

Schedules

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Schedule-A - Site of the Project

1.0 The Site

Site for the demonstration of energy efficient seawater desalination technologies in the Activation Area (AA) at Dholera Special Investment Region (DSIR) is as described in **Annexure-I** of this Schedule-A.

The dates of handing over the Site to the Contractor are specified in **Annexure-II** of this Schedule-A.

An inventory of the Site including trees and any other immovable property on, or attached to, the Site shall be prepared jointly by the Authority Representative and the Contractor, and such inventory shall form part of the Agreement.

The proposed location for seawater intake and reject systems is shown as tentative areas identified in **Annexure-III**.

The status of the Environment clearances is given in **Annexure-IV**.

Annexure I – Site

(Schedule-A)

1.0 SITE

The proposed location for the desalination plant is the waterfront area. According to CRZ Notification 2011, GoI generation of power by non-conventional power sources / desalination plants is allowed in areas CRZ –I (B) and CRZ-III subject to impact assessment study. A detailed study in this regard has been done by the client based on which the tentative location of the demonstration plant is identified and is indicated in drawing titled ‘Location of demonstration plant at Dholera SIR’ as attached.

Detailed study for the location of site for the demonstration of technology were conducted by expert teams. The following criteria were considered during the finalization of site.

1. Availability of renewable energy resources
2. Approach by road
3. Availability of water all through the year, since the region is located in low – high tide.
4. Intake methodology for sea water
5. Reject mechanism for the brine

The site is located near to Activation Area, Dholera Industrial City, Dholera Taluka, Ahmedabad. Gujarat State, India. Pin. 382455. The proposed desalination plant site is located on the coast line of Arabian Sea Delta.

- Nearest Airport: Ahmedabad of 100 kms. by road
- Nearest Railway Stations: Ahmedabad 112 Kms / Dhanduka 22 Kms

Well connected by road networks through all National Highways. The site area is more or less sandy, plain sea shore but approach road to the site is available. Adequate space is available at plant site for storing and safe keeping of items. Adequate land parcels will be allotted for demonstration of different energy efficient desalination technologies. It is proposed to bring water from the sea to a common intake system for use of prospective However, temporary shed, at the discretion of the contractor, may have to be made to have project office of the contractor and the shed needs to be demolished/ dismantled after completion of the job. Arrangement of transport and staying/accommodation for contractor’s personnel.

The proposed location for the demonstration of energy efficient seawater desalination technologies is within the government land. Each contractor who participates in the project will be given a land of approximately 75 x 50 m area for a period of minimum 12 months and maximum 14 months for the demonstrating energy efficient desalination technology including seawater intake, reject and management of utility water.

The individual contractor should find the source of power themselves during the period of installation, commissioning and operation.

The key results that are expected out of the proposed demonstration of seawater desalination technologies are;

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

1. Energy efficient systems which can improve / replace the current membrane / thermal technologies
2. Cost competitive technologies which are successfully operated in pilot scale for a minimum period of 12 months and maximum 14 months to give guidelines for commercial scale-ups. In the event there are man-days losses due to unprecedented circumstances, breakdowns, including natural calamity the same has to be compensated with additional man days to count minimum 12 months in total.
3. Environmentally viable technologies that can have a better intake and reject systems especially that will cater a high-low tide scenario.

Table 1: The tentative coordinates for the location

Sl. No.	Activity	Points	X-Co-ordinate	Y-Co-ordinate
1	Common Intake System	1	22 26 02.8152	24 51 819.493
2	Demonstration of technology	1	21 30 44.448	24 52 591.402
		2	21 32 83.0629	24 52 575.586
		3	21 32 55.4362	24 52 134.484
		4	21 30 15.2409	24 52 144.543
3	Common Reject System	2	22 22 59.3794	24 52 368.99

Index Maps and Location Maps of the project are given in Annexure III

1.1 Seismicity

The Dholera Special Investment Region falls under the Zone III of the Seismic zoning map of India – IS: 1893-2002.

2.0 Utilities / Services

The following list of services and systems must be considered by each contractor within his premises

Services to be provided at site by the contractor for Scope of work as Part A

1. Connection from common intake system for seawater intake
2. Connection to common reject system for brine disposal
3. Connection to common utility line for using the produced water economically
4. Electric connections to function the desalination process at individual plots
5. Effective communication system for remote monitoring of functions under study/evaluation

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

6. Effective metering devices to measure the intake, reject and the produced water at individual plot levels
7. Lab facilities to measure the quality of produced water and the brine reject at each plot level
8. RTU and SCADA of water utilities, power consumption, control and metering equipment
9. Street light Power, control and metering at each plot level
10. CCTV facilities to monitor plot level activity 24x7
11. Wi-fi Power, control and metering equipment
12. Fibre optic cables and its networking
13. Uninterruptable Power Supply (UPS) and diesel generator (DG) and other equipment for relevant storage of data for the period of minimum 12 months at site

Services to be provided at site by the contractor for Scope of work as Part B

1. Seawater intake facilities from the sea to the boundary wall of the individual contractors
2. Collection of brine from the boundary wall of individual contractors and disposal of same to the sea.
3. Collection of produced water from the plot level to the main produced water storage tank.
4. Facilities to store intake seawater storage for a period of 48 hours.
5. Facilities to store cumulative brine reject for a period of 48 hours
6. Facilities to store the cumulative produced water for a period of 48 hours
7. Measurement of seawater intake, brine reject and produced water at plot levels and at main storage tank levels.
8. Effective integration of communication from the instruments/storage/power/water devices from plot level to a common platform level for real time monitoring.
9. All approval from Government bodies and other statutory bodies pertaining environment clearances and other statutory clearances for the seawater intake, storage, brine reject and storage.
10. All studies for approval / clearances will be in the scope of the contractor for part B scope of work.
11. Provision, Operation and maintenance of the facilities as above for the individual contractors at plot level.
12. Depending on the site condition, the contractor has to take care any land levelling required at the plot level, to facilitate the work as per Scope A.

Annexure-II – Land Details

(Schedule-A)

Existing Land Ownership

The existing land for each of the demonstration plot will be under the ownership of Dholera Industrial City Development Limited (DICDL) through the period of design, supply, installation, commissioning, operation through minimum 12 months and maximum 14 months handing over the system back to the DICDL. During the period of operation and after the successful demonstration of the project the equipment used at site including the facilities for the common intake, reject and utility will be under the direct ownership of DICDL.

1.0 Handing over of Site to Contractor

Details of handing over of Site to Contractor are given in table below;

Table 1

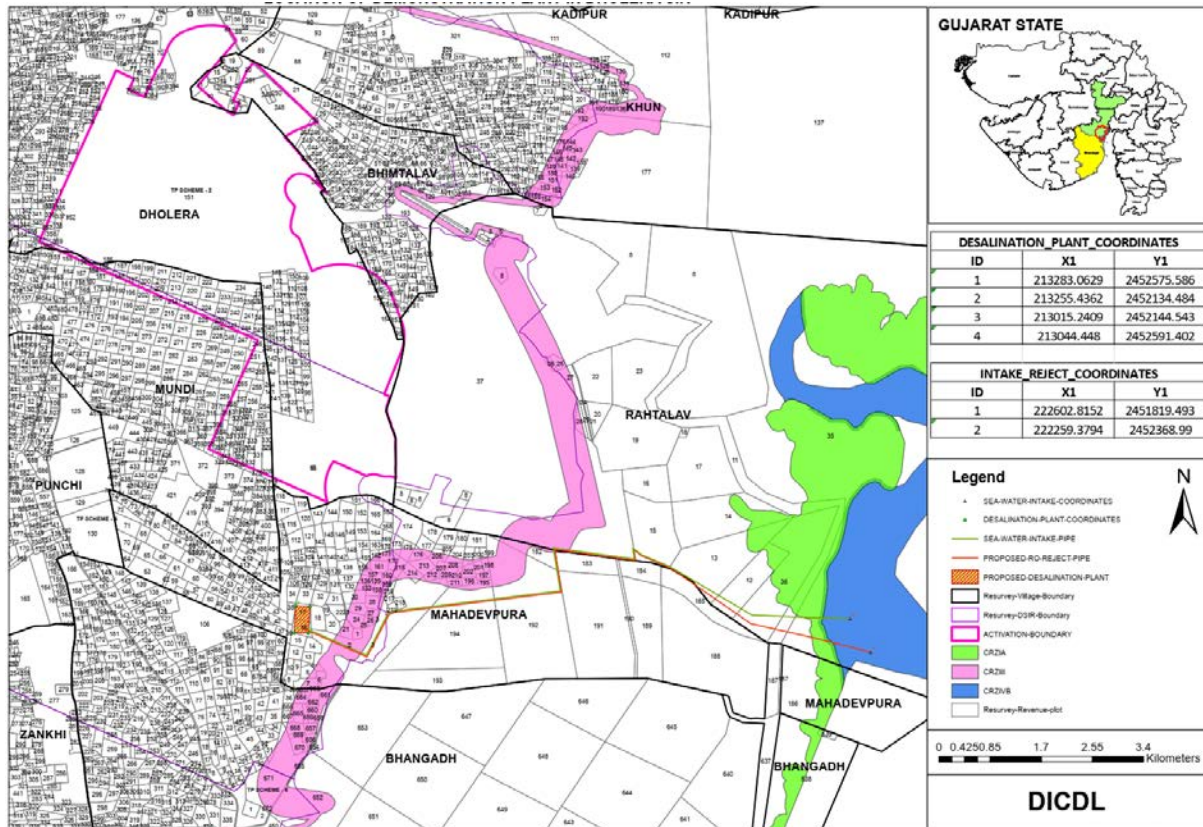
S. No.	Site Details
1	The average size of each of the plot will be 75m x 50m which excludes the common areas (approach roads, ducts for common intake, reject, utility lines, power lines). The contractor who does the Part A scope of work has to provide the required infrastructure facilities for movement of men, material and equipment in respective plots during installation, commissioning and operational phases of the project. The contractor who bids for Part B scope of work will have to provide approach roads for general access to each of the plots for carrying out the scope of work as indicated in part A in this tender. Contractor B shall provide required levelling of land to avoid any inundation due to high tide and monsoon throughout the course of the project during different seasons.

Annexure – III - Draft details of location for the Desalination plant

(Schedule-A)

1.0 Location of demonstration of desalination technology:

The location for demonstration of desalination technology will be done at the site marked in the development plan (land use plan) is shown below;



Annexure – IV - Site Topography

(Schedule-A)

- 1.0** The site is topographically flat. The area is low lying, sloping towards the Sea in east and prone to water logging during heavy rains. The he sites would have to be land filled to avoid inundation during high tide and monsoon season. Water table is around 3.0 m from Ground Level in March 2014. This will rise up to 1.5 m in monsoon with high tidal period. The soil mainly consists of alternate layers of gravels, fine to coarse grained sand and clay. Chemically the soils are loamy, mixed montmorillonitic, calcareous and mostly saline. The contractor who bids for Part B scope of work has to take this into consideration.

Annexure – V - Environment Clearances

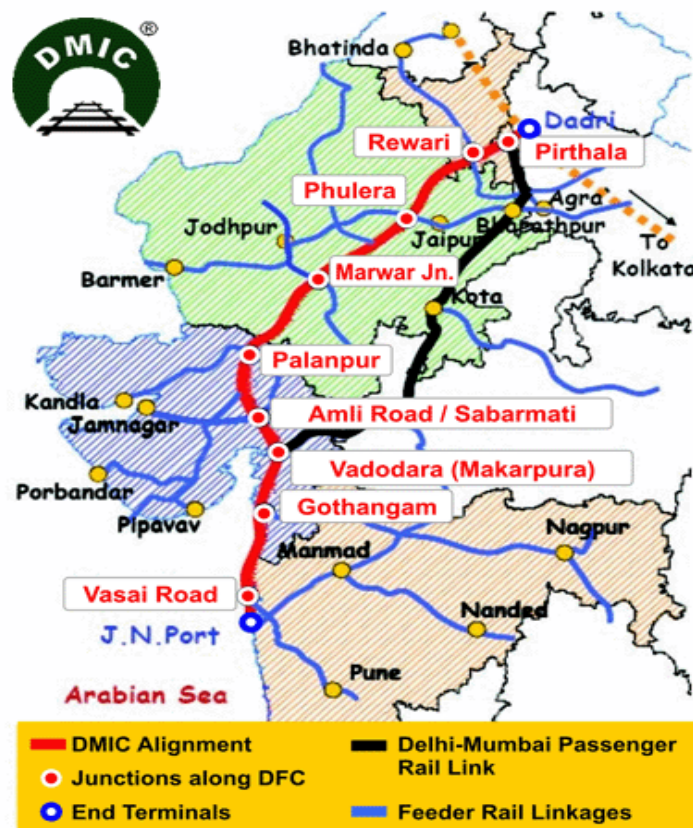
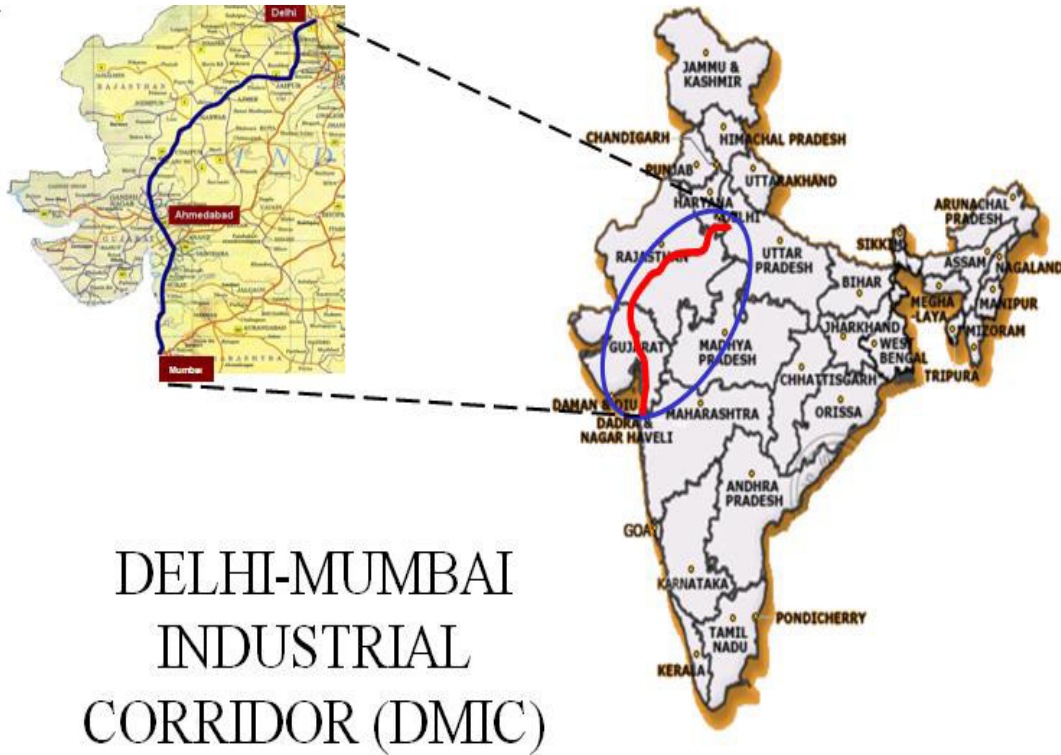
(Schedule-A)

1.0 The Environment clearance for Dholera Special Investment Region (DSIR) has been obtained. However, the bidder for the scope of work Part B in the tender has to obtain all clearances for the seawater intake, brine reject management for the period of the project. Any studies to be conducted as part of the scope of work will be on the contractor's purview.

The following studies and any other associated studies as part of job will be mandatory. Any processing fees for the approval will be in contractor scope of work.

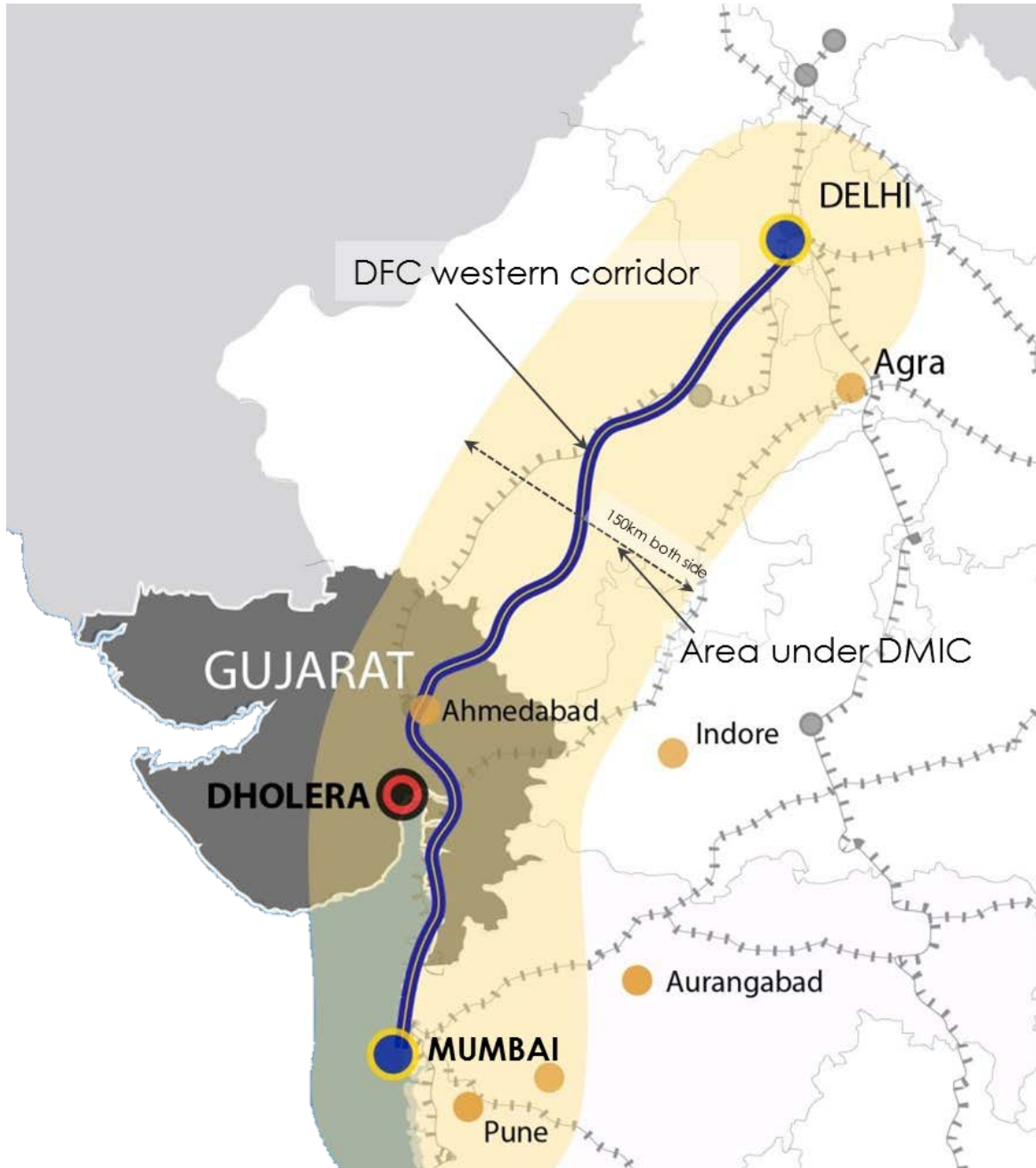
- a) GMB
- b) Approval from Kalpasar
- c) Coastal Regulatory Zone (GCZMA & MoEFF CC)
- d) Land requirement & ownership details
- e) Environmental Impact Assessment studies

Appendix A 1 - Index Maps and Location Maps



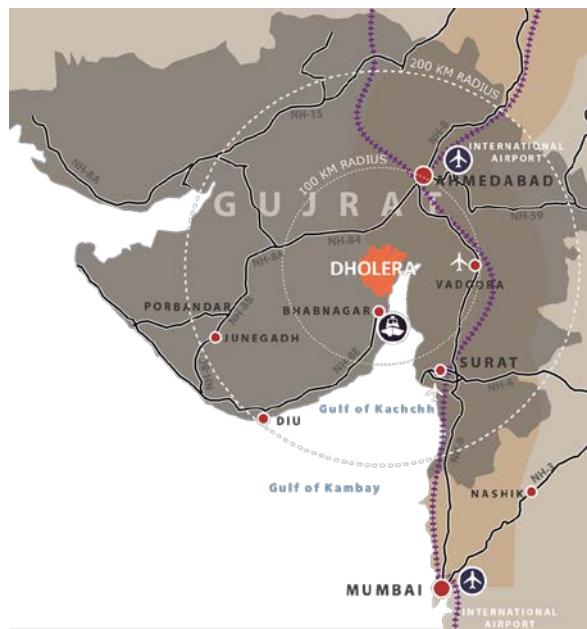
**DELHI MUMBAI INDUSTRIAL CORRIDOR (DMIC) /
DHOLERA SPECIAL INVESTMENT REGION (DSIR)**

Map-1



INDIA / GUJARAT / Dholera Special Investment Region (DSIR)

Map 2



Schedule B – Demonstration of Energy Efficient Desalination Technologies

SCOPE OF WORKS

The scope of work for the demonstration of energy efficient desalination technologies is divided into Part A and Part B as described below. The bidders should quote separately for Part A and Part B. The bidders can quote for Part A and/or Part B. The scope of work as indicated in Part A and Part B shall include the operation and maintenance for a period of minimum 12 months.

Part A

Demonstration of energy efficient, cost competitive and environment friendly seawater desalination technologies shall include design, fabrication, installation, commissioning operation and maintenance of the following as described in this Schedule-B and in Schedule-C.

1.0 GENERAL

- 1.1.1 Design, detailed engineering, manufacture/procurement/fabrication, assembly, testing and supply of a maximum 10,000 Litres Per day (LPD) seawater desalination system with a combination of thermal / membrane/ any other suitable technology or its combinations to be demonstrated for a period of minimum 12 months. The details of each of the plots and approach roads are indicated in the drawing titled ‘Typical details of single desalination plot (Part A)’, as part of the tender document.
- 1.1.2 The results from the demonstration of technologies should be able to substantiate design of seawater desalination projects to meet the water requirement through the development phases.
- 1.1.3 Seawater intake systems, pre-treatment methods and reject mechanism including compatibility of brine disposal, if any inside the allotted plots. Provision for the intake and reject mechanism will be provided at the plot level. Individual contractor should make the provision for storage of seawater (intake), reject (brine) and produced water for a period of 48 hours of operation. The supply will include associated process equipment, high pressure & low-pressure pumps, pressure exchangers, electrical drives/motors/agitators, in-plant process piping & utility piping (service water to all chemical preparation tanks from the overhead water tanks, compressed air lines), fittings, valves, proper piping supports, process instruments, instrument receiver panels, PLC in required nos., PC based SCADA control system, mandatory spares etc.
- 1.1.4 Manufacturers recommended spares for 18 months for trouble free maintenance are to be quoted and included in the total lumpsum cost.
- 1.1.5 The Contractors are advised to visit the site before submitting the Proposal for the works.
- 1.1.6 The Scope includes all temporary works required for the completion of works, testing and commissioning and handover till the successful demonstration of technologies and handing over to DICDL.
- 1.1.7 The Scope includes all consumables required for the completion of works , testing and commissioning and handover till successful operation and handing over to DICDL.
- 1.1.8 Execution of the work on site shall commence only after the approval of the employer (DICDL) / Employer’s engineers including but not limited to design, material etc.
- 1.1.9 Packing, forwarding, freight, safe delivery, unloading, safe keeping of items at site, erection & installation of equipment and machineries following safe industrial practices, external painting, testing & commissioning with required first charge materials, chemicals and

manpower as required till completion of satisfactory performance demonstration run matching to acceptance criteria (i.e. to show uninterrupted 365-day operation under design condition) and handing over of the plant.

- 1.1.10 Provision for sitting / staying of Security guard/s appointed by the contractor along with required furniture and other functional items as required and approved by Employer's Engineer.
- 1.1.11 Tools, tackles, cranes, forklift etc as required for unloading and erection jobs at the site are to be organized by the contractor and forms part of the scope. Water and electricity required for site erection, commissioning and final handing-over for demonstration has to be arranged by the bidder.
- 1.1.12 Laboratory support & assistance required for measurement of intake/reject/permeate water qualities/quantities for demonstration run for the period of 12 months at different points as deemed required to meet the Key Performance Indicators (KPI's) to be eligible for selection as a successful demonstrator is to be included within the scope of contract.
- 1.1.13 Provision for Demonstration for operation of the plant for (a) 8 Hrs (12) Hrs and (24 Hrs cycles
- 1.1.14 Electrical power and heat required for operation of the plant as part of demonstration should be made available by the contractor by energy efficient sources.
- 1.1.15 Instrumentation & control system, the complete job covering field instruments (process instruments, analytical online instruments, transmitters etc), receiver panel with indicators, data interface, PLC, SCADA systems etc.
- 1.1.16 Portacabins for instrument shelter, manpower stations and communication systems. The individual plots should be manned for security 24x7 with proper manpower at the contractor's arrangement.
- 1.1.17 Civil works for foundations to combat local weather conditions for the period of demonstration and evaluation and analysis of results. Civil design for equipment foundations with raised base & pockets as required based on loading data of vendor/OEM supplied drawing and construction of foundations are to be carried-out. All civil works related to vehicle equipment movement inside individual plots have to be done by the individual contractors.
- 1.1.18 Brine disposal tanks, storage, retravel and disposal systems as necessary indicated in the original proposal submitted and approved of Security guard/s appointed by the contractor along with required furniture and other functional items as required and approved by Employer's Engineer.
- 1.1.19 All portacabins / shelter houses should be arranged proper ventilation, climate control suitable for living as and how required for the manhours spent at site.
- 1.1.20 Proper disposal of any/all municipal solid waste from site to a location outside the DSIR through approval criteria as per GPCB/ CPCB/ CRZ criteria and clearances.
- 1.1.21 All communication interfaces for collection, monitoring, storing, and assessment of data in real time. The communication has to be interfaced with a common platform interface done by the contractor for part B scope of work. The data should be available for a minimum of 24 months after the completion of the work.

Part B

Provision of seawater intake system, brine management system and utility lines for the demonstration of technologies. The contractor shall manage the facilities for the period of 12 to 14 months from the date of commissioning of the Part A scope of work.

- 1.1.22 Survey of site, identification of location, submission of feasibility report, submission of detailed engineering report on possible locations for intake of minimum 200000 litres per day of seawater intake systems for demonstration of energy efficient seawater intake system at tentative locations as described in Annexure III
- 1.1.23 The intake system should be innovative form the current seawater intake system to accommodate the possibility of shorelines with high-low tide phenomenon, typical to Dholera Special Investment Region and some regions of the Gujarat coast.
- 1.1.24 Survey of site, submission of feasibility report, submission of detail engineering report for brine management from the project energy efficient seawater desalination project at AA in DSIR
- 1.1.25 Design, development and erect suitable facilities for supply, storage and distribution of uninterrupted maximum of 10,000 LPD (litres per day) seawater for a period of minimum period of 12 months from the nearest possible location from the site selected as shown in Annexure III . The estimated supply to each plot will be a maximum of 30,000 LPD. The contractor should have a provision to store the seawater intake per day for a period of 48 hours to avoid any breakdowns in supply.
- 1.1.26 Design, develop, deploy and operate brine management mechanism for collection, storage and disposal of brine from five test sites to a common reject mechanism at least 2 kms downstream of the identified seawater intake location. The estimated total brine is minimum 100,000 LPD,
- 1.1.27 Design, develop, deploy and operate a utility management system for collection of potable water from five sites, storage in a common utility tank.
- 1.1.28 The intake, reject and the utility lines should be monitored by SCADA system, to be remotely monitored by the employer/employers' engineer.
- 1.1.29 Proper manning should be arranged by the contractor at the intake, reject and the utility lines 24x7. The Intake reject and the utility lines should have proper monitoring systems to measure the parameters necessary for the broad outcomes of the project.
- 1.1.30 Proper lab arrangement at site to measure the quality of seawater intake, reject and the utility
- 1.1.31 All portacabins / shelter houses should be arranged proper ventilation, climate control suitable for living as and how required for the man-hours spent at site.
- 1.1.32 Proper disposal of any/all municipal solid waste from site to a location outside the DSIR through approval criteria as per GPCB/ CPCB/ CRZ criteria and clearances.
- 1.1.33 The contractor has to collect the produced water from each plot and store in a common utility tank outside plot level. The employer wish to utilise the produced water for various application from time to time.
- 1.1.34 The contractor should have automatic metering system to measure the supply of seawater to individual plots, collection of reject from each plots and measure of produced water from each

plot on a 24x7 for a period of 12 months. There should be sufficient storage provision of data for a period of minimum 12 months.

- 1.1.35 The contractor should interface the communication from each of the plot to a common platform for remote communication of the operating parameters.
- 1.1.36 The contractors scope of work for Part B, Scope of work is indicated in the drawings 'Intake, reject and utilities (part B), Layout plan of tentative pipe connection to individual plots (Part B) and SCADA interface drawings (Part B).
- 1.1.37 The contractor should provide proper land levelling for the Part A scope of work, including approach roads at plot level. The approximate land requirement for each technology demonstration is 75x50m. Each plot has to be separated from the other through proper temporary boundary walls with minimum height of 1.5 m using barbed wires.. Contractor to consider 5 plots for demonstration purpose. The approach roads do not have to be necessarily black top but should be mandatorily useful for transport of men and equipment during all seasons of the year. The contour level of site varies by 2 to 3 m. The sub soil water level at site varies from 1.5 to 3 m, below natural ground level. The site development works inside the demonstration plots includes filling and compacting earth. The average filling for the demonstration plot works is about 1.5 to 2 m.
- 1.1.38 The contractors scope of work for Part B, Scope of work is indicated in the drawings 'Intake, reject and utilities (part B), Layout plan of tentative pipe connection to individual plots (Part B) and SCADA interface drawings (Part B).

2.0 SPECIFICATIONS AND STANDARDS

The Demonstration of energy efficient seawater desalination systems shall be designed and constructed in conformity with the Specifications and Standards given in Schedule-D.

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

- **Appendix B I** : Deleted
- **Appendix B II** : **Demonstration of technologies** - Plot details
- **Appendix B III** : **Deleted**
- **Appendix B IV** : Scope of Civil and Structural Works
- **Appendix B V** : Scope of Electrical Works
- **Appendix B VI** : Deleted
- **Appendix B VII** : Scope of Fire Fighting Works
- **Appendix B VIII** : Scope of Plumbing Works
- **Appendix B IX** : Details of Fire Detection Alarm System, Smart Card based access and CCTV surveillance
- **Appendix B X** : Deleted
- **Appendix B XI** : Deleted
- **Appendix B XII** : Scope of Storm Water Drainage network
- **Appendix B XIII** : Deleted
- **Appendix B XIV** : Scope of Solid Waste Management Works
- **Appendix B XV** : Scope of IBMS / BAS Works
- **Appendix B XVI** : Tender Drawings

Appendix B I

(Deleted)

Appendix B II

1.0 Demonstration of technologies - Plot details

The details of the proposed locations, individual plots, total plot area, are shown in the drawings, as part of the tender document. The contractors should submit the details regarding civil infrastructure and roads for movement of vehicle / equipment inside individual plots. Individual contractors have to do the arrangement on themselves for such movements required during the course of the project.

Appendix B III

(Deleted)

Appendix B IV

1. CIVIL AND STRUCTURAL WORKS

The scope of work/ items of supply as mentioned in Part A and Part B of the tender document should abide by the civil and structural works as mentioned in Appendix B IV of the tender document.

1.1 Scope:

The Contractor shall design and construct the required civil works for the project based on the load characteristics and the soil bearing capacity at the site. Any required case specific strengthening works based on the individual technologies will be done by the contractor. Required geo technical analysis at the site will be done by the individual contractors. Any case specific security arrangements including fencing arrangements need to be done by the individual contractors.

Part A - scope of work:

Contractor should take care of provision for movement of men, vehicle and equipment inside respective plots during the installation, commissioning, operation and maintenance phases of the project throughout all seasons.

Part B - scope of work:

Standard earth filling (average filling of 1.5 to 2m) will be done by the contractor to take care of requirements for each plots, to a maximum of five plots, to facilitate access and movement of men, vehicle and equipment through the common area road network to individual plots throughout the demonstration period of the project as part of facilitation services of the project. Any earth filling required to avoid inundation during high tide and monsoon period will be in the scope of work of the contractor. Detail design of earth filling and road network should be submitted by the contractor after site survey. The same needs to be submitted as an additional item along with the bid.

- Land filling of the service area building plots:

Standard earth filling will be done by the client to accommodate vehicle approach to the site in the common area network as part of the roads and services. Any earth filling as per the detailed design which will be additional needs to be done by the individual contractors. The same needs to be submitted as an additional item along with the quote.

- Geotechnical and Topographical investigations: Site Topographic Survey and Geotechnical Investigations as deemed necessary by the Contractor has to be done by individual contractors. Investigations done by the client are attached as part of the tender document. Site Clearing, Site Grading, Excavation includes excavation for sump pits / lift pits.
- Foundation & substructure works. Foundation type for any heavy structures that is found to have an impact on the design and performance of the technology will be done on pile foundation only. Any excavation work will not be permitted at all/any point of time during the design, installation, commission and operational phase of the project. For clear understanding of the soil condition, Employer is providing reference data set related to soil testing and geotechnical information conducted during various construction projects within Activation Area. Contractor needs to do soil testing and geo-technical survey for proposed works, if found necessary.
- Implement Anti termite treatment / Water proofing / Insulation works wherever deemed necessary.
- Superstructure RCC works (If deemed necessary)
- Masonry (If deemed necessary)

- Plastering (If deemed necessary)
- Structural Steel work (If deemed necessary)
- Ancillary PCC / RCC works including equipment foundations / pedestals, etc (If deemed necessary)

1.2 Deleted

1.3 Deleted

1.4 Design Philosophy

Civil & Structural works shall be designed based on an understanding that the system to be designed, commissioned and operated for a period of minimum 12 months to have the results in line with the objective of the project. The land filling, civil and infrastructural developments as part of Part A and Part B scope of work shall take care of transportation of men, material, equipment required for installation, commissioning, operation and maintenance of all items required for the demonstration of desalination technologies for a period of minimum 12 months at the site.

Appendix B V

1. ELECTRICAL WORKS

The scope of work/ items of supply as mentioned in Part A and Part B of the tender document should abide by the electrical works as mentioned in Appendix B V of the tender document.

1.1. Scope

The scope of work shall cover the design, engineering, manufacture, assembly, testing of all electrical items as individual item OR as part of the technology demonstration desalination skid at manufacturer's works/ test labs. The contractor shall supply, delivery, properly pack and transport the items as individual units or/and assembled units to site, as found necessary by the contractor. The transportation to site, unloading, storing at site of all equipment, erection and commissioning, test at site, performance guarantee test run, training of Employer's personnel and handing over of the complete electrical system along with mandatory spares as per the terms & conditions will be in the scope of the contractors scope of work. Any sizing or rating of equipment provided are indicated as minimum sizes or ratings. Contractor to design the complete system and shall consider the requirements in totality before arriving at the sizing of equipment and components. All the load and sizing calculation including all the drawings has to be approved by Employer's Engineer. The brief scope shall be comprising of, but not limited to the following:

- The contractor should find his own source of power for the successful supply, installation, commissioning, testing, operation of the plant at site for a minimum period of 12 months from the date of commissioning. Liaoning work for getting approval for any / all items outside the existing approvals obtained for operations in DSIR will be in the scope of the contractor.
- Approval from all respective authorities for getting power, DG set, Electrical inspector etc. All official charges will be paid by the contractor after written approval from the Employer / Employers engineer..
- All switchgears like ACB & MCCB (as panel incomer only) shall be considered with TCP/IP open protocol for monitoring & controlling from SCADA / IBMS.
- Astronomical timer considered for external lighting
- Computers & security systems UPS considered with 0.5 hr. battery backup with N+1 configuration. The data backup should be for a period of 12 months, with a recovery period of within 24 hours in the event of a failure.
- Fire Fighting Panels, Fire Alarm Panel, Plumbing Panels, Potable Water Panel
- Separate HVAC panels for RTU & SCADA control room, office room, UPS room, Network/Telecom Room, RF Box room, Third floor room, etc. The incoming of each HVAC panel shall be fed through its respective utility's LT Distribution Board. Surge arrestors for Main & Sub main Power Distribution boards.
- All LT Power, control cables length and sizes as per the requirements.
- Common area and outdoor Lighting along with boundary lighting overall lighting system comprising of LED lighting, astrological timers based distribution boards, lighting transformers, light fittings, lighting poles, Power socket, associate lighting switches/sockets, associated cable, conduit and wiring.
- UPS system for critical equipment suitable as per the load requirement having 2 x 100% BC (Float cum boost chargers), manufacturers recommended spares and required capacity DCDB.

- Electrical SCADA system able to communicate and control all the major equipment like UPS, DG Set, all LT Distribution Boards including incomers & outgoings of main & sub main panels, etc.
- Maintenance Free Earthing system comprising of Earthing Electrodes, Earthing strips / conductors and associated accessories.
- Safety Equipment such as rubber mats, SLD, shock treatment charts, sign boards, smoke detectors and its mitigation system, firefighting equipment for electrical fire.
- Maintenance requirements as per Schedule E

1.2. System Design Requirements

- The following design criteria shall be considered by the Contractor for the equipment and services supplied under this contract:
- Safety to personnel and equipment during the operation and maintenance.
- Reliability of service.
- Minimum fire risk.
- Ease of maintenance and operation through remote monitoring and / via SCADA
- Automatic protection of all electrical equipment through selective relaying system along with relay co-ordination.
- Electrical supply to equipment within the design operation limits.
- Fail safe features.
- Suitability for applicable environmental factors.
- Maximum interchangeability of equipment.
- The design and equipment shall ensure satisfactory operation under variations of voltage $\pm 10\%$, frequency (+) 5% to (-) 5%, combined voltage and frequency 10% for A.C., -15% to +10% for DC as may be met under operating conditions, including those due to starting loads and short circuit and other fault conditions.
- System grounding
 - 11 kV : Unearthed system
 - 415 V : Solidly earthed
- Minimum Fault level (For all equipment)
 - 11kV: 31.5 kA for 1 Sec
 - 415V: 50 kA for 1 Sec
 - 230V : 12kA for 1 Sec
 - 110V DC: 10kA for 1Sec

1.3. Specific Requirements for Electrical Equipment

- The contractor should take care of all the power requirement as required by the respective technology for demonstration of objectives of the project.
- In the event, the contractor is using backup power source for reliability of N+1 grade, the contractor has to do proper synchronisation, transfer switch arrangements at his preview of jobs
- The contractor must have proper backup of power during the operating hours of the project through the demonstration to achieve the end result. Any loss of data, loss of characteristic parameters to achieve the end result calculations will be in the liability of the contractor and not on account of the employer.

- The contractor should have proper backup power for all computers / measuring instruments / equipment at lab to measure the data as described in the initial proposal submitted.
- The employer prefer to have each demonstration unit to run for 24 x 7 over the period of the demonstration of technologies at site.
- The site should necessarily have plot lights, fence lights during the night for security reasons.

1.3.1. DG Sets & Equipment

Supply of Silent Type Diesel Generating Set of minimum rating required for operation with suitable sound attenuated canopy with IP23 protection to run the equipment as deemed necessary for the contractor. The contractor should arrange the supply, storage and usage of diesel at site to abide through CRZ / GPCB/ CPCB rules governing environment.

Day storage tank if required should be fabricated out of 3mm thick MS sheet, with M.S. fuel pipe line, high- & low-level indicator and alarm contacts. The fuel tanks should be double skinned and should have anti vibration pads.

1.3.2. UPS

Supply of suitable high performance fully microprocessor controlled (three phase Input & three phase Output) online UPS system suitable for input and output parameters as per specifications. The UPS shall have inbuilt zig zag K rated isolation transformer at inverter output. The UPS shall be provided in powder coated fan cooled enclosure painted in colour as per specifications. The UPS shall be suitable for normal, emergency, recharge, by-pass and maintenance mode. The system be expandable in such a manner that addition of another module of similar capacity can double the system output with common by-pass. The UPS shall have a microprocessor based display and control panel. UPS shall have own batteries with 30 minute battery back-up. Complete system must be provided as per specifications approved drawing and as per site requirement including inter connecting cables from battery to UPS, UPS to panel etc.& supports for complete system as approved by the Engineer in charge.

1.3.3. Fire Fighting Panel

There shall be 1 set of Firefighting units set for each plot area established by the individual contractors. There should be a common firefighting unit set under the scope of work under Part B to take care of the intake, reject and the utility line arrangements, include the intake skid and the brine management area. The fire fighting units should be in accordance with fire and safety standards under the regulatory bodies of the state. The contractor will be liable for all/any damage that is caused for men, material and equipment at his premises during the design, installation, commissioning and operation of the system for a period of minimum 12 months.

The electric motors, control panels, storage tanks, incoming and outgoing busbars, feeders and the cables should be aligned to suit the requirement of the firefighting requirements.

1.3.4. Cable, Cable Trays, Race Ways & Earthing

Cable trays should be GI perforated type with suspension from ceiling with MS angle, rods, connection pieces, GI nuts, bolts, washers and fasteners as required. In the even the cable trays has to run through ground proper trenching mechanism should be employed for safety standards as approved by the employers engineer/ employer. Cable carrier system shall be designed for 70% loading.

Power cables and control cables shall run in different shafts. Separate riser and cable trays shall be provided for the LV system

Separate riser and cable trays shall be provided inside the Electrical shaft, ICT shaft & HVAC shaft throughout the building.

All cabling/wiring works shall be concealed wiring except for risers and in other areas where public or tenants do not have access or approved areas by the Employer.

1.3.5. Lightning Conductor

Proper Lightning Protection system has to be employed by the individual contractors for the scope of work inside his premises. Any damage for men, material and equipment will be in the account of the contractor. The conductor size for the arrestors should be suitable sized to cover the protection area / overlapping area. Each down conductor shall have complete physical isolation with structure and shall be connected to dedicated earth pits

1.3.6. Lighting System

The supply and installation as per IS codes complete in all respects such as : All lamps Internal wiring & point wiring between accessories to distribution boards and Earthing terminal

Electronic ballasts/drivers should be used for Light fittings to be installed with effective reflectors. Only energy efficient type LED light fixtures to be used for all type of indoor as well as outdoor lighting.

The luminaries shall be selected with highest technical efficiency and also aesthetic requirements for the site. The Lighting panels used for street lighting will be additionally provided with a timer device having twenty four hour hand set dial with a facility for setting ON & OFF times. There will be a provision of selecting either the manual control or the automatic control.

The required number of Pole mounted LED fixture for approach road and outdoor area to achieve a lighting level of 30 lux. In addition to this, landscape lighting shall be provided with planter Light/ Bollard light, post top lights, step lights, etc. for the front elevation of the building facade lighting shall be proposed.

1.3.7. Control Philosophy

Highly reliable, microprocessor-based Electrical SCADA system with substation automation system complying to International automation standard IEC – 61850 shall be provided at plot level by the individual contractors as part of job under Part A of the tender document. There should be a separate SCADA system to manage the common inlet, reject, utility lines.

1.3.8. System Earthing

Each contractor should take care of proper earthing systems inside his plots as per latest editions of Indian Electricity Rules, Relevant Indian Standards and codes of practice and Regulations existing in the state of Gujarat where the systems are to be installed. Complete earthing systems comprising of required earth connections necessary for effective and permanent bonding to earth be constructed by Contractor. Fully maintenance free earthing units only to be constructed for the entire earthing scope of works.

1.3.8.1. Protective Earthing

Earthing system installation shall be in strict accordance with the

Where ever earth pits are needed maintenance free earthing system and pits be deployed and the system shall consist of (but not limited to):

- a) Earth electrodes.
- b) Highly conductive and eco-friendly backfill compound.
- c) The connection from each maintenance free earth pit to the equipment/junction box shall be arranged by the Contractor

1.3.8.2. Separate earthing for DG

There should be separate earthing network/ring network for DG set.

1.3.8.3. Separate earthing for HT & LT Meter

There should be separate earthing network/ring network for HT & LT Meters.

1.3.8.4. Separate earthing for Lightning Protection

There should be separate earthing network/ring network for Lightning Protection.

1.3.8.5. Separate Clean earth

There should be completely separate Clean / Delta type of earthing network/ring network for ICT & network equipment, electronic and control equipment of any kind as per latest IS codes apart from earthing network for Electrical Substation equipment as well as other electrical and power equipment of service area building.

1.3.8.6. Earthing for Street Lighting

Provision has to be made for the space required for such type of earthing pits.

Appendix B VI

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Appendix B VII

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Appendix B VIII

1. PLUMBING

The scope of work/ items of supply as mentioned in Part A and Part B of the tender document should abide by the plumbing works as mentioned in Appendix B VIII of the tender document.

1.1. Scope of work (Part A)

The individual contractors will be liable for all the connections for seawater intake, brine reject and utility from the plot boundary level to the desalination skid and vice versa.

The supply, reject and utility lines should be metered at plot level for the daily intake/ reject/ product water/brine to assess the efficiency of the system.

There should be proper provision for tapping the seawater intake, brine reject and the produce water pipelines at the plot level to individual labs to measure the water / brine quality parameters to assess the efficiency of the desalination process.

All the connections inside the desalination skid will be in the account of the respective contractors.

Scope of work (Part B)

The Scope of works shall cover the design, engineering, supply, installation, testing and commissioning of the complete plumbing system including;

1.2. Suction of water from the sea using suitable suction and flow requirements including suction pumps.

Based on the survey and feasibility report detail engineering report has to be prepared. The intake for the seawater has to be designed based on the optimal distance between the intake point and the skids for demonstration of desalination technologies. The scope for innovative intake systems is encouraged to have zero environmental effects . All plumbing and laying of pipelines / motors/ auxiliary units will be to the scope of the contractor.

1.3. Seawater pipeline from inlet chamber to the individual plots

Laying of seawater intake pipeline from the intake skid to the main seawater tank. Provision for storage of seawater for a period of 48 hours. All auxiliary units for pumping of water to the individual plots should be provided by the contractor. Laying of pipelines from the main seawater tank to individual plot boundaries. Provision of metering devices at the inlet of the main seawater tank and inlet of individual plots. Detail engineering should be submitted on the pipe laying between the inlet skid to the plots. Drawings to be approved by the employer / employer's engineer. Proper isolation should be provided for supply to each individual plots. Isolation of supply at the main seawater tank also should be provided by the contractor. The seawater intake system should not violate the Environment Clearance (EC) obtained by DSIRDA/DICDL at any point of time during the course of the project. The intake system should be designed in compliance with prevailing rules and regulations of the GoI.

1.4. Brine management:

The contractor should collect the brine reject from individual plots, store it for the period necessary , transport back to the reject in accordance with the CRZ criteria for desalination reject. Provision to store brine for a period of 48 hours need to be arranged by the contractor.

There should be proper measuring mechanism to estimate the daily reject from the individual plots to the main brine reject pipeline.

The contractor should ensure that the brine reject to the sea will be in accordance with the CRZ / MOEF CC regulations all through the period of operation of the desalination plants over the period of 18 months. The reject mechanism will not violate the Environment Clearance of DSIR any time during the course of the project.

1.5. Utility lines:

The contractor should ensure that the utility lines are connected from each plot to a main pipeline to take the water to the utility storage tank. The water from each plot should be metered on an hourly basis. The contractor should ensure the proper sizing of the utility tanks to store the water till the time the tank are emptied for further use. The minimum storage will be for a period of 48 hours.

1.6. Management of seawater intake system, brine reject system and utility lines

The contractor shall be accountable for managing the seawater intake system, brine reject management, utility line management through the period of minimum 12 months. The contractor shall account for any repair in the lines including disruptions in the supply of seawater, disposal of brine reject and disruption in collection and storage of produced water. The contractor should keep the data log of quantity, quality parameters of intake from sea, brine reject, produced water collection, metering from individual plots for a period of minimum 12 months.

Appendix B IX

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Appendix B X

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1.1. Deleted

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1.3. Deleted

Appendix B XI

1. ROAD WORKS

The scope of work/ items of supply as mentioned in Part A and Part B of the tender document should abide by the road works as mentioned in Appendix B XI of the tender document.

1.1. Scope

The individual contractors should provide minimum required access of movement of vehicles inside respective plots. The details regarding same has to be submitted by the individual contractors as part of scope of work Part A. The contractor who quotes for part B scope of work should include minimum levelling of the plots for placement of the desalination skids and other accessories as part of scope of work Part A. The contractor for scope of work Part B should provide minimum access to individual plots through proper road network in the desalination plot area. The transportation and placement of the desalination skid and other accessories at the site will be the responsibility of the individual contractors, who quote for part A scope of work. The details of the road network is shown in the drawing 'Road network at plot level- Part B scope of work'.

Appendix B XI (a)

1.0 Deleted

2.0 Deleted

Appendix B XI (b)

1.0 Deleted

1.1 Deleted

1.2 Deleted

Appendix B XI (c)

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Appendix B XI (d)

(Deleted)

Appendix B XII

1. STORM WATER DRAINAGE NETWORK

The plots will be levelled to avoid any water logging during the high-low tide. The site is falling in the CRZ region and has typical high-low tide phenomenon. The contractor should take necessary requirement to use the slope to help flow by gravity where ever possible. The employer shall provide a common trench for flow of water through natural slope to the main drain in the common road network. Individual contractors should take care of dewatering if required during all seasons for the period of 12 months from installation thorough completion of demonstration. Individual bidders are asked to visit the site before submitting the quote to analyse the typical characteristics of the site.

Appendix B XIII

(Deleted)

Appendix B XIV

1. SOLID WASTE MANAGEMENT

1.1. Scope

The individual contractors will be liable for disposal of all the municipal solid waste generated at site during the period of construction, installation, commission and operation of the desalination units over the period of 18 months. A three bin system has to be provide in the individual plot level at different location for segregated collection of dry/wet waste and any hazardous waste. Any/all hazardous waste generated has to be stored separately to be provisioned for disposal through Gujarat Pollution Control Board (GPCB) authorised vendors. The contractor shall ensure that there will be no spillage of diesel / oil at the CRZ region which is declared sensitive under Government policy and norms. Individual contractors shall supply a health/safety / environment manual describing the activities/ precautions that will be taken at plot level during the installation, commissioning and operation of the technologies during the period of 18 months.

1.2. Deleted

1.3. Deleted

1.4. Disposal of Recyclables and Inert:

- The recyclables like paper, plastic and metal to be stored in the utility area for a maximum duration of 15 days and then sent outside DSIR through GPCB approved vendor.
- The inert to be stored in utility waste handling area and will be sent to the nearest authorized municipal solid waste landfill site through GPCB approved vendor.
- Any hazardous waste generated from the complex like used DG oil; old batteries etc. to be handed over to GPCB authorized hazardous waste handling vendors.

1.5. Deleted

1.6. Deleted

Appendix B XV

(Deleted)

Appendix B XVI

1. Tender Drawings

The contractor has to prepare the final drawings as per the detail design and in approval from the employer / employer's engineer. The employer can request further detailed drawings as part of detail engineering.

Please refer to the page no. 225

Appendix B XVII

1. Reference Data for soil testing and geo-technical survey

Reference data set related to soil testing and geo-technical information conducted during various construction projects within Activation Area. Bidder to request to the Employer and collect the data related to soil testing and geo-technical information conducted during various construction projects within Activation Area from the Employer's office .

Schedule C - Project Facilities

- 1.0** The Contractor shall design and construct the Project Facilities in accordance with the provisions of this Schedule C. Such Project Facilities shall include;
- (a) **Architectural:** The individual contractor shall ensure that the plots are detailed to keep maximum movement space for the vehicles in the event of evacuation and necessary loading / unloading mechanism.
 - (b) **Deleted**
 - (c) **Civil and Structural:**
 - 1) Earthquake preventive measures: Earthquake cannot be prevented. However, earthquake can be sustained by designing earthquake resistant structures using Indian Standards.
 - 2) Disaster (flooding) resistant building design :
 - a) Elevating as much of the desalination skids and other equipment as possible above the design flood level.
 - b) Designing the skid foundation and any portions subject to flooding to withstand design flood conditions and loads.
 - c) Using flood damage resistant materials for any portions of the skids and other equipment inside respective plots below the design flood level.
 - d) Local inhabitants have adopted strategy to overcome problem of flooding, by a raised plinth.
 - (d) **Ancillary facilities :** Ancillary facilities shall be provided in accordance with the provisions as per Schedule B& D and shall include :
 - 1) Compound wall with barbed wire fencing (Height of minimum 1.5 m) length around each of the plot or as specified by the Employer's Engineer.
 - 2) 02 Entry / Exit gates along with CCTVs
 - 3) External signage like technology name, organization name at entrance gate including its illumination and Internal signage like entry, exit, toilets, office etc.
 - (e) **Electrical Power Supply:** The office, lab and the security cabins shall be provided with electrical supply with standby emergency power systems.
 - (f) **HVAC:** The lab, portacabins and the office should be ventilated and climate controlled for living during the seasonal cycles over the period of operation of 18 months.
 - (g) **Fire Fighting facilities:** The individual plots shall be provided with proper Firefighting facilities including wet risers, sprinklers, fire hydrants and portable fire extinguishers in accordance with the provisions as per Schedule D & I and requirements of the statutory authorities.
 - (h) **Plumbing and Sanitary facilities:** The building will be provided with minimum sanitation facilities including functional equipped washrooms and potable water supply in accordance with the provisions as per Schedule B & D. The contractor shall make necessary collection,

storage and disposal of the waste from the sanitary provisions on a cycle basis not less than 48 hours.

Sanitary facilities shall include:

- 1) Sanitary fixtures and fittings.
- 2) Piping, valves, accessories required for the complete system
- 3) Rain water collection from roof top

(i) **Deleted**

(j) **Deleted**

(k) **Deleted**

(l) **Deleted**

2.0 Details of Visual Branding Elements for Service Area Building

a. **Deleted**

b. **Deleted**

c. **Deleted**

d. **Street Lighting**

Individual plots should have one street light at the entrance and one near the skid inside the plot. There should be a light at the entrance to the office / lab as part of scope A work. The contractor for scope B work should provide street lights at the road networks at a maximum distance of 50m each at the sides of the road.

Poles shall have modular attachments to mount cameras, Wi-Fi equipment and lightening arrestors, as required. Provision for mounting of Fabric / Flex banner (Modular clip-on) will be part of the solution.

The detailed specifications of all the street lighting equipment have been given in various schedules (**Schedule C & D**).

Typical Illustrative Drawings are shown under:



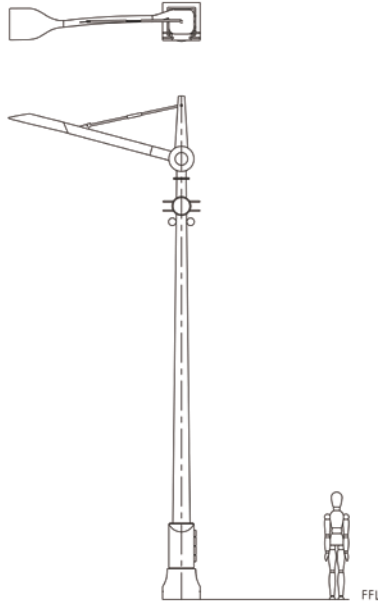


Typical Illustrative Drawings - Modular & Scalable Lamp Post System

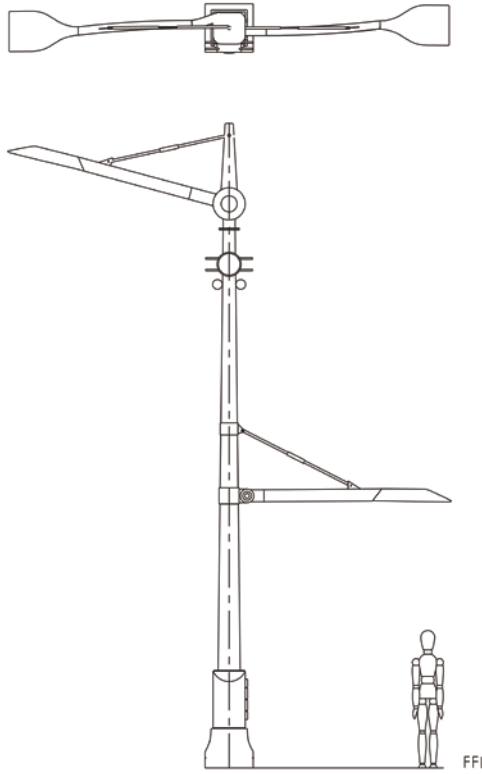


Typical Illustrative Drawings - Exploded view: Showing detachable modules / extension-arms for flex / fabric banners

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region



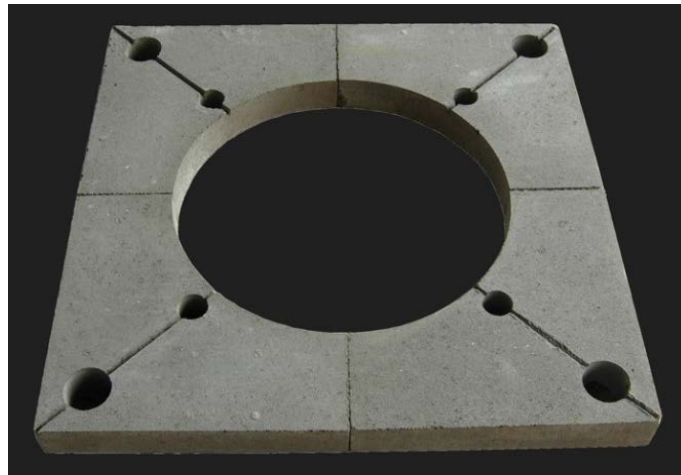
Typical Illustrative Drawing - Lamp Post with Single Offset Arm



Typical Illustrative Drawing - Lamp Post with Dual Offset Arms – Staggered Heights

e. Tree Grating

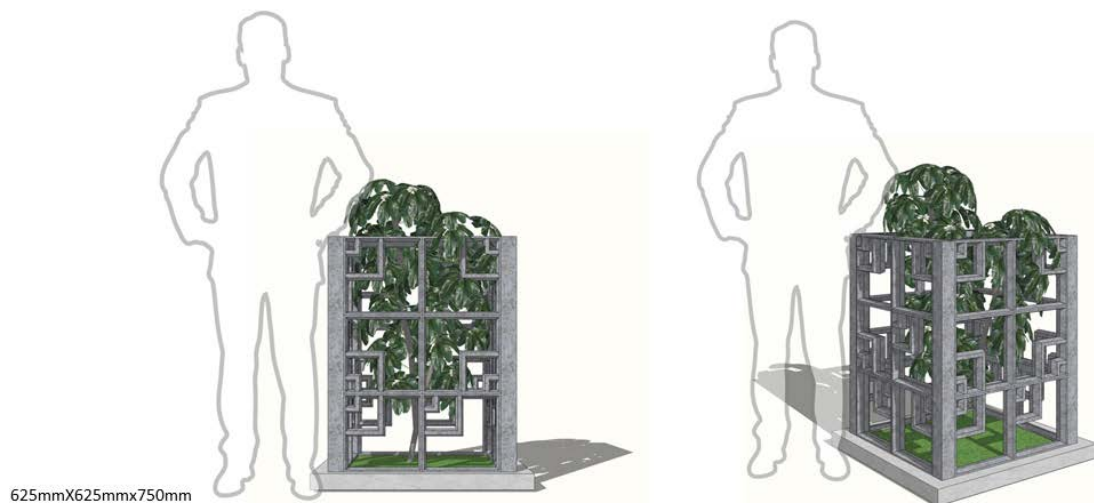
Typical Illustrative Drawing is shown under:



f. Tree / Sapling Protection

Typical Illustrative Drawings are shown under:

Based on standard 250 mm Ferrocement Module



3.0 (Deleted)

Schedule D - Standards & Specifications

The approximate water parameters at the seawater intake are given in table below:

The minimum expected water parameters at the utility (produced water) line from each plots are as below.

1.0 Deleted

2.0 Deleted

3.0 ELECTIRCAL WORKS

Standards and Specifications for the Design and Construction of Electrical works are given in this section; The standards of electrical equipment are general guidelines. Individual contractors should adhere to these standards wherever seem applicable as per the design and scope of work based on individual technology/ combination of technologies;

3.1 BACKGROUND

The contractor shall comply with all the minimum requirements of the Design and Construction of Electrical works as per the Latest Standards, Statutory requirements, National Building codes and all other relevant regulations

3.2 CODES AND STANDARDS

The system, design, materials, equipment, installation, testing and commissioning shall, in addition to all other applicable codes and standards, comply with the latest requirements of the following standards, codes, principles and specifications issued by Indian standards or IEC codes :-

Table: Codes for Electrical Works

Codes	Description
IS 335	Insulating oil
IS 2026	Power transformers (part I - V)
IS 10028	Code of practice for selection, installation and maintenance of transformers
IS 2099	Bushing for alternating voltages above 1000 V
IS 4257	Porcelain bushings for transformers
IS 3639	Power transformer fittings and accessories
IS 2705	Current transformers
IS 8468	On load tap changer
IS 8478	Application guide for tap changers
IS 6600	Guide of loading of oil immersed transformer

Demonstration of Energy Efficient Seawater Desalination Technologies
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Codes	Description
IEC 2544	Creepage distance for insulators & bushing congenial
IEC 76	Power transformers
IEC 214	On load tap changers
IEC 616	Terminal and tapping markings for power transformers
IEC 551	Determination of transformer and reactor sound levels.
IEC 137	Bushings for alternative voltage above 1000V.
IEC 354	Loading guide for oil immersed transformer
IS: 3043	Code of practice for earthing
IEEE: 32	Neutral Grounding Devices, standard requirements, Terminology & procedure.
IS 1271	Classification of Insulating Materials.
IS 2099	Bushing for alternating voltages above 1000 V
IS 2705	Current transformers
IS 3202	Code of practice for climate proofing
IS 3639	Power transformer fittings and accessories
IS 4257	Porcelain bushings for transformers
IS 11171	Dry type Transformer
IS 8478	Application guide for tap changers
IS10028	Code of practice for selection, installation and maintenance of Transformers
IS 1248 & 3107	Direct acting Electrical indicating instruments
IS 2099	Bushings for alternating voltages above 1000V
IS 2516	AC Circuit Breakers
IS 2705	Current Transformers
IS 3156	Voltage Transformers.
IS 3427	Metal enclosed switchgear and control gear for voltages Above 1000V but not exceeding 11000 V
IS 6875	Control switches for voltages up to and Including 1000V AC and 1200 V DC
IEC 56	HV alternating current circuit breakers.
IEC 137	Bushings for alternating voltages above 1000V
IEC 298	AC metal enclosed switchgear and control gear for rated voltages above 1kV and up to and including 72.5 kV.
IS 2147	Degree of protection for enclosure
IS 3842	Specification for electrical relays for AC system
IS 2208	Specification for HRC cartridge fuse links up to 650 Volts.

Demonstration of Energy Efficient Seawater Desalination Technologies
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Codes	Description
IS 5082	Wrought Al. And aluminum alloys, bars, rods, tube and Sections for electrical purposes.
IEC 694	Common clauses for high voltage switchgear and control gear standards.
IS 1248 & 3107	Direct acting Electrical indicating instruments
IS 2959	AC contactors up to 1000V
IS 13947	AC Circuit Breakers
IS 2705	Current Transformers
IS 3156 & 4146	Potential Transformers.
IS 4047	Specification for air break switches and combination fuse switch units for voltage not exceeding 1000V.
IS 6875	Control switches for voltages up to and including 1000V AC and 1200V DC.
IS 1822	Motor duty Switches
IS 12021	Specification for control transformer.
IS 8623	Factory built assembly of switchgear & control gear for voltage not exceeding 1000V
IS 13947 (Part I)	Degree of protection for enclosure
IS 3842	Specification for electrical relays for AC system
IS 2208 & 9224	Specification for HRC fuses.
IS 5082	Wrought Al. and aluminum alloys, bars, rods, tube and sections for electrical purposes.
IS 4237	General requirement for switchgear & control gear for voltage not exceeding 1000V.
IS 3231	Electrical relays for power system protection
IS 375	Marking and arrangement for switchgear bus bars, main connection and control aux. wiring.
IS 5578	Guide for marking of insulated conductors.
IS 3618	Pre-treatment of MS sheets for phosphatizing.
IS: 4722	Specification for rotating machinery
BS: 649	Performance and testing of diesel engines for general purposes.
IS 4729	Measurement and evaluation of vibration of rotating electrical machines.
IS 1950 (1962)	Code of Practice for Sound insulation of Non Industrial Buildings.
IS 8084-1976	Interconnecting bus bars for AC voltages above 1kV
IS 8623 (part-2)	Factory built assemblies-particular requirements of bus bar trunking systems.
IEC 439 (part-2)	Particular requirements of bus bar trunking systems
IS 13925	Shunt capacitors for power system

Demonstration of Energy Efficient Seawater Desalination Technologies
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Codes	Description
IS 3231	Electrical relays for power system Protection
IS 2705	Current Transformers
IS 1248	Direct acting electrical indicating instruments
IS 2147	Degree of protection
IS 5578	Marking & arrangement of switchgear, bus bars, main connection and auxiliary wiring
IS: 1554 (PART-I)-	PVC insulated (heavy duty) electric cables working voltage up to and including 1100V
IS: 7098 (PART-II)	Cross-linked polyethylene insulated PVC sheathed cables for working voltages from 3.3 kV up to and including 33 kV
IS: 8130	Conductors for insulated electric cables and flexible cords.
IS: 5831	PVC insulation and sheath of electric cables.
IS:3975	Mild steel wires, strips and tapes for armoring of cables.
IS:2633	Methods of testing weight, thickness and uniformity Of coating on hot dipped galvanized articles.
IS: 209	Specification of zinc.
IS: 3961(PART-II)	Recommended current ratings for PVC insulated And PVC sheathed heavy duty cables.
IS: 10418	Wooden drums for electric cables.
IEC: 540 & 540A	Test methods for insulation and sheaths of electric cables and cords.
IS: 10462 (PART I)	Fictitious calculation method for determination of dimensions of protective coverings of electrometric and thermoplastic insulated cables.
IS: 10810 (PART 58)	Oxygen Index test
IEC 146	Semiconductor Converters
IEC 1131-2	Programmable Controllers
IEC Publication 947, 1988	
IEC Publication 439, 1985	
IS 13947, 1993	Specifications of Low Voltage Switchgear & Control Gear
IS 8623, 1993	Specifications of Low Voltage Switchgear & Control Gear assemblies.
Indian Electricity Act, 1910	
Indian Electricity Rules, 1956	

Codes	Description
National Electrical Code 1985	
EN50081-1	EMI Emissions standard
EN50082-1	EMI Immunity standard
Electrical safety	EC730-1 and CE directives effective from 1 January 1996.
IEC 146-4	Method of specifying the performance and test requirements
IEC 146-5	Switches for UPS
IEC 439	Low Voltage switch gear and control gear assemblies
IEC 801	Electromagnetic compatibility for industrial process Measurement
IEC 950	Safety of IT equipment including electrical business equipment
1000-2-2	Electromagnetic compatibility – Compatible levels for low frequency conducted disturbances and signaling in public low voltage power supply systems
1000-4	Electromagnetic compatibility – Testing & measurement techniques
IS 3043	Code of practice's for earthing in Electrical installation.
IEEE 1100	Recommended practice for powering and grounding of sensitive Electronic equipment.
IEC 62305- 2	– Risk Management
IEC 62305-3	Protection against Lightning.
IS/IEC 62305	Protection Against Lightning Part 2 Risk Management.
IS 2309	Code of Practice for the protection of Building
IEC 62561 -2 & 7	Earthing and Bonding
IEC 62561 – 7	Earth Enhance Material
IEC 62561 – 2	

4.0 Deleted

5.0 Deleted

6.0 LIGHTNING PROTECTION:

Lightning is one of the most devastating natural phenomena. There are many discharges during lightning storms and some of them can even reach hundreds of kilo amperes. The electrical discharges are a great hazard to people, animal, buildings and electronic equipment's. Until now, there is no device that can prevent lightning formation or lightning strikes. However, it is possible to create a path (divert) for the lightning discharge to the ground which will minimize the damage to the environment through a well-designed Lightning Protection System (LPS). The purpose of a lightning protection system is to protect

buildings from direct lightning strikes and possible fire or from the consequences of lightning currents (non-igniting flash). If national regulations such as building regulations, special regulations or special directives require lightning protection measures, they must be implemented. If these regulations do not specify a class of LPS, a lightning protection system which meets the requirements of class of LPS III according to IEC 62305-3 (EN 62305-3) is recommended as a minimum.

7.0 MAINTENANCE FREE EARTHING SYSTEM

7.1 Earth termination clamp

- a) Wherever applicable, the earth termination clamps or Copper Bus Bars should be used to protect the men, material and equipment at site during the course of the project over the 18 month time. The contractor should rate the earth termination clamps as per requirement and rating.
- b) Earth Termination clamps should be of Gunmetal material.
- c) Copper bus bar of minimum 99.9% copper content shall preferably be exothermically welded to earth electrode or connected with the help of two number stainless steel nut bolts of appropriate size.
- d) Bi-metallic Connectors & Bi-metallic Lugs should be used for termination.
- e) Stainless steel washers & spring washer shall be supplied along with each stainless steel nut & bolt for any necessary connection and termination.

7.2 Installation of Earth system

- a) Where ever applicable, the earth electrode shall be installed in a bore of required depth to meet out the earth resistance value of lesser then one ohm.
- b) Wherever auguring is not feasible, pit shall be made and suitable size of PVC pipe shall be used to fix the electrode.
- c) At the centre of the hole the electrode shall be driven and around the electrode the highly conductive and eco-friendly backfill material shall be filled. Highly conductive and eco-friendly backfill material can be poured in either dry or slurry form.
- d) If applicable, the earth enhancement material shall be filled into augured hole in slurry form and allowed to set.
- e) The PVC pipe shall be removed simultaneously as the backfill compound is poured.
- f) If watering of Earth pit is required for curing, the same has to be done by contractor.
- g) The pit should be very compactly rammed with watering for 2-3 days and extra soil should be added if required.
- h) If trenches are required, 600 mm (depth) x 300 mm (wide) from the earth pit to the nearest point of connection should be made.

7.3 Inspection chamber (If required)

- a) Suitable inspection chamber shall be provided if necessary with proper masonry work in the inside and outside with proper flooring

Important – All the masonry works must have pre- approval from Employer’s Engineer and must match with road works planned.

7.4 Measurement of earth electrode resistance

- a) The earth resistance shall be measured using fall of potential method as per para 37 of IS: 3043.
- b) The successful working of the earthing pits implies that the Voltage between Neutral & Earth will never be more than 2 Volts.
- c) The effective earth resistance of each installation shall be less than 1 ohm in dry condition for all installations and less than 0.5 ohms for ATMs, Data Processing Centres etc.

8.0 Mechanical / Rotating equipment

The mechanical and electrical items that will be used for the project will depend on the technology used to demonstrate the end objective. Bidders should carefully select the technology and the equipment to obtain the final result, a cost competitive, energy efficient and environment friendly seawater desalination technology.

Item name	Expected Specifications
Static Mixer	FRP /PP with Flanged
Flash Mixing Tank (FMT)	Rectangular RCC tank duly epoxy coated
Coagulant Preparation cum Dosing Tank	Vertical right circular cylindrical tank, MSRL
Coagulant Dosing Pumps	Electro-metering diaphragm pump PP(Head), Hypalon (Diaphragm)
Flocculation Tank (FT)	Rectangular RCC water retaining structure duly epoxy coated
Coagulant Aid (PE) Solution Tank	Vertical right circular cylindrical tank MSRL
Coagulant Aid Dosing Pumps	Electro-metering diaphragm pump PP(Head), Hypalon (Diaphragm)
Lamella Settler with lamella plates	RCC with conical bottom. Lamella Plates: 1 lot of FRP plates.
Clarified Water Storage Tank (CWST)	Underground rectangular RCC Tank duly epoxy coated.
Filter Backwash Pumps (MGF backwash pump)	Vertical Submersible Centrifugal pump Casing & impeller: CF3M Drive: TEFC Sq. cage induction motor

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Item name	Expected Specifications
Filter.Air Blowers	Twin lobe air blower, CI Drive: TEFC sq. cage induction motor
Duplex Basket Filter	Duplex basket with Multilayer pleated mesh cartridge filter. Housing: SS 316 L Cartridge: SS 316 L
Module Blocks	Type of Module: Capillary UF module/ back washable spiral module Membrane: Polysulfone or polyether sulfone.
Filtrate Water Storage Tank	Underground rectangular RCC tank duly epoxy
Backwash Pumps	Vertical Submersible Centrifugal pump Casing & impeller: CF3M Drive: TEFC Sq. cage induction motor
Backwash Basket Filter	Single Basket filter with Multilayer pleated mesh cartridge filter, Housing: SS 316 L Cartridge: SS 316 L
Alkali Dosing Tank	Vertical right circular cylindrical tank FRP
Alkali Dosing Pumps	Electro-metering plunger pump SS316L(Plunger)
Acid Dosing Pumps	Electro-metering diaphragm pump PP(Head), Hypalon (diaphragm)
Hypochlorite Dosing Tank	FRP
Hypochlorite Dosing Pumps	SS316L (Plunger)
Acid unloading pumps	Non Metallic (PP)
Acid storage tank	MSRL
Acid Dosing Pumps	Electro-metering diaphragm pump PP(Head), Hypalon (diaphragm)
Anti-scalant Preparation cum dosing Tanks	MSRL
Antiscalant Dosing Pumps	Electro-metering plunger pump SS316L (Plunger)

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Item name	Expected Specifications
SMBS Preparation cum dosing tank	Vertical right circular cylindrical tank MSRL
SMBS Dosing Pumps	Electro-metering plunger pump SS316L (Plunger)
Static Mixer	FRP /PP
Cartridge Filter Feed Pumps	Vertical Submersible Centrifugal pump CF3M, TEFC Sq. cage induction motor
Cartridge Filters	Housing - MSRL Polypropylene fibres wound (Or suitable) on polypropylene core (Or Suitable)
High pressure pumps	Multistage horizontal centrifugal pump Duplex SS2205/ CD4MCU TEFC Sq. cage induction motor
Pressure Exchangers	(Suitable to required pressure)
Booster Pump	Super duplex or higher
Module system loaded with membrane elements	To suit to small skid configurations
Module Stack	Structural Material Carbon steel material of grade IS 226/IS 2062 Module should be rested with saddle support made of Engineering Thermoplastic. Stainless Steel with PVC cushion and strap screws.
Suck tanks	FRP
Permeate water storage tank	Underground compartmented RCC tank duly epoxy coated.
Brine collection Tank	Underground compartmented RCC tank duly epoxy
High Pressure Pump	Multistage Horizontal centrifugal pump Duplex SS Drive: TEFC Sq. cage induction motor.
Module system loaded with membrane	ASME code stamped and certified

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Item name	Expected Specifications
Module Stack	Structural Material Carbon steel material of grade IS 226/IS 2062
Suck back Tank	FRP
Permeate storage Tank	Underground RCC tank duly epoxy coated.
Cleaning Solution Preparation Tank	MSRL
Membrane Cleaning Pump	Single stage horizontal centrifugal pump Casing & Impeller: CF3M Drive: TEFC Sq. cage induction motor
Cleaning cartridge Filter	Housing: MSRL Suitable material
Permeate Transfer Pump cum flushing pump	Vertical Submersible Centrifugal pump CF3M TEFC sq. cage induction motor
Lime Stone Column (If required)	Vertical circular cylindrical MSRL column.
NaOH Dosing Tank or post treatment	FRP tank
NaOH Dosing Pump (post treatment)	Electro metering diaphragm pump; FRP tank.
Hypochlorite Dosing Tank (post treatment)	FRP tank
Hypochlorite Dosing Pump (post treatment)	Electro metering diaphragm pump FRP tank.
Final Product Water Storage Tank	Underground RCC tank (With compartment)
Associated interconnecting plant piping with valves, fittings etc.	Clarifier & MGF section pipes: MSRL,
Instruments, Instrument receiver panels, cable, cable tray, cable tray supports etc.	To suit to environment conditions for operational period
SCADA & PLC system, cables, cable tray, supports etc.	SCADA system software, hardware etc. (To suit to plant requirement and monitoring).

Item name	Expected Specifications
Civil design & construction of equipment foundations.	To suit to local environment conditions
Mandatory spares	Spares for all critical operations including pumps, motors etc. to be kept at site.

9.0 Piping layout

Sea water desalination plants suffer a wide variety of corrosion problems due to the operation in aggressive environment. Material selection hence requires precise balance between the corrosion resistance, mechanical properties, availability, weldability and cost. Taking all factors into consideration, following piping material have been selected.

- (i) Heavy duty ERW mild steel rubber lined (MSRL) pipes duly painted with chloro- rubber paints externally along with primer (2 coats of primer + 2 coats of finished paint) for low pressure pretreatment section.
- (ii) Austenitic seamless stainless steel of Grade 316L, for entire high- pressure lines i.e. inlet piping leading to the modules, feed header, reject header and reject return lines up to energy recovery device.
- (iii) Austenitic seamless stainless steel of Grade 316L, for low pressure lines of membrane section i.e. high pressure pump suction, brine reject lines from energy recovery device, permeate lines etc. including cleaning and flushing circuits.
- (iv) Heavy duty ERW GI pipe lines for service water connections to all chemical preparation systems, membrane cleaning system, flushing lines of dosing pumps from service water source available in the plant building.
- (v) Heavy duty ERW MSRL duly chloro-rubber painted for low pressure post-treatment section. In this section, lining rubber should be of food grade quality.
- (vi) UPVC lines with UPVC Valves & fittings for low pressure permeate lines namely from module permeate header to suck-back tank, suck back tank to permeate storage tank, permeate diversion line to clarified water tank.
- (vii) Heavy duty carbon steel pipe lines duly painted with fittings for air lines namely air blower to frontal pipe end& modules.
- (viii) Pipe fittings in interconnecting pipelines and frontal piping of filters in pretreatment section: ERW rubber lined fittings of same line size as that of respective pipe section. ASTM flanges are to be used.
- (ix) Pipe fittings in interconnecting pipelines in high pressure lines: Forged quality seamless fittings and of same pipe line size as that of respective pipe section. SS 316L, rating flanges are to be used.
- (x) Pipe fittings in interconnecting pipelines in low pressure lines: forged quality seamless fittings of same pipe line size as that of respective pipe section. SS 316L flanges, are to be used.

Materials and sizes in the individual pipe segments are provided below in tabulated manner. Valves & Fittings are to be of same size as line size. It may be noted that the valves shown in the process flow diagram are most tentative and minimum, actual nos. will be as per final approved P&I diagram.

10.0 Piping layout

- (a) Design of piping layout along with required pipe fittings and necessary pipe supports based on the final equipment layout approved by the purchaser and preparation of the piping layout drawing. Piping diagram have to be approved by the client.
- (b) Procurement of pipes, fittings, valves, support materials and gaskets as per approved QAP specifications.
- (c) Pre-dispatch inspection and testing of pipes, fittings and valves at supplier's works in presence of client / client's representatives.
- (d) Fabrication of pipe segments as per approved piping diagram, testing of fabricated segments like DP testing for all welds, radiography of 100% welds in high pressure lines, hydro testing of fabricated pipe segments and installation at site with necessary pipe supports. For MSRL pipe segments, bare fabricated CS pipe lines are to be organized for hydro-testing followed by spark test, hardness test, adhesion test, rubber thickness measurement etc after rubber lining. RCC foundation blocks/ pipe sleepers etc, wherever required for pipe supports are to be designed and built by the bidder to suit the site conditions.
- (e) Final testing and commissioning of entire system.

Painting of external surfaces of all tanks, columns, pipes, structural materials, pipe support materials (primer, finish coats : chloro rubber / epoxy, with due surface preparation /sand blasting and following safe industrial practices/ good engineering practices.

11.0 Data & Telecom Infrastructure

The contractor shall have minimum provision for communication networking inside the plots to communicate with the core team and with the individual team members for operation and maintenance and emergency reach outs as and when applicable. Video conferencing facility should be available at individual plot level by each contractor. The data should be stored with proper backup for the period of operation of 18 months and for another 1 year after the completion of the project.

All the data obtained during the process of the desalination project will be under the proprietary control of DICDL and DST alone. Contractors should bind to the above clause once the award of contract is done. Complete installation shall be done in accordance with installation practices for a well-structured cabling system, using components from a single vendor to ensure consistent and assured performance. The structured cabling distribution network shall serve as a vehicle for transport of data, video and voice telephony signals over a common network throughout the network.

- Devices and services that shall run on the passive network shall include, but not limited to, the following:
 - a.) Wireless LAN access
 - b.) Voice communications servers and IP/SIP end-points
 - c.) IP-based CCTV/Surveillance Cameras
 - d.) Access Door Controllers
 - e.) Various devices and controllers for AV system
 - f.) Video-conferencing equipment

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- Cabling installation for data and voice communications shall originate at networking racks and terminate at IOs terminated at wall.
- Installation, termination and identification of wiring between station outlets and networking distribution rack(s) and networking distribution rack(s) and main rack(s), shall be considered part of the system integrator's work.
- All cables and terminations shall be tested @500 MHz identified, labelled and documented at all locations.
- The system integrator carrying out the SITC shall make the system entirely operational for its intended use, by addition of components specific to its make/model even if not specifically mentioned in the BoQ.

Supported applications, but not limited to:

- Ethernet Applications – wired Ethernet and wireless as per IEEE 802.11a/b/g/n/ac
- IEEE 802.3af Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI)
- Telecom – BRI, PRI and Digital Subscriber Loop (DSL) Applications
- Voice, Video and ISDN Applications

References & Standards, but not limited to:

- TIA / EIA
- International Electro technical Commission (IEC)
- European Committee for Electro technical Standardization (CENELEC)
- American National Standards Institute (ANSI)
- Institution of Electrical and Electronics Engineers (IEEE)
- Wherever there is reference to multiple standards and/codes, the ones most recent and most stringent shall apply.

It shall be the responsibility of the system integrator and OEM manufacturer to ensure that:

- The Passive Components of structured cabling distribution network will be free from manufacturing defects in material and workmanship under normal and proper use.
- All Passive Components in the structured cabling distribution network shall meet or exceed the relevant component specification of the EIA/TIA 568-B, ANSI/EIA/TIA 568-C.2, TIA/EIA 568-C.3 and ISO/IEC 11801: 2002 standards; or later version as applicable at the time of installation.
- The structured cabling distribution network compliant channels will meet or exceed the Guaranteed Channel Performance as per relevant standards in the structured cabling distribution network Performance Specifications in effect at the time of installation.
- The specifications for items in this section, applies to the following:

- a.) CAT6/CAT6A cable and associated components such as Patch Panels, IOs/RJ45 Jacks, Patch Cords
- b.) Single-Mode fiber optic cable and associated components such as distribution shelves, LIUs, pigtails and patch cords
- c.) Networking Racks – for termination of networking cables

11.1 Cat6/cat6a & fiber optic cabling system

Following common specifications shall apply to all CAT6/CAT6A standards based structured cabling components, i.e., Cable, Patch Panel, IOs and Patch Cords.

- All components of the structured cabling system shall be from the same OEM manufacturer.
- As per structure cabling, LV integrator should have to consider maximum 90 meter CAT6A cable length from rack side patch panel to LAN I/O.
- Cabling system, conforming to ANSI/TIA/EIA 568-C.2 CAT6A Cabling system, ISO/IEC 11801 2nd edition, EN-50173-1.
- The cabling system components must be UL listed or equivalent.
- Cable conductor shall be 23 AWG solid bare copper.
- Operating Temperature shall be -20 Deg. C to +60 Deg. C.
- Delay skew shall not exceed 45 ns/100 m.
- 24 port loaded CAT6/CAT6A patch panel termination patten shall be TIA/EIA 568 A and B and shall be fully powder coated.
- CAT6/CAT6A patch cord shall be 24-26 AWG, multi stranded copper and shall be available in different length and color.
- Fiber optic cabling system shall meet or exceed relevant component specification of ITU-T G.652A, B, C & D, IEC - 60793-2-50, TIA/EIA 568-C.3.
- Fiber optic core shall be As per Telecordia GR20, ITU-T G652D, IEC-60793-2-50, TIA/EIA 492-CAAB.

11.2 Electronic Security – IP based Video Surveillance System / CCTV System

General

- The Surveillance System components must be TCP/IP based components working on the same backbone network as the Data Network (LAN).
- The 3rd party VMS system which is part of the tender should be capable of integrating in future with Video Analytics (VA) Systems from reputed and leading 3rd party VA system providers.

- Surveillance system shall network based storage for the specified time and quality as specified.
- Surveillance system must be scalable in terms of equipment (no. of cameras), storage capacity and licenses.
- True open platform functionality is an essential aspect of this specification; cameras from different OEMs must be able to integrate seamlessly with the specified 3rd party VMS platforms without any loss of features and functionality. Similarly, specified VMS platforms must also be able to integrate with a variety of cameras from different manufacturers.
- OEMs for cameras shall have to be different from the OEMs of VMS system so as to ensure openness of solution and to avoid dependency on any single brand.
- For better saving on storage and bandwidth the compression used shall be H.264 high profile for all types of cameras and devices. H.264 high profile shall be a common requirement for all cameras and devices irrespective of whether mentioned in individual sub-sections or not or if mentioned otherwise.
- All cameras shall be vandal resistant as per IK10 rating.
- All cameras shall be ONVIF Profile S compliant.
- Cameras shall have a wide dynamic range of between 85 to 95dB (for Fixed Box/CS-Mount and Indoor Dome/Mini-dome models and between 120 to 130dB (for indoor/outdoor PTZ models) for ensuring good image performance in varying light conditions.

References & Standards, but not limited to:

- ONVIF compliant and supporting H.264 High profile.
- Complete range of IEEE and ISO/OSI model standards and Ethernet protocols.
- UL listed, certified & approved components.
- Ruggedized, IP66 rated enclosures.
- IK10 or IEC 62262 compliant vandal-resistant enclosures.
- Full set of IEEE802.x, ANSI/EIA/TIA-568-C.2 standards, ISO/CENELEC specifications.
- G.711 (64kbps) and G.726 (32kbps) supported codecs for bi-directional audio.

11.3 Camera Specification:

- The camera shall have the capability to stream JPEG and H.264 high profile video in TCP protocol H.264 in UDP (unicast/multicast) protocol.
- The camera shall support JPEG and H.264 high profile compression. The camera shall be able to select the high quality mode in JPEG 1920 x 1080at minimum 25fps. The camera shall also be able to support full HD mode of 1920X1080 in H.264 compression mode with 30fps.
- The network interface shall be an 8-pin RJ-45 connector, 10Base-T/100Base-TX Ethernet. Both IPv6 and IPv4 shall be supported.

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- The camera shall support the following Network protocols: TCP/IP, UDP/IP, HTTP, HTTPS, RTSP, RTP, RTP/RTCP, FTP, SMTP, DHCP, DNS, DDNS, NTP, SNMP, UPnP, IGMP, ICMP, ARP.
- The camera shall have both FTP client and server capabilities.
- The PTZ camera shall be capable of 360 degree pan rotation and a minimum tilt range of -14° to 180°.
- The camera shall support multi-casting and uni-casting.
- The camera shall have a 2D and 3D noise reduction capability for reducing AGC noise to provide clear images without motion blur.
- The camera shall incorporate a built-in optical, auto-focus zoom lens, and shall have digital zoom capability.
- The camera shall offer IR cut filter that switches on/off to enhance low-light sensitivity during B/W mode.
- The camera shall have auto-iris type vari-focal lens as a standard accessory.

Video Management Software (VMS) Specification:

- The application must be able to support multiple brands of surveillance cameras at the same time.
- The VMS shall support ONVIF or PSI alliance – industry standards for the interface of IP-based physical security products.
- The VMS shall be based on a true open architecture that shall allow for use of non-proprietary workstation and server hardware, non-proprietary network infrastructure and non-proprietary storage.
- All video streams supplied from analog cameras or IP cameras shall be digitally encoded in H.264 or better compression formats and recorded simultaneously in real time.
- The VMS shall be able to retrieve and set the current position of PTZ cameras with presets.
- The VMS shall be able to use multiple CCTV keyboards to operate the entire set of cameras throughout the system, including cameras of various manufacturers' brands, including their PTZ functionalities.
- The VMS shall support mobile apps for various popular smart phones and tablets, including e.g., Apple iPod Touch, iPhone, and iPad., RIM BlackBerry smart-phones, Android-compatible smart-phones and tablets.
- It shall support monitoring of live camera, receive alarm push notifications, save snapshots locally on device or control PTZ.
- The VMS shall support Archiving, Failover and standby functionality, Unified web client and smart phone applications etc.

Video Surveillance Storage:

- The Video surveillance storage system shall be provided for 24 Hrs x 30 Days basis at 30fps.
- The Storage system shall be in High Availability (HA) mode.
- The storage system shall be RAID supported.
- The proposed solution shall support and be configured for FC & iSCSI protocols.
- The device should have the following certifications - FCC Class A or CE Mark for immunity against electromagnetic emissions.
- The device should have the following quality and safety standard certifications - CAN/CSAC22.2-60950/UL60950.

11.4 Fire Detection & Alarm System (FAS)

- The fire alarm system shall comply with requirements of NFPA Standard 72 (2013), IS 2189 (2008) and NBC (2016) for Protected Premises Signalling Systems. The system shall be electrically supervised and monitor the integrity of all conductors.
- The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994
- The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard for fire alarm applications. It should be FM (Factory Manual) approved and the installation shall be in compliance with the UL listing.

Manual Call Point:

The manual call point should be activated by manual push. The MCP shall instantaneously give a fire signal in the panel.

Random Sample Testing:

About 5% of all fire alarm components shall be subjected to random testing by connecting to the panels.

All smoke detectors shall be tested as given above and later cleaned with a vacuum cleaner.

Testing of Earthing system:

The earth continuity conductor including metallic parts of the equipment's shall be tested for earth to electrical continuity. All tests shall be carried out as per IS 3043 and resistance of complete installation shall not be more than one ohm.

12.0 COMMISSIONING AND ACCEPTANCE TESTS

The commissioning and acceptance tests shall be apart from the standard or routine tests prescribed and normally conducted by the manufacturer /Design-Build Contractor and will be irrespective of the fact whether the same are covered by such tests or not.

- a. Each sounder circuit shall be energized separately, and the sound level reading taken to check for conformity with the minimum standards.
- b. Mains failure performance.
- c. Battery disconnection test.
- d. Open circuit of each sounder circuit to be tested.
- e. Short circuit of each sounder circuit to be tested.
- f. The results of the above tests either by fault warning or fire alarm shall be recorded in the log books which will be signed both by the Design-Build Contractor and the employer's Representative.

12.1 TESTS AT SITE

- i) All commissioning tests at site will be in line with BS5839 / NFPA-71 and 72.
 - a. Loop Checking.
 - b. Double address.
 - c. Short circuit
 - b. Checking of smoke detectors, Heat detectors etc. by simulation.
 - c. Functional tests for fire alarm panel.
 - d. The Mock trial of the complete Fire Detection and Alarm system.
 - e. Cause and effect matrix.

References & Standards:

- NFPA standard 72, 2013 edition.
- National Building Code (NBC) 2016
- Indian Standard – IS 15908, Selection, Installation and Maintenance of Control and Indicating Equipments for Fire Detection and Alarm System-Code of Practice – 2011
- Indian Standard – IS 2189:1988, Code of practice for selection, installation and maintenance of Automatic Fire Detection and alarm system (second revision).
- IS: 2175 : Heat Sensitive Detectors.
- IS: 11360 : Smoke Detectors.
- BS: 5445, UL/FM/ NFPA/ : Fire Detection and Alarm System.
- VDS/EN54/LPCB

BS 5839	Code of practice for installation of fire alarm system
IS 2189	Code of practice for installation of automatic fire alarm system

Codes	Description
BIS 15908 -	Selection, Installation and Maintenance of Control and Indicating Equipments for Fire Detection and Alarm System--Code of Practice (2011)
IS:2189:1988	- Code of practice for selection, installation and maintenance of Automatic Fire Detection and alarm system (second revision)

Aspiration Smoke Detection System (ASD)

ASD is mandatory for individual porta cabins and lab facilities including office spaces in each of the plots.

Following codes & standards to be followed for Aspirating Smoke Detection:

References & Standards:

- The entire installation shall be installed to comply one or more of the following codes and standards:
 - AS 1670.1-2004, AS1603.8 – 1996, , ASNZS 3000
 - Fire Industry Association (FIA), Code of Practice for Design, Installation, Commissioning & Maintenance of Aspirating Smoke Detector (ASD) Systems
 - NFPA Standards, US
 - NEC Standards, US
 - NZS 4512 : 2003

Approvals

- All the equipment shall be designed, tested, approved, and listed by:
 - LPCB (Loss Prevention Certification Board), UK
 - FM (Factory Mutual), US
 - UL (Underwriters Laboratories Inc.), US
 - ULC (Underwriters Laboratories Canada), Canada

12.2 Public Address System & Emergency Communication System (PA)

- The Public Address system shall comply IEC 60849

References, Standards and Certifications for PA system shall be:

- IS 1881 code of practice for indoor installation of Public Address System
- IS 1882 code of practice for outdoor installation of Public Address System
- EN-60849
- ISO
- BS 5839
- EVAC specification

12.3 Access Control System (ACS) & Entrance Control System (ECS)

ACS and ECS is mandatory for skids, portcabins and office spaces including individual labs.

General

- The ACS & ECS System components must be TCP/IP based components working on the same backbone network as the Data Network (LAN).
- Access Control System must be a fully modular, scalable system that can be adapted for use with all configurations, from the most basic to the most advanced, and with all kinds of architecture, from the simplest to the most complex.
- Access Control System should be an upgradeable system consisting of several modules for managing all electronic security functions and having integration capabilities:
 - Access control.
 - Video surveillance.
 - Supervision.
- In essence the Access Control System shall provide the following:
 - Multi-site management
 - Web interfacing,
 - Openness to other systems,
 - Guard tour management,
 - Logic controllers.
- ACS system shall have multi server architecture.

Access Control Controller Specification:

- The ACS controller shall be TCP/IP based.
- The Controller shall have RS-485

Access Control Reader Specification:

- The ACS reader shall support multi factor authentication like bio-metric (PIN and/or IRIS), PIN and RFID.
- The reader shall be POE supported, Ethernet based.
- The reader shall have optical biometric sensor.
- The reader shall be IP65 rated weather proof.

Access Control Software Specification:

- The application software program shall be a true 32-bit (should also be compatible with 64-bit OS & hardware), ODBC compliant application.

- The application software shall be a modular and scalable, networked access control system having centralized architecture, capable of handling large corporations with multiple remote sites. The system shall allow for easy expansion or modification.
- The application software shall support time attendance, access control and visitor management facilities from anywhere.
- The application software shall support seamless integration with 3rd party application.

References & Standards:

- BS EN 50133-1 Alarm systems – access control systems for use in security applications
- BS EN50133-7 Application guidelines for access control systems
- EN 12209-1 Electro-mechanical locking devices
- BS 7807- Code of practice for Integrated Systems

12.4 LIST OF APPROVED MAKE / OEM MANUFACTURER FOR ELECTRICAL & ELV WORK MATERIALS (The list is tentative. All makes has to be indicated in the detail engineering by the individual contractors for approval from the employer/employers engineer)

- | | | |
|----------------------------|---|--|
| 1) Rigid PVC Conduit | : | ISI approved & manufactured from virgin material.
BBC, Precision, POLYCAB |
| 2) Accessories for conduit | : | Same make as of pipe. |
| 3) Flexible Copper Wires | : | FRLS type : Avocab, Havell's, Finolex, Polycab, KEL. |
| 4) Switches | : | MK(Blenze), Legrand(Arteor), Crabtree Schneider (Opale) or as per Interior approval |
| 5) LED Light Fixture or | : | any kind of light source
Phillips, Wipro, Surya, OSRAM, Artlite, Crompton, Keselec Schreder, Havell's, Zumtobel, Regent, Riggiani, Lance, Ligman, PUK, Disano.
(As suggested by architect - Sample to be approved) |
| 6) LT Panel | : | Ambit Switchgears, Expel Prosys, Shivanjali switchgears |
| 7) LED lamp souce | : | CREE, NICHIA, OSRAM |
| 8) Ceiling Fans | : | Crompton, Usha, Orient, Havell's |
| 9) Fan box | : | Cast Iron Type Only |

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10) Exhaust Fan	:	Crompton, Almonard,
11) Call bell	:	Anchor Ding Dong type.
12) PVC tape	:	Steel grip, Anchor
13) Distribution boards	:	Havell's, Legrand (Ekinoxe),Schneider MG, L&T, Hager. Factory fabricated. Double door type
14) ACB / MCCB / MCB / ELMCB & Acc	:	Havell's, Legrand (DX3), Schneider MG,L&T, Hager.
15) DB Surge protector	:	Legrand, Schneider, L&T, Hager, OBO
16) Timer	:	Legrand, Schneider, L&T, Hager, Theben
17) RTPFC Panel manufacturer :		Datar, EPCOS, L & T or Readymade As per Switchgear make
18) Metal Clad and Wheather proof Plug-socket	:	Havells, Legrand, Schnieder, L&T, Hager
19) LT Cables	:	Avocab, Finolex, Havells, Polycab, KEI
20) HT Cable	:	Avocab, Havell's, Finolex, KEI, Polycab
21) HT Joint Kit	:	Raychem, 3M
22) Panel Fabricators	:	CPRI Approved panel builders only
23) Load Manager / Energy Meter: (Suitable for PC Connected and LAN with open protocol, Sample to be approved)		Conzerve, Secure, Elmeasure, Rushabh.
24) Meters(Digital : V,A,PF etc)	:	Conzerve, Secure, Elmeasure.
25) Relay	:	Siemens, L&T, ABB, Schnieder
26) Connectors	:	ELMEX, Wago, Connectwell.
27) Glands	:	Compression type, Heavy duty and deep threding with rubber-ring and double washers. (Sample tobe approved) HMI, Comet, Dowell's
28) Cable Lugs	:	Dowell's, 3-D (long neck)
29) Button holder, Angle holder, ceiling rose	:	Anchor, CPL
30) M.S. Boxes	:	Fabricated out of CRCA sheets / Angle / Strip continuously welded (sample to be approved) with Powder coating / Colour coating.

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31) Whether protected junction boxes	:	Spelsberg, Hensel, SCAME
32) Ladder & Perforated type Cable Tray	:	Elcon, Rushabh, MEK, Indiana
32a) Wire Mesh Cable tray	:	Legrand , OBO
33) Raceway	:	OBO, MK (Ega), Legrand
34) Anchor Fastener	:	Hilti, 3M
35) Current Transformer	:	AE, Virat, Narmada
36) Indication Lamp	:	LED Type : Schneider, L&T, RASS, Salzer
37) Voltage Selecter Switch	:	L&T, Salzer
38) Ameter Selecter Switch	:	L&T, Salzer
39) Fire Stoppers	:	Hilti, 3M, OBO
40) Maintenance free / Chemical Earthing	:	JK,LPI,HAKEL
41) Lightning Arrestor	:	APS, LPI, HAKEL
42) UPS	:	Hitachi-Hirel, APC, Emerson, Numeric
43) Transformer	:	ABB, Voltamp, Cromption
44) HT Breaker panel	:	C & S, Schneider, ABB, L & T, Expel Prosys
45) D G Set	:	Sudhir Gensets, Gmmco, Sterling & Wilson
46) Stabilizer	:	Suvik, Belltronics, Protek-G, Consul
47) Power pack	:	Gogate / Eq.
48) Isolation Transformer	:	Automatic Electric, Servomax, Aplab
49) Street Light/ External Lighting/Architecture Poles:		NIV ENGINEERS, SKIPPER, BAJAJ
50) Single Phase A.C. Contactor:		MDS/ L&T/ Siemens
51) 4 Pole Three Phase A.C. Contactor:		L&T/ Siemens
52) Auto manual switches (3 way):		Kaycee/ L&T
53) Auto manual changeover switch:		Kaycee/ L & T
54) Current Relays	:	Sitn/Minilec/Sntry
53) Fire Alarm Panel	:	Cooper, Esser, Gent
54) Fire Pumps	:	Lubi, Kirloskar, Grundfos

13 HVAC WORKS

13.1 Design Parameters

Individual refrigeration units for porta cabins, office spaces and lab facilities should be provided by the contractor. The air conditioning units should be working for 24x7 cycle need based depending on the man-hours spent at site to meet the objective of the project.

14.0 WATER SUPPLY SYSTEM

Apart from the seawater intake, reject and the utility pipelines, the contractor should provide potable water for drinking inside the portacabins provided as office space, lab and security cabins. Provision for water is mandatory in the sanitation facilities provided in each of the plots.

Following codes and standards are made part of this specification and will be applicable based on supply of items as required mandatory for minimum sanitation facilities and utility lines in the portacabins as part of office space and lab facilities.

Table: Codes for Plumbing Works

IS 10446 – 1983	Glossary of terms relating to water supply and sanitation.
IS 1239	Mild steel tubular and other wrought steel pipes and fittings (Part-I)
IS 1239	Mild steel tubular and other wrought steel pipes and fittings (Part-II)
IS 779 -1978	Specifications for Water Meters - Domestic Type
IS 2104 – 1981	Specification for water meter boxes (Domestic type).
IS 2401–1973	Code of practice for selection, installation, and maintenance of domestic water meters.
IS 7413-1981	Insulation Material
IS 2065 –1983	Code of practice for Water Supply In Buildings (Second Revision)
IS 778- 1984	Specifications for copper alloy Gate, Globe And Check Valves for water supply purposes.
IS 1703 – 1977	Specification for ball valves (horizontal plunger type)including floats for water supply purposes.
IS 3004 – 1979	Specification for plug cocks for water supply purposes.
IS 3950 – 1979	Specifications for surface boxes for sluice valves.
IS 9338 – 1984	Specification for cast iron screw-down stop valves and stop and check valves for water works.
IS 4346 – 1982	Specification for washers for use with fittings for water services.
IS 5219 – Part 1	Specification for cast copper alloy traps – Part1 1982
IS 5312 – part 1	Specification for swing check type reflux (Non-return) 1969 valve for water works purposes part 1 single door pattern
IS 13049 – 1919	Diaphragm type (plastic body) float operated valve for cold water

	services – specification.
IS 13114 – 1991	Forged brass gate, globe and check valves for water works purposes – specification.
IS 14399 – part 1	Hot press moulded thermosetting glass fibre reinforced & Part 1 – 1996 polyester (GRP) resin sectional water storage tanks.
IS 310 –1965	Code of Practice for Water Supply
SP –35	Handbook of water supply and drainage (with special emphasis on plumbing)
IS 1172-1983	Code of Basic Requirement For Water Supply, Drainage & Sanitation (Third Revision)
IS 12183	Code of practice for Plumbing In Multi- Storey buildings Part I) – 1987 (Part 1 water supply)
IS 1200 - 1992	Method of Measurement Of Building And Civil Engg. Works.(Part 1 earthwork)
IS 2379 –1963	Specification of colour code for the identification of pipes.
SP 7 – 1983	National building code of India (Part IX – Plumbing services)
IS 2401 – 1973	Code of practice for selection, Installation and maintenance of domestic water meters.
IS 780-1984	Specification for Sluice valves for water works purposes (50 to 300mm size) (Sixth Revision)
	The Contractor shall comply with the water requirement, water supply lines and sewer lines as per the following manuals and Standards.
CPHEEO	Manual on water supply and treatment
CPHEEO	Manual on sewerage and sewage treatment

All the requirements must be in accordance with the statutory / authorities requirements.

15.0 SANITARY AND SEWERAGE SYSTEMS

CODES AND STANDARDS

Unless specifically mentioned otherwise, all the applicable codes and standards published by the Bureau of Indian Standards and their subsequent revision shall govern in respect of design, workmanship, quality and properties of materials and method of testing.

Following [Table] are the standards and codes are made part of these specifications.

Table: Codes for Sanitary and Sewerage System

Codes	Description
IS 10446 – 1983	Glossary of terms relating to water supply and sanitation.
IS 11208 –1985	Guidelines for registration of Plumbers
IS 5382 – 1985	Specification for rubber sealing rings for gas mains, water mains and sewers.
SP – 35	Handbooks of water supply and drainage (with special emphasis on plumbing)
IS 1172-1983	Code of Basic Requirement For Water Supply, Drainage &Sanitation (Third Revision)
IS 1200 - 1992	Method of Measurement Of Building and Civil Engg. Works.(Part 1 earthwork)
IS 2379 –1963	Specification of colour code for the identification of pipes.
SP 7 – 1983	National building code of India (Part IX – Plumbing services)
IS 1742 – 1983	Code Of Practice For Building Drainage (Second Revision)
IS 301 – 1971	Code of practice for Building Drainage
IS12251- 1987	Code Of Practice For Drainage In Basement
BS 5572 -1978 (Amendment No.2)	Sanitary pipe Works
BS 4660- 1973 (Amendment No.1)	PVC Underground Drain Pipes & Fittings.
IS 5329 – 1983	Code of practice for sanitary pipe work above ground for buildings First Revision)
IS 2527 – 1984	Code of practice for fixing rain water gutters and down take pipes for roof drainage. (First Revision) I
IS 5961 – 1970	Specification for cast iron gratings for drainage purposes.
IS 2527 – 1984	Code of practice for fixing rain water gutters and down take pipes for roof drainage. (First Revision)
CPHEEO	Manual on sewerage and sewage treatment
IS 1626 (Part 1)	Specification for asbestos cement building pipes and pipe –1980 fittings, gutter and gutter fittings, and roof fittings

16.0 ROAD WORKS

16.1 Roads and Parking Areas:

Standards and Specifications for Roads and Parking Areas are given in this section;

The Codes, Standards and Technical Specifications applicable for the design and construction are as given under;

- i. Indian Roads Congress (IRC) Specifications, Standards, Design Codes
- ii. IRC Special Publications
- iii. Ministry of Surface Transport Publications (Now Ministry of Shipping, Road Transport & Highways) – Part A
- iv. Policy circular/Advisory letters issued to all states/UTs on the matter pertaining to urban transport April 2008 – October 2014

Latest version of the Codes, Standards, Specifications, etc., notified/published at least 60 days before the last date of bid submission shall be considered applicable.

Where the Contractor intends to use an alternative to these Standards/Guidelines for delivering an equal or better product, he shall be permitted to use such alternative subject to the following conditions:

He shall demonstrate that the proposed alternative conforms to any of the following international Standards, Codes of Practice, Specifications, Guidelines, etc.

- I. American Association of State Highway and Transportation Officials (AASHTO)
- II. American Society for Testing of Materials (ASTM)
- III. Euro Codes
- IV. National Standards of any of the following countries: United States of America (USA), Canada, United Kingdom (UK), France, Germany, Sweden, Denmark, Norway, Netherlands, Spain, Australia, New Zealand, Japan and South Africa

In case the Contractor intends to use any alternative material/technology/method, whether patented or otherwise, that is not specifically covered in the Indian or International Standards as listed above, but the use of which has been permitted on similar projects (similar in category of road, traffic and climatic conditions) as the Project Road, he would be permitted, its use on certification by the owners of such similar projects regarding the continued successful performance of such materials, technologies, methods, procedures or processes for at-least 5 years of the service life of the project. Such a certification shall be supported with details of critical performance parameters.

16.2 Standards and Specifications for Construction

The Contractor shall comply with the Standards and Specifications for Construction of Roads and Parking Areas as given below.

All materials, works and construction operations shall conform to the Specifications for Road and Bridge Works (Fifth Revision, April 2013), issued by the Ministry of Road Transport & Highways (MoRT&H). Where the Standards and Specifications for a work are not given, Good Industry Practice shall be adopted to the satisfaction of the Employer's Engineer.

16.3 List of Standards: List of Standards is given in below Table:

Table

Code/Document No.	Description
1. IRC: 3-1983	Dimensions and weights of Road Design Vehicles
2. IRC: 32-1969	Standard for vertical and horizontal clearances of Overhead electric power and telecommunication lines as related to roads
3. IRC: 35-1997	Code of Practice for Road Markings (with Paints) (First Revision)
4. IRC: 37 -2012	Tentative Guidelines for the Design of Flexible Pavements
5. IRC: 38-1988	Guidelines for the design of curves for Highways & Design tables (First Revision)
6. IRC: 56-2011	Recommended Practices for Treatment of Embankment and Roadside Slopes for Erosion Control (First Revision)
7. IRC: 67-2012	Code of Practice for Road Signs (Third Revision)
8. IRC: 69-1977	Space Standards for Roads in Urban Areas
9. IRC: 86-1983	Geometric Design Standards for Urban Roads in Plains
10. IRC: 93-1985	Guidelines on Design and Installation of Road Traffic Signals
11. IRC: 98-2011	Guidelines on Accommodation of Underground Utility Services Along and Across Roads in Urban Areas (Second Revision)
12. IRC: 99-1988	Tentative Guidelines on the Provision of Speed Breakers for Control of Vehicular Speeds on Minor Roads
13. IRC: 103-2012	Guidelines for Pedestrian Facilities
14. IRC: SP: 23-1983	Vertical Curves for Highways
15. IRC: SP: 31-1992	New Traffic Signs
16. IRC: SP: 41-1994	Guidelines on Design of At-Grade Intersections in Rural & Urban Areas
17. IRC: SP: 44-1996	Highway Safety Code
18. IRC: SP: 50-2013	Guidelines on Urban Drainage
19. IRC: SP: 62-2004	Guidelines for the Design and Construction of Cement Concrete Pavement for Rural Roads
20. IRC: SP: 63-2004	Guidelines for the Use of Interlocking Concrete Block Pavement

17.0 SOLID WASTE MANAGEMENT SYSTEM

The following standards and codes and statutory requirements to be followed for design and implementation of the Solid Waste Management:

Table

Codes / Manuals	Description
CPHEEO	Manual on Municipal Solid Waste Management, Ministry of Urban Development, Government of India, 2000.
Guidelines by Supreme Court of India, 1999.	Solid waste management in class-I cities in India
[20/7/1998], S.O.630 (E), 1998.	Bio-medical waste (management and handling) rules
S.O. 2400(E), 1999.	Recycled plastic (manufacture and usage) rules
[25.9.2000], S.O. 908(E), 2000 and the amendment 2013.	Municipal waste (Management and Handling Rules),
	Batteries (Management and handling) Rules, 2001.
1999, S. O.705 (E), 2003.	Amendment to the Recycled Plastic Manufacturing and Usage Rules,
[17.9.2003], S.O.1069 (E), 2003.	Bio-Medical Waste (Management and Handling) (Amendment) Rules,
	Hazardous waste management and handling rule, 1989.
S.O.2265 (E), 2008	Hazardous Wastes (Management, Handling and Trans boundary Movements) Rules,.
S.O. 2400(E), 2009.	Plastics (Manufacture, Usage and Waste Management) Rules, [17.09.2009],
	E waste (Management and handling) Rules, 2011.
	DSIR bye-laws.

18.0 Water qualities

Raw water characteristics:

Table: Details of marine water quality monitoring locations

S. No.	Location Code	Depth in m	Geographical Co-ordinates
1.	MWQ - 1 - Top	Surface	22°09'18"N 72°18'9"E
	MWQ - 1 – Middle	2.0	
	MWQ - 1 - Bottom	4.0	
2.	MWQ - 2 - Top	Surface	22°10'30"N 72°18'15"E
	MWQ - 2 – Middle	2.0	

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	MWQ - 2 - Bottom	4.0	
3.	MWQ - 3 - Top	Surface	22°08'35"N 72°19'15"E
	MWQ - 3 - Middle	2.0	
	MWQ - 3 - Bottom	4.0	

Table: Results of Marine Water Quality Analysis

Parameters	MWQ - 1 - T	MWQ - 1 - M	MWQ - 1 - B	MWQ - 2 - T	MWQ - 2 - M	MWQ - 2 - B	MWQ - 3 - T	MWQ - 3 - M	MWQ - 3 - B
Temperature	25.0	24.7	24.5	26.1	25.5	24.8	25.6	25.2	24.3
pH	8.02	7.99	7.91	8.05	8.02	8.12	8.03	8.04	8.04
BOD	22	15	35	15	10	12	18	20	35
COD	160	136	420	140	108	112	180	196	304
Dissolved Oxygen (DO)	6.9	6.6	6.4	7.1	6.8	6.4	6.8	6.6	6.5
Total Suspended Solids (TSS)	437	3322	9508	506	507	5464	2350	11596	11492
Total Dissolved Solids (TDS)	19180	19458	19176	20218	19506	21448	20398	19284	22868
Fixed Dissolved Solids	7370	13280	7800	5510	8150	9170	12590	6410	6810

Expected produced water characteristics:

Table: Required produced water characteristics

Parameter	Value
Colour	Not more than 5 hazen Units
pH	6.5-8.5
Turbidity	less than 1 NTU
Suspended Solids	Not more than 1 mg/l
Taste	Unobjectionable
Odour	Unobjectionable
Coliform Organism	Absent
Aluminium (as Al)	Less than 0.2
Free Chlorine (after 30 Minutes)	Not less than 0.4 mg/l
Appearance	Clear
Bacteriological Standard (Total coliform and E coli)	No Coli form for 100% Sample taken.

Schedule E - Maintenance Requirements

(See Clauses 2.1 and 14.2)

1.0 Maintenance Requirements

- 1.1 The Contractor shall, at all times maintain the Project Components at site in perfect working conditions. The seawater intake system, the brine reject mechanism and the utility lines are very critical for the operation of the five desalination projects. Any dry run in the lines will affect the overall timeline of the project. The contractor who does the Part-B of the project should submit a detail maintenance schedule for the period of operation with a N+2 reliability for operation of pumps/ motors and N+1 reliability for power and water sources. The contractor who does the work at individual plot level should make sure that the desalination skid is operating to perform the required standards of output to cater to the overall objective of respective proposals. The reliability standards for the equipment should be set to make sure there are no breakdowns in operation that will affect the overall performance of the system.
- 1.2 The Contractor shall repair or rectify any and all defects or deficiencies set forth in Paragraph 2 of this Schedule-E within the time limit specified therein and any failure in this behalf shall constitute non-fulfilment of the Maintenance obligations by the Contractor. Upon occurrence of any breach hereunder, the Employer shall be entitled to effect reduction in payment terms as set forth in Clause 14.6 of this Agreement, without prejudice to the rights of the Employer under this Agreement, including Termination thereof.
- 1.3 All materials and works for operations and maintenance of roads and pavements shall conform to the Specifications for Road and Bridge Works (Fifth Revision, April 2013), issued by the Ministry of Road Transport & Highways (MoRT&H) and the relevant IRC publications.
- 1.4 All materials and works for operations and maintenance of Potable water supply system and distribution networks including valves, flow meters etc. shall conform to CPHEEO Manual and NBC on Operation and Maintenance of water supply systems, 2005, MoUD, GOI
- 1.5 Where the Standards and Specifications for any of the above work are not given, Good Industry Practice shall be adopted to the satisfaction of the Employer's Engineer.

2.0 Repair/Rectification of Defects and Deficiencies

The obligations of the Contractor in respect of Maintenance Requirements shall include repair and rectification of the Defects and deficiencies specified in Appendix E-I of this Schedule-E within the time limit set forth therein.

3.0 Other Defects and Deficiencies

In respect of any Defect or deficiency not specified in Appendix E-I of this Schedule-E, the Employer's Engineer may, in conformity with Good Industry Practice, specify the permissible limit of deviation or deterioration with reference to the Standards and Specifications, and any deviation or deterioration beyond the permissible limit shall be repaired or rectified by the Contractor within the time limit specified by the Employer's Engineer.

4.0 Extension of Time Limit

Notwithstanding anything to the contrary specified in this Schedule-E, if the nature and extent of any Defect or deficiency justifies more time for its repair or rectification than the time

specified in Schedule M, the Contractor shall be entitled to additional time in conformity with Good Industry Practice. Such additional time shall be determined by the Employer's Engineer and conveyed to the Contractor and the Employer with reasons thereof.

5.0 Emergency Repairs/Restoration

Notwithstanding anything to the contrary contained in this Schedule-E, if any Defect, deficiency or deterioration in the Project Components poses a hazard to safety or risk of damage to property, the Contractor shall promptly take all reasonable measures for eliminating or minimizing such danger.

6.0 Daily Inspection by the Contractor

The Contractor shall, through its engineer, undertake a daily visual inspection of the Project Components and maintain a record thereof in a register to be kept in such form and manner as the Employer's Engineer may specify. Such record shall be kept in safe custody of the Contractor and shall be open to inspection by the Employer and the Employer's Engineer at any time during office hours.

7.0 Repairs On Account Of Natural Calamities

All damages occurring to the Project Components on account of a Force Majeure Event or default or neglect of the Employer shall be undertaken by the Employer at its own cost. The Employer may instruct the Contractor to undertake the repairs at the rates agreed between the Parties.

Appendix E-I – Repair / Rectification of Defects and Deficiencies

(Schedule-E)

The Contractor shall repair and rectify the Defects and deficiencies specified in this **Appendix E-I** of Schedule-E.

1. Architectural , Civil maintenance

- 1.1. Any break down of door / window / hatch accessories in the portacabin facilities as part of office buildings, labs etc should be replaced / rectified within 24 hours
- 1.2. Any breakage of flooring/false flooring, dado, ceiling/false ceiling, peeling of paint, waterproofing, SS Railing, Electrical & telecom and trenches, etc should be rectified in 48 hours
- 1.3. Any damage to External premises outside the office portacabins that can hinder the free movement of men, material and equipment should be repaired, landfilled or dewatered within 48 hours.
- 1.4. Any accumulation of rain water, seawater inside the compound of respective contractors should be taken out / drained through proper slope mechanism / dewatering mechanism within 48 hours.
- 1.5. Any water leak in portacabins, office rooms, labs etc shall be stopped within 2 hrs and suitable rectification process undertaken.
- 1.6. Proper house keeping facility has to be undertaken by the individual contractors to handle all solid waste, hazardous/non-hazardous waste that are generated as part of the demonstration of the project.
- 1.7. Hardscape Any Hardscape / signage damage shall be repaired within 24 hrs

2. Electrical

- 2.1. Any LT Electrical equipment / instrument/ cables/ Accessories, communication equipment / instrument/ cables/ Accessories & Electronic equipment / instrument/ cables/ Accessories, etc. shall be restored within two hours in case of minor faults and within eight hours in case of major faults
- 2.2. Faulty lighting fixtures should be rectified within six hours.
- 2.3. Essential spares to be available for immediate repairs

3. HVAC, Fire Fighting and Plumbing

- 3.1. Outdoor and Indoor equipment of Air conditioning units, fighting and plumbing units - Minor repair shall be rectified within 4 hrs. and major repair (motor failure) shall be rectified within 24 hours.
- 3.2. Fans - Minor repair shall be rectified within 4 hrs. and major repair (motor/bearing failure)

shall be rectified within 8 hours.

- 3.3. Piping/valve/ traps/ Sprinklers/ Hose Reel/ Fire Hydrant/ fittings / Taps leakages - Shall be rectified/replaced within 2 hrs.
 - 3.4. Instruments like gauges/sensors - Shall be rectified / replaced within 2 hrs.
 - 3.5. Pumps - Minor repair shall be rectified within 4 hrs. and major repair (motor/bearing failure) shall be rectified within 8 hours.
 - 3.6. Underground and Overhead Tanks - Minor repair shall be rectified within 4 hrs. and major repair shall be rectified within 8 hours.
 - 3.7. Essential spares to be available for immediate repair
 - 3.8. Contractor to provide the spares at site as stock. The contractor should keep the logbook on replenishment of spares in timelines with the standard operation and maintenance schedule.
- 4. Fire detection , alarm system ,access control, Network System and CCTV surveillance**
- 4.1. Any damage breakage of any instrument, equipment, accessories, sensors and system in general should not remain nonfunctional for more than two hour.
 - 4.2. Essential spares to be available for immediate repair.
- 5. Solid Waste Management (SWM) :**
- 5.1. The bins should not be allowed to overflow at any point of time and should be emptied irrespective of pre-determined frequency of lifting the bins

Schedule F - Applicable Permits

(See Clause 3.1.7(a))

Applicable Permits

The Contractor who will bid for the part B of the tender document shall obtain, as required under the Applicable Laws, the following Applicable Permits:

- (a) Development Permission for seawater intake to a capacity of minimum 150,000 litres per day
- (b) Permission to run the seawater intake pipes through the CRZ region to the location of the desalination skids.
- (c) Permissions from MoEF & CC and other required permissions to be obtained from authorities to cater to the applicable permits / norms.
- (d) Permission of the State Government for drawing water from creek/sea
- (e) Permissions for collection, storage and disposal of brine from the individual desalination units through a centralized collection, storage and disposal mechanism.
- (f) Clearance of Pollution Control Board for required permissions/norms
- (g) Clearance of Village Panchayats and Pollution Control Board for setting up seawater intake, brine reject pipelines.
- (h) Permission of Village Panchayats and State Government for borrow earth; and
- (i) Any other permits, clearances or approvals required under Applicable Laws.
- (j) Environment Impact Assessment studies for the proposed Intake / Reject mechanism
- (k) Other related studies for possible locations for intake and reject facilities and related approvals

Schedule G – Form of Bank Guarantee

(See Clause 7.1.1, 7.5.3 and 19.2)

Annexure I – Performance Security

(See Clause 7.1.1)

.....
Employer.....,
Gandhinagar, Gujarat

WHEREAS:

- (A) _____ [name and address of contractor] (hereinafter called “the Contractor”) and [name and address of the EMPLOYER], (“**the EMPLOYER**”) have entered into an agreement (the “**Agreement**”) for “Demonstration of energy efficient seawater desalination Technologies near Activation Area at Dholera Special Investment Region” on Engineering, Procurement and Construction (“EPC”) basis, subject to and in accordance with the provisions of the Agreement.
- (B) The Agreement requires the Contractor to furnish a Performance Security for due and faithful performance of its obligations, under and in accordance with the Agreement, during the Construction Period/ Operation period/ Defects Liability Period (as defined in the Agreement) in a sum of Rs. Crore (Rupees Crore) (the “Guarantee Amount”).
- (C) We,through our branch at (the “Bank”) have agreed to furnish this bank guarantee (hereinafter called the “Guarantee”) by way of Performance Security.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful performance of the Contractor’s obligations during and under and in accordance with the Agreement, and agrees and undertakes to pay to the Employer, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Contractor, such sum or sums up to an aggregate sum of the guarantee amount as the EMPLOYER shall claim, without the EMPLOYER being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.
2. A letter from the EMPLOYER, under the hand of an officer not below the rank of [.....of EMPLOYER], that the Contractor has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the EMPLOYER shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final, and binding on the Bank, notwithstanding any difference between the EMPLOYER and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.

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3. In order to give effect to this Guarantee, the EMPLOYER shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.
4. It shall not be necessary, and the Bank hereby waives any necessity, for the EMPLOYER to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.
5. The EMPLOYER shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Agreement or to extend the time or period for the compliance with, fulfillment and/or performance of all or any of the obligations of the Contractor contained in the Agreement or to postpone for any time, and from time to time, any of the rights and powers exercisable by the EMPLOYER against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the EMPLOYER, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the EMPLOYER of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the EMPLOYER or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.
6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the EMPLOYER in respect of or relating to the Agreement or for the fulfillment, compliance and/or performance of all or any of the obligations of the Contractor under the Agreement.
7. Notwithstanding anything contained herein before, the liability of the Bank under this Guarantee is restricted to the Guarantee amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the EMPLOYER on the Bank under this Guarantee all rights of the EMPLOYER under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.
8. The Performance Security shall cease to be in force and effect 60 (sixty) days after the end of the Defects Liability Period as set forth in Clauses 7.1
9. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the EMPLOYER in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.
10. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorized to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the EMPLOYER that the envelope was so posted shall be conclusive.
11. This Guarantee shall come into force with immediate effect and shall remain in force and effect for up to the end **** month in the year ***** or until it is released earlier by the EMPLOYER pursuant to the provisions of the Agreement.

Signed and sealed this day of 20..... at

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

NOTES:

- (i) The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.
- (ii) The address, telephone number and other details of the head office of the Bank as well as of issuing branch should be mentioned on the covering letter of issuing branch.

Annexure II – Form for Guarantee for Withdrawal of Retention Money

(Schedule-G)

(See Clause 7.5.3)

.....,
EMPLOYER,
Gandhinagar, Gujarat

WHEREAS:

[Name and address of contractor] (hereinafter called “the Contractor”) has executed an agreement (hereinafter called the “Agreement”) with the [name and address of the EMPLOYER], (hereinafter called “the EMPLOYER”) for the “Demonstration of energy efficient seawater desalination Technologies near Activation Area at Dholera Special Investment Region” on Engineering, Procurement and Construction (the “EPC”) basis, subject to and in accordance with the provisions of the Agreement.

- a. in accordance with the Clause 19.18 of the Agreement, whenever the amount of the retention money (hereinafter called “Retention Money”) held by the EMPLOYER exceeds 1% (one per cent) of the Contract Price, the Contractor may, at its option, withdraw the Retention Money after furnishing to the EMPLOYER a bank guarantee for an amount equal to the proposed withdrawal.
- b. We,through our branch at (the “Bank”) have agreed to furnish this bank guarantee (hereinafter called the “Guarantee”) for the amount of Rs. (..... in words) (the “**Guarantee Amount**”).

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably undertakes to pay to the EMPLOYER, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Contractor, such sum or sums up to an aggregate sum of the Guarantee Amount as the EMPLOYER shall claim, without the EMPLOYER being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.
2. A letter from the EMPLOYER, under the hand of an officer not below the rank of [.....of EMPLOYER], that the Contractor has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the EMPLOYER shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final, and binding on the Bank, notwithstanding any difference between the EMPLOYER and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.
3. In order to give effect to this Guarantee, the EMPLOYER shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the

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near Activation Area at Dholera Special Investment Region

- Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.
4. It shall not be necessary, and the Bank hereby waives any necessity, for the EMPLOYER to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.
 5. The EMPLOYER shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Retention Money and any of the rights and powers exercisable by the EMPLOYER against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the EMPLOYER, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the EMPLOYER of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the EMPLOYER or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.
 6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the EMPLOYER in respect of or relating to the Retention Money.
 7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the EMPLOYER on the Bank under this Guarantee all rights of the EMPLOYER under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.
 8. The guarantee shall cease to be in force and effect 90 (ninety) days after the end of the Completion Period specified in Clauses 17.1 of the Agreement.
 9. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the EMPLOYER in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.
 10. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorized to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the EMPLOYER that the envelope was so posted shall be conclusive.
 11. This Guarantee shall come into force with immediate effect and shall remain in force and effect up to the end **** month in the year ***** or until it is released earlier by the EMPLOYER pursuant to the provisions of the Agreement.

Signed and sealed this day of 20..... at

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

(Name)

(Designation)

(Code Number)

(Address)

NOTES:

- (i) The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.
- (ii) The address, telephone number and other details of the head office of the Bank as well as of issuing branch should be mentioned on the covering letter of issuing branch.

Annexure III – Form for Guarantee for Advance Payment

(Schedule-G)

(See Clause 19.2)

.....
.....EMPLOYER,
Gandhinagar, Gujarat

WHEREAS:

- (A) [name and address of contractor] (hereinafter called “the Contractor”) has executed an agreement (hereinafter called the “Agreement”) with the [name and address of the EMPLOYER], (hereinafter called “the EMPLOYER”) for the “Demonstration of energy efficient seawater desalination Technologies near Activation Area at Dholera Special Investment Region” on Engineering, Procurement and Construction (the “EPC”) basis, subject to and in accordance with the provisions of the Agreement.
- (B) in accordance with the Clause 19.2 of the Agreement the EMPLOYER shall make to the Contractor an interest bearing advance payment (hereinafter called “Advance Payment”) equal to 10% (ten per cent) of the contract price for mobilization expenses and acquisition of equipment; and that the Advance Payment shall be made in three installments subject to the Contractor furnishing an irrevocable and unconditional guarantee by a scheduled bank for an amount equal to the 110% amount of each installment to remain effective till the complete and full repayment of the installment of the Advance Payment as security for compliance with its obligations in accordance with the Agreement; and the amount of (first/second/third) installment of the Advance Payment is Rs. **** cr. (Rupees ***** crore) (the “Guarantee Amount”).
- (C) We,through our branch at (the “Bank”) have agreed to furnish this bank guarantee (hereinafter called the “Guarantee”) for the Guarantee Amount.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful repayment on time of the aforesaid installment of the Advance Payment under and in accordance with the Agreement, and agrees and undertakes to pay to the EMPLOYER, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Contractor, such sum or sums up to an aggregate sum of the guarantee amount as the EMPLOYER shall claim, without the EMPLOYER being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.
2. A letter from the EMPLOYER, under the hand of an officer not below the rank of [.....of EMPLOYER], that the Contractor has committed default in the due and faithful performance of all or any of its obligations for the repayment of the installment of the Advance Payment under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the EMPLOYER shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final, and binding on the Bank, notwithstanding any difference between the EMPLOYER and the Contractor, or any dispute between them pending before any court,

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near Activation Area at Dholera Special Investment Region

- tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.
3. In order to give effect to this Guarantee, the EMPLOYER shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.
 4. It shall not be necessary, and the Bank hereby waives any necessity, for the EMPLOYER to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.
 5. The EMPLOYER shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Advance Payment or to extend the time or period of its repayment or to postpone for any time, and from time to time, any of the rights and powers exercisable by the EMPLOYER against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the EMPLOYER, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the EMPLOYER of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the EMPLOYER or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.
 6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the EMPLOYER in respect of or relating to the Advance Payment.
 7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the EMPLOYER on the Bank under this Guarantee all rights of the EMPLOYER under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.
 8. The guarantee shall cease to be in force and effect 90 (ninety) days after the end of the one year from the date of payment of the installment of the Advance Payment, as set forth in Clause 19.2 of the Agreement.
 9. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the EMPLOYER in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.
 10. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorized to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the EMPLOYER that the envelope was so posted shall be conclusive.
 11. This Guarantee shall come into force with immediate effect and shall remain in force and effect for up to the end **** month in the year ***** or until it is released earlier by the EMPLOYER pursuant to the provisions of the Agreement.

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

Signed and sealed this day of 20..... at

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

NOTES:

- (i) The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.
- (ii) The address, telephone number and other details of the head office of the Bank as well as of issuing branch should be mentioned on the covering letter of issuing branch.

Schedule H - Contract Price Weightages

(Scope of work - Part A)

(See Clauses 10.1.4 and 19.3)

1.0 The Contract Price for This Agreement is Rs.....

2.0 Proportions of the Contract Price for different stages of Demonstration of energy efficient seawater desalination Technologies near Activation Area at Dholera Special Investment Region shall be as specified below;

Table 1 (Demonstration of energy efficient seawater desalination technologies)

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage
1	2	3	4
Design and Construction phase			
Submission of process calculations including design drawings / process drawings to achieve the project outcomes.	2.5%	Process calculations and detail design drawings	
		Submission of design calculations as part of improved process design	20
		Submission of process design calculations to verify improved efficiency from existing membrane / thermal technologies	40
		Approval of calculations / drawings by the employer / DST	40
Geo-technical analysis of site	2.5 %	Analysis of soil bearing capacities	
		Tests for satisfactory strength bearing capacity of soil. Identification of suitable locations for mounting of skid, intake, reject and utility tanks. Submission of report on same.	100
Supply of items at site	7.5%	Supply of components to site	
		Submission of shipping / loading documents of equipment for delivery to site The employer/ employers engineer shall verify the equipment / component of supply as per design criteria / performance output at contractors facility before giving approval for shipping transportation to site.	30
		Unloading of equipment at site including desalination skid, intake, reject, utility tanks at site	70
Installation of	7.5%	Civil works	

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage
equipment at site		Levelling of land for placement of equipment	10
		Provision for discharge of water seepage to the main drain outside the plot	10
		MEP	
		Placement of skid, intake, reject and utility tanks at site	30
		Completion of all electrical connection required as per detail engineering report	20
		Completion of all plumbing works required as per detail engineering report	20
		Completion of all communication interfaces required for operation of lab, office and remote communications	10
Operation			
Commissioning of all the equipment to suit to experimental setup and approved final drawings	20%	Commissioning and integration to central monitoring system	
		Commissioning of equipment as per process flow drawings (0 th day). The completion day will be in tandem with the other contractors completion and integration to centrally monitored system	100
Operation of the system (0th day to 180th day)	25%	Successful operation of the system as per the design parameters approved through detail engineering report (0 to 180th day).	
		Satisfactory operation of the plant with successful operation parameters as per committed performances from 0 th day to 60 th day	30
		Satisfactory operation of the plant with successful operation parameters as per committed performances from 61 st day to 120 th day	30
		Satisfactory operation of the plant with successful operation parameters as per committed performances from 121 st day to 180 th day	40
Operation of the system (181st day to 365th day)	25%	Successful operation of the system as per the design parameters approved through detail engineering report (181st to 365th day).	
		Satisfactory operation of the plant with successful operation parameters as per committed performances	30

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage
		from 181 st day to 240 th day	
		Satisfactory operation of the plant with successful operation parameters as per committed performances from 241 st day to 300 th day	30
		Satisfactory operation of the plant with successful operation parameters as per committed performances from 301 st day to 365 th day	40
Submission of all relevant data, handing over of site to DICDL, Contractor manpower demobilisation	10%	Submission of all relevant data	1
		Approval from DST on successful completion of the project	1
		Handing over of site to the employer	1
		Manpower demobilization	1
		Issue of completion certificate	6

(Scope of work - Part B)

(See Clauses 10.1.4 and 19.3)

1.0 The Contract Price for This Agreement is Rs.....

2.0 Proportions of the Contract Price for different stages of Demonstration of energy efficient seawater desalination Technologies near Activation Area at Dholera Special Investment Region shall be as specified below;

Table 1 (Demonstration of energy efficient seawater desalination technologies)

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage
1	2	3	4
Provision for identification of seawater intake, Brine reject facilities and including utility lines			
Design of Seawater Intake and Brine Reject facilities	15%	Site survey for possible Intake and Reject locations	
		Submission of timelines along with detail action plan for survey and submission of report.	10
		Completion of survey at site and identification of probable locations with pre- feasibility report.	30
		Completion of land levelling for demonstration of technologies as part of scope of work, Part A, along with road networks.	30
		Submission of final report on the survey and identification of locations	30
Obtaining clearances for intake and reject mechanism	20 %	Obtaining clearances for Intake & Reject mechanism	
		Submission of EIA report to MoEF CC	20
		Approval from MoEF CC on the EIA report	20
		Approval of other documents necessary as part of clearances for Intake, Reject and desalination process	60
Facilitation of Intake and Reject facility as per the drawing layout. Facilitation of utility lines as per the specifications in the drawing	25%	Intake, Reject and Utility lines	
		Provision of intake facility of minimum 200,000 liters per day (LPD)	30
		Provision for Brine management facility of minimum reject of 100,000 liters per day (LPD)	40
		Provision for utility lines through collection, storage, and supply to useful purpose inside DSIR as per scope of work	30

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage
<p align="center">Facilitation for continuous seawater intake, disposal of brine and collection and supply of utility (Produced water) for application inside DSIR, excluding utility lines</p>	<p align="center">40%</p>	<p>Management of seawater, brine and produced water including as per scope of work for a minimum period of 365 days from the 0th day (Commissioning date)</p>	
		<p>Supply of uninterrupted seawater to individual plots, collection of brine from individual plots, disposal through approved reject mechanisms, collection, storage and use of produced water through efficient automated system (0th to 90th day)</p>	<p align="right">25%</p>
		<p>Supply of uninterrupted seawater to individual plots, collection of brine from individual plots, disposal through approved reject mechanisms, collection, storage and use of produced water through efficient automated system (90th day to 180th day)</p>	<p align="right">25%</p>
		<p>Supply of uninterrupted seawater to individual plots, collection of brine from individual plots, disposal through approved reject mechanisms, collection, storage and use of produced water through efficient automated system (181st day to 240th day)</p>	<p align="right">25%</p>
		<p>Supply of uninterrupted seawater to individual plots, collection of brine from individual plots, disposal through approved reject mechanisms, collection, storage and use of produced water through efficient automated system (240th day to 365th day)</p>	<p align="right">25%</p>

Schedule I - Drawings

(See Clauses 10.2.4)

1.0 Drawings

In compliance of the obligations set forth in Clause 10.2 of this Agreement, the Contractor shall furnish to the Employer / Employer's Engineer, free of cost, all Drawings listed in **Appendix I-I** of this Schedule-I.

2.0 Additional Drawings

If the Employer's Engineer determines that for discharging its duties and functions under this Agreement, it requires any drawings other than those listed in **Appendix I-I**, it may by notice require the Contractor to prepare and furnish such drawings forthwith. Upon receiving a requisition to this effect, the Contractor shall promptly prepare and furnish such drawings to the Employer's Engineer, as if such drawings formed part of **Appendix I-I** of this Schedule-I.

Appendix I-I - List of Drawings

(Schedule - I)

List of drawings is given in table below;

Table 1: List of drawings (Part A)

Sl. No.	Description
1	Site Layout Plan
2	Utility line network at plot level
3	Seawater intake line at plot level
4	Brine discharge and storage at plot level
5	Water balance diagram
6	Electrical SLD's
7	Communication network drawing
8	SCADA drawings
9	Fire fighting layout plan
10	SLD - plumbing
11	Earthing & Lightning Protection Drawings
12	Service Duct, Trench, Shaft, Raceway & Cable Tray Layout & Details
13	GA Drawings of all Vendor related Equipment
14	Coordinated utility lines for connection main lines

Table 2: List of drawings (Part B)

Sl. No.	Description
1	Site Layout Plan
2	Line network seawater intake system
3	Line network for brine management and disposal
4	Line management for utility network (Produced water)
5	Water balance diagram
6	Electrical SLD's
7	Communication network drawing
8	SCADA drawings
9	Fire fighting layout plan
10	SLD - plumbing
11	Earthing & Lightning Protection Drawings
12	Service Duct, Trench, Shaft, Raceway & Cable Tray Layout & Details
13	GA Drawings of all Vendor related Equipment
14	Coordinated utility lines for connection main lines
15	Seawater intake system
16	Brine disposal system

Table 3: List of drawings - As part of the tender document

S. No.	Description
1	Location map with drawings
2	Typical details of single desalination plot (Part A)
3	Typical desalination plot details
4	Layout plan of tentative pipe connections to individual plots (Part B)
5	Intake, reject and utilities drawings (Part B)
6	SCADA line diagram
7	Tentative flow chart – Desalination technologies
8	Road network drawings – Part B scope of work

Schedule J - Project Completion Schedule

(Scope of work – Part A)

(See Clauses 10.3.2)

1.0 Project Completion Schedule

During Construction period, the Contractor shall comply with the requirements set forth in this Schedule-J for each of the Project Milestones and the **Scheduled Completion Date**. Within 5 (five) days of the date of each Project Milestone, the Contractor shall notify the Employer of such compliance along with necessary particulars thereof.

2.0 Project Milestone-I

2.1 Project Milestone-I shall occur on the date falling on the 30th (Thirtieth) day from the Appointed Date (the “**Project Milestone-I**”).

2.2 Prior to the occurrence of Project Milestone-I, the Contractor should have completed submission of detail engineering report and completed the geotechnical study of the site. The contractor should have got approval from the employer/employers engineer on the detailed engineering report

3.0 Project Milestone-II

3.1 Project Milestone-II shall occur on the date falling on the 90th (Ninetieth) day from the Appointed Date (the “**Project Milestone-II**”).

3.2 Prior to the occurrence of Project Milestone-II, the Contractor shall have modelled the system in a suitable software and simulated results submitted along with detail engineering report. The employer/employers engineer shall make a visit to the contractors facility to validate the outcome of the design, simulated results, manufactured product and the tested factory output.

4.0 Project Milestone-III

4.1 Project Milestone-III shall occur on the date falling on the 150th (One fiftieth) day from the Appointed Date (the “**Project Milestone-III**”).

4.2 Prior to the occurrence of Project Milestone-III, the Contractor shall have completed supply, installation and all other integration work at site required for the commissioning of the project as per the original design of the desalination technology for the expected outcomes

5.0 Project Milestone IV

5.1 The project milestone – IV shall occur on the date falling 180th day from the Appointed date (the “**Project Milestone – IV**”).

5.2 Prior to the occurrence of the project milestone – IV, The contractor should have commissioned and integrated the items of supply inside the plot and integrated the items of supply with the common monitoring facilities for SCADA / remote monitoring.

6.0 Scheduled Completion Date

6.1 The Scheduled Completion Date for supply of items, installation of equipment at site and commissioning of the unit should occur on or before the 180th day from the Appointed Date.

7.0 Extension Of Time

7.1 Upon extension of any or all of the aforesaid Project Milestones or the Scheduled Completion Date, as the case may be, under and in accordance with the provisions of this Agreement, the Project Completion Schedule shall be deemed to have been amended accordingly.

8.0 Relation between the scope of work – Part A and scope of work – Part B

8.1 The part B scope of work has to be completed for the operation of items under the Part A scope of work. Any delay in completion of part B scope of work will delay the operation of items under the Part A scope of work.

8.2 The schedule start date for Part A scope of work will be after a minimum of 90 days after the schedule start date for Part B scope of work.

(Scope of work – Part B)

(See Clauses 10.3.2)

1.0 Project Completion Schedule

During Construction period, the Contractor shall comply with the requirements set forth in this Schedule-J for each of the Project Milestones and the Scheduled Completion Date. Within 5 (five) days of the date of each Project Milestone, the Contractor shall notify the Employer of such compliance along with necessary particulars thereof.

2.0 Project Milestone-I

2.1 Project Milestone-I shall occur on the date falling on the 90th (Ninetieth) day from the Appointed Date (the “Project Milestone-I”).

2.2 Prior to the occurrence of Project Milestone-I, the Contractor should have completed submission of schedules, study reports related to bathymetry, detail engineering report of provision for intake, reject and utility managements. . Land levelling required for Part A scope of work including the road networks at the demonstration site has to be completed in full The contractor should have completed at least 50% of the required EIA studies for the shortlisted intake and reject facilities.. He can invoice to a maximum of 15% of the total cost for scope B of the job.

3.0 Project Milestone-II

3.1 Project Milestone-II shall occur on the date falling on the 120th (One twentieth) day from the Appointed Date (the “Project Milestone-II”).

3.2 Prior to the occurrence of Project Milestone-II, the Contractor shall have continued with all construction work related to part B scope of work. The contractor should have obtained done workshops to obtain the clearances required for the intake-reject mechanism as part of facilitation work. The contractor should have completed all the work required for storage of seawater, brine management and utility. All necessary piping connections inside the project site has to be completed Stage Payment Statements for an amount not less than 25% (Twenty Five percent) of the Contract Price can be billed.

4.0 Project Milestone-III

4.1 Project Milestone-III shall occur on the date falling on the 180th (One eightieth) day from the Appointed Date (the “Project Milestone-III”).

4.2 Prior to the occurrence of Project Milestone-III, the Contractor shall have obtained the clearances required for the intake and reject facilities as per the design submissions. The contractor should have mobilized the equipment’s required for intake and reject mechanism. Stage Payment Statements for an amount 35% (Thirty five percent) of the Contract Price can be billed.

5.0 Project milestone IV

5.1 Project milestone IV shall occur on the date falling the 270th (Two seventieth) day from the appointed date.

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5.2 Prior to the occurrence of the Project Milestone – IV, the contractor shall have completed the intake, reject and produced water facilities and should have integrated it to the SCADA. The contractor should have commissioned the system with integration to individual plots. The part A scope of work should not have any hindrance due to lack of completion of work in Part B. Stage payment statement for an amount of 60% of the contract value can be billed.

6.0 Scheduled Completion Date

6.1 The Scheduled Completion Date for supply of items, installation of equipment at site and commissioning of the unit should occur on or before the 270th day from the Appointed Date.

6.2 On or before the Scheduled Completion Date, the Contractor shall have completed all the works as mentioned in the scope of work part B of this tender document.

7.0 Extension of Time

7.1 Upon extension of any or all of the aforesaid Project Milestones or the Scheduled Completion Date, as the case may be, under and in accordance with the provisions of this Agreement, the Project Completion Schedule shall be deemed to have been amended accordingly.

Schedule K - Tests on Completion

(See Clause 12.1.2)

1.0 Schedule for Tests

- 1.1 The Contractor shall, no later than 10 (ten) days prior to the likely completion of each stage of the project through the concept design to commission and operation of the project,, notify the Employer's Engineer and the Employer of its intent to subject the project components to Tests, and no later than 10 (ten) days prior to the actual date of Tests, furnish to the Employer's Engineer and the Employer detailed inventory and particulars of all works and equipment forming part of Works.
- 1.2 The Contractor shall notify the Employer's Engineer of its readiness to subject the project components to Tests at any time after 10 (ten) days from the date of such notice, and upon receipt of such notice, the Employer's Engineer shall, in consultation with the Contractor, determine the date and time for each Test and notify the same to the Employer who may designate its representative to witness the Tests. The Employer's Engineer shall thereupon conduct the Tests itself or cause any of the Tests to be conducted in accordance with Article 12 and this Schedule-K.

2.0 Tests

- 2.1 The contractors should submit the details of the required tests that are required at site for successful integration of individual skids to the utility, intake and reject pipelines. The tests should be aligned to satisfy integration of power water, communication networks in each plot. The employer/ employers engineer can modify the submitted list of test reports based on the study of the technology.
- 2.2 As a standard practice the contractor shall submit the list of tests that will be carried out during the commissioning and operation stages to review the efficiency of the desalination technologies based on the innovative processes.

The contractor/s who quote for part B of the scope of work should necessarily submit the tentative dates for the required tests to be conducted at the site. The date should be let known to the employer at least 15 days in advance.

Schedule L - Provisional Certificate and Completion Certificate

(See Clause 12.2 and 12.4)

Provisional Certificate

(See Clause 12.2)

1. I, (Name of the EMPLOYER’s Engineer), acting as EMPLOYER’s Engineer, under and in accordance with the Agreement dated (the “**Agreement**”), for “Demonstration of energy efficient seawater desalination Technologies near Activation Area at Dholera Special Investment Region” through Engineering, Procurement & Construction (EPC) Basis Contract through (Name of Contractor), hereby certify that the Tests in accordance with Article 12 of the Agreement have been undertaken to determine compliance of the Project with the provisions of the Agreement.
2. Construction Works that are incomplete on account of Time Extension have been specified in the Punch List appended hereto, and the Contractor has agreed and accepted that it shall complete all such works in the time and manner set forth in the Agreement. In addition, certain minor works are incomplete and these are not likely to cause material inconvenience to the users of the Project or other their safety. The contractor has agreed and accepted that as a condition of this Provisional Certificate, it shall complete such minor works within 30 (thirty) days hereof. These minor works have also been specified in the aforesaid punch list.
3. In view of the foregoing, I am satisfied that that Project can be safely and reliably placed in service of the users thereof, and in terms of the Agreement, the Project is hereby provisionally declared fit for entry into operation on this theday of20

ACCEPTED, SIGNED, SEALED
AND DELIVERED

SIGNED, SEALED AND DELIVERED

For and on behalf of

For and on behalf of

CONTRACTOR by

EMPLOYER’s Engineer by:

(Signature)

(Signature)

Completion Certificate

(See Clause 12.4)

1. I, (Name of the EMPLOYER’s Engineer), acting as EMPLOYER’s Engineer, under and in accordance with the Agreement dated (the “**Agreement**”), for “Demonstration of energy efficient seawater desalination Technologies near Activation Area at Dholera Special Investment Region” in the State of Gujarat under through Engineering, Procurement & Construction (EPC) Basis through (Name of Contractor), hereby certify that the Tests in accordance with Article 12 of the Agreement have been successfully undertaken to determine compliance of the Project with the provisions of the Agreement, and I am satisfied that the Project can be safely and reliably placed in service of the Users thereof..

2. It is certified that, in terms of the aforesaid Agreement, all works forming part of Project Works have been completed, and the Project Works is hereby declared fit for entry into operation on this theday of20

SIGNED, SEALED AND DELIVERED

For and on behalf of

EMPLOYER’s Engineer by:

(Signature)

(Name)

(Designation)

(Address)

Schedule M - Payment Reduction for Non-Compliance

(See Clauses 14.6., 15.2 and 19.7)

1.0 Payment reduction for non-compliance with the performance commitments

1.1 Monthly lump sum payments for non-compliance shall be reduced in the case of non-compliance with the commitments in the performance listed in the original design.

1.2 The Employer's Engineer shall calculate the amount of payment reduction on the basis of weightage in percentage assigned to non-conforming items as given in Paragraph 2.

2.0 Percentage reductions in lump sum payments

2.1 The following percentages shall govern the payment reduction:

**Table 1:
Percentage reductions**

Sr. No.	Item/Defect/Deficiency	Percentage
1	Produced water characteristics	
(i)	Non-performance over a period of 4 hours	3%
(ii)	Non-performance over a period of 8 hours	7%
2	Brine reject parameters	
(b)	Non-performance to the parameters for a period of 4 hours	6%
(i)	Non-performance to the parameters for a period of 8 hours	9%

**Table 2:
Percentage reductions Skid downtime**

Sr. No.	Item/Defect/Deficiency	Percentage
1	Skid down for more than 4 hours	5 %
2	Skid down for more than 8 hours	8%

**Table 3:
(Deleted)**

**Table 4:
(Deleted)**

**Table 5:
(Deleted)**

**Table 6:
(Deleted)**

**Table 7:
(Deleted)**

Schedule N – Selection of Employer’s Engineer

(See Clause 18.1.1)

1.0 Selection of EMPLOYER’s Engineer

1.1 The provisions of the Model Request for Proposal for Selection of Technical Consultants, issued by the Ministry of Finance in May 2009, or any substitute thereof shall apply for selection of an experienced firm to discharge the functions and duties of an EMPLOYER’s Engineer.

1.2 In the event of termination of the Technical Consultants appointed in accordance with the provisions of Paragraph 1.1, the EMPLOYER shall appoint another firm of Technical Consultants forthwith and may engage a government-owned entity in accordance with the provisions of Paragraph 3 of this Schedule-N.

2.0 Terms of Reference

The Terms of Reference for the EMPLOYER’s Engineer (the “TOR”) shall substantially conform with Annex 1 to this Schedule N.

3.0 Appointment of Government entity as EMPLOYER’s Engineer

Notwithstanding anything to the contrary contained in this Schedule, the EMPLOYER may in its discretion appoint a government-owned entity as the EMPLOYER’s Engineer; provided that such entity shall be a body corporate having as one of its primary functions the provision of consulting, advisory and supervisory services for engineering projects; provided further that a government-owned entity which is owned or controlled by the EMPLOYER shall not be eligible for appointment as EMPLOYER’s Engineer.

Annexure I – Terms of Reference for Employer’s Engineer

(Schedule - N)

1. Scope

- 1.1 These Terms of Reference (the “**TOR**”) for the EMPLOYER’s Engineer are being specified pursuant to the EPC Agreement dated (the “**Agreement**), which has been entered into between theName of EMPLOYER (the “EMPLOYER”) and (the “**Contractor**”) for “Demonstration of energy efficient seawater desalination Technologies near Activation Area at Dholera Special Investment Region” Basis, and a copy of which is annexed hereto and marked as Annex-A to form part of this TOR.
- 1.2 The TOR shall apply to design, construction and maintenance of the Project Roads and Services

2. Definitions and interpretation

- 2.1 The words and expressions beginning with or in capital letters and not defined herein but defined in the Agreement shall have, unless repugnant to the context, the meaning respectively assigned to them in the Agreement.
- 2.2 References to Articles, Clauses and Schedules in this TOR shall, except where the context otherwise requires, be deemed to be references to the Articles, Clauses and Schedules of the Agreement, and references to Paragraphs shall be deemed to be references to Paragraphs of this TOR.
- 2.3 The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Agreement shall apply, *mutatis mutandis*, to this TOR.

3. General

- 3.1 The EMPLOYER’s Engineer shall discharge its duties in a fair, impartial and efficient manner, consistent with the highest standards of professional integrity and Good Industry Practice.
- 3.2 The EMPLOYER’s Engineer shall perform the duties and exercise the authority in accordance with the provisions of this Agreement, but subject to obtaining prior written approval of the EMPLOYER/PMNC before determining:
- (a) any Time extension;
 - (b) any additional cost to be paid by the EMPLOYER to the Contractor;
 - (c) the Termination Payment; or
 - (d) any other matter which is not specified in (a), (b) or (c) above and which creates an obligation or liability on either Party for a sum exceeding Rs.5,00,000 (Rs. five lakh).
- 3.3 The EMPLOYER’s Engineer shall submit regular periodic reports, at least once every month, to the EMPLOYER/PMNC in respect of its duties and functions under this Agreement. Such reports shall be submitted by the EMPLOYER’s Engineer within 10 (ten) days of the beginning of every month.

- 3.4 The EMPLOYER's Engineer shall inform the Contractor of any delegation of its duties and responsibilities to its suitably qualified and experienced personnel provided, however, that it shall not delegate the authority to refer any matter for the EMPLOYER's prior approval in accordance with the provisions of Clause 18.2.
- 3.5 The EMPLOYER's Engineer shall aid and advise the EMPLOYER on any proposal for Change of Scope under Article 13.
- 3.6 In the event of any disagreement between the Parties regarding the meaning, scope and nature of Good Industry Practice, as set forth in any provision of the Agreement, the EMPLOYER's Engineer shall specify such meaning, scope and nature by issuing a reasoned written statement relying on good industry practice and authentic literature.

4 . Construction Period

- 4.1 During the Construction Period, the EMPLOYER's Engineer shall review the Reports, Designs and Drawings furnished by the Contractor along with supporting data, , process designs, desalination technologies, intake, reject design mechanisms, contribution to energy efficient process and cost effective desalination technolgiese environment protection and safety Clause 10.1.6. The EMPLOYER's Engineer shall complete such review and send its observations to the EMPLOYER/ PMNC and the Contractor within 15 (fifteen) days of receipt of such Reports, Designs and Drawings; provided, however that in case of a Structure, the aforesaid period of 15 (fifteen) days may be extended up to 30 (thirty) days. In particular, such comments shall specify the conformity or otherwise of such Drawings with the Scope of the Project and Specifications and Standards.
- 4.2 The EMPLOYER's Engineer shall review any revised Reports, Designs and Drawings sent to it by the Contractor and furnish its comments within 10 (ten) days of receiving such Reports, Designs and Drawings.
- 4.3 The EMPLOYER's Engineer shall review the (a) Quality Assurance Plan (b) Health, Safety and Environmental Management Plan submitted by the Contractor and shall convey its comments to the Contractor within a period of 21 (twenty-one) days stating the modifications, if any, required thereto. The Employer's Engineer shall ensure the Contractor's Project Management requirements, BIM and CAD requirements regularly and submit report on a monthly basis to the Employer/ PMNC.
- 4.4 The EMPLOYER's Engineer shall complete the review of the methodology proposed to be adopted by the Contractor for executing the Works, and convey its comments to the Contractor within a period of 10 (ten) days from the date of receipt of the proposed methodology from the Contractor.
- 4.5 Deleted.
- 4.6 The EMPLOYER's Engineer shall review the monthly progress report furnished by the Contractor and send its comments thereon to the EMPLOYER/ PMNC and the Contractor within 7 (seven) days of receipt of such report.
- 4.7 The EMPLOYER's Engineer shall inspect the desalination processes during the course of demonstration of the project in line with the KPI's and the overall objective of the project. EMPLOYERS ENGINEER shall submit a monthly Inspection Report bringing out the results of

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- inspections and the remedial action taken by the Contractor in respect of Defects or deficiencies. In particular, the EMPLOYER's Engineer shall include in its Inspection Report, the compliance of the recommendations made by the Safety Consultant.
- 4.8 The EMPLOYER's Engineer shall conduct the pre-construction review of manufacturer's test reports and standard samples of manufactured Materials, and such other Materials as the EMPLOYER's Engineer may require.
- 4.9 For determining that the Works conform to Specifications and Standards, the EMPLOYER's Engineer shall require the Contractor to carry out, or cause to be carried out, tests at such time and frequency and in such manner as specified in the Agreement and in accordance with Good Industry Practice for quality assurance. For purposes of this Paragraph 4.9, the tests specified in the relevant Codes or any modification/substitution thereof and standards for shall be deemed to be tests conforming to Good Industry Practice for quality assurance.
- 4.10 The EMPLOYER's Engineer shall test check at least 20 (twenty) percent of the quantity or number of tests prescribed for each category or type of test for quality control by the Contractor.
- 4.11 The timing of tests referred to in Paragraph 4.9, and the criteria for acceptance/ rejection of their results shall be determined by the EMPLOYER's Engineer in accordance with the Quality Control Manuals and/or the relevant Codes and Standards... The tests shall be undertaken on a random sample basis and shall be in addition to, and independent of, the tests that may be carried out by the Contractor for its own quality assurance in accordance with Good Industry Practice.
- 4.12 In the event that results of any tests conducted under Clause 11.10 establish any Defects or deficiencies in the committed results, the EMPLOYER's Engineer shall require the Contractor to carry out remedial measures and warn the contractors, to take action not to get the demonstration project cancelled.
- 4.13 The EMPLOYER's Engineer may instruct the Contractor to execute any work which is urgently required for the safety of the Project Works, whether because of an accident, unforeseeable event or otherwise; provided that incase of any work required on account of a Force Majeure Event, the provisions of Clause 21.6 shall apply.
- 4.14 In the event that the Contractor fails to achieve any of the Project Milestones, the EMPLOYER's Engineer shall undertake a review of the progress of the project and identify potential delays, if any. If the EMPLOYER's Engineer shall determine that completion of the Project Works is not feasible within the time specified in the Agreement, it shall require the Contractor to indicate within 15 (fifteen) days the steps proposed to be taken to expedite progress, and the period within which the Project Completion Date shall be achieved. Upon receipt of a report from the Contractor, the EMPLOYER's Engineer shall review the same and send its comments to the EMPLOYER/ PMNC and the Contractor forthwith.
- 4.15 The EMPLOYER's Engineer shall obtain from the Contractor two copies of all the Contractor's quality control records and documents before the Completion Certificate is issued pursuant to Clause 12.4.
- 4.16 EMPLOYER's Engineer may recommend to the EMPLOYER/ PMNC suspension of the whole or part of the Works if the work threatens the safety of the Users and pedestrians. After the Contractor has carried out remedial measure, the EMPLOYER's Engineer shall inspect such

remedial measures forthwith and make a report to the EMPLOYER recommending whether or not the suspension hereunder may be revoked.

4.17 In the event that the Contractor carries out any remedial measures to secure the safety of suspended works and Users, and requires the EMPLOYER's Engineer to inspect such works, the EMPLOYER's Engineer shall inspect the suspended works within 3 (three) days of receiving such notice, and make a report to the EMPLOYER/ PMNC forthwith, recommending whether or not such suspension may be revoked by the EMPLOYER.

4.18 The EMPLOYER's Engineer shall carry out, or cause to be carried out, all the Tests specified in Schedule-K and issue a Completion Certificate or Provisional Certificate, as the case may be. For carrying out its functions under this Paragraph 4.18 and all matters incidental thereto, the EMPLOYER's Engineer shall act under and in accordance with the provisions of Article 12 and Schedule-K.

5. Maintenance Period

5.1 The EMPLOYER's Engineer shall aid and advise the Contractor in the preparation of its monthly Maintenance Programme and for this purpose carry out a joint monthly inspection with the Contractor.

5.2 The EMPLOYER's Engineer shall undertake regular inspections, at least once every ten days to evaluate compliance with the Maintenance Requirements and submit a Maintenance Inspection Report to the EMPLOYER/ PMNC and the Contractor.

5.3 The EMPLOYER's Engineer shall specify the tests, if any, that the Contractor shall carry out, or cause to be carried out, for the purpose of determining that the Project Works is in conformity with the Maintenance Requirements. It shall monitor and review the results of such tests and the remedial measures, if any, taken by the Contractor in this behalf.

5.4 In respect of any defect or deficiency referred to in Paragraph 3 of Schedule-E, the EMPLOYER's Engineer shall, in conformity with Good Industry Practice, specify the permissible limit of deviation or deterioration with reference to the Specifications and Standards and shall also specify the time limit for repair or rectification of any deviation or deterioration beyond the permissible limit.

6. Determination of costs and time

6.1 The EMPLOYER's Engineer shall determine the period of Time Extension that is required to be determined by it under the Agreement.

6.2 The EMPLOYER's Engineer shall consult each Party in every case of determination in accordance with the provisions of Clause 18.5.

7. Payments

7.1 The EMPLOYER's Engineer shall advice withhold payments for the affected works for which the Contractor fails to revise and resubmit the Drawings/ documents and review reports to the EMPLOYER's Engineer in accordance with the provisions of Clause 10.2.4 (d).

7.2 EMPLOYER's Engineer shall -

- (a) advise the stagewise payment as per payment schedule and milestones for the scope of work as mentioned in Part A and Part B of this tender document. The payment advice will be made within 7 (seven) days of receipt of the Stage Payment Statement from the Contractor.

7.3 The EMPLOYER's Engineer shall, within 15 (fifteen) days of receipt of the Monthly Maintenance Statement from the Contractor pursuant to Clause 19.6, verify the Contractor's monthly statement and certify the amount to be paid to the Contractor in accordance with the provisions of the Agreement.

8. Other duties and functions

The EMPLOYER's Engineer shall perform all other duties and functions as specified in the Agreement.

9. Miscellaneous

9.1 A copy of all communications, comments, instructions, Drawings or Documents sent by the EMPLOYER's Engineer to the Contractor pursuant to this TOR, and a copy of all the test results with comments of the EMPLOYER's Engineer thereon, shall be furnished by the EMPLOYER's Engineer to the EMPLOYER/PMNC forthwith.

9.2 The EMPLOYER's Engineer shall retain at least one copy each of all Drawings and Documents received by it, including 'as-built' Drawings, and keep them in its safe custody.

9.3 Within 90 (ninety) days of the Project Completion Date, the EMPLOYER's Engineer shall obtain a complete set of as-built Drawings, in 2 (two) hard copies and in micro film form or in such other medium as may be acceptable to the EMPLOYER, reflecting the Project as actually designed, engineered and constructed, including an as-built survey illustrating the layout of the Project Works and setback lines, if any, of the buildings and structures forming part of Project Facilities; and shall hand them over to the EMPLOYER against receipt thereof.

9.4 The EMPLOYER's Engineer, if called upon by the EMPLOYER/PMNC or the Contractor or both, shall mediate and assist the Parties in arriving at an amicable settlement of any Dispute between the Parties.

9.5 The EMPLOYER's Engineer shall inform the EMPLOYER/PMNC and the Contractor of any event of Contractor's Default within one week of its occurrence.

9.6 The Employer's Engineer, if called upon by the Employer/ PMNC, shall attend the meetings on Project reviews, discussions to be held at Employer/ PMNC office with required reports and presentations.

The EMPLOYERS ENGINEER shall depute one person at the PMNCr office during the course of the project duration beginning the design of the project till the end of the project duration of 18 months. The EMPLOYERS ENGINEER shall submit the CV's of the 3 persons whom they seem be suitable for the scope of work. The PMNC shall select the suitable candidate for deputation.

Schedule O - Form of Payment Statements

(See Clause 19.4.1, 19.6.1, and 19.8.1)

1.0 Stage Payment Statement for Works

The Stage Payment Statement for Works shall state:

- (a) The estimated amount for the Works executed in accordance with Clause 19.3.1 subsequent to the last claim;
- (b) Amounts reflecting adjustments in price for the aforesaid claim;
- (c) The estimated amount of each Change of Scope Order executed subsequent to the last claim;
- (d) Amounts reflecting adjustment in price, if any, for (c) above in accordance with the provisions of Clause 13.2.3 (a); (e) Total of (a), (b), (c) and (d) above;
- (f) Deductions:
 - (i) Any amount to be deducted in accordance with the provisions of the Agreement except taxes;
 - (ii) Any amount towards deduction of taxes; and
 - (iii) Total of (i) and (ii) above.
- (g) Net claim: (e) – (f);
- (h) The amounts received by the Contractor up to the last claim:
 - (i) For the Works executed (excluding Change of Scope orders);
 - (ii) For Change of Scope Orders, and
 - (iii) Any deductions
 - (iv) Taxes deducted

2.0 Monthly Maintenance Payment Statement

The monthly Statement for Maintenance Payment shall state:

- (a) the monthly payment admissible in accordance with the provisions of the agreement;
- (b) the deductions for maintenance work not done;
- (c) net payment for maintenance due, (a) minus (b);

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(d) amounts reflecting adjustments in price under Clause 19.12; and

(e) amount towards deduction of taxes

3.0 Contractor's claim for Damages

Note: The Contractor shall submit its claims in a form acceptable to the EMPLOYER/ PMNC.

Schedule P - (Insurance)

(See Clause 20.1)

1.0 Insurance during Construction Period

1.1. The Contractor shall effect and maintain at its own cost, from the Appointed Date till the date of issue of the last Completion Certificate, the following insurances for any loss or damage occurring on account of Non Political Event of Force Majeure, malicious act, accidental damage, explosion, fire and terrorism:

(a) insurance of Works, Plant and Materials and an additional sum of [15 (fifteen)] per cent of such replacement cost to cover any additional costs of and incidental to the rectification of loss or damage including professional fees and the cost of demolishing and removing any part of the Works and of removing debris of whatsoever nature; and

(b) Insurance for the Contractor's equipment and Documents brought onto the Site by the Contractor, for a sum sufficient to provide for their replacement at the Site.

1.2 The insurance under paragraph 1.1 (a) and (b) above shall cover the EMPLOYER and the Contractor against all loss or damage from whatsoever cause arising under paragraph 1.1 other than risks which are not insurable at commercial terms.

2.0 Insurance for Contractor's Defects Liability

The Contractor shall effect and maintain insurance cover for the works from the date of issue of the Completion Certificate until the end of the Defects Liability Period for any loss or damage for which the Contractor is liable and arises from a cause occurring prior to the issue of Completion Certificate. The Contractor shall also maintain other insurances for maximum sums as may be required under the Applicable Laws and in accordance with Good Industry Practice.

3.0 Insurance against injury to persons and damage to property

3.1 The Contractor shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Paragraph 1 and 2 of this Schedule or to any person (except persons insured under Clause 20.9), which may arise out of the Contractor's performance of this agreement and occurring before the issue of the Performance Certificate. This insurance shall be for a limit per occurrence of not less than the amount stated below with no limit on the number of occurrences.

The insurance cover shall be not less than: Rs. 20 Lakhs.

3.2 The insurance shall be extended to cover liability for all loss and damage to the EMPLOYER's property arising out of the Contractor's performance of this Agreement excluding:

(a) the EMPLOYER's right to have the construction works executed on, over, under, in or through any land, and to occupy this land for the Works; and

(b) Damage which is and unavoidable result of the Contractor's obligations to execute the Works.

4.0 Insurance to be in joint names

The insurance under paragraphs 1 to 3 above shall be in the joint names of the Contractor and the EMPLOYER.

Schedule Q - BIM & CAD Requirements

(See Clause 3.1.7 K)

1. Objective

The Employer mandates the use Building Information Modelling (BIM) and Geographic Information Systems (GIS) right from the existing site conditions, Preliminary & Detailed planning, design, engineering, construction and operations of the DSIR to allow simulation, visualization and engineering analysis of all transportation, utility, building, civil works and geospatial infrastructures.

This includes an aggregate dynamic Building Information Modelling (BIM) in 3D for the city infrastructure systems involves civil, landscape, treatment plants, underground and aboveground utilities systems participating.

Building Information Modelling (BIM) and Geographic Information Systems (GIS) technology shall be used to develop and produce project models and simulations (e.g. in case of natural calamity etc.) as required for submittals.

The BIM infrastructure information models are to be used throughout the design, construction and operational life-cycle of the assets, including but not limited to for system collision detection, materials quantification, construction sequencing, energy analysis, carbon impact analysis and facility management

BIM and GIS models use shall be maximized for project reviews, decision support, design analysis, quantity take offs, construction sequencing and quality assurance during all phases and asset management plan for ICT systems and their city wide uses.

2. Scope

All infrastructures, networks and facilities designed by the Contractors as part of this assignment shall be consolidated as part of a spatial database preferably using MS-SQL Server Spatial or Oracle Spatial or Geo Database or other systems. The Contractor shall coordinate with the Employer/Employer's Engineer on the design of data scheme of the spatial database beforehand. Both the 2D and 3D spatial data shall be stored in project spatial database for mapping, modelling and analysis.

To successfully implement Building Information Modelling (BIM) and Geographic Information Systems (GIS) the Contractors shall develop detailed project BIM Execution Plan, defines uses for BIM and GIS on the project, assets information details and asset supply chain approach for city wide ICT integrations.

To effectively introduce BIM into the project delivery process, the Contractors shall outlines the overall vision along with implementation details for the team to follow throughout the project but not limited to project information, BIM goal & uses, project member's roles, staffing and competency, BIM process and strategy, BIM exchange protocol and submittal format, BIM data requirement, collaboration procedures and method to handle shared models, BIM design and

drawings quality checklist, technology use, asset information's spreadsheet for facility management, BIM & GIS international best practices or the best available in the global market, followed during implementations, and asset information tagging and integration approach for ICT. Refer to Appendix Q I – BIM Project Execution Plan template.

The Contractor shall be responsible to prepare detailed construction project schedule plan including but not limited to BIM Execution Plan (BEP), Master Document Register (MDR), Site Layout Plan, Project Folder Information Structure Hierarchy, 3D designs and drawings, Level of Development (LOD), construction and operation asset information spreadsheet, 4D construction scheduling and sequencing plan with simulations, BIM & GIS spatial database, etc.

The Contractor shall provide structured BIM approach to the production of all required design and as-built data and information for these works under the Contract, modelled on BS1192 collaborative production of architectural, engineering and construction information; Code of practice, including BIM quality checklist. Refer to Appendix Q I – BIM Project Execution Plan template.

The Contractor shall provide all native and design models list through MDR which shall be part of BIM Execution Plan (BEP) and Monthly Progress Report (MPR) but not limited to 2D Drawings, 3D models, animations, PDF's, native software files, calculation data sheets and collision detection reports, 4D Models & simulation, 5D Estimates & Quantities reports Asset List with the schema, ArcGIS interoperability models and files etc.

The Contractor shall be responsible for development of Master Document Register (MDR), Site Layout Plan in a form of 2D/3D and drawing sheet name plate, in consultation with Employer's Representative, at the start of the works that shall list all the 'file identifiers' and information details of the assets with their delivery dates and intermediate milestones. The following metadata shall be included but not limited to Program ID, Contract No, Originator Code, Discipline Code, Type, Zone, Level, Description/Title, and Delivery Date. Refer to Annexure-II of CAD Guidelines.

The Contractor shall prepare and share available existing data sets in a form of 2D/3D/GIS models for reference and liable for validating the models before utilizing/enhancing further. Data sets with distinct owners, e.g. DP, TP1, TP2, etc. shall be referenced into the model.

3D Models, 2D CAD drawing files shall have original plot composition files containing all extractions, CAD drawings shall have a corresponding PDF's provenance shown on the plot, i.e. the references, extractions, model revision used to generate plot. Drawing title block shall be consistent with setup by the Employer/ Employer's Engineer for the Contractor to use for the project.

The PMIS or Common Data Environment (CDE) setup by the Employer/Employer's Engineer are mandated for the Contractors to use, to collect, manage and disseminate all relevant approved project documents. The Contractor shall develop project folder information structure hierarchy that is consistent with the principles of the CDE for all models and drawings. Refer to Schedule-H.

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The Contractor shall outline a uniform and interoperable software/hardware platform across the entire Work Package, in that any software used shall be consistent with the principles of the sharing of multi-disciplinary object data in a CDE; That data shall include geometry and object attributes.

The coordinate system and unit convention for Design and drawings shall be consistent with completed/ongoing projects at Dholera SIR and geo reference details will be provided by the Employer. Vertical datum values/details will be provided by the Employer. DSIR falls in WGS84 UTM43N.

Document Management setups by Employer are mandated for the Contractor, Contractor shall follow and prepare asset spreadsheet as part of BIM Execution Plan (BEP) document. For effective and quality information, the Contractor shall represent Level of Development (LOD) i.e. Size, Volume, Shape, Height and Orientation for graphical/spatial data, non-graphical/spatial data

The Contractor shall be responsible to clearly outline the technology to be used for design and drawings production and software native outcomes in their BIM Execution Plan (BEP), in consultation with Employer/ Employer's Engineer and ICT Consultant.

The Contractor shall be responsible for preparation of construction-operations information exchange standard spreadsheet (COBie), and tag asset information within the infrastructure models but not limited to asset name, code, quantity, manufacturer, model no, serial no, etc. which controls the transition of As-Built data for operations and maintenance.

For seamless coordination and integration of drawing packages within BIM environment, the Contractor shall reference each models to other discipline models in timely manner and clash detection reports through software routines shall be run on the multi-discipline model. The reports of which will be included with transmittals during project delivery and on request of the Employer/ Employer's Engineer.

The Contractor shall also be responsible to develop GIS (Geographical Information System) spatial database and the Attribute database parameters (Schema) in Geo Data Base with level of details; extractions of vectors data from CAD and design models of each infrastructure component.

The Contractor shall carry out transfer of digital model files in mutually agreed conditions with the Employer and organize regular BIM conferences/Meeting as per the project management requirement.

3. Schedule of Deliverables

Project Information Model (PIM) and Asset Information Model (AIM) shall be submitted in a commonly accessible electronic formats as per the details given below;

Deliverables	Timeline
BIM Execution Plan (BEP)	Within 4 months of appointed date
Master Document Register (MDR)	Within 4 months of appointed date
BIM Design and Drawings Quality Checklist Plan	Within 4 months of appointed date
Designs and Drawings (Plan & Profile, design files, models, calculation sheets, Reports, all native files etc.) and Asset details in approved format	Along with submission of Designs and Drawings
4D Construction Logistic Scheduling Plan	Along with submission of GFCs
4D Simulation Models & Animations	Before start of Construction
As-Built Model with Asset Information	As per Project Schedule

Annexure – I – BIM Project Execution Plan (Sample Format)

(Schedule - Q)

Section A: BIM Project Execution Plan Overview

To successfully implement Building Information Modeling (BIM) on a project, the project team has developed this detailed BIM Project Execution Plan. The BIM Project Execution Plan defines uses for BIM on the project (e.g. design authoring, cost estimating, and design coordination), along with a detailed design of the process for executing BIM throughout the project lifecycle.

[INSERT ADDITIONAL INFORMATION HERE IF APPLICABLE. FOR EXAMPLE: BIM MISSION STATEMENT This is the location to provide additional BIM overview information. Additional detailed information can be included as an attachment to this document.

Please note: Instructions and examples to assist with the completion of this guide are currently in grey. The text can and should be modified to suit the needs of the organization filling out the template. If modified, the format of the text should be changed to match the rest of the document. This can be completed, in most cases, by selecting the normal style in the template styles.

Section B: Project Information

This section defines basic project reference information and determined project milestones.

1. PROJECT OWNER:
2. PROJECT NAME:
3. PROJECT LOCATION AND ADDRESS:
4. CONTRACT TYPE / DELIVERY METHOD:
5. BRIEF PROJECT DESCRIPTION: [NUMBER OF FACILITIES, GENERAL SIZE, ETC]
6. ADDITIONAL PROJECT INFORMATION: [UNIQUE BIM PROJECT CHARACTERISTICS AND REQUIREMENTS]
7. PROJECT NUMBERS:

PROJECT INFORMATION	NUMBER
CONTRACT NUMBER:	
TASK ORDER:	
PROJECT NUMBER:	

8. PROJECT SCHEDULE / PHASES / MILESTONES:

Include BIM milestones, pre-design activities, major design reviews, stakeholder reviews, and any other major events which occur during the project lifecycle.

PROJECT PHASE / MILESTONE	ESTIMATED START DATE	ESTIMATED COMPLETION DATE	PROJECT STAKEHOLDERS INVOLVED
PRELIMINARY PLANNING			
DESIGN DOCUMENTS			
CONSTRUCTION DOCUMENTS			
CONSTRUCTION			

Section C: Key Project Contacts

List of lead BIM contacts for each organization on the project. Additional contacts can be included later in the document.

Role	Organization	Contact Name	Location	E-Mail	Phone
Project Manager(s)					
BIM Manager(s)					
Discipline Leads					
Other Project Roles					

Section D: Project Goals / BIM Uses

Describe how the BIM Model and Facility Data are leveraged to maximize project value (e.g. design alternatives, life-cycle analysis, scheduling, estimating, material selection, pre-fabrication opportunities, site placement, etc.) Reference www.engr.psu.edu/bim/download for BIM Goal & Use Analysis Worksheet.

1. MAJOR BIM GOALS / OBJECTIVES:

State Major BIM Goals and Objectives

PRIORITY (HIGH/ MED/ LOW)	GOAL DESCRIPTION	POTENTIAL BIM USES

2. BIM USE ANALYSIS WORKSHEET: ATTACHMENT 1

Reference www.engr.psu.edu/bim/download for BIM Goal & Use Analysis Worksheet. Attach BIM Use analysis Worksheet as Attachment 1.

3. BIM USES:

Highlight and place an X next to the additional BIM Uses to be developed by the use of the BIM model as selected by the project team using the BIM Goal & Use Analysis Worksheet. See BIM Project Execution Planning Guide at www.engr.psu.edu/BIM/BIM_Uses for Use descriptions. Include additional BIM Uses as applicable in empty cells.

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
	PROGRAMMING		DESIGN AUTHORING		SITE UTILIZATION PLANNING		BUILDING MAINTENANCE SCHEDULING
	SITE ANALYSIS		DESIGN REVIEWS		CONSTRUCTION SYSTEM DESIGN		BUILDING SYSTEM ANALYSIS
			3D COORDINATION		3D COORDINATION		ASSET MANAGEMENT
			STRUCTURAL ANALYSIS		DIGITAL FABRICATION		SPACE MANAGEMENT / TRACKING
			LIGHTING ANALYSIS		3D CONTROL AND PLANNING		DISASTER PLANNING
			ENERGY ANALYSIS		RECORD MODELING		RECORD MODELING
			MECHANICAL ANALYSIS				

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X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
			OTHER ENG. ANALYSIS				
			SUSTAINABILITY (IGBC) EVALUATION				
			CODE VALIDATION				
	PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)
	COST ESTIMATION		COST ESTIMATION		COST ESTIMATION		COST ESTIMATION
	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING

Section E: Organizational Roles / Staffing

Determine the project’s BIM Roles/Responsibilities and BIM Use Staffing

1. BIM ROLES AND RESPONSIBILITIES:

Describe BIM roles and responsibilities such as BIM Managers, Project Managers, Draftspersons, etc.

2. BIM USE STAFFING:

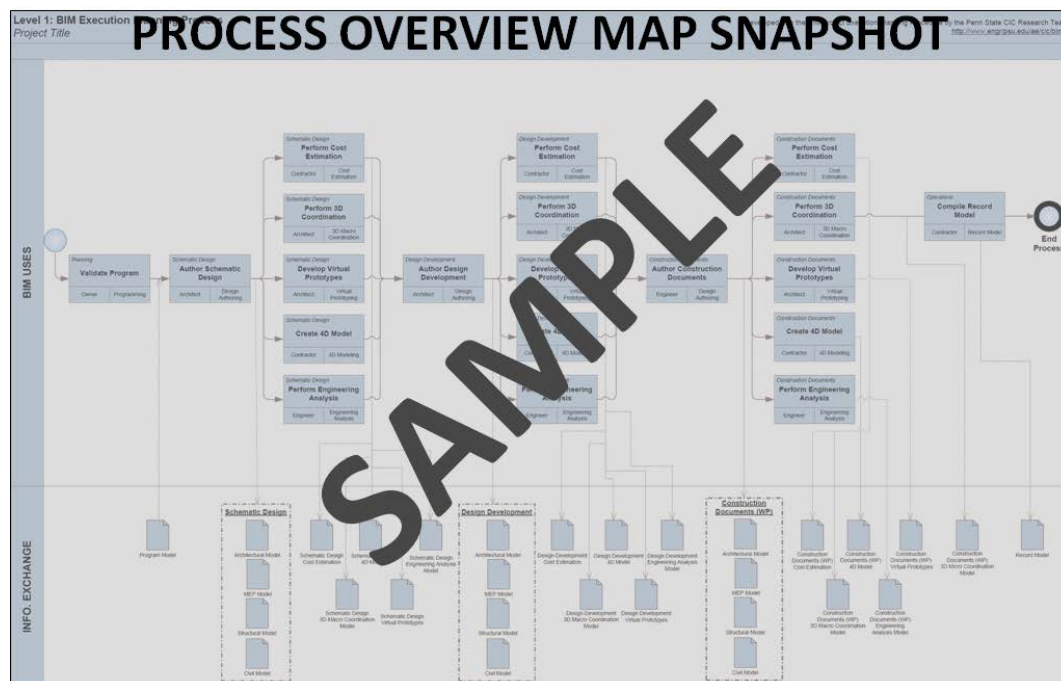
For each BIM Use selected, identify the team within the organization (or organizations) who will staff and perform that Use and estimate the personal time required.

BIM Use	Organization	Number of Total Staff for BIM Use	Estimated Worker Hours	Location(s)	Lead Contact
3D coordination	Contractor A				
	B				
	C				

Section F: BIM Process Design and Level of development (LOD)

Provide process maps & Level of Detail (LOD) for each BIM Use mentioned in section D: Project Goals/BIM Uses. These process maps provide a detailed plan for execution of each BIM Use. They also define the specific Information Exchanges for each activity, building the foundation for the entire execution plan. The plan includes the Overview Map (Level 1) of the BIM Uses, a Detailed Map of each BIM Use (Level 2), and a description of elements on each map, as appropriate. Level 1 and 2 sample maps are available for download at www.engr.psu.edu/BIM/download. (Please note that these are sample maps and should be modified based on project specific information and requirements). Please reference Chapter Three: Designing BIM Project Execution Process in the BIM Project Execution Planning Guide found at www.engr.psu.edu/BIM/PxP

1. LEVEL ONE PROCESS OVERVIEW MAP: ATTACHMENT 2



2. LIST OF LEVEL TWO – DETAILED BIM USE PROCESS MAP(S): ATTACHMENT 3

The following are examples. Modify for specific project. Some Process Maps may need to be removed, while some process maps may need to be added.

- a. Existing Conditions Modeling
- b. Phase Planning/ scheduling (4D Modeling)
- c. Quantity Take Offs & Cost Estimation (5D)
- d. Programming
- e. Site Analysis
- f. Design Reviews
- g. Design Authoring
- h. Energy Analysis

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- i. Structural Analysis
- j. Lighting Analysis
- k. 3D Coordination
- l. Site Utilization Planning
- m. 3D Control and Planning
- n. Record Modeling
- o. Maintenance Scheduling
- p. Building System Analysis

[Delete unused or add additional process maps from list]

3. BIM MODELING SCOPE / ELEMENTS / LEVEL OF DEVELOPMENT (LOD)

Model elements by discipline, level of development, and any specific attributes important to the project are documented using information exchange worksheet. Each Party shall be responsible for any Contribution that it makes to a model or that arises from that party's access to that model. Management of BIM must be clearly stated throughout the process and in accordance with the BEP, since such is not always the responsibility of the Architect.

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SECTION G: BIM INFORMATION EXCHANGES

Model elements by discipline, level of detail, and any specific attributes important to the project are documented using information exchange worksheet. See Chapter Four: Defining the Requirements for Information Exchanges in the BIM Project Execution Planning Guide for details on completing this template.

1. LIST OF INFORMATION EXCHANGE WORKSHEET(S): ATTACHMENT 4

The following are examples. Modify for specific project. Some Information Exchanges may need to be removed, while some Information Exchanges may need to be added.

- a. Existing Conditions Modeling
- b. Cost Estimation
- c. Phase Planning (4D Modeling)
- d. Programming
- e. Site Analysis
- f. Design Reviews
- g. Design Authoring
- h. Energy Analysis
- i. Structural Analysis
- j. Lighting Analysis
- k. 3D Coordination
- l. Site Utilization Planning
- m. 3D Control and Planning
- n. Record Modeling
- o. Maintenance Scheduling
- p. Building System Analysis
- q. [Delete unused information exchanges from list]

INFORMATION EXCHANGE (IE)

Information	Responsible Party
A. Accurate Size & Location, include materials and other parameters	ARCH, Architect
B. General Size & Location, include parameter data	CON, Contractor
C. Schematic Size & Location	CE, Civil Engineer ME, Energy Manager MEP, MEP Engineer SE, Structural Engineer TC, Trade Contractor

BIM Use Title	Programming	Design Authoring	Existing Conditions Modeling	Cost Estimation	3D Coordination	Design Reviews									
Project Phase	Planning	Design	Design	Design	Design	Design Reviews									
Time of Exchange (DD, DD, DD, Construction)															
Responsible Party (Information Receiver)															
Receiver File Format															
Application & Version															
Model Element Breakdown	Info	Resp Part	Additional Information	Info	Resp Part	Additional Information	Info	Resp Part	Notes	Info	Resp Part	Notes	Info	Resp Part	Notes
A. SUBSTRUCTURE															
Foundations															
			Standard Foundations												
			Special Foundations												
			Slab on Grade												
Basement Construction			Basement Excavation												
			Basement Walls												
B. SHELL															
Superstructure			Floor Construction												
			Roof Construction												
Exterior Enclosure			Exterior Walls												
			Exterior Windows												
			Exterior Doors												
Flooring			Floor Coverings												
			Floor Openings												
C. INTERIORS															
Interior Construction			Partitions												
			Interior Doors												
			Firestop												
Stairs			Stair Construction												
Interior Finishes			Wall Finishes												
			Floor Finishes												
			Ceiling Finishes												
D. SERVICES															
Conveying Systems			Elevator & Lift												
			Escalator & Moving Walks												
			Other Conveying Equipment												

2. MODEL DEFINITION WORKSHEET: ATTACHMENT 5

(Attach Model Definition Worksheet)

MODEL DEFINITION (MOD)

Information	Responsible Party
A. Accurate Size & Location, include materials and other parameters	ARCH, Architect
B. General Size & Location, include parameter data	CON, Contractor
C. Schematic Size & Location	CE, Civil Engineer ME, Energy Manager MEP, MEP Engineer SE, Structural Engineer TC, Trade Contractor

Project Phase Deliverable	Planning	Design	Construction	Operations								
Author File Format (if varies, specify in notes)												
Application & Version												
Model Element Breakdown	Info	Resp Part	Additional Information	Info	Resp Part	Additional Information	Info	Resp Part	Notes	Info	Resp Part	Notes
A. SUBSTRUCTURE												
Foundations			Standard Foundations									
			Special Foundations									
			Slab on Grade									
Basement Construction			Basement Excavation									
			Basement Walls									
B. SHELL												
Superstructure			Floor Construction									
			Roof Construction									
			Green Roof									
			Interior Columns									
			Beams									
			Trusses									
Exterior Enclosure			Exterior Walls									
			Curtain Wall Systems									
			Exterior Windows - Glass Panels									
			Exterior Doors									
Flooring			Floor Coverings									
			Floor Openings									
C. INTERIORS												
Interior Construction			Partitions									
			Interior Doors									
			Firestop									
Stairs			Stair Construction									
Interior Finishes			Wall Finishes									
			Floor Finishes									
			Ceiling and									
			Grid Ceiling									
			Ceiling Finishes									
D. SERVICES												

SECTION H: BIM AND FACILITY DATA REQUIREMENTS

The section should include the employer BIM requirements. It is important that the employers' requirements on BIM for the purpose of the facility to be considered so that they can be incorporated into the project's BIM process.

SECTION I: COLLABORATION PROCEDURES

1. COLLABORATION STRATEGY:

Describe how the project team will collaborate. Include items such as communication methods, document management and transfer, and record storage, etc.

2. MEETING PROCEDURES:

The following are examples of meetings that should be considered.

MEETING TYPE	PROJECT STAGE	FREQUENCY	PARTICIPANTS	LOCATION
BIM REQUIREMENTS KICK-OFF				
BIM EXECUTION PLAN DEMONSTRATION				
DESIGN COORDINATION				
CONSTRUCTION OVER-THE-SHOULDER PROGRESS REVIEWS				
ANY OTHER BIM MEETINGS THAT OCCURS WITH MULTIPLE PARTIES				

3. MODEL DELIVERY SCHEDULE OF INFORMATION EXCHANGE FOR SUBMISSION AND APPROVAL:

Document the information exchanges and file transfers that will occur on the project.

INFORMATION EXCHANGE	FILE SENDER	FILE RECEIVER	ONE-TIME or FREQUENCY	DUE DATE or START DATE	MODEL FILE	MODEL SOFTWARE	NATIVE FILE TYPE	FILE EXCHANGE TYPE
DESIGN AUTHORIZING - 3D COORDINATION	STRUCTURAL ENGINEER	(FTP POST) (COORDINATION LEAD)	WEEKLY	[DATE]	STRUCT	DESIGN APP	.XYZ	.XYZ .ABC
	MECHANICAL ENGINEER	(FTP POST) (COORDINATION LEAD)	WEEKLY	[DATE]	MECH	DESIGN APP	.XYZ	.XYZ .ABC

4. INTERACTIVE WORKSPACE

The project team should consider the physical environment it will need throughout the lifecycle of the project to accommodate the necessary collaboration, communication, and reviews that will improve the BIM Plan decision making process. Describe how the project team will be located. Consider questions like “will the team be collocated?” If so, where is the location and what will be in that space? Will there be a BIM Trailer? If yes, where will it be located and what will be in the space such as computers, projectors, tables, table configuration? Include any additional information necessary information about workspaces on the project.

5. ELECTRONIC COMMUNICATION PROCEDURES:

(Note: File Naming and Folder Structure will be discussed in Section L: Model Structure).

The following document management issues should be resolved and a procedure should be defined for each: Permissions / access, File Locations, FTP Site Location(s), File Transfer Protocol, File / Folder Maintenance, etc.

FILE LOCATION	FILE STRUCTURE / NAME	FILE TYPE	PASSWORD PROTECT	FILE MAINTAINER	UPDATE D
FTP SITE: ftp://ftp.****.com/**** /****	ROOT PROJECT FOLDER	FOLDER	YES *****	PW/PMIS	ONCE
	ARCH ROOT FOLDER	FOLDER			ONCE
	ARCH-11111-BL001.xyz	.xyz			DAILY
NETWORK drive @ PSU F:\PROJECT\BIM	ROOT PROJECT FOLDER	FOLDER	NO	PW/PMIS	ONCE
Project Management Software www.****.com					

SECTION J: QUALITY CONTROL

1. OVERALL STRATEGY FOR QUALITY CONTROL:

Describe the strategy to control the quality of the model.

2. QUALITY CONTROL CHECKS:

The following checks should be performed to assure quality.

CHECKS	DEFINITION	RESPONSIBLE PARTY	SOFTWARE PROGRAM(S)	FREQUENCY
VISUAL CHECK	Ensure there are no unintended model components and the design intent has been followed			
INTERFERENCE CHECK	Detect problems in the model where two building components are clashing including soft and hard			
STANDARDS CHECK	Ensure that the BIM and AEC CADD Standard have been followed (fonts, dimensions, line styles, levels/layers, etc)			
MODEL INTEGRITY CHECKS	Describe the QC validation process used to ensure that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements and the reporting process on non-compliant elements and corrective action plans			

3. Model Accuracy and Tolerances:

Models should include all appropriate dimensioning as needed for design intent, analysis, and construction. Level of detail and included model elements are provided in the Information Exchange Worksheet.

PHASE	DISCIPLINE	TOLERANCE
DESIGN DOCUMENTS	ARCH	ACCURATE TO +/- [#] OF ACTUAL SIZE AND LOCATION
SHOP DRAWINGS	MECH CONTRACTOR	ACCURATE TO +/- [#] OF ACTUAL SIZE AND LOCATION

4. BIM Quality checklist:

The section will cover the proposed BIM quality checklist.

SECTION K: TECHNOLOGICAL INFRASTRUCTURE NEEDS

1. SOFTWARE:

List software used to deliver BIM. Remove software that is not applicable.

BIM USE	DISCIPLINE (if applicable)	SOFTWARE	VERSION
DESIGN AUTHORING	ARCH	XYZ DESIGN APPLICATION	VER. X.X (YEAR)

2. COMPUTERS / HARDWARE:

Understand hardware specification becomes valuable once information begins to be shared between several disciplines or organizations. It also becomes valuable to ensure that the downstream hardware is not less powerful than the hardware used to create the information. In order to ensure that this does not happen, choose the hardware that is in the highest demand and most appropriate for the majority of BIM Uses.

BIM USE	HARDWARE	EMPLOYER OF HARDWARE	SPECIFICATIONS
DESIGN AUTHORING	XXX COMPUTER SYSTEM	ARCHITECT X	PROCESSOR, OPERATING SYSTEM, MEMORY STORAGE, GRAPHICS, NETWORK CARD, ETC.

3. MODELING CONTENT AND REFERENCE INFORMATION

Identify items such as families, workspaces, and databases.

BIM USE	DISCIPLINE (if applicable)	MODELING CONTENT / REFERENCE INFORMATION	VERSION
DESIGN AUTHORING	ARCH	XYZ APP FAMILIES	VER. X.X. (YEAR)
ESTIMATING	CONTRACTOR	PROPRIETARY DATABASE	VER. X.X (YEAR)

SECTION L: MODEL STRUCTURE

1. FILE NAMING STRUCTURE:

Determine and list the structure for model file names.

FILE NAMES FOR MODELS SHOULD BE FORMATTED AS:	
DISCIPLINE - PROJECT NUMBER – BUILDING NUMBER.XYZ (example: ARCH-11111-BL001.xyz)	
ARCHITECTURAL MODEL	ARCH-
CIVIL MODEL	CIVIL-
MECHANICAL MODEL	MECH-
PLUMBING MODEL	PLUMB-
ELECTRICAL MODEL	ELEC-
STRUCTURAL MODEL	STRUCT-
ENERGY MODEL	ENERGY-
CONSTRUCTION MODEL	CONST-
COORDINATION MODEL	COORD-

2. MODEL STRUCTURE:

Describe and diagram how the Model is separated, e.g., by building, by floors, by zone, by areas, and/or discipline.

3. MEASUREMENT AND COORDINATE SYSTEMS:

Describe the measurement system (Imperial or Metric) and coordinate system (geo-referenced) used.

4. BIM AND CAD STANDARDS:

Identify items such as the BIM and CAD standards, content reference information, and the version of IFC, etc.

STANDARD	VERSION	BIM USES APLICABLE	ORGANIZATIONS APLICABLE
CAD STANDARD		DESIGN AUTHORIZING	ARCHITECT
IFC	VERSION/MVD(s)	RECORD MODELING	CONSTRUCTION MANAGER

SECTION M: PROJECT DELIVERABLES

In this section, list the BIM deliverables for the project and the format in which the information will be delivered.

BIM SUBMITTAL ITEM	STAGE	Approximate Due Date	FORMAT	NOTES
	Design Development			
	Construction Documents			
	Construction			
Record Model	Close out		(.xyz)	See Record Model Information Exchange to ensure that the proper information is contained in this model

SECTION N: DELIVERY STRATEGY / CONTRACT

1. DELIVERY AND CONTRACTING STRATEGY FOR THE PROJECT:

What additional measures need to be taken to successfully use BIM with the selected delivery method and contract type?

2. TEAM SELECTION PROCEDURE:

How will you select future team members in regards to the above delivery strategy and contract type?

3. BIM CONTRACTING PROCEDURE:

How should BIM be written into the future contracts? (If documents / contracts are developed, please attach as attachment 6)

4. AGREEMENT FOR TRANSFER OF DIGITAL MODEL FILES

How the Contractor proposes to transfer and use digital model files.

SECTION O: ATTACHMENTS

1. BIM USE SELECTION WORKSHEET [FROM SECTION D]
2. LEVEL 1 PROCESS OVERVIEW MAP [FROM SECTION F]
3. LEVEL 2 DETAILED BIM USE PROCESS MAP(S) [FROM SECTION F]
4. INFORMATION EXCHANGE REQUIREMENT WORKSHEET(S) [FROM SECTION G]
5. MODEL DEFINITION WORKSHEET [FROM SECTION G]
6. DEVELOPED DOCUMENTS / CONTRACTS [FROM SECTION H]
7. BIM QUALITY CHECKLIST (FROM SECTION J)
8. DELIVERY STRATEGY / CONTRACTS (FROM SECTION N)

Annexure – II – CAD Guidelines

(Schedule - Q)

1 OVERVIEW

1.1 Purpose

Programme Manager for New Cities (AECOM) has initiated to manage a program that will assist in standardizing the use of CAD across all departments. The primary goal is to create an environment for seamless integration/collaboration between all disciplines & business lines of all Consultants/Contractors regarding the use of CAD for production of any drawing. The document will achieve this through setting out the Guideline for drawing data production. This will then enable drawing data to be incorporated into the Delhi Mumbai Industrial Corridor Development Corporation (DMICDC) GIS.

1.2 Application

This CAD standard shall be applied to all disciplines in all offices and design houses working in this Project. The scope of this document is to provide guidelines and procedures for adopting AutoCAD layering standards in preparing design and as-built drawings for automated transference to DMICDC GIS. This Guideline will address the following:

- i. Layer assignments,
- ii. Standard symbols
- iii. Layers and layer names,
- iv. Attributes to each feature,
- v. Templates,
- vi. Colour usage associated with line widths for all Highways and Utility drawings.

The Guideline are to be applied for all drawings from Concept through to As Built handover stage.

2 Filing and Storage of Drawings

2.1 Filing and Storage of Drawings

In order that the project information is readily accessible it is essential that all drawing data is filed and stored in a consistent and logical manner.

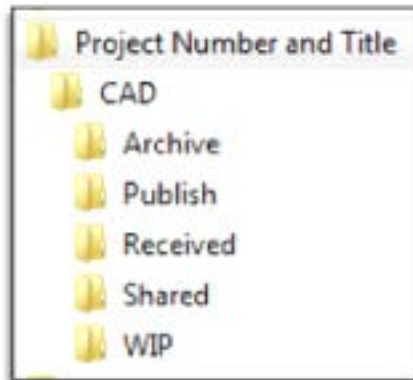
2.2 Electronic Copies

All electronic drawing and sketch files associated with a particular project shall be filed within the project folder.

2.3 Folder Structure

The standard folder structure for CAD data is as shown in Figure 1 below, it adopts the Code of Practice BS1192:2007 on Common Data Environment for collaborative working.

Figure 1:



2.4 Folder Name: Project Number and Title

This can be under the main office or discipline folder, or, if the number of files would render lists unwieldy, then further sub-folder are permissible. Folder names are not to include any symbols.

2.5 Sub Folder Name: CAD

Contains drawings and digital information organized as shown in Figure 1.

In a multi-disciplinary office the main sub-folders defined below may be sub-divided as necessary into the relevant disciplines:

2.5.1 Sub Folder Name: WIP (Work in Progress)

Contains the current working project drawings and sketches. This is where all files currently in the iterative process of design have not yet been approved to be shared.

This folder shall contain further sub-folders which can be amended to suit Project requirements.

2.5.2 Sub Folder Name: Shared

Contains verified, checked and approved CAD data for use by others for reference. This folder will hold the project specific drawings such as title frames, references, images, etc.

This folder shall contain further sub-folders which can be amended to suit Project requirements

2.5.3 Sub Folder Name: Published

Contains all final published sheet files, figures or sketches. This folder must contain the last issued Models/Xrefs. Data filed in this area shall never be deleted or overwritten, but will remain until archived.

2.5.4 Sub Folder Name: Archive

Contains all previous issues and superseded data. This folder is to allow retrieval of previously issued drawings at certain stages of design decisions. This folder will provide an audit trail of documentation and changes through the life of the project.

2.5.5 Sub Folder Name: Received

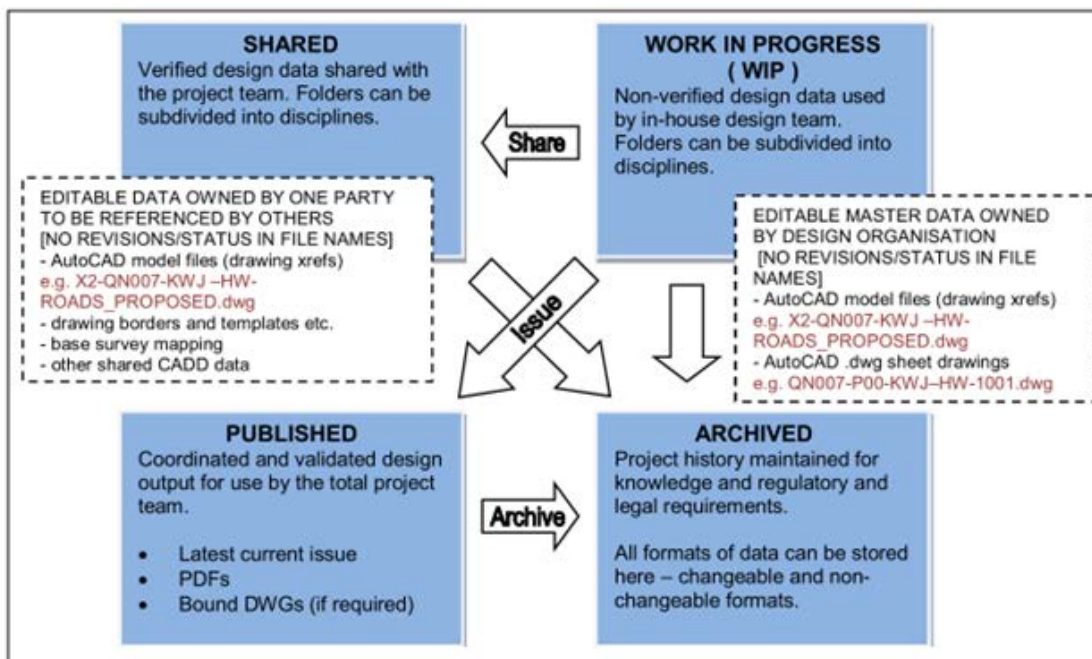
Contains read only copies of design data which have been received from Third Party sources or Stakeholders and will contain further sub-folders to identify the source and date of receipt.

The Received folder can be directly under the main project folder structure, under CAD or wherever the Employer / PMNC find it suitable. The vital concern is that a folder must be dedicated for incoming issues, where a full archive of all received information is stored with an audit trail that is related to the sending company and the date received and the current copy is easily identifiable throughout the project.

2.6 Collaborative Working

Figure 2 Application of Code of Practice BS1192:2007 on Common Data Environment (CDE)

Figure 2:



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- i. Within WIP folder each discipline can create a folder structure to suit its needs.
- ii. Common resource files such as title sheets, mapping, surveys, imagery and other shared CAD data must be available to all disciplines in the Shared area.
- iii. Once data has been checked, verified and approved, it must be copied to the Shared area and other disciplines notified.
- iv. When models are revised or updated; other disciplines referencing the model will be affected, so effective communication between disciplines is essential.
- v. When data files have been authorized and verified for issue, it is copied to the Published area, to maintain a local copy within the design organization's server.
- vi. The previous version of the data in the Published area shall be moved to the Archive area as a historical record and to maintain an audit trail.

2.7 Hard Copies

The print containing the original stamped, checked and approved signatures becomes the hard-copy 'master plot' for the drawing. See Section 3.3.13.

2.7.1 Drawings

The Project Implementation Plan (PIP) will define the area where the hard-copies for projects are to be filed.

The electronic version of the master plot of the drawing shall be known as the 'reference master'. The reference master, if required, shall be utilized for the electronic issue of the file.

Superseded master plots shall be retained and endorsed "superseded".

2.7.2 Check Prints

All completed and signed check prints shall be filed within the drawing office by the drafting checker in an area in accordance with the Project Implementation Plan (PIP).

All check prints are to be retained at least for the term of the project unless otherwise agreed with the Employer / PMNC. No check prints are to be disposed of without the consent of the Project Manager.

3 DRAWING DEVELOPMENT

3.1 Drawing Numbering System

The drawing numbers are to be entered into the drawing register during creation of the drawings so as to eliminate duplicate drawing numbers being assigned. The drawing number shall be unique for each drawing and will normally be in the form:

Table 1

	Originator code	-	Project Name	-	Discipline / Drawing Type code	-	Document code	Drawing Number	-	Sheet No
Example	AECOM	-	TP2E-RS	-	HW	-	DWG	1001	-	001
See Reference	3.1.1		3.1.2		3.1.3		3.1.4	3.1.5		

Fields will be separated by a hyphen (-)

Example: AECOM-TP2E-RS-HW-DWG-1001-01

3.1.1 Originator Code

A three letter code to identify who prepared the drawing. Refer to Appendix C.

3.1.2 Project Name

Refer to Appendix C

3.1.3 Drawing Type/ Discipline code

Two letter code to assist in identifying a discipline or type of drawing (i.e. HW for Highways, ST for Structures, LE for Landscape, SK for Sketch, etc.). Refer to Appendix C.

3.1.4 Document Code

Two letter code to assist in identifying type of document. Refer to Appendix C.

3.1.5 Drawing Number Code

Four digits sequential number for a specific drawing type series. Refer to Appendix C.

Subsequent issue of a drawing shall have the revision coding incremented by the next sequential number or letter.

Note #3:
Working drawings shall not have the drawing status and revision in the file name.

3.2 Model File (Xref) Naming

Model Files shall be named in accordance with the convention described below

Table 2

	Model type Identifier	Originator code		Project Name	-	Discipline code	-	Short Description
Example	X2	AECOM	-	TP2E-RS	-	HW	-	Proposed _Centre_line
See Reference	3.2.1	3.1.2		3.1.3		3.1.4		3.2.5

Example

X2- AECOM-TP2E-RS-HW -Proposed_Centre_Line

3.2.1 Model Identifier Code

This code identifies the model file if it is in 2D or 3D drawing as defined below:

Table 3

Description	Model Type Identifier
2D Model	X2
3D Model	X3

3.2.2 Originator Code

A three letter code to identify the Employer / PMNC who prepared the drawing. Refer to Appendix C.

3.2.3 Project Name

Refer to Appendix C

3.2.4 Drawing Type/ Discipline code

Two letter code to assist in identifying a discipline or type of drawing (i.e. HW for Highways, ST for Structures, LE for Landscape, SK for Sketch, etc.). Refer to Appendix C.

3.2.5 Short Description Field

A short description of the model/Xref file. An underscore is to be used in place of any spaces in the description field.

Working models shall not have the drawing status and revision in the file name.

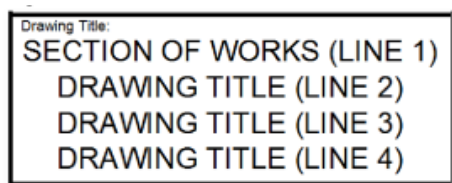
3.3 Drawing Title Blocks and Signatures

A standard drawing arrangement (drawing border and title block) shall be adopted for all drawings and shall be consistent across all drawings within the project. Title block entries shall be concise and informative to indicate fully the content of the drawing.

3.3.1 Drawing Title

- i) The top line shall identify the specific area or section within the contract, i.e. "HIGHWAYS", or it may be left blank where no such area or section exists.
- ii) The second third and fourth lines shall identify the content or purpose of the drawing, i.e. "TRAFFIC SIGNS AND ROAD MARKINGS"
- iii) Where several drawings depict similar detail and no other qualifications are available for distinguishing between them, the distinction shall be made by labelling each drawing consecutively with sheet numbers, such as "SHEET 1 OF 10", "SHEET 2 OF 10", etc.

Figure 3



3.3.2 Drawing Status

The issue DRAWING STATUS box shown below (Figure 4) shall be completed to describe the current status of the drawing. Refer to Table 5 for the list of drawing status/stages:

Figure 4

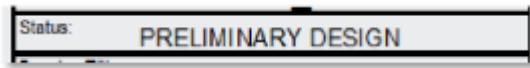


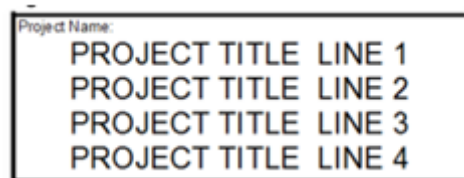
Table 4

Drawing Status
Concept Design
Preliminary Design
Detailed Design
Tender
Contract
As Built

3.3.3 Project Name Field

For Project Name refer to Baseline Assessment Report on detailed list of projects.

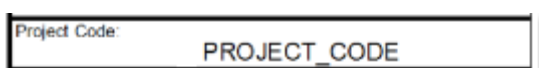
Figure 5



3.3.4 Project Code Field

For Employer / PMNC-specific project codes refer to Baseline Assessment Report on detailed list of prioritized projects.

Figure 6



3.3.5 Drawing Creation Date Field

The drawing creation date shall be in the whole word format for Month and Year as highlighted below (Figure 7):

Figure 7

Drawn: R SINGH	Checked: Y CHAUHAN
Designed: S MONDAL	Approved: P KUMAR
Date: AUGUST 2014	SCALE (A1) : 1:500 (A3) : 1:1000
Originator Drawing No: XXXXXX	
Project Drawing No: LBG-TP2E-RS-HW-DWG-1001-01	REV. R01

3.3.6 Revision History Table

A concise description of each approved and issued revision shall be entered into the revision description column. The revision columns indicate the history and development of the drawing; therefore, the description shall be as informative as is practical.

Drawings that are issued under specific Submissions or Milestones sets shall have clear, consistent revision description that states the purpose of the submission. e.g. ISSUED FOR APPROVAL, etc.

Figure 8

D01	30SEP13	REISSUED FOR APPROVAL	RK	YC	JS
D01	24SEP13	ISSUED FOR APPROVAL	RK	YC	JS
Rev	Date	Revision Description	Drawn	Chkd	Appd.

The date shown in the revision history table shall be in the format DDMMYY as highlighted in Figure 9 below

Figure 9

D01	30SEP13	REISSUED FOR APPROVAL	RK	YC	JS
D01	24SEP13	ISSUED FOR APPROVAL	RK	YC	JS
Rev	Date	Revision Description	Drawn	Chkd	Appd.

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The months shall be abbreviated as shown in table 6 below:

Table 5

Abbreviation	Month	Abbreviation	Month
JAN	January	JUL	July
FEB	February	AUG	August
MAR	March	SEP	September
APR	April	OCT	October
MAY	May	NOV	November
JUN	June	DEC	December

The date of completion of the revision and the initials of the person effecting the revision shall be stated.

The earliest revision descriptions shall be deleted when there is no space to include the current revision within the revision column.

3.3.7 Drawing Number Field

Drawing number field shall be completed as highlighted box below:

Figure 10

Drawn: R SINGH	Checked: Y CHAUHAN
Designed: S MONDAL	Approved: P KUMAR
Date: AUGUST 2014	SCALE (A1) : 1:500 (A3) : 1:1000
Originator Drawing No: XXXXXX	
Project Drawing No: LBG-TP2E-RS-HW-DWG-1001-01	REV. R01

Refer to Section 3.1 for drawing numbering convention.

3.3.8 Revision Field Box

Revision field box shall be completed as highlighted below: Refer to 3.10.3

Figure 11

Drawn: R SINGH	Checked: Y CHAUHAN
Designed: S MONDAL	Approved: P KUMAR
Date: AUGUST 2014	SCALE (A1): 1:500 (A3): 1:1000
Originator Drawing No: XXXXXX	
Project Drawing No: LBG-TP2E-RS-HW-DWG-1001-01	REV. R01

3.3.9 Name Fields

The 'Drawn', 'Designed', 'Checked' and 'Approved' field boxes on the title block, as highlighted below, shall include the first name initial and the full last name of the person who performed or is responsible for the major portion of the work.

Figure 12

Drawn: R SINGH	Checked: Y CHAUHAN
Designed: S MONDAL	Approved: P KUMAR
Date: AUGUST 2014	SCALE (A1): 1:500 (A3): 1:1000
Originator Drawing No: XXXXXX	
Project Drawing No: LBG-TP2E-RS-HW-DWG-1001-01	REV. R01

3.3.10 Drawing Scale Field

For completing the drawing scale field box in the title frame, refer to Section 3.6. A scale bar for presenting the scale of the drawing should be used in the drawing layout.

Figure 13

Drawn: R SINGH	Checked: Y CHAUHAN
Designed: S MONDAL	Approved: P KUMAR
Date: AUGUST 2014	SCALE (A1): 1:500 (A3): 1:1000
Originator Drawing No: XXXXXX	
Project Drawing No: LBG-TP2E-RS-HW-DWG-1001-01	REV. R01

3.3.11 Signatures

The revision history table shall contain the current issue revision number, date of issue, Drafter/Author, Checker, Approver signatures or initials and description of current revision.

Table 6

TITLE BLOCK	CAD	HARD COPY	PDF COPY
DRAWN BY	See 3.3.12	See 3.3.13	See 3.3.14
CHECKED BY	See 3.3.12	See 3.3.13	See 3.3.14
APPROVER BY	See 3.3.12	See 3.3.13	See 3.3.14

3.3.12 CAD Files

When issued, drawing files shall bear the typed CAD initials of the author, checker and approver on the revision history box.

Figure 14

Drawn: R SINGH	Checked: Y CHAUHAN
Designed: S MONDAL	Approved: P KUMAR
Date: AUGUST 2014	SCALE (A1) : 1:500 (A3) : 1:1000
Originator Drawing No: XXXXXX	
Project Drawing No: LBG-TP2E-RS-HW-DWG-1001-01	REV. R01

3.3.13 Hard Copy

The original hard copy set to be submitted to Employer/ PMNC shall be signed by hand and stamped. This set will become the control set for reference. The drawing shall bear hand signature of the drawing Approver beside his/her name in the Approved field box on the title frame as shown in Figure 15. Each drawing shall be stamped with the issuing company's official stamp.

Figure 15 Signed hard copy by Approver

Drawn: R SINGH	Checked: Y CHAUHAN
Designed: S MONDAL	Approved: P KUMAR PK
Date: AUGUST 2014	SCALE (A1): 1:500 SCALE (A3): 1:1000
Originator Drawing No: XXXXXX	
Project Drawing No: LBG-TP2E-RS-HW-DWG-1001-01	REV. R01

Original hand-signed copy is required for all 'Final' drawings submitted for: Concept design, Preliminary design, Detailed design, Tender set, Contract set, GFC drawings (during construction) and As Built.

Subsequent hard copies of the submitted original do not have to be hand signed. Scanned copies of the hand signed drawing are permitted as long as the clarity of the drawing is not compromised. Alternatively, copies may be printed directly from CAD. It is acceptable for these not to contain a copy of the hand signature, but to bear typed initials instead.

3.3.14 PDF Copy

When Issued, PDF copy can be generated electronically from the cad file bearing the typed initials of the author, checker and approver.

3.4 Units

All general drawing work (e.g. Xrefs) are to be in model space and be produced in meters to three decimal places. Drawing borders to be in paper space and in millimetres.

e.g. 54.000

78.720

0.325

Dimensions in metres and using whole numbers, can be expressed using the 'm' (metre) suffix as in the following

45.000m

The position of the decimal point shall be the same as a full stop and no space shall be left between the number and its units, to ensure clarity, as in the following example:

5.800m

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All other non-linear measurements, e.g. areas and volumes, shall be followed by the unit symbol. The most common non-linear measurements are as follows

Square metre - m²

Cubic metre - m³

All detail drawing work (e.g. standard details) is to be in model space and be produced in millimetres in whole numbers (i.e. no decimal places).

e.g. 10000

787

Dimensions in millimetres using whole numbers, can be expressed using the 'mm' (millimetre) suffix as in the following

250mm

Chainages shall be in metres and written as shown

0+100 (Chainages in whole numbers can be written without the decimal accuracy)

15+255.345

Chainages are plan measurements taken along a setting out line, and provide a horizontal distance not taking into account slope lengths.

3.5 Drawing Sizes

Drawing sizes shall conform to the International Standards Organization (ISO).

Sizes (in mm) are as follows: -

A0 – 1189 x 841

A1 – 841 x 594

A2 – 594 x 420

A3 – 420 x 297

A4 – 297 x 210

In general, all drawings shall be produced at the preferred A1 original size. The use of A0 size drawings shall be avoided wherever possible.

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Each group or set of drawings shall use only one drawing size unless situations make this impractical.

3.6 Scales

Scales used on drawings shall be selected as indicated in the table below. Only standard metric scales shall be used. In all cases, the selected scale shall be large enough to permit easy and clear interpretation of the information depicted.

Specific scale requirements of particular drawings such as layouts will be as stated as per RFP.

Table 7

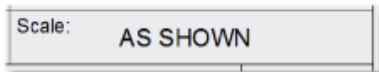
Permitted scales				
1:1	1:2		1:5	2:1
1:10	1:20	1:25	1:50	5:1
1:100	1:200	1:250	1:500	10:1
1:1000	1:2000	1:2500	1:5000	20:1
1:10,000	1:20,000	1:25,000	1:50,000	50:1

In exceptional cases where for functional reasons the recommended scale cannot be applied, intermediate scales may be chosen, provided that the required scale is of a whole number, such as 1:125, 1:150, etc.

The following scale notes shall be considered:

- ii. Number of scales on any one drawing shall be kept to a minimum.
- ii. CAD entities shall be drawn at full scale (1 Drawing unit = 1 Measurement unit). Final plotted scale shall be established during composition of the drawing layout for plotting.
- iii. Originators using AutoCAD shall employ the PAPER SPACE/MODEL SPACE facility to establish drawing layout and scales. All drawing entities shall reside in MODEL SPACE with the exception of view ports, general notes, revision clouding and its labels, title block and border.
- iv. Where different scales exist, each scale shall be specified under the title of the area of the drawing to which it applies and noted in the Title Block field as shown below:

Figure 16



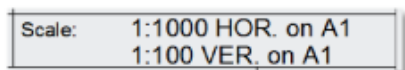
- v. Where a single scale is used on a drawing, it shall be specified within the title block only. (See the object area and shall be large enough to below). The scales selected shall depend on the object area and shall be large enough to permit easy and clear interpretation of information and ensure clarity of prints on the original as well as reduced copies i.e. A3 versions of A1 drawings.

Figure 17



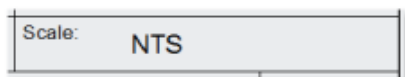
- vi. Where different scales are used for horizontal and vertical dimensions, such as in profiles, each scale shall be clearly indicated on the drawing as shown below:

Figure 18



When the drawing is not drawn to any scale, 'NTS' (Not to Scale) shall be placed in the title block as shown below:

Figure 19



Scale bars shall be shown on all drawings containing plans.

3.7 Key Plan

Where layout plans are produced on a number of drawings to cover the extent or section of the project, a Key Plan shall be included on each sheet, clearly indicating the section of the works under consideration. A dedicated box in the title frame is provided for the Key Plan as shown below.

Figure 20



3.8 Drawing Notes

Notes are to be numbered and positioned appropriately and shall include the following notes:

All Dimensions are in metres unless otherwise stated. (Only on drawings drawn in metres.)

All levels are in metres (Only on drawings where this note is applicable.)

All dimensions are in millimetres unless otherwise stated. (Only on drawings drawn in millimetres)

3.9 General Notes

Where notes are extensive and apply on several drawings, a General Notes Drawing shall be provided which consolidates all notes. Deviation from these notes on a particular drawing may be permitted, provided this amendment is shown in the Notes section of the drawing.

Where a General Notes Drawing is used, the first note on each applicable drawing shall contain the following statement: -

“1. FOR GENERAL NOTES, REFER TO DRAWING NO. XXX”

3.10 Drawing Revision

3.10.1 Revision Clouds and Triangles

Each area where changes/revisions made since the last issue / submission shall be ringed with a cloud and marked with an equilateral triangle containing the current revision letter.

Revision clouds and its triangle label shall be placed on the paper space.

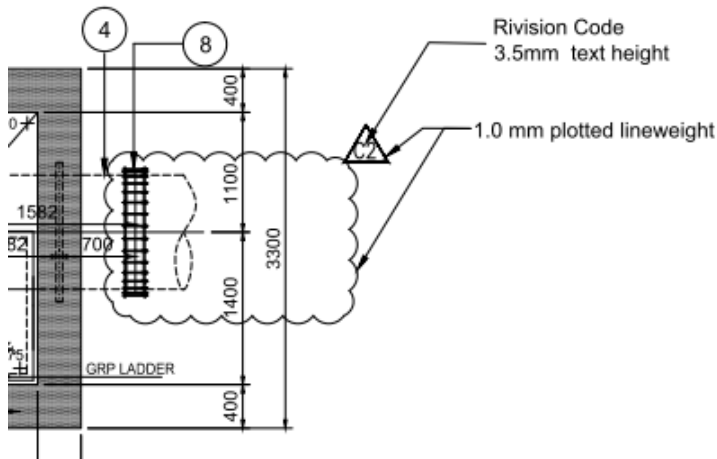
Arc length of cloud shall be 15 as a general rule to maintain consistency.

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Revision clouds shall be 1.0mm thick (gray or colour 252) and triangles shall be placed on layer REV.

Clouding and revision triangles denoting the previous revision shall be removed from the CAD file.

Figure 21



3.10.2 Revision Description

The date and description of the revision / issue shall be given in the revision history table on the title frame.

3.10.3 Drawing Revision Code

This code identifies the drawing revision and shall be as defined in Table 11 below. Subsequent issue of a drawing shall have the revision coding incremented by the next sequential number or letter.

Table 8

Revision / Issue Code
R01,R02,R03....etc.

Note: As drawings move from one stage to another all historical revision history under that stage is to be removed from the revision history on the title block.

3.11 Drawing Register and Transmittal Record

The issue of drawings shall be recorded on the drawing register and a transmittal provided by drawing originators containing like information. The drawing register shall be a concise and continuous record of drawing revisions and issue history.

The current revision indicator shall be recorded for each issue.

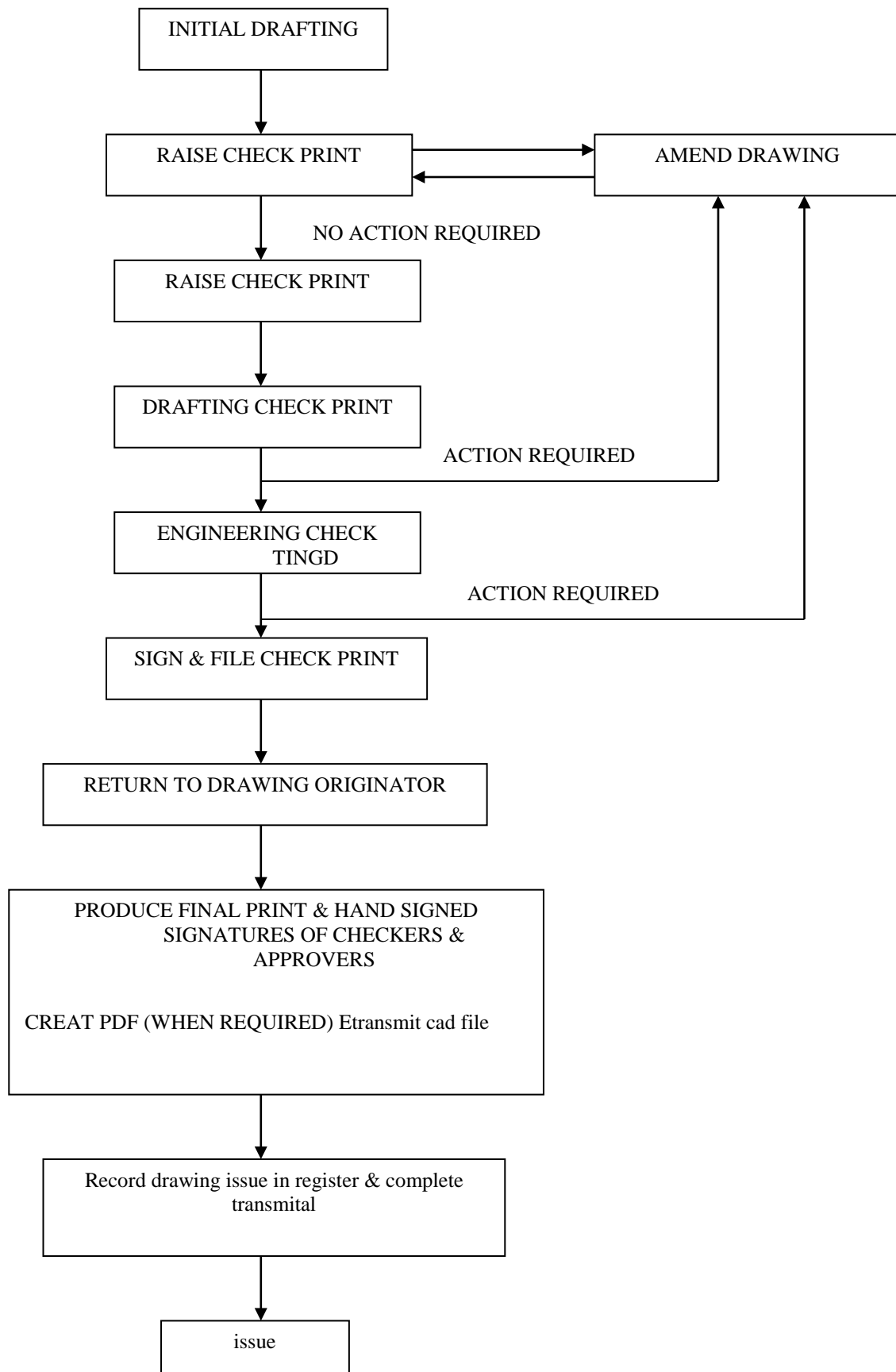
3.12 Checking and Approval of Drawings

During drawing production a system of continuous checking shall be employed by the Employer / PMNC to confirm that all CAD information fully complies with the conditions set out in this document.

It is imperative that all drawings are subjected to a Quality Assurance and Quality Control (QA/QC) check and are duly signed and authorized prior to issue.

Any drawing leaving the drawing office shall have been properly checked for presentation, clarity, accuracy, technical correctness and compliance with the relevant CAD Standard. Refer to the flow chart overleaf in Figure 22 for an overview of the checking procedure.

Figure 22: Flow diagram showing overview of CAD drawing checking procedure



3.12.1 Self Check

After preparation, the drawing shall be checked by the drawing originator and any required amendment to the drawing is to be carried out prior to handing over the check print for checking.

3.12.2 Drafting Check

Generally the Drafting Check must precede the Engineering Check.

The Drafting Check will normally be carried out by a person designated by the CAD Office representative/Manager.

The Drafting Check shall verify adherence to the Project Brief in conjunction with any applicable supplied criteria. The checker shall also make an assessment with respect to presentation, standard of workmanship and adherence to the CAD Standard Manual.

The Drafting Check shall, where deemed necessary, include an electronic check of the CAD File to ensure compliance with applicable standards and/or client requirements.

The check print shall be clearly marked by the checker with any required modifications.

Upon completion of the Drafting Check the checker shall then sign, date and highlight the required action to be taken.

Any amendment to the drawing requirements may, if required, be carried out prior to the Engineering Check and a new print raised, duly stamped and signed.

3.12.3 Engineering Check

The Engineering check will normally be carried out by a competent and relevant experienced Senior Engineer within the Employer / PMNC's organization.

The Engineering check shall verify adherence to the design calculations, design standards and associated construction issues.

Upon completion of the Engineering Check, the checker shall then sign, date and highlight the required action to be taken.

3.12.4 Further drawing amendments

Upon completion of the Drafting Check and Engineering Check the completed check print shall be returned to the originator of the drawing for amendment of the drawing.

Where required, further check prints shall be raised and the checks repeated.

3.12.5 Approval

Upon completion of the checking process, a clean print of the drawing shall be submitted to the relevant checkers for signature and to the designated authority for approval. This then becomes the controlled drawing for reference. The checker's and approver's initials together with the relevant dates shall be entered in the appropriate areas of the CAD file.

4.1 Drawing set up

- i. All AutoCAD drawings should be produced & saved in AutoCAD version not lower than 2009.
- ii. Pre-defined project drawing templates will be used for setting the layers of identifiable drawings (e.g. drainage, roads).
- iii. Units in AutoCAD shall be set to metres for Infrastructure layouts and profiles and millimetres for detail drawings such as standard details.
- iv. The CAD files provided will be in the current version of AutoCAD file format used on the project.
- v. Fonts and line types are to be followed as provided in this manual.
- vi. Files shall be purged before issue only.
- vii. Drawing features / entities must be in model space. Title frames must be in paperspace.
- viii. The colour and line type of each entity is drawn on BYLAYER.
- ix. All polygons shall be closed polylines.
- x. Do not place entities on layer 0. This layer is for the creation of blocks only.

4.2 Line Work

4.2.1 Line Types

The following guidelines shall apply to the use of line types:

LINETYPE to be set BYLAYER. (Deviation: Standard AutoCAD Blocks)

All layers shall have their entities set to 'BYLAYER'

All colours of AutoCAD objects to be BYLAYER. (Deviation: Standard AutoCAD Blocks)

The plotted appearance of line types shall be consistent across all drawings.

Modification of AutoCAD default source file is not permitted.

Lines on a drawing that cannot be represented by those in the default AutoCAD source file may be loaded from the approved Custom line types provided.

4.2.2 Line Weights

Table 9

Colour No.	Display Screen Color	Plotted Line Weight (mm)	Plotted Colour	
			DSIR_TP2_COL_A1.CTB	DSIR_TP2_BW_A1.CTB
1	RED	0.18	BLACK	BLACK
2	Yellow	0.25	BLACK	BLACK
3	Green	0.35	BLACK	BLACK
4	Cyan	0.50	BLACK	BLACK
5	Blue	0.70	BLACK	BLACK
6	Magenta	0.35	BLACK	BLACK
7	White	0.25	BLACK	BLACK
8	Dark Grey	0.20	Object Colour	BLACK
9	Light Grey	0.15	Object Colour	BLACK
10	Object Colour	0.6	Object Colour	BLACK
11-79 & 81-249	Object Colour	0.35	Object Colour	BLACK
80	Object Colour	0.6	Object Colour	BLACK
250-255 (Greys)	Object Colour	0.15	Object Colour	Object Colour

4.3 Text

4.3.1 General

The AutoCAD Styles shall have a default height setting = 0.

Sloping, italic, and elaborate fonts are not permitted.

The objective shall be to make all lettering highly legible so that information can be communicated with the minimal possibility of error in reading. Lettering sizes shall be chosen such that it shall remain legible when drawings are reduced to A3 size.

Lettering shall be consistent, both in size and placement. Lettering sizes for specific applications, such as notes or titles, shall not vary within the same drawing.

Lettering shall be uniform, clear, sharp and distinct. The mixing of lettering styles, sloping, italic, and elaborate fonts shall not be permitted.

All text shall be regularly spaced, upright and uppercase and not be underlined. Deviation: Titles under plans, details etc. are to be underlined.

All text shall be left justified. Deviation: Titles shall be centre justified and underlined.

Specific notations shall be carefully placed so they relate to the portion of the drawing or detail to which they apply.

The placing of notes through drawing lines is to be avoided.

Leader arrows relating to specific text or annotation shall be placed in model space with the detail it is referencing on the same layer as the text to which it relates.

4.3.2 Fonts

Permitted text fonts are as shown below:

Table 10

AutoCAD Style Name	AutoCAD Font File	CAD Usage
ISOCP	ISOCP.SHX	Technical/Engineering drawings
ARIAL	ARIAL.TTF	Presentation Drawings

4.3.3 Text Assignments

The table below indicates approved texts with their appropriate colour/application assignments:

Table 11

Plotted Text Heigh (mm)	Width Factor	Plotted Line weight	Usage
1.8	1	0.18	General text, Dimensions, Notes – used on A3 & A4 only where drawing is not plotted at a reduced scale.
2.5	1	0.25	General text annotations, Dimensions, Notes Special Notes
3.5	1	0.35	For more prominent notes or labels requiring special emphasis.
5.0	1	0.5	Normal Titles, Drawing Numbers, Section titles, Detail Titles
7.0	1	0.7	Major Titles

The preferred text height for general text and notes is 2.5mm.

The text height adopted for a project shall be consistent across all drawings unless situations make this impractical.

4.4 Dimensioning

Automated dimensioning commands within CAD software programs shall be used for creation and editing of dimensions, as shown in table 16 below.

The editing of dimension values via basic text editing commands is not permitted. Dimensions shall be associative and placed on their own unique layer.

Table 12

Dimension Text Height	Extension Line Offset	Extension Line Extension	Stack Offset	Arrow Size	Centre Mark
2.5mm	Dimexo = 2	Dimexe = 2	Dimdli = 6.25	Dimasz = 2.5	Dimcen = 1

4.5 Standard Symbols and Blocks

In order to promote consistency, standard symbols shall be utilized. All blocks are to be inserted into the drawing on its appropriate drawing layer. Where a symbol required is not available from the blocks provided with this manual, symbols compliant to international standards shall be used. These new blocks shall be submitted to Employer/ PMNC to update the list of standard symbols library for the programme.

All symbols shall be consistent within a drawing or set of drawings.

All blocks that need to be created as new blocks shall have all their elements saved on layer 0.

All symbols used within a drawing must be defined using a legend.

4.6 Hatching

Wherever possible, all hatching created shall be associative and placed on its own unique layer. Exploding of hatches must be avoided.

4.7 Colours

In AutoCAD, entity colour shall be assigned “ByLayer”. Deviation can be on standard blocks, i.e. are Road signs blocks where specific standard colours are assigned for each.

4.8 Layering

CAD Layering shall be in accordance with Employer/ PMNC AutoCAD Layering Standards as included in Appendix A of this document.

Additional layers may be required and the naming of such layers must be in the same format in accordance with Employer/ PMNC AutoCAD Layering Standards as shown in Section 4.8.1.

4.8.1 Layer Name Layout

Where new layers are to be created the AutoCAD layer naming convention is as follows:

1 2 3

RD_EX_CNRL

Where:

1 = Department Designator

2 = Status / Section Designator

3 = Feature / Entity Designator

Department Designator (Field 1)

This code identifies the Employer/ PMNC Department (i.e. B = Building Affairs, D = Drainage Affairs and RD = Roads Affairs.)

Status / Section Designator (Field 2)

This code identifies the main classification of the type of element within a discipline. For example

“EX_SEW” describes as existing sewer.

Feature / Entity Designator (Field 3)

This code further identifies the entity description feature name. For example “ABD” describes as the abandoned sewerage network.

4.8.2 List of Employer/ PMNC Standard Layers

See Appendix A.

4.9 Models/Reference Files (Xrefs)

Where CAD data is to be shared between drawings the use of reference files is to be adopted.

All reference files are to be inserted in model space with the UCS set to ‘world’. All files are to be inserted at 0,0,0.

Unused reference files shall be detached upon completion of drawings.

The number of reference files on a project shall be kept to a minimum.

The preferred method of attaching Xrefs shall be Overlay option.

Reference files shall be inserted on unique layer that does not conflict with the general content of the drawing. (i.e. layer Z_XREF in AutoCAD).

Reference files shall be “CLIPPED” within the Active drawing sheet file to ensure that only the design data relevant to the drawing is displayed.

Reference files issued externally or shared between departments shall indicate revised areas with a revision cloud and triangle. A revision history shall be maintained within the reference file. In AutoCAD, the revision history log shall be placed in paper space, see Figure 29 below.

For Model File Naming refer to Section 3.2

4.10 Plotting

The following standard colour source files shall be used:

Table 13

Colour	Black and White
LBG-TP2-RS-COL_A1.CTB	LBG-TP2-RS-BW_A1.CTB

This standard colour source file shall be flexible and can be adjusted to suit user’s need during plotting. When drawing files are required, CTB file used for the plotting of the drawing must also be submitted.

4.10.1 Date and File location update

These are field entities contained within the drawing border and are used to print the date and time of print, file location, file name, etc.

Figure 23

CAD Ref: Z:\Project\DSIR\201TP2E\XRF\ LBG-TP2E-RS-A1-TITLE-AUG 2014.dwg Last saved: Thu,7 Aug 2014 03:10 pm

4.11 Data Submission Standards

All drawing files must conform to the AutoCAD layering standards set forth in this document.

4.11.1 Submission

Refer to Programme Management Information System (PMIS) and Document Management procedures on submission of drawing.

4.11.2 File Format

Digital submittals shall be in PDF format & CAD format. DWG files must be in ZIP format when submitted in soft copy in CD. Also Refer to Document Management Procedures for submission of document.

Appendix A – AUTOCAD LAYERS DEFINITIONS

Annexure – II – CAD Guidelines

(Schedule - Q)

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A.1 General Layers

CORE LAYERS NON DISCIPLINE				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
Z_18TEXT	red	Continuous	0.18	TEXT AT RESPECTIVE HEIGHT
Z_25TEXT	white	Continuous	0.25	TEXT AT RESPECTIVE HEIGHT
Z_35TEXT	green	Continuous	0.35	TEXT AT RESPECTIVE HEIGHT
Z_50TEXT	cyan	Continuous	0.50	TEXT AT RESPECTIVE HEIGHT
Z_70TEXT	blue	Continuous	0.70	TEXT AT RESPECTIVE HEIGHT
Z_DIMS	red	Continuous	0.18	ALL DIMENSIONS
Z_DWG_GRID	251	Continuous	0.15	DESIGN ROAD FEATURE : GRID
Z_DWG_SHT	white	Continuous	0.25	DRAWING SHEET & TITLE BLOCK
Z_NORTH	green	Continuous	0.35	NORTH POINT
Z_REV	yellow	Continuous	0.25	REVISION CLOUD SAND TRIANGLE
Z_SECMK	green	Continuous	0.35	SECTION AND DETAIL MARKS
Z_XREF	white	Continuous	0.25	EXTERNAL REFERENCE (XREF)

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

GIS LAYERS				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
GIS_ACQ_BDRY	20	ACAD_ISO13W100	0.25	LAND AQUISITION BOUNDARY
GIS_CADASTRAL	red	Continuous	0.18	CADASTRAL PLOT
GIS_CNTRS	9	Continuous	0.15	CONTOURS
GIS_CNTRS_TEXT	red	Continuous	0.18	CONTOURS TEXT
GIS_CSTL	90	Continuous	0.35	COASTLINE
GIS_FLOWLINE	8	Continuous	0.20	FLOWLINES
GIS_PPLN	252	Continuous	0.15	POLICY PLAN
GIS_RD01	121	Continuous	0.35	MAJOR ROAD
GIS_RD02	151	Continuous	0.35	MINOR ROAD
GIS_RD03	181	Continuous	0.35	STREETS
GIS_ROW_BDRY	170	PHANTOM2	0.35	PROPOSED RIGHT OF WAY BOUNDARY
GIS_ZONE	13	Continuous	0.35	ZONE

A.2 Drainage layers

A.2.1 Storm Water Drainage

PROPOSED STORM WATER DRAINAGE (SWD)				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
D_PR_SWD	80	SWD_PR	0.6	PROPOSED STORM WATER LINES
D_PR_SWD_ATT	white	Continuous	0.25	PROPOSED SWD ATTRIBUTES (ID, Diameter, Length, Material etc.)
D_PR_SWD_DCH	90	Continuous	0.35	PROPOSED SWD DISCHARGE CHAMBER
D_PR_SWD_DT	yellow	Continuous	0.25	PROPOSED SWD DRAIN TRENCH
D_PR_SWD_FCH	90	Continuous	0.35	PROPOSED SWD FLUSHING CHAMBER
D_PR_SWD_FLOW	white	Continuous	0.25	ROPOSED SWD FLOW ARROW
D_PR_SWD_FMC	90	Continuous	0.35	PROPOSED SWD FLOWMETER CHAMBER
D_PR_SWD_GC	90	Continuous	0.35	PROPOSED SWD GULLY CONNECTION
D_PR_SWD_GL	90	Continuous	0.35	PROPOSED SWD GULLY
D_PR_SWD_ICH	90	Continuous	0.35	PROPOSED SWD INSPECTION CHAMBER
D_PR_SWD_ITCH	90	Continuous	0.35	PROPOSED SWD INTAKE CHAMBER
D_PR_SWD_MH	90	Continuous	0.35	PROPOSED SWD MANHOLE
D_PR_SWD_MH_ATT	white	Continuous	0.25	PROPOSED SWD MANHOLE ATTRIBUTES (ID, Depth, Cov. Lvl, Inv. Lvl, etc)
D_PR_SWD_OFCH	90	Continuous	0.35	PROPOSED SWD OUTFALL CHAMBER
D_PR_SWD_PS	90	Continuous	0.35	PROPOSED SWD PUMP STATION

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

D_PR_SWD_RM	90	RM_PR	0.35	PROPOSED SWD RISING MAIN
D_PR_SWD_VALV	90	Continuous	0.35	PROPOSED SWD VALVE
D_PR_SWD_VC	90	Continuous	0.35	PROPOSED SWD VALVE CHAMBER
D_PR_SWD_WCH	90	Continuous	0.35	PROPOSED SWD WASHOUT CHAMBER

EXISTING STORM WATER (SWD)				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
D_EX_SWD	96	SWD_EX	0.35	EXISTING STORM WATER LINES
D_EX_SWD_ATT	white	Continuous	0.25	EXISTING SWD ATTRIBUTES (ID, Diameter, Length, Material etc)
D_EX_SWD_DCH	96	Continuous	0.35	EXISTING SWD DISCHARGE CHAMBER
D_EX_SWD_DT	yellow	Continuous	0.25	EXISTING SWD DRAIN TRENCH
D_EX_SWD_FCH	96	Continuous	0.35	EXISTING SWD FLUSHING CHAMBER
D_EX_SWD_FLOW	white	Continuous	0.25	ROPOSED SWD FLOW ARROW
D_EX_SWD_FMC	96	Continuous	0.35	EXISTING SWD FLOWMETER CHAMBER
D_EX_SWD_GC	96	HIDDEN2	0.35	EXISTING SWD GULLY CONNECTION
D_EX_SWD_GL	96	Continuous	0.35	EXISTING SWD GULLY
D_EX_SWD_ICH	96	Continuous	0.35	EXISTING SWD INSPECTION CHAMBER

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

D_EX_SWD_ITCH	96	Continuous	0.35	EXISTING SWD INTAKE CHAMBER
D_EX_SWD_MH	96	Continuous	0.35	EXISTING SWD MANHOLE
D_EX_SWD_MH_ATT	96	Continuous	0.35	EXISTING SWD MANHOLE ATTRIBUTES (ID, Depth, Cov. Lvl, Inv. Lvl, etc)
D_EX_SWD_OFCH	96	DASHED2	0.25	EXISTING SWD OUTFALL CHAMBER
D_EX_SWD_PS	96	Continuous	0.35	EXISTING SWD PUMP STATION
D_EX_SWD_RM	96	RM_EX	0.35	EXISTING SWD RISING MAIN
D_EX_SWD_VAL V	96	Continuous	0.35	EXISTING SWD VALVE
D_EX_SWD_VC	96	Continuous	0.25	EXISTING SWD VALVE CHAMBER
D_EX_SWD_WCH	96	Continuous	0.25	EXISTING SWD WASHOUT CHAMBER

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

A.2.2 Domestic Sewage

PROPOSED DOMESTIC SEWAGE LINE				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
SEW_DE_PSWR	242	SEW_PR	0.35	DESIGN SEWER FEATURE:PROPOSED SEWER LINES
SEW_DE_MH	242	Continuous	0.25	DESIGN SEWER FEATURE: MANHOLE
SEW_DE_SWPS	242	Continuous	0.25	DESIGN SEWER FEATURE: SEWAGE PUMPING STATION
SEW_DE_VSHFT	242	Continuous	0.25	DESIGN SEWER FEATURE: VENT SHAFT
SEW_DE_SCONN	242	Continuous	0.25	DESIGN SEWER FEATURE: SEWER CONNECTION
SEW_DE_MHFC	242	Continuous	0.25	DESIGN SEWER FEATURE: MANHOLE FRAME & COVER
SEW_DE_STP	242	Continuous	0.25	DESIGN SEWER FEATURE: SEWAGE TREATMENT PLANT
SEW_DE_PM	242	Continuous	0.25	DESIGN SEWER FEATURE: SEWAGE PUMPING MAIN

A.2.3 Industrial Effluent Design Layers

PROPOSED INDUSTRIAL EFFLUENT				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
INEFF_DE_PINEF	white	Continuous	0.35	DESIGN INDUSTRIAL EFFLUENT FEATURE:PROPOSED INDUSTRIAL EFFLUENT
INEFF_DE_VSHFT	white	Continuous	0.25	DESIGN INDUSTRIAL EFFLUENT FEATURE: VENT SHAFT
INEFF_DE_IEPS	white	Continuous	0.25	DESIGN INDUSTRIAL EFFLUENT FEATURE:INDUSTRIAL EFFLUENT PUMPING STATION
INEFF_DE_SINLET	white	Continuous	0.25	DESIGN INDUSTRIAL EFFLUENT FEATURE: SECONDARY TREATMENT PLANT INLET S
INEFF_DE_TERTIARY TREATMETN PLANT	white	Continuous	0.25	DESIGN INDUSTRIAL EFFLUENT FEATURE: TERTIARY TREATMENT PLANT

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

A.2.4 Potable Water

PROPOSED POTABLE WATER LINE				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
PW_DE_PWTM	Blue	Continuous	0.35	DESIGN POTABLE WATER FEATURE: POTABLE WATER TRANSMISSION MAIN
PW_DE_PWDIST	Blue	Continuous	0.25	DESIGN POTABLE WATER FEATURE: POTABLE WATER DISTRIBUTION
PW_DE_PWPS	Blue	Continuous	0.25	DESIGN POTABLE WATER FEATURE: POTABLE WATER PUMPING STATION
PW_DE_VCH	Blue	Continuous	0.25	DESIGN POTABLE WATER FEATURE: VALVE CHAMBER
PW_DE_FH	Blue	Continuous	0.25	DESIGN POTABLE WATER FEATURE: FIRE HYDRANT
PW_DE_POTRES	Blue	Continuous	0.25	DESIGN POTABLE WATER FEATURE: POTABLE WATER RESERVOIR
PW_DE_PWM	Blue	Continuous	0.25	DESIGN POTABLE WATER FEATURE: POTABLE WATER METER
PW_DE_PWFIT	Blue	Continuous	0.25	DESIGN POTABLE WATER FEATURE: POTABLE WATER FITTINGS

A.2.5 Recycled Water

PROPOSED RECYCLED WATER				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RW_DE_RWPM	Green	Continuous	0.35	DESIGN RECYCLED WATER FEATURE: RECYCLED WATER PUMPING MAIN
RW_DE_RWDIST	Green	Continuous	0.025	DESIGN RECYCLED WATER FEATURE: RECYCLED WATER DISTRIBUTION
RW_DE_RWPS	Green	Continuous	0.025	DESIGN RECYCLED WATER FEATURE: RECYCLED WATER PUMPING STATION
RW_DE_RWRES	Green	Continuous	0.025	DESIGN RECYCLED WATER FEATURE: RECYCLED WATER RESERVOIR
RW_DE_RWVCH	Green	Continuous	0.025	DESIGN RECYCLED WATER FEATURE: RECYCLED WATER VALVE CHAMBER
RW_DE_RWFIT	Green	Continuous	0.025	DESIGN RECYCLED WATER FEATURE: RECYCLED WATER FITTINGS

A.3 Road Layers

A.3.1 Road Design Layers

PROPOSED ROAD				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_DE_AFNCE	22	FENCELINE1	0.35	DESIGN ROAD FEATURE: ANIMAL FENCE
RD_DE_BICYL	green	Continuous	0.35	BICYCLE LANE
RD_DE_BRDG	yellow	Continuous	0.25	DESIGN ROAD FEATURE: BRIDGE FLYOVER
RD_DE_CHNL	red	HIDDEN2	0.18	DESIGN ROAD FEATURE: CHANNEL
RD_DE_CILND	green	Continuous	0.35	DESIGN ROAD FEATURE: ENTRAL/ROUNDAABOUT ISLAND
RD_DE_CLMN	red	Continuous	0.18	DESIGN ROAD FEATURE: COLUMN
RD_DE_CLVT	white	Continuous	0.25	DESIGN ROAD FEATURE : CULVERT
RD_DE_CNRL	red	CENTER2	0.18	DESIGN ROAD FEATURE: CENTERLINE
RD_DE_CSLPE	magenta	Continuous	0.35	DESIGN ROAD FEATURE: CONCRETE SLOPE PROTECTION
RD_DE_ECWAY	cyan	Continuous	0.5	DESIGN ROAD FEATURE: EDGE OF CARRIAGEWAY
RD_DE_FNCE	green	FENCELINE2	0.35	DESIGN ROAD FEATURE: FENCE
RD_DE_FTPH	11	Continuous	0.35	DESIGN ROAD FEATURE: FOOTPATH
RD_DE_GRAIL	white	Continuous	0.25	DESIGN ROAD FEATURE: GUARD RAIL
RD_DE_ILND	green	HIDDEN2	0.35	DESIGN ROAD FEATURE: ISLAND

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

PROPOSED ROAD				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_DE_JLND	green	Continuous	0.35	DESIGN ROAD FEATURE: JUNCTION ISLAND
RD_DE_KBDD	green	HIDDEN2	0.35	DESIGN ROAD FEATURE : DROPPED KERB
RD_DE_KBED	white	Continuous	0.25	DESIGN ROAD FEATURE: EDGE KERB
RD_DE_KBFL	yellow	DASHED2	0.25	DESIGN ROAD FEATURE: FLUSH KERB
RD_DE_KBRD	cyan	Continuous	0.5	DESIGN ROAD FEATURE: RAISED KERB
RD_DE_LOW	blue	DASHDOT2	0.7	LIMIT OF WORKS
RD_DE_EMBK	yellow	Continuous	0.25	DESIGN ROAD FEATURE: EMBANKMENT
RD_DE_MEDIAN	green	Continuous	0.35	DESIGN ROAD FEATURE: MEDIAN
RD_DE_OTHR	red	Continuous	0.18	DESIGN ROAD DATA : OTHER INFORMATION
RD_DE_PBAY	green	Continuous	0.35	DESIGN ROAD FEATURE: PARKING BAY
RD_DE_PDCCR	8	Continuous	0.2	DESIGN ROAD FEATURE: PEDESTRIAN CROSSING
RD_DE_PRAMP	green	Continuous	0.35	DESIGN ROAD FEATURE: PEDESTRIAN RAMP
RD_DE_PRKG	white	Continuous	0.25	DESIGN ROAD FEATURE: PARKING
RD_DE_PTS	yellow	Continuous	0.25	DESIGN ROAD DATA : IPS, CURVE POINTS ETC
RD_DE_PVMT	8	Continuous	0.2	DESIGN ROAD FEATURE: PAVEMENT (BITUMINOUS, CONCRETE ETC.)

Demonstration of Energy Efficient Seawater Desalination Technologies
near Activation Area at Dholera Special Investment Region

PROPOSED ROAD				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_DE_RAILWAY	white	TRACKS	0.25	DESIGN ROAD FEATURE: RAILWAY
RD_DE_RAMP	yellow	Continuous	0.25	DESIGN ROAD FEATURE: RAMP
RD_DE_RLVL	white	Continuous	0.25	DESIGN ROAD FEATURE: ROAD LEVEL
RD_DE_RNDA	white	Continuous	0.25	DESIGN ROAD FEATURE: ROUND ABOUT
RD_DE_RSTL	white	Continuous	0.25	DESIGN ROAD FEATURE: ROAD SPEED TABLE
RD_DE_SHLDR	green	Continuous	0.35	DESIGN ROAD FEATURE: SHOULDER
RD_DE_SPTR	20	Continuous	0.35	DESIGN ROAD FEATURE: ROAD SEPARATOR
RD_DE_UPSS	yellow	Continuous	0.25	DESIGN ROAD FEATURE: UNDERPASS TUNNEL
RD_DE_URAREA	40	DASHED2	0.35	DESIGN ROAD FEATURE: UTILITY RESERVE AREA
RD_DE_VBAR	magenta	Continuous	0.35	DESIGN ROAD FEATURE: VEHICLE BARRIER
RD_DE_VERGE	yellow	Continuous	0.25	DESIGN ROAD FEATURE: VERGE

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near Activation Area at Dholera Special Investment Region

EXISTING ROAD				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_EX_AFNCE	22	FENCELINE1	0.35	EXISTING ROAD FEATURE: ANIMAL FENCE
RD_EX_BICYL	green	Continuous	0.35	BICYCLE LANE
RD_EX_BRDG	yellow	Continuous	0.25	EXISTING ROAD FEATURE: BRIDGE FLYOVER
RD_EX_CHNL	red	HIDDEN2	0.18	EXISTING ROAD FEATURE: CHANNEL
RD_EX_CILND	green	Continuous	0.35	EXISTING ROAD FEATURE: ENTRAL/ROUNABOUT ISLAND
RD_EX_CLMN	red	Continuous	0.18	EXISTING ROAD FEATURE: COLUMN
RD_EX_CLVT	white	Continuous	0.25	EXISTING ROAD FEATURE : CULVERT
RD_EX_CNRL	red	CENTER2	0.18	EXISTING ROAD FEATURE: CENTERLINE
RD_EX_CSLPE	magenta	Continuous	0.35	EXISTING ROAD FEATURE: CONCRETE SLOPE PROTECTION
RD_EX_ECWAY	cyan	Continuous	0.5	EXISTING ROAD FEATURE: EDGE OF CARRIAGEWAY
RD_EX_FNCE	green	FENCELINE2	0.35	EXISTING ROAD FEATURE: FENCE
RD_EX_FTPH	11	Continuous	0.35	EXISTING ROAD FEATURE: FOOTPATH
RD_EX_GRAIL	white	Continuous	0.25	EXISTING ROAD FEATURE: GUARD RAIL
RD_EX_ILND	green	HIDDEN2	0.35	EXISTING ROAD FEATURE: ISLAND
RD_EX_JILND	green	Continuous	0.35	EXISTING ROAD FEATURE: JUNCTION ISLAND

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near Activation Area at Dholera Special Investment Region

EXISTING ROAD				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_EX_KBDD	green	HIDDEN2	0.35	EXISTING ROAD FEATURE : DROPPED KERB
RD_EX_KBED	white	Continuous	0.25	EXISTING ROAD FEATURE: EDGE KERB
RD_EX_KBFL	yellow	DASHED2	0.25	EXISTING ROAD FEATURE: FLUSH KERB
RD_EX_KBRD	cyan	Continuous	0.5	EXISTING ROAD FEATURE: RAISED KERB
RD_EX_LOW	blue	DASHDOT2	0.7	LIMIT OF WORKS
RD_EX_EMBK	yellow	Continuous	0.25	EXISTING ROAD FEATURE: EMBANKMENT
RD_EX_MEDIAN	green	Continuous	0.35	EXISTING ROAD FEATURE: MEDIAN
RD_EX_OTHR	red	Continuous	0.18	EXISTING ROAD DATA : OTHER INFORMATION
RD_EX_PBAY	green	Continuous	0.35	EXISTING ROAD FEATURE: PARKING BAY
RD_EX_PDCR	8	Continuous	0.2	EXISTING ROAD FEATURE: PEDESTRIAN CROSSING
RD_EX_PRAMP	green	Continuous	0.35	EXISTING ROAD FEATURE: PEDESTRIAN RAMP
RD_EX_PRKG	white	Continuous	0.25	EXISTING ROAD FEATURE: PARKING
RD_EX_PTS	yellow	Continuous	0.25	EXISTING ROAD DATA : IPS, CURVE POINTS ETC
RD_EX_PVMT	8	Continuous	0.2	EXISTING ROAD FEATURE: PAVEMENT (BITUMINOUS, CONCRETE ETC.)

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near Activation Area at Dholera Special Investment Region

EXISTING ROAD				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_EX_RAILWAY	white	TRACKS	0.25	EXISTING ROAD FEATURE: RAILWAY
RD_EX_RAMP	yellow	Continuous	0.25	EXISTING ROAD FEATURE: RAMP
RD_EX_RLVL	white	Continuous	0.25	EXISTING ROAD FEATURE: ROAD LEVEL
RD_EX_RNDA	white	Continuous	0.25	EXISTING ROAD FEATURE: ROUND ABOUT
RD_EX_RSTL	white	Continuous	0.25	EXISTING ROAD FEATURE: ROAD SPEED TABLE
RD_EX_SHLDR	green	Continuous	0.35	EXISTING ROAD FEATURE: SHOULDER
RD_EX_SPTR	20	Continuous	0.35	EXISTING ROAD FEATURE: ROAD SEPARATOR
RD_EX_UPSS	yellow	Continuous	0.25	EXISTING ROAD FEATURE: UNDERPASS TUNNEL
RD_EX_URAREA	40	DASHED2	0.35	EXISTING ROAD FEATURE: UTILITY RESERVE AREA
RD_EX_VBAR	magenta	Continuous	0.35	EXISTING ROAD FEATURE: VEHICLE BARRIER
RD_EX_VERGE	yellow	Continuous	0.25	EXISTING ROAD FEATURE: VERGE

A.3.2 Traffic and Safety

TRAFFIC & SAFETY - DESIGN				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_DE_TS_BARL	green	Continuous	0.35	TRAFFIC: BARRIERS, RAILS & BOLLARDS
RD_DE_TS_CTRL-BOX	red	Continuous	0.18	TRAFFIC: CONTROL BOX OR SERVICE BOX
RD_DE_TS_DET-LOOP	8	Continuous	0.2	TRAFFIC : DETECTOR LOOP
RD_DE_TS_DUCT	30	Continuous	0.35	TRAFFIC : DUCT
RD_DE_TS_HMPL	8	Continuous	0.2	TRAFFIC : SPEED HUMPS
RD_DE_TS_INCH	12	Continuous	0.35	TRAFFIC : INSPECTION CHAMBER
RD_DE_TS_MNHL	yellow	Continuous	0.25	TRAFFIC : MANHOLE
RD_DE_TS_OHLL	white	Continuous	0.25	TRAFFIC : OVERHEAD CABLE/LINE
RD_DE_TS_OTHR	yellow	Continuous	0.25	TRAFFIC : OTHER
RD_DE_TS_PBDG	31	Continuous	0.35	TRAFFIC : PEDESTRIAN BRIDGE
RD_DE_TS_PGR	40	Continuous	0.35	TRAFFIC : PEDESTRIAN GUARDRAIL
RD_DE_TS_PUP	13	Continuous	0.35	TRAFFIC : PEDESTRIAN UNDERPASS
RD_DE_TS_RDSN	yellow	Continuous	0.25	TRAFFIC: ROAD DIRECTIONAL SIGNS (EX: DIRECTIONS, LIMITS ETC.)
RD_DE_TS_SIGN	white	Continuous	0.25	TRAFFIC: SIGNS (EX: WARNINGS, SPEED LIMITS ETC.)
RD_DE_TS_SIGN-POST	white	Continuous	0.25	TRAFFIC : SIGN POST

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near Activation Area at Dholera Special Investment Region

TRAFFIC & SAFETY - DESIGN				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_DE_TS_SIGNAL	white	Continuous	0.25	TRAFFIC SIGNAL
RD_DE_TS_SIGNAL-POST	white	Continuous	0.25	TRAFFIC SIGNAL POST/POLE
RD_DE_TS_STNM	green	Continuous	0.35	TRAFFIC : STREET NAME POST/SIGN
RD_DE_TS_STUDS	8	Continuous	0.2	TRAFFIC : STUDS
RD_DE_TS_TEXT	white	Continuous	0.25	TRAFFIC : ANNOTATIONS /DESCRIPTIVE TEXT
RD_DE_TS_TPP	8	Continuous	0.2	TRAFFIC : POLICE PLATFORM
RD_DE_TS_UGLL	yellow	Continuous	0.25	TRAFFIC : UNDERGROUND CABLE/LINE

TRAFFIC & SAFETY - EXISTING				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_DE_TS_BARL	green	Continuous	0.35	TRAFFIC: BARRIERS, RAILS & BOLLARDS
RD_EX_TS_CTRL-BOX	red	Continuous	0.18	TRAFFIC: CONTROL BOX OR SERVICE BOX
RD_EX_TS_DET-LOOP	8	Continuous	0.2	TRAFFIC : DETECTOR LOOP
RD_EX_TS_DUCT	30	Continuous	0.35	TRAFFIC : DUCT
RD_EX_TS_HMPL	8	Continuous	0.2	TRAFFIC : SPEED HUMP
RD_EX_TS_INCH	12	Continuous	0.35	TRAFFIC : INSPECTION CHAMBER

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near Activation Area at Dholera Special Investment Region

TRAFFIC & SAFETY - EXISTING				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_EX_TS_MNHL	yellow	Continuous	0.25	TRAFFIC : MANHOLE
RD_EX_TS_OHLL	white	Continuous	0.25	TRAFFIC : OVERHEAD CABLE/LINE
RD_EX_TS_OTHR	yellow	Continuous	0.25	TRAFFIC : OTHER
RD_EX_TS_PBDG	31	Continuous	0.35	TRAFFIC : PEDESTRIAN BRIDGE
RD_EX_TS_PGR	40	Continuous	0.35	TRAFFIC : PEDESTRIAN GUARDRAIL
RD_EX_TS_PUP	13	Continuous	0.35	TRAFFIC : PEDESTRIAN UNDERPASS
RD_EX_TS_RDSN	yellow	Continuous	0.25	TRAFFIC : ROAD DIRECTIONAL SIGNS (EX: DIRECTIONS, LIMITS ETC.)
RD_EX_TS_SIGN	white	Continuous	0.25	TRAFFIC : SIGNS (EX: WARNINGS, SPEED LIMITS ETC.)
RD_EX_TS_SIGN-POST	white	Continuous	0.25	TRAFFIC : SIGN POST
RD_EX_TS_SIGNAL	white	Continuous	0.25	TRAFFIC SIGNAL
RD_EX_TS_SIGNAL-POST	white	Continuous	0.25	TRAFFIC SIGNAL POST/POLE
RD_EX_TS_STNM	green	Continuous	0.35	TRAFFIC : STREET NAME POST/SIGN
RD_EX_TS_STUDS	8	Continuous	0.2	TRAFFIC : STUDS
RD_EX_TS_TEXT	white	Continuous	0.25	TRAFFIC : ANNOTATIONS /DESCRIPTIVE TEXT
RD_EX_TS_TPP	8	Continuous	0.2	TRAFFIC : POLICE PLATFORM
RD_EX_TS_UGLL	yellow	Continuous	0.25	TRAFFIC : UNDERGROUND CABLE/LINE

A.3.3 Street Lighting Layers

STREET LIGHTING - PROPOSED				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_DE_ST_CBLE	cyan	Continuous	0.5	STREET LIGHTING CABLE
RD_DE_ST_DUCT	20	Continuous	0.35	STREET LIGHTING DUCT
RD_DE_ST_FDPL	magenta	Continuous	0.35	STREET LIGHTING FEEDER PILLAR
RD_DE_ST_POLE	yellow	Continuous	0.25	STREET LIGHTING POLE
RD_DE_ST_SUBSTN	cyan	Continuous	0.5	STREET LIGHTING SUBSTATION
RD_DE_ST_TEXT	white	Continuous	0.25	STREET LIGHTING ANNOTATION/TEXT

STREET LIGHTING - EXISTING				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_EX_ST_CBLE	cyan	DASHED2	0.5	STREET LIGHTING CABLE
RD_EX_ST_DUCT	20	HIDDEN2	0.35	STREET LIGHTING DUCT
RD_EX_ST_FDPL	magenta	Continuous	0.35	STREET LIGHTING FEEDER PILLAR
RD_EX_ST_POLE	8	Continuous	0.25	STREET LIGHTING POLE
RD_EX_ST_SUBSTN	cyan	Continuous	0.5	STREET LIGHTING SUBSTATION
RD_EX_ST_TEXT	white	Continuous	0.25	STREET LIGHTING ANNOTATION/TEXT

A.3.4 Road Furniture Layers

ROAD FURNITURE LAYERS				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_F_BNCH	yellow	Continuous	0.25	ROAD/STREET FURNITURE: BENCH/SEAT
RD_F_LGHT	white	Continuous	0.25	ROAD/STREET FURNITURE: LIGHTING
RD_F_OTHR	white	Continuous	0.25	ROAD/STREET FURNITURE: OTHERS
RD_F_POLE	yellow	Continuous	0.25	ROAD/STREET FURNITURE: POLE
RD_F_TEXT	white	Continuous	0.25	ROAD/STREET FURNITURE: ANNOTATION/TEXT

A.3.5 Roads – Common Layers

(ROADS) - COMMON LAYERS				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_C_25DASH	white	DASHED2	0.25	HIDDEN DETAILS
RD_C_25HID	white	HIDDEN2	0.25	HIDDEN DETAILS
RD_C_50OUT	cyan	Continuous	0.5	ALL CONCRETE OUTLINES IN SECTION
RD_C_50REBARS	cyan	Continuous	0.5	REINFORCEMENTDETAILS
RD_C_CHAIN_TEXT	white	Continuous	0.25	CHAINAGE TEXT
RD_C_CHAIN_TICK	yellow	Continuous	0.25	CHAINAGE TICK MARK
RD_C_CONT_MAJR	8	Continuous	0.2	MAJOR CONTOUR
RD_C_CONT_MINR	9	Continuous	0.15	MINOR CONTOUR
RD_C_COORD_GRID	252	Continuous	0.15	COORDINATE GRID
RD_C_CTRLINE	red	CENTER2	0.18	CENTRE LINE
RD_C_HATCH	red	Continuous	0.18	HATCH
RD_C_MATCH_LINE	blue	PHANTO M	0.7	SHEET CONTINUATION MATCH LINE
RD_C_PROF	cyan	DASHED2	0.5	PROFILES
RD_C_PROF-LINE	green	Continuous	0.35	PROFILE LINES
RD_C_PROF_GRID_M AJR	8	Continuous	0.2	PROFILE GRIDLINE @ MAJOR STATIONS
RD_C_PROF_GRID_MI NOR	9	Continuous	0.15	PROFILE GRIDLINE @ MINOR STATIONS

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(ROADS) - COMMON LAYERS				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
RD_C_SPT_HGT	yellow	Continuous	0.25	SURVEY ROAD FEATURE : SPOT HEIGHT MARKER && TEXT
RD_C_SPT_NUM	yellow	Continuous	0.25	SURVEY ROAD FEATURE : SURVEY POINT NUMBER
RD_C_TABLE	white	Continuous	0.25	TABLES
RD_C_TEXT	white	Continuous	0.25	COMMON TEXT

A.4 Utilities Layers

A.4.1 Electricity

(ELECTRICITY)				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
SVE_11KV	240	ACAD_ISO04W100	0.35	SERVICES FIXTURES (ELECTRICITY) : 11KV
SVE_132K	240	ACAD_ISO04W100	0.35	SERVICES FIXTURES (ELECTRICITY) : 132KV
SVE_66KV	240	ACAD_ISO04W100	0.35	SERVICES FIXTURES (ELECTRICITY) : 66KV
SVE_ABDL	13	Continuous	0.35	SERVICES FIXTURES (ELECTRICITY) : ABANDONED LINE
SVE_DUCT	10	Continuous	0.35	SERVICES FIXTURES (ELECTRICITY) : ELECTRICITY DUCT
SVE_ERTH_PIT	8	Continuous	0.2	SERVICES FIXTURES (ELECTRICITY) : EARTH PIT
SVE_FT_TEE	30	Continuous	0.35	SERVICES FIXTURES (ELECTRICITY) : ELECTRICAL FITTING TEE
SVE_LOVV	220	Continuous	0.35	SERVICES FIXTURES (ELECTRICITY) : LOW VOLTAGE
SVE_MEDV	150	Continuous	0.35	SERVICES FIXTURES (ELECTRICITY) : MEDIUM VOLTAGE
SVE_MHLL	white	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY) : UTILITY/MANHOLE
SVE_MNHL	white	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY) : MANHOLE
SVE_MRKR	white	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY) : MARKER

Demonstration of Energy Efficient Seawater Desalination Technologies
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(ELECTRICITY)				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
SVE_OHLL	white	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY) : OVERHEAD LINE
SVE_OTHR	white	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY) : OTHER
SVE_POLE	white	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY) : POST/POLE
SVE_PYLN	white	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY) : PYLON
SVE_SBOX	white	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY) : SERVICE BOX
SVE_SJNT	green	Continuous	0.35	SERVICES FIXTURES (ELECTRICITY) : ELECTRICAL STRAIGHT JOINT
SVE_SSTL	yellow	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY) : SUBSTATION
SVE_TEXT	white	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY): ANNOTATION / TEXT
SVE_TRANSF	cyan	Continuous	0.5	SERVICES FIXTURES (ELECTRICITY) : TRANSFORMER
SVE_UGLL	white	Continuous	0.25	SERVICES FIXTURES (ELECTRICITY) : UNDERGROUND LINE

A.4.2 Oil and Gas

OIL & GAS				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
SVO_BNDL	171	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : BUND
SVO_DUCT	241	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : OIL / GAS DUCT
SVO_GVLV	171	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : GAS VALVE
SVO_MNHL	171	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : MANHOLE
SVO_MRKR	171	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : MARKER
SVO_OTHR	171	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : OTHER
SVO_PLNL	171	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : PIPE LINE
SVO_POLE	171	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : POST / POLE
SVO_PUMP	171	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : PUMP
SVO_SBOX	171	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : SERVICE BOX
SVO_TANK	171	Continuous	0.35	SERVICES FIXTURES (OIL AND GAS) : TANK
SVO_TEXT	white	Continuous	0.25	SERVICES FIXTURES (OIL AND GAS) : ANNOTATION / TEXT

A.4.3 Telecommunications

TELECOMMUNICATIONS				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
SVT_ABDL	13	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : TELEPHONE ABANDONED LINE
SVT_ACCOR	20	DASHED2	0.35	SERVICES FIXTURES (TELECOMS) : AERIAL CABLE CORRIDOR
SVQ_BCCOR	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : BURRIED CABLE CORRIDOR
SVQ_BOOT	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : TELEPHONE BOOTH
SVQ_DIST_PT	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : DISTRIBUTION POINT
SVQ_DOTL	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : OTHER
SVQ_DUCT	yellow	Continuous	0.25	SERVICES FIXTURES (TELECOMS) : DUCT
SVQ_JBOX	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : JOINT BOX
SVQ_MNHL	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : MANHOLE
SVQ_OHLN	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : OVERHEAD LINE
SVQ_OTHR	20	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : OTHER
SVQ_POLE	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : POST / POLE

Demonstration of Energy Efficient Seawater Desalination Technologies
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TELECOMMUNICATIONS				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
SVQ_SBOX	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : SERVICE BOX
SVQ_SCCOR	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : SURFACE CABLE CORRIDOR
SVQ_SSTA	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : SUBSTATION
SVQ_TEXT	white	Continuous	0.25	SERVICES FIXTURES (TELECOMS) : ANNOTATION / TEXT
SVQ_TOWR	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : TOWER
SVQ_TRAN_NT WK	10	DASHDOT	0.6	SERVICES FIXTURES (TELECOMS) : TRANSMISSION NETWORK
SVQ_TRAN_PT	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : TRANSMISSION POINT
SVQ_UDCOR	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : UNDER GROUND DUCT CORRIDOR
SVQ_UGLN	30	Continuous	0.35	SERVICES FIXTURES (TELECOMS) : UNDER GROUND LINE

A.4.4 Water

WATER				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
SVW_ABDL	13	Continuous	0.35	SERVICES FIXTURES (WATER) : ABANDONED WATER LINE
SVW_BNDL	130	Continuous	0.35	SERVICES FIXTURES (WATER) : BUND
SVW_CLR_PT	200	Continuous	0.35	SERVICES FIXTURES (WATER) : CHLORINATION POINT
SVW_CPRT	200	Continuous	0.35	SERVICES FIXTURES (WATER) : CASING PROTECTION
SVW_DRKL	130	Continuous	0.35	SERVICES FIXTURES (WATER) : DRINKING AREA
SVW_DUCT	30	Continuous	0.35	SERVICES FIXTURES (WATER) : DUCT
SVW_FT_ADPT R	150	Continuous	0.35	SERVICES FIXTURES (WATER) : FITTING ADAPTER
SVW_FT_BEND	150	Continuous	0.35	SERVICES FIXTURES (WATER) : FITTING BEND
SVW_FT_ENDC AP	150	Continuous	0.35	SERVICES FIXTURES (WATER) : FITTING ENDCAP
SVW_FT_RDCR	150	Continuous	0.35	SERVICES FIXTURES (WATER) : FITTING REDUCER
SVW_FT_TEE	150	Continuous	0.35	SERVICES FIXTURES (WATER) : FITTING TEE
SVW_GCHNL	200	Continuous	0.35	SERVICES FIXTURES (WATER) : GRAVITY CHANNEL
SVW_GPIPE	200	Continuous	0.35	SERVICES FIXTURES (WATER) : GRAVITY PIPE

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WATER				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
SVW_HYDR	200	Continuous	0.35	SERVICES FIXTURES (WATER) : HYDRANT
SVW_METER	200	Continuous	0.35	SERVICES FIXTURES (WATER) : METER
SVW_MNHL	170	Continuous	0.35	SERVICES FIXTURES (WATER) : MANHOLE
SVW_MRKR	130	Continuous	0.35	SERVICES FIXTURES (WATER) : MARKER
SVW_PIPE	170	Continuous	0.35	SERVICES FIXTURES (WATER) : WATER PIPE LINE
SVW_PUMP	200	Continuous	0.35	SERVICES FIXTURES (WATER) : PUMP
SVW_SCSR	200	Continuous	0.35	SERVICES FIXTURES (WATER) : SCADA SENSOR
SVW_SPIPE	200	Continuous	0.35	SERVICES FIXTURES (WATER) : SERVICE PIPE
SVW_STRG_PT	200	Continuous	0.35	SERVICES FIXTURES (WATER) : STORAGE POINT
SVW_TANK	230	Continuous	0.35	SERVICES FIXTURES (WATER) : TANK
SVW_TANK_FIL_PT	200	Continuous	0.35	SERVICES FIXTURES (WATER) : TANKER FILLING POINT
SVW_TEXT	white	Continuous	0.25	SERVICES FIXTURES (WATER) : ANNOTATION / TEXT
SVW_VALV	160	Continuous	0.35	SERVICES FIXTURES (WATER) : WATER SLUICE VALVE, AIR VALVE, FLOW CONTROL VALVE, SERVICE VALVE, SYSTEM VALVEVALVE
SVW_WELL	200	Continuous	0.35	SERVICES FIXTURES (WATER) : WELL
SVW_WFAC	200	Continuous	0.35	SERVICES FIXTURES (WATER) : WATER FACILITY

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WATER				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
SVW_WMAIN	170	DASHDOT 2	0.35	SERVICES FIXTURES (WATER) : WATER MAIN
SVW_WSCON	200	Continuous	0.35	SERVICES FIXTURES (WATER) : WATER SERVICE CONENCTION

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A.4.5 Commercial

COMMERCIAL				
Layer Name	Screen Colour	Line type	Plotted Line weight	Description
SVC_TEXT	white	Continuous	0.25	SERVICE FIXTURES (COMMERCIAL) : ANNOTATION / TEXT
SVC_SBDL	white	Continuous	0.25	SERVICE FIXTURES (COMMERCIAL) : SIGNBOARD
SVC_POLE	white	Continuous	0.25	SERVICE FIXTURES (COMMERCIAL) : POST / POLE
SVC_OTHR	white	Continuous	0.25	SERVICE FIXTURES (COMMERCIAL) : OTHER FEATURES
SVC_BBDL	30	Continuous	0.25	SERVICE FIXTURES (COMMERCIAL) : BILLBOARD
SVC_BANK	white	Continuous	0.25	SERVICE FIXTURES (COMMERCIAL) : ATM AND SIMILAR FEATURES

Appendix B – USEFUL TABLES FOR AUTOCAD

Annexure – II – CAD Guidelines

(Schedule - Q)

Appendix B - Useful Tables for AutoCAD

Table 1 - Model Space Zoom XP Factors (Metres)

Scale of Drawing	Zoom XP Scale
1 : 1000	1
1 : 1250	0.8
1 : 2500	0.4
1 : 5000	0.2
1 : 10000	0.1
1 : 25000	0.04
1 : 50000	0.02
1 : 500	2
1 : 200	5
1 : 100	10
1 : 50	20
1 : 20	50
1 : 10	100
1 : 5	200
1 : 2	500
1 : 1	1000

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Table 2 – Model Space Zoom XP Factors (Millimetres)

Scale of Drawing	Zoom XP Scale
1 : 500	0.002
1 : 200	0.005
1 : 100	0.01
1 : 50	0.02
1 : 20	0.05
1 : 10	0.1
1 : 5	0.2
1 : 2	0.5
1 : 1	1

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Table 3 - Text Heights for use in Model Space (Metres)

Scale of Drawing	Factor (Multiply)	Text Height		
		0.25 Pen	0.35 Pen	0.5 Pen
1 : 1000	1.00	2.5	3.5	5
1 : 1250	1.25	3.125	4.375	6.25
1 : 2500	2.50	6.25	8.75	12.5
1 : 5000	5	12.5	17.5	25
1 : 10000	10	25	35	50
1 : 25000	25	62.5	87.5	125
1 : 50000	50	125	175	250
1 : 500	0.5	1.25	1.75	2.5
1 : 200	0.2	0.5	0.7	1
1 : 100	0.1	0.25	0.35	0.5
1 : 50	0.05	0.125	0.175	0.25
1 : 20	0.02	0.05	0.07	0.1
1 : 10	0.01	0.025	0.035	0.05
1 : 5	0.005	0.0125	0.0175	0.025
1 : 2	0.002	0.005	0.007	0.01
1 : 1	0.001	0.0025	0.0035	0.005

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Table 4 - Text Heights for use in Model Space (Millimetres)

Scale of Drawing	Factor (Multiply)	Text Height		
		0.25 Pen	0.35 Pen	0.5 Pen
1 : 500	500	500	1250	1750
1 : 200	200	200	500	700
1 : 100	100	100	250	350
1 : 50	50	50	125	175
1 : 20	20	20	50	70
1 : 10	10	10	25	35
1 : 5	5	5	12.5	17.5
1 : 2	2	2	5	7
1 : 1	1	1	2.5	3.5

Appendix C – DRAWING TYPE AND DRAWING NUMBER SERIES

Annexure – II – CAD Guidelines

(Schedule - Q)

Appendix C Project Number

PHASE 1A	Project Codes
TP1 AND TP2 URBAN DEVELOPMENT	
TP2E Roads and Services	TP2E-RS
TP2W Roads and Services	TP2W-RS
TP1 Roads and Services	TP1-RS
Activation Area Roads and Services	TP2E-AA

Appendix C Originator Code

Originator Code	Design Consultant Name
AECOM	AECOM
DMICDC	Delhi Mumbai Industrial Corridor Development Corporation Limited
GIDB	Gujarat Industrial Development Board
GICC	Gujarat Industrial Corridor Corporation
DSIRDA	Dholera Special Investment Regional Development Authority
LBG	Louis Berger Group
DEP	Design Point
TCE	Tata Consulting Engineering
ATK	Atkins

Appendix C Drawing Type Code

Document Code	Description
DWG	DRAWING
DL	DRAWING LIST

Appendix C - Drawing Type and Drawing Number Series

Discipline / Drawing Type	Title Series	Drawing No.
SK – Sketch Drawings	General Layouts and miscellaneous drawings	0000 - 0249
	Geotechnical	0250 - 0499
	Highways	0500 - 0999
	Site Clearance	1000 - 1499
	Traffic	1500 - 1999
	Street Lighting	2000 - 2499
	Fencing	2500 - 2999
	Grading	3000 - 3999
	Structures	4000 - 4999
	Utility Services Corridors	5000 - 5499
	Surface Water	5500 - 5999
	Foul Sewer	6000 - 6499
	Treated Sewerage Effluent	6500 - 6999
	Potable Water	7000 - 7499
	Fire Water	7500 - 7999
	Electricity	8000 - 8499
	Telecommunications/	8500 - 8999
Environmental	9000 - 9499	
Landscape	9500 - 9999	

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Discipline / Drawing Type	Title Series	Drawing No.
GE - General	Drawing Lists	0001 - 0999

GT - Geotechnical	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999

	Standard & Miscellaneous Details	7000 - 7999
HW - Highways	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, District, Zone & Municipality Boundaries, Road Corridor etc..	0001 - 0999
	Cross Sections (Detailed and Typical), Pavement Types	1000 - 1999
	Proposed Road Layout & Key Plan	2000 - 2999
	Setting Out Plan (Horizontal Alignment Plan)	3000 - 3999
	Road Profiles	4000 - 4999
	Junction Layout Plan and Levels	5000 - 5999
	Swept Path Analysis For Junctions	6000 - 6999
	Standard & Miscellaneous Details	7000 - 7999
	Detail Road Signs & Markings	8000 - 8999
SC – Site Clearance	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Site Clearance Layout & Key plan	2000 - 2999

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Discipline / Drawing Type	Title Series	Drawing No.
	Standard & Miscellaneous Details	7000 - 7999

TR - Traffic/ Transport	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Traffic Flow	1000 - 1999
	Bus Route	2000 - 2999
	Traffic Signal	3000 - 3999
	Traffic Management Plan	4000 - 4999
	Traffic Diversion Plan	5000 - 5999

	Standard & Miscellaneous Details	7000 - 7999

SL - Street Lighting	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Street Lighting Typical Cross Sections	
	Street Lighting Layout & Keyplan	2000 - 2999
	Electrical Work For Road Lighting and Traffic Signs	3000 - 3999
	Standard & Miscellaneous Details	7000 - 7999
FE - Fencing	General Notes, Abbreviations & Legends, Location plan, General Key Plan, etc.	0001 - 0999

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Discipline / Drawing Type	Title Series	Drawing No.
	Fencing Layout & Keyplan	2000 - 2999
	Standard & Miscellaneous Details	7000 - 7999

GR - Grading	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Existing Grading and Topographic Survey Layout Plan & Keyplan	1000 - 1999
	Proposed Grading Layout & Keyplan	2000 - 2999

	Standard & Miscellaneous Details	7000 - 7999

ST - Structures	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	GAD of Structures	1000 - 1999

	Standard & Miscellaneous Details	7000 - 7999

UC - Utility Services Corridor	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Utility Cross Sections	1000 - 1999
	Combined Utilities Plan Layout	2000 - 2999

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Discipline / Drawing Type	Title Series	Drawing No.
	Standard & Miscellaneous Details	7000 - 7999

PW - Potable Water	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Potable Water Network Plan	
	Proposed Potable Water Layout & Keplan	2000 - 2999
	Longitudinal Sections (Profiles)	3000 - 3999
	GAD of MBR and Pump Houses, SLD for the pumping arrangement from MBR, GAD of ESRs	4000 - 4999

	Standard & Miscellaneous Details	7000 - 7999
	SCADA system for Potable water distribution network	8000 - 8999
RW - Recycle Water	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Recycle Water Network Plan	1000 - 1999
	Proposed TSE Layout & Keyplan	2000 - 2999
	Longitudinal Sections (Profiles)	3000 - 3999

	Standard & Miscellaneous Details	7000 - 7999

FS - Sewerage	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999

Demonstration of Energy Efficient Seawater Desalination Technologies
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Discipline / Drawing Type	Title Series	Drawing No.
	Sewerage Network	1000 - 1999
	Sewer Layout & Keyplan	2000 - 2999
	Longitudinal Sections (Profiles)	3000 - 3999

	Standard & Miscellaneous Detail	7000 - 7999
IE- Industrial Effluent	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Industrial Effluent Network Plan	1000 - 1999
	Proposed Industrial Effluent Layout & Keplan	2000 - 2999
	Longitudinal Sections (Profiles)	3000 - 3999

	Standard & Miscellaneous Details	7000 - 7999
SWD – Storm Water Drainage	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Surface Water Network Plan	1000 - 1999
	Proposed Surface Water Layout & Keyplan	2000 - 2999
	Longitudinal Sections (Profiles)	3000 - 3999

	Standard & Miscellaneous Details	7000 - 7999

Demonstration of Energy Efficient Seawater Desalination Technologies
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Discipline / Drawing Type	Title Series	Drawing No.
STP- Sewage Treatment Plant	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc	0001 - 0999
	STP Layout Plan, Hydraulic flow, process flow diagram, Process And Instrumentation Diagram, Electrical single line diagram etc., STP Network Plan.	1000 - 1999
	Detail Layout & Keplan	2000 - 2999
	GAD of STP	4000 - 4999
	PLC /Automation system for the STP, PLC system for the Sewage pumping (intermediate and terminal) and treatment systems	5000 - 5999
	Standard & Miscellaneous Details	7000 - 7999

CETP – Common Effluent Treatment Plant	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc	0001 - 0999
	CETP Layout Plan, Hydraulic flow, process flow diagram, Process And Instrumentation Diagram, Electrical single line diagram etc., CEPT Network Plan	1000 - 1999
	Detail Layout & Keplan	2000 - 2999
	GAD of CETP	4000 - 4999
	PLC /Automation system for the CETP, PLC system for the effluent pumping (intermediate and terminal) and treatment systems	5000 - 5999
	Standard & Miscellaneous Details	7000 - 7999

EL - Electricity	General Notes, Abbreviations & Legends, Location	0001 - 0999

Demonstration of Energy Efficient Seawater Desalination Technologies
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Discipline / Drawing Type	Title Series	Drawing No.
	Plan, General Key Plan, Cluster layout, zoning etc.	
	Sub-station & network Layout, Single line diagram, General Arrangement etc.	1000 - 1999
	Extra High Voltage Electricity Supply Layout & Keyplan	2000 - 2999
	High Voltage Electricity Supply Layout & Keyplan	3000 - 3999
	Medium Voltage Electricity Supply Layout & Keyplan	4000 - 4999
	Low Voltage Electricity Supply Layout & Keyplan	5000 - 5999

	Standard & Miscellaneous Details	7000 - 7999

ICT	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	ICT Network plan	1000 - 1999
	Telecom Layout & Keyplan	2000 - 2999

	Standard & Miscellaneous Details	7000 - 7999

EN - Environmental	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Existing Site Features	1000 - 1999
	Sensitive Receptors	2000 - 2999
	Surveys & Investigations	3000 - 3999

Demonstration of Energy Efficient Seawater Desalination Technologies
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Discipline / Drawing Type	Title Series	Drawing No.
	Monitoring Locations	4000 - 4999

	Standard & Miscellaneous Details	7000 - 7999

LS - Landscape	General Notes, Abbreviations & Legends, Location Plan, General Key Plan, etc.	0001 - 0999
	Landscape Layout & Key plan (General Arrangement)	1000 - 1999
	Hardscape	2000 - 2999
	Soft scape	3000 - 3999
	Grading & Levels	4000 - 4999
	Landscape Furniture & Lighting	5000 - 5999
	Irrigation (Mainline, Drip & Spray)	6000 - 6999
	Standard & Miscellaneous Details	7000 - 7999

Schedule R - (Guidelines for Quality, Health, Safety and Environment Plan)

(See Clause 3.1.7 L)

The Contractor shall prepare and submit a project specific Health, Safety and Environment (HSE) plan based on the Manual for Quality, Health, Safety, and Environmental Procedures within 30 days of the Appointed Date and implement the same diligently during the contract period

Schedule S - Project Control / Management - Terms of Reference

The Contractor shall perform all the Project Management activities necessary for proper planning, management and control of the work. Below are some of the typical tasks that are required to be performed by contractor:

1. Participate in the project kick-off workshop with project stakeholders designated by Employer/ PMNC. The kick-off workshop shall accomplish the following objectives:
 - Common understanding of the project goals and objectives
 - Define respective roles and responsibilities and
 - Agree on the methods of communication and reporting throughout the project duration.
2. Participate in monthly project status review meetings and present the project progress update in the meeting. The frequency of project status review meetings may change based on actual requirements.
3. **Schedule:** The Contractor shall submit a Level 3 schedule that cover's the full scope of Contractor's work within 20 calendar days from date of appointment. This will be reviewed within 10 calendar days by Employer /PMNC. The Contractor shall incorporate the comments and resubmit the schedule no later than 10 calendar days after receiving the comments from Employer/ PMNC. Upon approval the level 3 schedule will become the baseline schedule for all the future monitoring and tracking.

The Contractor should keep to the following guidelines

- i. Develop and incorporate a detailed Work Breakdown Structure (WBS) for all project schedules that are submitted.
 - ii. All schedules shall be created, maintained and submitted to Employer /PMNC in the latest version of Oracle Primavera P6 or equivalent in an electronic format.
 - iii. All schedules shall follow the Critical Path Method (CPM) of scheduling and shall have meaningful and realistic logical ties and relationships between activities.
 - iv. The use of negative lags is not permitted in the baseline and all other versions of the schedule.
 - v. The schedule must contain all the long lead procurement items identified.
 - vi. Shall exercise reasonableness while assigning constraints in schedule and milestones
 - vii. Upon approval, the copy of the Baseline schedule will become the first Current Schedule.
 - viii. The Current schedule shall be actively updated and maintained by the Contractor every month.
 - ix. The updated Primavera P6 or equivalent schedule file should be submitted every month along with Monthly progress report in electronic format. A pdf copy of the updated schedule with all activities also needs to be submitted
 - x. A schedule narrative document shall accompany the updated electronic schedule describing the work performed in the reporting period.
4. **Cash Flow:** Prepare project cash flow at the start of the project. Prepare monthly statements to show the actual versus plan spending; update the cost periodically

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5. **Risk Register:** Maintain an active risk register addressing the risks and mitigation measures (could be in excel format) that lists the project risks related to their Scope of Work.
6. **Inter-Project Links:** Identify potential inter-project links, inter-dependencies or conflicts / interference to work or work areas and narrate them in the monthly progress report.
7. **Monthly Progress Report:** Prepare and submit a monthly progress report (standard format and template will be provided by Employer /PMNC at a later date). Items 3 to 6 mentioned above shall be the minimum information that will need to be included in the monthly progress report.
8. For better collaboration, Contractor shall use the Programme and Document Management system that will be provided by Employer/PMNC at a later date and pay for the cost of procuring licenses to use the system.
9. Timely submission of monthly progress report and the monthly updated electronic schedule file in the required and acceptable format.

Tender Drawings