioned in the point for holistic conservation. ERCA monitoring and supervision shall be on intimation.

Formulas:

Total water consumed at Resort = Q litres (refer appendix for water consumption on site)

considering that 5% of water is consumed for drinking purpose hence 95 % of the water to be potentially reused.

water required for drinking purpose

$$= 5\% * Q$$

$$= A \text{ litres}$$

water required for flushing (visitors) = 60 litres per person per day

total water for flushing for guest/visitors

$$= X * 60 \dots\dots\dots (X \text{ is number of guests})$$

$$= K \text{ litres}$$

water required for flushing (staff) = 45 litres per person per day

total water for flushing for staff

$$= Z * 45 \dots\dots\dots (Z \text{ is number of staff})$$

$$= M \text{ litres}$$

total water for flushing = $K + M$

= N litres

hence, water available for waste water treatment

= $Q - A - N$

= O litres

hence, water available for grey water treatment is= O litres

and water available for black water treatment is = N litres

Scores: 4 points: Resorts are situated in natural landscape settings, and with sloping sites, grey water treatment system is challenging to implement on site. But it is primary as waste generated will otherwise contaminate waterbodies around and soils, and can cause unhealthy ecological conditions, can negatively interfere with natural systems, and ecological processes on site. Thus, 4 points.

G) BLACK WATER TREATMENT

F2: 100% Black water treatment

Rationale: Black water is the waste water from toilets that has to be treated in STPs (Sewage Treatment plants). Black water contains higher level of pathogens, than grey water, and hence needs complete and careful process. Recycled black water be used to water lawns, or non food vegetation, to conserve fresh water. Plants that are grown with black water do not need any fertilizer. Ref: (R1), (G9)

Consultants: Black water treatment consultants from appointed team of Resort.

Strategies: After passing through STPs it needs greater amount of filtration and decontamination as compared to grey water due to its nature. Black water treatment should be done by natural waste water treatment systems to be used for treating waste water like phytoremediation, Phytoid, root zone treatment, soil bio technology. Choice of different plant species depends on factors such as the rooting depth, plant productivity and tolerance to high loads of wastewater. like Canna spp., Iris spp., Cyperus spp., Typha spp., Phragmites spp., Juncus spp., Poaceae spp. and Paspalum spp) Species appropriate for the purpose to be used.

Documentation: Drawings showing STP site details and STP detail drawings and capacity, filtration processes, method, list of plant species with their location , and details to be submitted for Eco-Rating.

Time span: Drawings with proposal, and details to be submitted at stage B1, as mentioned in the point for holistic conservation. ERCA monitoring and supervision shall be on intimation.

Formulas:

Total water consumed at Resort = Q litres (refer appendix for water consumption on site)

considering that 5% of water is consumed for drinking purpose hence 95 % of the water to be potentially reused.

water required for drinking purpose

$$= 5\% * Q$$

$$= A \text{ litres}$$

water required for flushing (visitors) = 60 litres per person per day

total water for flushing for guest/visitors

$$= X * 60 \dots\dots\dots (X \text{ is number of guests})$$

$$= K \text{ litres}$$

water required for flushing (staff) = 45 litres per person per day

total water for flushing for staff

$$= Z * 45 \dots\dots\dots (Z \text{ is number of staff})$$

$$= M \text{ litres}$$

total water for flushing = K + M

$$= N \text{ litres}$$

hence, water available for waste water treatment

$$= Q - A - N$$

$$= O \text{ litres}$$

hence, water available for grey water treatment is= O litres

and water available for black water treatment is = N litres

Scores: 4 points: Resorts are situated in natural landscape settings, and with sloping sites, black water treatment system is challenging to implement on site. But it is primary as waste generated will otherwise contaminate water bodies around and soils, or increase load on city drainage. If it contaminates waterbodies around and soils, and it can cause serious unhealthy ecological conditions, can negatively interfere with natural systems, and ecological processes on site and region. Thus, 4 points.

H) SOLID WASTE MANAGEMENT

H1: Plastic free zone , with supporting measures.

Rationale: Resort should be a plastic free zone. Plastic is extremely harmful for Ecology. Plastic accumulates and causes land and water pollution. It enters the food chain and food web through fauna. It negatively interferes with natural systems and landscapes. Ref: (R1),(G9)

Consultants: Appointed team should take needed measures.

Strategies: Supporting measures to keep resort plastic free are needed. Packed food delivery from restaurants should be free of plastic. Providing refill dispensers for soaps and shampoos. Drinking water fountains should be planned on site to refill glass bottles, and avoid any packed water bottle waste. Use of biodegradable materials is mandatory.

Documentation: Submit drawings at B1 stage and photographs of supporting measures once implemented . Expect ERCA site inspection anytime.

Time span: Measures needed at all stages of project and mainly operational phase. Expect ERCA site inspection anytime.

Formulas: not applicable here.

Scores: 2 points: Since extremely harmful for Ecology. It is a primary and mandatory measure.

H2 : Waste segregation on site

Rationale: Wheeled Colour coded waste bins help in waste segregation at primary level. NOTE: Incineration of waste on site or disposal of waste in water body would disqualify the project from being considered for Eco-Rating system. Managing waste is important to maintain healthy ecology.

Consultants: Appointed team should take needed measures.

Strategies: Use wheeled wastebins with compartments and colour codes for better segregation of waste.

Documentation: Submit drawings at B1 stage and photographs of supporting measures once implemented. Expect ERCA site inspection anytime.

Time span: Measures needed at all stages of project and mainly operational phase. Expect ERCA site inspection anytime.

Formulas:

s. no.	unit type	occupancy	rate (kg/cap/day)	total waste generated (kg/day)
1.	Resort visitors	x	a	P
2.	Restaurant	f	b	Q
3.	Resort staff	z	c	R
	Total			P+Q+R or say m kg/day

During the operation phase, waste will generate from hotel and restaurants with canteen for staff. The solid waste generated from the project shall be mainly domestic waste which includes hotel and restaurant with street sweepings and is estimated **m kg/day** approximately.

Scores: 1 point: easy to implement and mandatory to follow.

H3 : Vermiculture, composting pits, biogas plant to manage waste

Rationale: With accommodation, restaurants, guests, visitors and staff on site, solid waste is generated. This solid waste instead of transporting to far off places for disposal, should be managed on site itself using vermiculture, composting pits, or biogas plant as feasible or workable on a site. Ref: (R1)

Consultants: Appointed team should take needed measures.

Strategies: use Vermiculture, composting pits, biogas plant to manage solid waste.

Documentation: Give site drawings with areas demarcated for waste management, with drawings, details and photographs of vermiculture or compost pits.

Time span: Measures needed at all stages of project and mainly operational phase. Expect ERCA site inspection anytime.

Formulas: Formula in point H2 above to be referred.

Scores: 2 points: Waste generation and accumulation causes unhygienic conditions and health hazards, pollutes land, air and water. Hence is primary to manage waste for healthy patterns on site.

J) CONSERVATION OF FLORA AND FAUNA

J1 : Detail Documentation and efforts to conserve Flora and fauna in and around site.

Rationale: Flora and Fauna are important living parts of Ecology. With bio diversities and Ecosystems on site, it is necessary to take care that we do not disturb the existing ones. As in nature, flora and fauna are interdependent in different ways, any reduction or increase in number of species, or introduction of invasive species spoils the balance of the natural systems. It becomes responsibility of Resort owners, to care for the natural landscapes from which they gain profits. And to care for it, it is necessary to understand the numbers and dynamics of existing life on site, to note the changes if any and take needed steps in order to conserve the rich Ecology.

Consultants: Horticulturists, landscape design consultancy, Environmental consultants. And local people should be involved for same. Suggestion is to invite and involve students, NGOs and Researchers for study of flora and fauna, by choice of Resort owners.

Strategies: Detail documentation of flora and fauna in and around site.

Documentation: Documentation, site drawings with mapping and list of species with number and photographs of flora and fauna on site. Description of efforts for its conservation - including trees, shrubs, creepers, herbs, grasses, types of fauna and their list with common and scientific names with list and photographs should be submitted. Ref: (R1), (G9)

Time span: Documentation to be submitted at B1 stage, and efforts needed at all stages of project and mainly operational phase. Expect ERCA site inspection anytime.

Formulas: Not applicable here.

Scores: 6 points: Flora and Fauna are life and dynamic elements of site and natural landscapes. As living organisms, these are primary. Also, their regular documentation annually is investment of time, money and challenging to take efforts to conserve as it is very specific to site and its conditions. Thus, 6 points.

J2 : Preservation and plantation of native plant species.

Rationale: Native plant species as the name suggests are adapted to environment of the place these belong to. Due to that, they do not require fertilizers or extra efforts to grow. They are well set in that environment, and natural mechanisms, thus do not need pesticides. Native plants give benefits like oxygen, food, shade, prevent erosion, naturally without extra human efforts, which are needed in case of exotic species. Also, introduction of new species changes original landscape character of the place. Ref: (R1), (R2), (R3), (R4), (G1), (G2), (G3), (G7),(G8),(G9) **Note:** Monoculture creates favourable environment for spread of viruses like COVID-19 and similar kinds, hence monoculture is strictly prohibited , variety of species and preferably those producing fruits and flowers are recommended. Native plants attract birds, bees, pollinators - much needed for biodiversity. Hence natural landscapes with natural species are to be reinforced on any Resort site.

Consultants: Landscape design consultancy, Horticulturist, environmental consultants, and inhouse team to plan and supervise the same.

Strategies: Documentation and planning for preservation and plantation of native species. Suggestion is to invite and involve students, NGOs and Researchers for study of flora and fauna, by choice of Resort owners. For Resorts in western ghats: - Shrubs like sabja, sontakka, adulasa, tarwad, dhayati, karwand, banana plant, Murudsheng, Dhayati, Adulasa, Nirgudi. Understory shrubs/ herbs - Kuda, Basil, pudina, Brahmi, Wild fruits, besides guava and chiku, Khirani, bhokar, meki, amoni, charoli, dhamodya, grow Native fruits like Amoni, Bhokar, Charoli, Dhamodya, Karwand, Limboni, Meki, Shindolya, Tembhurni, plants with food supply throughout the year like Mango, jackfruit, Hadga, Shevga, Peepal, Karanj , Waras, Palas, enhance microclimate, habitat, create biodiversity areas. Check Native plant list given in appendix.

Documentation: Detail documentation as stated in J1, which shall indicate native species with list of species, drawings and photographs.

Time span: Detail documentation as stated in J1, shall be submitted at stage B1.

Formulas: Not applicable here.

Scores: 4 points: As mentioned before, trees and plants are life and dynamic elements of site. As living things, these are primary. Native plantation with its many benefits, help retain natural landscape character of place. 2 points for preservation

during life time of Resort and 2 points for plantation of more native species instead of exotic varieties.

J3 : Uprooting invasive species, and prohibition of genetically modified species.

Rationale: Invasive plant species, as the name suggests spreads, grows aggressively, and does not let other plants grow and replaces them, due to which it disturbs and invades existing Ecosystems of the place. Hence invasive species should be uprooted completely. Invasive species alters natural composition of any area. For Resorts, in process of beautification, new varieties tend to get introduced. Genetically modified species are prohibited as mentioned in guidelines of WGEEP report (MOEF) for Western Ghats. Ref: (R1),(R2),(R3),(R4),(G1), (G2), (G3), (G4), (G7),(G8),(G9)

Consultants: Landscape design consultancy, Horticulturist, environmental consultants, and inhouse team to keep check on the same.

Strategies: Uproot invasive species completely. Do not plant genetically modified species. Subabhul, cosmos, raanmari, jalparni, tantani, Caesalpinia, lantana should be especially checked and uprooted in western ghats. These should be uprooted mechanically - not with chemicals.

Documentation: Detail documentation as stated in J1, with list of species, drawings and photographs. Check to be kept on changes in same, or introduction of new varieties. Suggestion is to invite and involve students, NGOs and Researchers for study of flora and fauna, by choice of Resort owners.

Time span: Detail documentation as stated in J1, shall be submitted at stage B1.

Formulas: Not applicable here.

Scores: 2 points: As mentioned before, trees and plants are life and dynamic elements of site. Invasive species and genetically modified species disturb Ecology, and natural processes of a place massively, hence primary.

J4 : Lawns to be minimal with justification , covered with native grasses.

Rationale: Lawns are aesthetically pleasing. Lawns need extra care, regular watering, which takes up huge amounts of water. Besides high water requirement , lawns need large amounts of pesticides, also irrigation of lawns and fertilizers create greenhouse gases, which are harmful to environment. Hence lawns should be minimal with justification for specific functions only if needed in Resort. Ref:(G1),

(G7), (G8) Herb lawns doesn't need deweeding and harbour high plant diversity. Lawns catch morning dew, and increases soil moisture. Creates favourable microclimate to grow shrubs and trees. Grasses are insulating layer over top soil, forms mulch that degrades and adds to organic matter. Habitat for microwildlife, ground dwelling creatures, insects, grasses, seed eaters.

Consultants: Landscape design consultancy, Horticulturist, environmental consultants, and inhouse team to take care.

Strategies: Avoid lawns completely or cover justified lawn areas with native grasses. Create herb lawns of Durva or use mandukparni in surrounding, for Resorts in western ghats. Check list of native species in appendix.

Documentation: Submit site plan showing exact lawn areas and areas stated, detail drawings with maintenance measures. List of native grasses. Submit descriptive justification for need of lawn area.

Time span: Detail documentation shall be submitted at stage B1. Intimate ERCA. Expect ERCA inspection anytime.

Formulas: Not applicable here.

Scores: 2 points: Measures are easy to follow and mandatory. Yet this measure is considered primary as related to water, vegetation and environment.

J5 : Creative / Ecological / Nature theme park

Rationale: On site, if there are limited activities for recreation in nature, or if there is scope and need of developing a part of land on site, then a creative, Ecological or nature theme park to be created, that should merge with natural landscape character of the natural settings. All guest activities in Resort should help connect with nature, for exploration and adventure, like nature play, nature trails, any fitness activities, any learning spaces could be carved out in natural ways and natural materials, to address needs of various age groups. Activities like Go karting in nature trails, or any activities causing even slightest harm to fauna are prohibited. Ref: (R1), (G4), (G9).
Note : Most importantly park should follow the very basis of ERCA, that is 'Reinforcing natural landscapes to reactivate natural systems'

Consultants: Landscape design consultancy, Architect, Horticulturist, environmental consultants, inhouse team to collaboratively plan for it.

If any conservation measure is implemented, then respective consultant from appointed team shall be involved.

Strategies: Design for a creative / Ecological / Nature theme park , which does not change natural landscape character of the place, and helps reactivate natural systems on site.

Documentation: Submit schematic as well as detail design proposal including all drawings that explains the proposed creative and Ecological nature theme park.

Time span: schematic proposal to be submitted at stage B1 and detail proposal shall be submitted at stage B1 or 6 months before execution on site, whichever is less.

Formulas: Not applicable here.

Scores: 5 points: This is a different scale of proposal which may depend on area and conditions of site where it is proposed. This part of proposal shall create a larger impact on Ecology and surroundings, as it is about reactivating natural systems on site – 2 points, in a positive way, and challenges in development – 2 points, 1 additional point for better Ecological concepts and creativity.

K) ENERGY SAVING AND GENERATION

K1 : Generation and use of solar energy.

Rationale: Solar energy is a renewable source, in which light and heat of sun is harnessed, to convert into electricity. Technologies like photovoltaic panels, solar heating, solar architecture, parabolic solar cookers, solar lights are used. Solar energy is easy to implement and Economic for long term use. Initial installation cost may seem high, but in long run, it is Economic. Ref: (R1), (R2), (R3), (R4)

Consultants: Solar energy consultants, environmental consultants from appointed team.

Strategies: Technologies like photovoltaic panels, solar heating, solar architecture, parabolic solar cookers, solar lights or any feasible method specific to site.

Documentation: Submit site drawings and detail drawings of all solar installations on site, with calculations and numbers related to energy generation, and its comparison with energy demand on site.

Time span: ERCA to be intimated on installation. Expect ERCA site inspection anytime.

Formulas: Scope of solar energy consultants and environmental consultants.

Scores: 2 points: Initial installation cost may seem high but Solar energy is easy to implement and Economic in long run. Thus 2 points.

K2 : Eco lighting - use solar lights and LEDs , with red light arrangement (and with automatic light shut off n control)

Rationale: Solar lighting, and LEDs, with automatic light shut off and control to be used. Automatic light shut off - time control with mains is useful as electricity is saved when spaces are not in use and do not require to be lit. Solar lights are Economic in longer run even if initial installation cost is high. LEDs are preferred over CFLs., because CFLs have minor amount of mercury in them, which is hazardous when disposed. LEDs are costly but last longer. Ref: (R1), (R2), (R3), (R4)

Arrangement of red lights, so as, to not disturb nocturnal fauna is mandatory. Colour is perceived when brain combines signals received from cones and rods in retina of eye, that are sensitive to different spectral wavelengths. Rods being more sensitive to light, allow nocturnal fauna to see at night. Red sensitive L-cones enable humans to see red light in night. But most nocturnal animals do not have L-cones so are oblivious when illumination is with red light. Hence advantage is that humans can view at night in that red light while nocturnal fauna does not get disturbed and function normally.

Consultants: MEP (Mechanical, Electrical, Plumbing) consultants from appointed team.

Strategies: Solar lighting, and LED lights recommended.

Documentation: Submit detail drawings of site lighting layout, number, connections, details of all solar lights and LED lights on site, along with calculations on consumption of energy.

Time span: Documentation and drawing details to be submitted at B1 stage . ERCA to be intimated on installation, which should be during construction stage and again during operational phase with addition of lights . Expect ERCA site inspection anytime.

Formulas: Scope of electrical consultants (MEP)

Scores: 2 points: Initial installation cost of solar lights and LEDs seem high but is easy to implement and Economic in long run, and work even better with automatic

shut off and control. And red lights for night time are mandatory to not disturb the nocturnal fauna. Thus 2 points.

K3 : Use of electric vehicles to travel within site

Rationale: Use of electric vehicles, to travel within the site. CNG is compressed / liquified natural gas produces lesser harmful emissions but Electric cars produce lesser emissions than CNG and are Economical. Hence electric vehicles are preferred over CNG vehicles. Ref: (R1)

sources: Vehicle dealers.

Strategies: Use of electric vehicles to travel within site

Documentation: Details and documents showing use of electric vehicles on site

Time span: ERCA to be intimated. Use of electric vehicles during all stages of project, especially operational phase. Expect ERCA site inspection anytime.

Formulas: Not applicable here.

Scores: 1 point: Easy to implement and mandatory.

K4 : Meters for consumption of water and electricity.

Rationale: Install meters for electricity and water to keep check on its consumption. In case of any leakage or overuse, it acts as a check to control the wastage. Ref: (R1), (R2), (R3),(R4)

Consultants: MEP (Mechanical, Electrical, Plumbing) consultants from appointed team.

Strategies: Installing meters for consumption of water and electricity.

Documentation: Details and documents showing installations of meters on site during construction and before operational phase.

Time span: ERCA to be intimated once installed. Expect ERCA site inspection anytime.

Formulas: MEP consultants to specify limits for consumption.

Scores: 1 point: Water is primary Ecological element , but installations are easy to implement and mandatory. Thus 1 point.

L) EDUCATION, AND AWARENESS

L1 : Signage on site to encourage guests to walk and cycle.

Rationale: Signages on site that display encouragement to walking and cycling as healthy ways and lifestyle, are a gentle reminder for guests to pick healthier habits and in turn make them enjoy natural landscapes. And as a benefit, reduce harmful emissions due to use of vehicles. Ref: (R1), (G9)

Consultants: Landscape design consultancy to design and execute, from appointed team for resort.

Strategies: Signage on site to encourage guests to walk and cycle.

Documentation: Submit signage design details , demarcations on site plan showing signage positions, and photographs on execution.

Time span: Before operational phase starts, signage should be put up on site. ERCA to be intimated. ERCA inspection would follow.

Formulas: not applicable here.

Scores: 1 point: easy to implement on site.

L2 : Planned activities in nature for education and awareness for guests

Rationale: Education and awareness about Ecological conservation makes a big difference as people then actually start realizing and caring for Ecology. Instead of restrictions and penalties, an awareness and education is a better approach to teach them to respect nature and Ecology of place.

Sources: Local community, or people with knowledge about species shall be involved.

Strategies: Resort to plan activities like bird watching, or plant walk, mini treks , nature trails for exploration of biodiversity, games, or activities for kids and elders too, that are nature oriented. Ref: (G3), (G9)

Documentation: Descriptive report on all proposals, photographs during operational phase as implemented.

Time span: During operational phase.

Formulas: not applicable here.

Scores: 2 points: Constantly educating and making guests aware about Ecological conservation and reinforcing natural landscapes is primary , as it changes people's perspective towards nature, and instead of just enjoying nature and resources for free, we inculcate in them an attitude of care towards nature.

L3 : Educating and keeping staff aware about Ecological conservation practices.

Rationale: Education and awareness about Ecological conservation trains staff to follow greener ways, so that better Ecological practices inculcate, in the working system and culture of Resort of respecting and protecting its surroundings.

Sources: Professionals with knowledge about Ecology to be involved to train.

Strategies: Train staff for better Ecological practices.

Documentation: Submit a guidebook for staff and descriptive report on trainings for staff.

Time span: During operational phase.

Formulas: not applicable here.

Scores: 2 points: Constantly educating and keeping staff aware about Ecological conservation is primary, as it encourages them to adopt greener ways in relation to soil, air, water and trains them to care for Ecology, and natural systems on site, in their daily work.

N) COMMUNITY AND CULTURE**N1 : Ecological initiatives by Resort owners beyond the site boundaries**

Rationale: Ecological initiatives by Resort owners beyond their property is an extremely noble act. It goes way beyond gaining profits from region to a great social service as they are in the position to do good around. - like adopting a village, helping them develop, educating locals and villagers about Ecological conservation practices, or carrying out any Ecological conservation practices like rain water harvesting, preserving flora and fauna around resort site, providing solar energy to villagers, or creating fire lines in forests around to make forests safe from devastating fires, etc. Initiatives may depend on need of the community and Ecology, as needed in the region. Ref: (R1), (G9)

Consultants : CSRs or NGOs shall be involved.

Strategies: Different Ecological initiatives as needed and suitable for region.

Documentation: Descriptive study and proposals report, photographs, videos and documentation about work done around site.

Time span: During operational phase for life time of resort.

Formulas: not applicable here.

Scores: 10 points: It is primary to think about the larger region, because natural landscapes, natural systems and Ecological conservation never works as isolated factor. Site is small part of Ecology and a large natural system of natural landscapes - 2 points It costs extra when resort invests beyond the site boundaries. - 2 points It is challenging to gain trust of villagers and work with them for co-benefits.- 2 points . 4 points are additional points for the noble act. Scores / number of points here are subjective and will be as per joint and final decision of ERCA panel.

N2 : Promoting Economy of local communities.

Rationale: Promote local Economy in various ways - by recruiting 75% service staff from local communities nearby. Fruits and vegetables to be bought from locals to help them gain profits along with advantage to resort. Buying natural products like henna, reetha, sandal, natural soaps made or packed by villagers. Ref: (R1), (G9)

Sources: Local communities.

Strategies: Look for working along co-benefits with local communities.

Documentation: Descriptive report, photographs, videos and documentation to explain co-benefits.

Time span: During operational phase for lifetime of resort.

Formulas: not applicable here.

Scores: 2 points: It is challenging to gain trust of villagers, and locals, and work mutually that is advantages to Resort as well as local communities.

N3 : Preserving culture of local communities.

Rationale: Culture means customs, beliefs, cuisines, ways, and social behaviour of a group of people staying in a community. Cultural heritage reflects and shapes beliefs, values, aspirations, and thus defines a community and gives character to a region. Resort should take efforts by serving local cuisines, cookery class for local delicacies, display and sale of local art and handicrafts, having theme programmes based on local dances and stories. Ref: (R1), (G9).

Sources: local communities.

Strategies: Preserving culture of local communities.

Documentation: Descriptive report, photographs, videos and documentation to explain culture and efforts by Resort to preserve it.

Time span: During operational phase for lifetime of resort.

Formulas: not applicable here.

Scores: 2 points: It is challenging to gain trust of villagers, and locals, and work mutually such that it is advantages to Resort as well as local communities.

P) EXCELLENCE OR INNOVATION

P1: Excellence or innovation in design and technology

Rationale: A research is growth in findings and new knowledge, which helps in development and better understanding to mankind, similarly innovation in design and excellence becomes a prototype for others to learn from and follow, and hence is a contribution of knowledge which is most valuable for mankind.

Consultancies: Designers and Engineers.

Strategies: Think beyond typical for innovation.

Documentation: Submit new ideas, design proposals, documentation of executed work to be considered towards excellence and innovation.

Time span: As per choice of Resort owners.

Formulas: not applicable here.

Scores: 10 points: Innovation and Knowledge is greatest contribution to any field. Scores / number of points here are subjective and will be as per joint and final decision of ERCA panel. Score shall be more, if innovation further and strongly supports the core idea of ‘Reinforcing natural landscapes to reactivate natural systems’ on site.

Developed Eco-Rating system is as follows :

	FRAMEWORK OF ECOLOGICAL CONSERVATION MEASURES	X type Resorts	Y type Resorts
			valid till 31.3.2025
A	PREDESIGN STAGE MEASURES		
A1	Appointment of collaborative professional team of respective field experts [M]	2	*
A2	Detail study of all site features and ecological layers [M]	2	*
B	DESIGN STAGE MEASURES		
B1	Holistic Plan and design for preservation of natural features on site :	4	*
C	CONSTRUCTION STAGE MEASURES		
C1	Preconstruction measures:		
C1.1	Preservation of existing trees, native or medicinal trees and plants. [M]	2	*
C1.2	Biofencing the property	1	*
C1.3	Site to build toilets for labourers and compost pits before Resort construction starts.[M]	1	*
C2	During construction measures		
C2.1	Retaining natural features of site during construction [M]	2	*
C2.2	Preservation of top soil [M]	2	*
C2.3	Lighting on construction site to be solar lighting.[M]	1	*
C2.4	Regular PUC check for vehicles and machinery during construction.[M]	1	*
C3	Post construction measures		
C3.1	Construction waste to be given to the recyclers [M]	1	*
C3.2	Use of eco-friendly materials and products for construction	1	*
R	COMPENSATORY CLAUSE - 20 Points for 'Y' type Resorts.		
R1	Research and Educational programmes	*	20
D	SOIL CONSERVATION		
D1	Increasing tree cover by tree plantation on site for soil conservation.	2	2

	FRAMEWORK OF ECOLOGICAL CONSERVATION MEASURES	X type Resorts	Y type Resorts
D2	Use Bunds or vegetation to control soil erosion.	2	2
D3	Use Organic fertilizers only [M]	1	1
D4	Use Organic pesticides only [M]	1	1
E	RAIN WATER HARVESTING		
E1	Rain water harvesting system on site.	6	6
E2	permeable/ impermeable paving - 25% max.	1	1
F	GREY WATER TREATMENT		
F1	100% Grey water treatment	4	4
G	BLACK WATER TREATMENT		
G1	100% Black water treatment	4	4
H	SOLID WASTE MANAGEMENT		
H1	Plastic free zone, with supporting measures [M]	2	2
H2	Waste segregation on site [M]	1	1
H3	Vermiculture, composting pits, biogas plant to manage waste	2	2
J	CONSERVATION OF FLORA AND FAUNA		
J1	Detail Documentation and efforts to conserve Flora and fauna in and around site.	6	6
J2	Preservation and Plantation of Native species [M]	4	4
J3	Uprooting invasive species, and prohibition of genetically modified species. [M]	2	2
J4	Lawns to be minimal with justification , covered with native grasses.	2	2
J5	Creative / Ecological / Nature theme park	5	5
K	ENERGY SAVING AND GENERATION		
K1	Generation and use of solar energy.	2	2
K2	Eco lighting - use solar lights and LEDs (with automatic light shut off n control)	2	2
K3	Use of electric vehicles to travel within site [M]	1	1
K4	Meters for consumption of water and electricity. [M]	1	1

	FRAMEWORK OF ECOLOGICAL CONSERVATION MEASURES	X type Resorts	Y type Resorts
L	EDUCATION, AND AWARENESS		
L1	Sinage on site to encourage guests to walk and cycle.[M]	1	1
L2	Planned activities in nature for education and awareness for guests	2	2
L3	Educating and keeping staff aware about ecological conservation practices.[M]	2	2
N	COMMUNITY AND CULTURE		
N1	Ecological initiatives by Resort owners beyond the site boundaries	10	10
N2	Promoting economy of local communities.	2	2
N3	Preserving culture of local communities.	2	2
P	EXCELLENCE OR INNOVATION		
P1	Excellence or innovation in design and technology	10	10
	Total scores	100	100
	* not applicable here, [M]-mandatory		

	ECO - RATING SYSTEM
	CORE POINTS - 40
	3. ECO GROVE-AVERAGE [41-60 points]
	2. ECO WOODS -GOOD [61-80 points]
	1. ECO FOREST - BEST [81-100 points]

Table 3.1e: Developed Eco-Rating system

Source: Author

3.3 Case Studies

Criteria for Choice of **Resort case studies** are :

One International case study in an environmentally sensitive country Bhutan that is located in a biodiversity hotspot.

Resorts in **Western Ghats**.

Resorts that are in **Natural landscape settings**.

Resorts that are well known brand or **famous - most visited** and liked by travellers.

Resorts with **area of 25 acres** or more.

Resorts that **more or less follow environmental conservation measures**.

Comparative Study of Rating systems, guidelines, and case studies were used to first form the framework of ecological conservation measures for Resorts and decide scores. Eco-Rating system is developed by comprehension, analysis, inference, and refining through rationale for each point, along the parameters mentioned earlier. Author's Academic landscape learnings, readings of various Rating systems, Guidelines, Author's Professional experience of 18 years in Architecture and correlated informal landscape learnings, and casestudies cumulatively supported the process.

Thus,

Main step 1 was to develop an Eco-Rating system as a tool to incentivize Ecological conservation in Resort situated in sensitive natural landscape settings of Western Ghats.

Next step 2, was using this developed Eco-Rating system, as a tool to evaluate the Resort that seemed to fall short among the selected case studies, and then enhance that Resort towards better solutions and design proposal.

All the case studies which were simultaneously studied along with Rating systems and guidelines, are elaborated here. Hence, by choices along the criteria, following are the Resort case studies as elaborated next.(P.T.O)

3.3.1 Six Senses, Punakha, Bhutan.



Figure 3.3.1a: Six senses, Punakha, Bhutan

Source: *SIXSENSES BHUTAN*. n.d. <https://www.sixsenses.com/en/Resorts/bhutan>. 5 December 2019

Location: Six Senses is located in the colourful Himalayan Kingdom of Bhutan.

Country: Bhutan

Region: Eastern Himalayas

Elevation from sea level: 1500 metres.

Area: 25 acres

Economic Aspects:

Bhutan measures its progress with Gross National Happiness (GNH) philosophy and not Gross Domestic Product (GDP). GNH plays an important role in the implementation of government policies based around four basic pillars, 1) Environmental Conservation, 2) good governance, 3) sustainable socio-Economic development, 4) preservation and promotion of culture.

Environmental Aspects:

"Bhutan is the only country in the world that by its own constitution protects its forests," -Juergen Nagler, UN Development Program in Bhutan.

Environmental protection is enshrined in the constitution. Minimum of 60% of Bhutan's total land should be maintained under forest cover for all time.

Design concept and Challenges:

The hotel is segregated into five small hotels, located at major tourist spots—Thimphu, Paro, Punakha, Gangtey, and Bumthang, and comprises of a total of 82 units. Each city has its own content with different characteristic of geography, weather and vernacular architecture. Design regulation in Bhutan is that architectural design must reflect the “Bhutaness”. Main design concept is to re-interpret the Bhutanese architecture. The challenge was to adapt each hotel to its physical

surroundings and also attain individuality for each hotel concept. Based on the traditional Bhutanese house, locally available and sustainable harvested materials were used.

The approach concept is from local plants to create the arrival perception to the guest, which are, Cherry blossom for Thimphu, Step paddy field for Punakha, Rhododendrons for Gangtey, Pine forest for Bhumthang and Apple orchard for Paro.

Design Materials:

Building materials consist of timber, stone, and earth.

Materials for Punakha were: Exterior wall: Rammed earth finish Interior wall: Plastered finish, local timber finish, rattan partitions. Floor: Local stone, local timber finish.

Conservation Measures:

Rammed earth walls provide excellent insulation and provide interior spaces with a constant temperature. Use on-site reverse osmosis plants and crystal water refinery to collect and produce high-quality drinking water that is served in glass bottles.

Practices of active energy, water, waste and purchasing management are employed.

The use of chemicals is closely monitored. The construction of the spa is the traditional rammed earth, to conserve the vernacular construction technic.

Community Development:

Collaborated with the Ministry of Agriculture and Forest (MOAF) and local farmers, the hospitality team is developing an Ecological village for the purpose of local food production and education. Training courses to learn about growing new crops and study new farming techniques.

Picking up the latest trends in nutrition and recycling, to reduction of imports to balance the local diet. The aim of the management is to become self-sufficient.

Local farmers and children attend training courses to learn about growing new crops and study new farming techniques, as well as picking up the latest trends in nutrition and recycling. The organic and sustainable village is a pioneer project to introduce “superfoods” to the local community. By law, foreign tourists must be accompanied by a licensed guide during their entire stay in the Kingdom and independent travel is not permitted. This helps in providing employment for the locals. Only a limited amount of tourists is allowed to visit.

3.3.2 The Machan Resort, Lonavala, Maharashtra

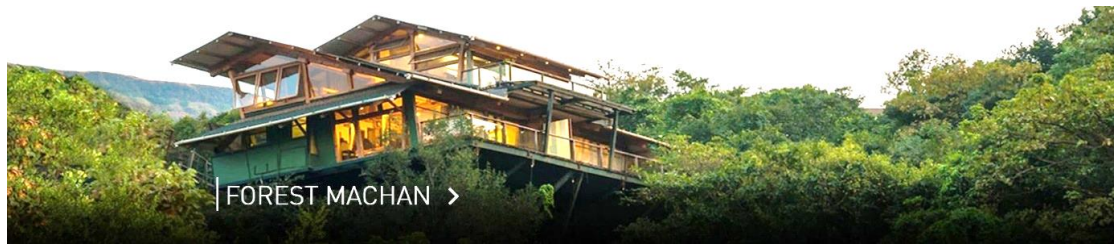


Figure 3.3.2a: The Machan Resort, Lonavala

Source: LLP, Macchan Resorts. *The Macchan*. 2019. <https://www.themachan.com/about-us.php>. 5 December 2019.

Location:

State: Maharashtra

Region: Western Ghats

Elevation from sea level: 775 metres.

Area: 25 acres

Economic Aspects: Clearly shows understanding and vision of Resort owners in relation to conservation measures even if initial costs are higher, in the long run it is beneficial in every way.

Environmental Aspects: This resort is at Lonavala in Western Ghats, a biodiversity hotspot.

Design concept and Challenges:

It took 20 years to find this 25 acres of wooded, peaceful and serene land.

The locals used to slash and burn trees. It took 2 years to fence the entire land, preventing of felling, trapping and hunting. It took 9 years to prune wild trees and weeds. Today there are more than 20,000 indigenous trees, and 90% are flowering / fruiting, with a rich biodiversity. These ideas were followed in design concept also.

To minimise the cutting of trees the architect restricted the footprint of the building on the ground. Foundations go down to the hard rock and the highest point [the crow's nest] is 26 meters from the ground. No machines were used in its erection nor were any trees cut or damaged during construction.

An old tree is retained in the hollow between the columns which acts like an internal courtyard for the house in the air.

Macchan means tree house in hindi. Each tree house is raised 35-45 feet above ground level, directly over the forest. Types of Tree houses are Heritage Macchan, Canopy Macchan, Jungle Macchan, Sunset Macchan, Starlight Macchan.

Heritage Machan is built around a natural wild fig tree, and each macchan has its speciality as the names suggest. The property being on a slope, construction was not possible on site. Everything was made in Pune and assembled on site.

Design Materials:

The structure was designed to be one with nature. A frame of four RCC columns tied with beams at two levels acts like the trunk, which is about 6 meters high. A relatively light pre-fabricated steel structure branches out in all directions and forms the skeleton of the building. Nut and Bolt steel structure clad in wood, designed to withstand earthquakes and wind speeds of up to 200 Kmph

Conservation Measures:

Made out of all recyclable materials, wood, glass and steel. No tree, leaf has been cut during the entire building process. Generation of almost all energy off grid from renewable sources (solar and wind). Use of only LEDs and CFLs for all lighting needs and soon moving towards 100% LEDs only. Cook 50% of total meals and 20% of guest meals on parabolic solar cookers. Recycle 80% of all grey water and use this water to plants on the property. Provide pure mountain water for consumption, from a 300 feet deep bore well. Organically grow all the flowers.

Have 4 km of private paths, on which guided trails are conducted, so that guests can explore the beautiful flora and fauna of the region. Limit their accommodation so that each guest can have around 1 acre of green space, thus reducing the stress on the forest while providing a private and serene experience.

Dedicate 10% of profits to the flora and fauna of the Western Ghats. Conduct in depth research studies on the environment and share these with relevant NGOs.

Treat all trees for termites annually, leading to only 5% of trees being affected by termites today. Prune trees annually to improve health and growth. Heavily patrol the area to prevent hunting, tree cutting and overgrazing.

Landscape Techniques:

Create perennial waterholes for animals, especially in the summer months. Build earthen bunds to raise the subsoil moisture level, and raise the water table.

Ecological Benefits:

Due to a much smaller footprint and cantilevering a large part of structure the damage to the land is reduced. The building is largely dismountable, that a large part of the material can be reclaimed and reused.

A few barking deer have now made Jambulne their permanent home. Small animals like rabbit, mongoose, porcupine, squirrel etc. are a far more common occurrence.

An Ecologically balanced Forest has now emerged.

Community Development:

50% of staff at Resort is local community. Free electricity is provided to villagers till half kilometre distance Fresh produce is bought from villagers.They provide internships to naturalists to study flora and fauna of area, conduct training in environmental matters, in hospitality, and support their personal development.

3.3.3 Banasura Hill Resort, Wayanad, Kerala

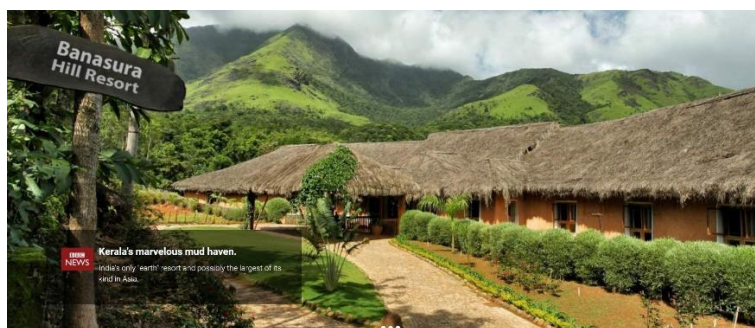


Figure 3.3.3a: Banasura hill Resort,Kerala

Source Banasura Hill Resorts. *banasura*. 2019. <https://www.banasura.com/> 25 December 2019.

Location:

State : Kerala

Region: Western Ghats

Elevation from sea level: 980 metres.

Area: 35 acres

Economic Aspects: Investment costs of conservation are worth.

Environmental Aspects:

Banasura Hill Resort is an Eco and nature resort that has been named Asia's largest 'earth' resort. Considered one of the 'greenest' destination in the Nilgiris biosphere.

Wayanad has a tropical wet climate with an annual average rainfall of over 2,300mm.

Design concept and Challenges:

The main building of the resort has a carpet area of 20,000 square feet. It is a massive two-storey structure made entirely of mud with a roof of bamboo and coconut palm fronds. The building is designed without any concrete pillars, thus extra attention has been paid to load bearing and load balancing aspects to ensure stability.

Design Materials:

Made up of locally available earth materials. Resort has been built from mud and recycled wood. Only 5% cement is used in the walls. Mud plastering over cement has also been employed in a few places. It is built using mud excavated from the site itself.

Conservation Measures:

The material can be reused and recycled indefinitely as a building material and returned to the earth. No air-conditioners are needed as the mud walls act as an effective regulator of heat and cold. There is a cooling stream flowing through the property. Natural light is exploited to the fullest, while CFL lamps provide extra lighting, minimizing energy consumption. Periodic anti-termite treatment is done using cashew-shell oil rather than chemical agents. A bio-gas plant recycles organic waste and fires the resort's kitchens. A bio-fencing has been created in and around the resort by planting Guadua bamboo saplings. It helps in regulating water levels, absorbing huge amounts of carbon dioxide from the atmosphere, producing oxygen, preventing soil erosion and conserving bio diversity. Large areas have been used to cultivate pepper, coffee and arecanut, Tall Rosewood and Eucalyptus trees.

Landscape Techniques:

Highly aromatic Vetiver grass is planted. Its cluster roots run vertically like a mesh to a depth of almost 5m, effectively preventing soil erosion and arresting water run-off. These measures help to conserve the Ecological balance of the place and preserve its natural heritage and biodiversity.

Community Development:

Local tribals were called in for the labour and their expertise in building with mud was also tapped. The Resort values and respects the sociocultural identity of the local community. They intend to culturally sensitize the guests through interaction with the local community. They encourage guests to visit tribal villages close to the resort. This not only helps in the exchange of knowledge and wisdom between visitors and

local residents, but also helps in inculcating in the host community a sense of pride in what they are.

Soil and Water conservation measures by government of Kerala:

The suitability of a soil conservation treatment depends on: Slope, Rainfall (amount and distribution), Soil type and depth, Water holding capacity, Location of impervious layer, Agricultural practices, Land use/land cover, Economics.

To intercept rainfall where it falls and to obviate the chances of the runoff water from acquiring erosive velocities in arable land the Department has been implementing various soil and water conservation measures in arable land like :

Earthen bunds: small embankment type structures.

Help to check the velocity of the run-off, to carry excessive rainfall safely downstream and to let off stream flow in natural channels.

Increases the time of concentration of rainwater where it falls thereby allowing rainwater to percolate into the soil.

Stone pitched contour bunds: constructed in contour at suitable intervals in slopes.

Lead to reduction in soil erosion and increased water availability for crop plants.

Landscape Techniques:

Vegetative hedges: adopted in areas having low infiltration (< 8 mm/hr) and more than 800 mm rainfall.

Graded bunds are laid along pre-determined longitudinal grade instead of along the contours for safe disposal of excess runoff.

Contour /staggered trenches: reduces run off velocity drastically.

Increase the time for water to infiltrate into the soil.

Facilitate sedimentation and deposition of eroded material, serve as porous filters.

Drainage Line Treatments.

Planting of woody perennials wherever necessary to control soil erosion.

Moisture conservation pits: constructed over the land surface to arrest excess surface runoff and silting and thus leading to ground water recharge.

3.3.4 Wildernest Nature Resort, Goa



Figure 3.3.4a: Wildernest Resort, Goa

WILDERNEST. n.d. <http://www.wildernest-goa.com/> 10 December 2019

Location:

Located near meeting of borders of Goa, Maharashtra, and Karnataka, the Chorla Ghats are the residence of tigers, leopards, sloth bears, and an important nesting site for critically endangered vultures.

State: Goa

Region: Western Ghats - Chorla

Elevation from sea level: 817 metres.

Area: 450 acres (including forest land within the property)

Economic Aspects: Minimal intervention and yet needed investments for Ecology.

Environmental Aspects:

Eco-cottage at Wildernest has spectacular view of the Vazra Falls, flowing over the green steep slopes of the Swapnagandha Valley. Guests at Wildernest can spot megafauna like the gaur, smaller creatures, slender loris, a tiny primate known to the locals as vanmanas or the spirit of the forest, pill millipede, a small, tight pearly-black ball; the Malabar gliding frog; and the tortoise shell beetle.

Design concept and Challenges:

Earlier the misty forestland was opened up for mining and was on path of destruction. Captain Nitin Dhond, wildernest's managing director, alongwith other nature lovers and Ecologists acquired the forest approach road. They slowly managed to secure 450 acres of this crucial wildlife corridor connecting mhadei and bhimgad wildlife sanctuaries. Now at the heart of the flourishing forest is Wildernest. Their Mantra: "To develop & practice wildlife and Eco-tourism in the Sahyadris, through sustainable and commercial Eco-friendly initiatives, for the purpose of creating

appreciation of nature and providing a platform for experiencing the exquisite natural & cultural riches that abound the Sahyadris"

Design Materials:

Its cottages are fashioned from acacia wood. Wood, used as a raw material for construction of Eco-huts has been procured from the social forestry sector.

Conservation Measures:

Natural landscape is retained or followed. Use of indigenous plants promoted.

The resort relies largely on solar electricity. Rainwater harvesting is being practiced for water preservation. The entire area is demarked as a plastic free zone.

Biodegradable waste disposal is done through effective microbe composting.

Sewage disposal done without using chemical effluents. Rainwater harvesting practiced for water preservation.

Landscape Techniques:

Traditional gravitational water conservation measures are practised. Natural contours are maintained.

Community Development:

Employs residents of nearby villages who serve the most delicious local fare.

Plantation drives for medicinal plants are carried out with the help of locals in the region. In the process of helping develop means and methods to document the traditional knowledge of the local communities in the region. Activity centres where local artisans perform. Cultural activities and bonfires are a part of the activities held at the resort. The food is true to its region.

The nature conservation facility:

Established to facilitate research and long term monitoring of the biodiversity of the Western Ghats. An attempt to provide a platform for Ecologists and wildlife biologists. Attempts to raise awareness in general amongst the local communities and villages of the mahadayi region and its surrounding areas about the environment.

The facility is divided into: Interpretation center: houses the data collected by researchers in the area A small library: on subjects of conservation and Ecology

Biodiversity laboratory: data collation and analysis is carried out at the facility.

Maintains a medicinal plant nursery and undertakes plantation drives for medicinal plants. Recognized as a hub of activity for volunteers and students who train here under researchers of international repute.

3.4 Tungi Resort, Lonawala

3.4.1 Climate

Tungi Resort site is about 775 m above sea level in Western Ghats.

Tungi is in taluka Maval of Lonavala. Lonavala is a beautiful hill station in Pune district of Maharashtra. As per Koppen-Geiger climate classification Lonavala is considered to be ‘Am’ that is Tropical Monsoon Climate.

Max. temperature – 27.9 degrees celcius, Min. temperature – 20.9 degrees celcius.

Wind direction – southwest monsoon winds, Wind direction – north east in winter.

Total rainfall is more than 4000mm per year, Average rainfall is 750mm.

3.4.2 Strategic Location in region

Tungi Resort has a unique and strategic location in natural landscape settings, overlooking Pawna lake on its three sides. Pawna lake is backwaters of Pawna dam over Pawna river. Resort is on a plateau at 775 m. above sea level, situated in hilly terrain of Lonavala with serene views of Pawna lake in its surrounding.

Combination of these, makes it a blissful self-contained destination. Adjacent Tung fort (Kathingad) and view of Tikona fort at a distance - with a rich history of Marathas adds cultural value to the place. Lohagad and Visapur fort are close by as tourist attraction, along with caves and variety of site seeing points of the hill station, Lonavala.

Reaching Tungi site:

By Air: Mumbai International Airport (110 km) and Pune Domestic Airport (66 km) are very well connected to all major international and national airports, respectively.

Reaching the location is quite comfortable by driving via Mumbai-Pune express highway. From Khandala station, and also from Kamshet, Tungi site is about a 30 kms drive by car or rickshaw.

By Rail : Lonavala is midway on main rail line between Mumbai-Pune. From Lonavala station, Tungi site is about a 30 kms drive by car or rickshaw.

By Road : From both Mumbai and Pune, Lonavala is about 3 hours of smooth drive on Mumbai-Pune highway . From Khandala bypass, and also from Kamshet, Tungi site is about a 30 kms drive by car or rickshaw.

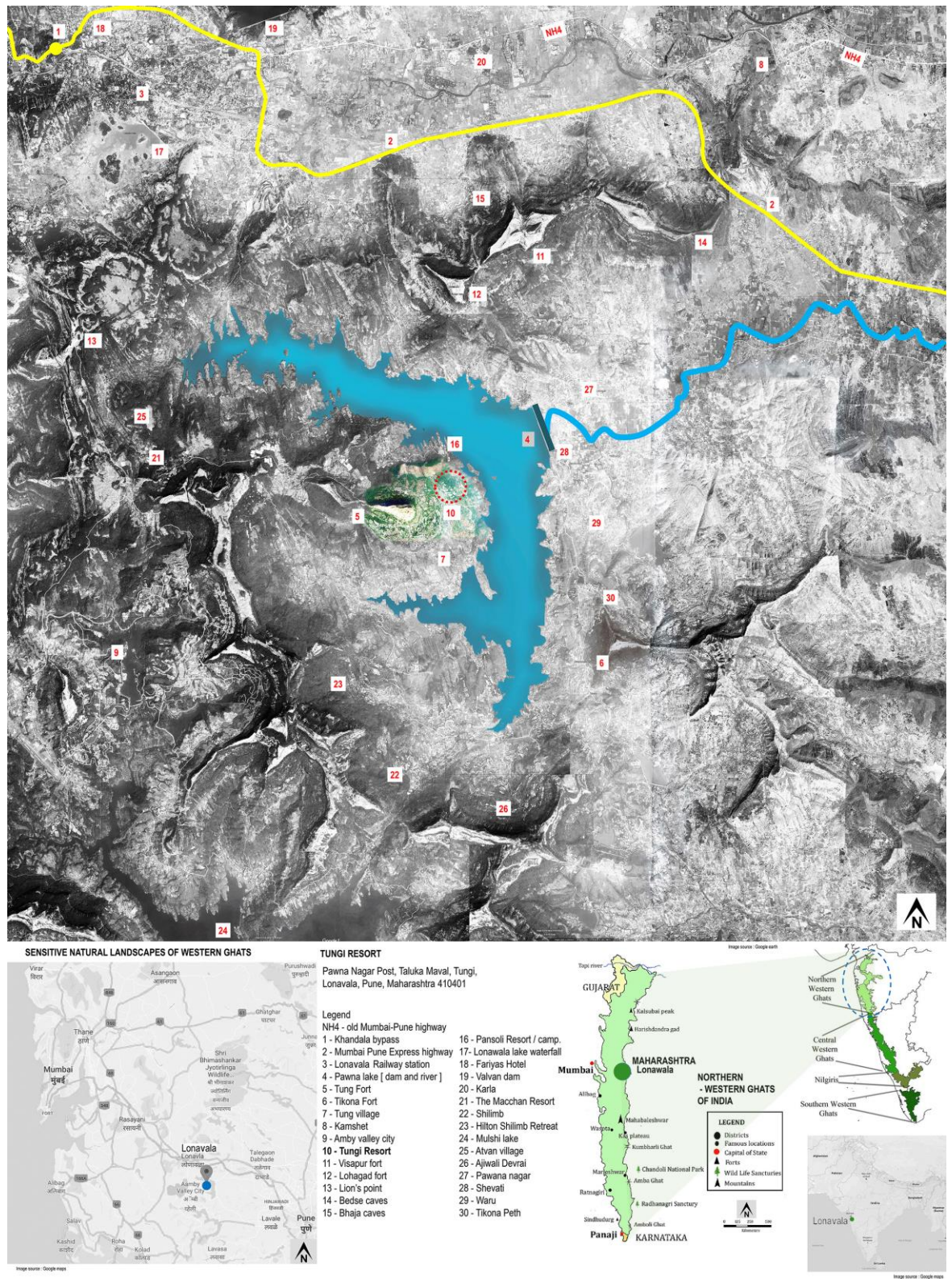


Figure 3.4.2a: Strategic Location of Tungi Resort

Source: Google earth, Google maps, Author

Lonavala is famous for its delicacies and is well-known across India, for the production of ‘chikki’. People of Lonavala celebrate their festivals with joy and

enthusiasm and the whole town participate in the festivities. Ganesh Chaturthi and Vijayadashami are the most popular festivals. People also celebrate the festival of music. Languages that dominate here are Marathi and Hindi.

Lonavala is also known as the 'Jewel of the Sahyadri Mountains'.

Some of the best places to visit in Lonavala are Lohagad Fort, Rajmachi Point, Karla Caves, Valvan Dam, Tiger's Leap, Bhaja Caves, Rajmachi Fort, Bhushi Dam, Korigad Fort, Kune Waterfalls, Tikona Fort, Visapur Fort, Bedsa Caves, Lonavala Lake, and Tung Fort. Best time to visit Lonavala and Khandala is during the monsoon, between July - September, when the scenic spots become lush green and the waterfalls are in full flow.

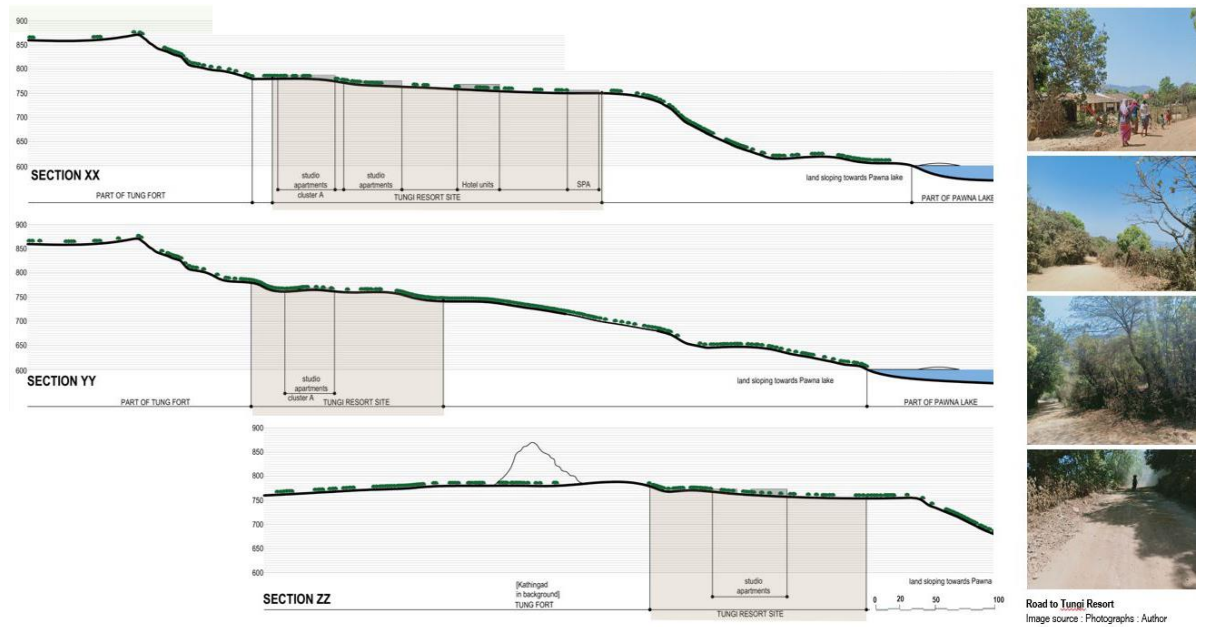


Figure 3.4.2b: Sections through Tung region

Source: Author

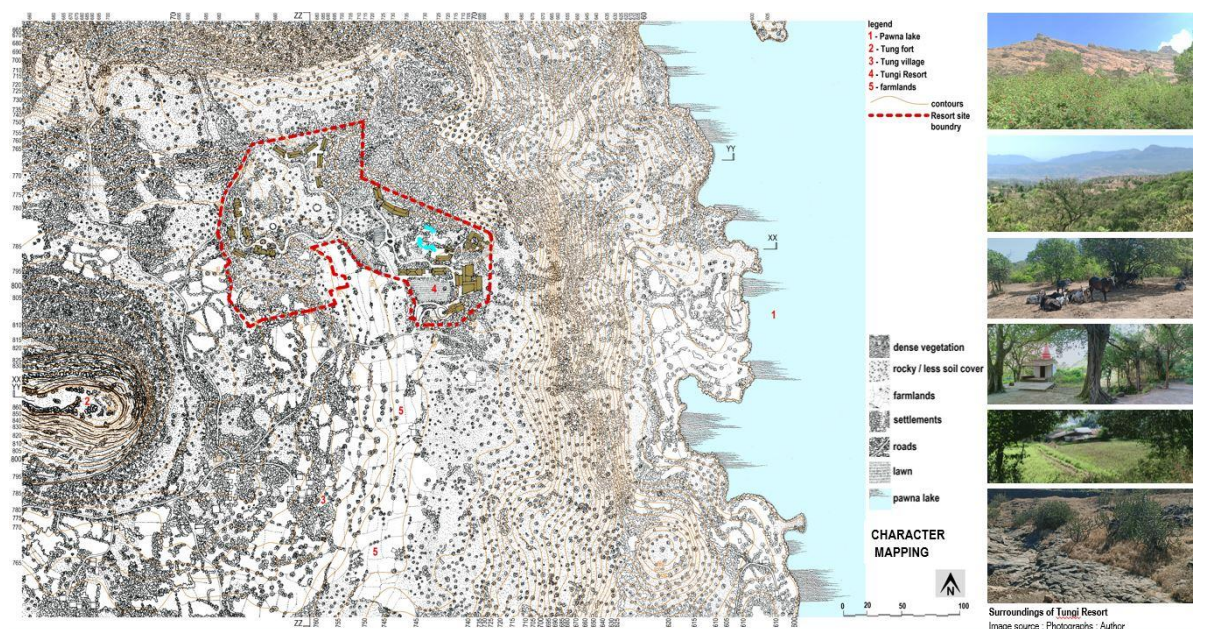


Figure 3.4.2c: Character mapping - Tungli Resort in Tung region.

Source: Author

3.4.3 Geology, Hydrology, Hydrogeology, and Soils.

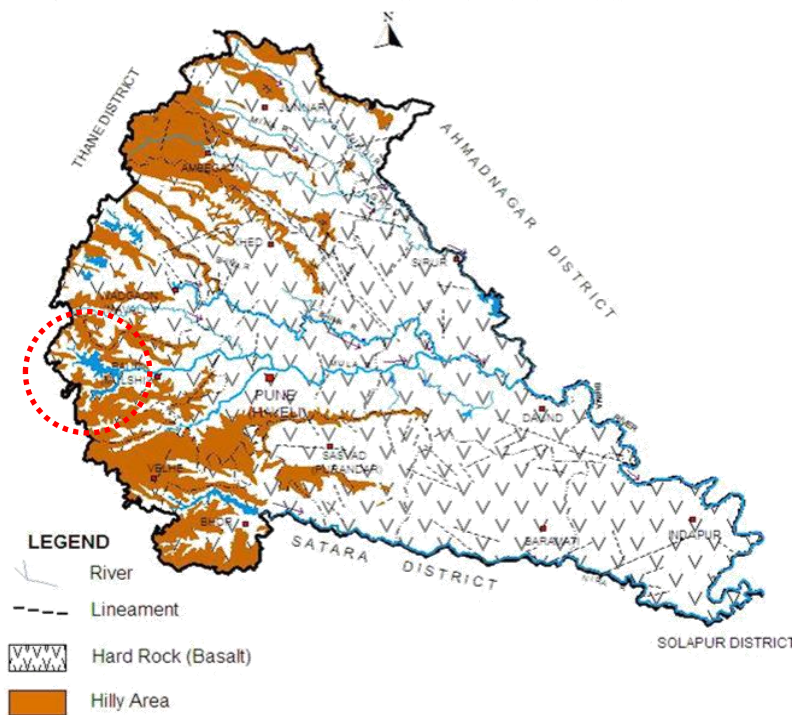


Figure 3.4.3a: Hydrogeology of Pune

Source: **CGWB** – Central Ground Water Board

Ministry of water resources, Government of India.

Western Ghats is one of the physiographic unit of Pune. Lonawala is in Western Ghats. Pune is divided into 14 talukas namely Pune city, Khed , Haveli, Junnar, Ambegaon, Shirur, Daund, Indapur, Purandhar, Baramati, Bhore, Mulshi, Velhe, and Maval. Tungri falls in Maval Taluka.

Important rivers that are flowing through the district are Bhima, Andhra , Karna , Shivganga, Pushpavati, Indrayani, Pawna. All rivers have a semi dendritic pattern and drainage density is high. Pawna lake is backwaters of Pawna dam over Pawna river.

Deccan trap basalt occupies 95% of Pune, except the areas along river banks that has alluvium deposits of recent age. Deccan traps are hard impervious rock formations, of upper cretaceous to Eocene age.

These are one of the largest igneous rock features on earth , that are result of volcanic eruptions in history of earth.

Basaltic lava flows are generally horizontally disposed over a wide stretch and give rise to table land type of topography called plateau.

' Trap ' in geology refers to step like hills forming the landscape of the region.

Hydrogeology includes water bearing formations like weathered, fractured, jointed and vesicular basalts. Ground water occurrence and movement depends on nature , density, distribution, interconnection, and weathering.

Quality of ground water is good and suitable for drinking and irrigation. Contamination due to localized Nitrate is found and needs to be checked before use.

Dug wells are most feasible in entire basaltic deccan trap. Bore wells tap deeper fractures and need proper scientific investigation.

In basaltic area, artificial recharge structures are check dams, gully plugs, percolation tanks, nalla bunds, contour bunds, ponds, etc.

Shallow alluvial formation of recent age also occurs as narrow stretches along major rivers. In alluvium the granular detrital material like sand and gravel usually occurring as thin layer in the district yields water. But due to its limited extent the ground water potential in this formation is negligible.

The soils in this area are mainly medium black and deep black, High level red to reddish brown laterite soil , light brown to dark brown forest soils.

The hill tops and slopes are covered with forest trees, and grasses. Small strips of land on hill slopes are used for cultivation, where hill millets like nagli wari, are grown. On some lands, paddy is grown. The soils are inferior and have poor fertility. Western and central portion of Maval tahsils is extremely rugged. The soils are red to reddish brown in colour, varying in depth and texture paddy is the main crop valleys and nagli, wari etc. are grown on hill slopes, major portion of area is under forest and pastures.

Ground water in the district occurs under phreatic, semi- confined and confined conditions. Vesicular units of rock when exposed or lying few meter below surface forms a potential source.

Thickness from few meters to 10m. varies, also nature, density of vesicles ,their distribution, interconnection ,weathering are decisive factors for occurrence and movement of water within. In Deccan trap Basalt, the yield of the dug wells in different formations ranges from 30 to 150 lpm/ day depending upon local hydrogeological conditions and the yields of borewells also, that show wide variations.

Variation of yields in a single type of aquifer is due to lateral/spatial variation in permeability of the formation/aquifer material. There are mainly two types of ground water structures in the district i.e. dug wells and borewells. Electrical conductivity (EC) , total alkalinity (TA), Total hardness (TH), Nitrate (NO₃) fluoride (F) are parameters to check quality of water, determined keeping in view its effect on biological system of human being.

Dug wells are most feasible in entire basaltic deccan trap. Borewells tap deeper fractures and need proper scientific investigation. In this basaltic area , artificial recharge structures are check dams, gully plugs, percolation tanks, nalla bunds, contour bunds, ponds etc. Existing dug wells can be used for artificial recharge, and thus water should be properly filtered to recharge these. Percolation tanks are also suitable. Artificial recharge structures work where sufficient thickness of saturated / unsaturated aquifer exists, and water levels are more than 5m deep.

Future development should be taken up with planning and care. Mass awareness programmes involving local public should be organised.

Due to high nitrate content in water and its continuous intake, infant “Methemoglobinemia” occurs also called Blue Baby Syndrome.

Wells should be analysed, and water should be used for drinking if suitable. Sanitary protection including leakage from sewers is important.

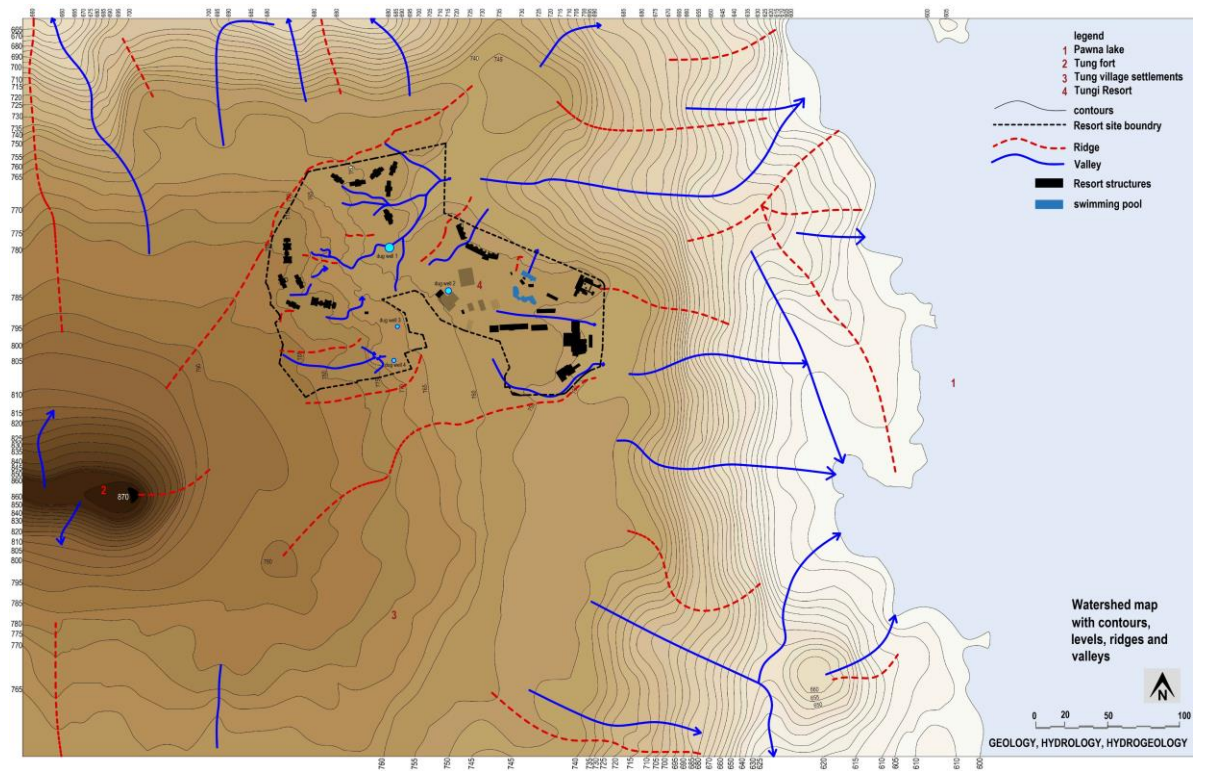
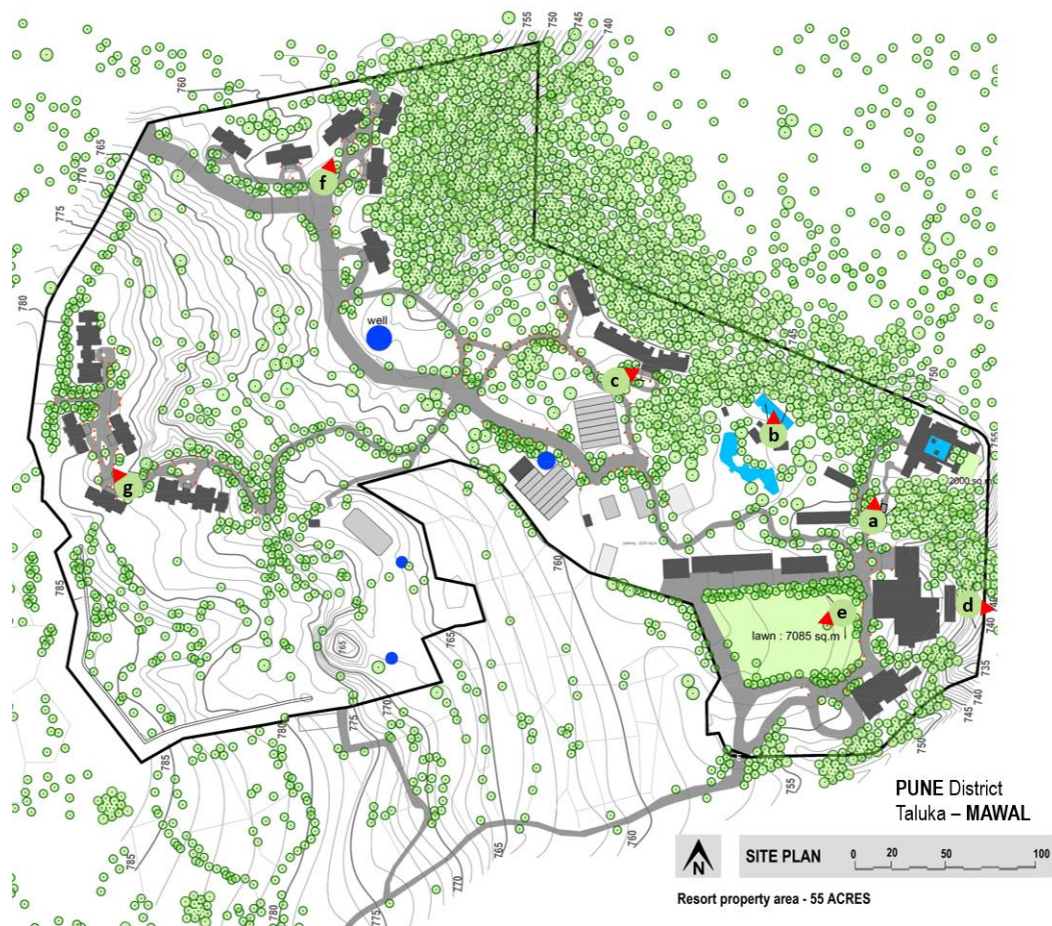


Figure 3.4.3b: Hydrology of Tung region

Source: Author

3.4.4 Site plan



Legend

E - Entrance to site

- | | |
|--------------------|---|
| Common Guest areas | 1) Reception and Lounge |
| | 2) F & B - Food and Beverages |
| | 3) Spa |
| | 4) Happy Hub - 4a - north wing, 4b - south wing |
| Guest Stay units | 5) Hotel 1 - cb sunbird |
| | 6) Hotel 2 - oriental turtle dove |
| | 7) Studio apartments - cluster A -
A1- lager falcon (2bhk), A2 - kestrel (2bhk),
A3- oh buzzard,(2bhk)A4 - black Kite(2bhk),
A5- besra sparrow hawk(2bhk) |
| | 8) Studio apartments - cluster B
B1- Red Wattled lapwing (1bhk Hotel Suite),
B2 - Cattle Egret(1bhk), B3 - golden plover (2bhk),
B4 - white throated kingfisher(1bhk),
B5 - Ruff and reeve(1bhk), B6 - Indian Heron(2bhk) |
| | 9) Administration building |
| | 10) Utility building |
| | Staff buildings |

- P - Pool area
Ps - Pool area snacks counter
P1 - Ladies changing room,
P2 - Gents changing room
S - Solar panels
R - Shed
R1 - DG Shed
N - Nursery
C - Children's play area
B - Basket ball court
● - well
- lights

Figure 3.4.4a: Site plan of Tungi Resort

Source: Author

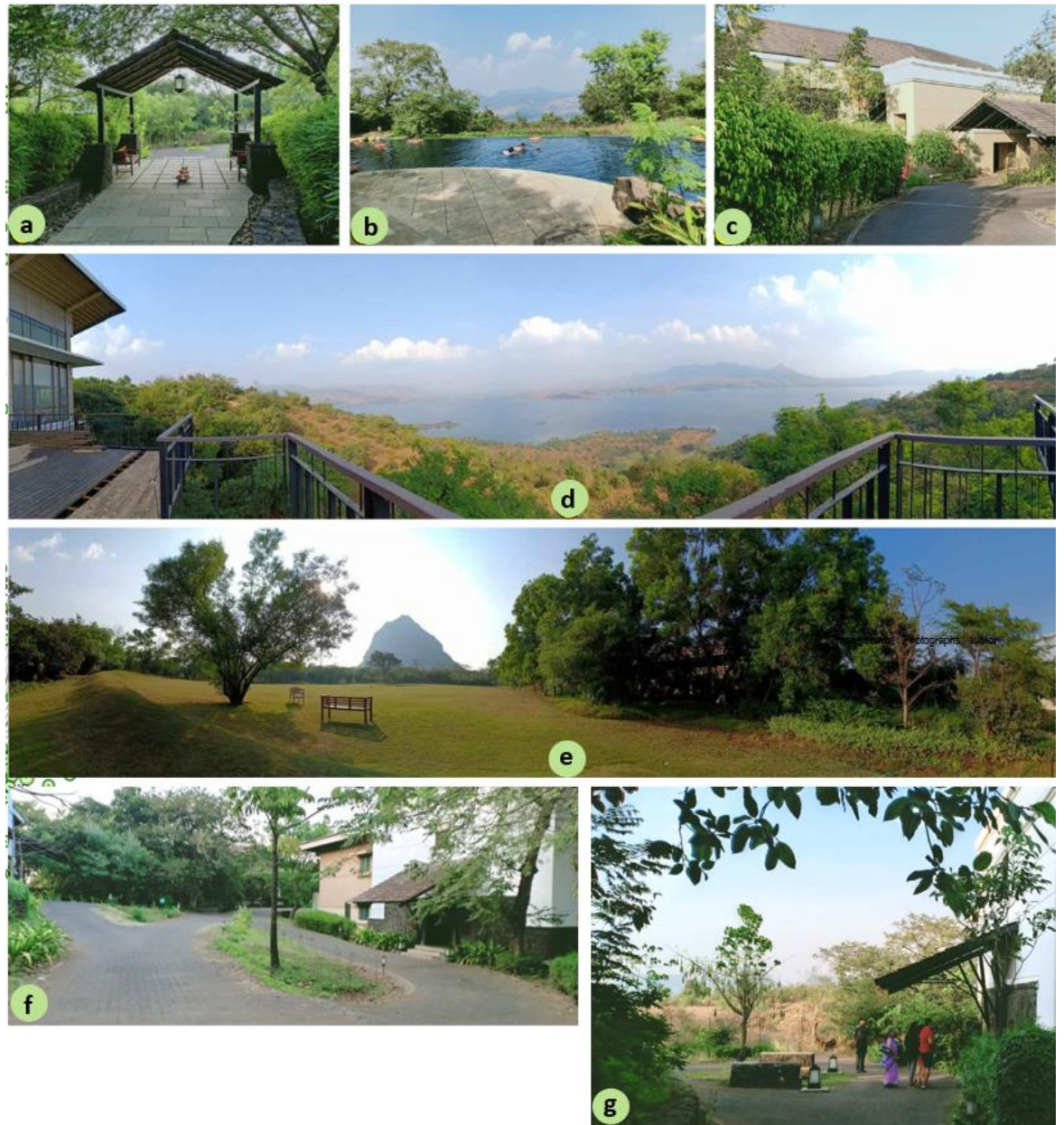


Image source : Photographs : Author

Figure 3.4.4b: Site photographs

Source: Author

- a) Way to SPA
- b) Swimming pool
- c) Hotel building porch
- d) View towards pawna lake
- e) Lawn area 7085 sq.m.
- f) Cluster A
- g) Cluster B

3.4.5 Site Sections

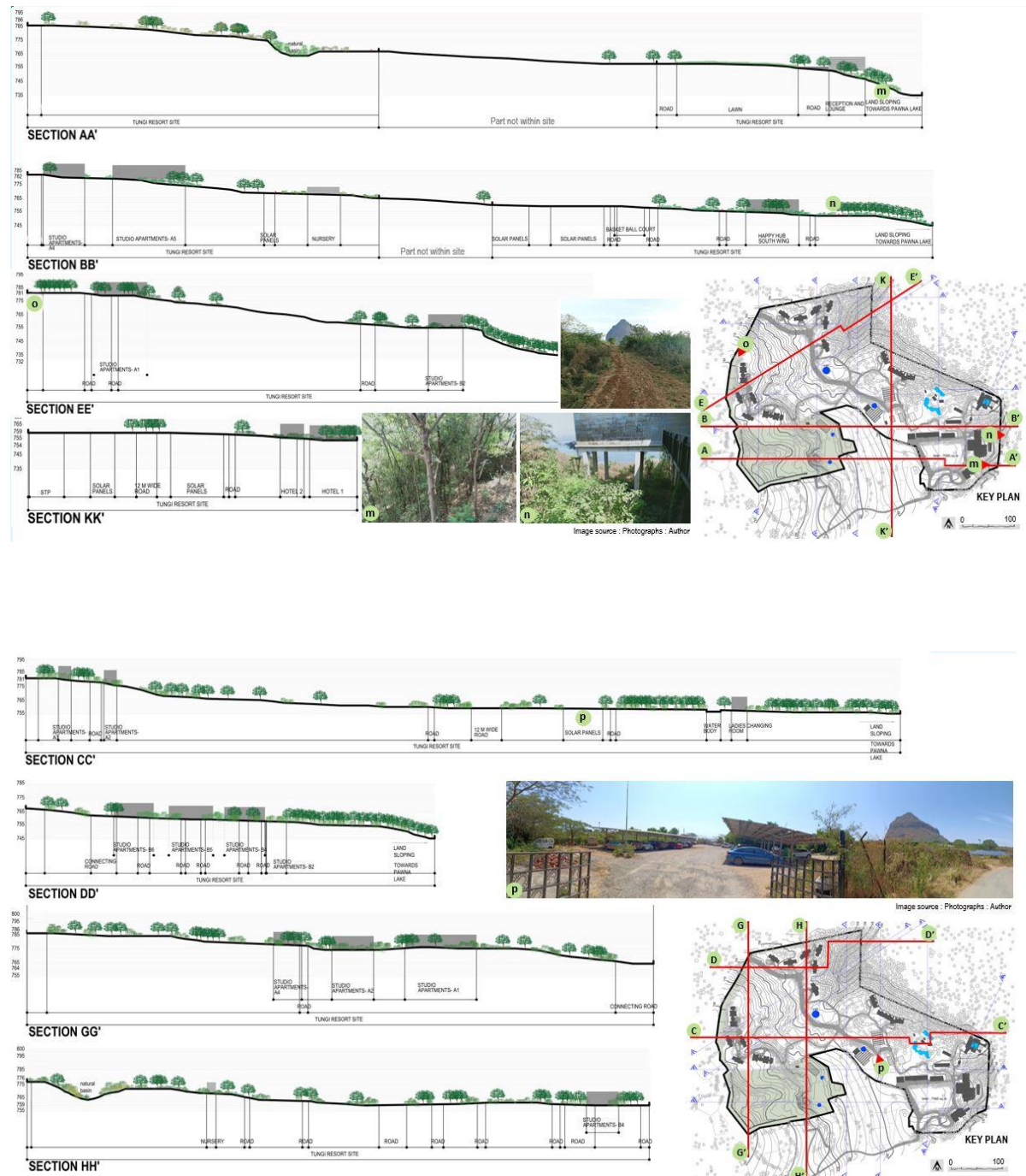


Fig : 3.4.5a : Site sections

Source: Author

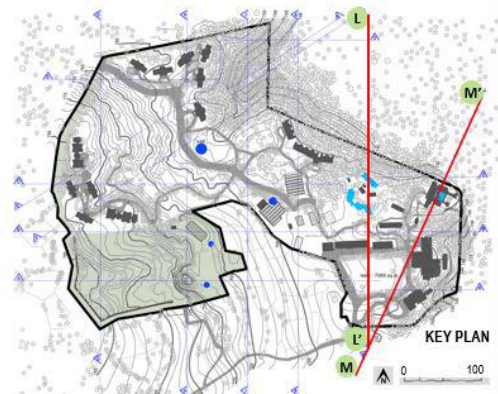
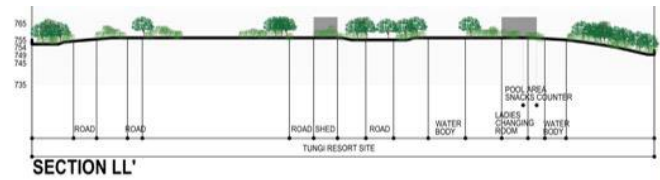
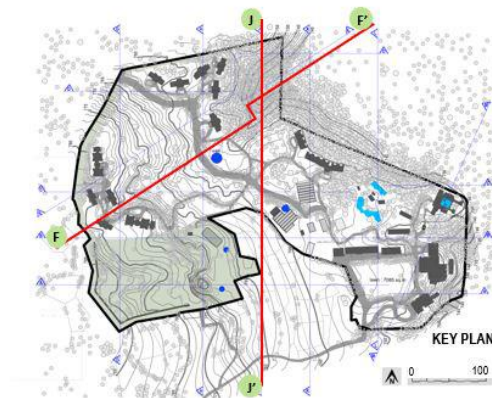
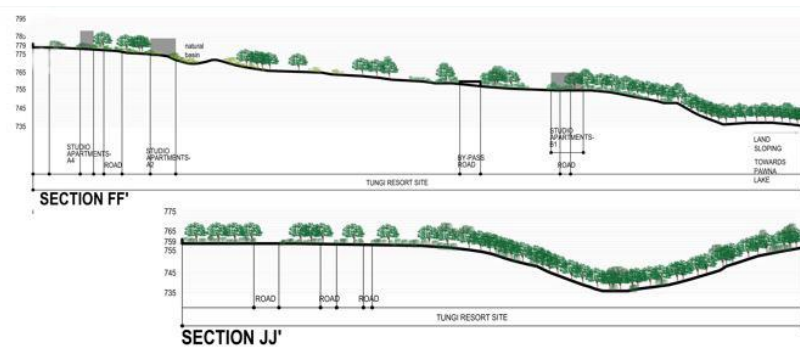


Fig : 3.4.5 b : Site sections

Source: Author

3.4.6 Site hydrology

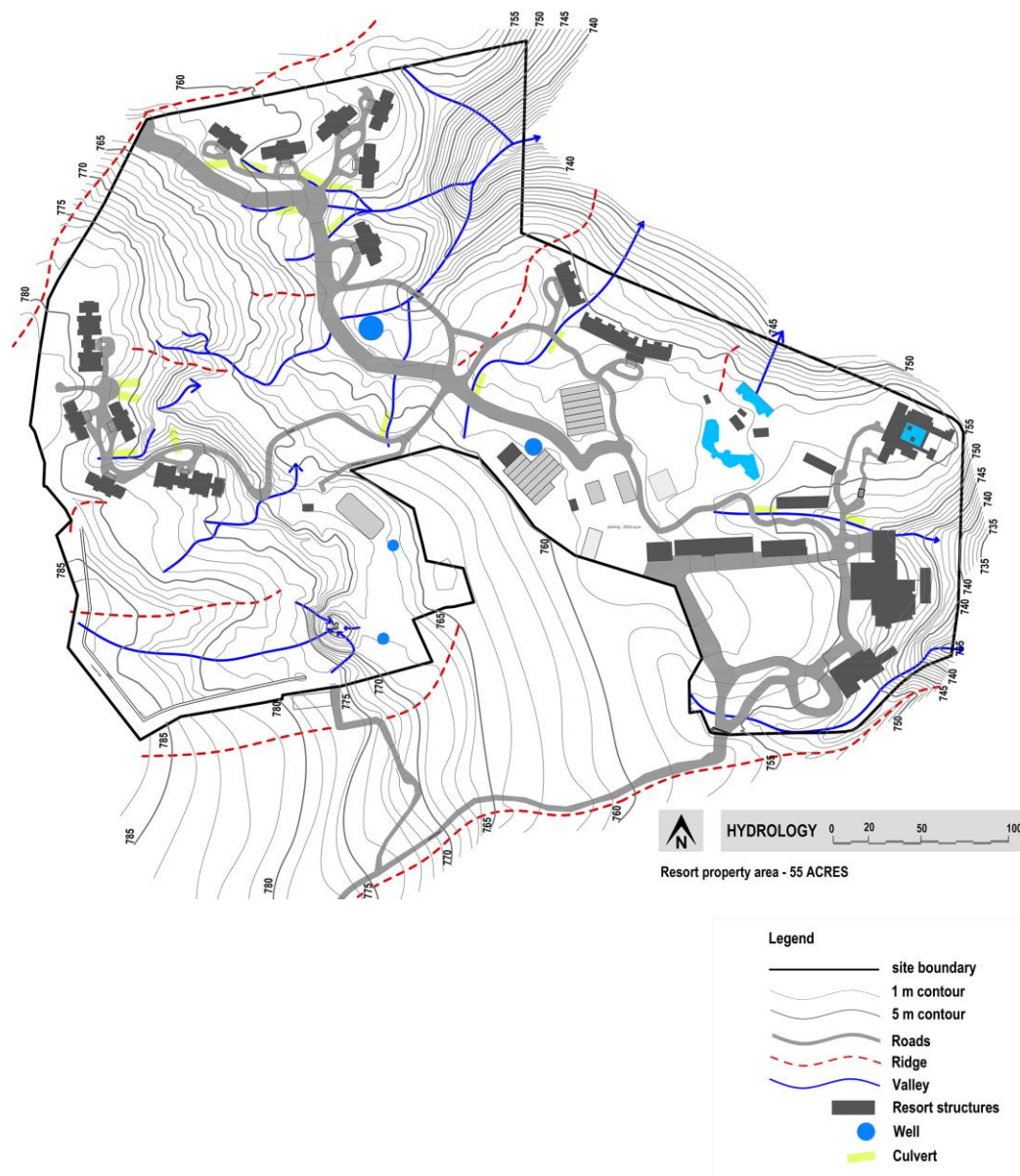


Figure 3.4.6a: Tungi site Hydrology

Source: Author

Inference : There is very high run-off during rains in various directions , and water should be channelised for rain water harvesting.

3.4.7 Slope Analysis

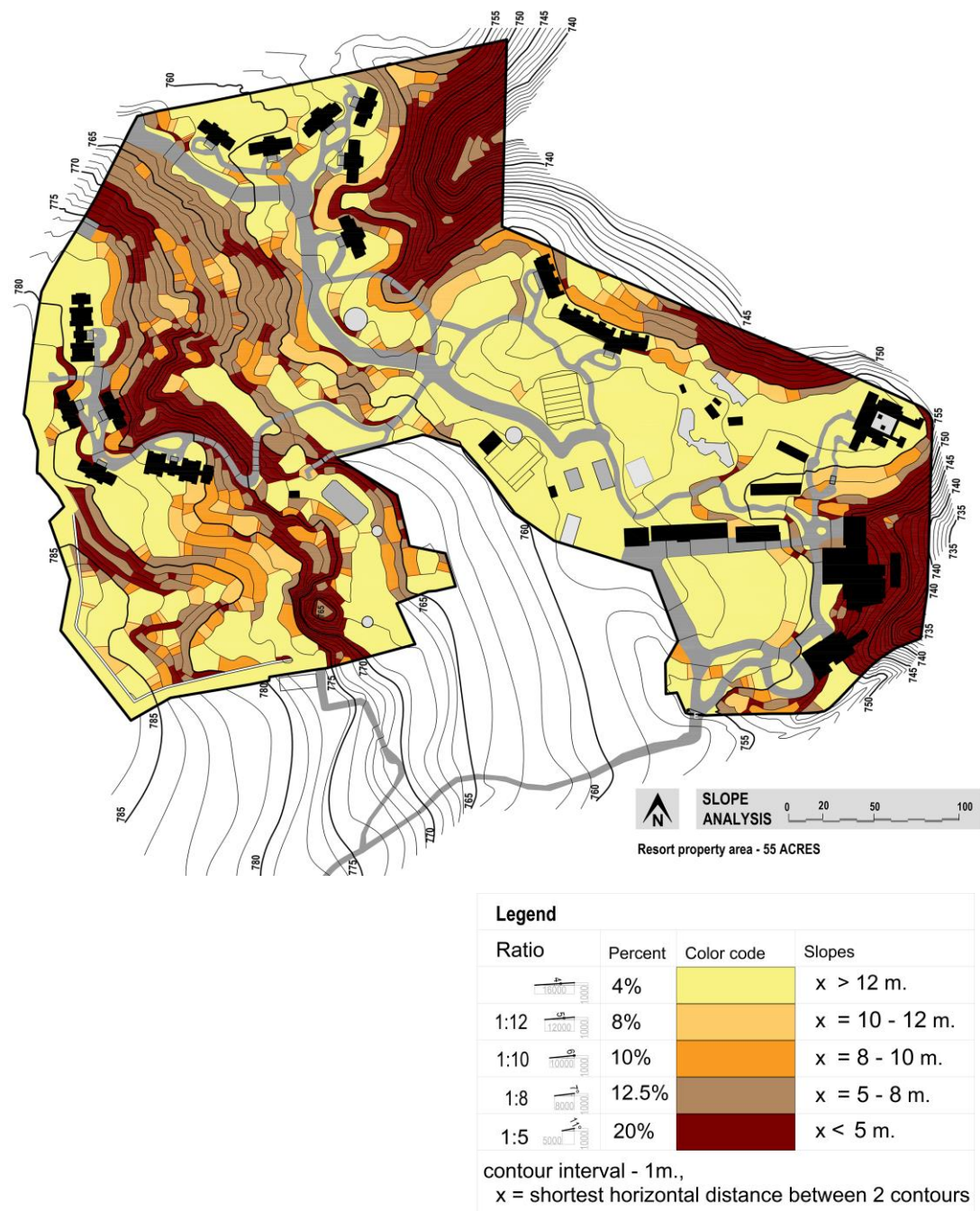


Figure 3.4.7a: Tungi site Slope analysis

Source: Author

Inference: Control intense soil erosion in areas with slopes steeper than 1:10, especially in the areas that are not covered with vegetation.

3.4.8 Flora

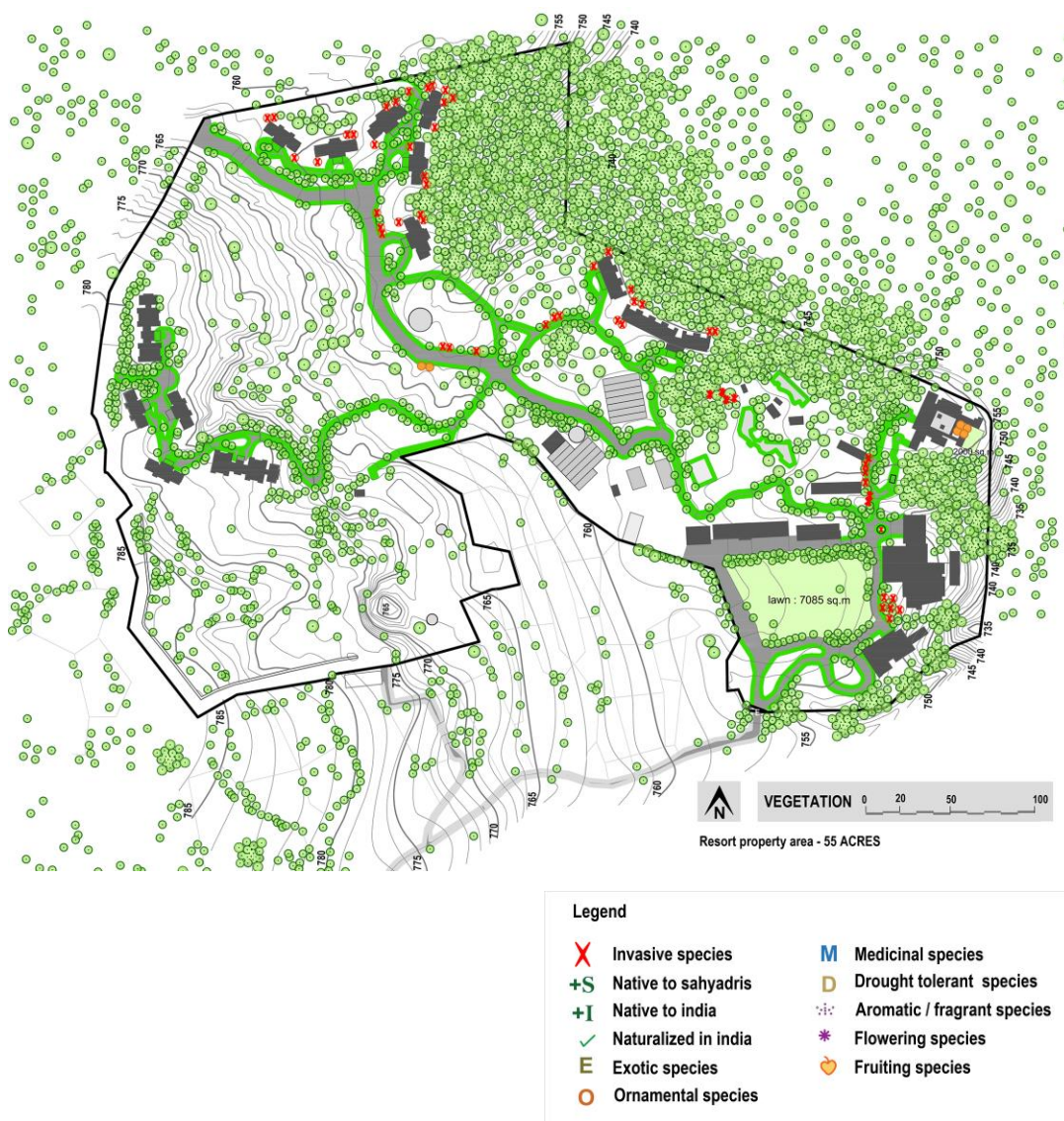


Figure 3.4.8a: Tungi site Vegetation

Source: Author

Inference : With added efforts for plantation in Resort, more of exotic species, and invasive varieties are rapidly grown on site with sole purpose of beautification. Native plantation is needed on site for self-regulating, sustainable landscapes as well as to maintain natural landscape character of the region.

EXISTING PLANT MATERIAL IN RESORT					
TREES / UPPER STOREY			MIDDLE AND LOWER STOREY		
Common name	Botanical name	Type	Common name	Botanical name	Type
① Australian Babul	<i>Acacia auriculiformis</i>	X D	Wild sage	<i>Lantana camara</i>	X
Gulmohar	<i>Delonix regia</i>	x O E ✓ D	Yellow oleander	<i>Thevetia Peruviana</i>	E O *
Nirgudi	<i>Vitex nigundo</i>	+S M D	Lajalu	<i>Mimosa Pudica</i>	✓ O M
Pichkari	<i>Spathodea campanulata</i>	O E ✓ D	Jaswand	<i>Hibiscus rosa-sinensis</i>	+I O M *
Copper pod	<i>Peltophorum Pterocarpum</i>	O E ✓ D	Shatavari	<i>Asparagus Racemosus</i>	+S O M
Rain tree	<i>Samanea Saman</i>	+S * D	green pampas	<i>Cortaderia Selloana</i>	E O
Saptaparni	<i>Alstonia scholaris</i>	+I * D	purple pampas	<i>Cortaderia Selloana</i>	E O
Silk cotton tree	<i>Bombax ceiba</i>	+S * D	Rhoeo	<i>Tradescantia spathacea</i>	E O
Kadu mehendi	<i>Clerodendrum inerme</i>	+S M D	Philodendron	<i>Philodendron selloum</i>	E O
Karanj	<i>Pongamia pinnata</i>	+S D	Mondo grass	<i>Ophiopogon japonicus</i>	E O
Mango	<i>Mangifera indica</i>	+S	Wedelia	<i>Wedelia trilobata</i>	E O
Pangara	<i>Erythrina variegata</i>	+S D	Bear grass	<i>Yucca glauca</i>	E O
Bhend	<i>Thespetia populnea</i>	+S * D	Golden duranta	<i>Duranta erecta</i>	E O
● Madagascari almond	<i>Terminalia Mantaly</i>	E	Agave	<i>Agave americana</i>	E O D
Karwanda	<i>Carissa carandas</i>	+S	Railway creeper	<i>Ipomoea cairica</i>	✓ O *
Sonchafa	<i>Magnolia champaca</i>	+I O * :i:	Spider lily	<i>Crinum asiaticum</i>	X E O
Peepal	<i>Ficus religiosa</i>	+I E	Lemon grass	<i>Cymbopogon citratus</i>	+S
Champa	<i>Plumeria alba</i>	+I O * :i:	Buddha belly	<i>Bambusa ventricosa</i>	E O
Avla	<i>Phyllanthus emblica</i>	+S	yellow bamboo	<i>Bambusa vulgaris</i>	E O
Palas	<i>Butea monosperma</i>	+S *	Sontakka	<i>Hedychium coronarium</i>	+I O * :i:
Bakul	<i>Mimosops elengi</i>	+S * :i:	Peacock flower	<i>Caesalpinia pulcherrima</i>	X *
Umber	<i>Ficus Racemosa</i>	+S	Fern	<i>Nephrolepis exaltata</i>	+S
Chinch	<i>Tamarindus indica</i>	+I E	Golden Fern	<i>Acrostichum aureum</i>	+S
Ritha	<i>Sapindus laurifolius</i>	+S	Korean grass	<i>Zoysia japonica</i>	E O
Kinjale	<i>Terminalia Paniculata</i>	+S D	Dallas grass	<i>Paspalum dilatatum</i>	E O
Kadamba	<i>Neolamarkia cadamba</i>	+S D	Pendilanthus	<i>Euphorbia tithymaloides</i>	E O
			Heliconia	<i>Heliconia rostrata</i>	E O
			Croton	<i>Croton petron</i>	E O
			Brazilian Joyweed	<i>Red alternanthera</i>	E O
			Palms	<i>Arecaceae</i>	E O

Table 3.4.7c: List of existing flora on Tungi site

Source: Author

3.4.9 Fauna

In and around the site, we see fauna like birds, bees, butterflies, variety of insects, barking deer, other wild deers, wild boar, earthworms, frogs, crabs, snakes, scorpions.

3.4.10 History, community and culture

Tung fort was built before 1600 CE by the Adil Shahi dynasty but was captured by Chhatrapati Shivaji Maharaj on 4th sept 1656. This fort served as a watchtower in the past to see Maval region of the Pawna and Mulshi valleys Marathas lost it again on 18th June 1665. In 1670 -71, was again won over by Marathas, till 13 May, 1704, won over by Aurangzeb. In 1749, it was again won over by Marathas. After 1818, it was with British, and was with bhor sansthan, after British rule ended.

The fort is conical and consists of strongly fortified walls, ramparts and also has several bastions. It has steep climbs with a very narrow route on the edge of the mountain throughout. A steep climb on grassy slopes leads to the ruins of a temple at the summit.



Figure : 3.4.10 a : Tung fort

Source : photographs - Author

Tikona is the hill fort in Maval in Western India. Generally, the forts in this area are Buddhist and Hinayana practices, so these forts should be built between 800 and 1000 AD. About 1585 C.E. Sardar Malik Ahmed Nizam Shah won this fort and joined the Nizamshahi fort. In 1657, Shivaji Maharaj brought the whole of Konkan, which had been Nizam territory, under his control when he conquered Tikona. On entering inside the door, there are water cisterns on the right and a fortified bastion on the left. There is a big water tank behind the Lord Mahadev temple.

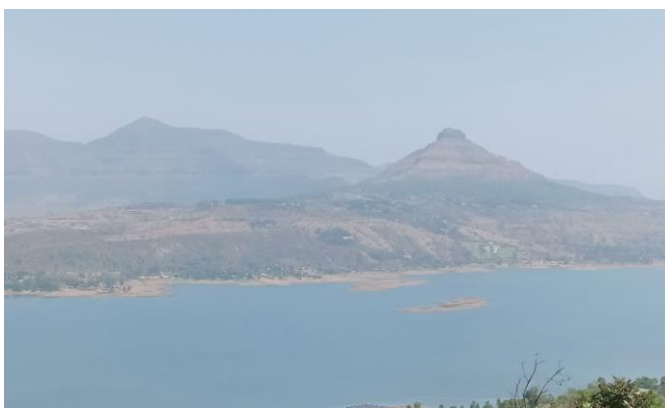


Figure : 3.4.10 b : Tikona fort

Source : photographs - Author



Fig : 3.4.10 c : Tung village
Source : photographs - Author

Tung Village in Maval taluka, is located around 300 m from the entrance of the fort and Tungi resort site. This village is about 30 kms from Lonawala station.

Tung village is about 1930 acres in size. Population is about 958 and 151 families.(2011 census). This community is traditionally into farming. They grow rice in their farmlands, and in areas with minimal soil cover, they grow nachni, as main crops besides vegetables and fruits for their daily needs. Few from village work in hotels and restaurants in lonawala. Village has Panchayat and school. Houses in village are of mud, thatched roofs, some structures are of bricks and cement, and mangalore tiles.

3.4.11 Mapping of activities and concerns

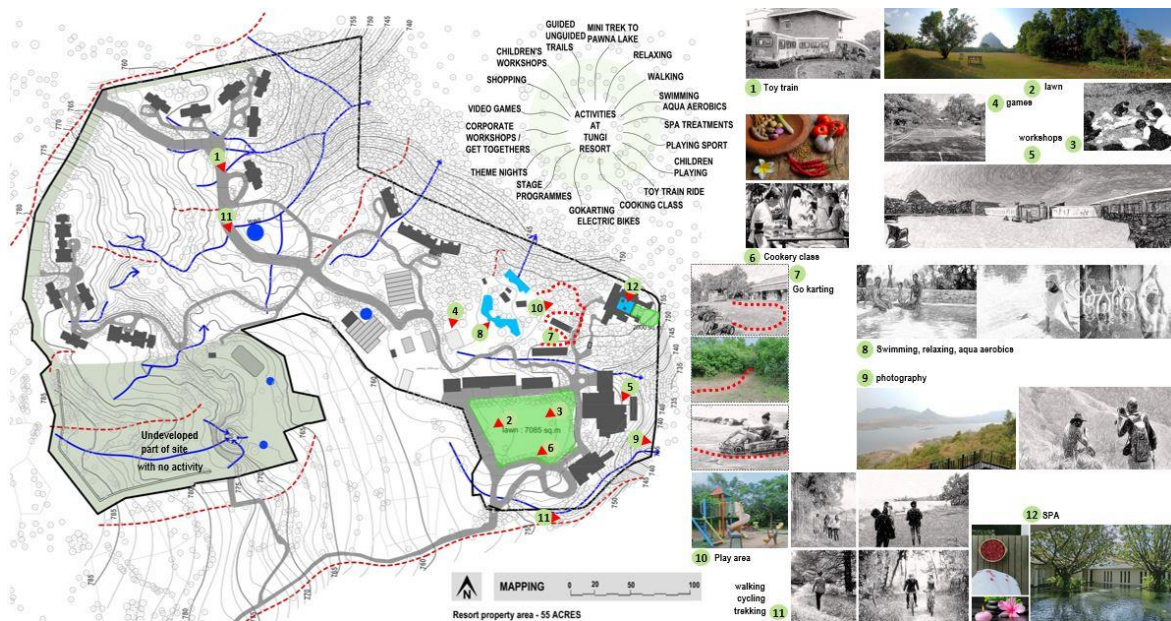


Figure 3.4.11a: Mapping of activities

Source: Author

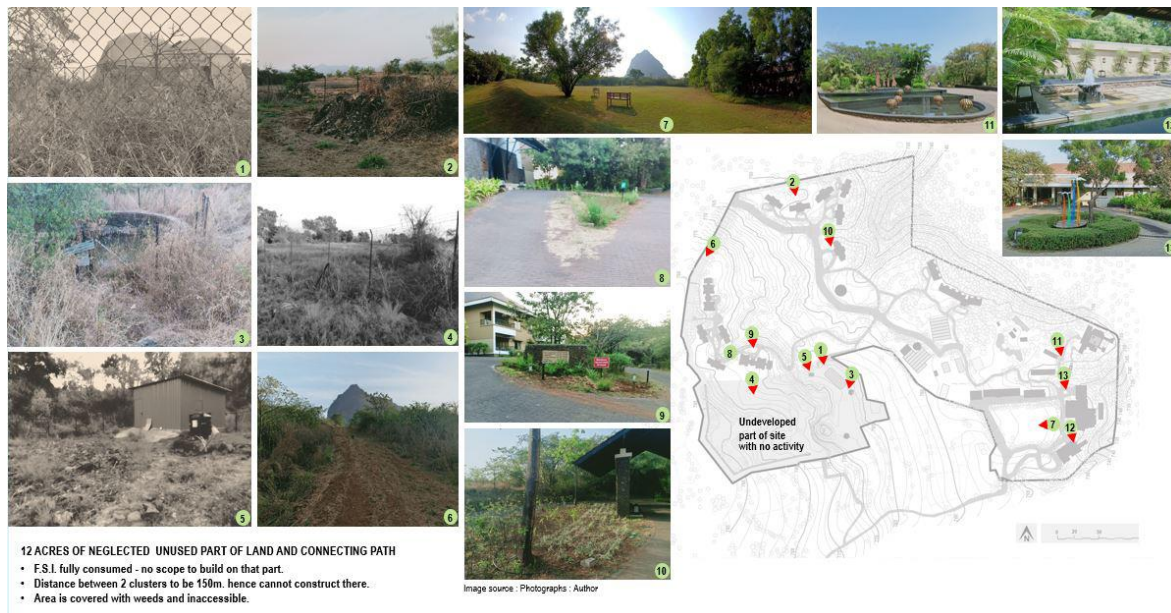


Figure 3.4.11b: Mapping of concerns

Source: Author

Inference : 1] Neglected part of land needs restoration, and 2] when high maintenance of manicured landscape stops, landscapes degrade as it is not a self-regulating system like natural landscapes, and also highly manicured landscapes change the original landscape character of a region, hence reinforce natural landscapes in such Resorts is a better design solution.

3.4.12 Study Models

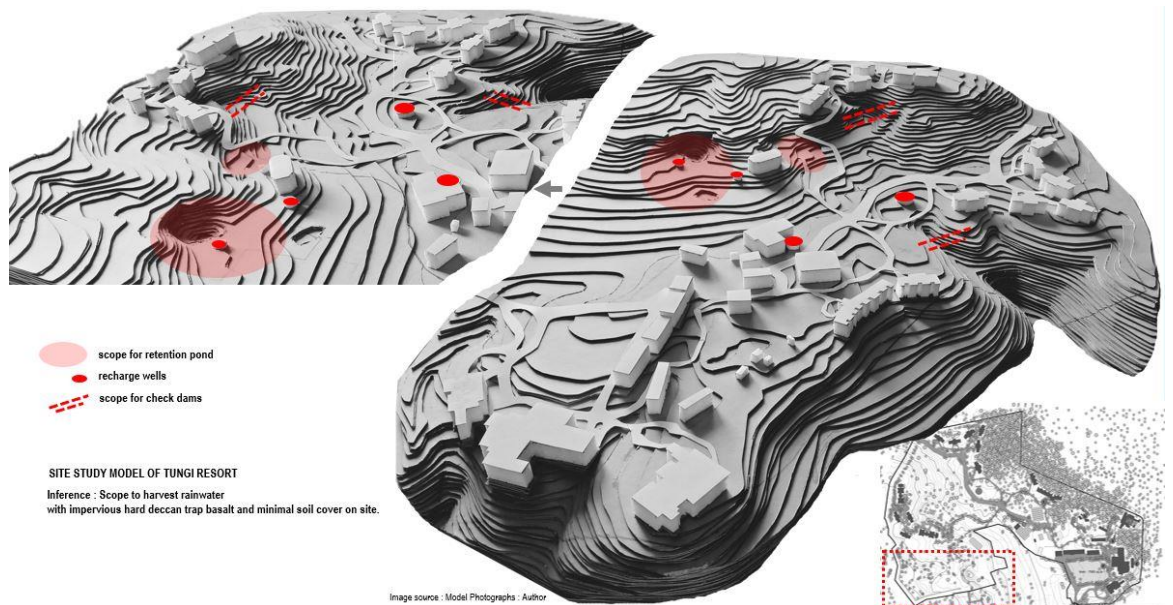


Figure 3.4.12a: Study model

Source: Author

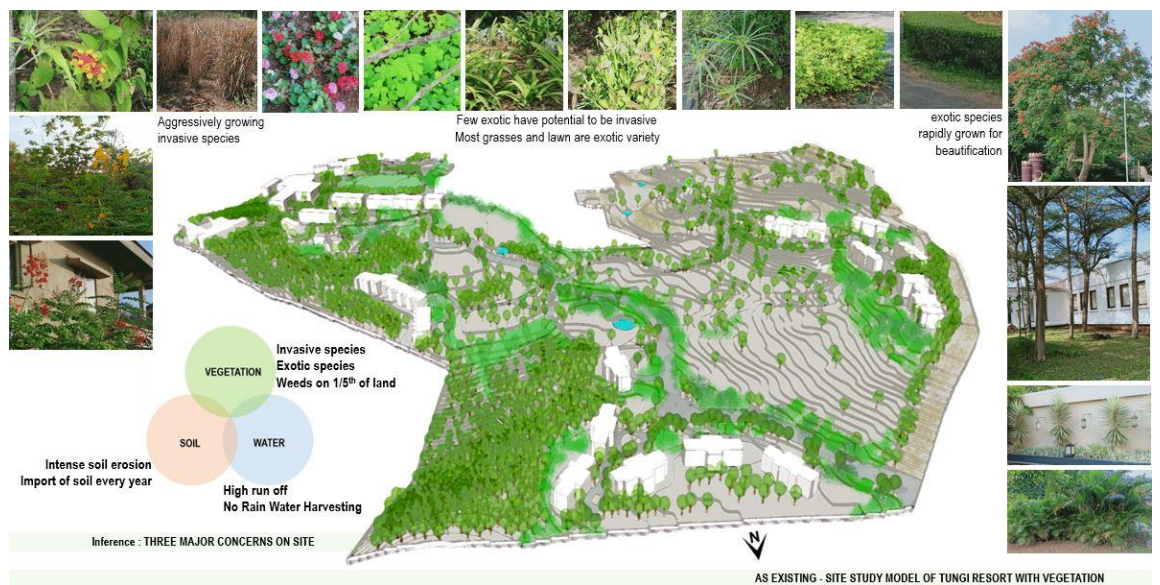


Figure 3.4.12b: Study model with vegetation

Source: Author

3.4.13 SWOT Analysis

STRENGTHS POPULAR BRAND IN RESORT AND HOSPITALITY STRATEGIC LOCATION SPECTACULAR VIEWS DEVELOPED INFRASTRUCTURE PROVIDES ENVIRONMENT FOR RELAXATION PROVIDES ACTIVITIES FOR RECREATION	WEAKNESSES INADEQUATE OVERALL MEASURES FOR CONSERVATION NEGLECTED UNDEVELOPED PART OF LAND INTENSE SOIL EROSION NO RAIN WATER HARVESTING ON SITE NO MANAGEMENT FOR SOLID WASTE NO EFFORTS FOR CONSERVATION OF FLORA AND FAUNA PLANTATION FROM BEAUTIFICATION POINT OF VIEW
OPPORTUNITIES UNDEVELOPED PART OF LAND AVAILABLE FOR DEVELOPMENT MORE AND BETTER GUEST ACTIVITIES IN NATURE NATURE THEME PARK TO PLAN GUEST ACTIVITIES USE HUMAN RESOURCES FROM VILLAGES NEAR BY DESIGN IN SYNC WITH NATURE + ECOLOGICAL CONSERVATION	THREATS MAJOR THREATS FROM INVASIVE SPECIES ADDED GENERATION AND ACCUMULATION OF WASTE DEPLETION OF AVAILABLE RESOURCES NO OR LESS PLANTATION OF NATIVE SPECIES MORE AND MORE ADDITION OF EXOTIC SPECIES CHANGING LANDSCAPE CHARACTER

Table 3.4.13a: SWOT Analysis

Source: Author

3.5 Evaluation of Tungi Resort using developed Eco-Rating system.

With study of rating systems, guidelines, articles on these Resorts, related readings, interviews with guests and visitors of all the selected case studies of Resorts, author chose to evaluate Tungi Resort Lonavala, as it seemed to be falling short in terms of Ecological conservation. Tungi Resort was studied in detail, and was evaluated using author's developed Eco-Rating system as a tool.

We see in table below that reflects its shortcomings. This evaluation further helped author to develop a design programme for Tungi site with needed interventions for Ecological conservation, enhancement and Eco-design for Resort.

	Name	Tungi Resort, Lonavala
	State	Maharashtra
	Region	Western Ghats
	Area	55 acres
	Average Level	775 m.
	Eligibility	Y type resort

	FRAMEWORK OF ECOLOGICAL CONSERVATION MEASURES	X type Resorts	Y type Resorts	TUNGI RATING
			valid till 31.3.2025	
A	PREDESIGN STAGE MEASURES			
A1	Appointment of collaborative professional team of respective field experts [M]	2	*	*
A2	Detail study of all site features and ecological layers [M]	2	*	*
B	DESIGN STAGE MEASURES			
B1	Holistic Plan and design for preservation of natural features on site :	4	*	*
C	CONSTRUCTION STAGE MEASURES			
C1	Preconstruction measures:			
C1.1	Preservation of existing trees, native or medicinal trees and plants. [M]	2	*	*
C1.2	Biofencing the property	1	*	*
C1.3	Site to build toilets for labourers and compost pits before Resort construction starts.[M]	1	*	*

	FRAMEWORK OF ECOLOGICAL CONSERVATION MEASURES	X type Resorts	Y type Resorts	TUNGI RATING
C2	During construction measures			
C2.1	Retaining natural features of site during construction [M]	2	*	*
C2.2	Preservation of top soil [M]	2	*	*
C2.3	Lighting on construction site to be solar lighting.[M]	1	*	*
C2.4	Regular PUC check for vehicles and machinery during construction.[M]	1	*	*
C3	Post construction measures			
C3.1	Construction waste to be given to the recyclers [M]	1	*	*
C3.2	Use of eco-friendly materials and products for construction	1	*	*
R	COMPENSATORY CLAUSE - 20 Points for 'Y' type Resorts.			
R1	Research and Educational programmes	*	20	0
D	SOIL CONSERVATION			
D1	Increasing tree cover by tree plantation on site for soil conservation.	2	2	0
D2	Use Bunds or vegetation to control soil erosion.	2	2	0
D3	Use Organic fertilizers only [M]	1	1	1
D4	Use Organic pesticides only [M]	1	1	1
E	RAIN WATER HARVESTING			
E1	Rain water harvesting system on site.	6	6	0
E2	permeable/ impermeable paving - 25% max.	1	1	1
F	GREY WATER TREATMENT			
F1	100% Grey water treatment	4	4	4
G	BLACK WATER TREATMENT			
G1	100% Black water treatment	4	4	4
H	SOLID WASTE MANAGEMENT			
H1	Plastic free zone, with supporting measures [M]	2	2	2
H2	Waste segregation on site [M]	1	1	0
H3	Vermiculture, composting pits, biogas plant to manage waste	2	2	0
J	CONSERVATION OF FLORA AND FAUNA			
J1	Detail Documentation and efforts to conserve Flora and fauna in and around site.	6	6	0

	FRAMEWORK OF ECOLOGICAL CONSERVATION MEASURES	X type Resorts	Y type Resorts	TUNGI RATING
J2	Preservation and Plantation of Native species [M]	4	4	0
J3	Uprooting invasive species, and prohibition of genetically modified species.[M]	2	2	0
J4	Lawns to be minimal with justification , covered with native grasses.	2	2	0
J5	Creative / Ecological / Nature theme park	5	5	0
K	ENERGY SAVING AND GENERATION			
K1	Generation and use of solar energy.	2	2	2
K2	Eco lighting - use solar lights and LEDs (with automatic light shut off n control)	2	2	2
K3	Use of electric vehicles to travel within site [M]	1	1	1
K4	Meters for consumption of water and electricity.[M]	1	1	1
L	EDUCATION, AND AWARENESS			
L1	Sinage on site to encourage guests to walk and cycle.[M]	1	1	1
L2	Planned activities in nature for education and awareness for guests	2	2	1
L3	Educating and keeping staff aware about ecological conservation practices.[M]	2	2	1
N	COMMUNITY AND CULTURE			
N1	Ecological initiatives by Resort owners beyond the site boundaries	10	10	0
N2	Promoting economy of local communities.	2	2	1
N3	Preserving culture of local communities.	2	2	1
P	EXCELLENCE OR INNOVATION			
P1	Excellence or innovation in design and technology	10	10	0
	Total scores	100	100	24
	* not applicable here, [M]-mandatory			Tungi Resort, Lonavala
				NEEDS ENHANCEMENT

	ECO - RATING SYSTEM	
	CORE POINTS - 40	
	3. ECO GROVE-AVERAGE [41-60 points]	
	2. ECO WOODS -GOOD [61-80 points]	
	1. ECO FOREST - BEST [81-100 points]	

Table 3.5a: Evaluation of Tungi Resort

Source: Author

Tungi Resort doesnot fulfil requirements of core points - 40, and thus needs corrective measures and a design proposal for ERCA certification.

3.6 Summary of inference



Figure 3.6a: Google timeline showing Tungi resort

Source: Google earth

Major concerns on site are : Design and Management of soil, water and vegetation which are very crucial elements to reinforce natural landscapes.

On the decade old Tungi Resort site, certain sustainable measures are an after thought and instead of just beautification, site needs a new vision towards better landscape performance, and self-regulating natural systems that renew its own natural resources, with a holistic approach.

Summary of Inference :

Barren to Green has been the change with a lot of human effort at Resort, yet better landscape design is needed because :

1. Better design solutions in relation to soil, water, and vegetation can save **human efforts and maintenance costs** at Resort.
2. Resort to follow the framework of eco-rating system, for a **holistic approach conducive to change in natural processes** on site.
3. Approach needs to be more natural and sustainable, **to regenerate ecosystems for self-regulation and systemic changes** on site.

DESIGN FOR THE FUTURE - NOT A FUTURE THAT IS EXTRAPOLATED
FROM THE PAST WITH HIGH CONSUMPTION AND WASTE BUT A
FUTURE THAT IS SUFFICIENT, REGENERATIVE, AND EFFICIENT.
- SHIFT STUDIO– AR SANJAY PRAKASH

4 Design intent, & Design programme.

4.1 Design intent

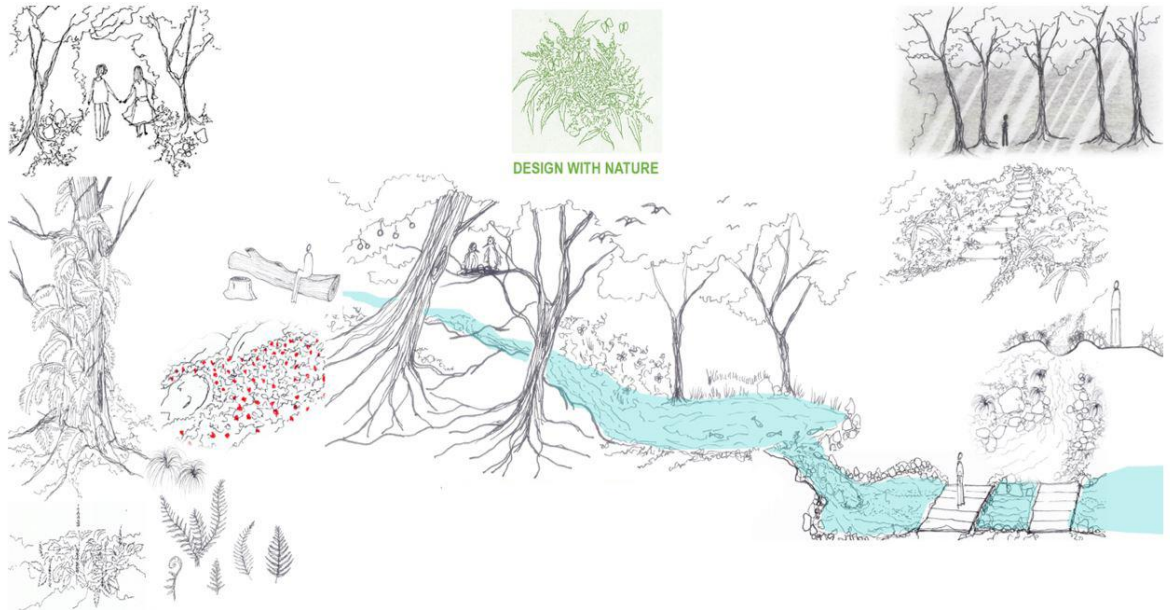


Figure 4.1a: Design intent sketches

Source: Author

The Design Intent is along underpinning idea of

‘Reinforce Natural landscapes

To Reactivate Natural Systems’

Where reinforce means to strengthen the very idea, as well as literally protect, restore, improve, and enhance natural landscapes keeping it **natural, free, wilder, untamed.**

In hilly terrain of Lonavala, at 775 m. above sea level, Tungi Resort has a unique and strategic location in natural landscape settings, overlooking Pawna lake on its three sides.

Design intent is to conserve positives of the site, restore, improve and enhance its state of being a ‘Natural’ landscape. A design proposal that respects the naturalness or wilderness of the place which is a unique quality which separates such landscape character from any urban, rural or man made set up. A place where the man-made things are subtle and merge in nature and where nature is dominant over the built. Main intent as mentioned is to reactivate natural systems on site.

Thus, first is to follow a **holistic approach to Ecological conservation**, using the developed Eco-Rating system, its framework and evaluation, for the Resort in the natural landscape settings of the biodiversity hotspot. Also, to enhance the place for visual and physical **connect with nature** in variety of ways for recreational opportunities. To design a **relaxing, rejuvenating, engaging and exciting** place with surprise elements in nature for guests. To design a place that invites guests in nature, allows close interaction with flora and fauna, allows adventure, exploration and play in nature creating **love for Nature** in minds of guests.

4.2 Design Programme

Design programme is Linked to Research, developed Eco Rating system, detail Site Study and evaluation, and is as follows :

The part of table coloured in blue, is to be adopted or followed by Resort owners and management.

The part of table coloured in green, to be planned and designed, including corrective measures, as part of holistic approach to ecological conservation.

	FRAMEWORK OF ECOLOGICAL CONSERVATION MEASURES	Y type Resorts	TUNGI RATING
		valid till 31.3.2025	

R	COMPENSATORY CLAUSE - 20 Points for 'Y' type Resorts.	Total scores	*
R1	Research and Educational programmes	20	0

Resort owners and management shall follow points given in detail framework of ERCA, and use it as an opportunity towards promoting their brand in relation to their new values towards better ecological practices through eco-branding.

H	SOLID WASTE MANAGEMENT		
H2	Waste segregation on site [M]	1	0
H3	Vermiculture, composting pits, biogas plant to manage waste	2	0

Resort owners to implement waste segregation, vermiculture, composting pits, and biogas plant after checking feasibility under guidance of consultants, and regular maintenance of the system as mentioned in detail in framework of ERCA.

L	EDUCATION, AND AWARENESS		
L2	Planned activities in nature for education and awareness for guests	2	1
L3	Educating and keeping staff aware about ecological conservation practices. [M]	2	1

Resort owners to take responsibility to plan activities for education and awareness of guests and Resort staff, on regular basis even after certification, as given in framework.

N	COMMUNITY AND CULTURE		
N1	Ecological initiatives by Resort owners beyond the site boundaries	10	0
N2	Promoting economy of local communities.	2	1
N3	Preserving culture of local communities.	2	1

Resort owners to study and plan for ecological initiatives beyond the site boundaries, to further promote economy and culture of local communities, as explained in framework.

P	EXCELLENCE OR INNOVATION		
P1	Excellence or innovation in design and technology	10	0

This point is to be considered for any planning and design on any part of site, and if it proves to be excellent or innovative, it would gain more scores as per the ERCA system. Vision of Resort owners to excel, in their creation can add to the scores and certification.

J	CONSERVATION OF FLORA AND FAUNA		
J1	Detail Documentation and efforts to conserve Flora and fauna in and around site.	6	0
J2	Preservation and Plantation of Native species [M]	4	0
J3	Uprooting invasive species, and prohibition of genetically modified species. [M]	2	0

Besides mentioned important points, different possibilities and need of planting native trees, middle and lower storey to be explored, after detailed site study, to follow corrective measures and new design proposal.

	FRAMEWORK OF ECOLOGICAL CONSERVATION MEASURES	Y type Resorts	TUNGI RATING
		valid till 31.3.2025	

D	SOIL CONSERVATION		
D1	Increasing tree cover by tree plantation on site for soil conservation.	2	0
D2	Use Bunds or vegetation to control soil erosion.	2	0

Design:- for stone bunds and use plantation as solution to slow down water run-off and control soil erosion.

E	RAIN WATER HARVESTING		
E1	Rain water harvesting system on site.	6	0

Design :- a rainwater harvesting system, retention ponds, swales to channelise water, recharge wells, along with a riparian edge and biodiversity park , as a proposal for multiple solutions to implement ecological conservation holistically .

J	CONSERVATION OF FLORA AND FAUNA		
J4	Lawns to be minimal with justification, covered with native grasses.	2	0
J5	Creative / Ecological / Nature theme park	5	0

Design :- a riparian edge and biodiversity park along with rain water harvesting , which is an ecological yet creative nature theme park, to preserve and plant native species, that attracts fauna to this new native flora, and thus gives opportunities for guest interaction with native flora, fauna and explore nature.

	Total scores	100	24
	* - not applicable here, [M]-mandatory	Out of	Tungi Resort, Lonavala
			NEEDS ENHANCEMENT

On the decade old Tungi Resort site, certain sustainable measures are an after thought and instead of just beautification, site needs a new vision towards better landscape performance, and self-regulating natural systems that renew its own natural resources, with a holistic approach.

5 Design proposal

5.1 Underpinning idea with design programme

The Design proposal, same like the research is underpinning idea of

‘Reinforce Natural landscapes

To Reactivate Natural Systems’

Where reinforce means to strengthen the very idea, as well as literally protect, restore, improve, and enhance natural landscapes keeping it natural ..free ..wilder ..untamed.



Figure 5.1a: Visual character of design proposal.
Source: Author

Thus,

Design programme can be summarised merging with the underpinning idea as follows :

- ‘Reinforce natural landscapes to Reactivate natural systems’ with soil, water, and vegetation, as major areas of intervention.
- Visually to be natural ..free ..wilder ..untamed and Functionally protect, conserve , restore , revive natural landscapes, and Create forest / biodiversity park , with recreational benefits.

More specifically,

- Controlling Soil Erosion - Stone bunds to channelise water towards natural collection points on site, wells, slow down runoff, and use vegetation to control intense soil erosion.
- Rain Water Harvesting - optimize natural land form , collect water in ponds and wells for daily use and landscape, slow down runoff, recharge ground water.
- Native vegetation - native vegetation that creates suitable environment for habitats and ecosystems at various places on site, along riparian edge and biodiversity park.

5.2 Umbrella concept [covering macro to micro level]

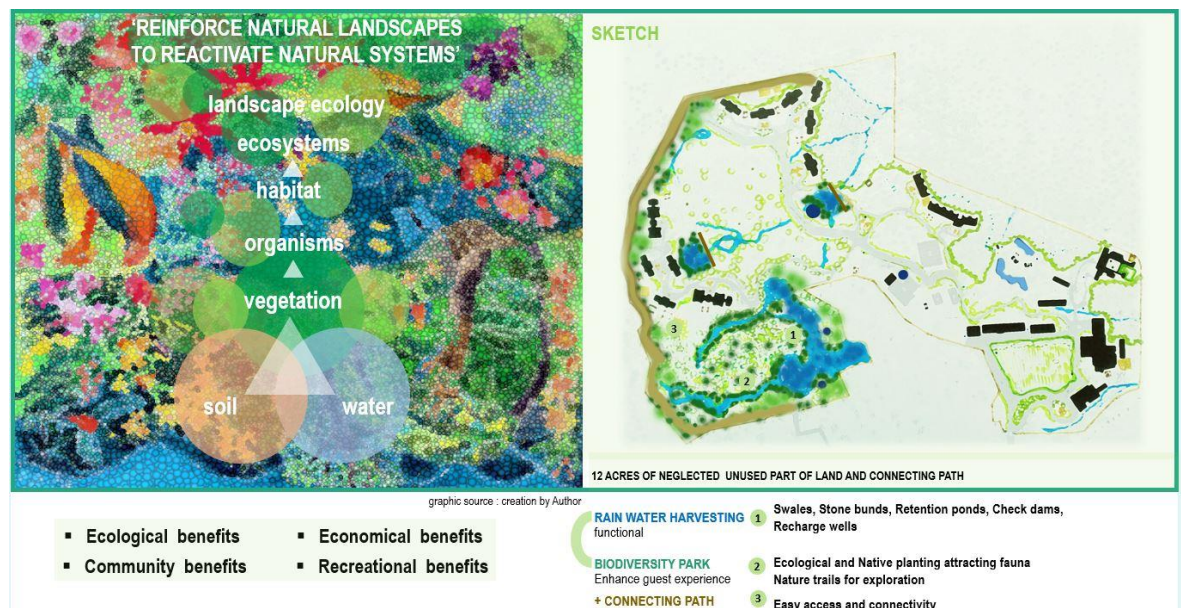


Figure 5.2a: Umbrella Concept and sketch
Source: Author

Umbrella concept is 'Reinforce natural landscapes to Reactivate natural systems' that governs design proposal and new master plan. Figure 5.1.2a: graphically shows importance and interdependence of elements of soil, water and vegetation , which is responsible for growth of organisms by creating habitats towards better ecosystems, landscape ecology and improved landscape performance on site, by improvement in natural processes and self regulating systems on site.

Besides the points mentioned in design programme , part of design proposal is to develop the undeveloped, 12 acres of neglected piece of land and use it for Rain water harvesting on site which is a functional aspect. Along with function, thought is to merge these water bodies with a riparian edge and Biodiversity park that restores and conserves flora, attracts fauna , and at the same time gives opportunity for the guests to explore nature and enjoy activities in nature like nature trails, bird watch, plant walks, and such other explorations. Proposal includes development of the connecting path as shown in sketch which would be a kuccha road connection between cluster B, A and proposed Biodiversity park.

Overall the design proposal is largely to reinforce and reactivate natural landscapes which would form its visual character of natural, free, wilder and untamed nature for ecological benefits as well as recreational benefits like inviting experience, fun, adventure activities, Vantage points, visual connect with nature, relaxing, rejuvenating, engaging, surprise elements in nature for guests.

5.3 Soil management, and Rain water harvesting

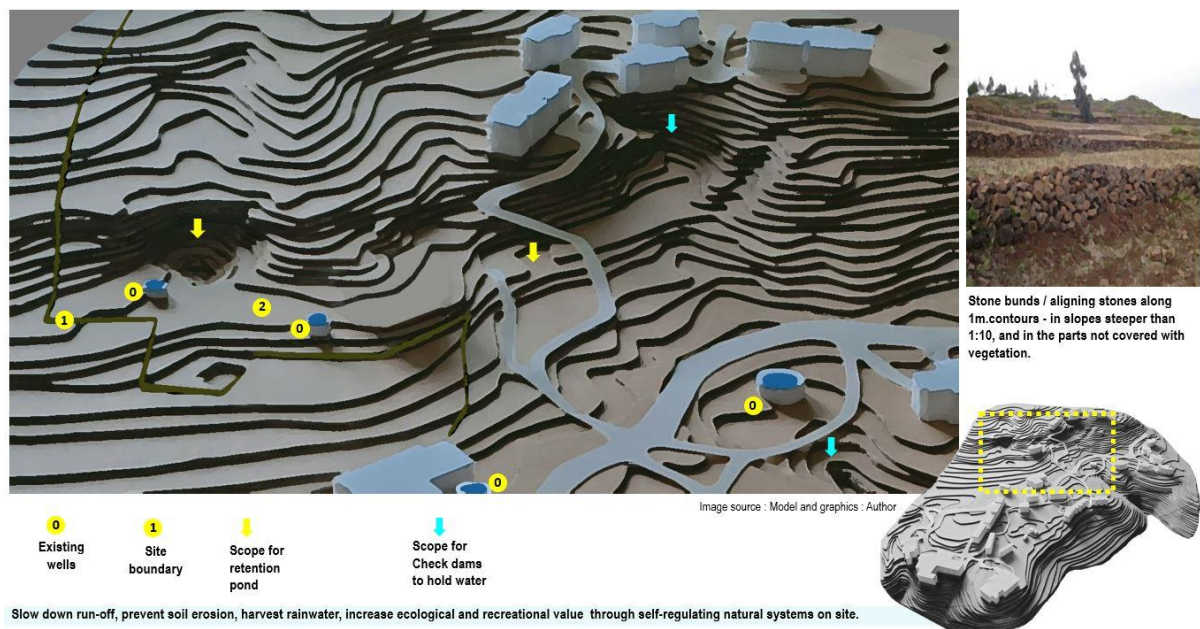


Figure 5.3a: Soil management
Source: Author

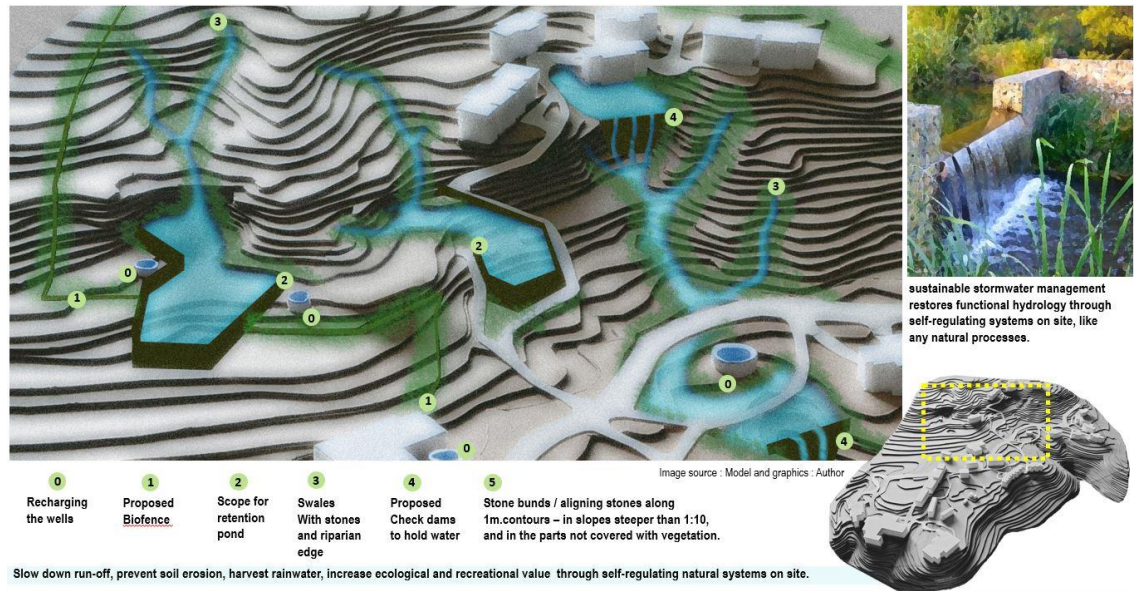


Figure 5.3b: Rain water harvesting
Source: Author

5.4 Felicitous plantation

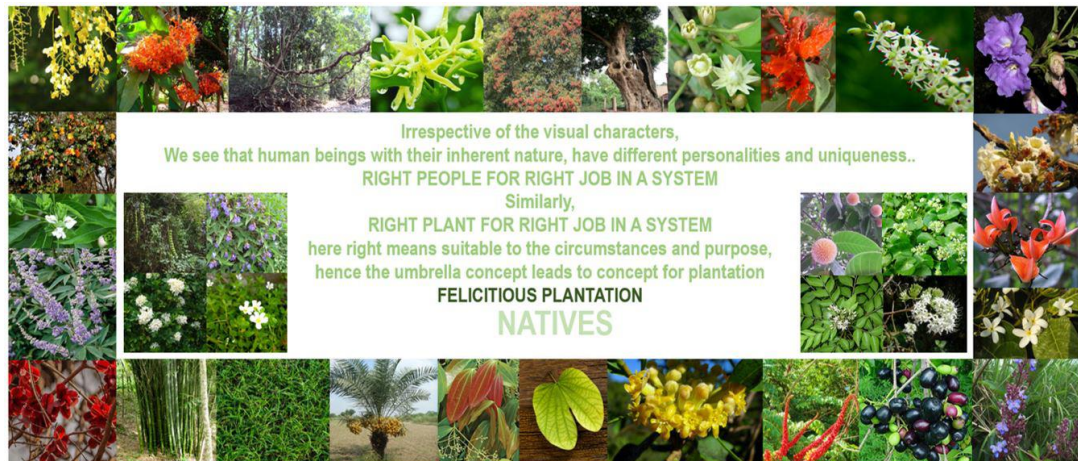


Figure 5.4a: images collage : Sahyadris native plants
Source: Author

Besides soil management and rain water harvesting, vegetation is third area of concern which is to be dealt by planting natives. Here is an additional thought of felicitous plantation, not from visual point of view but with a functional perspective. Irrespective of the visual characters, we see that human beings with their inherent nature have different characters, personality and uniqueness.. Right people for right job in a system, similarly, **Right plant for right job in a system**, here right means suitable to the circumstances and purpose, hence the umbrella concept leads to micro concept of **Felicitious plantation**.



Figure 5.4b: Master Plan and site sections
Source: Author

Name	Scientific name	Name	Scientific name	Name	Scientific name
Pisa	<i>Actinodaphne angustifolia</i>	Hedu / Haldu	<i>Haldina cordifolia</i>	Shindi	<i>Phoenix sylvestris</i>
Shirish	<i>Albizia lebeck</i>	Varas	<i>Heterophragma roxburghii</i>	Karanj	<i>Pongamia pinnata</i>
Satvin	<i>Alstonia scholaris</i>	Kuda	<i>Holarhena pubescence</i>	Beeja	<i>Pterocarpus marsupium</i>
Rohitak	<i>Aphanamixis polystachya</i>	Khuri	<i>Ixora brachiata</i>	Muchkund	<i>Pterospermum acerifolium</i>
Apta	<i>Bauhinia racemosa</i>	Nana	<i>Lagerstroemia microcarpa</i>	Putranjiva	<i>Putranjiva roxburghii</i>
Savar	<i>Bombax ceiba</i>	Taman	<i>Lagerstroemia speciosa</i>	Khadshingi	<i>Radermachera xylocarpa</i>
Asna	<i>Bridelia retusa</i>	Moi	<i>Lansea coromandelica</i>	Valunj	<i>Salix tetrasperma</i>
Palas	<i>Butea monosperma</i>	Chandva	<i>Macaranga peltata</i>	Reetha	<i>Sapindus laurifolius</i>
Kumbh	<i>Careya arborea</i>	Amba	<i>Mangifera indica</i>	Seeta Ashok	<i>Saraca asoca</i>
Bherli Maad	<i>Caryota urens</i>	Khirmi	<i>Manilkara hexandra</i>	Kusum	<i>Schleichera oleosa</i>
Bahava	<i>Cassia fistula</i>	Limbara	<i>Melia dubia</i>	Ambada	<i>Spondias pinnata</i>
Gela	<i>Catunaregam spinosa</i>	Anjani	<i>Memecylon umbellatum</i>	Kuker	<i>Sterculia guttata</i>
Tamalpatra	<i>Cinnamomum zeylanicum</i>	Nagchafa	<i>Mesua ferrea</i>	Padal	<i>Stereospermum colais</i>
Bhokar	<i>Cordia dichotoma</i>	Bakul	<i>Mimusops elengi</i>	Jambhul	<i>Syzygium cumini</i>
Varun	<i>Crataeva adansonii</i>	Kalam	<i>Mitragyna parvifolia</i>	Behda	<i>Terminalia bellirica</i>
Shisam	<i>Dalbergia latifolia</i>	Barthondi	<i>Morinda pubescens</i>	Hirda	<i>Terminalia chebula</i>
Amla	<i>Emblica officinalis</i>	Pandhar	<i>Murraya paniculata</i>	Kinjal	<i>Terminalia paniculata</i>
Pipar	<i>Ficus amplissima</i>	Kadamb	<i>Neolamarkia cadamba</i>	Ain	<i>Terminalia tomentosa</i>
Nandruk	<i>Ficus microcarpa</i>	Narkya	<i>Nothapodytes nimmoniana</i>	Bhend	<i>Thespesia populnea</i>
Umbar	<i>Ficus racemosa</i>	Parjambhul	<i>Olea dioica</i>	Kharal	<i>Trema orientalis</i>
Shivan	<i>Gmelina arborea</i>	Tetu	<i>Oroxylum indicum</i>	Kala Kuda	<i>Wrightia tinctoria</i>
Dhaman	<i>Grewia tiliifolia</i>	Kala Palas	<i>Ougeinia ojeinensis</i>	Tirfal	<i>Zanthoxylum rhetsa</i>

NATIVE SHRUBS LIST - SAHYADRI	
Name	Scientific name
Karvand	<i>Carissa congesta</i>
Karvi	<i>Carvia callosa</i>
Bharangi	<i>Clerodendrum serratum</i>
Pandharfal	<i>Flueggea spp.</i>
Rametha	<i>Gnidia glauca</i>
Murudsheng	<i>Helicteres isora</i>
Adulsa	<i>Justicia adhatoda</i>
Kadhipatta	<i>Murraya koenigii</i>
Phapat	<i>Pavetta crassicaulis</i>
Chitrak	<i>Plumbago zeylanica</i>
Nirgudi	<i>Vitex negundo</i>
Dhataki	<i>Woodfordia fruticosa</i>

NATIVE CLIMBERS LIST - SAHYADRI	
Name	Scientific name
Gunj	<i>Abrus precatorius</i>
Samudra ashok	<i>Argyrea nervosa</i>
Shatavari	<i>Asparagus racemosus</i>
Sagargota	<i>Caesalpinia bonducella</i>
Piluki	<i>Combretum albidum</i>
Calri	<i>Cryptolepis dubia</i>
Amph raki	<i>Elaeagnus conferta</i>
laldadang	<i>Embelia tsjeriam-cottam</i>
gayamphi	<i>Entada rheedei</i>
Ukshi	<i>Getonia floribunda</i>
bhadr nashalni	<i>Gynema sylvestre</i>
annatbhur	<i>Hemidesmus indicus</i>
bhadrhirata	<i>Hiptage benghalensis</i>
lakeyi	<i>Moullava spicata</i>

NATIVE PLANTATION - BAMBOO	
Name	Scientific name
Bamboo Kalak	<i>Bambusa arundinacea</i>
Bamboo Mes	<i>Dendrocalamus strictus</i>
Uda	<i>Pseudoxytenanthera stocksii</i>

NATIVE PLANTATION - GRASSES	
Name	Scientific name
Brahmi	<i>Bacopa monnieri</i>
Mandukarni	<i>Centella asiatica</i>
Durva	<i>Cynodon dactylon</i>
Lemon grass	<i>Cymbopogon cytratus</i>
Vetiver	<i>Chrysopogon zizanioides</i>

Table 5.4a: Sahyadri - Native plant list
Source: services, OIKOS for Ecological. Research and Documentation. n.d. <http://www.oikos.in/html/oikos-research-and-documentation.html>. 26 January 2020.

5.5 Better design solutions based on Research.

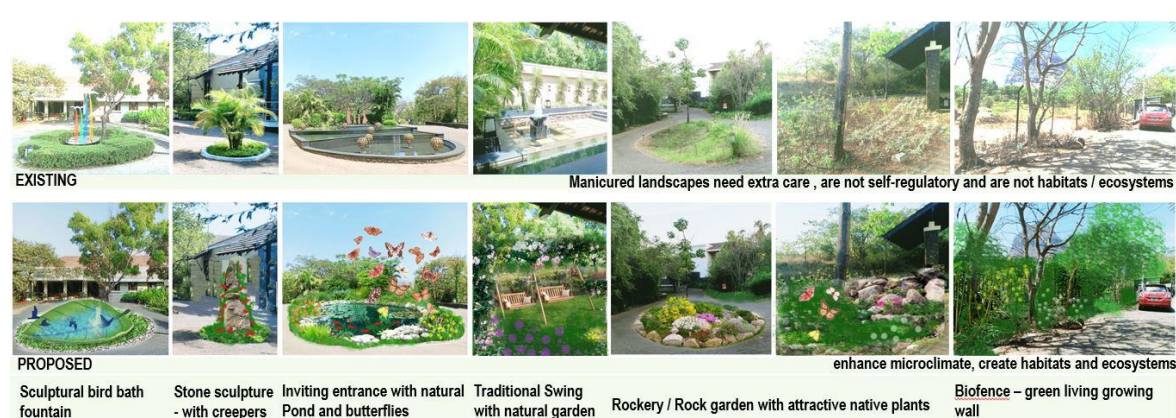


Figure 5.5a: Better Design solutions based on Research.

Source: Author

Sculptural bird bath fountain: Bird bath attract fauna and quench their thirst especially in summers. In sculptural form, it becomes a focus, attractive, aesthetic , functional element and relaxing feature. Add Stone sculpture with creepers at various small islands on site to enhance spaces.

Inviting entrance with natural pond and butterflies : Natural pond carved out, with few gappi fishes, grasses like mandukparni, durva, bramhi along pond with flowering shrubs attracting butterflies, makes an inviting entrance space, and area near reception with traditional swings in playful butterfly garden as a welcoming space.

Rockery/rock garden with attractive native plants: Import of soil is strictly prohibited, as mentioned in framework too. Make soil with combination of a variety of plant based materials like leaf litter, cuttings, cocopeat, agricultural wastes, dung, decomposed wastes can form best growing mix. Use stone bunds, rocks, rockery with native plants, to control soil erosion.

Biofence - green living growing wall: Adulasa, Nirgudi, Karwand, sagargota, chillar, murundsheng, kadipatta, dhayati, Rui, baman, and trees like pipar, Umbar, shivan, kalam, etc and bamboo biofence.

Sahyadris Native plant list of upper, middle and lower storey plantation is given in appendix.

5.6 Design ideas to enhance Resort experience



Figure 5.6a: sketch collage of design ideas
Source: Author

Hot Air Eco-Balloons is great way to explore nature , with a feeling if freedom to travel through the skies. Attached basket carries number of people together to enjoy view from the top.

Hot air balloons are based on a basic scientific principle: warmer air rises in cooler air. Essentially, hot air is lighter than cool air, because it has less mass per unit of volume. A cubic foot of air weighs roughly 28 grams (about an ounce). If air is heated by 100 degrees F, it weighs about 7 grams less. Thus, each cubic foot of air contained in a hot air balloon can lift about 7 grams. To keep the balloon rising, one needs a way to reheat the air. Hot air balloons do this with a burner positioned under an open balloon envelope. As the air in the balloon cools, the pilot can reheat it by firing the burner. Propane gas powers the flame required to heat the air in the Hot Air Balloon . Propane is the instant high-energy source of LPG, giving off both water and nitrogen as by products, and is considered to be a "clean" gas making it environmentally friendly. The propane is stored in compressed liquid form, in lightweight cylinders positioned in the balloon basket. The intake hose runs down to the bottom of the cylinder, so it can draw the liquid out. The hot air won't escape from the hole at the bottom of the envelope because buoyancy keeps it moving up.

5.7 Bird's eye view of Masterplan - Tungi Resort, Lonavala.



Figure 5.7a: 3D model image with design proposal.
Source: Author



Figure 5.7b: 3D model image with design proposal.
Source: Author

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Apendices

A1. Architect's interview

TUNGI RESORT , LONAVALA

IMK Architects - interview

Principal Architect Rahul Kadri

Questions

1.Please share about site planning of Tungi Resort in brief , your ideas, and design decisions of views, levels, privacy/ isolation, recreation.. architectural planning ...

2. Are there any plans of future expansion of Tungi Resort and what are those like?

3.Why is it that there were foreign architects involved only in the beginning of project...currently neither environment consultants nor landscape consultants are appointed for a holistic approach? (except a horticulturist on site). Was their solution satisfactory? Is currently what is being done is fine?

4. The project is about 10 years old , and is it that before 1.4.2012 as few points mentioned in HRACC guidelines, it was not mandatory to follow Eco friendly/ conservation practices on site? as there are few STPs, but no soil / water conservation, waste management...

5.What is your own.. honest opinion on overall landscape design of Tungi site?

6. From point of view of Architect of this project , is there anything that you would like to suggest, anything that should be followed, or can add value to the place ?

A2. Horticulturist's interview

TUNGI RESORT, LONAVALA

Horticulturist [Mr. Patil] - interview

What are the landscape related issues on site?

Why there are so many exotic species in landscape here?

Is there any landscape architect involved in the project?

Whom do you take suggestions from , to carry out the landscape development here?

Are any environmental experts or conservation experts involved in the daily working here?

Why there is so much of heavy maintenance, pruning and manicured landscape here?

Where does filtered water from STP go?

How is well water used? Only well water is extracted? as there doesn't seem any system filtering and recharging wells ?

What is done about the waste management on site? Don't see any compost or vermiculture pits here ?

Is there any rain water harvesting system for the site ?

A3. Resort manager's interview

TUNGI RESORT , LONAVALA

Executive - interview

What is the uniqueness of the resort according to you, and what do guests like ?

What are the measures taken at Resort to care for the environment ?

What are the measures taken at Resort to not disturb the fauna of the place?

What are the different activities at resort?

What are the outdoor activities at Resort in nature ?

What are the cultural activities and local cuisines at Resort?

A4. Resort guest survey

Visitor feedback at Tungi Resort Lonavala

Email address *

How would you rate the ease and convenience of walking / cycling in the resort?

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

Did your room have good view and direct access to the outdoor space ?

How would you rate the outdoor experience in the resort in terms of nature trails and fitness features ?

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

How would you rate the resort in the proper placement of signages and information ?

1	2	3	4	5
☐	☐	☐	☐	☐

On a hot day, how would you rate the comfort level in the outdoor seating and walking areas ?

1	2	3	4	5
☐	☐	☐	☐	☐

Does the level of outdoor lighting in the resort seem satisfactory?

Do the spaces / activities provided in the outdoor area satisfy all the age groups in your family?

Does the resort design use it's location near the Pawna lake to its full potential ?

Did you experience any noise disturbance from the roads adjacent to the resort?

- ☐ Yes
- ☐ No
- ☐ Maybe

Are there enough washrooms in the outdoor areas?

- ☐ Yes
- ☐ No

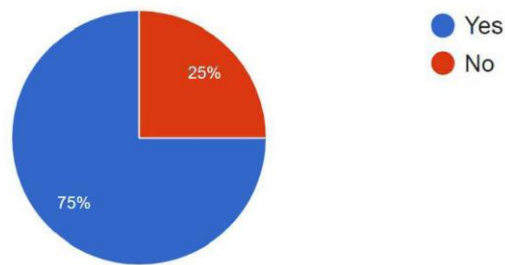
Did you get a chance to explore the local art and local cuisine in the resort?

- ☐ Option 1
- ☐ Yes
- ☐ No
- ☐ Other:

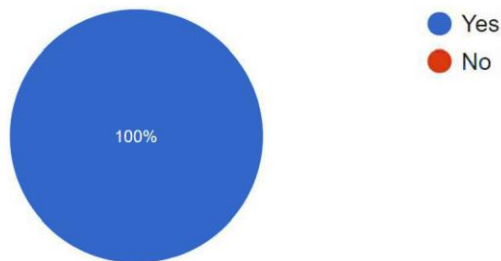
Was there provision of drinking water fountains at convenient distances in the resort?

- ☐ Option 1
- ☐ Maybe
- ☐ Other:

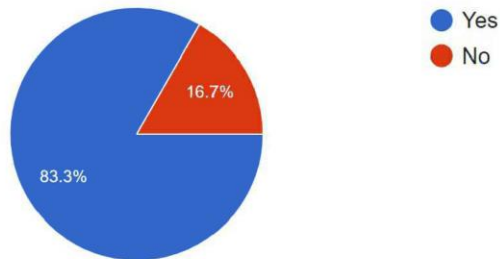
Did your room have good view and direct access to outdoor space ?



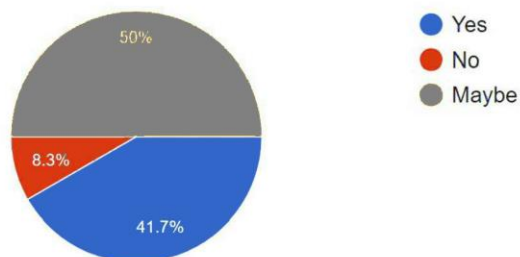
Does the level of outdoor lighting in the resort seem satisfactory?



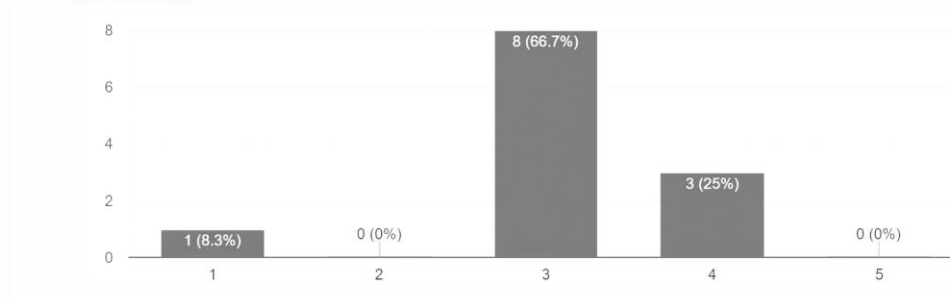
Do the spaces/ activities provided in the outdoor area satisfy all the age groups in your family ?



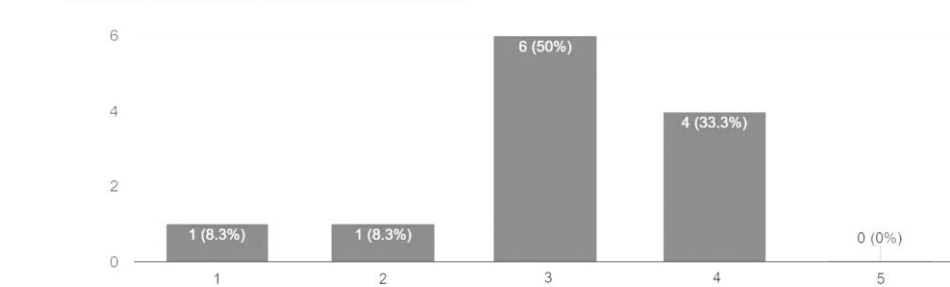
Does the resort design use its location near the pawna lake to its full potential?



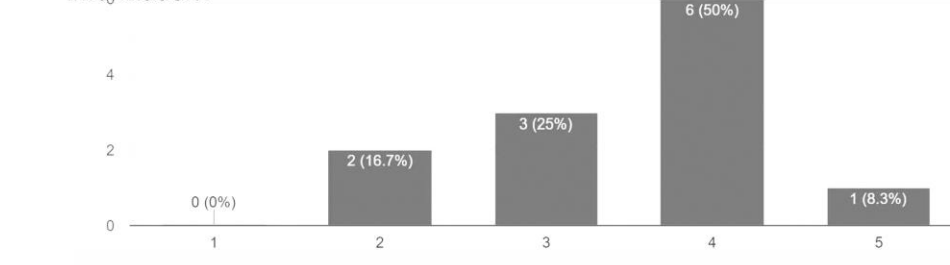
How would you rate the ease and convenience of walking / cycling in the resort?



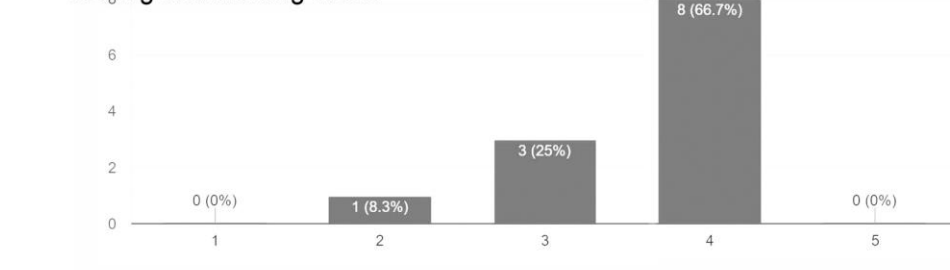
How would you rate the outdoor experience in the Resort in terms of nature trails and fitness features?



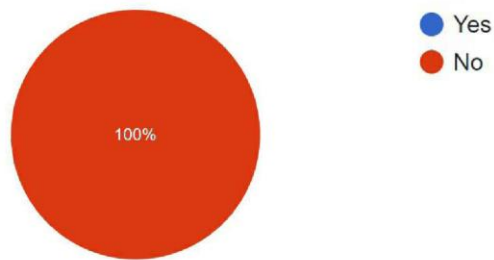
How would you rate the resort in the proper placement of signages and information?



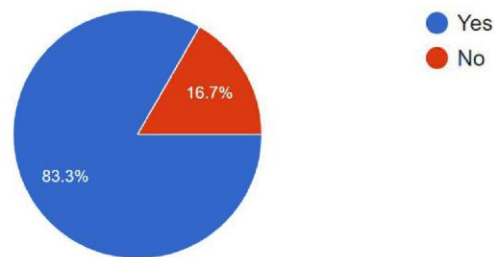
on a hot day, how would you rate the comfort level in the outdoor seating and walking areas



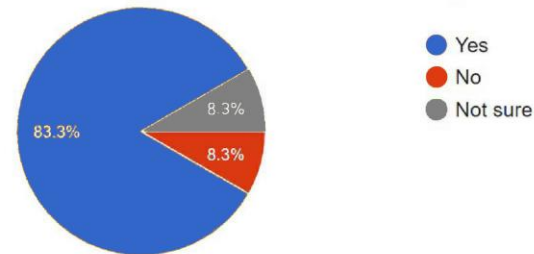
Did you experience any noise disturbances from the roads adjacent to the resort ?



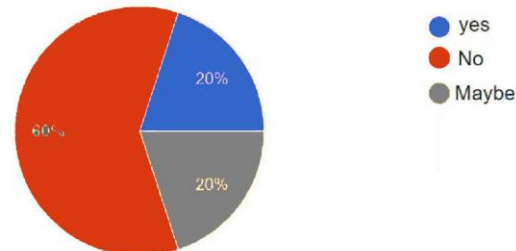
Are there enough washrooms in the outdoor areas?



Did you get a chance to explore the local art and local cuisine in the Resort ?



Was there provision of drinking water fountains to refill bottles at convenient distances in the Resort?



A5. Water consumption at Resort - approximate calculations

no. of guests	units	ground + 1st - structures
36 x (avg.)3 = 108 2 adults 1 kid	36 no.s - Hotel units	H1 - 6 + 6 = 12 H2 - 12 + 12 = 24 (ground + 1st) 12+24 = 36
4 x (avg.)4 = 16 2 adults 2 kids	04 no.s - Hotel suites[B1]	B1 - 2 + 2 = 4 (ground + 1st)
44 x (avg.)4 = 176 2 adults + 2 adults / kids	44 no.s - cluster A	A - 10+10+8+8+8 = 44 5 bldgs
40 x (avg.)4 = 160 2 adults + 2 adults / kids	40 no.s - cluster B	B - (4 + 4) X 5 = 40 5 bldgs
floating population = 40 visiting day guests on weekends and holidays Total guests = 500	Total accommodation units- 124	kids and teenagers = 150 approx.
restaurants guest no.s = 500 including staying guests + visiting guests		staff = 150 front office, back office staff room service boys, cleaners drivers, gardeners

WATER CONSUMPTION :

Total number of people in Resort = Resort guest / visitors + staff

1) Resort visitors= X (staying visitors) + Y (floating population)

= A people

2) Staff workers= Zworkers

Total number of people in Resort= A + Z = B people

as per DCR rules:

Hotels with lodging accommodations are allowed to have 180 litres per head per day consumption.

Staff considered to be using 135 litres per day

Floating visitors are allowed 15 liters per head per day

Total water consumed by guest (by per person) =X *180

= C litres

total water consumed by floating visitors= Y * 15

= D litres

total water consumed by staff= Z* 135

= E litres

water consumed at restaurant= P * 70 (70 per seat)

= F litres

hence total water consumed at Resort= C + D +E +F

= Q litres = Q /1000 cu.m.

(1 litre = 0.001 cu.m.)

A6. List of Native species for Western Ghats

NATIVE TREE LIST - SAHYADRI	
Name	Scientific name
Pisa	<i>Actinodaphne angustifolia</i>
Shirish	<i>Albizia lebbek</i>
Satvin	<i>Alstonia scholaris</i>
Rohitak	<i>Aphanamixis polystachya</i>
Apta	<i>Bauhinia racemosa</i>
Savar	<i>Bombax ceiba</i>
Asna	<i>Bridelia retusa</i>
Palas	<i>Butea monosperma</i>
Kumbh	<i>Careya arborea</i>
Bherli Maad	<i>Caryota urens</i>
Bahava	<i>Cassia fistula</i>
Gela	<i>Catunaregam spinosa</i>
Tamalpatra	<i>Cinnamomum zeylanicum</i>
Bhokar	<i>Cordia dichotoma</i>
Varun	<i>Crataeva adansonii</i>
Shisam	<i>Dalbergia latifolia</i>
Amla	<i>Emblica officinalis</i>
Pipar	<i>Ficus amplissima</i>
Nandruk	<i>Ficus microcarpa</i>
Umbar	<i>Ficus racemosa</i>
Shivan	<i>Gmelina arborea</i>
Dhaman	<i>Grewia tiliifolia</i>
Hedu	<i>Haldina cordifolia</i>
Varas	<i>Heterophragma roxburghii</i>
Kuda	<i>Holarrhena pubescence</i>
Khuri	<i>Ixora brachiata</i>
Nana	<i>Lagerstroemia microcarpa</i>
Taman	<i>Lagerstroemia speciosa</i>
Moi	<i>Lannea coromandelica</i>
Chandva	<i>Macaranga peltata</i>
Amba	<i>Mangifera indica</i>
Khirni	<i>Manilkara hexandra</i>
Limbara	<i>Melia dubia</i>
Anjani	<i>Memecylon umbellatum</i>
Nagchafa	<i>Mesua ferrea</i>
Bakul	<i>Mimusops elengi</i>
Kalam	<i>Mitragyna parvifolia</i>
Barthondi	<i>Morinda pubescens</i>
Pandhar	<i>Murraya paniculata</i>
Kadamb	<i>Neolamarckia cadamba</i>
Narkya	<i>Nothapodytes nimmoniana</i>
Parjambhul	<i>Olea dioica</i>
Tetu	<i>Oroxylum indicum</i>

Kala Palas	<i>Ougeinia oojeinensis</i>
Shindi	<i>Phoenix sylvestris</i>
Karanj	<i>Pongamia pinnata</i>
Beeja	<i>Pterocarpus marsupium</i>
Muchkund	<i>Pterospermum acerifolium</i>
Putranjiva	<i>Putranjiva roxburghii</i>
Khadshingi	<i>Radermachera xylocarpa</i>
Valunj	<i>Salix tetrasperma</i>
Reetha	<i>Sapindus laurifolius</i>
Seeta Ashok	<i>Saraca asoca</i>
Kusum	<i>Schleichera oleosa</i>
Ambada	<i>Spondias pinnata</i>
Kuker	<i>Sterculia guttata</i>
Padal	<i>Stereospermum colais</i>
Jambhul	<i>Syzygium cumini</i>
Behda	<i>Terminalia bellirica</i>
Hirda	<i>Terminalia chebula</i>
Kinjal	<i>Terminalia paniculata</i>
Ain	<i>Terminalia tomentosa</i>
Bhend	<i>Thespesia populnea</i>
Kharal	<i>Trema orientalis</i>
Kala Kuda	<i>Wrightia tinctoria</i>
Tirfal	<i>Zanthoxylum rhetsa</i>

NATIVE SHRUBS LIST - SAHYADRI	
Name	Scientific name
Karvand	<i>Carissa congesta</i>
Kaarvi	<i>Carvia callosa</i>
Bharangi	<i>Clerodendrum serratum</i>
Pandharfal	<i>Flueggea spp.</i>
Rametha	<i>Gnidia glauca</i>
Murudsheng	<i>Helicteres isora</i>
Adulsa	<i>Justicia adhatoda</i>
Kadhipatta	<i>Murraya koenigii</i>
Phapat	<i>Pavetta crassicaulis</i>
Chitrak	<i>Plumbago zeylanica</i>
Nirgudi	<i>Vitex negundo</i>
Dhayati	<i>Woodfordia fruticosa</i>

NATIVE CLIMBERS LIST - SAHYADRI	
Name	Scientific name
Gunj	<i>Abrus precatorius</i>
Samudrashok	<i>Argyreia nervosa</i>
Shatavari	<i>Asparagus racemosus</i>
Sagargota	<i>Caesalpinia bonducella</i>
Piluki	<i>Combretum albidum</i>
Calri	<i>Cryptolepis dubia</i>

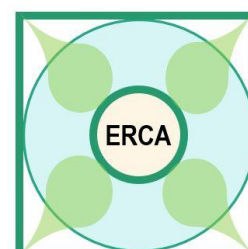
Amph raki	<i>Elaeagnus conferta</i>
laldadang	<i>Embelia tsjeriam-cottam</i>
gayamphi	<i>Entada rheedei</i>
Ushi	<i>Getonia floribunda</i>
bhadh nashalni	<i>Gymnema sylvestre</i>
annatbhur	<i>Hemidesmus indicus</i>
bhadhlirata	<i>Hiptage benghalensis</i>
lakeyi	<i>Moullava spicata</i>

NATIVE PLANTATION - BAMBOO	
Name	Scientific name
Bamboo Kalak	<i>Bambusa arundinacea</i>
Bamboo Mes	<i>Dendrocalamus strictus</i>
Uda	<i>Pseudoxytenanthera stocksii</i>

NATIVE PLANTATION - GRASSES	
Name	Scientific name
Brahmi	<i>Bacopa monnieri</i>
Mandukparni	<i>Centella asiatica</i>
Durva	<i>Cynodon dactylon</i>
Lemon grass	<i>Cymbopogon cytratus</i>
Vetiver	<i>Chrysopogon zizaniodes</i>

Table z: Sahyadri -Native plant list

Source : services, OIKOS for Ecological. Research and Documentation. n.d. <http://www.oikos.in/html/oikos-research-and-documentation.html>. 26 January 2020



Thank You!

