Initial Environmental Examination

Document Stage: Draft
Project Number: 53262-001
November 2020

IND: Agartala City Urban Development Project – Revival and Restoration of Ujjayanta Palace Complex in Agartala City PART C

Prepared by Project Management Unit, Agartala Smart City Limited, Government of Tripura for the Asian Development Bank.

FIGURE 31 EXISTING & PROPOSED CONDITION OF THE CENTRAL WATER CHANNEL

4.2.1.3 WTP & PUMPS

There are many fountains inside the Ujjayanta Palace garden and the water demand of these fountains will be catered by the existing water bodies.

There are two big water bodies in the Ujjayanta Palace, acting as a natural water reservoir; the same water will be used for fountains. Two water treatment plants are proposed (one for each water body).

Two submersible pump sets will be placed in the water body itself to feed the Water Treatment plant consisting of Dual Media Filter & dosing system.

Each fountain will be having its individual inlet from the main header line coming from water treatment plant with automation like water level sensor & solenoid valves.

For cleaning and maintenance purpose a drainage network is also proposed, and the drained water will be collected in the water bodies.

FIGURE 32 EXISTING & PROPOSED WATER CHANNEL (EASTERN ARM

4.2.2 REVIVAL OF THE NORTH GATE AND TRANSFORMATION OF ASTABAL

Being the architectural representative example of neoclassical style, these structures have huge historical and cultural association with the city.

4.2.2.1 NORTH GATE

The North gate should be retained because of its huge cultural association with the local community. To prolong the life of the heritage structure, it has been proposed to be treated with removal of vegetation growths and strengthened by plastering the surface cracks with lime mortar. Finally, the structure is to be repainted to keep parity with the Ujjayanta Palace building.

4.2.2.2 TRANSFORMATION OF THE ASTABAL

The redundant Astabal Structure also needs to be restored and it is considered for adaptive reuse as a shopping arcade. The arcade is proposed to showcase the indigenous arts and crafts of Tripura. However, the scope also includes retrofitting of pedestrian pathway and adjacent street furniture on the existing road in front of the Astabal. While proposing the same, public amenities have also been kept in mind like Public toilets and Water ATMs, which have been proposed strategically at suitable locations. The adjacent figure shows the location of the site in the Key plan and the different elements proposed on it.

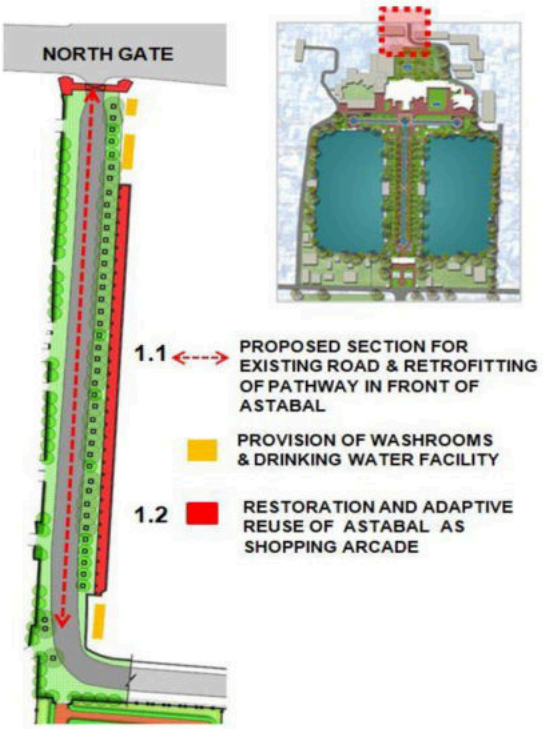


FIGURE 33 PROPOSED ELEMENTS ON THE ASTABAL AND NORTH GATE SITE

4.2.2.2.1 RETROFITTING OF PEDESTRIAN PATHWAY

The existing road in front of the Astabal is proposed to be retrofitted with pedestrian walkways on either side to ensure potential number of customers to the shopping arcade. These are further furbished with shady trees, benches for seating, dustbins for maintaining cleanliness on the site and decorative lamp posts ensure safety. The pathways are also provided with tactile paving for the visually impaired visitors. Additionally, public toilets and water ATMs are proposed at nearby locations for the ease of the shoppers.

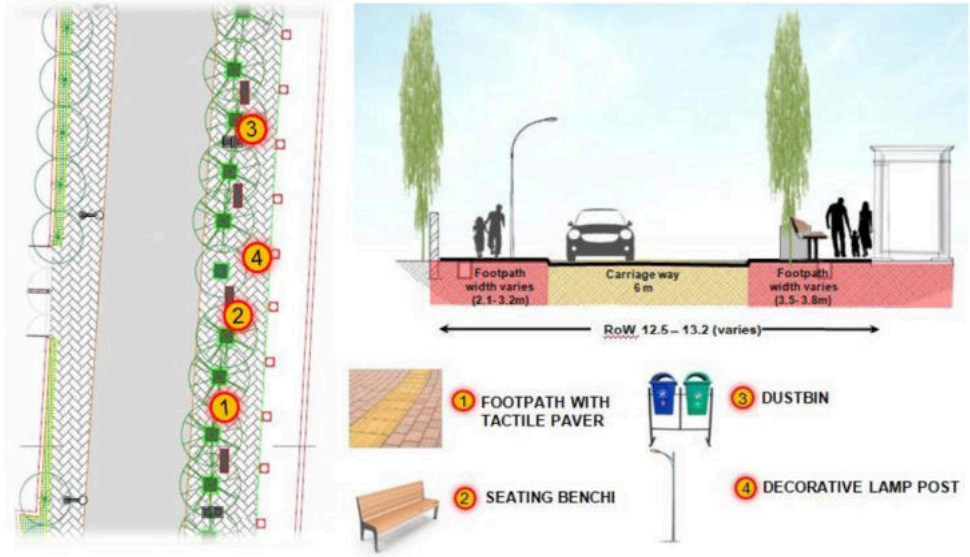


FIGURE 34 PLAN, SECTION AND ELEMENTS PROPOSED ON THE RETROFITTED ROAD

FIGURE 35 PROPOSED VIEW OF ROAD AFTER RETROFITTING & UPLIFTMENT

4.2.2.2.2 RETROFITTING OF THE SHOPPING ARCADE INTO THE ASTABAL

The Astabal structure is proposed to be retrofitted with moderate interventions to develop it into a shopping arcade. Therefore, the shops are proposed to be partitioned with GRC screens and secured with lockable aluminum rolling shutters. The flooring is proposed with a raised plinth of polished Kota and white marbles to maintain the heritage ambience of the site. Additionally, the signage and lighting fixtures are also to be of wall-embedded heritage style.

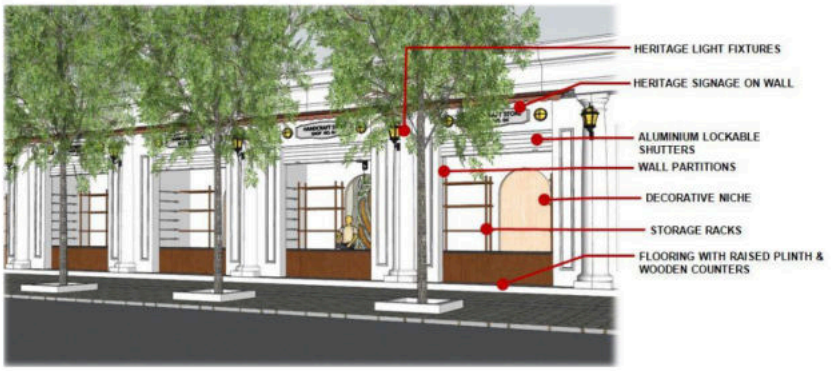


FIGURE 36 PROPOSED VIEW OF THE SHOPPING ARCADE

Within the shops there are provisions for a seating for the shop-keeper, a decorative niche, bracket fan, decorative hanging, a wooden counter and two storage racks.

FIGURE 37 SECTIONAL VIEW SHOWING SHOP INTERIORS

4.2.3 FOOD COURT DESIGN

The food court has been proposed adjacent to the Astabal area, demolishing a redundant structure. The proposal aims at promoting the local, regional and international cuisines. The food court features two large food stalls (8M. x 8M.) and organic pattern of seating for a capacity of 110 seats. The entire plot covers an area of 60M. x 18M.

Several landscape elements like feature walls, pergola, softscape lawns, stepping stones, fountain etc. have been proposed to make the space vibrant and interesting. A pathway connects the different elements on the site. The seating for the customers is all outdoor but different variations have been provided to create an interesting ambience for the visitors. Some of these include seating under the pergola, seating under mushroom shaped umbrella etc.

The food court is further proposed to be bounded with a low height partition wall to ensure security through visual accessibility and showcasing of the offered services on the site.

FIGURE 39 AERIAL VIEW OF THE PROPOSED FOOD COURT

FIGURE 38 PROPOSED VIEW OF THE FOOD COURT FROM THE ACCESS ROAD

4.2.4 REVIVAL OF REAR GARDEN

The rear garden of the Ujjayanta Palace already has some excellent features and elements in it but due to lack of maintenance is now in a non-functional state. Hence, the proposal aims at restoring its lost valor by retaining the proposed fountain and proposing a few. The garden has therefore been sub-divided into four zones which are shown in the following figure:

FIGURE 40 LAYOUT PLAN SHOWING THE DIFFERENT ZONES IN THE REAR GARDEN

FIGURE 41 LAYOUT PLAN SHOWING THE DIFFERENT ELEMENTS

1.1.1 VISITORS' PARKING

The visitors' parking has been proposed strategically at a central location nearby to the both the shopping arcade as well as to the rear garden. It covers an area of 24M.X 40M. and is proposed to accommodate 12 four-wheelers and 40 two-wheelers. The following figure shows the proposed layout of the parking lot.

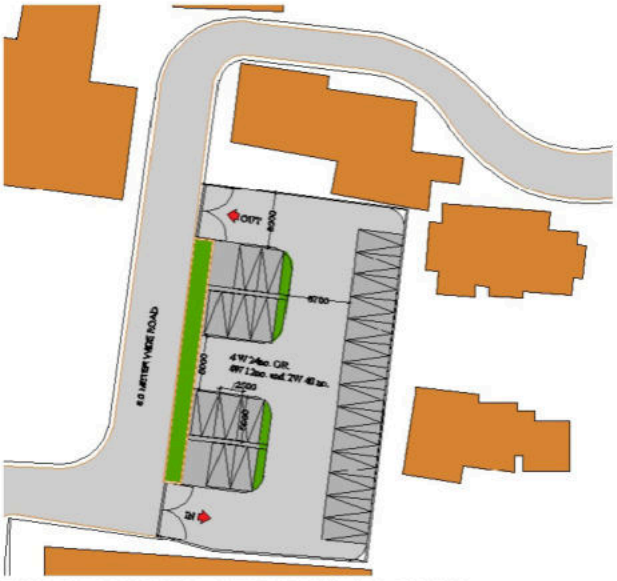


FIGURE 42 PROPOSED LAYOUT OF VISITOR'S PARKING

At present it is a vacant ground used for unauthorized parking and hence the roads and proposed landscapes are to be implemented on the site to develop it into a full-time parking lot.

4.2.5 EASTERN LAKE EDGE DEVELOPMENT

To enhance the aesthetics and usability of the existing lake edge, redevelopment of the stretch has been proposed. The scope includes redeveloping the pathway while retaining the existing trees, providing a green belt all along, replacement of the railings and providing Ad panels and signages along the newly designed lamp posts. The proposed lamp posts and railings are considered to match the architectural style of the existing palace complex.

FIGURE 43 EXISTING & PROPOSED CONDITION OF THE EASTERN LAKE EDGE

The following figures show the detailed plan of the proposed stretch.

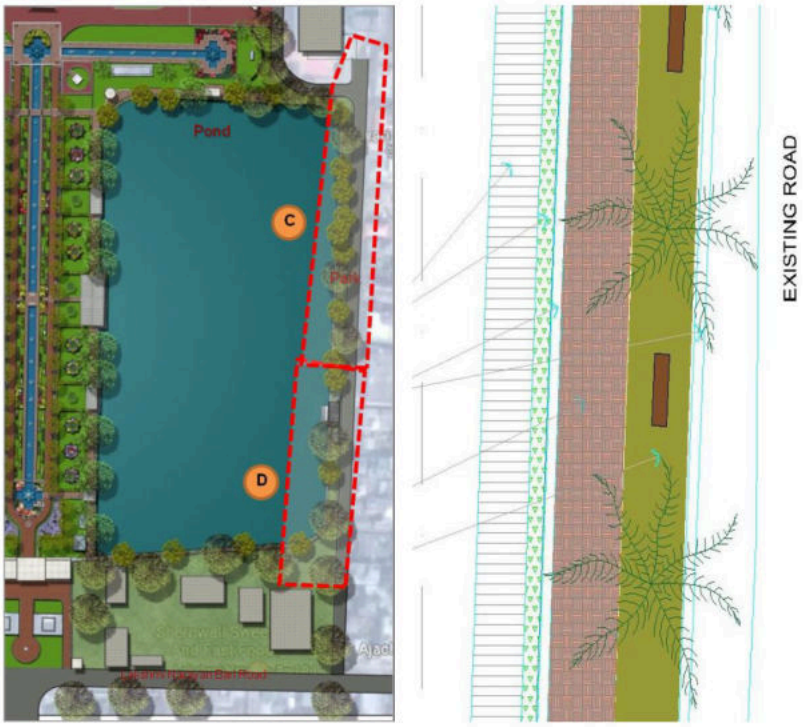


FIGURE 44 DETAILED PLAN AND TYPICAL PLAN OF THE EASTERN EDGE

4.2.6 REVIVAL OF THE EASTERN POND

The eastern lake needs to be cleared of all vegetations and garbage disposals to make it suitable for different proposed water activities like boating etc. To accommodate such activities, a floating deck and a platform is proposed on the western bank of the pond.

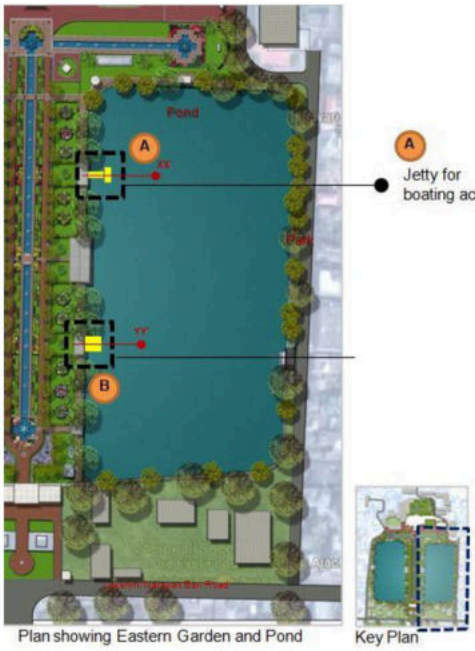


FIGURE 45 PLAN SHOWING THE PROVISION OF WATER ACTIVITIES ON THE EASTERN POND

FIGURE 46 FLOATING DECK

4.2.7 REVIVAL OF THE WESTERN POND

The Western Lake of the Palace complex is proposed to be revived in order to bring back the life and glamour to the zone, as well as to add functionality to the beautiful water body. Hence, it is proposed to house the musical fountains and laser shows, depicting the rich heritage, culture and history of the Palace. These activities are planned in the evening hours for the regular visitors and the tourists and are expected to generate huge revenue to the development authorities and the local bodies, maintaining the campus.

FIGURE 47 MUSICAL FOUNTAINS IN THE WESTERN POND

FIGURE 48 LASER WATER SHOWS

5. ASSESSMENT AND EVALUATION OF OVERALL IMPACT OF THE PROPOSED DEVELOPMENT

The impact of proposed development can be considered as a part of reviving the lost glory of the palace complex. The development is to preserve the very identity of the heritage complex, it is imperative that a cohesive urban vocabulary be introduced to tie the discrete areas and create a unique identity for the precinct.

5.1 IMPACT ON BUILT HERITAGE

The likelihood of any possible impact both adverse or beneficial of the proposed project based on identified attributes of the monument has been analyzed based on a five-point scale. On the other hand, the project already has a beneficial impact of generation of specialist knowledge regarding the heritage resources due to the requirements of a systematic heritage impact assessment.

2-3 UJJAYANTA PALACE BUILDING

Value of heritage asset/heritage attributes	Scale & severity of change/ impact				
	NO CHANGE	NEGLIGIBLE CHANGE	MINOR CHANGE	MODERATE CHANGE	MAJOR CHANGE
Ujjayanta Palace building					
Architectural	Neutral				
Historical	Neutral				
Cultural	Neutral				
Social	Neutral				

2-4 ASTABAL

Value of heritage asset/heritage attributes	Scale & severity of change/ impact				
	NO CHANGE	NEGLIGIBLE CHANGE	MINOR CHANGE	MODERATE CHANGE	MAJOR CHANGE
Astabal					
Architectural		Minimal			
Historical		Minimal			
Cultural	Neutral				
Social	Neutral				

2-5 NORTH GATE

Value of heritage asset/heritage attributes	Scale & severity of change/ impact				
	NO CHANGE	NEGLIGIBLE CHANGE	MINOR CHANGE	MODERATE CHANGE	MAJOR CHANGE
North Gate					
Architectural		Minimal			
Historical		Minimal			
Cultural	Neutral				
Social	Neutral				

2-6 LANDSCAPE ELEMENTS (CHHATRIS, CURVED WALL)

Value of heritage asset/heritage attributes	Scale & severity of change/ impact				
	NO CHANGE	NEGLIGIBLE CHANGE	MINOR CHANGE	MODERATE CHANGE	MAJOR CHANGE
Landscape elements (Chhatris, curved wall)					
Architectural		Minimal			
Historical		Minimal			
Cultural	Neutral				
Social	Neutral				

5.2 IMPACT ON NATURAL HERITAGE

The impact on the natural heritage has been analysed on the similar note.

2-7 TWIN LAKE

Value of heritage asset/heritage attributes	Scale & severity of change/ impact				
	NO CHANGE	NEGLIGIBLE CHANGE	MINOR CHANGE	MODERATE CHANGE	MAJOR CHANGE
Twin lake					
Historical	Neutral				
Cultural	Neutral				
Social	Neutral				
Landscape		Minimal			

2-8 PALACE FRONT GARDEN

Value of heritage asset/heritage attributes	Scale & severity of change/ impact				
	NO CHANGE	NEGLIGIBLE CHANGE	MINOR CHANGE	MODERATE CHANGE	MAJOR CHANGE
Palace Front Garden					
Historical	Neutral				
Cultural	Neutral				
Social	Neutral				
Landscape		Minimal			

2-9 REAR GARDEN

Value of heritage asset/heritage attributes	Scale & severity of change/ impact				
	NO CHANGE	NEGLIGIBLE CHANGE	MINOR CHANGE	MODERATE CHANGE	MAJOR CHANGE
Rear Garden					
Historical			Low		
Cultural			Low		
Social	Neutral				
Landscape	Neutral				

5.3 INTEGRATION OF THE PROPOSED REVIVAL PROJECT WITH THE PALACE COMPLEX AND ITS SURROUNDINGS

The proposed construction will have negligible impact on the proposed type of development presently existing on site as proposed construction is well integrated with the existing fabric.

This intervention aims at restoring the landscape characteristics and making the garden and waterfront a pleasant leisure place for the regular visitors and tourists. It will also facilitate the visitor movement by providing protection from the scorching sun while walking down the garden. The scope will include improvement of landscape elements, outdoor lighting and palace facade illumination, rejuvenation of the water channels and fountains, introduction of shaded pathways, and upgradation of the general ambiance of the garden.

FIGURE 49 3D VIEW OF THE PROPOSED DEVELOPMENT

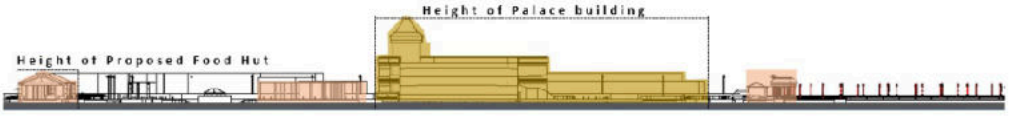


FIGURE 50 SECTION SHOWNG THE HEIGHT OF THE STUCTURES

The 3D view highlights the interventions proposed, it depicts clearly that the proposal includes majorly revival of the existing fabric and re-establishing the integrity of the complex. Restoring the north gate, transforming the astabal, integration of a designed food court, revival of the rear garden with public amenities and facilitating the twin lakes with water activites and light and sound show.

The materiality of the Palace building, astabal and north gate is brick and lime mortar. The material of new additions like the Food Hut will be distinguishable from the Palace building.

2-10 IMPACT ASSESSMENT TABLE

Significant Impact			
Moderate Impact			
Minor Impact	★ ★ ★		
	Low likelihood	Medium likelihood	Medium likelihood

★ Palace Building
★ Astabal
★ North Gate

The visual and historical relationship of the palace complex with the surroundings will be maintained. The proposal does not include construction of high/ medium rise building in consideration to the existing structure.

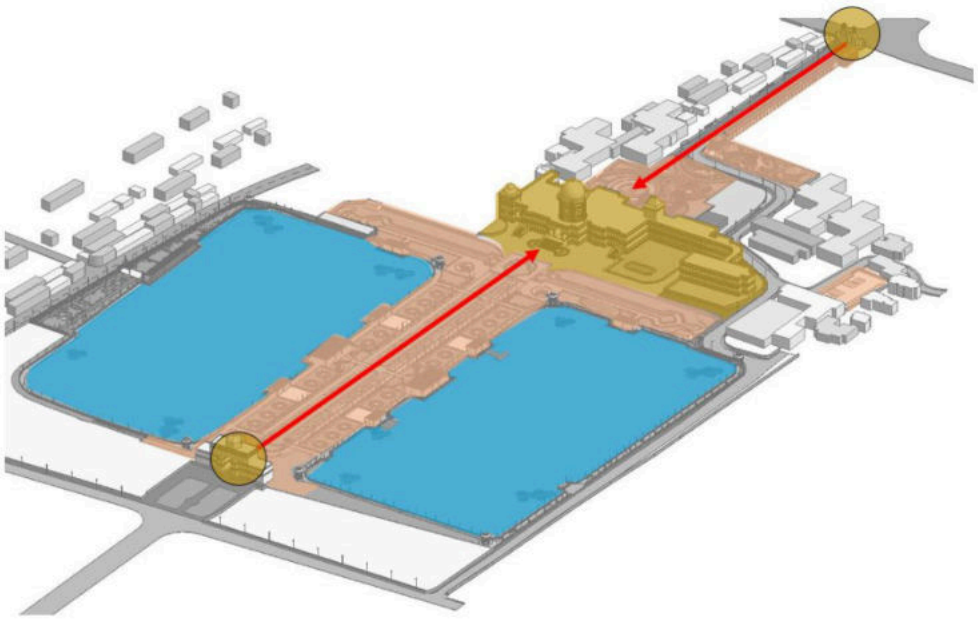


FIGURE 51 3D VIEW SHOWING THE VISUAL AXIS

The proposed project will have a positive impact to the existing natural heritage in the site. Existing trees and shrubs are retained, and new shrubs and trees have been planted. The twin lakes will be revived following the principles of lake conservation.

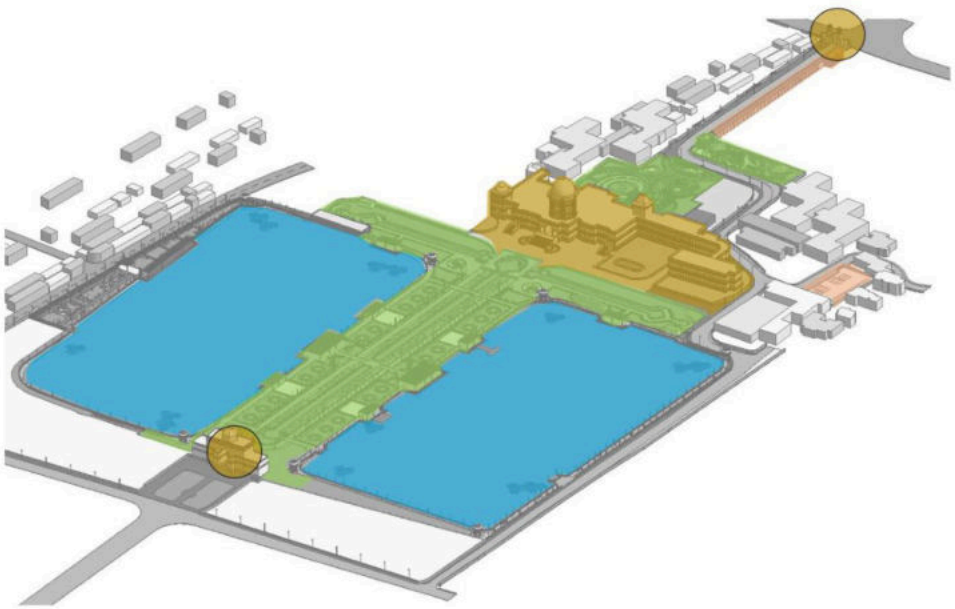


FIGURE 52 3D VIEW SHOWING THE NATURAL HERITAGE

5.4 INCORPORATION OF COMMENTS AFTER STAKEHOLDER INTERACTION AND FINALIZATION

The following dates mention the Stakeholder consultation undertaken by the HIA team.

- Agartala Municipal Corporation on 21-05-2019
- CEO of Agartala Smart City Limited (ASCL) on 21-05-2019
- Department of Tourism, Government of Tripura - Curator of Tripura state museum and with Director, Tourism, Government of Tripura on 14-05-2019 & 21-05-2019
- Public consultation was held on 23-10-2019

The comments received have been undertaken after understanding the impacts on heritage the proposal has been finalized.

6. MITIGATION MEASURE PROPOSED

In compliance with the requirements of Model Building Bye laws by CPWD Dept. and INTACH Charter for Conservation of Unprotected Architectural Heritage and Sites in India. It has been ensured that landscape elements like Chhatris, Curved wall etc. will be retained, and restoration work like repair, plastering with lime mortar will take place. For the Astabal and North Gate the following MDT tests are advised to be undertaken before commencement of the proposed interventions like Flat jack test for old Brick work, Pendulum Hammer test for old mortar and Rebound hammer test for old Concrete work, if any.

General Mitigation Measures Required

- Encouraging the local commercial organization towards the use of Corporate Social Responsibility for upgrading the present state of heritage resources in the Palace complex.
- Management Plan for the Ujjayanta Palace complex keeping in mind the needs of the functional buildings in the premises.
- Conservation Plan for individual heritage structures.
- Connecting Heritage back to the people with the help of heritage trail linking all the underused network of open spaces within the assessment area of the project.
- Several unattended and derelict public open spaces are presently located around the site. The proposal is to link these open spaces which would enhance the overall character of the place.
- Protection Integration and improvement, upkeep, maintenance of the open spaces, temple sites, lakes in the surroundings.

7. CONCLUSION

The proposed development seeks to revive the palace complex to its lost glory. It includes the adaptive reuse of Astabal structure for public amenities, restoration of the North gate, redevelopment of rear garden, new construction of food hut, restoration of palace garden, revival of the twin lake with water activities and light and sound show. This new, proposed use will secure the conservation of the heritage building.

The proposed development aims to respect the significant heritage fabric on the site while activating it with a compatible use.

The proposed development generally maintains the visual and historical relationships among the Palace building and the surroundings, it respects the grandeur of the precinct. New construction will be composed of materials that are distinguishable from the heritage fabric.

The loss of a heritage attribute, the change in use, represents a natural evolution that is occurring within the neighborhood.

8. PROJECT PERSONNEL

Sangita Agrawal

Sangita Agrawal is the HOD of the Architecture Department in Tata Consulting Engineers Limited. She has thirty plus years of experience in the field of architecture, master planning, urban development and landscape projects.

Pratima Marwah

Pratima Marwah is a Landscape Architect with Tata Consulting Engineers Limited. She received her Masters in Landscape Architecture from School of Planning and Architecture, Delhi and has experience in the field of landscape architecture and urban development projects.

Dipanjan Mitra

Dipanjan Mitra is an Urban Planner with Tata Consulting Engineers Limited. He has experience in the field of architecture and mater planning projects.

Prasad Dharasurkar

Prasad Dharasurkar is an Urban Planner with Tata Consulting Engineers Limited. He received his Masters in City Planning degree from IIT Kharagpur. He has experience in the field of architecture and mater planning projects.

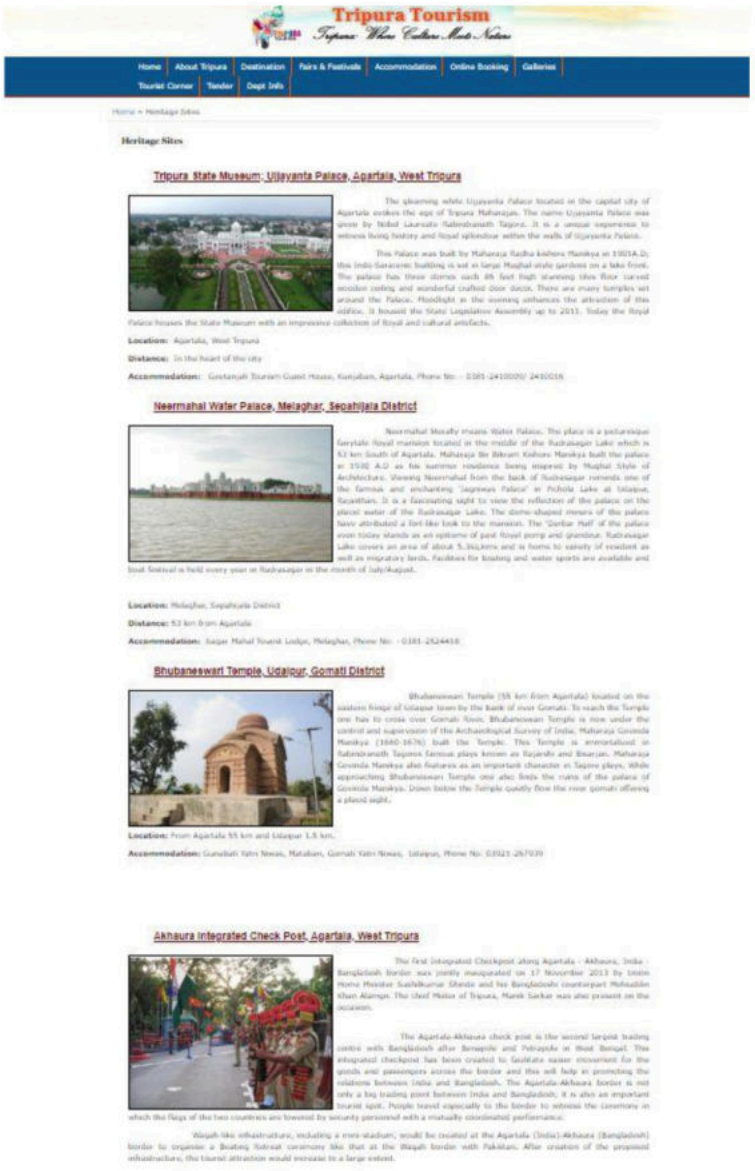
Nandini Mukhopadhyay

Nandini Mukhopadhyay is a Conservation Architect with Tata Consulting Engineers Limited. She received her Masters in Architecture (Conservation) from School of Planning and Architecture, Bhopal. She is a member of ICOMOS India Chapter (International Council on Monuments and Sites).

9. ABBREVIATIONS

ADB	—	Asian Development Bank
AMC	—	Agartala Municipal Corporation
ASCL	—	Agartala Smart City Limited
ASCP	—	Agartala Smart City Plan
BOQ	—	Bill of quantity
HIA	—	Heritage Impact Assessment
INTACH	—	Indian National Trust for Art and Cultural Heritage
GAPA	—	Greater Agartala Planning Area
GoI	—	Government of India
MOEF&CC	—	Ministry of Environment and Forests and Climate Change
PIU	—	Project Implementation Unit
PWG	—	Project Working Group
PMC	—	Project Management Consultant
PCR	—	Physical Cultural Resources
SEIAA	—	State Environment Impact Assessment Authority
TSECL	—	Tripura State Electricity Corporation Limited
TSPCB	—	Tripura State Pollution Control Board
UDD	—	Urban Development

10. APPENDICES



Tripura Tourism

Tripura: Where Culture Meets Nature

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Heritage Sites

Tripura State Museum, Ujjayanta Palace, Agartala, West Tripura

The gleaming white Ujjayanta Palace located in the capital city of Agartala evokes the age of Tripura Maharajas. The name Ujjayanta Palace was given by Nobel Laureate Rabindranath Tagore. It is a unique experience to witness living history and royal splendour within the walls of Ujjayanta Palace.

This Palace was built by Maharaja Radha Kishore Manikya in 1901A.D; this Indo-Saracenic building is set in large Mughal-style gardens on a lake front. The palace has three storeys each 46 feet high stunning tiles floor carved wooden ceiling and wonderful crafted door panels. There are many temples set around the Palace. Floodlight in the evening enhances the attraction of this edifice. It housed the State Legislative Assembly up to 2011. Today the Royal Palace houses the State Museum with an impressive collection of Royal and cultural artefacts.

Location: Agartala, West Tripura

Distance: In the heart of the city

Accommodation: Gostanjali Tourism Guest House, Kunjaban, Agartala, Phone No: - 0381-2410000/ 2410016

Neermahal Water Palace, Melaghar, Sepahijala District

Neermahal literally means Water Palace. The place is a picturesque fairytale royal mansion located in the middle of the Rudrasagar Lake which is 53 km South of Agartala. Maharaja Bir Bikram Kishore Manikya built the palace in 1930 A.D as his summer residence being inspired by Mughal Style of Architecture. Viewing Neermahal from the back of Rudrasagar reminds one of the famous and enchanting 'Jagmandir Palace' in Pichola Lake at Udaipur, Rajasthan. It is a fascinating sight to view the reflection of the palace on the placid water of the Rudrasagar Lake. The dome-shaped minars of the palace have attributed a fort-like look to the mansion. The 'Darbar Hall' of the palace even today stands as an epitome of past royal pomp and grandeur. Rudrasagar Lake covers an area of about 5.3sq.kms and is home to variety of resident as well as migratory birds. Facilities for boating and water sports are available and boat festival is held every year on Rudrasagar in the month of July/August.

Location: Melaghar, Sepahijala District

Distance: 53 km from Agartala

Accommodation: Jaipur Mahal Tourist Lodge, Melaghar, Phone No: - 0381-2524418

Bhubaneswari Temple, Udaipur, Gomati District

Bhubaneswari Temple (55 km from Agartala) located on the eastern fringe of Udaipur town by the bank of river Gomati. To reach the Temple one has to cross over Gomati River. Bhubaneswari Temple is now under the control and supervision of the Archaeological Survey of India. Maharaja Govinda Manikya (1660-1676) built the Temple. This Temple is immortalized in Rabindranath Tagore's famous plays known as Rajarshi and Bisarjan. Maharaja Govinda Manikya also features as an important character in Tagore plays. While approaching Bhubaneswari Temple one also finds the ruins of the palace of Govinda Manikya. Down below the Temple quietly flow the river gomati offering a placid sight.

Location: From Agartala 55 km and Udaipur 1.5 km.

Accommodation: Gunabati Yatri Niwas, Matabari, Gomati Yatri Niwas, Udaipur, Phone No: 03923-257039

Akhaura Integrated Check Post, Agartala, West Tripura

The first Integrated Checkpost along Agartala - Akhaura, India - Bangladesh border was jointly inaugurated on 17 November 2013 by Union Home Minister Sushilkumar Shinde and his Bangladeshi counterpart Mohiuddin Khan Alamgir. The chief Minist of Tripura, Manik Sarkar was also present on the occasion.

The Agartala-Akhaura check post is the second largest trading centre with Bangladesh after Benapole and Petrapole in West Bengal. This integrated checkpost has been created to facilitate easier movement for the goods and passengers across the border and this will help in promoting the relations between India and Bangladesh. The Agartala-Akhaura border is not only a big trading point between India and Bangladesh; it is also an important tourist spot. People travel especially to this border to witness the ceremony in which the flags of the two countries are lowered by security personnel with a mutually coordinated performance.

Wagah like infrastructure, including a mini-stadium, would be created at the Agartala (India)-Akhaura (Bangladesh) border to organise a Beating Retreat ceremony like that at the Wagah border with Pakistan. After creation of the proposed infrastructure, the tourist attraction would increase to a large extent.

S. No	Construction of Indoor Stadium	Cost (Rs. Lakhs)
8.	Aralia School field (8000sqm+600sqm gallery)	431.00
9.	Land Cost (15000sqm)	75.00
	Sub Total	**4340.00**
	Total	**8106.00**

Markets: The city economy is dependent primarily on the tertiary sector with a small manufacturing base. There are 9 markets maintained by AMC within municipal limits, of which, Battala and Maharaj Ganja Bazaar are important as the main service and distribution center of Greater Agartala. Eight markets of 600 sqm, 700 sqm and 900sqm has been proposed under JNNURM and the total estimated cost amounts to **Rs. 471 lakhs.**

Table 15-25: Cost Estimates for markets:

S. No	Development of Markets	Cost (Rs.Lakhs)
1.	Aralia (600 sqm building)	48.00
2.	Vidyasagar (600 sqm building)	48.00
3.	Kashipur (600 sqm building)	48.00
4.	Barjala (600 sqm building)	48.00
5.	Golchakkar (600 sqm building)	48.00
6.	Siddhi Asram(600 sqm building)	48.00
7.	MB Tilla Market (900 sqm building+Land of 1000sqm)	72.00
8.	Pratapgarh Market (700 sqm building)	56.00
9.	Land Cost (10000sqm+1000sqm)	55.00
	Sub Total	**471.00**

Heritage and conservation: Urban improvement and heritage conservation of Ujjayanta palace complex has been proposed with a total investment cost of **Rs.1136.96 lakhs**

Table 15-26: Cost Estimates for Cultural and Heritage

S. No	Architectural Heritage / Cultural Heritage	Cost (Rs Lakhs)
1.	Urban Improvement and heritage conservation of Ujjayanta Palace complex	1136.96
	Sub Total	**1,136.96**

Preservation of Water Bodies: With a vision to make Agartala an eco-friendly city, the preservation of the water bodies existing in the Municipal areas have been proposed with an estimated cost of **Rs. 700 lakhs.**

Table 15-27: Cost Estimates for Water Bodies

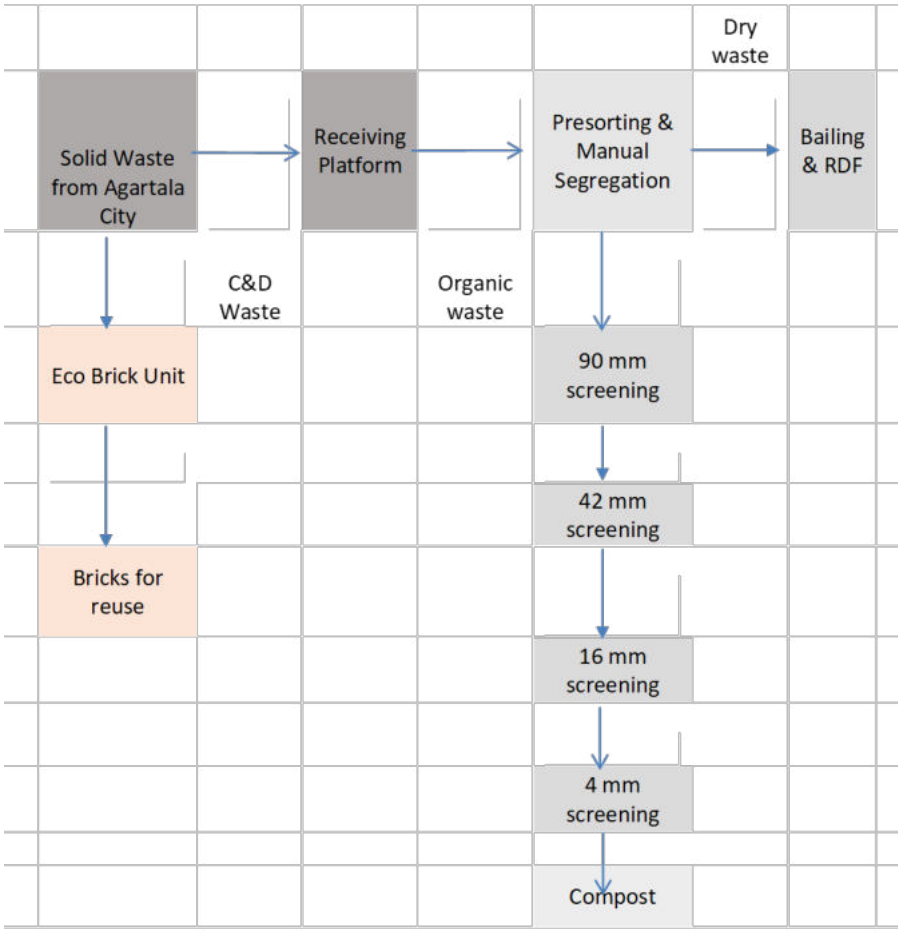
S. No	Preservation of Water Bodies	Cost (Rs lakhs)
1.	Preservation of existing water bodies (20 locations)	700.00
	Sub Total	**700.00**

15.11. OTHER ENABLING DEVELOPMENT PROJECTS

It is envisaged to develop Agartala city as gateway to North Eastern Region in the future. Furher, it is also envisaged to develop all necessary infrastructure that enable investor friendly environment. To facilitate such future vision, the following

Appendix 14: Environmental Audit Report of Existing C&D waste Management site in Agartala

Introduction

Location	DC Nagar Lunga, Agartala. Area Available – 14.568 hectares
Start of operation (year)	2012
Owned by	Agartala Municipal Corporation Operator of the Plant – Joint Venture of Proton Enviro Solutions Pvt. Ltd. And Hydro air Tectonics Ltd.
Contact person and designation	 Chinmay Chakraborty, Asst. Engineer, Mechanical Division
Capacity	250 TPD Daily Waste Processed – 126 TPD Waste Landfilled per day – 6.2 TPD
Treatment process	Windrow Based Composting **Facilities Present:** Compost Plant (1 no.), Sanitary Landfill (1 no.), Eco Brick Unit (1 no.), Plastic Granulating Unit (1 no.) Weighbridge and Internal Roads

Process flow diagram	
Reuse	Reuse of Eco bricks

Google map of Site

III. Compliance with Applicable National and State Laws, Rules, and Regulations

Law, Rules, and Regulations	Description and Requirement	*Y = compliant (if applicable, specify expiration date of permit/clearance)* *N = non-compliant*[20] *N/A = not applicable (state justification)*
EIA Notification	The EIA Notification of 2006 states that environmental clearance is required for certain defined activities/projects.	N Environmental Clearance (EC) to be obtained from State Environmental Impact Assessment Authority (SEIAA) EC timelines and expected monitoring dates will be included based on latest status prior to contract awards.

[20] Compliant = There is sufficient and appropriate evidence to demonstrate that the particular regulatory requirement has been complied with; non-compliant = clear evidence has been collected to demonstrate the particular regulatory requirement has not been complied with.

Law, Rules, and Regulations	Description and Requirement	*Y = compliant (if applicable, specify expiration date of permit/clearance)* *N = non-compliant*[20] *N/A = not applicable (state justification)*
Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989	Storage of chlorine (threshold quantity greater than 10 tons but less than 25 tons) in WTPs will require clearance from Tripura Pollution Control Board .and Directorate of Industrial Health and Safety	NA No hazardous waste is stored or processed in DC Nagar Lunga SWM Site
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Consent to operate from TSPCB	Y Consent is valid till 17-01-2025.
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	Consent to operate from TSPCB	Y Consent is valid till 17-01-2025.
Environment (Protection) Act, 1986 and CPCB Environmental Standards	Emissions and discharges from the facilities to be created, refurbished, or augmented shall comply with the notified standards. a. Wastewater disposal standards	Y
Noise Pollution (Regulation and Control) Rules, 2002 amended up to 2010	Applicable ambient noise standards with respect to noise for different areas/zones	NA The operations of SWM site doesn't come under Noise Pollution Rules 2002.
National Institute of Occupational Safety and Health (NIOSH) Publication No. 2002-149	Compliance with NIOSH Guidance for Controlling Potential Risks to Workers Exposed to Class B Biosolids	Y All workers are provided with required PPEs like hand gloves, safety shoes and face masks.
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 2003 as amended	As per Rule 6, every user agency, who wants to use any forest land for non-forest purposes shall seek approval of the central government.	NA. No forest land is acquired for the SWM site, land is already in possession of AMC.
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	No development activity is permitted in the "protected area," and all development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	NA Site is not situated near any 'protected area' identified by the ASI.
The Child Labor (Prohibition and Regulation) Act, 1986	No child below 14 years of age will be employed or permitted to work in any of the occupations set forth in the Act's Part A of the Schedule or	Y. No child labor is engaged in the facility

Law, Rules, and Regulations	Description and Requirement	*Y = compliant (if applicable, specify expiration date of permit/clearance)* *N = non-compliant*[20] *N/A = not applicable (state justification)*
	in any workshop wherein any of the processes set forth in Part B of the Schedule are present.	

IV. Institutional Arrangement

Parameter	
Operations	8 hours
Manager per shift	1
No of engineer on-site	
Estimated number of technical employees on-site per shift	2
Estimated number of laborers on-site per shift	21
Estimated number of employees in charge of environmental management and monitoring	NA
Frequency of air quality monitoring	NA, No Regular Monitoring is done
Frequency of water quality monitoring	NA, No Regular Monitoring is done
In-house laboratory for water quality analyses (Yes/None). If none, provide name of third-party laboratory.	No in house laboratory. Need based monitoring is done by Tripura State Pollution Control Board.

V. **Corrective Action Plan**

i. Environmental Clearance for the Solid Waste Management Site to be obtained from State Environmental Impact Assessment Authority (SEIAA).

ii. Regular Environmental Monitoring to be carried out by Agartala Municipal Corporation (AMC).

Copy of Consent Certificate for DC Nagar Lunga Waste Management Facility of AMC

Certificate Sl. No 11568

TRIPURA STATE POLLUTION CONTROL BOARD

PARIVESH BHAWAN, Pandit Nehru Complex, Gorkhabasti,
Kunjaban, Agartala - 799 006, West Tripura.

No.F.17(10)/TSPCB/W/Solid Waste\(M-Red)/5363/ 2961-65 Date : 18/02/2020

CERTIFICATE FOR CONSENT TO ESTABLISH & OPERATE

Under Section 25/26 of Water (Prevention and Control of Pollution) Act, 1974 and
Under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981

Reference : i) Your Application No.406 Dated :05-12-2019
ii) Our NOC Register Sl. No.11678 For: Fresh Consent

Capital Investment : Rs. 16.50 Cr. Production Capacity : Compost : 7500 MT
Type : Common Solid waste processing plant Category: Red

With reference to the above Application, a provisional Consent to Establish & Operate Certificate is hereby issued in favour **Mechanical Division, The Executive Engineer (Mech.), Agartala Municipal Corporation, Agartala, Tripura (West)** discharge its industrial and other effluents arising out of their premises into a stream/ well/ land as per section 25/26 of Water (Prevention and Control of Pollution) Act,1974 and to make emission from the plant /unit as per Section 21 of the Air (Prevention and Control of Pollution) Act,1981situated at **Agartala, Tripura (West)** to observance of other codal formalities of the Govt. of India/Govt. of Tripura/District Administration/ Agartala Municipal Corporation or concerned Municipal Council or concerned Nagar Panchayat (whichever is applicable)/ Health Department/Industries & Commerce Department and subject to observance of the terms & conditions stated at **Annexure-I**

The Tripura State Pollution Control Board may, at any time, revoke any of the conditions applicable under the Consent to Operate and shall communicate the same in writing.

AMC shall have to obtain EC from SEIAA/EIAA for Operation of Solid Waste processing facility under EIA Notification, 2006 as amended to date.

This Certificate is valid 17.01.2025. Application for extension of validity of Consent Certificate shall have to be made one month before the date of expiry of validity of this Certificate.

18/02/2020

(Aparajita Das)
Asst. Environmental Engineer
Tripura State Pollution Control Board

To
The Executive Engineer(Mech.)
Mechanical Division
Agartala Municipal Corporation
Agartala, Tripura West

Copy to the:-

1. Municipal Commissioner, Agartala Municipal Corporation for kind information.
2. District Magistrate & Collector, West Tripura District for kind information.
3. Director, Industries & Commerce, Department, Tripura for kind information.
4. Sub-Divisional Magistrate, Mohanpur for kind information.

Asst. Environmental Engineer
Tripura State Pollution Control Board

Compliance to CTO Conditions

Sr. No.	Consent Conditions	Compliance
General Conditions		
1.	Agartala Municipal Corporation (AMC) shall prepare a solid waste management plan as per the State Policy and Strategy on Solid Waste Management.	Will be complied and prepared
2.	AMC shall arrange for door to door collection of segregated solid waste from all households including slums and informal settlement, commercial, institutional and other non-residential premises. From multi-storage buildings, large commercial complexes, malls, housing complexes, etc., this may be collected from the entry gate or any other designated location.	Door to door collection of segregated waste is being done.
3.	AMC shall establish a system to recognize organizations of waste pickers and promote and establish a system for integration of these authorized waste-pickers and waste collectors to facilitate their participation in solid waste management including door to door collection of waste.	Will be complied
4.	AMC shall facilitate formation of Self Help Groups, provide identify cards and thereafter encourage integration in solid waste management including door to door collection of waste.	Will be complied
5.	AMC shall frame bye-laws incorporating the provisions of these rules within one year from the date of notification of these rules and ensure timely implementation.	Will be complied
6.	AMC shall prescribe from time to time user fee as deemed appropriate and collect the fee from the waste generators on its own or through authorized agency.	Complied, user fee are being levied to waste generators.
7.	AMC shall direct waste generators not to litter i.e. throw or dispose of any waste such as paper, water bottles, liquor bottles, soft drinks cans, tetra packs etc., or burn or burry waste on streets, open public spaces, drains, waste bodies and to segregate the waste at source as prescribed under these rules and hand over the segregated waste to authorized the waste pickers or waste collectors authorized by the local body.	Will be complied
8.	AMC shall setup material recovery facilities or secondary storage facilities with sufficient space for sorting of recyclable materials to enable informal or authorized waste pickers and waste collections to separate recyclables from the waste and provide easy access to waste pickers and recyclers for collection of segregated recyclable waste such as paper, plastic, metal, glass, textile from the source of generation or from material recovery facilities; Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be printed white and those for storage of other wastes shall be printed black.	Will be complied
9.	AMC shall establish waste depositions centers for domestic hazardous waste and give direction for	Will be complied

Sr. No.	Consent Conditions	Compliance
	waste generators to deposit domestic hazardous wastes at this center for its safe disposal. Such facility shall be established in a city or town in a matter that one center is set up for the area of 20 Sq. Km or part thereof and notify the timings of receiving domestic hazardous waste at such centers.	
10.	AMC shall ensure safe storage and transportation of the domestic hazardous waste to the hazardous waste disposal facility or as may be directed by the Tripura State Pollution Control Board.	Will be complied
11.	AMC shall direct street sweepers not to burn tree leaves collected from street sweeping and store them separately and handover to the waste collectors or agency authorized by local body.	Will be complied
12.	AMC shall provide training on solid waste management to waste-pickers and waste collectors	Will be provided
13.	AMC shall collect waste from vegetable, fruit, flower, meat, poultry and fish market on day to day basis and promote setting up of decentralized compost plant or bio-methanation plant at suitable locations in the markets or in the vicinity of markets ensuring hygienic conditions.	Will be complied
14.	AMC shall collect separately waste from sweeping of the streets, lanes and by-lanes daily, or on alternate days or twice a week depending on the density of population, commercial activity and local situation.	Will be complied
15.	AMC shall set up covered secondary storage facility for temporary storage of street sweepings and silt removed from surface drains in case where direct collection of such waste into transport vehicles is not convenient. Waste so collected shall be collected and disposed of at regular intervals as decided by the local body.	Will be complied
16.	AMC shall collect horticulture, parks and garden waste separately and process in the parks and gardens, as far as possible.	Will be complied
17.	AMC shall transport segregated bio-degradable waste to the processing facilities like compost plant, bio-methanation plant or any such facility. Preference shall be given for onsite processing of such waste.	Will be complied
18.	AMC shall transport non bio-degradable waste to the respective processing facility or material recovery facilities or secondary storage facility.	Will be complied
19.	AMC shall transport construction and demolition waste as per the provisions of the Construction and Demolition Waste management Rules, 2016.	Will be complied
20.	AMC shall involve communities in waste management and promotion of home composting, bio-gas generation, decentralized processing of waste at community level subject to control of odour and maintenance of hygienic conditions around the facility.	Will be complied
21.	AMC shall phase out the use of chemical fertilizer in two years and use compost in all parks, gardens	Will be complied

Sr. No.	Consent Conditions	Compliance
	maintained by the local body and whenever possible in other places under its jurisdiction. Incentives may be provided to recycling initiatives by informal waste recycling sector.	
22.	AMC shall facilitate construction, operation and maintenance of solid waste processing facilities and associated infrastructure on their own or with private sector participation or through any agency for optimum utilization of various components of solid waste adopting suitable technology including the following technologies and adhering to the guidelines issues by the MoUD from time to time and standards prescribed by the CPCB. Preference shall be given to decentralized processing to minimize transportation cost and environmental impacts such as Bio-methanation, microbial composting, vermin-composting, anaerobic digestion or any other appropriate processing for bio-stabilization of biodegradable wastes. Waste to energy processes including refused derived fuel for combustible fraction of waste or supply as feedstock to solid waste based plants or cement kilns.	Will be complied
23.	AMC shall undertake on their own or through any other agency construction, operation and maintenance of sanitary landfill and associated infrastructure as per Schedule 1 for disposal of residual wastes in a manner prescribed under these rules.	Will be complied
24.	AMC shall make adequate provision of funds for capital investments as well as operation and maintenance of solid waste management services in the annual budget ensuring that fund for discretionary functions of the local body have been allocated only after meeting the requirement of necessary fund for solid waste management and other obligatory functions of the local body as per these rules.	Will be complied
25.	AMC shall submit application for renewal of authorization at least sixty day before expiry of the validity of authorization.	Will be complied
26.	AMC shall prepare and submit annual report in Form IV on or before the 30th April of the succeeding year to the Commissioner or Director, Municipal Administration or designated Officer	Will be complied
27.	AMC shall send the annual report to Secretary-in-Charge of the State Urban Development Department and to the Tripura State Pollution Control Board or Pollution Control Committee by the 31st May of every year.	Will be complied
28.	AMC shall educate workers including contract workers and supervisors for door to door collection of segregated waste and transporting the unmixed waste during primary and secondary transportation to processing or disposal facility.	Will be complied

Sr. No.	Consent Conditions	Compliance
29.	AMC shall ensure that the operator of a facility provides PPE including uniform, fluorescent jacket, hand gloves, raincoats, appropriate foot wear and masks to all workers handling solid waste and the same are used by the workforce.	Will be complied
30.	AMC shall ensure that provisions for setting up of centers for collection, segregation and storage of segregated wastes are incorporated in building plan while granting approval of building plan of a group housing society or market complex.	Will be complied
31.	AMC shall frame bye-laws and prescribe criteria for levying of spot fine for persons who litters or fails to comply with the provisions of these rules and delegate powers to officers or local bodies to levy spot fines as per the bye laws framed	Will be complied
32.	AMC shall create public awareness through information, education and communication campaign and educate the waste generators on the following namely Not to litter. Minimize generation of waste. Reuse the waste to the extent possible. Practice segregation of waste into bio-degradable, non-biodegradable (recyclable and combustible), sanitary waste and domestic hazardous wastes at source. Practice home composting, vermi-composting, bio-gas generation or community level composting. Wrap securely used sanitary waste as and when generated in the pouches provided by the brand owners or a suitable wrapping as prescribed by the local body and place the same in the bin meant for non-biodegradable waste. Storage of segregated waste at source in different bins. Handover segregated waste to waste pickers, waste collectors, recyclers or waste collection agencies. Pay monthly user fee or charges to waste collectors or local bodies or any other person authorized by the local body for sustainability of solid waste management.	Will be complied
33.	AMC shall stop landfilling or dumping of mixed waste soon after the timeline as specified in the rule 23 for setting up and operationalization of sanitary landfill is over.	Will be complied
34.	AMC shall allow only the non-usable, non-recyclable, non-biodegradable, non-combustible and non-reactive inert waste and pre-processing rejects and residues from waste processing facilities to go to sanitary landfill and the sanitary landfill sites shall meet the specifications as given in Schedule-I, however, every effort shall be made recycle or reused the rejects to achieve the desired objectives of zero waste going to landfill.	Will be complied

Sr. No.	Consent Conditions	Compliance
35.	AMC shall investigate and analyze all old open dumpsites and existing operational dumpsites for their potential of bio-mining and bio-remediation and wherever feasible take necessary action to bio-mine or bio-remediate the sites. In absence of potential bio-mining and bio-remediation, it shall be scientifically capped as per landfill capping norms to prevent further damage to environment.	Will be complied
	Specific Conditions	
1.	The ground water quality within 50 m of the periphery of landfill site shall be periodically monitored covering different seasons in a year that is, summer, monsoon and post-monsoon period to ensure that the ground water is not contaminated.	Will be complied
2.	Ambient air quality at the landfill site and at the vicinity shall be regularly monitored. Ambient air quality shall meet the standards prescribed by the Central Pollution Control Board for Industrial area.	Will be complied
3.	The notifications of Government of Tripura regarding banning of Plastic Carry Bags issued vide Notification No. F.8(30)/DSTE/ENV/ Pt-22/1679-97 dated 10-03-2015 and No. F.8(30)/DSTE/ENV/ Pt-11/1984-2003 dated 19-03-2015 should be strictly adhered to	Will be complied
4.	Public liability insurance coverage shall have to be provided to the workers of the unit	Will be complied
5.	A copy of the consent Certificated should be displayed in the office of the unit	Will be complied
6.	The unit will have to follow other norms and standards issued by TSPCB from time to time	Will be complied

APPENDIX 15: CONSULTATION WITH ONGC ON CSR FUNDING

TITLE SHEET

TATA CONSULTING ENGINEERS LIMITED	MINUTES OF MEETING	MEETING DATE 11.12.19& 4.00 PM	SH 01 OF 01

PRM No.-	CLIENT:ASCL	PROJECT: Agartala Smart City Project	VENUE: ASCL Conference Hall

SUBJECT: Stake holder meeting with ONGC in connection with CSR activities for Ujjayanta Palace on 11.12.2019 in the Conference hall of Agartala Smart City Limited.

PRESENT

ORGANISATION ASCL		ORGANISATION ONGC		ORGANISATION TCEL	
1.	Dr. Shailesh Kr. Yadav (CEO, ASCL)	1.	Dr. U.K Pandey (GM- HR, ONGC Tripura Asset.)	1.	P.K Pal (Sr. GM)
2.	R. Pal (EE, ASCL)			2.	Rajib Das (T.L- PMC ASCL)

SL. NO.	POINTS DISCUSSED	ACTION BY	TARGET DATE
	ASCL made a detailed presentation to ONGC on the proposed development around Ujjayanta Palace building. The following points were discussed in the meeting:-		
1.	**General:-** It was learnt from ONGC that: • CSR activities for those initiatives whose Social value of high are preferred. • ONGC's CSR policy is aligned with Schedule 7 of Company ACT. • One time assistance is provided. No recurring expenditures. • Financial limit of CSR upto Rs. 10 L including GST (Rs. 8.4L) can be sanctioned within financial power of local ONGC office, for higher amount approval for higher ups even Board approval is required. • CSR Check list of ONGC is to be referred while applying for CSR Grant.		
2.	**Possible areas of CSR grant for Ujjayanta Palace Complex :-** After a detailed deliberation, following areas are identified for CSR grant from ONGC:- • Dustbin, toilet, drinking water supply, composting / Composter. • Areation fountain for water quality improvement of the Ujjayanta lakes • Solar powered street lights on the promenade in the hinterland of Ujjayanta palace. • Assistance to set up shops in the Astabal area, in case the shops are meant for generation of livelihood of poor people. • Rainwater harvesting. • Packaged STP. • Creation of Awareness program on heritage value through media, setting up information kiosk etc.		
3.	**Action Item:-** A comprehensive proposal for the CSR activities of Ujjayanta Palace is to be submitted, along with estimate for consideration of ONGC.		

Enclo: 1. Attendance Sheet.
2. Meeting photographs.

Note: All concerned to revert in case of any modifications / additions / omissions in the above MOM, within 2 working days of transmission of this document, after which this MOM shall deemed to be correct and accepted by all as the formal MOM.

FILE NAME: F121R5.DOC

TCE FORM NO. 121 R5

ATTENDANCE OF THE STAKE HOLDER MEETING WITH OMNGC IN CONNECTION WITH CSR ACTIVITIES FOR UJJAYANTA PALACE ON 11.12.2019 IN THE CONFERENECE HALL OF AGARTALA SMART CITY LIMITED

SL NO.	NAME	DESIGNATION	E- MAIL	LANDPHONE/MOBILE NUMBER	SIGNATURE
1	Dr Shailesh K Yadav	CEO ASCL	—	8126744842	11/12
2					
3	R. Pal	EE / ASCL			
4	P. K. Pal	Sr. G M.	pkpal@tec.co.in	9863014731	
5	Rajib Das	T.L.P.M.C. ASCL	rdas@tce.co.in	9830355039	
6	Dr U. K. PANDEY	CGM (HR), ONGC Tripura Asset	hr_Tripura@ongc.co.in	9968282171	11.12.19
7					
8					
9					
10					
11					
12					

Stakeholder's Consultation with ONGC, Venue: - ASCL Conference Hall, Date: - 11-12-2019
Meeting Photographs

APPENDIX 16: HERITAGE TRAIL – UJJAYANTA PALACE

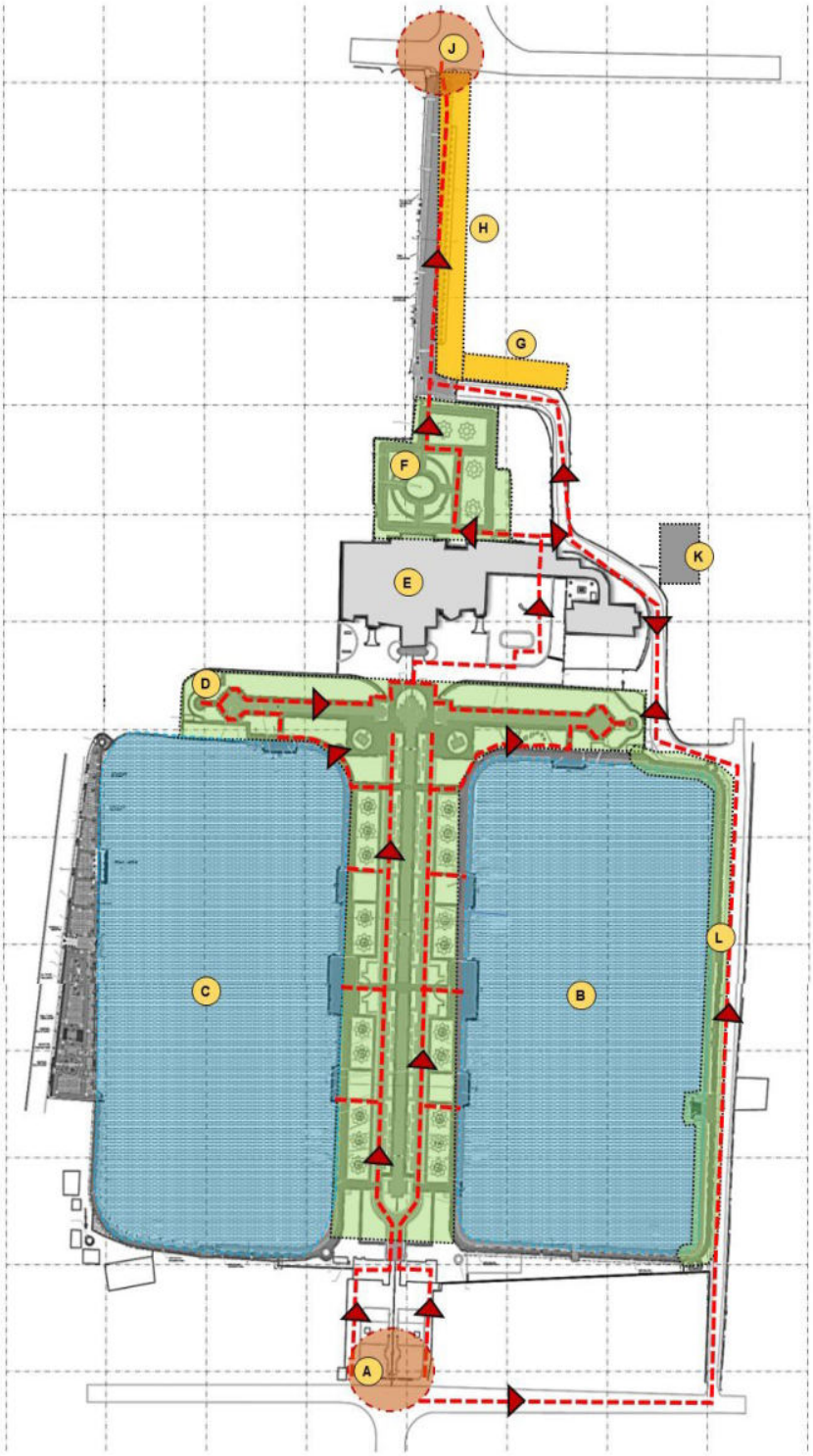
The identified open spaces and heritage structures connected by the heritage trail form South Gate to North Gate is listed below:

(i) South Gate
(ii) Twin lakes with water activities and musical fountain
(iii) Central Promenade with landscaped garden, Ghats, sitting spaces, Chhatris, Curved walls, sculptures, etc.
(iv) Ujjayanta Palace building – Museum
(v) Rear Garden- Multi-activity plaza
(vi) Eastern side Lake edge development
(vii) Food Court
(viii) *Astabal* Area – Shopping Arcade
(ix) North Gate

The heritage trail with the sequence of spaces is represented in the Heritage trail map in next page.

The tourists will enter the ticketed Palace Complex from the South Gate and see the Central Promenade twin lakes and participate in the associated activities, then visit the Ujjayanta Palace Museum and leave the Ticketed palace complex. After than they can enjoy the Rear Garden multiactivity plaza first and then relax at the Food Court or they can take a stroll at the Eastern side lake edge and then to Rear garden and Food court. In the end visit the *Astabal*- shopping arcade and the North Gate.

Heritage Trail Map



LEGEND

A	SOUTH GATE
B	EASTERN LAKE WITH WATER ACTIVITIES
C	WESTERN LAKE WITH MUSICAL FOUNTAIN
D	CENTRAL PROMENADE
E	UJJAYANTA PALACE BUILDING
F	REAR GARDEN – MULTI-ACTIVITY PLAZA
G	FOOD COURT
H	ASTABAL AREA – SHOPPING ARCADE
J	NORTH GATE
K	VISITOR PARKING
L	EASTERN LAKE EDGE DEVELOPMENT

SYMBOLS

- LAKE
- GARDENS
- BUILT STRUCTURES
- PARKING
- START AND END POINTS
- HERITAGE TRAIL

APPENDIX 17: FOREST DEPARTMENT LETTER ON TREE CUTTING AND COMPENSATORY PLANTATION

No.F.11-13/WFD/Deptt.Oprnt/2018-19/ 11595-597
Government of Tripura
Office of the District Forest Officer
West Tripura, Agartala

Dated 27/01/2020

To
The chief executive officer
Agartala Smart City Ltd
UD Bhavan, Agartala

Sub: - request for providing details on compensatory plantation and provisional cost for felling of trees along designated urban roads regarding.
Ref: - No F.4(34)/ASCL/2018/917 dated 19/02/2020

Sir,

With reference to subject cited above, the tentative preliminary estimate for extraction of trees would be 3696000 (thirty six lakh ninty thousand only) as submitted by sdfo sadar.(copy enclosed).

The compensatory plantation must be raised twice the amount of tree felled so in this case minimum one hectare artificial regeneration plantation must be raised the suitable land for which may be identified at nearby degraded forest land at later stage .The cost of raising one hectare plantation will be 324662(three lakh twenty four thousand six hundred and sixty six only) as per government of Tripura notification vide noF.6-273/FC/For-2004/Pt-I/2599-627 dated 24/09/2019 (copy enclosed)

This is for favour of your kind information and doing the need full

Yours faithfully,

(Shakti Kant Singh, IFS)
District Forest Officer
West Tripura District

Copy to:
1. SDFO Sadar for information and necessary action
2. Range officer Sadar for information and necessary action

27/02

District Forest Officer
West Tripura District

APPENDIX 18: WHO Interim Guidance on Water, Sanitation, Hygiene and Waste Management for the COVID19 virus

World Health Organization

unicef

Water, sanitation, hygiene, and waste management for the COVID-19 virus

Interim guidance
19 March 2020

Background

This interim guidance supplements the infection prevention and control (IPC) documents by summarizing WHO guidance on water, sanitation and health care waste relevant to viruses, including coronaviruses. It is intended for water and sanitation practitioners and providers and health care providers who want to know more about water, sanitation and hygiene (WASH) risks and practices.

The provision of safe water, sanitation, and hygienic conditions is essential to protecting human health during all infectious disease outbreaks, including the COVID-19 outbreak. Ensuring good and consistently applied WASH and waste management practices in communities, homes, schools, marketplaces, and health care facilities will help prevent human-to-human transmission of the COVID-19 virus.

The most important information concerning WASH and the COVID-19 virus is summarized here.

- Frequent and proper hand hygiene is one of the most important measures that can be used to prevent infection with the COVID-19 virus. WASH practitioners should work to enable more frequent and regular hand hygiene by improving facilities and using proven behavior-change techniques.
- WHO guidance on the safe management of drinking-water and sanitation services applies to the COVID-19 outbreak. Extra measures are not needed. Disinfection will facilitate more rapid die-off of the COVID-19 virus.
- Many co-benefits will be realized by safely managing water and sanitation services and applying good hygiene practices.

Currently, there is no evidence about the survival of the COVID-19 virus in drinking-water or sewage. The morphology and chemical structure of the COVID-19 virus are similar to those of other human coronaviruses for which there are data about both survival in the environment and effective inactivation measures. This document draws upon the evidence base and WHO guidance on how to protect against viruses in sewage and drinking-water. This document will be updated as new information becomes available.

1. COVID-19 transmission

There are two main routes of transmission of the COVID-19 virus: respiratory and contact. Respiratory droplets are generated when an infected person coughs or sneezes. Any person who is in close contact with someone who has respiratory symptoms (sneezing, coughing) is at risk of being exposed to potentially infective respiratory droplets.[1] Droplets may also land on surfaces where the virus could remain viable; thus, the immediate environment of an infected individual can serve as a source of transmission (contact transmission).

Approximately 2–10% of cases of confirmed COVID-19 disease present with diarrhoea,[2-4] and two studies detected COVID-19 viral RNA fragments in the faecal matter of COVID-19 patients.[5,6] However, only one study has cultured the COVID-19 virus from a single stool specimen.[7] There have been no reports of faecal–oral transmission of the COVID-19 virus.

2. Persistence of the COVID-19 virus in drinking-water, faeces and sewage and on surfaces.

Although persistence in drinking-water is possible, there is no evidence from surrogate human coronaviruses that they are present in surface or groundwater sources or transmitted through contaminated drinking water. The COVID-19 virus is an enveloped virus, with a fragile outer membrane. Generally, enveloped viruses are less stable in the environment and are more susceptible to oxidants, such as chlorine. While there is no evidence to date about survival of the COVID-19 virus in water or sewage, the virus is likely to become inactivated significantly faster than non-enveloped human enteric viruses with known waterborne transmission (such as adenoviruses, norovirus, rotavirus and hepatitis A). For example, one study found that a surrogate human coronavirus survived only 2 days in dechlorinated tap water and in hospital wastewater at 20°C.[8] Other studies concur, noting that the human coronaviruses transmissible gastroenteritis coronavirus and mouse hepatitis virus demonstrated a 99.9% die-off in from 2 days[9] at 23°C to 2 weeks[10] at 25°C. Heat, high or low pH, sunlight, and common disinfectants (such as chlorine) all facilitate die off.

It is not certain how long the virus that causes COVID-19 survives on surfaces, but it seems likely to behave like other coronaviruses. A recent review of the survival of human

coronaviruses on surfaces found large variability, ranging from 2 hours to 9 days.[11] The survival time depends on a number of factors, including the type of surface, temperature, relative humidity, and specific strain of the virus. The same review also found that effective inactivation could be achieved within 1 minute using common disinfectants, such as 70% ethanol or sodium hypochlorite (for details, see Cleaning practices).

3. Keeping water supplies safe

The COVID-19 virus has not been detected in drinking-water supplies, and based on current evidence, the risk to water supplies is low.[12] Laboratory studies of surrogate coronaviruses that took place in well-controlled environments indicated that the virus could remain infectious in water contaminated with faeces for days to weeks.[10] A number of measures can be taken to improve water safety, starting with protecting the source water; treating water at the point of distribution, collection, or consumption; and ensuring that treated water is safely stored at home in regularly cleaned and covered containers.

Conventional, centralized water treatment methods that use filtration and disinfection should inactivate the COVID-19 virus. Other human coronaviruses have been shown to be sensitive to chlorination and disinfection with ultraviolet (UV) light.[13] As enveloped viruses are surrounded by a lipid host cell membrane, which is not robust, the COVID-19 virus is likely to be more sensitive to chlorine and other oxidant disinfection processes than many other viruses, such as coxsackieviruses, which have a protein coat. For effective centralized disinfection, there should be a residual concentration of free chlorine of $\geq$0.5 mg/L after at least 30 minutes of contact time at pH <8.0.[12] A chlorine residual should be maintained throughout the distribution system.

In places where centralized water treatment and safe piped water supplies are not available, a number of household water treatment technologies are effective in removing or destroying viruses, including boiling or using high-performing ultrafiltration or nanomembrane filters, solar irradiation and, in non-turbid waters, UV irradiation and appropriately dosed free chlorine.

4. Safely managing wastewater and faecal waste

There is no evidence that the COVID-19 virus has been transmitted via sewerage systems with or without wastewater treatment. Further, there is no evidence that sewage or wastewater treatment workers contracted the severe acute respiratory syndrome (SARS), which is caused by another type of coronavirus that caused a large outbreak of acute respiratory illness in 2003. As part of an integrated public health policy, wastewater carried in sewerage systems should be treated in well-designed and well-managed centralized wastewater treatment works. Each stage of treatment (as well as retention time and dilution) results in a further reduction of the potential risk. A waste stabilization pond (an oxidation pond or lagoon) is generally considered a practical and simple wastewater treatment technology particularly well suited to destroying pathogens, as relatively long retention times (20 days or longer) combined with sunlight, elevated pH levels, biological activity, and other factors serve to accelerate pathogen destruction. A final disinfection step may be considered if existing wastewater treatment plants are not optimized to remove viruses. Best practices for protecting the health of workers at sanitation treatment facilities should be followed. Workers should wear appropriate personal protective equipment (PPE), which includes protective outerwear, gloves, boots, goggles or a face shield, and a mask; they should perform hand hygiene frequently; and they should avoid touching eyes, nose, and mouth with unwashed hands.

WASH in health care settings

Existing recommendations for water, sanitation and hygiene measures in health care settings are important for providing adequate care for patients and protecting patients, staff, and caregivers from infection risks.[14] The following actions are particularly important: (i) managing excreta (faeces and urine) safely, including ensuring that no one comes into contact with it and that it is treated and disposed of correctly; (ii) engaging in frequent hand hygiene using appropriate techniques; (iii) implementing regular cleaning and disinfection practices; and (iv) safely managing health care waste. Other important measures include providing sufficient safe drinking-water to staff, caregivers, and patients; ensuring that personal hygiene can be maintained, including hand hygiene, for patients, staff and caregivers; regularly laundering bedsheets and patients' clothing; providing adequate and accessible toilets (including separate facilities for confirmed and suspected cases of COVID-19 infection); and segregating and safely disposing of health care waste. For details on these recommendations, please refer to Essential environmental health standards in health care.[14]

1. Hand hygiene practices

Hand hygiene is extremely important. Cleaning hands with soap and water or an alcohol-based hand rub should be performed according to the instructions known as "My 5 moments for hand hygiene".[15] If hands are not visibly dirty, the preferred method is to perform hand hygiene with an alcohol-based hand rub for 20–30 seconds using the appropriate technique.[16] When hands are visibly dirty, they should be washed with soap and water for 40–60 seconds using the appropriate technique.[17] Hand hygiene should be performed at all five moments, including before putting on PPE and after removing it, when changing gloves, after any contact with a patient with suspected or confirmed COVID-19 infection or their waste, after contact with any respiratory secretions, before eating, and after using the toilet.[18] If an alcohol-based hand rub and soap are not available, then using chlorinated water (0.05%) for handwashing is an option, but it is not ideal because frequent use may lead to dermatitis, which could increase the risk of infection and asthma and because prepared dilutions might be inaccurate.[19] However, if other options are not available or feasible, using chlorinated water for handwashing is an option.

Functional hand hygiene facilities should be present for all health care workers at all points of care and in areas where PPE is put on or taken off. In addition, functional hand hygiene facilities should be available for all patients, family members, and visitors, and should be available within 5 m of toilets, as well as in waiting and dining rooms and other public areas.

2. Sanitation and plumbing

People with suspected or confirmed COVID-19 disease should be provided with their own flush toilet or latrine that has a door that closes to separate it from the patient's room. Flush toilets should operate properly and have functioning drain traps. When possible, the toilet should be flushed with the lid down to prevent droplet splatter and aerosol clouds. If it is not possible to provide separate toilets, the toilet should be cleaned and disinfected at least twice daily by a trained cleaner wearing PPE (gown, gloves, boots, mask, and a face shield or goggles). Further, and consistent with existing guidance, staff and health care workers should have toilet facilities that are separate from those used by all patients.

WHO recommends the use of standard, well-maintained plumbing, such as sealed bathroom drains, and backflow valves on sprayers and faucets to prevent aerosolized faecal matter from entering the plumbing or ventilation system,[20] together with standard wastewater treatment.[21] Faulty plumbing and a poorly designed air ventilation system were implicated as contributing factors to the spread of the aerosolized SARS coronavirus in a high-rise apartment building in Hong Kong in 2003.[22] Similar concerns have been raised about the spread of the COVID-19 virus from faulty toilets in high-rise apartment buildings.[23] If health care facilities are connected to sewers, a risk assessment should be conducted to confirm that wastewater is contained within the system (that is, the system does not leak) before its arrival at a functioning treatment or disposal site, or both. Risks pertaining to the adequacy of the collection system or to treatment and disposal methods should be assessed following a safety planning approach,[24] with critical control points prioritized for mitigation.

For smaller health care facilities in low-resource settings, if space and local conditions allow, pit latrines may be the preferred option. Standard precautions should be taken to prevent contamination of the environment by excreta. These precautions include ensuring that at least 1.5 m exists between the bottom of the pit and the groundwater table (more space should be allowed in coarse sands, gravels, and fissured formations) and that the latrines are located at least 30 m horizontally from any groundwater source (including both shallow wells and boreholes).[21] If there is a high groundwater table or a lack of space to dig pits, excreta should be retained in impermeable storage containers and left for as long as feasible to allow for a reduction in virus levels before moving it off-site for additional treatment or safe disposal, or both. A two-tank system with parallel tanks would help facilitate inactivation by maximizing retention times, as one tank could be used until full, then allowed to sit while the next tank is being filled. Particular care should be taken to avoid splashing and the release of droplets while cleaning or emptying tanks.

3. Toilets and the handling of faeces

It is critical to conduct hand hygiene when there is suspected or direct contact with faeces (if hands are dirty, then soap and water are preferred to the use of an alcohol-based hand rub). If the patient is unable to use a latrine, excreta should be collected in either a diaper or a clean bedpan and immediately and carefully disposed of into a separate toilet or latrine used only by suspected or confirmed cases of COVID-19. In all health care settings, including those with suspected or confirmed COVID-19 cases, faeces must be treated as a biohazard and handled as little as possible. Anyone handling faeces should follow WHO contact and droplet precautions[18] and use PPE to prevent exposure, including long-sleeved gowns, gloves, boots, masks, and goggles or a face shield. If diapers are used, they should be disposed of as infectious waste as they would be in all situations. Workers should be properly trained in how to put on, use, and remove PPE so that these protective barriers are not breached.[25] If PPE is not available or the supply is limited, hand hygiene should be regularly practiced, and workers should keep at least 1 m distance from any suspected or confirmed cases.

If a bedpan is used, after disposing of excreta from it, the bedpan should be cleaned with a neutral detergent and water, disinfected with a 0.5% chlorine solution, and then rinsed with clean water; the rinse water should be disposed of in a drain or a toilet or latrine. Other effective disinfectants include commercially available quaternary ammonium compounds, such as cetylpyridinium chloride, used according to manufacturer's instructions, and peracetic or peroxyacetic acid at concentrations of 500–2000 mg/L.[26]

Chlorine is ineffective for disinfecting media containing large amounts of solid and dissolved organic matter. Therefore, there is limited benefit to adding chlorine solution to fresh excreta and it is possible that this may introduce risks associated with splashing.

4. Emptying latrines and holding tanks, and transporting excreta off-site.

There is no reason to empty latrines and holding tanks of excreta from suspected or confirmed COVID-19 cases unless they are at capacity. In general, the best practices for safely managing excreta should be followed. Latrines or holding tanks should be designed to meet patient demand, considering potential sudden increases in cases, and there should be a regular schedule for emptying them based on the wastewater volumes generated. PPE (long-sleeved gown, gloves, boots, masks, and goggles or a face shield) should be worn at all times when handling or transporting excreta offsite, and great care should be taken to avoid splashing. For crews, this includes pumping out tanks or unloading pumper trucks. After handling the waste and once there is no risk of further exposure, individuals should safely remove their PPE and perform hand hygiene before entering the transport vehicle. Soiled PPE should be put in a sealed bag for later safe laundering (see Cleaning practices). Where there is no off-site treatment, in-situ treatment can be done using lime. Such treatment involves using a 10% lime slurry added at 1-part lime slurry per 10 parts of waste.

5. Cleaning practices

Recommended cleaning and disinfection procedures for health care facilities should be followed consistently and correctly.[19] Laundry should be done and surfaces in all environments in which COVID-19 patients receive care (treatment units, community care centres) should be cleaned at least once a day and when a patient is discharged.[27] Many disinfectants are active against enveloped viruses, such as the COVID-19 virus, including commonly used hospital disinfectants. Currently, WHO recommends using:

- 70% ethyl alcohol to disinfect small areas between uses, such as reusable dedicated equipment (for example, thermometers);
- sodium hypochlorite at 0.5% (equivalent to 5000 ppm) for disinfecting surfaces.