

Development Plan for Sangram Sagar Lake
Jabalpur, Madhya Pradesh

Submitted

*In partial fulfilment of the requirements for
the award of the degree of*

**MASTER OF ARCHITECTURE
(LANDSCAPE)**

By

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Declaration

I **Sanjana Khemani**, Scholar No.:2017MLA014 hereby declare that the thesis entitled Landscape Development Plan for Sangram Sagar Lake, Jabalpur, Madhya Pradesh, submitted by me in partial fulfilment for the award of Master of Architecture (Landscape), in School of Planning and Architecture, Bhopal, India, is a record of bona fide work carried out by me. The matter embodied in this thesis has not been submitted to any other University or Institute for the award of any degree or diploma.

17th May 2019
Khemani

Sanjana

Certificate

This is to certify that the declaration of Sanjana Khemani is true to the best of my knowledge and that the student has worked under the guidance of the following panel.

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“What we do to our Landscape, we ultimately do it to ourselves.”

- Anonymous

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ABSTRACT

Through research analysis and site evaluation, this thesis is conducted to realize the historical and cultural importance of lakes in Jabalpur city and what problems have caused the degradation of the lakes. A detail case example of Sangram Sagar Lake is dealt with to know how these kinds of landscapes help in shaping up the city's open spaces. It also asks two questions: first, what is the potential of the contemporary urban lakefront to structure and perpetuate meaningful spectacle; and second, how our heritage and cultural values along with the surroundings can be utilized to its maximum potential to build up a space that is open to all irrespective of cast, creed, age and gender. It also helps in promoting tourism and act as city's green pockets.

Two case study cities—Mansagar Lake, and Hauz Khas Lake—are evaluated in order to understand contemporary design strategies in urban lake/lakefront projects. With the help of existing lakefront scenarios and their solutions and previously evaluated data, a design plan has been proposed as the Landscape Development Plan for Sangram Sagar Lake, Jabalpur. It is idealised to become an experience for the people visiting the place and its neighbourhoods, creating awareness about the past; its history and culture. People of all age groups can enjoy heritage as not only the past but a living tradition. The guided tours will go a long way in keeping the socio-cultural roots of the city alive and give a boost to tourism as well.

1 Introduction

1.1 Background- Why water?

Water is life- and one could say that our whole mankind is built on the use of water. It is vital for the existence of life on earth and is an indispensable part of human life. We all owe our livelihood and sustenance from water. Since the beginning of being; civilizations have witnessed growth along with water bodies, establishing the strong significance of water as a driving force in the process of development. The Indus Valley civilization along Indus River, Mesopotamian civilization flourished along Tigris-Euphrates River, and so on. Throughout history, there have been varied numbers of provisions to guarantee an ample amount of water for living. Indigenous people have been very ingenious in drawing their water from rivers, lakes, wells, and ponds. They have taken into consideration that water is very crucial and often regarded as a sacred element. In the long run, the availability of the abundant or adequate amount of water has been one of the crucial factors for the development of a society – cities, and communities. Water being more than just a commodity or a valuable resource, it is an economic and social good. This places responsibility in the public domain for its proper management and oversight as fresh water is a non-renewable resource that will exhaust over time. For future generations, balancing water use, water quantity and water quality are of great importance. While the supply of fresh water will be relatively more important than quantity, the highest priority water quality issues will be. At the same time, using water wisely and avoiding wasting this important natural resource is becoming increasingly important. Consequently, the judicious use of water and the conservation of water bodies become a prime objective and responsibility for all.

Madhya Pradesh is bestowed with abundant water resources but due to improper management coupled with excessive exploitation, most of the water bodies are severely stressed and are at a stage of depletion. In time to come, water demand and supply gap will grow wider, leading to bigger equity issues in socioeconomic development and environmental sustainability. They play a vital role in maintaining the environmental sustainability of urban areas, whether man-made or natural, fresh water or brackish. These water bodies perform significant environmental, social and economic functions, ranging from being a drinking water source, recharging groundwater, and acting as sponges for flood control, supporting biodiversity, and providing livelihoods. They have, however, become today's biggest urbanization casualty.

1.2 Water bodies of Jabalpur

Jabalpur town is situated in the eastern part of Madhya Pradesh about 300 km from capital Bhopal. It is located at 23° 10' 32 " N, 79° 53' 44" E and MSL 402 M.

Jabalpur has been centre hub for the Kalchuri's and Gond's regime. The area is best owed with bountiful of water resources both natural and manmade, important being the river Narmada. The former rulers of the region have reportedly constructed several water bodies to conserve the rain water and to cater recreational, domestic and agricultural needs of the region. There were 52 big water bodies, 'Tals' and 84 small water bodies, 'Tallaiyas' reportedly existed in Jabalpur in the past but at present only 36 lakes are in existence within the town. The Gond rulers in 15th Century A.D. built major lakes of the city as a means of conserving rain water that could be used for drinking, irrigation, bathing, etc. These lakes were built by creating bunds at lower altitude which would help in stopping the rainwater that flowed from higher altitudes. The Lakes were built without any help from engineers, government, or without any measurements and estimation. They had learnt the techniques from their ancestors of lake construction. The creation of bunds had three benefits: increased moisture content in soil, water made soil fertile, brought in extra soil from upstream which kept the fertility capacity fresh & Kaans (*Saccharum spontaneum*) grass dies due to excess water which acts as a rich manure. The then Gond King Sangram Singh created the Sangram Sagar lake for providing drinking water and other drainage works to his state. Rani Durgavati, wife of Chhatrapati Shiva, son of Sangram Singh, who carried forward this tradition of constructing a pond for water conservation during the Gond regime.



Figure 1 Ranital Lake, Jabalpur



Figure 2 Devtal Lake, Jabalpur



Figure 3 Khandari Lake, Jabalpur

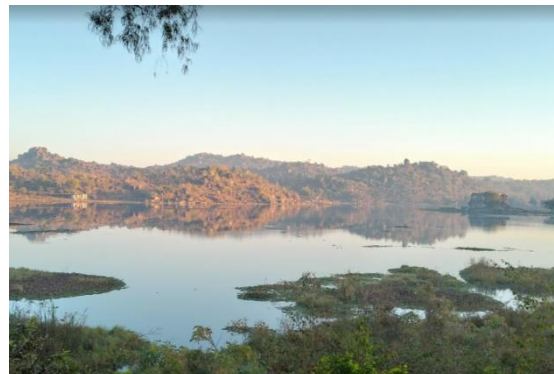


Figure 4 Sangram Sagar Lake, Jabalpur



Map 1 Lakes in Jabalpur City, source- Google Earth

Many of the water bodies of the Jabalpur town have been completely vanished due to change of land use pattern, encroachment, urbanization and anthropocentric activities. Water resources management is a critical issue facing global concern. It covers planning, development, distribution and management of use of water as a resources and meeting the demand of its users in the key to sustainable development. In spite of several initiatives taken by the policy makers at international and national level, water is still facing global crisis today. Government agencies are not able to manage its function solely. A proper monitoring of water and water resources is required, general awareness will help the government to water resources.

1.3 Introduction to Site

Jabalpur is an old town in central India located in the heart of the country on the banks of the Holy River Narmada and is situated on the plains of its tributaries- Hiran and Gaur. The Narmada River Valley has the famous Marble Rocks; the only one of its kind in the world where the entire river flows for almost 2 km through varied coloured and tinted marble rocks with deep water falling in between. Jabalpur is connected by National Highway No.7 between North and South (Varanasi to Kanyakumari), NH No. 12 from Jabalpur to Jaipur and NH 12 A from Jabalpur to Raipur. It also has a good state road network connecting it with most of the state's districts. Jabalpur's topography is unique. Jabalpur city is surrounded by low, rocky, and barren hills. Bargi hills are located in the Jabalpur city's south eastern part. With rich biodiversity and scenic beauty, much of the area is well protected, and Madan Mahal Fort remains highlight its historic importance.

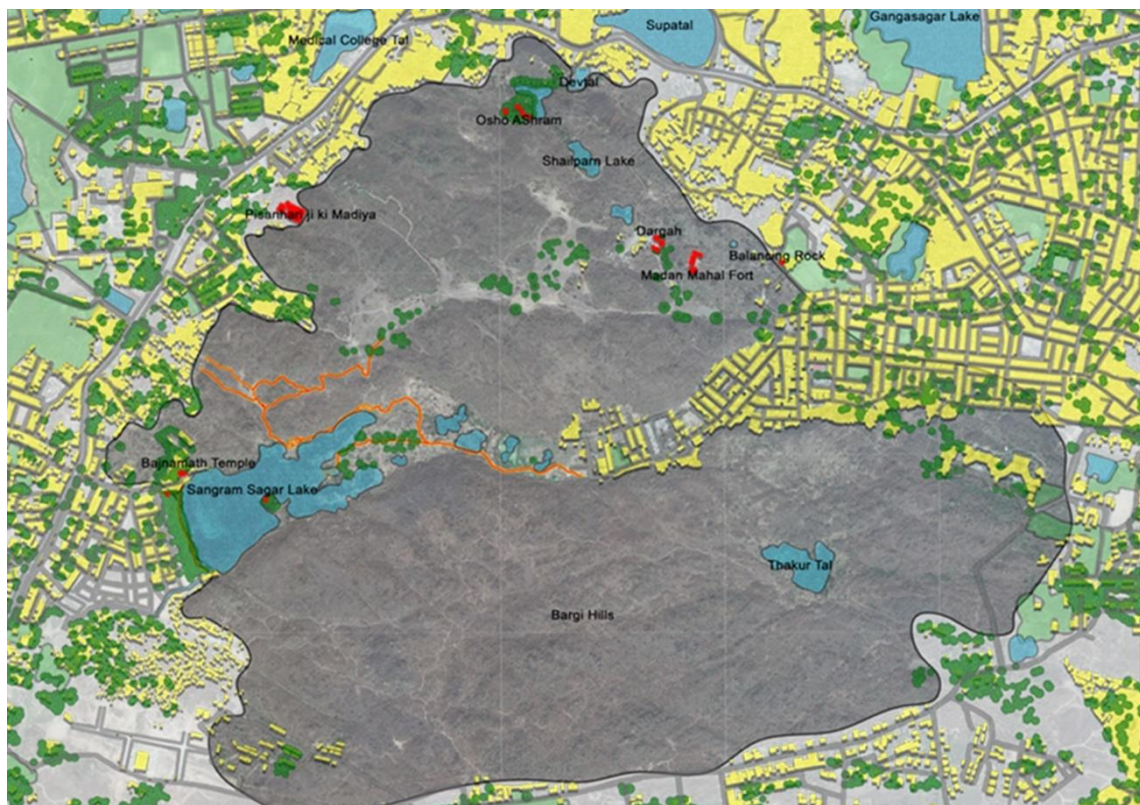


Figure 5 Sangram Sagar Lake



Figure 6 Bajnamath Temple

Sangram Sagar Lake is one out of many lakes in Jabalpur City. It is located approximately 15 km from the city; built by King Sangram Shah, a Gond ruler in the 15th century, along with its adjoining structures. A temple that enshrines Lord Bhairav, a fierce and dark-complexioned form of Lord Shiva is located in the immediate vicinity. It is called as Bajnamath Temple or simply Bhairav Baba Temple and witnesses a huge footfall throughout the year. The lake along with its surroundings has a strong historic and cultural value; yet it holds a much neglected outlook from the community. The idea is to revive the lake and its setting to match the urban environment whilst holding onto its natural integrity. This will create a positive outcome towards the ecological importance of the place and act as a recreational area for the people visiting the temple. It will act as an urban/cultural public space combined with a self-sustaining, productive and naturalized edge to give a new meaning to nature in the city. It will create a good development plan for the city in terms of economic development, sustainable development, and landscape aspects and fulfil needs and requirements of the people.



Map 2 Sangram Sagar Lake and its surroundings- Base Plan

1.3.1 About Jabalpur

Jabalpur was previously known until 2006 as Jubbulpore, a tier 2 city in Madhya Pradesh State, India. It is included after Bhopal, Indore, and Gwalior in the list of Madhya Pradesh's major cities. It is Madhya Pradesh's third largest urban agglomeration and according to the 2011 census, the 37th largest urban

agglomeration in the country. It is a well-known Dhuandhar Falls city and Bhedaghat's white marble rocks.

Jabalpur City is Madhya Pradesh's major industrial, administrative and business center. The city is home to the State High Court and several state government departmental headquarters. Jabalpur has a major military base and is a major arms and ammunition production center in the country, which is the city's primary source of work. It also has a number of smaller industries. It is a major forest product trading center and producer, experiencing rapid growth in all sectors. Jabalpur is the Jabalpur district's administrative headquarters, which is the state's second-most populous district and division of Jabalpur. Historically, it was a center of the dynasties of Kalachuri and Rajgond that helped to develop a syncretic culture influenced by intermittent reigns of Mughal and Maratha.

1.3.2 Location of Jabalpur City

Jabalpur town is located about 300 km from the capital Bhopal in the eastern part of Madhya Pradesh. It is at 23 ° 10' 32" N, 79 ° 53' 44" E and 402 M MSL. Jabalpur was the focal point for the regime of the Kalchuri and Gond. The area has plenty of natural and manmade water resources, important being the Narmada River. The Narmada River originates from Satpura's north-eastern end and runs in the depression between the Satpura and Vindhya ranges, draining the Satpura range's northern slope, running west to the Arab Sea.

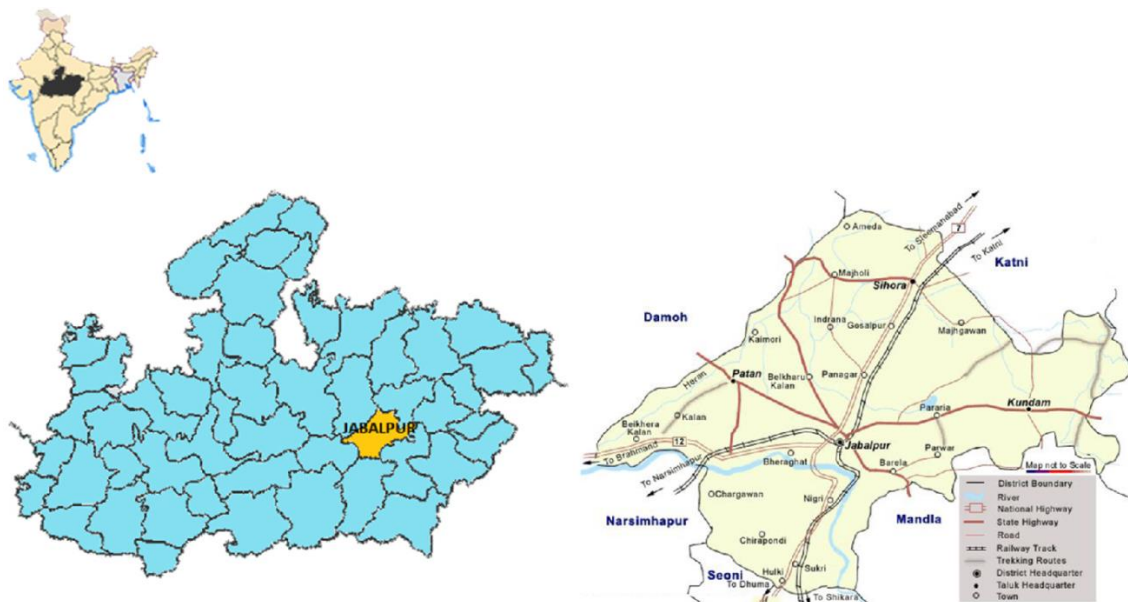


Figure 7 Location of Jabalpur

1.3.3 History

The king of Gondwana, Raje Madan Shah Madawi of Mandla (ruling period from 1138 to 1157) built a watchtower and a small hilltop fort at Madan Mahal, an area

known as Madan Mahal Fort in Jabalpur City. The Gond King, Sangram (whose son, Raje Dalpat Shah Madawi, married Rani Durgavati) held Singaargarh fort in Sangrampur in the 1500s and built the Sangram Sagar Lake in the valley of Madan Mahal hills and Bargi hills by creating a dam on the south-west side of the lake. He also built a monument that is now in a dilapidated state in the middle of the lake.

Historical Timeline:

Ancient/Pre Historic

- Madan Mahal Hills and Bargi Hills lie in the South West part of the City
- Tripur Tirth was the name given to this city by Tripurasura who was the main asura

1100 AD

- The Gondwana king of that era – Raje Madan Shah Madawi, ruler of Mandla town, (ruling period from 1138 to 1157) had built a watch tower and a small fort on Madan Mahal hills, an area located in Jabalpur



Figure 8 Madan Mahal Fort, Jabalpur

1500 AD

- Sangram Shah, a Gond ruler (ruling period from 1480 to 1541) built Sangram Sagar lake in the valley surrounded by Madan Mahal Hills and Bargi Hills by building a stop damn on the west side of the lake

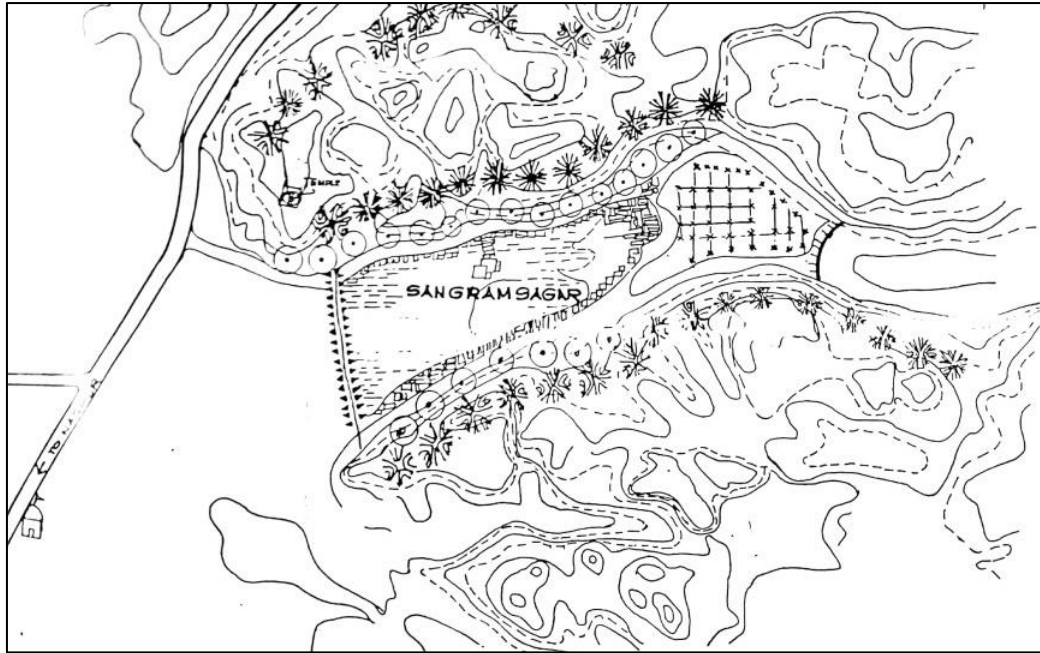


Figure 9 Plan of Sangram Sagar Lake, source- National Informatics Center

1600 AD -1700 AD

- Rani Durgawati was a great fighter and warrior of the Gond Dynasty. She realized the importance of water conservation and hence she constructed more than 85 small ponds/lakes in the city, mainly Ranital, Haathital, Devtal, Supatal, Ganga sagar and Hanumantal

1800 AD -1900 AD

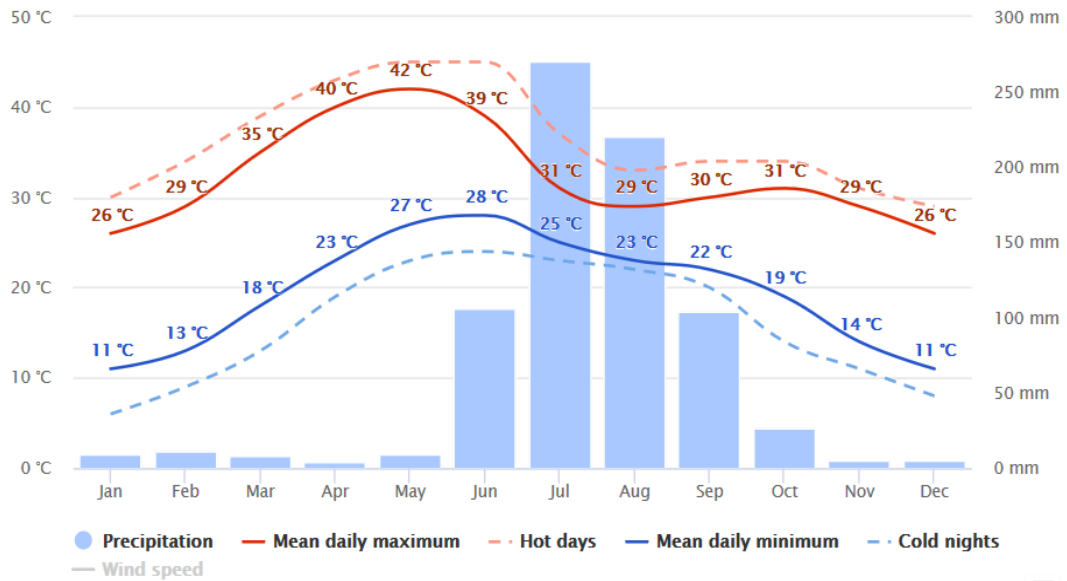
- Subjects like water conservation and environment become secondary in this fast pace of development. After independence, the construction of a new city is brutally started to bridge the ponds considered to be the glory of Jabalpur

2000 AD

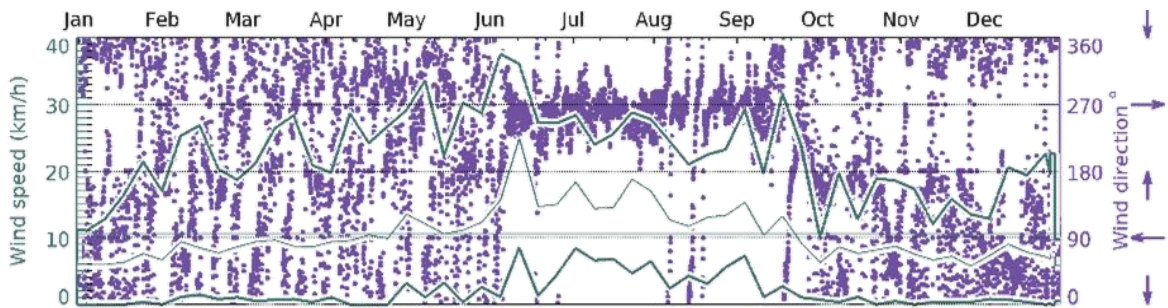
- Out of 52 Talab built by the Gond rulers only 36 remain at present

1.3.4 Climate

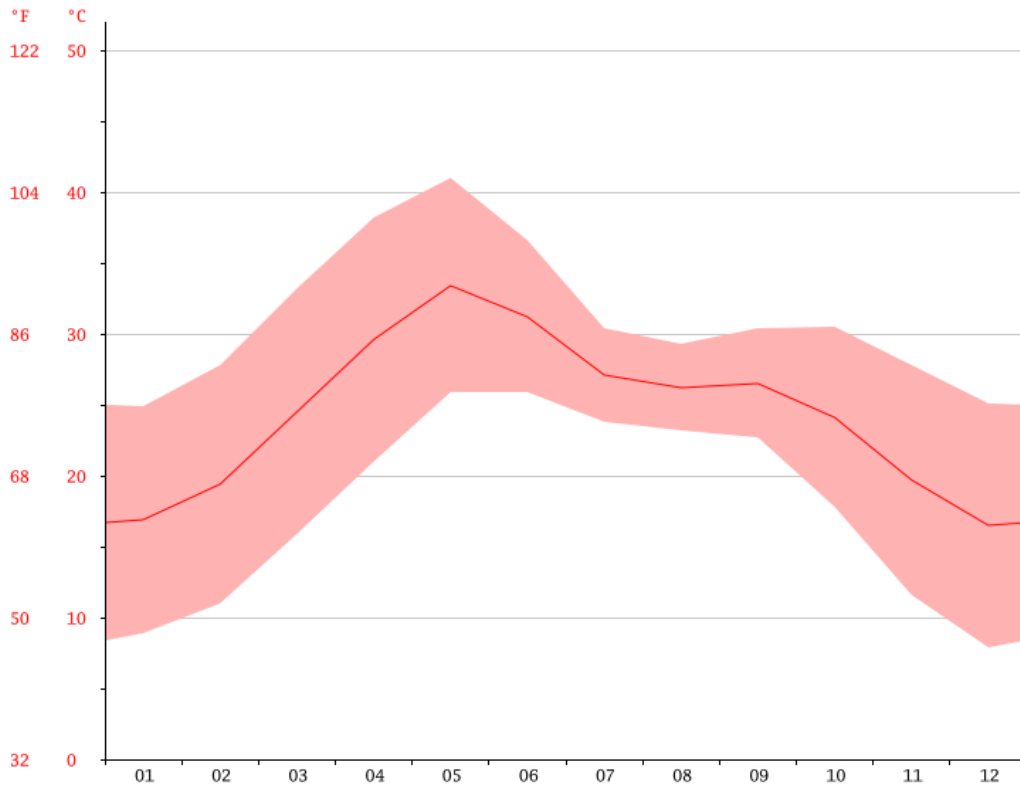
Jabalpur has an extreme climate typical of north-central India (Madhya Pradesh and southern Uttar Pradesh). Summer starts at the end of March and lasts till the month of June. May is the hottest month of the year, with temperatures rising above 45 ° C (113 ° F) at an average. The Summer seasons is the followed by the Southwest Monsoon, which starts from June lasts until early October and produces 889 mm (35 in) of rain from July till the month of September. The average annual rainfall is almost 1,386 mm (54.6 inches). Winter begins at the end of November and ends at the beginning of March. January is the coldest month of the year, with a daily average temperature close to 15 ° C (59 ° F).



Graph 1 Average Temperatures, source- meteoblue.com



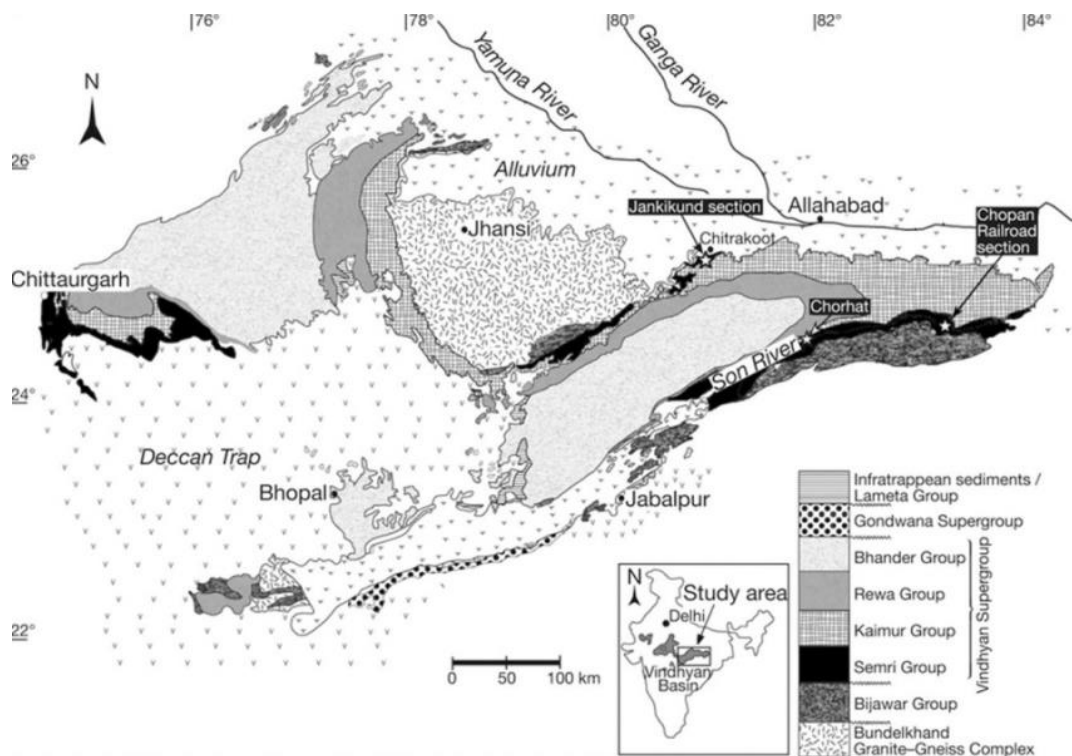
Graph 2 Wind speed and direction, source- meteoblue.com



Graph 3 Average Temperatures, source- Climate-data.org

1.3.5 Geography

Jabalpur's topography is unique. It is located on the banks of the perennial Narmada River, with a rich forest in the vicinity, and a scenic, low-rise hills-pointed landform. The town is surrounded by low rocky and barren hills-north-east hills of Karia Pather, east hills of Sita Pahad and Khandari, and south-west hills of Madan Mahal and rock outcrops. The city's entire area is hilly, with slopes varying from 2 to 30% in grade. However, the low hills form a barrier to continuous urban form development and restrict interconnections between different parts of the city. The lowlands stretch across the west and northwest of the city, with gradual northwest slopes. The town is almost bifurcated by a central ridge running parallel to the railway line that girds the town in the shape of a horseshoe"). The ridge starts from the east hills and runs to the city's west side. The plain on the ridge's northern side gradually slopes from east to northwest, while the southern side slopes southward.



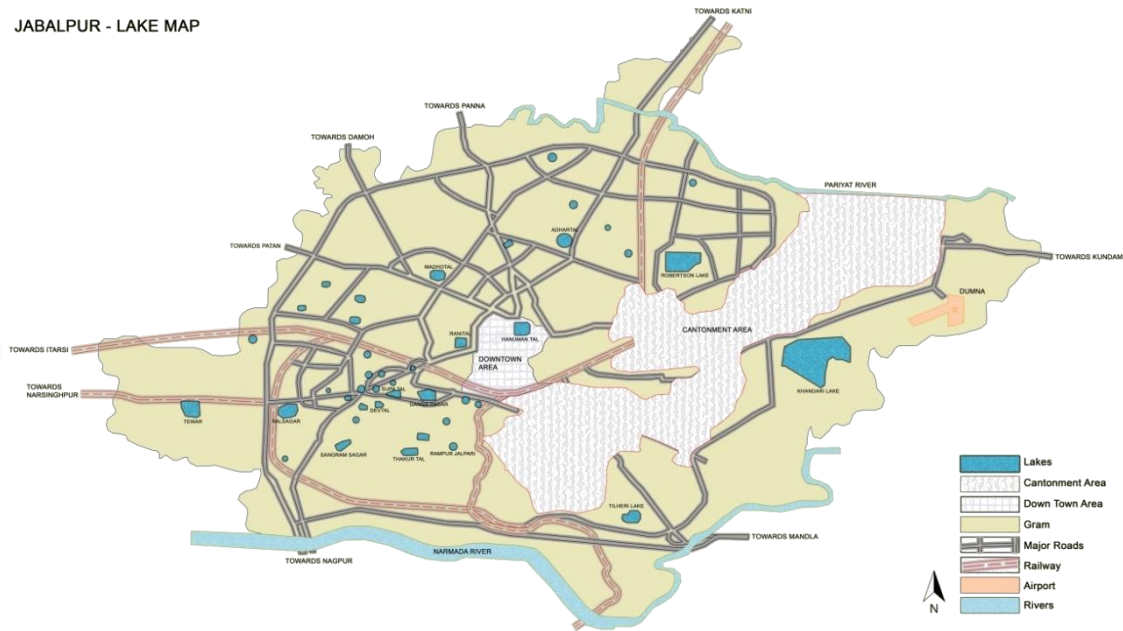
Map 3 Geological Map of Vindhyan Basin- Central India, After Azmi et al. (4), based on several sources

1.4 Lakes in Jabalpur

Jabalpur has been centre hub for the Kalchuri's and Gond's regime. The area is best owed with bountiful of water resources both natural and manmade, important being the river Narmada. The former rulers of the region have reportedly constructed several water bodies to conserve the rain water and to cater recreational, domestic and agricultural needs of the region. There were 52 big water bodies, 'Tals' and 84 small water bodies, 'Tallaiyas' reportedly existed

in Jabalpur in the past but at present only 36 lakes are in existence within the town.

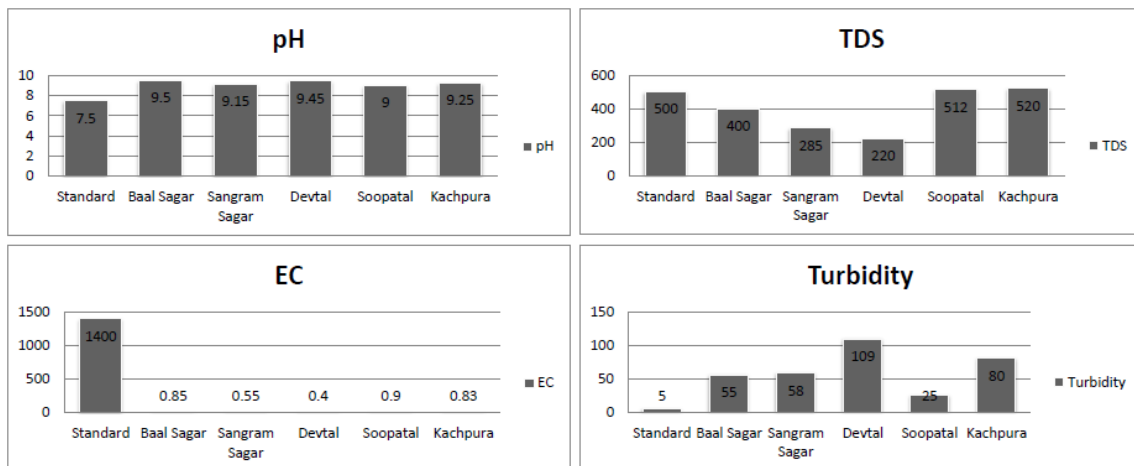
JABALPUR - LAKE MAP



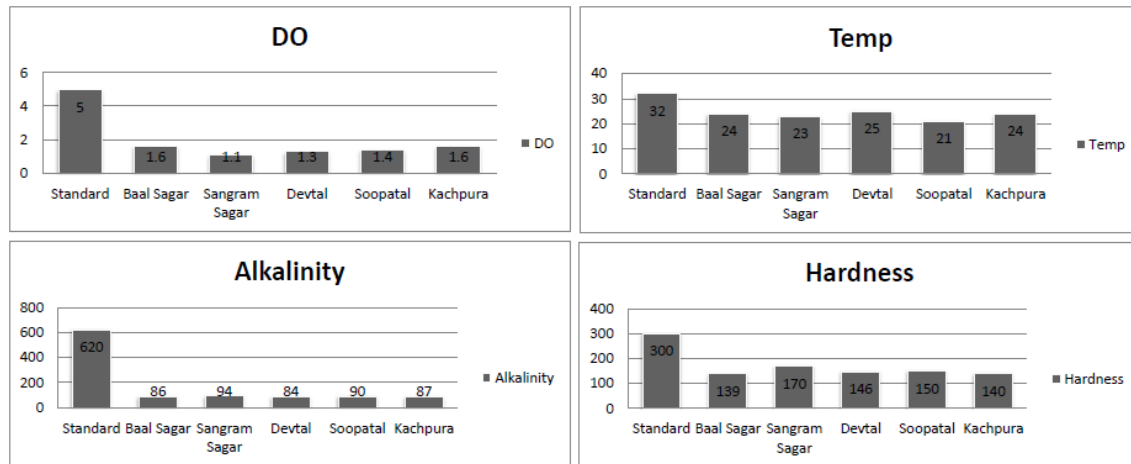
Map 4 Lake Map, Jabalpur, source- Author

1.5 Status of Lakes

Many of the water bodies of the Jabalpur town have been completely vanished due to change of land use pattern, encroachment, urbanization and anthropocentric activities. Water resources management is a critical issue facing global concern. It covers planning, development, distribution and management of use of water as a resources and meeting the demand of its users in the key to sustainable development. In spite of several initiatives taken by the policy makers at international and national level, water is still facing global crisis today. Government agencies are not able to manage its function solely. A proper monitoring of water and water resources is required, general awareness will help the government to water resources.



Graph 4 Water Quality Comparison of different Lakes



Graph 5 Water Quality Comparison of different Lakes

Studies carried out in a recent investigation (May 2017) revealed that one of the most important causes of water pollution is unplanned urban development without adequate attention to suitable management of sewage and waste material. The results concluded that almost all the lakes of Jabalpur are affected with pollution. Supatal, Balsagar and Shahital are polluted with high dissolved solids and this is because of pollutants which comes with the effluents from nearby drains, water is highly turbid in maximum lakes and value of turbidity exceed the permissible limits, Nitrate percentage is more in Gangasagar, Sagda Talab and Machrhi Bijori Lake, although it is within permissible limit and pH range of 6.5 to 8.5 is normally accepted as per guideline suggested by WHO. In this study pH values were found in the range of 7.5 to 8.5 in the water samples. This shows that pH was observed to be slightly alkaline in nature in all the lakes of Jabalpur city.

2 RESEARCH BACKGROUND

2.1 Need of Research

Lakes and water bodies have always attracted and shaped many urban developments, resulting in a close and integrated water-city relation (Butuner, 2006; Breen et al., 1996). Dramatic changes occurred due to the industrial revolution affecting the relationship with water bodies, yet by the mid-20th century industrial activities began to move to outer city zones, leaving vast lands and presenting an opportunity for revitalising these areas (Butuner, 2006). Lakes have an unquestionable value as an ecological, recreational and economic resource to urban areas. Nonetheless, lakes are subject to serious pollution problems as they function as sinks for streams and lakeside activities, both from point sources such as domestic and industrial and non-point sources such as agricultural run-off and land use activities (Abdullah, 2009; Golubev, 1989). A sustainable approach should find a balance between human needs and the ability of the water resource to recover and regenerate. Such an approach need recognise the intricate relationship between the land activities and the water body.

2.1.1 *Functions of Lakes*

To know the need and importance of the thesis topic let us consider the functions of lakes. From the viewpoint of management of lakes, while it is of great importance and desirable to protect, and mostly necessary, rehabilitate or restore them against degradation of the habitat (e.g. by siltation) or water quality (by domestic sewage, industrial effluents, or other wastes) to maintain their primary functions, the revitalization and restoration must accord the highest priority to natural lakes as ecosystems with multiple functions and values.

The functions of lakes as ecosystems are to provide goods and services that are of great value to humans. Ground water recharge and flood mitigation are services provided by the hydrological function. Water is valued by humans for drinking, bathing, irrigation, power generation and other uses. The biological production in lakes provides for food such as fish. The lakes also provide many socio-cultural and recreational benefits; some of which are translated into direct economic benefits through tourism. Thereby this research topic along with thesis will help to revive the lake to serve to nature with its services.

2.1.2 *Ignorance of Historical Context*

The landscape of Madan Mahal is a perfect blend of heritage, nature, urbanity and has religious and spiritual significance. One can see religious harmony in the Madan Mahal complex, where on one edge is the mosque complex with Dargahs and the other edge has the Sharda Devi temple. Also located in the vicinity is the

Osho Ashram as well as the Bajnamath temple complex next to the Sangram Sagar. One can see lot of untouched beautiful lakes dotted around the entire Madan Mahal zone. The area also boasts of two public green zones one near the Osho ashram and other near the Sangram Sagar.

2.1.3 *Lack of Ecological Awareness*

The area has rich density and diversity of some species of medicinal importance like *Gymnema sylvestre*, *Butea superba*, *Mucuna pruriens*, *Andrographis paniculata*, *Barleria cristata*, *Aegle marmelos*, *Feronia limonia*, and *Celastrus paniculatus*. These were encountered throughout the site with almost every second tree supporting the climbers. The area surrounding the Thakur Tal has rich diversity of aquatic plants. A big patch (50 sq m) of threatened insectivorous species *Drosera burmannii* was located on the western boundary of the pond along the stream as well as *Drosera burmannii* along the catchment stream, which charges the reservoir were recorded from the area. It is good indicator of the kind of vegetation the area can support. It needs protection from trampling by cattle and human beings. The area supports rich herbaceous vegetation, including grasses and sedges. Thus protection of flora and fauna becomes a main goal.

2.2 Issues and Problems

Studies carried out in present investigation revealed that one of the most important causes of water pollution is unplanned urban development without adequate attention to suitable management of sewage and waste material. Lake Conservation Authority of Madhya Pradesh has done a survey to measure the quality of water of some lakes of Jabalpur and it is observed that almost all the lakes of Jabalpur are affected with pollution. Supatal, Balsagar and Hathital are polluted with high TDS and this is because of pollutants which comes with the effluents from nearby drains, water is highly turbid in maximum lakes and value of turbidity exceed the permissible limits, Nitrate percentage is more in Gangasagar, Sagda Talab and Machrhi Bijori Lake, although it is within permissible limit and pH range of 6.5 to 8.5 is normally accepted as per guideline suggested by WHO. In this study pH values were found in the range of 7.5 to 8.5 in the water samples. This shows that pH was observed to be slightly alkaline in nature in all the lakes of Jabalpur city.

2.3 Future Potential/Outcome

Reviving Sangram Sagar Lake will help shape future of Jabalpur city. It will control lake pollution, Cultural and Economic development of the lake and its setting, tourist inflow, accommodate all user groups in an urban nature environment. Lakes sustain all kinds of life forms and a project like this can be a

medium through which the general populace can be educated about the need to revive water bodies. Such initiatives are easy to plan and implement and can trigger an hour-needed environmental revolution in urban cities. For a model like this to work, it is crucial for local people to collaborate with other stakeholders to successfully utilise resources and ensure the protection and conservation of green and blue spaces in cities. Further, implementation of integrated water resource management strategies are essential to maintain, augment and manage India's water resources.

3 Aim, Objective and Scope

3.1 Aim

The aim is to retain, restore and revive the identity of Sangram Sagar Lake, the importance it holds through a holistic landscape design approach whilst catering to its immediate surroundings and development of the city.

3.2 Objectives

Sangram Sagar Lake has huge potential to become an exceptional natural space in the middle of a dense urban city.

- To retain the existing catchment area of the lake.
- To revive lake peripherals and lake body, ecosystem and bring sustainable maintenance of the lake through controllable measures.
- To retain the quite rural character, valuable areas and the heritage value identification of the temple.
- To restore the vacant lands and available shores into accessible, green spaces with higher biological, ecological and recreational values, create social meeting space with new values for sustainable tourism and leisure.

3.3 Scope

- To give it a natural edge; this will restore biodiversity and support the stability of the lake ecology and to soften the transition between the constructed and natural edges through planning and materials.
- To design a place to move around the lake as to establish it as a fine urban space as well as natural, recreational area.
- To develop a context-sensitive design in the surrounding areas to create a better urban nature program; temple precinct to have its identity and integrate with other structures in its premises.

3.4 Methodology

The methodology to be adopted will be to follow the following list in order:

- Collection of available data of the site- history, government tender document, water quality reports, etc.
- Literature study – about lakes, management and conservation of lakes, treatment of lakes, case studies, cultural and historic value of lakes and lake revival as a measure for the development of a city
- Prepare a research paper of all the above data
- Site visit- record observations

- Site analysis- topography, vegetation, climate, surface hydrology, geography, history, land use water quality and soil test, etc.
- Landscape Character analysis, activity mapping, spatial analysis, etc.
- Community needs and demand study
- Site constraints/Issue identification- detail key issues of the site needed to be resolved for the revival of the lake
- Prepare an outline map for integrated restoration of Sangram Sagar lake-catchment area, sustainability, tourism and visitors, and water treatment methods
- Develop a conceptual plan for site opportunities

4 Literature review

4.1 Lakefront Development

Development of land and water can indeed be complex processes, with many regional variations. Every user, country and city has different approval processes, different geotechnical and hydrological factors, and different lakefront perspectives. With decades of international experience, people have come to understand the "big picture" of global development on the lake front and have created a way to break down the development process on the lake front into universal, manageable pieces while maintaining a place for variation and singularity.

The most complex and difficult plans of all the landscape plans are the urban lakefront landscape plans. It usually consists of a greenbelt, architecture, arrangement of landscapes and shorelines. A lakefront area is closely linked to water, so it has different characteristics of the landscape from other places. It has five features:

a. Natural biological aspect:

The water system structure contains soil and geology atmosphere, hydrosphere, and biosphere; there are also some communities that include animals, plants, and microbes, of course. Compared to other parts of a city, there is less change in lakefront areas, the environment is well protected, and not much pollution.

b. Public aspect Lakefront areas are the most public areas:

The nature of the lakefront area makes the ecosystem balanced in an ecological way. The lakefront areas have high-quality spaces, such as green belts, squares and sometimes sandy beaches, in economic terms. These are often set up shopping, walking and relaxing areas.

c. Historical cultural aspect:

Many years ago, in ancient times, the original places for people to live were the urban waterfront areas. It became the first place to be developed; it had a major impact on urban development. Water is also the door to communicate in transportation, trading, information and culture with other cities, all transportation was done on water at that time. In the lakefront areas, therefore, the culture emerged first.

d. Diversity characteristic:

The characteristic of diversity can be seen in three aspects. It consists of water, field, and superposition in the physiognomy aspect. It encompasses architecture, city and landscape in the spatial division aspect. As far as the

ecosystem is concerned, it is made up of water system and land system. So there is plenty of natural landscape in lakefront areas.

e. Characteristic aspect:

In Kevin Lynch's famous work, *The Images of the City* published in 1960, he said that space has five elements:

- Paths, such as the streets, sidewalks, trails, and some other channels;
- Edges, perceived boundaries such as walls, buildings, and shorelines;
- Districts, relatively large sections of the city distinguished by some identity or character;
- Nodes, such as focal points and intersections;
- Landmarks, readily identifiable objects which serve as reference points.

Channels are the easiest one among these that people can feel; lakefront space is the most obvious channel. (Kevin Lynch, 1960)

4.2 Lakefront as a Public Open Space

Cities are searching for a lake front which is a place of public pleasure. They want a lake front with ample visual and physical access to the water and the land, all day, all year round. Cities also want a lakefront that serves more than one purpose: they want it to be a place to live and work, and a place to play. In other words, they want a place that in all its aspects-economic, social and cultural which contributes to the quality of life. Urban lakefront as part of urban public space, has important functions like providing a comfortable, safe space, with pleasant hydrophilic aspects, which encourage recreation, learning, exercises, and enhance interpersonal communication between citizens, the water area should be designed to provide a wide range of activity, to meet people at different levels, different needs; the environment must be close to people's daily lives, to facilitate contact and make people feel warm; it should attract participants to activities and induce them to their creative potential, and thus a greater range of social interaction, exchange of ideas and cultural sharing. Through the lake front, people can be more exposed to nature, new friends, influence habits of people, shape social trends, enhance a sense of social awareness, and foster the modern yet traditional way of life, and promote social harmony.

Promoting Tourism and Boosting Local Economy - Lakefronts are a human gift and a valuable resource. Lakefront landscape is a good carrier that reflects the character of the city, providing people with very local charm. Not only is a lakefront rich in natural resources from the landscape, it also maintains abundant cultural resources from the landscape. Lakefronts provide entertainment venues

in a city to swim, fish, row, water ski, skate and other water activities. Lakefront landscape planning can revitalize the local economy and promote tertiary industry development.

4.3 Case Studies

4.3.1 Mansagar Lake, Jaipur

Mansagar Lake is situated in the northern part of Jaipur's modern city. Raja Mansingh-I, who reigned over Amer in 1610, built the lake. The Mansagar Lake was formed in the midst of Nahargarh hills (west side of the lake), Amer hills (north side of the lake) and Amargarh hills (east side of the lake), by building a dam on the Darbhawati River to address the drought in the surrounding lands. During his reign (1699-1744), Raja Jai Singh-II, who also founded the town of Jaipur (Pink City), south of the lake, increased the height of the dam. The lake today has an area of approximately 300 acres (1.21 sqkm).

Catchment area of Lake Mansagar:

The lake's catchment area covers an area of 23–24 km² and has three-sided hills surrounding the lake and the fourth (south of the lake) town of Jaipur. The run-off to the lake is carried by -Nagtalai Nala (natural channel) and Brahmapuri drain, which covers 60% of Lake Mansagar's urbanized catchment area. These drains carry heavy pollution from this urbanized catchment, which are the whole old Pink city of Jaipur and the northern part of the modern city of Jaipur.

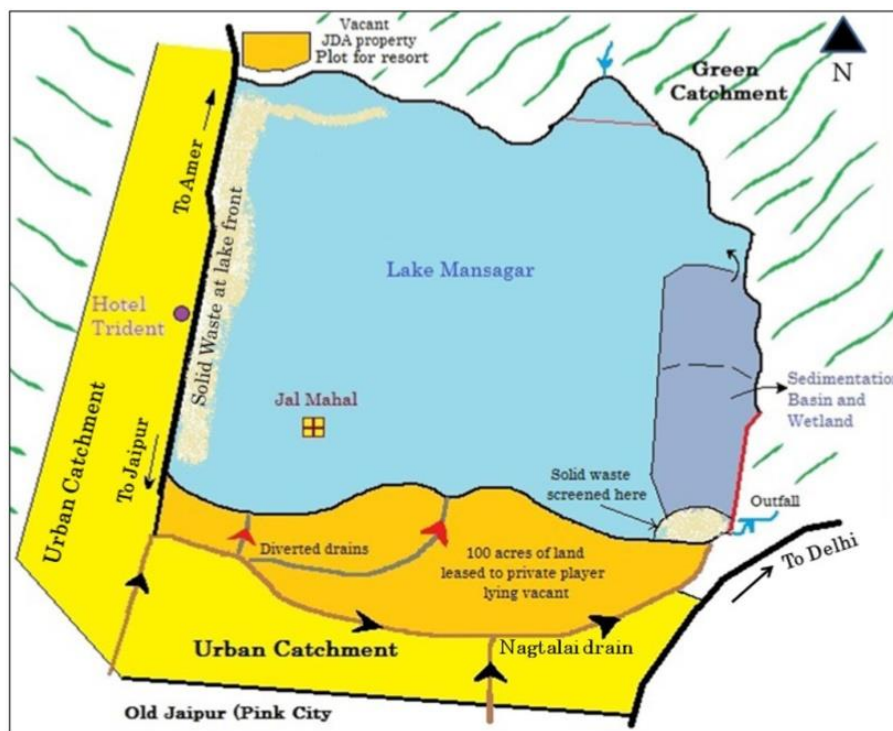


Figure 10 Catchment of the Lake, source- NIUA, author's illustration

Figure 10 illustrates the lake and its immediate catchment area's characteristics. It shows the areas where solid waste was found to be stretched along the front of the lake, indicating lack of maintenance and area cleanliness. The figure also shows the lake's diverted drains and sedimentation basin, which contributed to the lake's restoration. Vacant land plots in the northern and southern edges of the lake are the result of litigation arising from the revival of Lake Mansagar in the public private partnership. The figure also illustrates the lake's urban and natural catchment.

Issues:

The lake remained in good condition until the maharajas (former city rulers) ruled the city of Jaipur, but the situation became alarming when the Jaipur administration diverted walled city sewage through the Brahmpuri nallah and Nagtalai nallah drains into the lake in 1962. Growth of aquatic weeds such as water hyacinths suppressed algal growth and added dead organic pollution load leading to a drop in the water body's fish count. The lake became an example of polluted body of water, receiving sewage from the city. The lake's aquatic life worsened and migratory birds stopped reaching this natural habitat. An unbearable stench emanated from the lake and filled the lake bed with sewage soaked silt that posed a hazard to the environment and health. The lake became a breeding ground for mosquitoes.

Steps taken:

Cleaning the lake was a hard task. The first step was to monitor sewage and solid waste from entry through drains into the lake. As part of the initiative to divert drainage and storm water into a 7-meter deep sedimentation basin built on the lake's east side (toward the dam), a 1.5-km channel was built. This resulted in physical water screening and removal from water of solid waste and pollutants (primary screening). At the same time, the private player's second step was to dredge the lake bed. This increased the depth of the lake from 1.5 meters to over 3 meters, helping to increase the lake's storage capacity.

Water sample from the lake indicated that after passing through the sedimentation basin, the Biochemical Oxygen Demand (BOD) recorded a sharp decline. The BOD entering the sedimentation tank was 450 BOD, but at the point of exit it was reduced to 25. The lake's e-coli bacteria also shrunk to just 7,000 in 2009-113 from 2.4 million in 2000.

In addition to these two major steps, several other measures have helped to restore the water body. Also to treat 7 million litres of waste water daily and discharge the treated water into the lake, two sewage treatment plants were built. This water source helped to ensure water supply to the lake. The Mansagar Lake used to dry up in the summer before the restoration effort, but it remains perennially full. Five nesting islands were created to attract migratory birds to

attract flora and fauna, fish were introduced and giant bubblers were installed to aerate the lake.

4.3.2 *Hauz Khas Lake, Delhi*

Sultan Allauddin Khilji, the then ruler, built the Hauz Khas Lake in 1295 for the inhabitants of Siri, one of Delhi's seven cities. It was originally called Hauz Alai after Allauddin, but Firoz Shah Tughlaq, who had it de-silted in 1305 (Stephan, 2002), changed the name to Hauz Khas ("royal tank"). The lake, covering an area of 58515 sqm and with an effective depth of 2.20 m, dried up a few decades ago because it was diverted due to construction work by the storm water drains that fed it. Due to urban development and new residential colonies, a shrinking catchment area added to its misery. Even though during the monsoon season, July-September, the lake used to fill up, it just couldn't hold the water long.



Figure 11 Hauz Khas Lake, Delhi



Figure 12 Floating Islands, Hauz Khas Lake

Though on all three fronts, the project scores well. There is scope for improvement, especially on the social front, in economic, environmental and social terms. The environmental benefits of the project should be better publicized, increasing environmental awareness, particularly of the local community. By advertising and explaining the water, quality parameters may allow the mental block many residents have against recycled wastewater to be completely removed in time. Some residents also complained that there has been an increase in the number of mosquitoes since the lake's revival. Others contradicted them, though. It can be projected as a major tourist spot of the city as the site combines history and nature. The floating fountains, abandoned due to some snags, can be revived to make the site more attractive. They could also reintroduce boating.

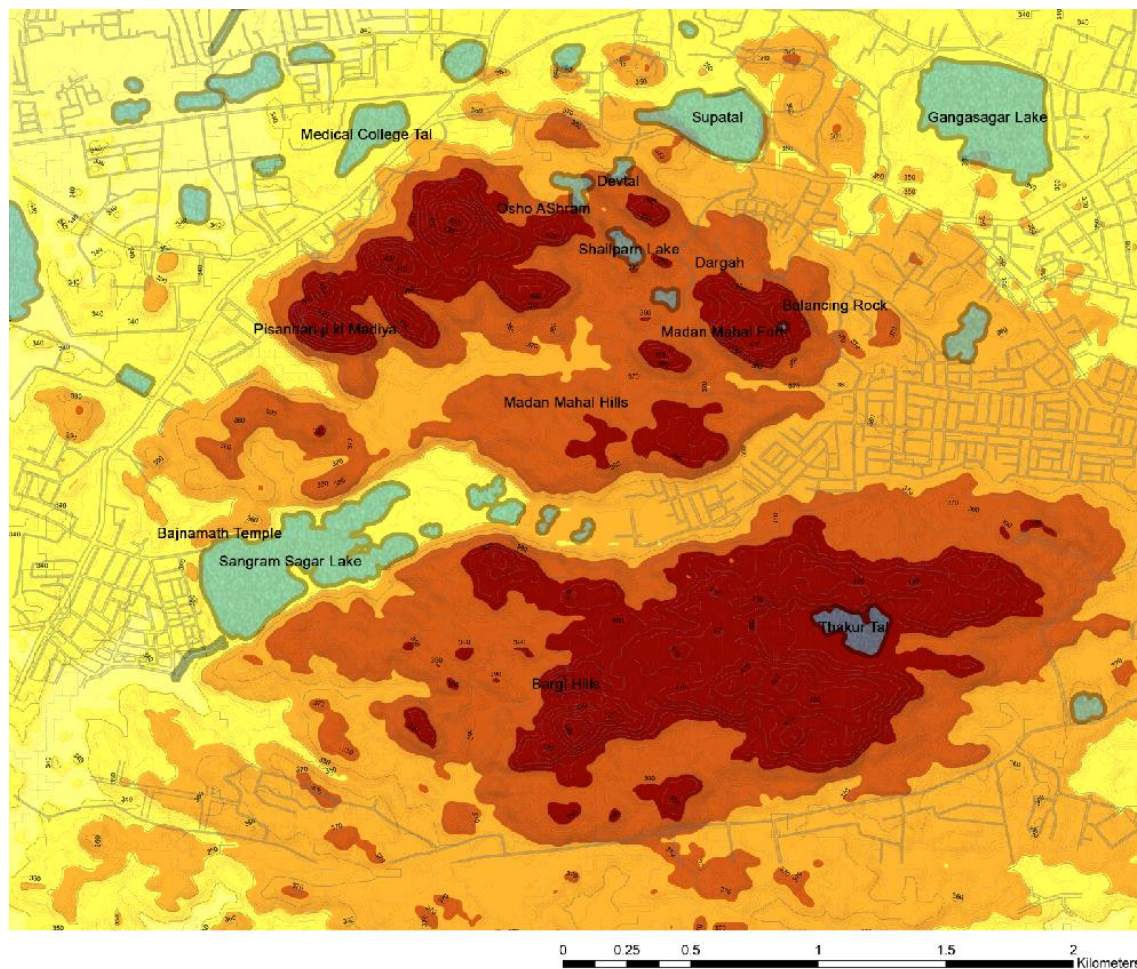
	Objectives	Measures	Initiatives	Performance Indicators
Economic	<ul style="list-style-type: none"> - Long term financial sustainability - Bringing down cost of water supply including tankers and borewells 	<ul style="list-style-type: none"> - Recovery of capital cost - Cost of water supply - Life cycle cost 	<ul style="list-style-type: none"> - Using existing STP as water source - Using natural gradient of land to reduce pumping costs - Using cascade aerators to reduce electricity costs 	<ul style="list-style-type: none"> - Capital cost recovery within short period due to reduced cost of water supply - Annual maintenance cost recovery in terms of health and recreation
Environmental	<ul style="list-style-type: none"> - Restoration of lake and surrounding environment - Recycling of water - Raising of Groundwater Table 	<ul style="list-style-type: none"> - Water Quality (CPCB norms) and Quantity - Ground Water Level - Per Capita Water availability - Revival of lake ecosystem 	<ul style="list-style-type: none"> - Using treated water from STP as a continuous water source - Frequent water testing by CPCB - Additional bioremediation of water - Composting of collected waste - Introduction of fish to tackle algae/ weeds - Using aerators 	<ul style="list-style-type: none"> - Permanent presence of water in the lake - Water Quality in accordance with CPCB norms for lakes - Rise in groundwater table - Ease of watering in adjacent parkland - Reuse of waste as compost - Presence of variety of water birds
Social	<ul style="list-style-type: none"> - Increasing water availability - Enhancing aesthetic value - Creating recreational space - Improving public health 	<ul style="list-style-type: none"> - Better household water supply - Aesthetically pleasing surroundings - Number of visitors - Air and water quality 	<ul style="list-style-type: none"> - Development of adjacent parkland - Provision of boating - Creation of walkways and shelters - Introducing moving fountains in the lake - Spraying insecticides for mosquito removal - Public discussions to explain benefits 	<ul style="list-style-type: none"> - Increased satisfaction with domestic water supply - Increase in visitors in the surrounding areas - Increase in morning walkers - Increase in photographers and birdwatchers - Visitor satisfaction

Table 1 Hauz Khas Lake Project: Sustainability Matrix

5 Site Analysis

5.1 Topography Analysis

Jabalpur's topography is really admirable. Throughout the city there are hills that give a picturesque setting. The hills contain mineral deposits and ancient remains, making them subjects of great interest to geologists and archaeologists. Here the hills are rocky with countless barren hills. The city has lots of lakes and water tanks. The city is also located in the ranges of Vindhya and Satpura. Rivers, hills and plateau intersection add to the majesty of Jabalpur's landscape.

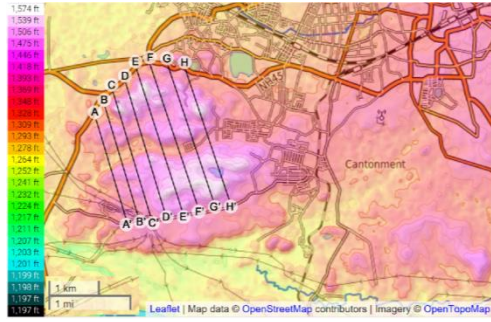


Map 5 Topography Analysis Map

LEGEND:

Altitude (m)

- 307 - 324
- 324 - 338
- 338 - 350
- 350 - 368
- 368 - 390
- 390 - 436



Map 6 Key Map

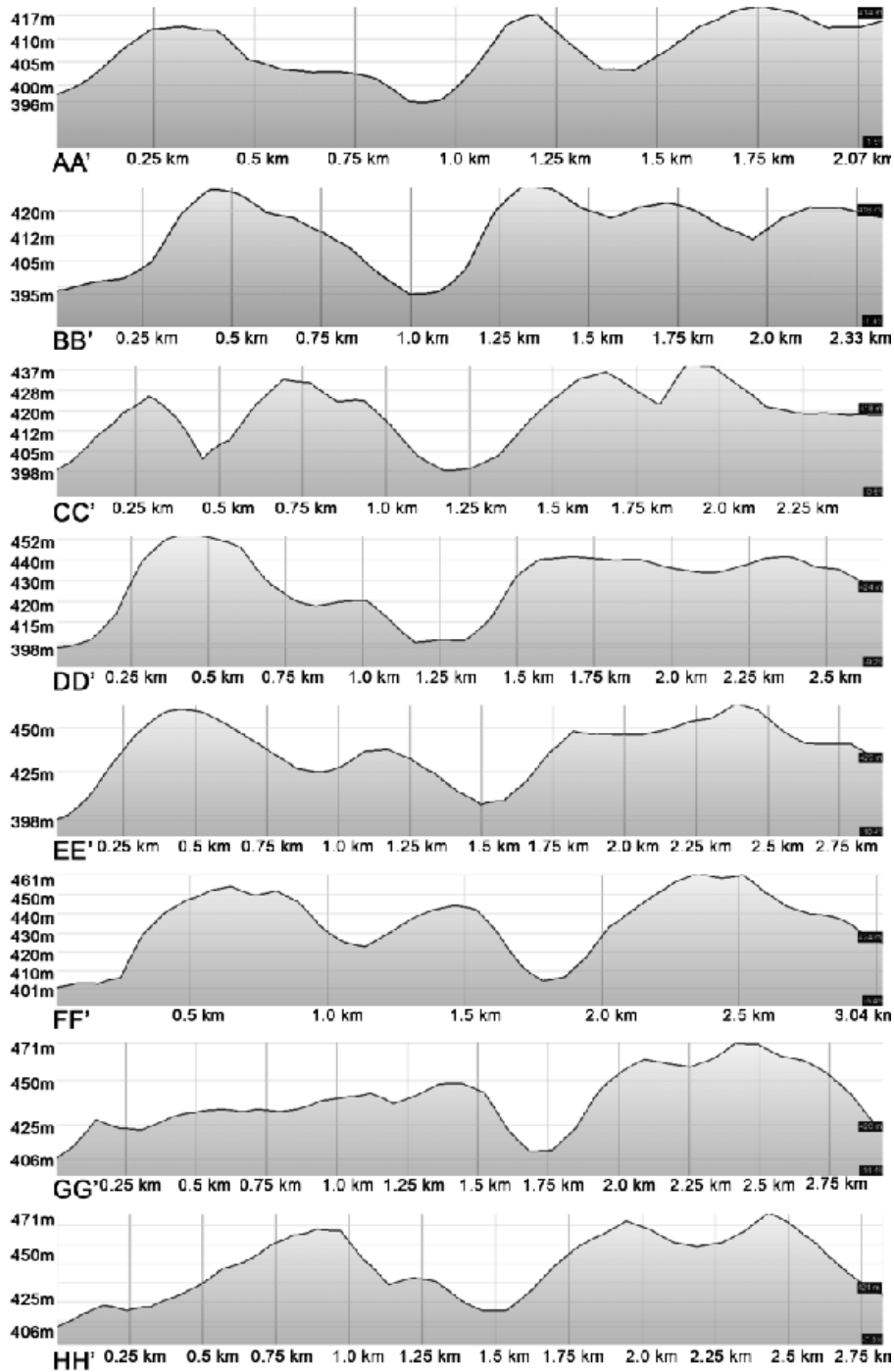


Figure 13 Sections

5.2 Slope Analysis

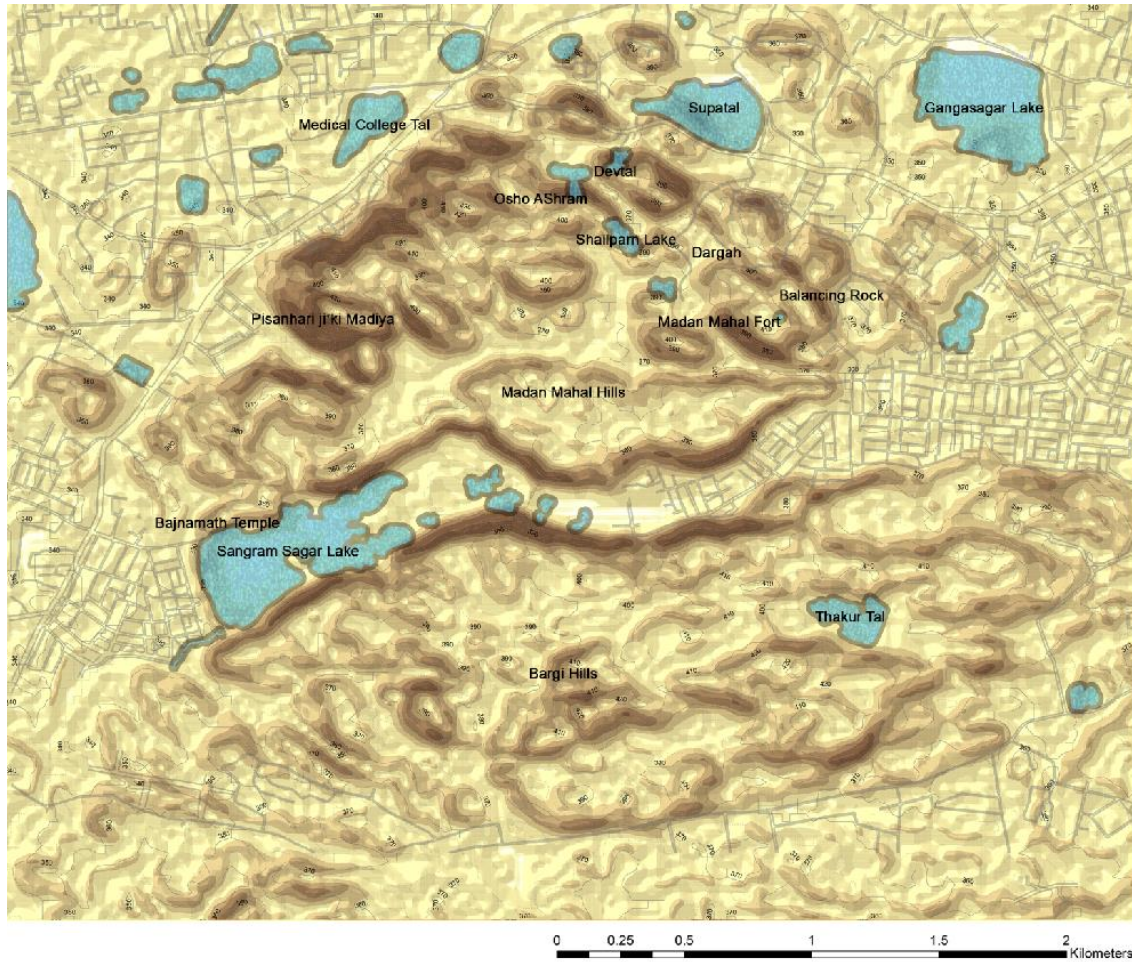
Slope is an important determinant as it affects terrain hydrology, soil depth and susceptibility to erosion, potential for recharge and storage of the surface, and vegetation. Slope also determines the suitability as well as conservation measures for different land uses. Since the study region's topography is highly undulating with hills, deep valleys and plateaus, it has a wide range of slopes. For analysis purposes, the slope categories are as follows:

- Moderately Steep Slope (20-25%)
- Moderate Slope (10-15% and 15-20%)
- Gentle Slope (5-10%)
- Flat Gentle (0-5%)

The edges of the mountains (Madan Mahal Hills on the north and Bargi Hills on the south) are characterized by 20 per cent and above steep slopes. They fall sharply to the foothills, forming the Lake Valley of Sangram Sagar.

	SLOPE		ACCESSIBILITY	SUPPORT FOR VEGETATION	EFFECT ON GROUND WATER PERCOLATION	NATURAL SURFACE WATER COLLECTION	DEVELOPMENT
1	20-25 %	Moderately Steep	Difficult for walking, meandering roads can be planned	Difficult to establish vegetation	Very Less	Can be achieved	Difficult but can be achieved
2	15-20 %	Moderate	Steps for walking	Grass and ground Covers to be planter for slope stabilization	Less	Can be achieved	Can be achieved
3	10-15 %	Moderate	Ramps, cutting and filling required for vehicular roads	Grass and ground Covers to be planter for slope stabilization	Less	Can be achieved	Can be achieved
4	5-10 %	Gentle	Easy for Vehicular and Pedestrian Access	Vegetation can be achieved with measures	High	Easily possible	Possible
5	0-5%	Almost Flat		Vegetation can be established easily	High	Easily possible	Easily possible

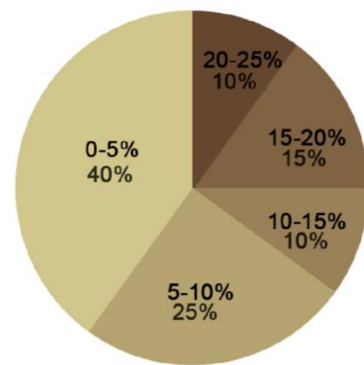
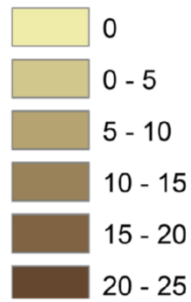
Table 2 Slope Category and Analysis



Map 7 Slope Analysis Map

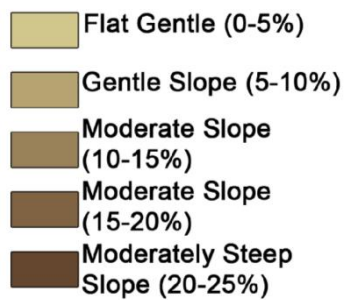
LEGEND:

Slope (%)



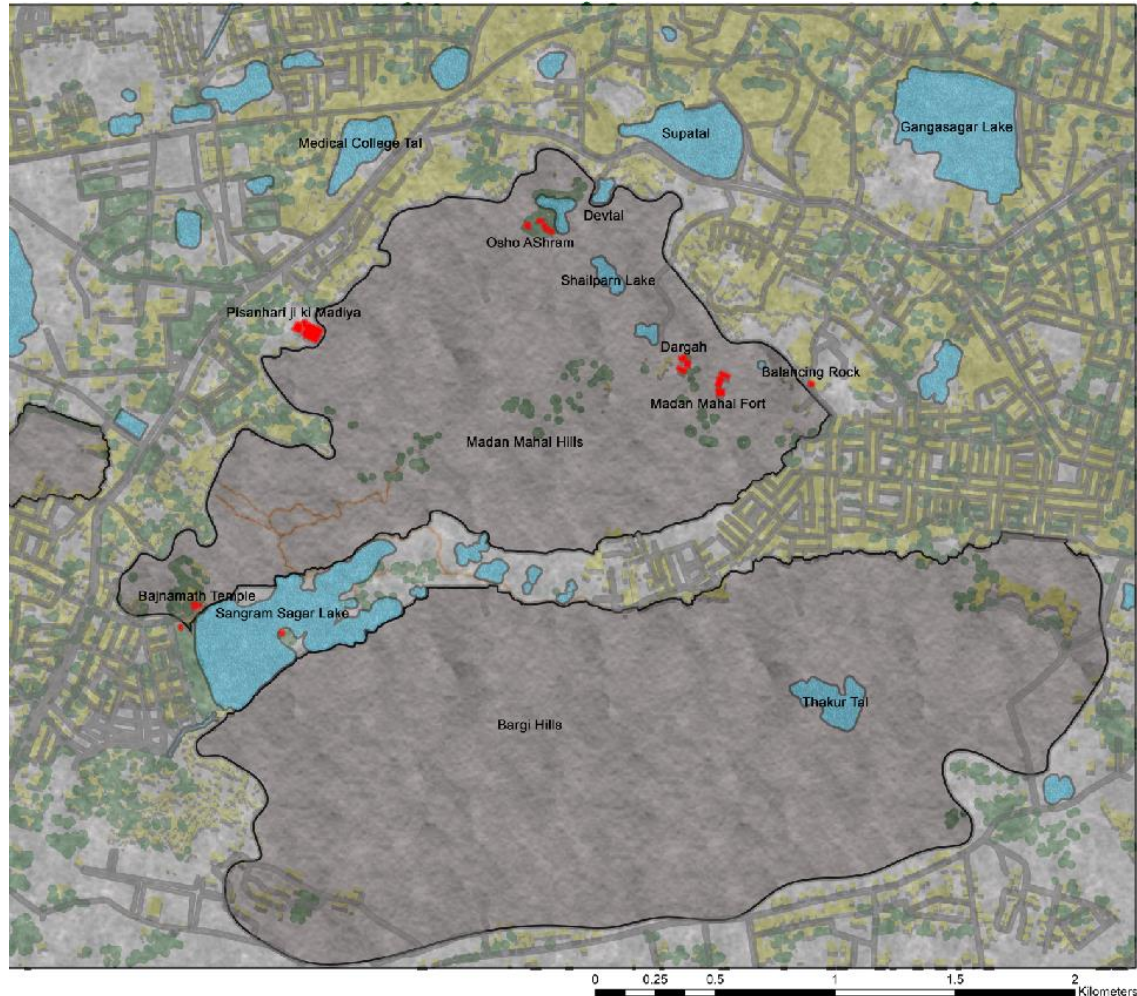
Graph 6 Percentages of Slope Categories

LEGEND



5.3 Geology Analysis

The hills are full of rich deposits of calcareous, bauxite, clay, manganese, iron ore and many other useful ores. The Madan Mahal granites in the Mahakoshal group occur around Jabalpur in batholiths and conical hills. Most of the accessory minerals are microcline, quartz or plagioclase, hornblende, tourmaline, apatite, zircon, illuminite, etc. Jabalpur granite has a low content in Si, Na, and Ir but a low content in Al, Mg, Ti, or Ca.



Map 8 Geology Analysis Map

LEGEND:

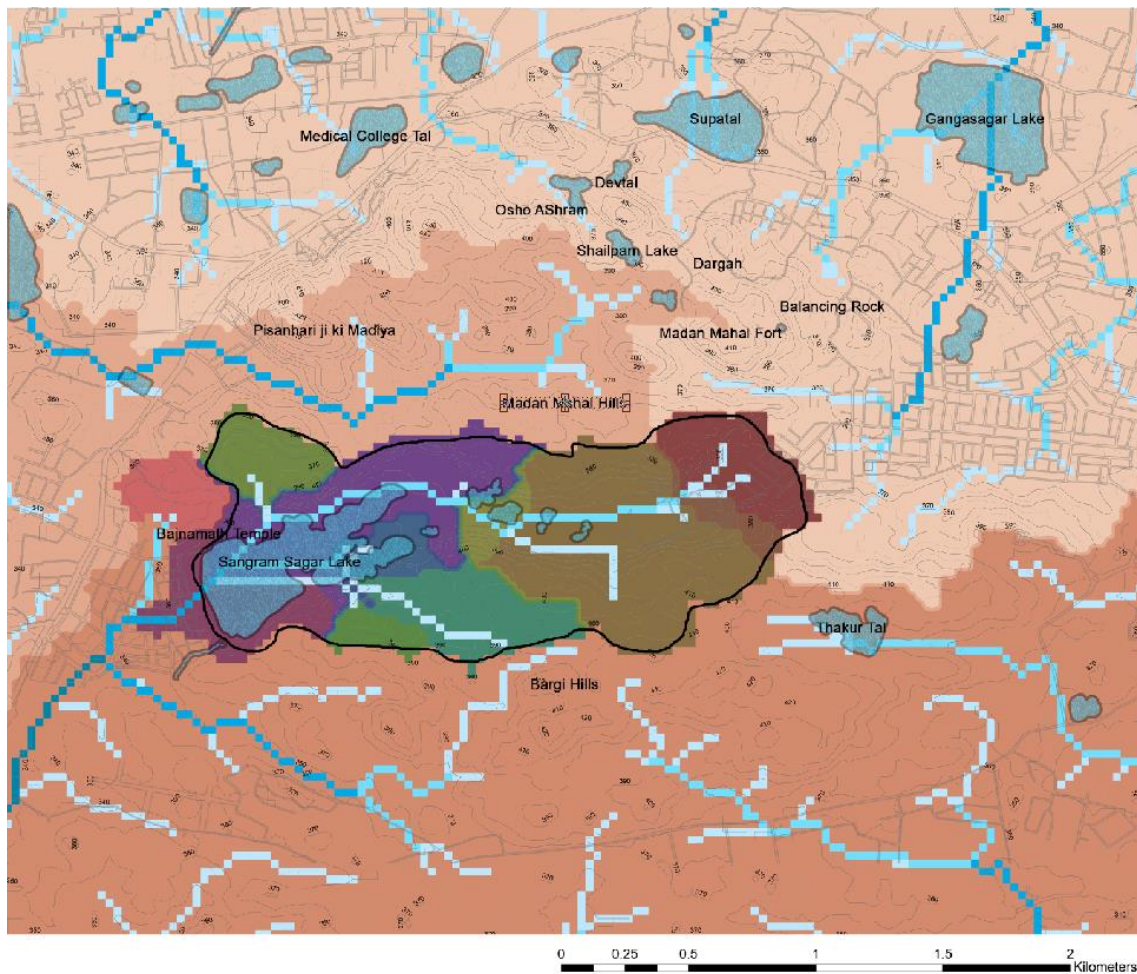
Denudational Origin



Granite rocks occur around Jabalpur very extensively. Most of the city of Jabalpur is situated in a valley with a thick deposit of alluvium soil. This region is home to Sandy Clayey and Sandy Coarse soil.

5.4 Hydrology Analysis

Jabalpur receives an average rainfall of 1386mm, that is highest in the months July and August (1600mm). The average ground water level of the region ranges between 30 to 80 m deep well. The site selected has an about 72% of average run-off due to slope and undulating topography, rocky surfaces which are mostly impervious and shallow soil depths. So the maximum rain water results in run-off. Sangram Sagar Lake is fed by rain water and remains perennial throughout the year. However the lake depth fluctuates from a drop of 1.5m from time of heavy rains to lean period season. The possibility of percolation of water is very less because of the rocky terrain. Check dam has been built on western face of Sangram Sagar Lake to store water.



Map 9 Hydrology Analysis Map

LEGEND:	
Stream Order	Minor Watershed
1	1
2	2
3	3
4	4
5	5
	6
	7
	8
	9
	10
	11
	12

Calculation of Watershed Volume-
Curve Number:

CN method has been adopted to calculate the runoff from the watersheds of the region. This method is based on the Manual on Artificial Recharge of Groundwater by the Central Groundwater Board. To arrive at the curve numbers, slope, vegetation, soil type, and land use has been considered and list is as follows:

Total Water Available in Watershed (Supply)

To calculate the amount of water collected in a given watershed, the equation is as follows:

Volume of water received in watershed = Average annual rainfall x area

Run off Calculation:

According to Soil Conservation of US-Curve Number Method,

$$S = (25400/CN) - 254$$

Where,

S= Retention (mm), CN= 0 to 100

So,

$$Q = [P - 0.2(S)]^2 / [P + 0.8(S)]$$

Where,

Q= Lake Flow (mm), P= Rainfall (mm)

Thus, to calculate total runoff volume,

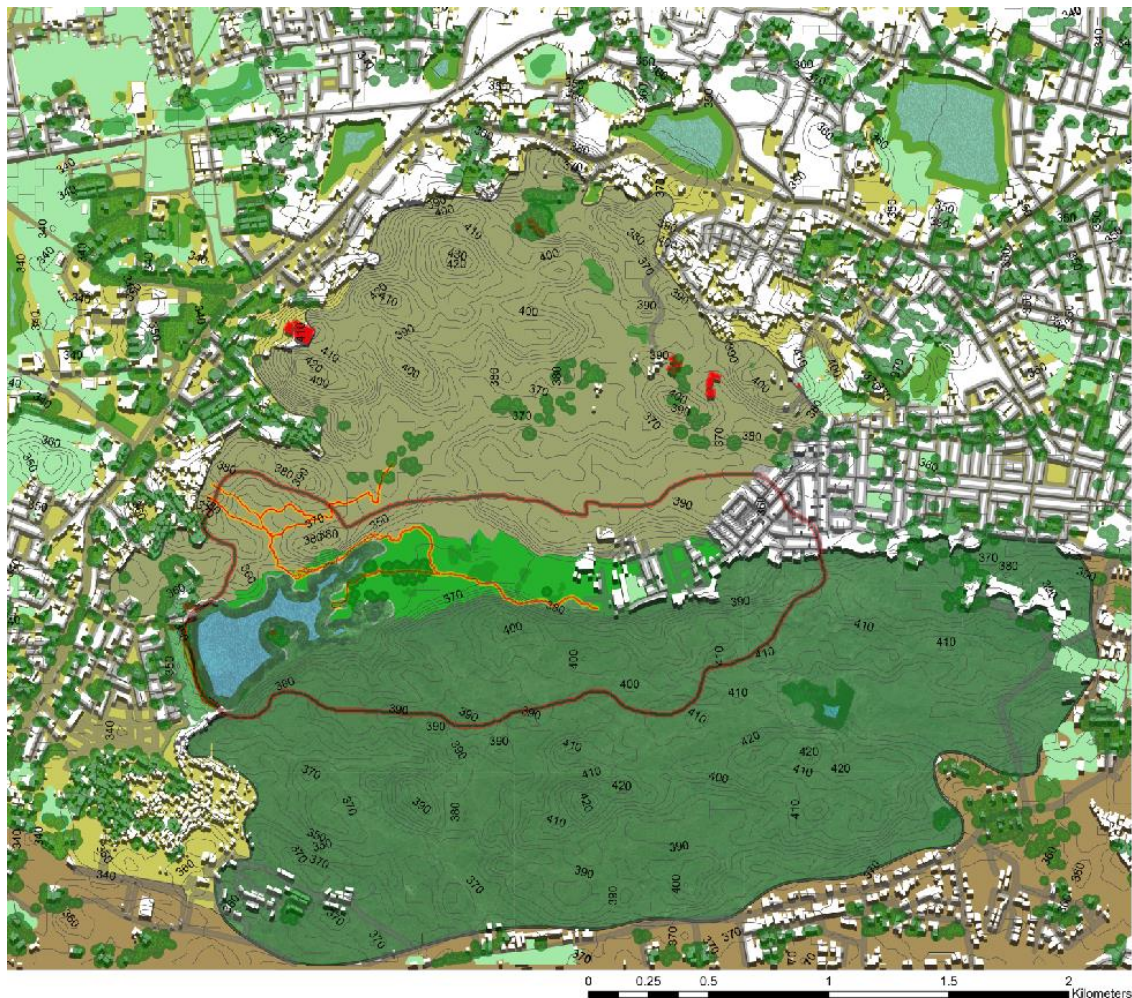
$$\text{Runoff Volume (cu m)} = Q \text{ (m)} \times \text{Area (sq m)}$$

MINOR WATERSHED	AREA OF WATERSHED (SQ. M.)	VOLUME OF WATER RECEIVED IN WATERSHED (CU. M.)	RUN-OFF (CU. M.)	RUN-OFF IN PERCENTAGE
1	161874.3	210436.5	178492.3	84.8
2	38325.4	49823.0	42800.9	85.9
3	404685.6	526091.3	437090.1	83.1
4	49806.7	64748.7	54919.8	84.8
5	124678.2	162081.7	143273.8	88.4
6	41322.4	53719.1	49325.9	91.8
7	183050.1	237965.1	226141.0	95.0
8	71318.7	92714.3	81955.8	88.4
9	28328.0	36826.4	32890.3	89.3
10	336281.62	437166.1	394263.6	90.2
11	156818.23	203863.7	187191.4	91.8
12	101477.54	131920.8	108797.8	82.5

Table 3 Run-off Calculation Table

5.5 Vegetation Mapping

The forest type of Jabalpur is attributed to relatively low rainfall and lower altitude i.e. 300m-400m above main sea level. Many species growing in this forest type are common to the moist deciduous forests. Mains species found in this type are *Anogeissus latifolia*, *Terminalia tomentosa*, *Diospyros tomentosa*, *Chloroxylon swietenia*, *Hardwickia binnata*, *Boswellia serrata*, *Soymida febrifuga*, *Mitragyna parvifolia*, *Madhuca indica*, *Lagerstroemia parviflora*, *Aegle marmelos* and *Butea monosperma*, etc.



Map 10 Vegetation Analysis Map

LEGEND:

- Forest Cover protected under MOEF
- Scrublands
- Medium mixed dry deciduous trees and shrubs
- Submerged Species
- Sparsely distributed trees and shrubs
- Water calltrop farming
- Barren/Rocky - very less vegetation

Bamboos occur as heavily browsed under growth and become bushy. These forests are fire-prone. Dry twigs and leaves thickly cover the forest floor. The forests have degraded due to repeated forest fires in the past and so some fire-hardy species are growing in these areas.

5.6 Visual Analysis

Sangram Sagar Lake along with Bajnamath Temple is a tourist destination site. It is also noted for its medieval architecture. The lake front park is a very popular picnic spot for local residents. Activities like kite flying, bird watching, picnic spot, leisure spot, religious activities, water caltrop farming, etc. can be seen in and around the site apart from normal religious activities. Site features include:



Figure 14 Sangram Sagar Lake



Figure 15 Bajnamath Temple



Figure 16 Sangram Sagar Lake Dam



Figure 17 Historical Monument



Figure 18 Hanuman Temple



Figure 19 Lake View during different times of the year

List of Landscape elements that can be seen in the above images are as follows:

- Landforms elements: create potential for different activities e.g. viewpoints from ridges can provide panoramic views of the surroundings.
- Water elements: presence of water bodies can be influential in shaping the landscape.
- Vegetation: quality of vegetation adds more value to vistas and enhances experience of the visitors.
- Views: visual continuity enables a person to understand the sense of enclosure of a certain vista.
- Accessibility: pedestrian and vehicular accessibility plays important role in visualizing spaces. For eco sensitive zones pedestrian accessibility is favourable. At the same time the designed spaces should accessible for the handicapped and disabled people of all age groups.

5.7 Activity Mapping

Sangram Sagar Lake along with Bajnamath Temple is a tourist destination site. It is also noted for its medieval architecture. The lake front park is a very popular picnic spot for local residents.

Activities like kite flying, bird watching, picnic spot, leisure spot, religious activities, water caltrop farming, etc. can be seen in and around the site. Shailpern Lake along with the garden is famous for picnic spot among couples and families.

The Osho ashram has restricted entry but is set in a natural landscape environment and sees foreign tourist inflow as well. The Devtal Lake with series of temples is a religious spot located on the Madan Mahal Hill.

The accessibility to these places is bit difficult and hence people are not in much favour to visit these places but have huge potential to be developed as landscape tourist sites.

Madan Mahal Fort and Balancing Rock are extremely famous tourist destination spot and for local people as well and see huge footfall throughout the year.

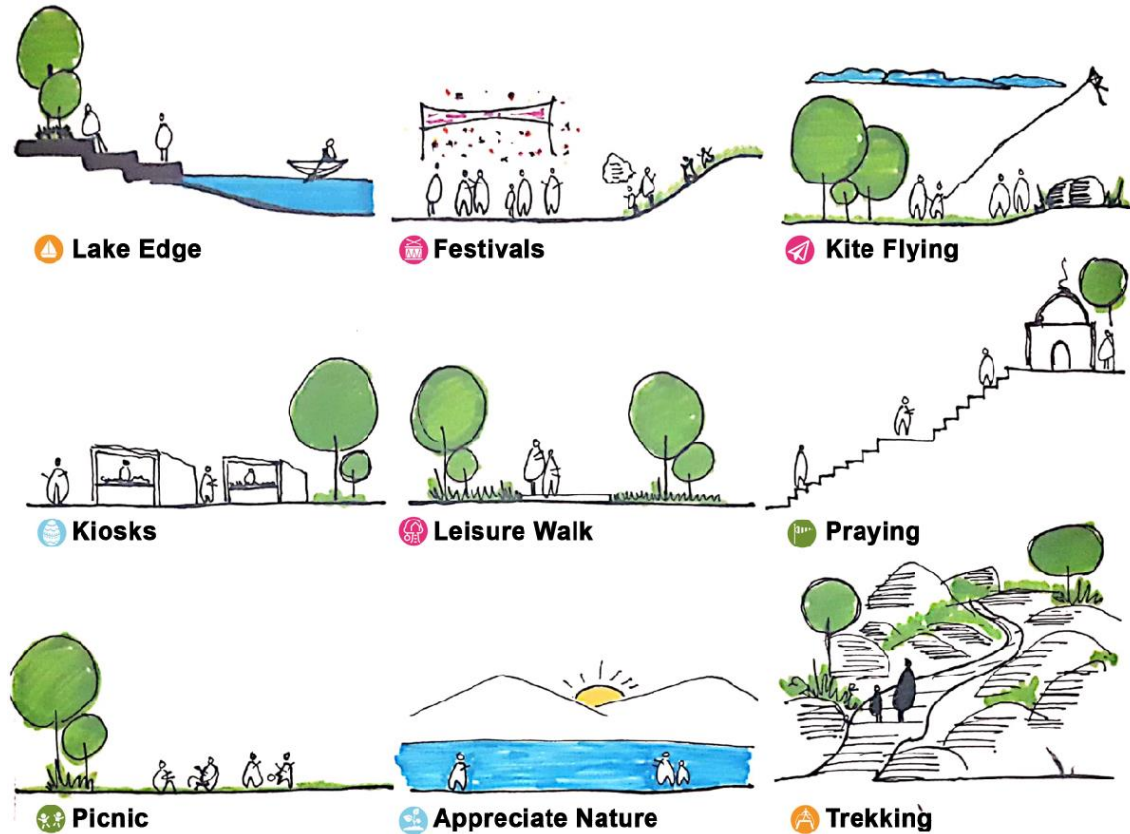
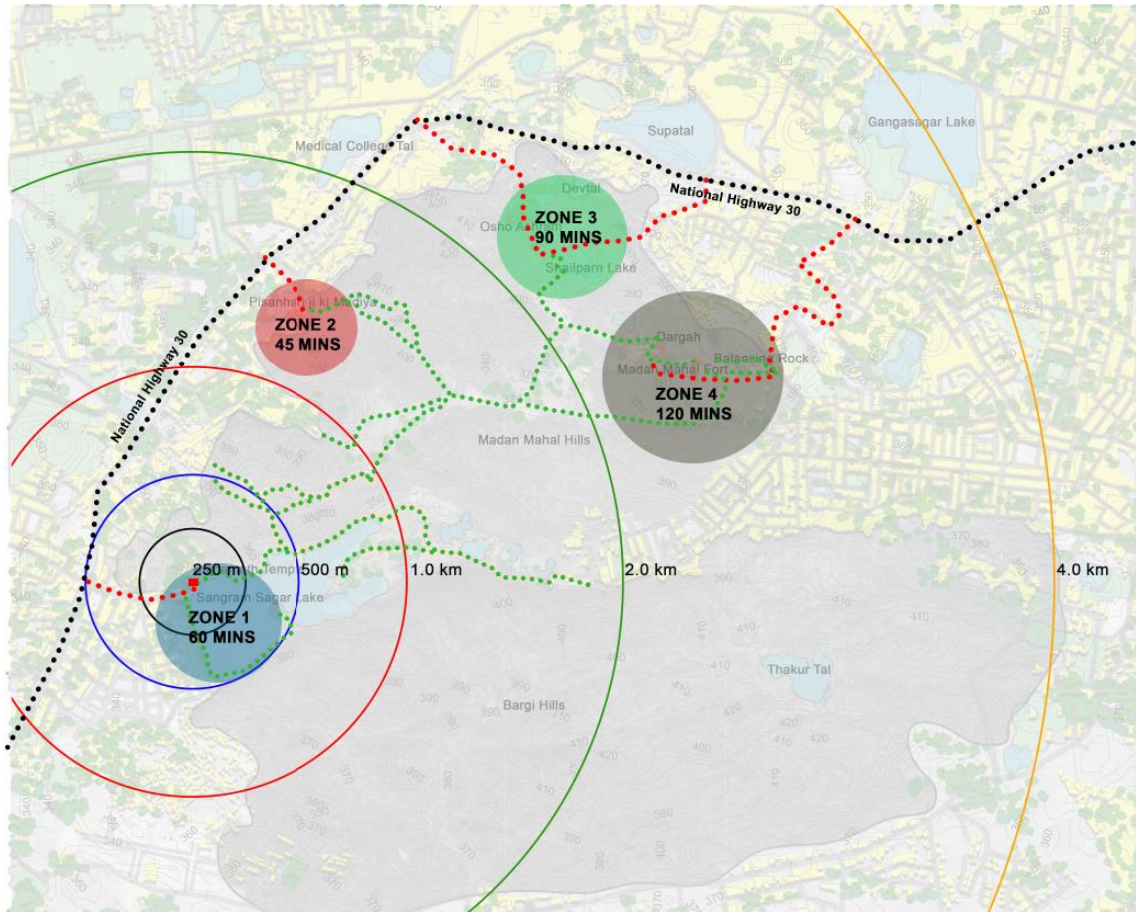


Figure 20 List of activities recorded on site have been show with representative sketches



Map 11 Map showing Circulation in and around the site

Zone No.	Key Areas	Average Footfall/Day	Activities
Zone 1	Bajnamath Temple Hanuman Temple Sangram Sagar Lake	180	Praying Shopping (Kisoks) Festivals Leisure Walk Picnic Appreciate Nature Bird Watching Kite Flying Boating
Zone 2	Jain Temple	120	Praying Trekking Dharamshala stay Festivals
Zone 3	Osho Ashram Devtal Lake Devtal Temple Shailpam Lake Shailpam Garden	300	Meditation Tourism Praying Leisure Walk Couples/Friends Picnic Nature Walk Bird Watching Festivals
Zone 4	Madan Mahal Fort Balancing Rock Dargah Sharda Devi Temple	380	Heritage Walk Appreciate Nature Trekking Praying Festivals Photography Picnic Leisure Walk

Table 4 Zone wise footfall and activities

5.8 Inferences

Topography Inference:

Highest altitude - 475 m

Lowest altitude - 380 m

The site is undulated with extreme rocky terrain; hence it would be very difficult and expensive to carve out road networks.

However pedestrian trails already exists and can be retained for future development so as to provide connections to various places.

Moreover the road network to connect the touristic places might not be in coherence with the natural character of the place.

The visual character of the hills is the attraction for tourists and local people and thus, due respect to the nature should be given while designing.

Slope Analysis Inference:

The Hills have gentle slopes at the top and are more of plateaus, showing suitability for vegetation, agriculture, low impact development (which does not hinder the visual character) and trails. The Bargi hills come under Ministry of Environment and Forests and hence cannot be intervened.

Soil erosion adversely affects the vegetation cover and hence the forest resources and agriculture that depends on the local community. Thus, it can be inferred that soil erosion affects people's livelihood directly and indirectly and also results in the lake's siltation.

Geology Analysis Inference:

Jabalpur has more or less complete sequence of geological formations like Achaeans, Vindhyan, Gondwana, Lameta, Deccan trap and Intertrappeans. The region comprising of Bargi hills constitutes Deccan trap characterized by hilltops and terrace like formations. The area has lameta beds occurring in patches along with limestone, sand stone and clays. A large area in this region is covered by Archaean formations which consist of conglomerate, phyllites, and mica schist, marble and ferruginous rocks. Soil of the study area is gravel to sandy loam in texture and usually blackish brown in colour.

The geology of the site has proven to be rich in minerals and thus, care should be taken to preserve the natural character of the site. As it form a distinctive feature.

The soil depth in the region is marked by rocky outcrops which are highly prone to erosion and show barren rock faces. The major portion of the study region is covered by shallow to moderately shallow soils ranging from 20 to 30cm deep. Deep soils in excess of more than 100 cm are found at very few places.

The absence of vegetation on hills marks the poor soil quality and indicates concern for the variety of species that can sustain.

Hydrology Analysis Inference:

The settlements have come up in the valley region of the lake which hinders the run-off.

The watershed should be devoid of settlements and construction; such that water directly flows in the lake. No major development should come in the minor watershed of the lake.

Vegetation Inference:

The area has rocky terrain throughout the Bargi hills up to Madan Mahal. There is a clear demarcation of biotic interference and protection along the Madan Mahal hills. The area nearing habitation shows signs of heavy biotic pressure. As a result, the hill is devoid of tree vegetation. The areas protected from pressure are Thakur tal and Bargi hills bordering the MPEB campus towards the Nayagaon, Purwa and Sangram Sagar and therefore has comparatively dense vegetation which can be clearly divided into tree, shrub and herbaceous layers.

The major tree species along with local names and importance can be highlighted at regular intervals by putting signage.

A nature trail can be developed around Thakur Tal and Bargi hill adjoining Nayagaon. Signage highlighting no disturbance zone can be put at the vantage points.

Since the area around Madan Mahal fort is devoid of tree species that area needs to be covered with plantations of representative species of the areas involving local people.

Bird watching points can be identified so that interested visitors can make use of the area.

Activity Mapping Analysis:

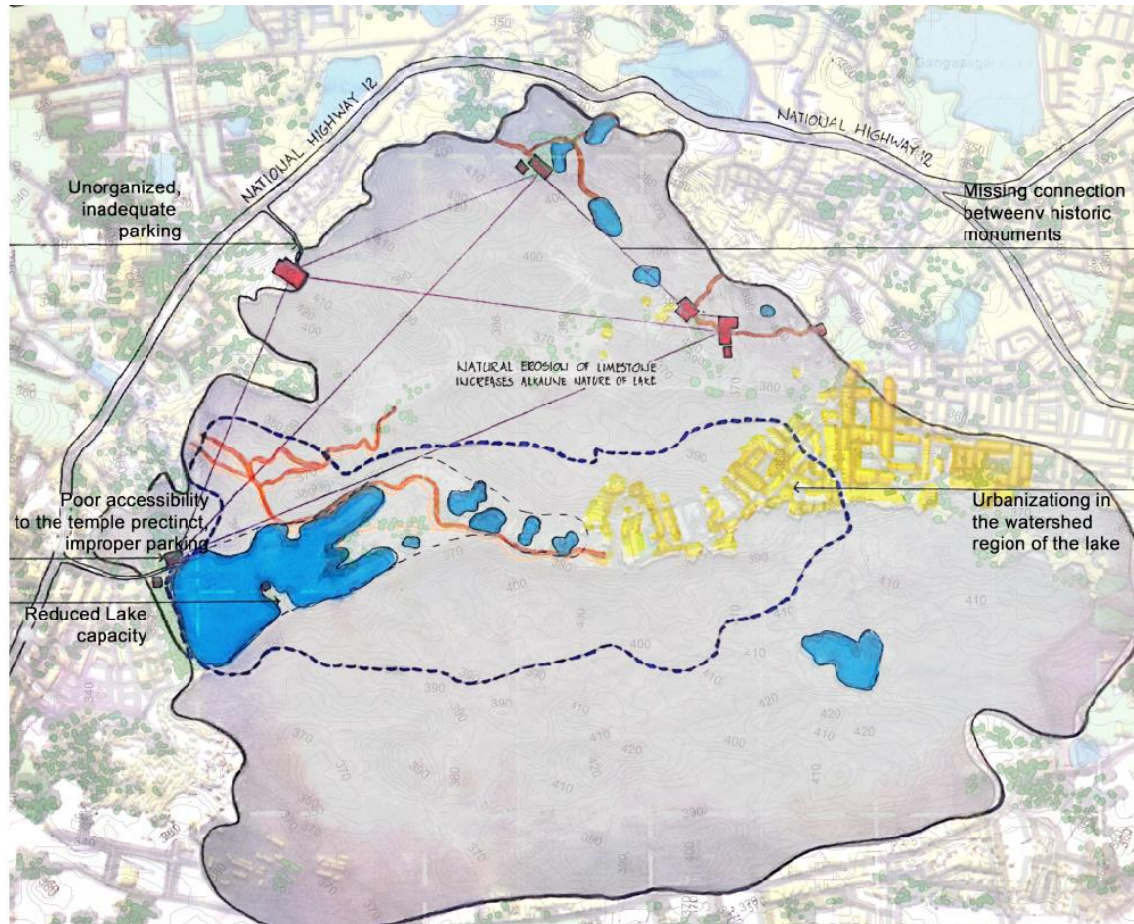
The visitors shall experience the city of Jabalpur and its neighbourhoods as never before. The idea would be create awareness about the history and culture of this important centre and lesser known parts of the city. People of all age groups can enjoy heritage as not only the past but a living tradition. These guided tours will go a long way in keeping the socio-cultural roots of the city alive and give a boost to tourism as well.

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6 Issue and Site Identification

6.1 Issues and Problems



Map 12 Issue Identification Plan A

Issues	Information
Algal Bloom	The erosion of rocks brings nutrients in the water body which give rise to algal blooms. Not all algal blooms are destructive to environment but excess growth of water hyacinth causes lake pollution, hinders visual appearance, and affects lake quality.
Invasive species	Non-native species influence propensities and fisheries, spread illness, and compete with local species for nourishment.
Urban Sprawl	The greater our cities worship to develop, population and urbanization tends to grow which end up taking more space in the limited space. This impacts the environment character, influences water quality, reduction in lake size, reduction in catchment of the lake.
Climate Change	Temperature is changing around the world, and these changes influence water loss, evaporation of water. It also causes natural conditions to changes such as algal bloom.

Eutrophication	Natural siltation is hard to prevent as erosion is a natural process. This causes lake to convert into a wetland after some years and eventually dry up over a period of time.
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Sedimentation/Turbidity	Suspension of silt can be disservice to water quality and aquatic species.
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Table 5 Identified Lake Ecology Issues

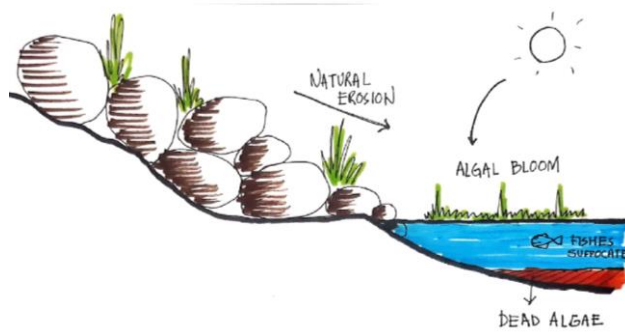


Figure 21 Effect of Algal Bloom on Lake Ecology



Figure 22 Issue Identification Plan B

Issues Identified at Plan B:

1. Reduction in Lake Size
2. Lake Pollution because of various reasons
3. Improper Parking
4. Unorganized Vendor distribution along access road
5. Ruined state of temple precinct, seating spaces, existing ghat, etc.



Figure 23 Unorganized Vendors, Lake Pollution and Ruined State of Temple

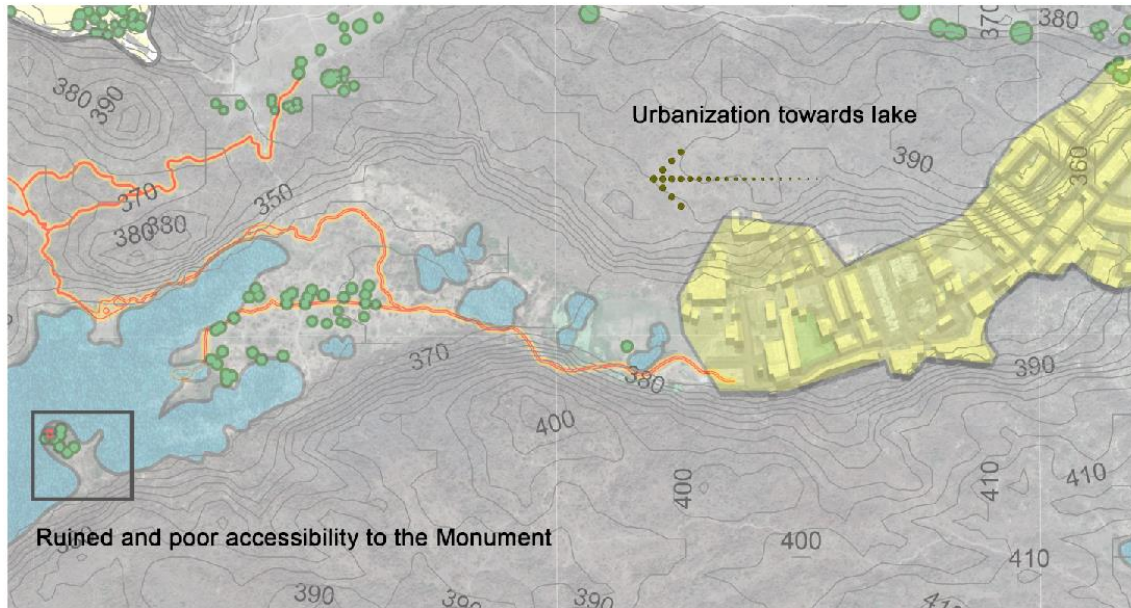


Figure 24 Issue Identification Plan C

Issues Identified at Plan C:

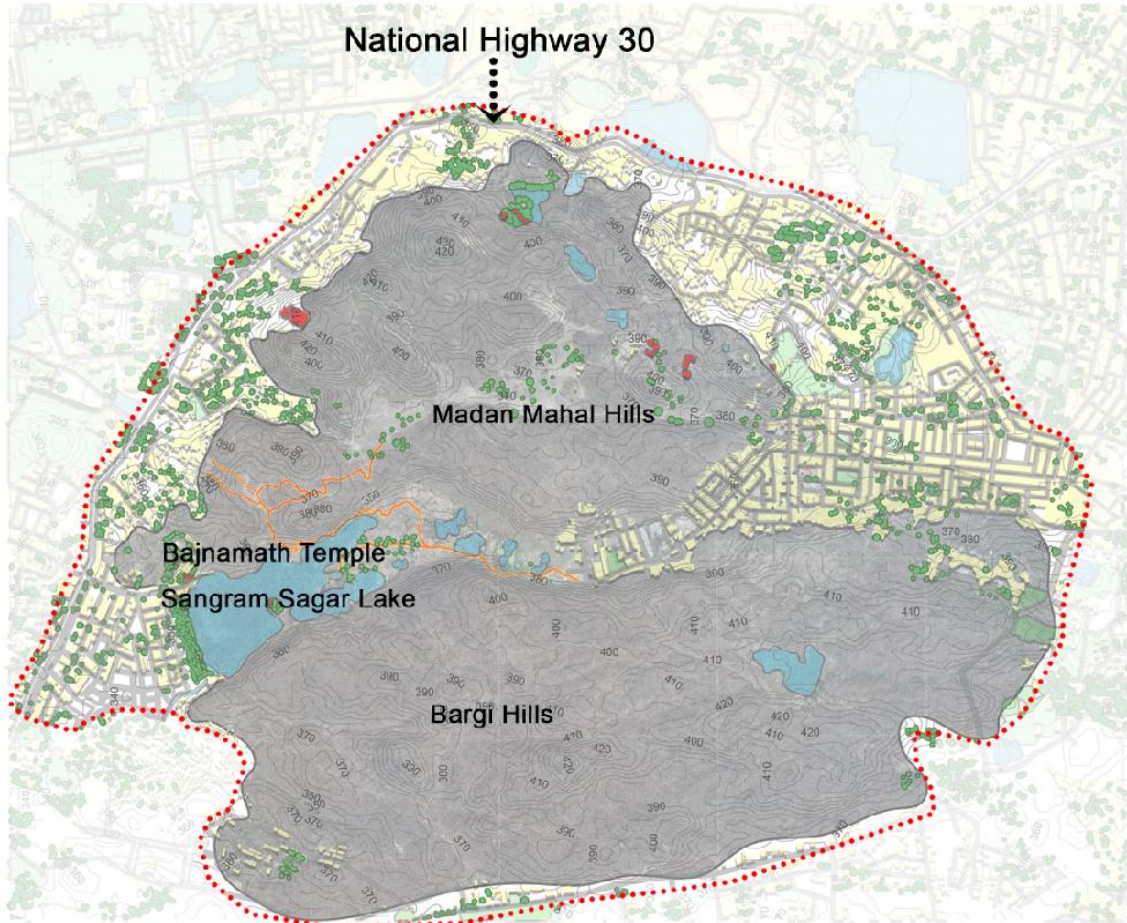
1. Urban Settlements coming up in the valley region of the lake
2. Agricultural farmlands turned into Residential areas
3. Waste from Urban settlements are directly and indirectly released into the lake
4. Anthropogenic activities pose threat to the lake
5. Ruined state of Historical monument located in the lake and its accessibility is also an issue; can be improved to preserve the heritage of the city
6. Soil erosion, rock erosion, lack of vegetation, etc. also are a matter of concern
7. Degrading ecosystem and biodiversity in terms of flora and fauna both is also an issue that needs to be taken care of; site specific measures need to be taken
8. Unorganised temple street
9. Haphazard cultivation of water chestnuts.
10. Disregard for existing historic structure due to inaccessibility.



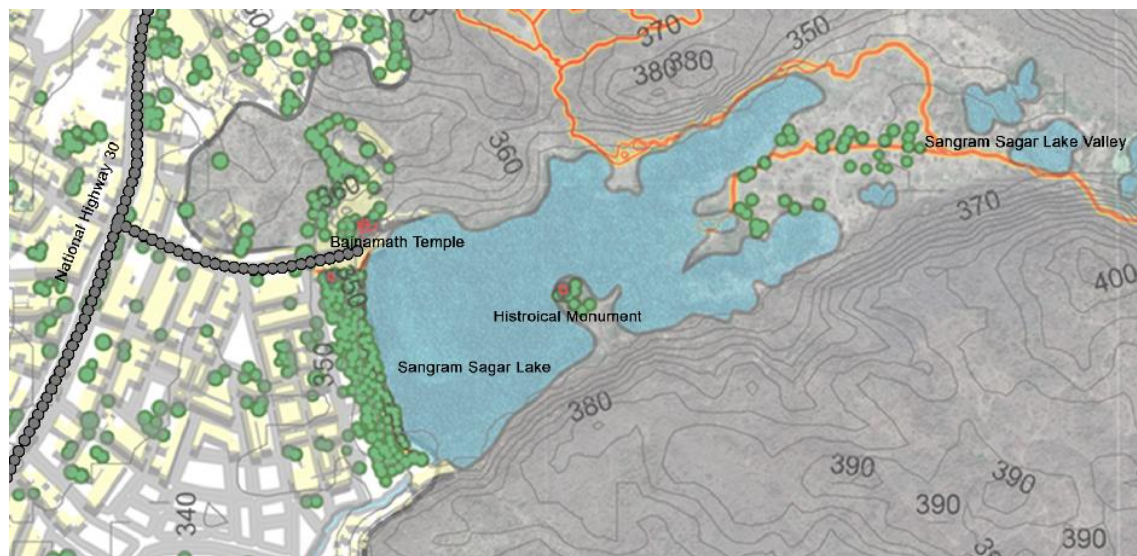
Figure 25 Ruined State of Monument

6.2 Delineation of Site

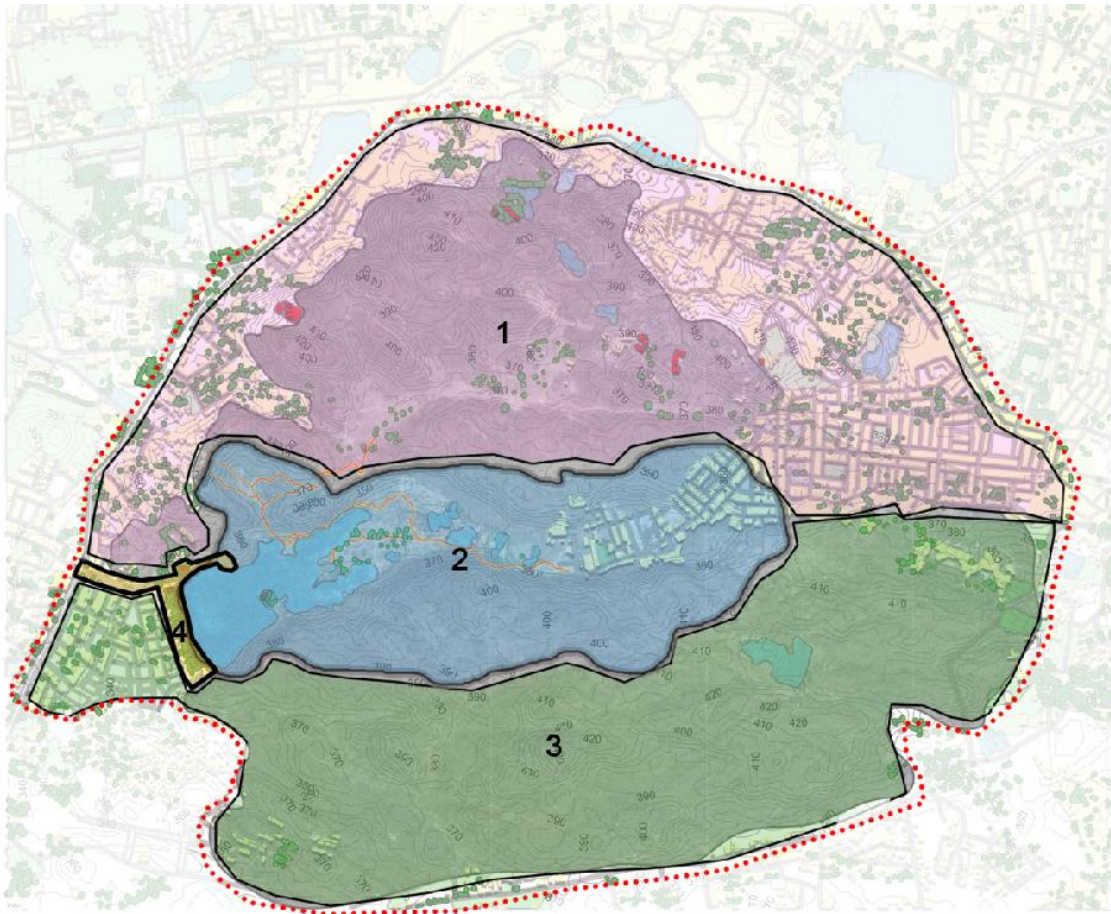
The Site identified is bounded by the National Highway on the west and north direction and Bargi hills form the extent of the site in the southern edge.



Map 13 Site identification for framing policies and guidelines



Map 14 Site Identification for Detail Design

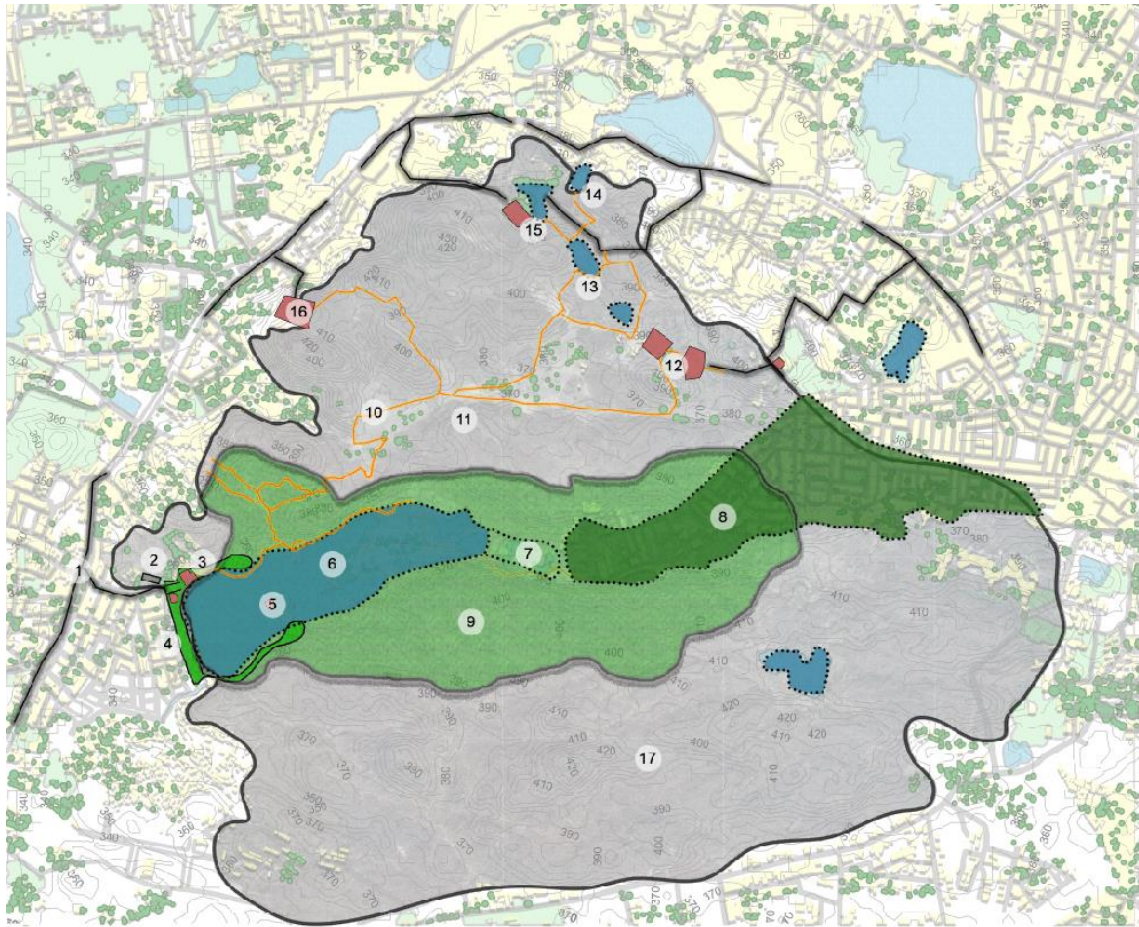


Map 15 Site Zoning

Conceptual framework:

- 1 Historical and Cultural Tourism Circuit- only policies and guidelines
- 2 Watershed region of the Lake- careful planning and rehabilitation of the Urban settlements, propose planting palette, propose methods to control soil and rock erosion
- 3 Propose planting palette; Bargi Hills area under protected forest (MoEF); no intervention
- 4 Detailed Design of the Temple Precinct, Lake front park, access road, existing ghats need to be re-addressed and detail proposal for the same with policies and guidelines

6.3 Programme Development



Map 16 Programme Development Plan

LEGEND:

1. Entrance Road
2. Parking
3. Temple Precinct
4. Lake Front Park
5. Historical Monument
6. Sangram Sagar Lake
7. Reed bed System
8. Farmlands
9. Watershed Planting
10. Trekking Trail
11. Madan Mahal Hills
12. Madan Mahal Fort Complex
13. Shailpern Lake
14. Devtal Lake
15. Osho Ashram
16. Jain Temple
17. Bargi Hills- Protected Forest

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Design Proposal and Recommendations