# SCOPE OF WORK

## 1. INTRODUCTION

**Motihari** is located in the northwestern part of Bihar. The municipality of Motihari was established in 1879 and now it is the district head quarter of East Champaran. The MotiJheel is the pride and main attraction of this town. The Jheel is located in the centre with the town spread on either bank.

## 2. CONCEPTS PROPOSED ON MOTIJHEEL LAKE

Various developmental activities are proposed on Motijheel Lake is given below:

- ***De-silting***
- ***De-weeding***
- ***Improving bunds***
- ***Tree plantation***
- ***Development of parks***
- ***Toilet blocks***
- ***Bathing Ghats***
- ***Dobhighats***
- ***Pathways***
- ***Parking***
- ***Peripheral drain all around the lake***
- ***Construction of Silt Traps to storm water Inlets***
- ***Construction of 2No's of Sewage Treatment Plants (STP)***
- ***Construction of Boat Jetty***
- ***Construction of Food courts***
- ***Miscellaneous structures recommended to be constructed***

It is found necessary to construct following structures inside the lake:

a. Entrance gates to Parks.
b. Security rooms
c. Watchmen residential building (If required)
d. Gazebos: for recreation and shelter in the park area and walk way sides-

e. Pergolas: for recreation purpose in the park area and walk way sides-

***Other structures recommended to be constructed:***

- Street lighting using Solar Energy
- Road Development
- Boating
- Toilets etc.,
- Plantation of trees and flowers plants along the boundary inside the lake and in the park area:
- Arrangement for feeding regular supply of water for plantation and green belt development:
- Improvements to the approach roads around the lake area:
- Litter Bins:
- Providing electrification and illumination to the entire lake area:
- Providing high mast lights:
- Providing floating fountains in the lake area for Aeration:
- Providing benches and dust bins signage& direction boards in lake and park area and walkway sides:

**Table 5-1: Area Statement of Proposed Activities**

| **Area Statement for Motijheel** | | |
|---|---|---|
| **S. No** | **Lake Component** | **Cumulative Area in Sq.M** |
| 1 | Lake Water spread Area | 978654 |
| 2 | Area covered with Bund | 44580 |
| 3 | Tree Plantation all along the lake periphery | 26748 |
| 4 | Development of park | 13093 |
| 5 | Toilet blocks | 180 |
| 6 | Bathing Ghats | 3000 |
| 7 | Dhobi Ghats | 2125 |
| 8 | Construction of path ways to a distance of 1.5km on either side (total 3km) of park area with 8m width | 24000 |
| 9 | Vehicle parking area Near Bathing Ghats and Parks | 2950 |
| 10 | STPs (2 numbers) | 16188 |

| | | |
|---|---|---|
| 11 | Other Miscellaneous activities | 10814 |
| | Total | 1122332 |

## 3. De-silting

Silt removed from a lake or water body is classified as waste by the Environment Agency, and as such is subject to the waste regulations. This means that the silt disposal process is controlled by legislation. The first stage of the de-silting process is to carry out a survey to establish the depth, and to analyze the chemical composition of the silt to characterize it for disposal, the silt may contain heavy metal contamination or hydrocarbons from road runoff that make it hazardous and so cannot be spread to land without remediation. Out of several de-silting methods Floating dredgers which will work on the surface of the water and either pump the silt ashore using underwater dredge pumps. Or they are excavators mounted on floating platforms to dig the silt and cast it ashore or into barges for disposal. The floating excavator can also feed a pumping system. If the water can be drained out of the lake then the silt can be excavated and hauled in dump-trucks to the tip site or the silt can be loaded into a pumping system where it is screened and macerated before being pumped to a disposal area. Pumping silt reduces the impact of the works because there are not dumpers running backwards and forwards to the tip area. Before the silt can be transported off site it must be dried, this requires additional equipment and storage space.

In order to estimate the quantity of silt a detailed bathymetric survey has been conducted within the Mothijheel Lake. The average thickness of accumulated silt is about 0.8m. Based on the survey it is calculated about 7.8 Lakhs cum of silt is present within the lake. During de-silting temporary linear shaped silt drying beds are proposed near the outer side of lake. The dried silt from the drying beds should be further disposed in a suitable open dump yard within 5km radius of the lake.

Desilting is becoming a major component of any Lake Conservation Project now a days. The basic reasons given for necessity of desilting are – increasing the storage capacity and checking eutrophic conditions. Desilting is proposed at a depth of 0.8m in Motijheel . Detailed methodology for desilting is given below**.**

**Detailed Methodology for Desilting**

Dredging is the removal of accumulated lake bottom sediments ("Muck"). Sediments are commonly removed to improve navigation, restore recreational access for leisure boating, swimming, and fishing, or regain lost storage capacity in water supply reservoirs. Dredging also is done to remove nutrient-rich sediments, remove toxic substances, reduce rooted aquatic plant growth, lessen sediment re-suspension by winds and waves, and improve fish habit.

Dredging sometimes can improve water quality by reducing the amount of nutrients available from the sediments, thereby reducing nuisance algae blooms. This can occur through direct removal of nutrient-rich sediments, or by deepening the lake enough to allow thermal stratification to develop and thereby limit nutrient movement from deep-water areas to the upper waters. Dredging in areas of rooted aquatic plants controls their growth through direct removal, and also can limit future re-growth if the new water depths are deeper than sunlight can reach. For lakes that freeze over in the winter, fish survival can be enhanced by removing oxygen-demanding sediments and creating deeper water areas. Sometimes, however, sediment removal can dig up the unexpected. Dredging too shallow may uncover fertile sediments and provide a perfect place for aquatic plants to grow if the bottom gets enough sunlight. Dredging too deep may expose old arsenic treatments or nutrient-rich wastes from a forgotten sewage treatment plant.

The decision to dredge shall be based on sufficient study that shows accumulated sediment is having an adverse impact on water quality, recreation, or navigation.

The Environmental management plan for Lake Dredging is an action plan aiming to control pollution at the source level to the possible extent with the available and affordable technology followed by treatment measures before they are discharged. It encompasses the mitigation measures that are proposed in order to synchronize the economic development of the study area with the environmental protection of the region. The Environmental Management plan should consider addressing the operational management of issues such as Turbidity, Noise, Odour, Water quality and contaminated sediments. The EMP should also address the collection and storage of sewage and garbage on board all vessels as well as contingencies for oil spills. Issues that shall be addressed in an Environmental Management Plan are detailed below:

**a) Minimise Effects on water quality**

- Increase monitoring for turbidity (This will identify but not minimize turbidity);
- Incorporate or re-orientate silt screen
- Reduce overflow of barges or bunds
- Increase travel path of fluid within bunds to increase sedimentation
- Decrease rate of dredging
- Select appropriate dredge for material being dredged
- Relocate dredge to an alternative location
- Use silt screens where practical and sediments are fine
- If necessary, monitor water quality including turbidity, as well as sea-grass and for other sensitive species.

**b) Minimize Effects of Contaminated Sediments**

Monitor water quality near dredging operations removing highly contaminated sediments. Dredge contaminated sediments first and dispose to land or place on spoil grounds first and cover with clean sediments.

Use Silt screens to contain contaminated sediment

**c) Sensitive Biological Communities**

Map location of sensitive communities

Detail measures to protect sensitive communities when dredging.

**d) Land Disposal**

Site bounded area to minimize impacts

Control water quality of discharge

Monitor discharge to ensure excessive sediment is not discharged

**e) Prevent Noise Nuisance in Residential Areas**

Liaise with the local community to identify areas and times sensitive to noise

Alter or enclose equipment to reduce noise at the source

Use sound-absorbing materials to prevent the spread of noise by isolating the source.

Monitor noise levels

### f) Ensure that Small Odor problems do not Alarm Nearby residents.

Inform residents of temporary nature of any odors and grey sediment

Cease dredging on very hot days (greater than 350 C) or times of high public use Inform public of works using on-site signs.

### 1. Sediments Temporary Storage & Transportation

Croplands and pasturelands are commonly utilized for land-application of trucked sediments or for sitting disposal basins. Landfills are another option for trucked sediments. The closer the disposal site is to the lake, the better option.

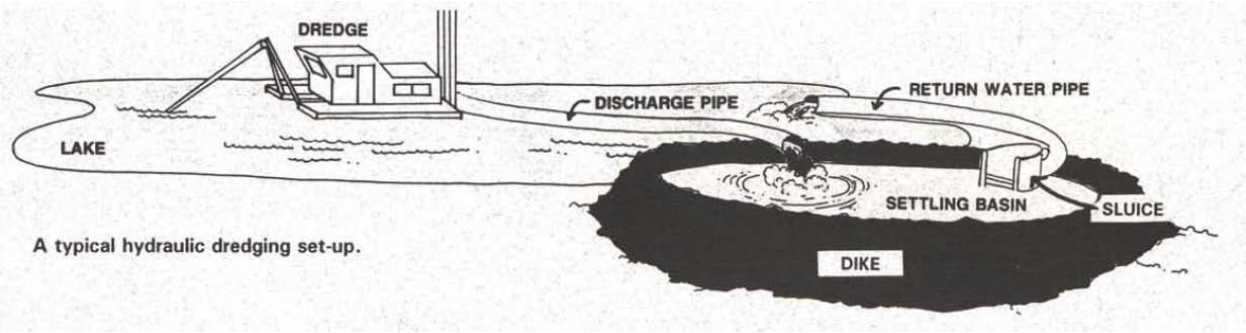
In urban areas when open land is scarce, finding a proper site nearby may be very difficult. Generally, dredging is more cost-effective when the disposal site is located within 1 Km of the dredging area. However, it is not uncommon to hydraulically pump sediments up to 2 Kms or more, or truck sediments even farther.

Dried sediments later may be incorporated into the landscape at the disposal site. Alternatively, the dried sediments may be removed and used as fill or disposed of elsewhere.

For hydraulic dredging projects, a disposal basin must be designed and constructed to hold not only all the dredged sediments once they've dried, but also be large enough to allow the pumped sediment/water slurry enough time to settle out the solids and return relatively clear water to the lake.

Also, because lake sediments tend to increase in volume temporarily during hydraulic dredging, a "bulking factor" is added when designing the disposal basin. A 120% bulking factor is typical. For example, if 10000 cubic yards of sediment were to be dredged, the disposal basin would have to be sized to hold 1.2 times 10,000 or 12,000 cubic yards.

Geology of the disposal site must be considered as well. Some sites may be too porous and could allow nearby lakes or streams, or the groundwater table, to be impacted. Costs increase when the sediments must be trucked far away or the disposal site modified to contain the sediments. If the lake sediments themselves are found to have elevated concentrations of contaminants (e.g., heavy metals, certain pesticides), special handling and disposal will be required. Nutrient-enriched sediments are not considered contaminated and therefore do not require special handling. A typical hydraulic dredging set up is given below:



A typical hydraulic dredging set-up.

Dried Silt from the temporary bunds shall be carrying to the land fill site through closed trucks during night time. Spillage proof transportation systems shall be followed

Land fill construction for storing dried dredged material shall be as per the USEPA specifications & National Standards.

For the proposed project suitable place will be identified within 3Km radius. Dredged material will be temporarily stored and will be disposed to Municipal secured Landfill.

## 4. De-weeding

De-weeding is the process of removing the weeds grown on the surface of the water body mainly in the stagnated water bodies. There are two types of de-weeding methods viz. manual and mechanical. Here in the present project area it is suggested to proceed any one type of method or in combination of both. The area occupied with weeds within Moti jheel is about 640201Sq.m.

Deweeding is proposed on the lake. Weeds (water hyacinth) could be used as a compost or fertilizer. The advantage of utilizing water hyacinth as a compost or fertilizers are it is easy to produce low cost and the resources are abundantly available. In Motihari the best use of water hyacinth can be made by using it as a compost or fertilizer due to the following reasons:

1) In and around Motihari agriculture activity is predominant, where organic manures are preferred.
2) Organic manure produced can improve soil fertility.
3) The maintenance of the plants especially the fertilizing requirements are quite costly
4) The plants have high mineral content and hence promote plant growth very well.
5) It would reduce the cost and make Motihari greener.
6) They can be used not only in parks but also in small gardens to grow plants which require lot of manure.

## 5. Improving bunds at selective locations

The proposed lakes are having ring bunds all along the periphery of the lakes. Motijheel is having bund length of about 9000 meters. It is observed during field survey at several locations these bunds are either not having proper strength or the height of bund is reduced to the natural ground level, due to the effect of surface erosion process since longer lime. Hence it is suggested to improve the bunds with available local natural earth material preferable with impervious or low permeable material.

In order to prevent the erosion of bunds, It is also suggested to have Bio-engineering method of bunds wherein dense plantation should be taken up in the inner and outer slopes of bunds. The detailed drawing of bunds and pathways are presented in corresponding annexure.

The supplier of Geo-cell material for the development of bunds is given below:

## 6. Tree plantation

Tree plantation is a part of Lake Beautification. A 3m width strip all around the lake boundary is allocated for the development of tree plantation. Tree Plantation shall be done as per BOQ.

## 7. Development of parks

The proposed parks are basically oriented towards the development of recreation opportunities. Park design is influenced by the intended purpose and audience, as well as by the available land features. The proposed parks are intended to provide recreation for children whichinclude a playground similarly for adults it is proposed to have walking paths and decorative landscaping. Apart from that Specific features, such as picnicking, walking, food stalls and bird watchingare also be included to support specific activities.

During first phase of development in Motijheel, it is proposed to have one park. The tender drawing of park is attached.

## 8. Toilet Blocks

It is estimated to have 5 toilet blocks and 6 additional toilet blocks along the periphery of the lake. These toilet blocks are having 4.0 m x 4.5 m and 8.74 m x 3.0 m. The tender drawing of toilet blocks is attached.

## 9. Bathing Ghats

The Chat Puja is one of the very famous religious occasion in Mothihari town takes place every year, on which hundreds of pilgrims will have holy dip within the lake. Keeping this in view about 4 bathing ghats are proposed all around the lake. The term Ghat refers to a series of steps leading down to a body of water, something as small as a pond or as large as a major river.

These new ghats are associated with hand railings, changing room and a vehicle parking area. The tentative dimensions of bathing ghats are 15m x 20m occupying 300sq.m area each. The distance between the successive bathing Ghats is about 700m to 900m. The detailed drawing of bathing ghats is attached.

## 10. Pathways

Path ways are proposed all around the lake periphery of both the lakes. The tentative length of pathway shall be 3km. These pathways are having 1m width of green belt area, 3m width of walkway, 2.5m width of jogging and cycling area and 1.5m width of utility development area such as sitting benches, electrical poles, safety railing and signage boards etc., all put together it is occupying a width of 8m covering a total area of 24000Sq.m. This includes following work activities

i) Compacting original ground supporting sub-grade Loosening of the ground up to a level of 500 mm below the sub-grade level, watered, graded and compacted in layers to meet requirement of table 300-2 for sub-grade construction.

ii) Providing and laying 60mm thick factory made cement concrete interlocking paver block of M -30 grade made by block making machine with strong vibratory compaction and of approved size and design/ shape laid in required colour and pattern over and including 50mm thick compacted bed of course sand, filling the joints with coarse sand etc. all complete as per the direction of Engineer-incharge.

iii) Half brick masonry with bricks of class designation 100A in foundations and plinth in : Cement mortar 1:4 (1 cement: 4 coarse send)

iv) Earth work in excavation in foundation trenches or drains(not exceeding 1.5 m in width or 10 sqm on plan) including dressing of sides and ramming of bottoms, lift up to 1.5 m . including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.

v) 15 mm cement plaster 1:3 (1 cement: 3 coarse sand ) finished with a floating coat of neat cement

vi) Colour washing such as green, blue or buff to give an even shade for New work (two or more coats) with a base coat of white washing

vii)

**11. Peripheral drain all around the lake**

It is proposed to provide underground peripheral drain all around the lake. Total length of drain is about 9Km. 4.5Km in the western side and 4.5Km in eastern side. Manholes are also proposed to construct at an interval of 30m. RCC pipes are proposed to carry wastewater. The entire drain will be connected to Collection well by gravity. The slope provided for laying pipeline as per design. The dia of the pipe varies from 250mm to 300mm. Sewage will be pumped to STP. The tender drawing of peripheral drain is attached.

## 12. Sewage Treatment plants

2 No's of 2MLD STPs (Extended Aeration system) are proposed to treat wastewater coming from the peripheral drain. In a sewage treatment plant, the process is a biological process.

Major aerobic suspended treatment process is

- Activated Sludge Process
- Extended Aeration system
- Sequential Batch reactor
- Membrane Bio reactor
- Moving Bed Bio reactor

Last three systems are little bit costly and are used for less flow rate systems. Extended Aeration system is basically modified system of activated sludge process. The system is usually designed on the basis of low organic rate (low F/M ratio) and longer aeration to generate less biomass solids through endogenous respiration. The main advantage of operating the system at these conditions is that the excess sludge produced in the reactor is completely mineralized thereby eliminating the separate sludge clarification and its further handling and treatment.

This process can be used for one or several of the following purposes:

1) Oxidizing carbonaceous biological matter
2) Oxidizing nitrogeneous matter: mainly ammonium and nitrogen in biological matter.
3) Removing phosphates
4) Driving off entrained gases such as Carbon dioxide, Ammonia, Nitrogen, etc.
5) Generating a biological floc that is easy to settle.
6) Generating liquor that is low in dissolved or suspended material.

In activated sludge process wastewater containing organic matter is aerated in an aeration basin in which micro-organisms metabolize the suspended and soluble organic matter. Part of organic matter is synthesized into new cells and part is oxidized to $CO_2$ and water to derive energy. In activated sludge systems the new cells formed in the reaction are removed from the liquid stream in the form of a flocculent sludge in settling tanks. A part of this settled biomass, described as activated sludge is returned to the aeration tank and the remaining forms waste or excess sludge. Sewage treated from STP will be allowed to lake.The detailed drawing of peripheral drain is presented in corresponding annexure.

## 13. PROPOSED SERVICES WITH THE LAKE BOUNDARY

### 13.1 Water Supply

The water supply scheme within the facility is designed based on the assumption that a maximum of around 2000 visitors shall visit the proposed facility. And their water requirement is adopted as 15LPCD as per National Building Code (NBC). Hence water demand for the visitors is estimated as 30000 Litres per day.

A small intake well with pump can be provided for use of water for toilets, washing clothes, plantation & landscaping but municipal water connection is proposed for food courts & vending area. Also proposed to use water from the lake through tankers and will apply for landscaping and plantation. Separate Over head tanks for small food courts and visitors, for half day water requirement of 10000 litres and 15000 litres respectively shall be provided at the top of the proposed toilet blocks.

For the visitors' convenience, a water pipeline of 25mm dia GI pipe is proposed to lay along the pathways to supply water at each wash basin and water tap is proposed at every 100m spacing. Drinking water tap shall be provided at every 500 meter interval and shall be connected to the municipal water supply line.

Water supply system is suggested to cater the needs of public visiting the parks, toilet blocks and dhobi ghats. It is proposed to have at least 7 bore wells to meet the water supply requirement. The number of bore well may increase as per site condition.

### 13.2 Wastewater

The sewage generated from the public conveniences& wastewater generated from Dhobi Ghats shall be connected to the peripheral drain which will be catered to STP plant for treatment.

### 13.3 Solid waste Management

It is estimated that 400Kg of solid waste shall be generated at the rate of 0.2Kg/capita/day from visitors activities at the proposed amenities. Separate 60 Litter bins for biodegradable and recyclable shall be placed at spacing of 40m to collect the generated solid waste daily. These bins shall be transported to the nearby community bins provided by local municipality/corporation.

### 13.4 Electrical System

Solar power lighting is proposed along the pathways, at parking places and along the main entrance road. For high illumination at the children play area and public gathering places conventional electrical system is proposed.

#### a) Details of Solar system:

**Operational Hours** **:** 4 hours for all lights along pathways and parking places (5pm to 9pm)

**:** 12 hours for one third of the total lights along pathways and total lights for Main entrance road (5pm to 5am)

**Distance between poles:** 30m

b) Details of Proposed Electrical System (Conventional system) for Children Play area, food courts area etc.

The electrical services are designed based on the following design standards and references as shown in **Table 5-2.**

**Table 5-2: Electrical design Standards and References**

| **Low Voltage Switch Boards** | |
|---|---|
| IEC 60439-1/1999 | Low-Voltage switchgear and control gear assemblies – Part 1: Type- tested and partially type-tested assemblies |
| IEC 60269 | Low voltage fuse |
| IEC 60529/1989 | Degree of protection provided by enclosures (IP Code) |
| IEC 60947-1/1988 | Low-voltage switchgear and control gear – Part 1: General Rules. |
| IEC 60947-2/1995 | Low-voltage switchgear and control gear – Part 2: Circuit- Breakers. |
| IEC 60947-7/1999 | Low-voltage switchgear and control gear – Part 7: Ancillary equipment |
| IS 8828 | Low Voltage switchgear & control gear - Part V Control circuit Devices and switching elements MCB |
| IS 3231 | Electrical relays for power system protection |
| IS 10118 | Code of Practice for selection, installation and Maintenance of Switchgear & control gear. |
| IS 8623 | Low Voltage switchgear & control gear assemblies |
| IS 2147: 1962 | Degree of protection enclosures for low voltage switchgears |
| IS 3231: 1986 | Electrical relays for power protection |
| IS 2551: 1982 | Danger notice plate |
| IS 3842 | Application guide for relays |
| IS 5051 | Electromagnetic relays |
| LV Power & Control Cables | |
| IEC 60228/1978 | Conductors of Insulated cables |
| IEC 60502-1/2004 | Power cables with extruded insulation and their accessories for rated |

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|---|---|
| | Voltage from 1 kV – Part 1: Cables for rated voltage of 1 kV |
| IS 694 | PVC insulated cables for working voltages up to and including 1100V |
| IS 1554 | PVC insulated (heavy duty) electric cables. |
| IS 7098 | Cross-linked polyethylene insulated PVC sheathed cables |
| IS 5578 | Guide for marking of insulated conductors |
| IS 732 | Code of practice for electric wiring installations |
| IS 1255 – 1983 | Code of practice for installation and maintenance of power cables |
| IS 8130 -1984 | Conductors for insulated electrical cables. |
| IS 10418- 1982 | Drums for electrical cable |
| IS 10810- 1988 | Methods of test for cables |
| IS 3961- 1987 | Recommended current rating |
| IS 5891- 1970 | Recommended short circuit rating of high voltage PVC cables |
| IEC 245/ CEI 20-19/ BS 6007 / BS 6899 | Submersible Power cables |
| **Wiring Accessories and Miscellaneous Electrical Equipment** | |
| IEC 60529/1989 | Degree of protection provided by enclosures (IP Code) |
| IEC 60309 | Plugs, socket-outlets and couplers for industrial purposes - Part 1: General requirements |
| IEC 60884-1 | Plugs and socket-outlets for household and similar purposes - Part1: General requirements |
| IEC 60669-1 | Switches for household and similar fixed-electrical installations - Part1: General requirements |
| IS 4615 | Switch socket outlets |

| | |
|---|---|
| IS 1293 | 3 pin plugs and socket outlets up to 250 volts |
| IS 3854 | Switches for domestic and similar purposes |
| IS 5133 Part-I&II 1969 | Boxes for the enclosure of electrical accessories |
| Light Fittings | |
| IEC 60598-1/2003 | Luminaries – Part 1: General requirements and tests |
| IEC 60598-2 | Luminaries – Part 2: Particular requirements |
| IEC 60400 | Lamp holders for tubular fluorescent lamps and starter- holders |
| IS 1913 | General Safety requirements for luminaries |
| IS 3553 | Specification for Watertight Electric Lighting Fittings |

### 13.5 Signage Plan

**Signage Boards:** The purpose of providing signage in the project area is

a. To help and protect the safety of visitors
b. To provide direction and guidance for the use of project and facilities
c. Inform and educate the public about the project.

The following types of signs are proposed in Motijheel lake area

**a) Identification Signs:** These signs help to orient the visitor and identify important areas and facilities. These signs indicate the administrative setups like Ticket counters, features like inlets, outlet, overflow weir, boating jetty, restaurant; children play area, toilet block, sewage pumping station, STP etc. Size of the sign board shall not be larger than 0.5m X 0.2m.

**b) Information Signs:** These are signs located in key areas throughout the site that provide important information for the visitor. The message shall be conveyed in a brief, clear manner and be located to provide information to the visitor as it is needed. This type of signs include Bulletin Board Sign, shall be large enough to post rules, regulations, and other information pertinent to a particular site; Instructional Signs,shall provide instructions for the use or operation of specific facilities such as boating jetty, Ghats etc, shall be used in association with other signs, facilities to provide supplemental information like park opening and closing time etc. Size of sign board should not be larger than 1m X 0.3m.

**c) Directional Signs:** These are signs that show the location of specific project features or facilities.Directional signs shall be located to provide the visitor adequate time to make a decision. Size of the boards shall not be larger than the size 0.3 m X 0.15 m.

**d) Regulatory/Warning/Security Signs:** These signs shall be provided for the protection of visitors and the environment. This type of signs include Vehicular signs, will be placed at entrances and exits to project areas and features, and along the travel routes within a project, to regulate motor vehicle traffic; Pedestrian signs regulate foot traffic within the recreation areas and adjacent to areas where the public is restricted and warn of latent hazards. Care shall be taken to ensure that the signs are placed in the best location to be seen by the public. Size of sign board shall not be larger than 1m X 0.3m.

**13.6 Plant Species proposed on Motijheel Lake**

Details of the plant species proposed on Motijheel Lake at different places are given as below

**List of Plants Proposed on Motijheel**

- Wherever available Tamarind, Banyan, Silk Cotton, Neem, Arjun, Siris, Peepal, Badam and Ber trees need to be retained and aesthetic landscaping to be developed around them.
- The following species are selected for plantation around the lakes and in selected green areas/parks which will not only beautify the environment but also support local birds, butterflies, insects and animals thus enhancing the biodiversity around the lakes

| S.No | Botanical Name | Habit | Flowering season | Significance | Suggested areas |
|---|---|---|---|---|---|
| 1. | *Acacia catechu* | Shrub | May -August | Oblong | Along the lake bund |
| 2. | *Acacia nilotica* | Tree | Aug - Jan | Spreading | Along the lake bund |
| 3. | *Alstona scholaris* | Tree | Dec -Mar | Round | Park areas, walkways |
| 4. | *Anogeissus latifolia* | Tree | May - July | Round / Oblong | Park areas, walkways |
| 5. | *Barringtonia acutangula* | Tree | March - May, Sept - Oct | Spreading | General park area |
| 6. | *Bauhinia purpurea* | Tree | Sept - Nov | Oblong | Along the lake bund, General park area |
| 7. | *Bauhinia racemosa* | Small Tree | Mar -June | Oblong | Park areas, walkways |
| 8. | *Bougainvillea spectabilis* | Shrub | Throughout the year | Oblong / Round | Along the lake bund, General park area |
| 9. | *Buchanania lanzan* | Tree | Jan - mar | Round | Park areas, walkways |
| 10. | *Carissa spinarum* | Shrub | Mar - May | Round | Along the lake bund |
| 11. | *Cardia dichotoma* | Tree | March - April | Round/ Oblong | Park areas, walkways |
| 12. | *Dalbergia latifolia* | Tree | August - Sept | Round | Park areas, walkways |
| 13. | *Dalbergia sisoo* | Tree | March - Apri - June | Round | Park areas, walkways |
| 14. | *Diospyros melanoxylon* | Tree | Feb - April | Oblong | Park areas, walkways |
| 15. | *Dryptes roxburghii* | Tree | Mar - May | Round | Park areas, walkways |
| 16. | *Emblica officinalis* | Tree | June - July | Oblong | Along the lake bund, General park area |
| 17. | *Embryopteris* | Tree | Mar - May | Spreading | Park areas, walkways |

| | | | | | |
|---|---|---|---|---|---|
| | *peregrina.* | | | | |
| 18. | *Erythrina variegata* | Tree | Feb - May | Oblong | Park areas, walkways |
| 19. | *Ficus elastica* | Tree | - | Spreading /Round | Park areas, walkways |
| 20. | *Ficus virens* | Tree | Jan - May | Oblong | Park areas, walkways |
| 21. | *Gardenia jasminoides* | Tree | April - Aug extended upto Sept. | Oblong | Along the lake bund, General park area |
| 22. | *Gardenia resinifera* | Tree | Mar - June. | Oblong | Along the lake bund, General park area |
| 23. | *Grevillea robusta* | Tree | Feb - April | Oblong | Park areas, walkways |
| 24. | *Grewia subinequalis* | Tree | Apr - June | Round | Park areas, walkways |
| 25. | *Hibiscus rosa-sinensis* | Shrub | Throughout the year | Round / Oblong | Along the lake bund, General park area |
| 26. | *Ixora rosea* | Tree | More or less throughout the year | Oblong | Along the lake bund, walkways |
| 27. | *Jacaranda mimosaefolia* | Tree | March - April | Round | Park areas, walkways |
| 28. | *Lagerstroemia parviflora* | Tall Tree | June | Round / Oblong | Park areas, walkways |
| 29. | *Lawsonia inermis* | Shrub | April - July | Round | Along the lake bund |
| 30. | *Madhuca longifolia* | Tree | Feb - April | Round/Oblong | Park areas, walkways |
| 31. | *Millingtonia hortensis* | Tree | Oct - Dec. | Oblong/Round | Park areas, walkways |
| 32. | *Mimusops hexandra* | Tree | Sept - Nov | Oblong/Round | Park areas, walkways |
| 33. | *Moringa oleifera* | Tree | Jan - April | Oblong | Along the lake bund, walkways |
| 34. | *Nerium indicum* | Shrub | Throughout the year | Oblong / Round | Along the lake bund |
| 35. | *Peltophorum pterocarpum* | Tree | May - Sept | Oblong/Round | Park areas, walkways |
| 36. | *Pithecellobium ducle* | Tree | Jan - Feb | Oblong. | Park areas, walkways |
| 37. | *Samanea saman* | Tree | Mar - June. | Spreading/Round | Park areas, walkways |
| 38. | *Sapindus emarginatus* | Tree | Oct - Dec. | Oblong / Round | Park areas, walkways |
| 39. | *Sapium sebiferum* | Tree | June - Aug | Round | Park areas, walkways |
| 40. | *Soymida febrifuga* | Tree | Mar. | Round/Oblong | Park areas, walkways |

| | | | | | |
|---|---|---|---|---|---|
| 41. | *Syzygium cumini* | Tree | Mar - May | Oblong/Spreading. | Park areas, walkways |
| 42. | *Terminalia chebula* | Tree | Mar - Oct | Round/Oblong | Park areas, walkways |
| 43. | *Thespesia populneoides* | Tree | Throughout the year | Round | Park areas, walkways |

**The Developmental Major Activities of Motijheel is given below:**

| S.No. | Name of the Developmental Activity | Q'ty |
|---|---|---|
| 1 | De-silting | Total Lake |
| 2 | De-weeding | Total Lake |
| 3 | Sewage Treatment Plant – 2 MLD | 2 |
| 4 | Peripheral drain all around the lake | 9 Km |
| 5 | Development of Bio-Engineering bunds | Total Lake |
| 6 | Pathways | 22242 Sqm |
| 7 | Bathing Ghats surrounding Motijheel Lake | 4 |
| 8 | Development of parks | 1 |
| 9 | Toilet Blocks (4.0 x 4.5 m) | 5 |
| 10 | Toilet at Ghats (8.74 x 6.0 m) surrounding Motijheel Lake | 6 |
| 11 | Change Rooms (8.0 x 3.0 m) surrounding Motijheel Lake | 6 |
| 12 | Benches surrounding Motijheel Lake | 50 Nos |
| 13 | Dustbins surrounding Motijheel Lake | 150 Nos |
| 14 | Construction of Silt Traps for all inlets | 5 |

| | | |
|---|---|---|
| 15 | Tree Plantation with Maintenance surrounding Motijheel Lake | 1000 Nos. |
| 16 | Electrical works | As per site requirement/ BOQ |
| 17 | Water Supply and Sanitary works | As per site requirement/ BOQ |

## 14. Development of Approach Roads

The proposed lake developmental activity will provide the development of path way and other facilities around the lake. Apart from these there is a peripheral road existing presently. It is proposed to develop this ring road in neat form along with the approach roads from different colonies surrounding the lake. The budgetary aspects and designs for these approach roads should be taken up separately which is not included in this DPR since it is not a part of lake developmental activity.

## 15. Approvals and Clearance required

List of approvals required with their time frame for Motijheel Lake restoration Project have been given in **Table 5-3.**

**Table 5-3: Approvals and Clearances**

| Activity | Obligation | Departments Responsible | Estimated time Taken |
|---|---|---|---|
| Construction | Permission for land use and construction activity | Department of Town and Country Planning | 2 months |
| Setting up Generator and Sewage Pumping Station and STP | No Objection Certificate to Establish and consent to operate under water | Bihar pollution control board, East Champaran | 2 months |

| | | | |
|---|---|---|---|
| | and pollution control Acts | | |
| Electricity | Sanction of power connection | Electricity board, Motihari | 2 months |

**16. Details of public consultation and the requirement of various components.**

| S. No | Name of the organization / department | Components |
|---|---|---|
| 1 | Bihar State Pollution Control Board | STP |
| 2 | Department of Environment, | STP |
| 3 | Water Resources Department | Complete water supply |
| 4 | Bihar Urban Infra Structure Development Corporation Ltd | Complete concepts |
| 5 | Motihari Nagar Parishad | Food Courts, Bathing Ghats, Dhobhi Ghats, Pathways, Parking |
| 6 | Forest Department | Tree Plantation |
| 7 | State /Central Ground Water Department | Wells & Intake wells |
| 8 | Bihar RajyaJalParishad | Water Supply line, Sewerage, Silt Traps construction, Peripheral Drain |
| 9 | PHED | Desilting, Deweeding, Peripheral Drain, Silt Traps construction, |
| 10 | Bihar State Electricity Board | Electrical approvals & Necessary permissions |
| 11 | Disaster management authority | Necessary Approvals for Development of Lake |
| 12 | Urban Local Bodies | Complete Civil Structures |
| 13 | Urban Development Authorities | Complete Civil Structures |
| 14 | Town Planning Department | Complete Civil Structures |

# 17. OPERATION & MAINTENANCE PLAN

## 17.1 INSTITUTIONAL FRAMEWORK (Organization and Operation) Strategy

### 17.1.1 Operation & Maintenance institution

The developed and rejuvenated tanks needs continuous O & M immediately post completion of the development. The Prime contractor who undertakes the work shall maintain the tank for a period up to defects liability period or for a period of one year minimum. The local neighborhoods and area should be involved in the formulation of committee for O&M. If strong community exists, a committee can be formed with the Government official as the secretary. As a social and environmental initiative, the project O&M needs to be supported by MNP. A small portion of the O&M can be met through some user fees after the tank and its development are fully complete and to the satisfaction of the users. A committee of intelligent citizens, NGOs, Academics and business persons, Government needs to be created for the overall advisory and monitoring. Within the MNP, it maybe advisable to monitor bythe environment cell under the special commissioner for tackling environmental issues and O&M of the lake.

### 17.1.2 Outline of Existing Billing and Collection

As this is social and environmentally significant project, there has been precedent of collection and billing for Morning Joggers, lake Visitors , Parking , & Boating, etc.,

### 17.1.3 Project Operation and Maintenance (O&M)

The project operation and maintenance requires regular upkeep of the facilities and the infrastructure developed under the tank rejuvenation project. Some of the key O&M activities include:

1. Maintenance of engineering components like cleaning of silt traps, drains etc.
2. Periodic monitoring of quantity of water flowing in to the tank.
3. Clearing solid waste and garbage (including bags, papers, etc) reaching the tank through the channels or from the visitors or illegal dumping.

4. Regular monitoring of the water coming in through the feeder channels, catchments, STPs and tank water.
5. Maintenance of Plantings and garden area including putting the watering system to work.
6. Regular disinfection of the lake and surrounding including the spraying of fungicides for bio remedial measures.
7. Daily sweeping and cleaning
8. Regular maintenance of the play equipment, lighting , etc., if any
9. Surveillance and security from vandalism and other illegal activity.
10. Monitoring of the quality of water – Periodic monitoring of quality of water at least once in 6 months is required.
11. Monitoring of ecological parameters like fish, birds etc has to be done periodically
12. Bioremediation – Spraying of chemicals once in 6 months is required.
13. Maintenance of vegetation
14. Solid Waste management system – litterbins, public toilets, drinking water, etc.,
15. Security – Watch / ward for safe keep

Daily, recurrent, frequently scheduled service and monitoring of the facilities is essential to meet the needs of ever-increasing user groups, to support new and existing recreation programs.

The overall objective is “to determine the most cost effective and efficient manner of providing high quality management and maintenance of the proposed facility”. This objective can be achieved by following below mentioned steps.

1. TURF CARE - GRASS - Grass height maintained according to species and variety of grass. Mowed at least once every five working days, but may be as often as once every three working days. Weed control should be practiced so that not more than one percent of the surface has weeds present.

2. FERTILIZER - Adequate fertilizer level to ensure that all plant materials are healthy and growing vigorously. Amounts depend on species, length of growing season, soils and rainfall. Distribution should ensure an even supply of nutrients for the entire year. Trees, shrubs and flowers should receive fertilizer levels to ensure optimum growth.

3. IRRIGATION - Sprinkler irrigated. Manual systems could be considered adequate under plentiful rainfall circumstances and adequate staffing. Frequency of use following rainfalls, temperature, seasonal length and demands of plants material.

4. SHRUB BEDS – Landscape bed areas should be kept in a weed, leaf and debris-free condition. Shrubs should be trimmed to maintain desired shape and to maintain natural growth habit of plan species.

5. LITTER CONTROL - Minimum of once per day, 7 days per week. Extremely high visitation may increase the frequency. Receptacles should be plentiful enough to hold all trash generated between servicing

6. PRUNING - Usually done at least once per season unless species planted dictate more frequent attention. Sculptured hedges or high growth species may dictate a more frequent requirement than most trees and shrubs in natural, growth style plantings.

7. DISEASES & INSECT CONTROL - Usually done when disease or insects are inflicting noticeable damage, reducing vigor of plant materials or could be considered a bother to the public. Some preventative measures may be utilized such as systemic chemical treatments, cultural prevention of disease problems can reduce time spent in this category.

8. LIGHTING - Replacement on a scheduled frequency and/ or repair of fixtures when observed or reported not working
9. SURFACES - Should be cleaned, repaired, repainted or replaced when appearance has noticeably deteriorated.

10. REPAIRS - Repairs to all park elements of the design should be done immediately upon discovery provided replacements parts and technicians are available to accomplish the job. When disruption to the public might be major, repairs may be postponed to a time period that is less disruptive

11. INSPECTION - Inspections of this area should be done daily by a trained staff member.

12. RESTROOMS - When in seasonal use should be maintained at least once per day as long as they are open to public. High use may dictate two servicing's per day. Servicing period should ensure an adequate supply of paper and that restrooms are reasonably clean and free from foul odors.

13. SPECIAL FEATURES - Should be maintained for safety, function and high quality appearance as per established design.

The lake area shall be declared as "litter free zone" and necessary facilities need to be created for dumping.

### 17.1.4 Performance Metrics:

The performance metrics which are vital for the upkeep of the environment include the quality of water, the greening and enrichment of bio diversity mainly through flora and fauna studies. All these metrics shall be developed on completion of the project for the operation and maintenance. Many of these parameters are a matter of painstaking research and currently there is not much data available to develop a full fledged model.

### 17.1.5 Man Power for operation and maintenance (O&M)

For maintaining the gardens, other vegetative cover around the Lake, 20 males have been recommended. To maintain cleanliness of the toilet blocks, five Toilet attendants have been recommended. Totally 25 people are estimated for the maintenance of facility.

As regards to the cost of maintenance of power supply, pumping, disinfection and sanitation, & other miscellaneous works like maintenance of silt trap and screen barrier etc., lump sum provision has been made. An Increase in expenditure to the tune of 10% for every year may be anticipated.

### 8.1.6 Local contribution:

The local community may be willing to offer their time on pro bono basis for the O&M. These may not be measured directly in financial terms. These will increase participation of the community and bring accountability of operators/contractors as well as watch dog for the government. Voluntary contribution can be channelized on continual basis for better upkeep. This can be followed with branding exercise to allow for citizen, corporate contributions as well voluntary social work to be included in the O&M. The estimated annual cost for Operation and Maintenance Plan of the proposed project is given in **Table 8.1.**

**Table 8.1. Required Resources for Operation & Maintenance**

| S.No | Description | Qty | Units |
|---|---|---|---|
| **A** | **Manpower** | | |
| 1 | Security Staff | 4 | Nos |
| 2 | Ticket counter staff | 2 | Nos |
| 3 | Staff at Facility | 10 | Nos |
| 4 | Sweepers cum Gardeners | 4 | Nos |
| 5 | Fitter (Water Supply & Sewerage System) | 2 | Nos |
| 6 | Environmental Management Cell | | |
| I | Project Manager cum Horticulturist | 1 | Nos |
| ii | Technician cum Electrician | 2 | Nos |
| **B** | **Services Maintenance** | | |
| 1 | Water Supply | LS | LS |
| 2 | Sewerage @ 0.25 % of Sewerage Cost per annum | | |
| 3 | Drainage –Desilting | LS | LS |
| 4 | Solid waste - Replacement of Collection Bins once in two years | | |
| 5 | Electricity Charges | 465 | KWH |
| 6 | Electricity Maintenance @ 1% of Electrical Cost per annum | | |
| 7 | Solar Power Lighting Systems - Replacement of Battery once in two years | | |
| **C** | **Other Maintenance Cost** | | |
| 1 | Renovation of civil structures once in Two years | | |
| 2 | Green Area Development & Sprinkler system for lawn @1% of its cost | | |
| 3 | Gardening | | |
| a | Bio manure @0.5kg/tree once in 3months | 194 | Kg |
| b | Bio manure @0.33kg/shrub once in 3months | 219 | Kg |
| c | Bio fertilizer @ 0.5kg/tree once in 3months | 194 | Kg |
| d | Bio fertilizer @0.33kg/shrub once in 3months | 219 | Kg |
| 4 | Environmental Monitoring | | |
| a | Air quality, stack emissions and Noise levels | 5 | Location |
| b | Water&Wastewater Quality | | |
| i | Sewage Treatment Plant (4MLD) | MLD | |
| i | Ground water | 2 | Location |
| ii | Surface Water | 5 | Location |

**SITE OFFICE ,COMPUTOR, OPERATOR AND VEHICLE**

If the tendered cost is more than Rs. Five crores, contractor will have to provide Air conditioned site office (A/c) with one attendant on is site with furniture and toilet along with a computer with operator and also a four wheeled light motor vehicles (Not more than Three year old) with driver & fuel for the use of Client's Engineer (Average 3000 km/month) till the completion of work including testing and trial run and performance period for which contractor shall make sufficient provision in his rates as below.

| **Contract Value** | **Site office(A/c)** | **Four wheel LMV (A/c)** (Capacity not less than 1800 CC) | **Computer** |
|---|---|---|---|
| More than 5.00 crore to Rs. 25.00 crore | One (20 sq/m) | One | One Desktop with operator |