NOIDA METRO RAIL CORPORATION LIMITED

CONTRACT NO: NMRC/Projects/NGNEDDC/2025/415

Contract NGNEDDC: Detail Design Consultant (DDC) for Civil, Architectural and E&M works including Traction works for Elevated Sections of Extension Projects of Aqua Line from Noida Sec-51 to Knowledge Park-V, Noida Sec-142 to Botanical Garden & Depot Station to Boraki including augmentation of existing depot and RSS works (31.595 km).

VOLUME-3

Scope of Works

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SCOPE OF WORK

1 INTRODUCTION

1.1 Purpose of this Document

Noida Metro Rail Corporation Ltd. (NMRC) has started the development of 03 Extension Corridors of its Existing Operational Aqua Line metro which comprises of 31.595 km Elevated Corridors and 21 nos. of Elevated Stations along with augmentation of the existing Depot. These extension corridors have to be realized within the next 5 years. Thus, it is proposed to engage a Detail Design Consultant (DDC) for Civil, Architectural, Traction & Power Supply (RSS, TSS, ASS), Augmentation of Existing Depot including SCADA and Building Services Works for these 03 extension corridors of Noida Metro Project.

This document describes the General Scope of Services to be provided by the Detailed Design Consultant (DDC). The emphasis is to explain the requirement of work, interfaces with other DDCs/ Contractors/ NMRC for achieving an efficient and safe system to the best International Standards and Practices. DDC shall follow acceptable standards and design procedures akin to best systems wherever not explicitly mentioned.

2. EXTENT OF SERVICES

2.1 Services to be provided

The DDC shall perform the Services set out in this Agreement.

The DDC shall deliver sufficient designs and documents to enable NMRC to construct works as per the details below:

S. No.	Description of Corridor	Total Elevated Length (Km)	Elevated Station (In Nos.)	RSSs
1.	Extension of Aqua Line from Noida Sector - 51 to Knowledge Park V (Greater Noida)	17.435	11	1
2.	Extension of Aqua Line from Noida Sector – 142 to Botanical Garden (Noida)	11.56	8	1
3.	Extension of Aqua Line from Depot Station to Boraki MMTH (Greater Noida)	2.6	2	0
	Total -	31.595	21	2

Note –

a. All 03 extension corridors are planned as Elevated corridors having a total length of 31.595 kms comprising of 21 Elevated Stations.

b. DDC shall take into consideration all the Service/Systems of the Existing Aqua Line Corridor for the Integrated Planning and Seamless Connection of the 03 Extension Corridors to the Existing Operation Aqua Line.

2.1.1 These Services generally include, but are not limited to:

a) Prepare and Review of Tender drawings of Civil works also including Entry Exit structures, Architectural finishing, water supply, Sanitary installations & Drainage works, PEB Structures and Roof Sheeting works, for value engineering process and proposing design alternatives or improvement of elevated stations, for NMRC's review and modifications accordingly;

b) Review of alignment in general and station locations in particular with a view of optimization of neighborhood connectivity and MMI integration, for NMRC's review and modifications accordingly;

c) Perform cost effective Detailed Designs of Architectural, Structure (including track supporting structure), Building Electrical and Mechanical services including Building Management System (BMS) for the Elevated stations and augmentation of existing Depot based on approved designs and design criteria for Elevated stations including viaduct.

d) Manage the design task for cost, schedule and performance compliance;

e) Detailed structural design for Elevated stations including Entry/Exit Structures, PEB Structure, Roof Sheeting Works, etc.

f) Preliminary design for stations, viaduct, exit Staircase etc. as per project requirement.

g) Proof checking of structural design and scheme of construction suggested by the Contractor for Viaduct substructure and superstructure's spans (including I-Girder, Cross Over, Long Spans, U-Girder, etc.)

h) Integration of the superstructure – U-Girder's design provided by NMRC with the structure design proposed by the contractor for Viaduct.

i) Perform detailed designs for building works, the fitting out of stations with architecture finishes and services including illuminations, lifts, escalators, water supply, drainage, power supply and other passenger amenities;

j) Perform the detailed design activities for Power supply & Distribution system (220kV/132kV/110kV, and 33kV for RSS/TSS/ASS), 25 kV OHE Traction Electrification, 02 RSSs for mainline & depot and SCADA system for entire network.

   It shall be the responsibility of DDC (Traction & Civil team) to maintain detailed interface with Civil, E&M, S&T and other systemwide contractors for incorporation of requirements related to 25 kV OHE Traction, 33kV, Earthing & Bonding, Stray current management etc. for mainline, depot and RSSs throughout the design, construction phase.

k) Perform detailed designs for multi-modal transfer facilities for road and pedestrian traffic, landscaping, traffic management and road and station interfaces for the surrounding roads and neighborhood;

l) Preparation & Review of Plans & Designs of Augmentation of the Existing Depot for accommodating all 03 Extension Corridors in phased wise manner.

m) Review and suggest change as necessary in the detailed designs done by Design Build Contracts for Viaduct to the plan made by contractor for temporary and permanent diversion works for all utilities affected by the station works / viaducts. Take into account utilities identified by contractors during execution and design structures accordingly. Provide items in the Construct Contract BOQ for diversion of these utilities. Review of alignment plan duly marked with; utilities identified by concerned agencies which will be given to DDC in hard/ soft copies by NMRC.

n) Co-ordinate and integrate designs and details with contractors and consultants employed by NMRC working on contracts pertaining/relevant to the site of works for this contract regarding DDC's drawings;

o) Integration of Building Services with the existing M&E systems at interchange stations including fire compartmentation.

p) Proper Integration of various Services/Systems in the Extension Corridors with the various Services/Systems of the Existing Aqua Line.

q) Prepare and update during construction Combined Services Drawings (CSD), Structural-Electrical-Mechanical Opening Drawings (SEM) and identify embedded items/openings indicating system wide information for the purpose of E&M co-ordination and civil construction interfaces;

r) Prepare BOQs, Technical Specifications, Construction Cost Estimates, Tender Documents, Tender Drawings for Tendering of all the associated construction/ execution contracts including but not limited to Civil, E&M works including BMS, Lifts & Escalators, Traction and Power Supply including SCADA, RSSs, S&T, AFC, Track, Depot Augmentation work, Rolling Stock, etc. for all 03 extension corridors, modify the cost estimate, BOQ, specifications, tender documents & drawings as necessary before the contract is awarded.

s) Incorporate and co-ordinate changes in design due to system wide interfacing with other DDCs/ Contractors/ NMRC;

t) Incorporate changes in design resulting from NMRC's design reviews;

u) Consult and co-ordinate with various City and Government authorities that interface with the NMRC project. NMRC will assist with the co-ordination;

v) Prepare necessary documentation and obtain necessary planning and other required approvals for the integrated complex consisting of Station designs, Station layouts, Track supporting structures including Traction, Power Supply, E&M facilities and Fire Detection/ Suppression system, Conceptual layouts and drawings for Property Development, if any, etc. from the relevant approving authority;

w) Plan, design, detail, control, co-ordinate, and execute the design phase of the Works for production of drawings, documents and reports to meet the key schedule dates included in the Agreement and as directed by NMRC;

x) Maintain a Quality Control activity and an effective internal procedure for checking the accuracy of Work and assuring compliance with contract

requirements;

y) Attend meetings connected with the Work whenever required; and

z) Make available their services as and when required during the construction/ execution contract: to modify existing designs or drawings as necessary to incorporate site conditions and unforeseen conditions; to assist NMRC's site supervision staff in clarification of queries resulting from the design; to review and confirm "As-Built" drawings prepared by Contractors.

aa) DDC is required to establish and maintain its office at Noida/Gr. Noida, throughout the contract duration.

bb) DDC is required to carry out proof checking of all temporary structure and enabling works including construction scheme and method statement proposed by the various contractors.

cc) NMRC shall be the Employer for this contract. Bidding/tendering for Construction/Execution contracts shall be done by NMRC and NMRC shall be the Employer in contracts so awarded. Bid documents and cost estimates for construction/execution contracts shall be prepared by DDC under this contract for NMRC.

2.2 Contracting strategy for construction

2.2.1 Elevated packages – Civil Works

The Detail Design Consultant will prepare the Preliminary design for elevated stations and viaduct. Based on the design, Tender Document, Drawings, BOQs, Cost Estimates, Technical Specification shall be prepared by DDC.

For the viaducts, the detailed design of the substructures and superstructure's spans other than U-Girder (including I-Girder, Cross Over, Long Spans, etc.) would be done by the Civil Contractors based on the preliminary designs prepared by Detail Design Consultant. The design of U-Girder shall be provided by NMRC

DDC shall be responsible for proof checking of the Structure Design submitted by the Contractor and Proof Checking & integration of U-Girder design and structure design proposed by the Contractor.

For the stations, DDC shall be responsible for Detailed Architectural, Structural and E&M Building Services of Stations.

Following the award of the construction contracts, the detailed design of Elevated stations will be performed by the DDC. The Detail Design Consultant will have to perform the Detailed Structural Design of Elevated Stations and Proof Checking of Structural Design of the Viaduct substructures and superstructure done by civil contractors.

Post award of civil contracts The Detail Design Consultant will have to perform:

- Proof checking of Viaduct
- Detailed design of Architecture and Structure for stations;

For detailed Scope of work, section 3.9 of this volume shall be referred.

2.2.2 Elevated Packages – Traction Works

The DDC shall prepare the preliminary & definitive design for the Traction work, Power Supply, RSSs. Based on the design, tender documents, drawings, cost estimates, BOQ, specifications will be prepared by DDC and the tenders shall be floated accordingly.

2.2.3 Elevated packages – Building Services

The DDC shall prepare the preliminary & definitive design for the Elevated Stations. Based on the design, tender documents for Elevated stations will be prepared and the tenders will be floated accordingly. The design shall finalize the major equipment capacities and the quantities of the miscellaneous items.

Post award of civil contracts, the detail design consultant will however to perform:- Detailed design of BMS, Traction, Power Supply & SCADA and E&M for all stations and Depot as well as incorporate requirements of Signaling, Telecom, AFC, Rolling Stock, Track, Lift, Escalator, PSG and all other system wide contractors in design and drawings.

2.3 Duties and Responsibilities of the DDC

The DDC shall initiate, and actively pursue and involve itself in all investigations and enquiries, consultations, studies, collection and compliance with pertinent information and data, convening of and attendance at meetings, and in any other activities as are or may be necessary for producing the detailed design, drawings and documents to the specified requirements.

The DDC shall carry out the Services in accordance with its own methods, in compliance with the provisions of the Agreement. Any and all changes necessary to ensure that the DDC's design, drawings and documents conform to the intent and purpose set out in the Agreement, shall be made at the DDC's own expense.

The DDC represents that it is a professional and experienced consultant providing full consultancy services, and hereby agrees to bear full responsibility for the correctness and technical merit of the services performed.

The DDC shall obtain the necessary design and regulatory approvals from the appropriate authorities for the stations, station areas, and any associated joint developments. NMRC will provide co-ordination for this process.

2.4 Basis of Detailed Design

The detailed design, drawings and documents shall be developed by the DDC from the appropriate conceptual, preliminary and standard drawings, design criteria, outline specifications and other information to be issued to or gathered by the DDC and as approved by NMRC.

The DDC shall comply in producing its detailed design and drawings in accordance with the checking requirements specified in Section 7 of this document.

In order to ensure uniformity of all Design Contracts, conceptual drawings, design criteria, outline specifications, standard pro-formats, and documentation will be issued to the DDC, and compliance with the requirements specified therein shall be mandatory unless prior agreement in writing for any changes has been obtained from NMRC.

The DDC shall thoroughly study the information contained in the conceptual drawings, Design Criteria, specifications, standard proformas and documentation issued to it. If there are any points of disagreement or inconsistency, the DDC shall immediately refer these, giving reasons for the disagreement, in writing to NMRC for a ruling.

The details of property development, including the floor area, number of stories shall be worked out by the DDC on the basis of market potential and building rules, if applicable.

Though only conceptual design and drawings are to be made for the property development, the lighting, circulation, staircases and other services required for the property development area, though required later are to be planned for.

2.5 Input for interface

The basic interface inputs will be provided at the time of preliminary design, in stages. Survey Maps and Plot Size of each station shall be made available in NMRC on AutoCAD. Any survey required outside the station land will have to be carried out by DDC.

3.0 SERVICES TO BE PERFORMED BY THE DDC PRIOR TO THE AWARD OF CONSTRUCTION CONTRACTS

3.1 Available Information

The DDC shall study all the available information and conceptual drawings issued (if any) or made available to it in the Scope of Services, carry out all necessary analyses, and request any further information or data which is necessary for its design development from NMRC which will be provided, if available.

3.2 Additional Information

DDC shall use the approved Outline Design Criteria and any other approved design specifications as provided by NMRC as the basis for developing the full design, Construction reference Drawings, Cost Estimates and BOQs for all Architecture, Structure, Traction & Power Supply, RSSs, including SCADA and E&M works for stations, RSS & augmentation of depot.

3.2.1 Systems shall comply with the following codes of practice, standards, specifications and manuals wherever specified.

National Building Code of India, 2016

The Guides of the Chartered Institution of Building Services Engineers

Acceptable Internationally recognized standards for this Contract are:

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BS	British Standards
BIS	Bureau of Indian Standards
DIN	Deutsche Industrie Normen
IEC	International Electrotechnical Commission
IEEMA	Indian Electrical and Electronics Manufacturers Association
JIS	Japanese Industrial Standards
NEC	National Electrical Code (NFPA 70)
NEC	National Electrical Code (Indian)
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
VDE	Verband Deutsche Elektrotechniker
BS 7671: 1992	"Requirements for Electrical Installations"

In case, standards and Codes for any specific element are not defined in documents referred to in Clause 3.2 above, DDC may use applicable Standard or Code from the above list with the approval of NMRC.

3.2.2 Unless otherwise stated, the E & M System design and execution shall comply with all applicable local regulations issued by the agencies listed below:

- Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations'2023.
- National Building Code 2016
- Chief Inspector (Electrical), State Govt. Of Uttar Pradesh
- Central Pollution Control Board
- Uttar Pradesh Fire Services
- Public Works Department
- Central Public Works Department
- Uttar Pradesh Power Supply Units (PSO)/ Uttar Pradesh State Power holding Company Limited.
- Chief Electrical Inspector for Noida-Greater Noida MRTS
- Gautam Budha Nagar Administration
- Noida & Greater Noida Authority
- National Safety Council

3.2.3 Any additional requirements imposed by local agencies not listed above shall be incorporated into the designs. Local codes, regulations and standards shall take precedence where their standards or requirements are more onerous than other international standards.

The design of any one system shall be to a single code or specification. Parallel use of different codes for one particular item or component shall not be allowed.

Should the DDC propose to use alternative Standards or Codes of Practice, they shall submit two copies of these with justification for their use to NMRC for review and acceptance within 2 weeks from the Issue of Letter of acceptance.

3.2.4 The DDC shall study all subsurface and sub-soil data made available to it. The DDC shall be responsible for all-additional borings, geophysical surveys, and field and laboratory tests that it may require for the performance of the DDC services. The cost of such additional investigations will be paid separately by NMRC either through DDC or directly to the agency hired for such Geotechnical Investigations.

The DDC shall prepare a Geo-technical Survey Assessment incorporating the additional Geo-technical data and shall submit to the NMRC for acceptance.

The soil samples and rock cores obtained in the course of the additional geo-technical investigations shall be delivered to the NMRC by the DDC on acceptance of the Geo-technical Assessment Report by the NMRC.

3.3 Design Alternatives

The DDC shall perform Design Alternatives as per the conditions of the Contract. The DDC shall develop alternative layouts and designs for the substructure, superstructure and architecture of the elevated and underground stations within the overall design parameters defined in the Agreement. The DDC shall perform proof checking of structural design and scheme of construction suggested by the Contractor for elevated, the objective of which will be to reduce construction cost without adversely affecting the required transit system functions such as capacity, service life, reliability, economy of operation or ease of maintenance and which shall not require any extension of design or construction time.

The DDC shall offer state of the art design for the Building Services and the alternative designs shall also be offered for E&M services and OHE system

Several design alternatives may be required as per the site conditions or any other specific requirement of the project.

Design alternatives are to be presented within 8 weeks of the Date of Commencement.

Each design alternative shall be presented in sufficient detail to clearly define the proposed design alternative including:

- A description of the difference between each proposed design alternative and the comparative advantages and disadvantages of each. Clearly illustrated sketches, drawings, diagrams, calculations, published reports or other means that allows evaluation shall accompany the written description.

- A detailed estimate of the amount of savings in construction cost.
- All further work of preparing tender documents, detailed design, drawings, etc. will be done as per the alternatives approved by NMRC. Different alternatives may be approved for different locations.
- All costs associated with this shall be included in the Lump Sum price.

3.4 Detailed Design

The DDC shall prepare detailed designs based on the requirements provided in the drawings and documents issued to it. If the DDC disagrees with the design requirements of the specified works it shall propose alternative designs to NMRC for approval. Upon approval the DDC shall completely design and detail the Works, provide Tender and Contract Drawings and other documents for the construction contract and be fully responsible for such design and detailing.

The detailed design of the specified works and the incorporation of all system wide requirements are the responsibility of the DDC. The design shall be developed from the conceptual drawings, outline specifications and design criteria prepared and issued to the DDC by NMRC. Any critical difficulty identified shall be immediately drawn to the attention of NMRC, but not withstanding that, the DDC shall remain totally committed to the overall integrity of the design, if necessary, actively seeking advice, information and clarification so as to avoid abortive work. The DDC shall incorporate in its design, the relevant seismic criteria and earthquake design, as required by the design criteria.

The DDC's design shall take into account the installation requirements of the system wide information listed in Section 3.6 of this Document, which will include the provision of openings, conduits, fixings, bases, plinths and loadings. Provision of earth electrodes, Earthing bonds to steel reinforcement to be catered for. The DDC shall make provision in its design programme for the inclusion of these requirements at a later date as they cannot be finally determined until after the award of the system wide contracts. The DDC shall incorporate the requirements of the system wide contractors into its design as appropriate and as they become available.

The design of Lifts and Escalators will be carried out by others under a separate systemwide contract.

3.5 Requirements for Earthing, Bonding and Corrosion Protection

The DDC shall incorporate the relevant requirements of design criteria in its design.

3.6 System wide Information

The DDC shall incorporate all the relevant information made available to it regarding the system wide works in its design and other documents including, but not limited to:

- Rolling Stock;
- Track Work;

- Overhead Line Electrification;
- Signaling;
- Communications including Closed Circuit Television (CCTV), Public Address (PA), and SCADA Systems;
- Traction Power, Power Supply and Emergency Power Supply Equipment;
- Automatic Fare Collection System;
- Lifts and Escalators; and
- HVAC system.
- Solar Energy System
- Platform Screen Gates, if applicable.

3.7 System wide Requirements

System wide requirements in the form of preliminary Systems information, as indicated in Clause No. 3.6 above, will be provided by NMRC for the purpose of preparation of the CSD and SEM drawings by the DDC.

The general arrangement of the station, the major equipment locations and major services routes, and the cable routes are to be shown on the CSD drawings. The major equipment loads pressure rating of air plenum, major openings and major embedded items and other similar interface are also to be shown on these drawings.

During the detailed design phase and continuing through the construction phase the DDC shall co-ordinate with NMRC, and other system wide DDC's to obtain system wide requirements such as embedded conduits, floor trunking, wall and floor openings, equipment concrete plinths, air conditioning equipment space, sleeves, hoisting hooks, earthing, lightning arresters etc., and incorporate into the architectural drawings for construction contracts.

The layouts for the stations and other buildings shall be coordinated by compatibility review meetings chaired by the DDC, which NMRC will attend, during the design stage.

DDC shall be responsible for Preparation of Minutes of Meeting and its issue.

Lead E&M and Lead Traction to attend all design interface meetings and shall maintain judicious record of inputs/requirement till the end of project.

At the final submission stage detailed layouts shall be coordinated and drawn by the DDC on one set of CSD drawings. These drawings serve to co-ordinate major routings of all services. It is an information drawing and is not used for construction. It directs the system wide DDC's and contractors to prepare their respective shop drawings in accordance with the routings shown on them. These drawings shall be included in the Contract Documents as information drawings. During design and continuing through the construction phase the DDC shall revise completed or partially completed SEM opening drawings and architecture drawings to incorporate

the additional system wide requirements defined by the system wide CSD's.

Additional layout details and system wide requirements requested by systems and E&M Contractors during construction shall be incorporated into the CSD, SEM opening drawings and architecture drawings. Sub-Section 4.2 describes construction stage services regarding final CSD and system wide requirements. DDC shall make available the CAD electronic data to the System and E&M Contractors who will incorporate these additional details in the design.

DDC will review and incorporate the modified design. However, DDC will repeatedly interface with System Contractors / other DDCs to ensure compatible complete design.

The DDC shall submit a Design Brief describing in words, diagrams and graphics. This Design Brief should take into account the following considerations.

It is of utmost concern that the design of the station shall be safe in the event of a fire. In this respect it is essential that the suitable necessary details be incorporated into the design as per prevalent rules, regulations, code and practice.

3.8 Architecture Design Services

The Architecture services shall include the detailed design of all Architecture and landscaping works, preparation of drawings, specifications, cost estimates and other documents, as required, in order to obtain tenders and to construct the Works, together with such other services as are set out and referred to in this General Scope of Services. The works specifically include obtaining the necessary approvals from the concerned Civic Authorities.

The DDC shall prepare drawings with sufficient detail to fully describe the architecture design of the stations, ancillary facilities, and property development, including mechanical and electrical equipment and any structures visible to the public. These drawings shall address at a minimum such issues as:

- Station and ancillary buildings architecture design
- Site design, landscape design and urban design.
- Existing site characteristics, which are to remain.
- Proposed land uses and relationships to surrounding properties.
- Visual corridors to and from proposed property development.
- Pedestrian paths and vehicular links.
- Hierarchies of public and private spaces.
- General concepts of building massing.
- Integration with existing and proposed property development.
- Floor and ceiling finishes to have good light dispersing properties to enhance illumination.
- ECBC Rating and GRIHA Rating Standards

- The DDC shall prepare design solutions responding to requirements for public and private transportation facilities and open space provisions within the proposed property development sites. The DDC shall prepare all the conceptual designs and drawings for property development keeping in view the prevailing building rules and he shall not be required to prepare detailed drawings.
- The DDC shall investigate each site in support of the environmental review process as it relates to surrounding neighborhoods and property development, both existing and proposed; and also, the environmental impacts upon present and committed future recreational facilities, parks or other open spaces and landscaped facilities. The detailed design shall be finalized after the environmental review is completed.

This shall include as a minimum the following:

- Identify levels of architectural and landscaping treatment necessary to mitigate environmental impacts whether physical, visual or noise related, in relation to the preparation of an Environmental Impact Report which may need to be co-ordinated with relevant Government and Municipal Departments. Provide continuing design support to the environmental review process.
- Prepare such designs as may be required to address and mitigate potential environmental impacts upon present and committed future recreational facilities, parks or other open spaces and landscaped facilities.

The DDC shall address additional issues as required to support the architecture and urban design concepts for station sites and property development, including but not limited to:

- Building control dimensions
- Height, depth, setback and massing requirements
- Major features such as building arcades
- Street/wall relationships
- Other relevant issues

The DDC shall analyse available flood data and propose solutions for flood control at interfaces and thresholds between proposed grade levels and stations and ancillary facilities.

The DDC shall incorporate and co-ordinate designs, and prepare drawings and documentation for the following system wide elements which will be used in all stations:

System wide architectural items to be included in the tender documents:

- Finishes Schedules: Floor Finishes; Wall and Column Finishes; Ceiling Systems and Finishes
- Railings, Barriers and Gates
- Stair and Handrail Details:

- Escalator Finish Details
- Lift Finishes Details
- Platform Details
- Doors and Frames
- Miscellaneous Public Area Details
- Platform Edge Lighting
- Public and Staff Toilet Room Details
- Staff Room Details
- Signs and Graphics Details
- Landscaping and External Works
- Plans, Sections, Elevations and
- Details of
    - Ticket Office
    - Ticket Hall Supervisor's Office and Excess Fares Collection
    - Information and Enquiries
    - Station Control Room
    - Platform Supervisor's Booth
    - Other Booth and Office Details
    - Door and Window Details
    - Countertop and Casework Details
    - Station Manager's Room, Pump Houses, Auxiliary Substation
    - Handicapped facilities (including ramps, tactile tile layouts etc.)

The DDC shall prepare Standard Specifications for architectural standard design elements and for the supply and installation of architectural standard finishes and materials. He shall also include specifications for any site-specific non-standard material that is to be incorporated into the design. Architectural Standard Specifications shall include but not be limited to the following:

- Site work: Granite Kerbs, Concrete Kerbs, Natural Stone Pavers, Brick Pavers, Concrete Block Pavers and Grass-Concrete Pavers.
- Concrete: Concrete Floor Surface Treatments; Precast Concrete Architectural Panels; Glass Reinforced Cement Panels.
- Masonry: Mortar, Grout and accessories for Granite or Other Stone; Mortar Grout and Accessories for Paver Tile; Mortar and Grout for Masonry and Exterior Setting Beds; Granite or Other Stone Flooring and Bases; Granite or Other Stone: Cubic and Veneer.

- Metals: Vitreous Enamelled Steel Panels; Barriers and Railings; Drain Grates, Manhole Covers, Cladding and Shutters.
- Thermal and Moisture Protection: Sealants
- Doors and Windows: Entrances and Storefronts; Hollow Metal Doors and Frames; Rolling Grilles; Glass and Glazing.
- Finishes: Paver Tile; Wall Tile; Metal Ceilings; Field Painting.
- Specialties: Toilet Partitions and Accessories; Equipment Cabinets; Graphics and Signage; Ashtray and Litter Bins; Telephone Enclosures; Booths and Workstations.
- Mechanical Work: Plumbing Fixtures and Trim.
- Electrical: Lighting, air conditioning and water pumping.
- Landscape: Landscape Soft works and Establishment Works.
- Natural lighting shall be harnessed to the maximum extent.

The DDC shall submit the documents and products of its architecture and urban design work as described in Section 8.

The DDC shall provide continuing support in the form of design data, design calculations, CADD files, 1:200 scale models of each station and the like as requested, whether for promotion, approval, or other illustrative purposes. The model shall be A0 size mounted on a wooden base with Plexiglas cover and shall be submitted within 4 months of the date of issue of the Letter of Commencement.

Other deliverables may be identified by the NMRC, as required to support the goals of architecture, urban design, and landscape or property development. The DDC shall prepare and submit to the NMRC cost estimates for the architectural works at each station. These estimates shall be based on quantities taken off the DDC produced drawings but where no drawings exist, the quantities shall be determined by using similar job information and typical relationship of quantities. Cost estimates are required for each submittal.

The DDC shall submit a Design Brief describing in words, diagrams and graphics the Architectural Objectives and illustrating how these will be met. This Design Brief should take into account the following considerations:

- The alignment and the viaduct structure will greatly influence the station design
- Stations Building, RSS, Depot shall be designed to achieve highest MRTS Green Building Rating.
- Design of roofs of Stations Buildings, RSS, Depot, Viaduct (wherever feasible) shall be suitable for rooftop solar power plant installation i.e. flat/inclined roofs as per the sun direction with no shadow causing objects in between. Design of rooftops should also take into consideration the requirement for making them accessible for installation and maintenance of solar power plants with suitable cable routing arrangement and walkways etc.

- The stations should be as transparent as possible to allow for maximum natural air flow through the concourse and platform areas.
- The detailing of every element within the station area is important, not only for visual and aesthetic reasons but to ensure that materials are durable and can easily be maintained.
- The integration and co-ordination of the architectural finishes with the structure and Electrical and Mechanical fittings and services runs is required.
- The design of the station to be safe in the event of a fire is of utmost concern. In this respect it is essential that the following considerations are incorporated into the design:
- All building materials shall be specified to have a class “1” flame spread rating as defined under BS 476 and relevant BIS standard and shall be incombustible.
- The fire protection of an opening depends on the construction of the complete assembly. All three elements (door, frame and hardware) shall be of types that have been proven by test to be capable of performing their required function in time of fire. All elements making up a door or roller shutter assembly shall carry a label confirming that the tests, in respect of class and fire rating, have been passed.
- Partition walls and openings shall conform to the compartmentation requirements and the requirements of relevant local authorities.
- Durability of all station elements is important and as such the following considerations shall be incorporated into the design:
- Corrosion protection is required for all exposed and hidden elements
- Precautions must be taken to prevent bimetallic corrosion
- The choice of finishes shall take into account durability and ease of maintenance, safety, fire resistance, cost, source of supply and replacement, aesthetic considerations
- The following considerations which relate to the type of finishes in stations shall also be taken into account:
    - Location
    - Services interface
    - Acoustic requirements
- Where structural and service elements are used as part of the finished architectural effect (for example exposed duct work or light fittings at ceiling level) the layout, configuration and detailing of those services elements shall be considered as being part of the architectural finishes and shall require architectural acceptance.
- The selection and detailing of finishes shall take full account of passenger and staff safety.

- Review of As-Built Drawings of Station which have been prepared and submitted by the contractor.

3.9 Structural Design Services

3.9.1 Civil works (Preliminary Stage)

The aim at this stage is to develop the conclusions of the Value Engineering of the Detailed Project Report, and prepare the concepts for the design.

After the definition of the main principles and needs of the project in the transverse tasks, the main dimensions of the structures with integration of system requirements and others services, will be defined.

The objective will be to reach a sufficient level of design for the Tendering process, that is: definition of the functional aspects and architectural layout; definition of the final geometry of the works; selection of the construction methods; definition of the construction sequences; pre-dimensioning of the main bearing structural elements; definition of reinforcement ratios; identification of all the requirement for mitigation measures, if any; definition of the requirements for monitoring the works through proper instrumentation.

The main outputs will be:

- Set up technical framework for the project: lists of specifications and standard selected (design and construction)
- Review of the Survey Works performed by NMRC for sufficiency for the design works (Topographic survey and mapping, Utilities investigation, Hydro-meteorological data, Geotechnical survey and investigation).

If need be, the Detail Design Consultant shall request NMRC for additional surveys.

It is intended that the Detail Design Consultant will review the investigation campaigns launched by NMRC and advise if further surveys are required to perform the design.

The Detail Design Consultant will be preparing the Geotechnical Interpretation Report, indicating the uncertainties, the residual risk and suggesting to NMRC the way of sharing or transferring these risks between NMRC and the future Contractors.

- General Arrangement Drawing:
    - Plan and profile of general alignment, with proposed station location within Right of Way and survey
    - Structural arrangement drawings
    - Utilities layout drawings
- Conceptual drawings for Viaduct, special bridge (if any, cross-over, long spans) Elevated ramp to At Grade, elevated stations and their other structures including embankments etc.

- Conceptual interface studies for system integration, cable routing etc. for stations.
- Conceptual Interface studies for stations
- Preliminary planning with tentative production rates
- Estimation of preliminary quantities per structure type
- Identification of land acquisition (if required) for temporary and permanent structures
- Justification of the proposed construction methodology: launching gantry for elevated viaduct, type of retaining structures for deep excavations, etc.

The vertical and horizontal alignment of the entire stretch inclusive of its geometrics and pier locations will be provided by NMRC in hard and soft and will be reviewed by the DDC and changes along with revised plans will be suggested/ incorporated by DDC by issuing the revised plans after duly approved by NMRC. The final approval of alignment and pier locations will be given by NMRC.

As an intermediate outputs, The Detail Design Consultant will submit a report summarizing the different options and propose recommendations for each structure type. The said report will highlight the benefits of the proposed solution in term of cost, quality and planning.

As a final output, drawings and preliminary BOQ shall form the Tender document for Contractor to bid. The Tender documents will be based on preliminary calculation with a reasonable allowance for variation at Detailed Design stage.

3.9.2 Civil Works (Detailed Design Stage)

For the Elevated stations, DDC will perform the Detailed Architectural and Structural design of the stations which are to be executed by the Civil Contractor.

For the Elevated sections -Viaduct, NMRC has planned to have Design & Built contracts which would include Detailed design of Viaduct's substructures, and superstructure (except U-Girders), special spans, etc. based on DDC's preliminary designs.

However, in order to ensure the compatibility with the Preliminary Design, Detail Design Consultants have to perform proof- checking of the design submitted including U-Girder. The DDC is also required to carry out proof checking of all temporary structures & enabling works including construction scheme and method statement proposed by the contractor.

The proof-checking, which we assume will require counter-calculations to be performed, will mainly focus on the adequacy between calculation reports and drawings, and ensure compatibility with contract provisions & proposed construction sequence. Interfaces and functional requirements will also be considered. In addition, technical support from the DDC in review of variation claims (if any) shall also be part of scope of the DDC.

The key aspects covered by the proof checker/DDC will be:

- Reference standards;
- Design Basis Report
- Design Criteria;
- Interpretation of the geotechnical and hydro geological investigations;
- Identification of the initial geological, geotechnical and construction risks and quantification of the mitigation measures and contingency measures during construction to reduce the residual risks;
- Construction method and construction sequence;
- Applied load cases and design assumptions;
- methods of analysis, which have to be appropriate and valid;
- Geotechnical and structural design of the temporary and permanent works;
- ultimate and service design capacities of all components;
- Fabrication Drawings for all Steel Structure works
- Proof checking of temporary works (including scaffolding, shuttering details etc.) to facilitate the construction of permanent works.
- overall stability of the structures in both the short-term and long-term conditions;
- water tightness requirements and proposed technical solutions;
- construction and reinforcement details;
- design of the mitigation measures;
- suitability of the design to the construction methodology adopted by the Contractor;
- integrity of structural member and structures as a whole;
- constructability;
- monitoring design;
- Interface drawings civil works / M&E equipment.

At this stage it is necessary to precisely define and fine tune the main dimension of the structures, with integration of latest information from systems, and others services.

The interpretation of the Survey's Work campaign and its outputs will be incorporated at this stage.

To perform the Detailed Design of Civil Works the main interface features shall be validated as an input as also approved the Preliminary Design of the selected alternative(s).

The following deliverables will be prepared:

3.9.2.1 Viaduct

- **Superstructure:**

  Please note that the design of substructure and superstructure (except U-Girders), shall be in the scope of the contractor. However, DDC shall have to carry out the proof checking of design and drawings submitted by the contractor including U-Girder provided by NMRC. The proof checking which we assume will require counter calculations/independent calculation to be performed. The adequacy between calculation reports and drawings, and ensure compatibility with contract provisions proposed construction sequence/ method statement.

- Proof checking of structural design of Special Spans (including Balanced Cantilever Bridges, Extradosed Bridges etc.)/obligatory/non-standard/I-girder/steel span, or any other structural element proposed by design and built Contractor.
- Proof checking of scheme of construction for all superstructure spans including special span/ nonstandard / I-girder/ Pi-Girder etc. by launching girder or any other structural element proposed by design and built Contractor.
- Proof checking of U-Girder
- Review of alignment w.r.t SOD & clearance & suggest modifications/ improvements.
- Proof checking of Track supporting structure (Track Plinth).

- **Substructure and Foundation:**

- Proof checking of structural design and scheme of construction submitted by the Contractor for bearings, sub-structures and foundation of viaduct.
- All temporary structures, enabling works, construction scheme, lifting plans etc. shall also be proof checked by the DDC.

  Proof checking of:

  - Rail/Structure Interaction reports
  - Track plinth design
  - Stray current and earthing design
  - Design of any special arrangement on parapet such as view cutter, noise barrier, etc.
  - Design of structural arrangement for all traction, signaling & electrical works such as supporting arrangement for cables etc.

- OHE traction system.
- Approval of all shop drawings such as bearings, expansion joints, steel

structures submitted by contractor.

3.9.2.2 Elevated Station:

- The scope of DDC covers the Detailed Design of all the structural component of station building and its ancillary components including entries, exits, connecting corridors/FOBs etc. submitted by the contractor along with construction sequence.
- All the temporary structures/ Enabling structure for the execution work of Elevated Stations shall be proof checked by the consultant.
- The detailed design of roof PEB structure for station building, entry-exit structures, Roof Sheet Structure, etc. shall also be in the scope of the DDC.
- Construction method and construction sequence, including design of enabling work/ construction scheme/ lifting plans etc.
- Proof checking of:
  - Rail/Structure Interaction reports
  - Track plinth design
  - Stray current and earthing design
- For at grade sections:
  - Listing of coordinates of the leading points for implantation of the Works
  - Proof checking of Design of embankment, soil treatment (if required), retaining wall (if required), reinforced earth wall (if required)
  - General layout drawings
  - Architectural layout and cross sections
  - General interface drawings and main openings for cable routing
  - General site rehabilitation drawings
  - Quantities of main materials.
- Ramp:
  - Technical Specification (requirements of load, materials, construction and other requirements);
  - Proof checking of structural design of ramp.
  - Location: coordinates of the leading points, chainage;
  - Architectural design, dimensions, levels of the main structures;
  - Interface design with railway system and other systems (if any);
  - Drainage and utilities connection (if any);
  - Construction methods and sequences;
  - Traffic management measure;

- Quantities of main materials.

- Interfaces:
  - Preparation of Rail/Structure Interaction reports
  - Track plinth starter Bar design
  - Stray current and earthing design
- Catenary pole anchorage design
- Approval of all shop drawings such as bearings, expansion joints, and steel structures submitted contractor.
- The Design of roof PEB structure for station building, entry-exit structures & all ancillary structures such as UG Tank, Sump, Elevated water tank, DG room, Pump room, Machine room etc. shall also be in the scope of the DDC.
- Design of structural works for architectural finishing, Interfaces and functional requirements such as design of louvers, structural glazing, ACP, cladding, counters, GRC jali, etc.

3.9.2.3 DELETED

3.9.2.4 Augmentation of Depot:

- The scope of DDC covers the cost effective and optimized design for the augmentation of the existing Depot of the Operational Aqua Line including detailed design of all the required structural components of Depot buildings for serving all 03 Extension Corridors along with Operational Aqua Line.
- This augmentation of Depot is to be planned in phase wise manner considering the requirement of the 03 Extension Corridors.
- The main interface features shall be validated as an input as approved during the Preliminary Design of the selected alternative(s).

The following deliverables will be prepared for Depot buildings:

- Listing of coordinates of the leading points for implantation of the works
- Design of the concrete outline, reinforcements for all structures (except station and viaduct) including ancillary buildings, pavements, boundary walls, track plinth, etc.
- General layout drawings
- Phased Manner of Augmentation of Depot
- Sketch of the various phases of the construction method
- General interface drawings
- Geotechnical and structural design of the temporary and permanent works
- Plan view of the various phases of the site boundaries with the authorized accesses to the site and the street temporary diversions,

- Schedule of the works
- Quantities of main materials.

The integrity of all permanent structural member and structure as whole will be examined and reported as part of design submission.

3.10 Electrical and Mechanical Services for Stations

The Electrical and Mechanical services shall include the detailed design of all building accommodation and architectural interfaces with E & M services in the stations, and ancillary buildings. The provision of cable duct/ trenches for the 33 kV cable looped in and out at the ASS is also part of the scope of DDC. The route includes the trench / conduit planned to carry 33/11 kV cable from viaduct to the electric substation. Otherwise for lighting in circulation area, only 415/420 V power distribution is planned. Air conditioning is planned only at few selected office / equipment rooms. The criteria shall cover these specific areas only. The scope shall include the preparation of drawings, layouts, specifications, erection/ mounting details, interface with the system wide contractor or arising out of concurrent works, cost estimates and other documents, as required. This shall include the incorporation of architectural co-ordination requirements with the requirements of other disciplines for the following services:

a) Structural and facilities for lifts & escalators;
b) E&M support provisions;
c) Low voltage distribution;
d) Normal lighting;
e) Emergency lighting connected to ups backed by dg set and normal supply;
f) Essential lighting backed by dg set supply;
g) General purpose power;
h) Signage;
i) Stand-by generator;
j) Uninterruptible power supply system (ups) for lighting loads;
k) Earthing and bonding;
l) Lightning protection;
m) Power factor correction at major loads; linear; short switching non-linear
n) Power supplies for other contracts;
o) Fire detection;
p) Fire protection;
q) Water services; pumps and automatic control;
r) Drainage, plumbing and sewerage with STP;
s) Lifting equipment at plant rooms;

t) Public telephone facility; (local calls, STD, ISD in booths only)

u) Lighting power distribution for parking areas, circulation area, station face lighting;

v) Provision of cable ducts, cable ways or trenches for all the cables including incoming 33 kv supply cable or cables supplied by all contractors.

w) Lt distribution and fire prevention measures for passenger amenities/commercial development/ advertisements inside station.

3.11 Over Head Traction Equipment (25 kV), Auxiliary Power Systems (33 kV), Receiving Sub Stations (RSSs) and associated SCADA

a) Preparation of Design of Over Head Traction Equipment (25 kV), Auxiliary Power Systems (33 kV) and associated SCADA for the construction of the 03 Aqua Line Extension Corridors i.e., from Noida Sec-51 to Knowledge Park-V, Noida Sec-142 to Botanical Garden & Depot Station to Boraki Noida as per the requirements of the Engineer/Employer. This will include working out the sizing of all the equipment, supported by mathematical calculations, preparation of design reports, preparation of typical drawings.

b) The Design work of the OHE for the existing two no's IBL's in the existing NMRC Depot as well as augmentation of depot is also included in the scope of work.

c) Assessment of the quantity of each material required for OHE, Auxiliary Power Supply and SCADA, preparation of technical specifications and related drawings and preparation of interface matrix for finalization of BOQ based Tender document to finalize Traction contractor.

d) The DDC shall carry out the Auxiliary & Traction Simulation Sizing Study to determine the location of RSSs, the current flow in the RSSs to decide the capacity of the Traction transformers, Auxiliary transformer, voltage drop in OHE etc. RSS outage scenarios with the object of validating the location of RSSs, and sizing the transformers & cables and other equipment of RSS.

e) The DDC shall carry out a review and recommend the best possible location for the receiving substations based on the study. If the locations are acceptable to Employer from point of view of land availability and cable laying feasibility etc. then the locations will be firmed up.

f) Detailed Design of earthing system for RSS (including switchyard + Control room building but not limited to), ASS & TSS at all the depot and stations, including the Earthing panels for connecting the running rails to earth, earthing panels and plan for structures, gantries and foundations of these installations.

g) DDC shall prepare Design / Drawings for erection of earthing system for ASS and RSS. Design of earthing system for stations, equipotential bonding for stations, touch and step potential protection at stations for passengers.

h) To prepare the detailed equipment sizing and layout, RSS control room,

Fencing wall Layout and other drawings & specification including but not limited to specifications of all equipment, cables, calculations, interlocking schemes with its detailed operation plan, protection schemes with step by step calculation, electrical schematic drawings and layout drawings pertaining to receiving substations as per the land availability, site conditions, keeping in view the various clearances to be observed

i) To prepare the detailed equipment layout and other drawings and specifications pertaining to ASS and RSS as per room/space availability at the station concourse/platform, site conditions, S&T Equipment keeping in view the various applicable statuary clearance to be observed.

j) Protection co-ordination with power supply provider and the detailed protection scheme to be adopted in all RSS and ASS including those required for feeders, traction and auxiliary network. The digital protection system should be duly compatible with SCADA system for operation, control, and data management of protection system from OCC & BCC through SCADA. This should be compatible with existing NMRC SCADA and protection system.

k) Preparation of BOQs, technical specifications and drawings, construction cost estimate for the associated elevated/at grade construction contract for the entire corridors including all spares, tools including & construction vehicles if any. DDC shall propose an Interface Matrix to be followed by construction contractor for the system installation in coordination with other system/civil work contractor.

The DDC shall study the existing design of corresponding systems of NMRC Aqua Line and prepare the design for the OHE, ASS and SCADA works accordingly. The DDC shall ensure that the proposed designs are compatible with the existing systems of Aqua line Corridor for seamless integration of all the equipment.

A. OHE Works:

i. The DDC shall submit the OHE design for Extension Line Corridor after studying OHE Systems of existing Aqua Line. Scope of OHE design shall include but not limited to the followings:

- Interconnection of OHE at existing Sector-51 station of NMRC for extension of supply in the Aqua Line extension corridor.
- Traction equipments sizing.
- Preparation of 25 kV Sectioning Diagram covering complete mainlines (Elevated) and depots and finalization of locations of OHE posts (SP/SSP/SS/FP), considering future provision of RSS at Sector 123.
- Based on the track plans and layout plans of stations and other structures, DDC shall prepare pegging plans and detailed OHE plans for main line & depot. Typical Cross section drawings will be prepared for each design, as required by Engineer/Employer.

- Detailed design of structure foundations for OHE, BT, FP, SS, SP and SSP including any future FP, SSP, as applicable, and the arrangement of electrical connections from BT/FP/SP/SSP to OHE matching with the skyline of city, shall be furnished by DDC.
- The designer shall submit the detail design of OHE using conventional mast as used in Indian railways/Metros.
- The designer shall also give the detailed drawing of the OHE fittings required for flexible OHE.
- Calculations to determine the equipment sizing, catenary voltage drop, maximum catenary current, maximum rail potential rise, maximum Contact wire and catenary wire temperature rise etc. taking into consideration the Normal as well as extended feed Conditions.
- The DDC shall prepare detailed earthing and bonding plan for the Aqua Line Extension Corridor to ensure safety of equipment and human beings. For collection of data and drawings regarding structures requiring earthing, reinforcement bars and tracks, track-circuiting and signaling plans, the DDC shall interface with concerned designer/designated contractor.
- OHE Span is to be maximized and calculations supporting maximum span is to be submitted.
- Activities as mentioned below w.r.t. OHE Works shall also be done in addition to above works.

The design should include the Lightening Arrestors at all switching posts in its design.

B. ASS Works:

The DDC shall submit the ASS design for Extension Line Corridor after studying of the ASS Systems of existing Aqua Line. Scope of ASS design shall include but not limited to the followings:

- Preparation of Auxiliary Power Supply scheme consider the new RSSs.
- Selection and sizing of Auxiliary Transformers, Power and Control cables, lightning arresters, isolators, bus bar arrangement, circuit breakers, CT's, PT's, metering panels and other equipment at each ASS.
- Interconnection of 33 kV Double Circuits at ASSs of existing Sector-51 station, Sector-142 station, Depot station of NMRC for the extension of supply in the proposed 03 Extension corridors. DDC shall visit the existing ASSs for assessing the requirements to have seamless integration between existing ASSs of the Operational Aqua Line and future ASSs of 03 Extension Corridors.

- Extension Corridor and incorporate the same in the design submissions and Specifications accordingly.
- To prepare the detailed equipment layout and other drawings & specification pertaining to ASS as per the land availability, site conditions, and track layouts keeping in view the various clearances to be observed as per applicable rules and standards.
- Preparation of Power Supply diagram for whole 33 kV network for full corridor including, elevated, involving ASS wise SLD, layouts, design calculations.
- Planning and designing of earthing system for ASS, structures, gantries, cable sheath, foundations of various equipment etc.
- 33 kV protective covers,/ shrouds on terminals, etc are to be designed/identified as per Cable length and size for 33 kV feeder for transformer to be selected considering VCB switching transients.
- Prepare the layout of various indoor type auxiliary substations equipment layout, preparation of layout of control and distribution panel including indoor circuit breakers, other switchgear and bus bar arrangements. DDC scope of work excludes the work of design of distribution and control for station load (design of distribution system at 415 V level and below).
- The power cable layout and its design shall be done for its compliance of IEEE 575.
- DDC to Plan & design Power and control cable run layout in the ASS premises, control room, cable trenches, supporting and clamping arrangement, cable termination etc.
- Activities as mentioned below w.r.t. ASS Works shall also be done in addition to above works.

C. SCADA Works:

- Existing section of NGN line is provided with Siemens make Traction SCADA and Siemens make SAS at both the RSS. DDC will prepare following options:
    - Extend the existing traction SCADA to new Section.
    - To replace the Siemens make SCADA of the existing section with the new SCADA and integrating the new sections on the new SCADA.
    - Providing standalone Traction SCADA for the new section.
- DDC shall prepare the techno-commercial comparison of all above three options and shall prepare design, drawings and technical specification for the option approved by the Employer.

- Activities as mentioned below w.r.t. SCADA Works shall also be done in addition to above works.

D. Power Supply arrangement:

- This work would involve working out the overall power requirement (both traction & auxiliary) for the Entire Aqua Line Corridor including extension as included in the subject Tender. The power required for property development is also to be worked out based on inputs by NMRC. The Headway Data, Train Parameters etc. as required by DDC for calculation of Traction Load, shall be provided by NMRC.
- Optimization/Simulation study, which will include prescribing of the power supply arrangements for all corridors, including likely extension of the corridor, under normal & emergency conditions and voltage drop at farthest end in each case. This study will take into account emergency conditions arising due to failure of one or more power sources, transmission grid network and/or power supply equipment. The overall reliability of the power supply system, under various conditions, shall be analyzed and reliability percentage indicated in the report. The study would cover composite power supply arrangement detailing as a minimum the various power receiving point of employer, corresponding power supply points of power supply authority, method of extending supply from substation of power supply authority to NMRC. NMRC's receiving substation, implementation of internal 25kV & 33kV network of the Employer including sectioning arrangements, cable cross sections, other technical details and locations and land/or area required for the RSS.
- The scope of work under this Work would involve:
    - DDC shall study the maximum loading of each RSS (02 new and 02 existing) during normal Power Feeding and during failure of any one of the RSS. Maximum loading of each RSS is also to be extrapolated for the traffic projections of 2041, to be supplied by NMRC, for the scenarios, normal Feeding as well as N-1 scenario.
    - DDC shall indicate minimum headway of the trains in the new corridor, which can be catered without augmenting any of the existing RSS.
    - **Power for traction:**
    - This will be worked out by DDC by Calculating the Traction Power requirement. The Headway Data, Train Parameters etc. as required by DDC for calculation of Traction Load, shall be provided by NMRC. This will also take into consideration of regenerative braking.

- **Power for auxiliaries at stations, and along the line:**
- This will be worked out by the DDC on the basis of inputs from Employer pertaining to station E&M design.
- **Power for property development**
- This will be worked out by the DDC on the basis of inputs from Employer pertaining to Property Development within the footprint of station building and/or in the vicinity of the structure.

- As a part of this Work DDC shall be required to prepare and submit Report on Power Supply arrangement for the entire Power Network, incorporating power requirements under varying train running conditions and headway in Normal operating conditions, Emergency operating conditions and designed headway as explained in Clause 2.4 of Outline Design criteria, and validate these jointly with NMRC.
- The power supply arrangement proposed would give due consideration to power reliability. The scope of DDC in interacting with power supply authority is limited to technical aspects and legal/tariff negotiations are not in his scope.
- **Interface:**

  DDC will effectively interface with the designers/contractors of the Civil, structural, architectural, E&M, S&T etc. and provide and collect all details as are necessary, so that all the interface issues are in the designs and drawings are addressed and incorporated in the various submissions.
- Study as per standards, for limiting the induction effect due to 25kV & 33kV 3 phase Power supply running along the viaduct through cables on the adjoining signal (including PSD) and telecommunication circuits and recommend the mitigation measures.

E. Designing of protection and interlocking scheme for each ASS, OHE Post:

- Design and prepare overall protection philosophy, protection settings, relay timings to ensure proper protection coordination from NMRC Extension Corridor for OHE and Auxilliary Networks upto RSS & Grid substation level using load pattern and power flow study. The protection scheme should take into account all parameters including relay settings at GSS, supply cables from Grid, the impedances of OHE and Cables.
- Designing of interlocking scheme for 25 kV OHE and 33 kV Auxilliary Network.
- Modifications in Protection Settings of Existing Electrical Installations of NMRC, for the requirement of linking of the existing

facilities to the 03 Extension Corridors, is under the scope of DDC, if required.

F. Other Works:

- Prepare BOQ for the systems included in the scope of the tender, technical specifications and drawings, construction cost estimate, interface documents for the associated elevated construction contract for OHE, ASS and SCADA including all spares including maintenance vehicles & construction vehicles keeping in view the uniformity related with the various systems operational in the existing Aqua Line Corridor.
- Technical specifications shall be prepared considering the design of the equipment used in the existing section and as far as possible, should be of similar to the ones used in the existing sections. All the tests including special tests shall also be included in the test schedule as per the latest standards.
- Make available their service as and when required during the construction activities for amendments/modifications as applicable, if any, in the existing designs/drawings incorporating any site unforeseen site conditions, as applicable.
- The DDC will be required to make their services available for providing additional details, modify drawing and issue clarifications whenever required during the construction phase. This would involve attending meeting at design office at Noida whenever required. The DDC shall assist the Employer in approving the as built and other drawing prepared by the construction contractor.
- The attendance of DDC at site, if required by employer for construction activity will be payable separately on man-days/visits basis as per rates agreed in the contract. (Activity-II) (Excluding attendance review/clarification/interface meeting, etc.)

G. SERVICES TO BE PERFORMED BY THE DDC PRIOR TO THE AWARD OF CONSTRUCTION CONTRACTS.

i. **Available information:**

The DDC shall study and take guidance from all the available information including those made available during design e.g. DPR of Noida Metro and drawings issued or made available as per the scope of services to carry out all necessary analysis, and request any further information or data which is necessary for its design development from the Employer's Representative which will be provided if available. Any data, information, standards not available with the Employer shall have to be collected by the DDC at their own cost.

ii. **Additional information**

The DDC shall, if so required, carry out field survey and soil investigations

wherever required. The cost of these services shall be included in the Lump sum set forth in the Agreement.

iii. **Ministry of Railway (RDSO) Approvals, as applicable**

If any new type of Overhead mast, Structure or equipment is proposed to be used, its safety worthiness will have to be evaluated and sanction of Ministry of Railways will have to be obtained. Detailed investigation and testing will have to be done in this connection.

The DDC shall prepare requisite design reports, calculations, drawings, test criteria, test procedures etc. as are necessary to obtain the Ministry's approval. The DDC should be in a position to provide necessary support (have experts with adequate qualification, knowledge and experience) to assist NMRC for effective interaction with Indian authorities viz. Ministry of Railways, RDSO and Commission of Metro Rail Safety (CMRS).

iv. The DDC shall prepare detailed designs based on the principles of Existing Aqua line of Noida Metro and Design Criteria. Any critical difficulty identified shall be immediately brought to the attention of employer's representative, but not withstanding that, the DDC shall remain totally committed to the overall integrity of the design, if necessary, actively seeking advice, information and clarification so as to avoid abortive work.

The DDC's design shall take into account the installation requirements of the system wide information. The DDC shall prepare detailed designs based on the principles of program for the inclusion of these requirements at a later date as these may not be finally determined until after the award of the system wide contracts. The DDC shall incorporate the requirements of the system wide contractors into its design as appropriate and as they become available. DDC will be required to suitably interface with designer/contractor of various systems for their proper interface/interconnection with the Elevated portion (with specific reference to OHE, internal 33kV cable, earthing & bonding systems etc). Further the SCADA system design has to take into account 25kV switching station and 33kV station ASS.

v. List of drawings

The details by DDC of various drawings which would be required to be submitted are as under: The soil testing report for the foundation design for the depot will also be done by the DDC. (the list is not exhaustive and if necessary additional drawings may also be prepared by the DDC without any additional cost.)

TRACK ELECTRIFICATION FOR MAIN LINE & DEPOT

- Pegging Plan
- OHE layout drawing
- OHE profile drawing

- Cross section drawing
- Structure Erection Drawing
- Feeder drawing
- Dropper Schedule

POWER SUPPLY DISTRIBUTION, SWITCHING STATIONS AND BOOSTER TRANSFORMERS

- Total Supply System Layout Plan, Location plan for Power Installations and Power Schematic diagram.
- Single line diagram of ASS and OHE system
- Protection drawings of OHE Posts & ASS
- Location plan and schematic diagram
- Layout drawings of ASS & Switching stations
- Power and control cable run layout diagram
- Structural assemble and structures drawings
- Foundation layout drawings
- Control room panel layout diagram
- Control, protection scheme and metering arrangement drawing
- Earthing system layout drawings for ASSs and 25kV system.

SCADA SYSTEM

- General arrangement drawing
- Overall layout diagram
- Power supply Schematic and wiring layout diagram
- Control wiring and equipment interface diagram
- List of other special drawings.

OTHER GENERAL LAYOUT DRAWINGS

- Fencing layout
- Bonding/Earthing layout
- Miscellaneous drawings
- Employment Schedule and charts
- The DDC shall review and furnish following typical drawings for traction overhead equipment, power supply distribution system including switching posts
- Uninsulated overlap

- Insulated overlap
- Termination arrangement
- Neutral section arrangement
- FP/SP/SSP/SS feeding arrangement to OHE
- Through bare conductor
- Through cable
- Jumpering arrangement of various equipments of sub stations.
- Cable laying profile diagram at grade and viaduct
- Any other drawing required for proper execution of work

vi. **Track electrification drawing**

Pegging Plans

The pegging plans indicating the location of OHE structures, arrangement of overhead equipment and other general particulars are to be prepared.

OHE layout diagram

- The OHE layout plan incorporating following information shall be submitted.
- The run of wires in different thickness or colour in special cases and terminations.
- The run of wires for future wiring indicated to the contractor, in dotted lines.
- Exact position of all cut out-in-insulators, including section insulators.
- Direction and value of stagger at each traction structure location.
- Clearance of live conductors to structures in the vicinity including bridges, signals, gantries etc.
- Layout of feeders
- Jumper connections and connection to switches and switching stations
- Location and numbers of switches
- Schematic sectioning diagram drawn to a convenient scale showing section insulator number of switches, elementary sections and connections to switching stations.
- Tables giving references of approved profile drawings, feeder layout plans and other relevant drawings.

OHE profile drawings

After completion of the overhead equipment layout plans, the contractor shall prepare an overhead equipment profile drawing showing the actual height of the contact wire under each over line structure the gradient and height of the contact wire on either of structure and the encumbrances at structures until normal height of contact wire and encumbrances are restored.

Cross section drawings

Cross Section drawings for each structure showing guy rods, if any, indicating the cross section of formation/viaduct, height and nature of bank, whether new or old, nature of soil, type of foundation block, structure proposed, reverse deflection of the structure and all necessary particular for erection of the foundation.

Structure erection drawing

The DDC shall prepare structure erection drawings indicating track layout, cantilever arrangement and stability analysis of cantilever, height of contact wire, catenary wire, stagger, setting distance of masts etc.

Feeder drawings

On the basis of these general alignment drawings, the DDC shall prepare and submit the longitudinal profile drawing for the feeders running from Noida Metro, SP, SSP and BT stations to OHE showing the details of structures, jumpering arrangement and the clearances of live conductors from ground. After approval of these drawings, the DDC shall submit drawings for the foundations and structures proposed to be used at locations of supporting structures.

Dropper Schedule

The DDC shall submit dropper schedule for various span lengths and encumbrances covering overlaps neutral sections turnouts crossovers and any other typical locations after reviewing the dropper schedule adopted over Existing line for Noida Metro.

vii. Power Supply distribution, Switching stations and Booster transformers drawing

Location Plan and Schematic diagram:

- The DDC shall prepare the location plans and schematic connection diagram for, all the switching stations, booster transformers and auxiliary substations of the stations and depots incorporating following details
- OHE/Track layout in the vicinity of the receiving cum traction substation, switching stations and BT location.
- Location/orientation of feeding post, other switching posts BT and arrangement of cross and longitudinal feeders to be anchored, if any, including jumper connection with the OHE and busbar of

switching posts.

- Location of auxiliary substation w.r.t the station building and other land-marks including cable entry and exit.
- Scheme of connection of the interrupters and other equipments.
- Fencing out line at the, ASS, switching posts and BT locations.
- Auxiliary substation, switching station layout drawings.
- Layout drawing for ASS and switching stations indicating the arrangement of various equipment, bus bar arrangement, cable run layout, location and position of the pedestal insulators on different structures, high level/low level gantries and other steel framework and fencing. The drawing shall also indicate the space requirement and clearances for each equipment, structures and control room within the earmarked land area for the substation and switching posts.
- The drawing shall also give a schematic connection diagram and an isometric view of bus bars and their connections. The drawings shall include sectional elevation views at various cross sections of the switching posts to cover plan and sectional views at the level of transmission line conductor/cable termination, busbar/; Insulators/Isolators beams, CT,VT and LA's beams as applicable .Drawing shall include the schedule of all equipment required along with drawing references of details of these equipments.
- Power and control cables run layout diagram, including cross section drawing.
- These drawings shall indicate the power and control cables run ASS and switching stations premises and power cables run layout along the section. The layout drawing for cable run along the section would include cross section drawing for each typical location showing erection arrangement, spacing and also space for S&T and other system wide cable. The drawing shall indicate the details of cable trenches/cable-ducts/basement trays/conduits/trough/under platform voids/cable hangers and other cable supports. The cable joints and end terminations shall be shown in the drawing apart from indicating interconnection of cables between various equipment and SCADA cubicles, control panels along with schematic arrangements and physical disposition of equipment, colour coding/ code numbering and index scheme adopted for terminals. The drawings shall also indicate the cable size grade of insulation (also voltage grade for which cable is meant) and quantity of each cable. Cable route shall also show the important landmarks and cable route indicators. The DDC shall submit separate drawing of each ASS, switching stations and along the corridor. The DDC shall check the design and capacity of 33 kV voltage level cables as submitted by

the other contractor keeping into consideration of cross bonding, wherever required, and also check the design of cross bonding scheme accordingly.

- Structural assembly drawings for switching posts and BTs indicating the steel structures for mounting individual equipment, high level steel structures and other steel frame works/ assembly shall be prepared. The drawings shall also have a schedule of component members along with reference of various members. The weight of component members shall be indicated in the separate weight and drilling schedule.
- Foundation layout drawings Foundation layout and cross section drawings for each ASS, switching stations and BT locations shall be prepared indicating the layout of all the foundations in plan, transverse cross-section of various foundations through center line of structures and all equipments. The drawing shall show the details of foundation of various structures, gantries, equipment mounting structures, circuit breakers, interrupters, transformers etc. cable trenches and fencing uprights. All foundations shall be marked serially on the drawing and listed in a schedule on the drawing indicating the volume of concrete for each foundation blocks.

viii. **Control room panel layout diagram**

The diagram shall indicate the physical layout of various control and protection panels e.g. transformer protection panel, circuit breaker and interrupter control panel, SCADA panel, 415 Volts LT distribution control panel of ASS, AC/DC power supply distribution board, incoming and outgoing power supply control panels, battery sets and chargers and any other such equipment's/boards/panels inside the substations and other switching posts building/control room. The drawing shall mention the size (length, width and height) of panels, location, distances from the walls/trenches and other such measurements details. For indoor substations (like ASS of station), location of the transformer and HT/LT cabling route shall also be indicated. Size of ASS room to be optimized after considering all equipment sizing and space optimization.

ix. SCADA drawing

General arrangement drawing

Drawing for general layout arrangement of various SCADA equipment. This shall indicate the size and location of various equipment viz master computer, interface/server equipment between master and RTU, work stations, printers, MDB communication facilities, power supply equipment like UPS, battery, battery charger and other relevant details.

Power supply schematic and wiring layout diagram

This drawing shall indicate schematic arrangement of power supply system feeding to all SCADA equipment of OCC and BCC and RTUs in

ASS and other switching stations. It shall also show alternate power supply scheme from UPS/battery, wiring/cable layouts/routes, distribution boards and other such details to facilitate easy detection of fault and corrective action.

I/O schedule and corresponding cable schedule of SCADA for ASS, OHE, switching stations, SP, FP etc.

Control wiring and equipment interface diagram

This drawing shall indicate the schematic details of master equipments, RTU's and Mimic Diagram Board indicating therein all the equipment-to-equipment interface connections.

List of other special drawings

The DDC shall prepare a list of other important relevant drawings of SCADA equipment like hardware configuration, component level wiring and connection diagram and drawings for integrating Aqua line extension SCADA with existing SCADA systems and other minute drawings to be submitted by the construction contractor later on.

x. Other general layout drawings

Fencing layout plan

Fencing layout drawing for each switching station, BT station, Auxiliary sub-station indicating the layout of the entire fencing and anti-climbing device in part shall be prepared. Each up right, fencing panel and fixture on the up-right shall be indicated on the drawing by its reference number. A schedule of components viz. up-rights, panels, fixtures and barbed wire shall be included in the drawings indicating the drawing references of components. An individual drawing shall be made for each type of panel, fencing post and fixture for mounting the anti-climbing device. The drawing of each fencing post shall indicate the unit weight of the fencing post. The design of the fencing should also match with the station building architecture.

Earthing layout plans

Earthing layout drawings for OHE systems on elevated decks, each complete ASS and Switching station indicating the layout of full earthing system/earthing mat in plan shall be made. The drawings shall show the location of earth electrodes and earth pits and mark the runs of earthing strips and connections, to each equipment and structures, fencing post, fencing panel and control panel. All components shall be marked with their reference numbers. For future details of the runs of conductors and connections, separate drawings, which may be common to all switching stations, may be made and references to these drawings marked on the layout. A schedule of components shall be made out in the drawings giving drawing references of components. The SCADA earthing system shall be separate and not connected to

power supply earthing network.

Miscellaneous drawing

Miscellaneous drawings applicable to all ASS, BT station, SCADA system and switching stations shall be prepared. These drawings shall include drawings or sketches made for study of clearances, scheme of interlocks, number plates of various equipments, caution and instruction boards, outriggers for busbar support and non-standard bus bar connectors.

Employment schedule and charts

The DDC shall prepare employment schedule and charts for: •

- Volume charts and equivalent chart for foundation of OHE structure.
- Employment schedule for pure gravity type of foundations if any or other arrangement for OHE and all other type of substation structures for various direct loads and bending moments.
- Employment schedule for all other foundations for various depths of parent soil from the datum level.
- Employment schedule for masts/structures.
- Dropper schedule.
- Sag tension charts for cross feeders for various spans and tensions.
- The DDC shall co-ordinate its design with the relevant agencies and interfacing DDC's and contractors.
- The Employer's representative shall provide the DDC with the relevant data for the preliminary track alignment. The DDC shall verify/adjust the alignment data as necessary and prepare the plan and profile sheets as required for the Tender Documents.

xi. Deleted

xii. System wise Requirements

For system wise requirements preliminary information in the form of preliminary Civil Engineering chainage shall be given to the DDC. The DDC has to make liaison with the system wide DDC/Contractors to get additional information. During the detailed design phase and continuing through the construction phase the DDC shall coordinate with the Employer's Representative, and other system wise DDC's to obtain systemwide requirements such as station layouts, signaling location, cross over locations, via duct arrangement. The DDC shall attend layout and station building compatibility review meeting during design stage. During design and continuing through the construction phase, the DDC shall revise the completed or partially completed drawings to incorporate the additional

systemwide requirements. Additional layout details and system wide requirements requested by systems and Civil Engineering Contractors during design/construction shall be incorporated into the drawings. Sub-section 2.2 describes construction stage services regarding system wide requirements.

xiii. Interface with other system wide design consultants/contractors/utilities.

The DDC shall co-ordinate all design work with various systemwide-consultants/contractors/utilities including but not limited to:

- Interface with via duct construction DDC/Contractor for informing the location and design of OHE structures and foundations.
- Interface with station building DDC/contractors so as to finalize details of structure foundations and method of supporting the OHE at stations and for suitably locating the BT, SP and SSPs.
- Interface with other system wide DDC/Contractors viz. signaling and telecommunications, rolling stock and other systemwide contractors.
- Employers representative/System wide Contractors for interfacing SCADA with OCC.

3.12 Fire Detection and Suppression

Design of complete Fire- Detection & Alarm system including monitoring and control through a Fire Alarm Panel at Station Control Room and OCC through BMS / SCADA

Designs of Fire suppression system in all Elevated Station Building / other structures including Hydrants, Hose Reels, Sprinklers System, Fire Hose Cabinets, Portable Extinguishers, Gas Based Flooding, etc.

3.13 Design of Permanent & Temporary Water Supply & Drainage System and Rain Water Harvesting System

The DDC shall design and detail the temporary and permanent drainage of the Works and detail the connections of these Works to the existing drainage systems. The drainage systems to be detailed as part of the design shall include but not be limited to:

- Sumps and pumps inside any building or structures, whether above ground or below ground, for the collection of water other than foul sewerage;
- Drainage systems inside and outside any building or structure for the conveyance by gravity of water from the sump(s)
- Or other collection points to the appropriate sewer or drain of the drainage authority;
- Systems for the surface water drainage of reinstated roadways, landscaped areas, car parks and other paved areas associated with the Works and for the

conveyance of the surface water to the appropriate drainage system of the relevant drainage authority; and

- Drainage systems for the conveyance of water from NMRC station buildings to discharge points acceptable to the appropriate drainage authority.
- Design of pumping arrangement for raw water supply, treated water supply, sedimentation sump pumps, Water treatment plant, water mains within the station, Station drinking water supply, Firefighting and Sprinkler Pumps together with the Jockey Pumps, Seepage and Sewage Pumps etc.
- Design of automatic control & monitoring of operation of pumps, incoming supply, liquid level controllers or the equivalent arrangement based on the liquid levels in the various tanks.
- Design of Sumps for Seepage & Sewage and a suitable drainage system inside / outside station, at station, entry / exit, shaft, structures and connection with city mains.
- Design of Deep tube well, pipe line with control valves, treatment of water & storage tanks with level monitors for providing standby water supply for drinking water & toilet for staff, air conditioning, firefighting and station cleaning etc.
- Design an efficient rainwater harvesting system, associated structures, including surface runoff collection arrangements, rainwater collection chambers, filtration units, and recharge pits/wells for groundwater replenishment, ensuring compliance with local regulations and environmental norms.

3.14 Co-ordination and Utility Services

NMRC will assist DDC to liaison with the Utility Authorities for all the necessary requirements for Utility supply. The DDC shall furnish relevant drawings and documents required to obtain approval for construction from Utility Authorities. DDC shall assist NMRC in applying for operational licenses by responding to questions of Utility Authorities.

The DDC shall co-ordinate provisions, including design of connections to the existing utilities services, required for the stations and ancillary buildings, to include but not be limited to:

- Sewerage;
- Ducts for the future installation of public telephones;
- Fresh water supply;
- Electrical ducts;
- Fire protection and detection systems; and
- Other facilities and utilities not designed by the utility authorities.

The DDC shall co-ordinate all design work with various system wide contractors

including design connections to the utility services, to include but not be limited to:

- Electrical substations and associated high voltage and traction power supply systems;
- Electrical underground conduit banks within NMRC right-of-way;
- Fare collection system;
- Signalling;
- Telecommunications;
- Any other system wide contracts.

3.14.2 Co-ordination with Uttar Pradesh Fire Services for Fire NOC

The DDC will assist NMRC to liaison with Uttar Pradesh Fire Services (UPFS) for Fire NOC. The DDC shall furnish relevant drawings and documents required to obtain approval for construction from UPFS. At the request of NMRC, DDC shall assist NMRC in obtaining Fire Department Clearance by responding to questions of UPFS.

Existing Utilities

The DDC shall study and use the records and drawings of existing and planned utilities made available by NMRC. The DDC shall list all the utility conflicts discovered and inform NMRC, in writing, of its recommendations for modifications and diversions. The DDC shall co-ordinate with and gather additional technical information after NMRC has arranged the initial contact with the various utility authorities that are involved in the Works.

The DDC shall also assist NMRC in the co-ordination with the concerned authorities that perform the design, diversions and modifications for enhancement of the utility capability due to DDC design of the station. NMRC shall use this information for further action with the authorities concerned. If information is not sufficient for the detailed design, the DDC shall make recommendations for additional surveys to be done by NMRC. And provide items in the Construct Contract for identification of such utilities. The DDC should review any relocation of utilities with the intent to minimize costs by designing for the permanent relocation initially in lieu of a temporary and then permanent relocation. Prepare the BOQ for utility diversion to be included in the civil contract.

For any joint survey meeting, formal or informal, with the relative utility authority the DDC shall prepare the required information, make a presentation, and prepare meeting minutes according to the instructions of NMRC. All the correspondence, meeting minutes, and information transmittals between NMRC, the DDC, and the relative utility authorities shall be written in English.

DDC shall be responsible for its issue of Minutes of Meeting for the meetings with NMRC, Architects or concerned System wide Consultants / Contractors.

3.15 Units of Measurements

All units of measurement used in the Design shall be in accordance with the International System of Units (S.I)

3.16 Proprietary Items

DDC shall ensure that there are no named or Proprietary products in the Documents or on Drawings. In case of any Named or Proprietary item, DDC is responsible for taking necessary clearance.

3.17 Disposal Sites

The DDC will give conceptual details in the tender documents about the probable disposal site keeping in view the environmental impact study of DPR.

The DDC shall review the Contractors proposals regarding the potential disposal areas.

3.18 Construction Programmes

The DDC shall produce suggested construction programmes based upon its assumed methods of construction and work sequences. The programme shall be prepared through a computer package compatible with Primavera. The programme shall include interface activities with system wide and other contractors. The programmes shall be submitted to NMRC for review of compatibility with other programmes and for any subsequent amendment as required. DDC's construction implementation schedule, shall demonstrate that the design can be constructed within the schedule guidelines of the Contract Documents and indicate the earliest available dates for completion of the Works. This shall include significant schedule milestone events (i.e. trackbed releases, technical room availability, etc.) based on logic restraints, reasonable resources, achievable production rates, and solid construction practices. During the design review stages of the approved construction programme, NMRC may require the DDC to make adjustments based upon the DDC's professional judgment. Where considered to be neither cost effective nor feasible, NMRC shall be informed of the findings.

3.19 Construction Cost Estimates

The DDC shall prepare and submit to NMRC, construction cost estimates for each station and viaduct in its design scope including ASS, cable network, SCADA system, switching stations and OHE for depot and main line under separate heads (project-wise). These estimates shall be based on the schedule of rates (SOR)/LAR/market rate/ rate analysis and as per the quantity take-off from prepared drawings, but where no drawings exist the quantities shall be determined by using similar job information and typical relationship of quantities. All modifications of the cost estimate before contract award shall be in the DDC's Scope of Service.

The estimates shall show the unit rates and quantities adopted and shall give details of how the unit rates were developed. The estimates shall be broken down into separately identifiable sections of Works as directed by NMRC. The DDC shall input cost estimate data onto CDs and submit these CDs in accordance with Section 9 - Submission of Documents herein.

NMRC shall review design drawings and prepare a Bill of Quantities separately to

verify the DDC's take-off from the prepared drawings. The DDC shall revise the Bill of Quantities as required by NMRC and modify the Cost Estimate accordingly.

3.20 Confidentiality of Estimates and Design Budgets

All estimates shall be treated as strictly confidential and shall be submitted by the DDC in sealed envelopes separately from other documents that it is required to provide.

3.21 Presentation Material, Mock-ups, Working Models and Samples

The DDC shall provide the NMRC with information covered by this Design Lot for such purposes of presentation or display as the NMRC may require. Information shall consist of material in the form of descriptions of the Works executed and the resources and manpower employed, and shall include graphs, sketches and photographs for inclusion in publications or for making into displays and exhibits.

3.22 Tender Documentation

NMRC will prepare the E&M works and other building services Tender Documents. However, responsibility for preparing draft material that is peculiar to each station for these documents in electronic format shall be that of the DDC based on documents prepared by NMRC. The DDC shall prepare the Bills of Quantities, Special Conditions of Contract and Technical Specifications, including the Scope of Work and Tender Drawings.

The DDC shall assist the Employer representative in the preparation of any other documents as required. In general, the DDC shall try to follow the ~~format of tender~~ technical specifications of the existing line of Noida Metro but would also incorporate changes as are necessary based on experience of existing line of Noida Metro and/or specific features of the section.

3.23 Amendments to Tender Documents

The DDC shall provide additional design and other information not included in the Tender Documents as may be required by NMRC. This shall include, but not be limited to:

- Amendments as appropriate to the Bills of Quantities;
- Draft written replies to tenderers queries where relating to the DDC's design;
- Addenda to tender documents and drawings.
- Technical clarification for technical evaluation of the tender, whenever required.

3.24 Contract Drawings

The DDC shall submit to NMRC a complete set of "Good For Construction" contract drawings for that contract that has been produced as a co-ordinated package. The DDC shall also furnish a schedule of issue of construction drawings. The DDC shall also furnish a complete set of CAD file tapes/diskettes for contract drawings. The tapes/diskettes shall be fully compatible with NMRC computer system. The construction shall confirm to the tender drawings specification & BOQ. Any deviation / variations with reasons shall be clearly brought out in writing to seek approval,

before execution.

3.25 Property Developments

Conceptual designs of property developments along with the railway designs shall be prepared by the DDC. The property developments will occur at the stations as identified by NMRC. Continuous MRTS functions must be accommodated in all aspects. Operations and maintenance must not be compromised by construction or operation of joint development projects. Conversely, the property development project must also operate independently with minimal or no impact from the operation of the MRTS.

The schemes shall be designed taking into account the building rules and regulations of all statutory bodies. The designs shall be evolved taking into account Neighborhood Urban Planning. The water, electricity and sewage connection for property development shall be independent of main station connection.

3.26 Extent of Design Services

For manpower planning purposes, the schedule dates are indicated in BOQ. The DDC shall be responsible for managing and adjusting its manpower to accommodate variations in schedule during the estimated design period, and such variations shall not constitute a claim for extended design services.

4 SERVICES TO BE PERFORMED BY THE DDC DURING CONSTRUCTION

Services during construction shall be deemed to commence for each construction package on award of the construction contract. For manpower planning purposes, estimated schedule dates are indicated in BOQ. For E&M, and BMS, following activities are to carried out by DDC:

Construction Support Activities including attending various site meetings, coordination, review of shop/working drawings of the contractor's and modifications/revisions to CRD and other drawings as required

a) Review of technical proposals of equipments/materials

b) Review of design proposals

c) Review of Working Reference Drawings (WRDs)

d) Revising/updating Construction Reference Drawings (CRDs)

e) Review of carrying out rate analysis for variation proposals etc.

4.1 Contract Drawings

Additional contract drawings or revisions to the contract drawings previously issued for construction shall be prepared by the DDC and submitted to NMRC. Where changes to the contract drawings are required, the DDC shall be responsible for preparing all data related to the detailed design onto drawings to be issued to the Contractor. NMRC will then issue the drawings to the contractor for construction of the Works.

4.2 System wide Information

The DDC shall incorporate full and final information relating to system wide equipment and services into the CSDs. The timing for issue of the CSDs will be determined by NMRC dependent upon the award of the System wide Contracts. Final system wide requirements defined by CSDs and those required by System wide Contractors and by E&M Contractors shall be incorporated into the SEM and SOD drawings and architectural drawings for construction.

The DDC shall review relevant system wide contractor shop drawings that affect the DDC design. The DDC shall review to ensure compatibility and, after review shall revise and issue all the necessary drawings as and when required by NMRC.

The DDC shall design the embedded items and include these works in the respective civil contracts as directed by NMRC. The interface between the civil contractor's work and the system wide contractor's work shall be clearly defined.

DDC will interface with systemwide consultants/ contractors for ensuring the proper coordination in designing and developing the station / viaduct.

4.3 Construction Methods and Temporary Works

The DDC shall review shop and working drawings, and material samples of architectural items of the construction contractor. Furthermore, the DDC shall assess, and report to the NMRC, the construction contractor's proposed construction methods and temporary works design with respect to their effect on the permanent works and give their views to improve the method etc. submitted by the contractor.

4.4 Site Meetings

The DDC team for each discipline i.e., Civil, Architectural and E&M shall be headed by ‘Project Leader of relevant experience in the concerned field of not less than 10 years as Project Leader with total experience of not less than 20 years and have the experience of handling minimum 03 projects of similar nature and complexity (sufficient proof shall be submitted to substantiate the qualification and experience). All the Team Leaders shall be mobilized and available at project office, to be set up near project sites in Delhi NCR, for the entire duration of the project).

DDC shall attend site meetings when requested by the NMRC, during the design stage and for the clarification/ correction of design and drawings and make periodic site visits.

DDC will draft the MOM of meetings.

4.5 Site Visits

At the request of NMRC, the DDC shall visit the site to provide his expert opinion on the performance, quality, progress etc., of the Works and to report whether the work is progressing generally as designed. The result of such visits shall be reported to NMRC immediately, if urgent actions are required, and shall be included in the DDC's monthly reports in all cases.

4.6 As-Built Drawings of the Works

The DDC shall review the contract record drawings and as-built information submitted by the contractors to the NMRC on a continuous basis prior to the

issuance of the Certificate of Completion for the construction contract. The DDC shall prepare relevant calculations reconciled with as-built conditions and information necessary for the maintenance of the works.

4.7 Liaison Work

The DDC shall co-ordinate and liaise with all concerned local authorities and private and Government agencies to obtain approvals, testing and clearances as deemed necessary, depending on the conditions prevalent at site.

4.8 Co-ordination with Contractors & Other Designers

During the construction phase, the DDC shall be responsible for expeditious implementation of the evolved designs and sorting out any design interface problems with the construction contractors and other contractors working on the section including the depot.

5 ORGANISATION OF THE DETAILED DESIGN CONSULTANT

5.1 General

The DDC shall establish an efficient organization for carrying out all services according to programme requirements. The organization shall provide effective management of the tasks of the contract including those that must be carried out concurrently by separate disciplines and teams. The organization shall also ensure that all information that becomes available during the design period is directed to the appropriate design teams and effective checking procedures are continuously maintained to ensure that required standards are met. Proper coordination between the different disciplines of DDC will be maintained. All the design and drawings will be certified by all the experts of concerned disciplines like E&M Systems, Fire Detection / Suppression system etc. In addition, all CSD and SEM opening drawings shall be signed by the Project Leader who will be in charge of inter disciplinary coordination.

Upon its appointment, the DDC shall promptly commence setting up its exclusive organization to the satisfaction of the NMRC and in confirmation with the organization chart and work experience requirements given in clause 1.1.3.2 of NIT of this Agreement, and shall be housed in one place at Noida/Gr. Noida at his own cost. All works by the DDC shall be performed in Noida/Gr. Noida unless otherwise approved by the NMRC in advance.

However, DDC has to deploy the supporting staff as mentioned in Schedule D of BOQ to support NMRC for 03 Extension Projects well versed with design aspects and relevant experience for which office space of approximately 50 sqm shall be provided by NMRC in its premises.

The DDC shall furnish the CV's of all the key personnels as identified so in the QA Plan who shall be working on this project along with a detailed organization chart and seek approval. If NMRC judges that the continuation of any person is not in the interest of the project, a written notice will be given to DDC who will promptly remove the person within a week. NMRC can withdraw the approval of such persons if continuation of the person is judged by NMRC.

The DDC to provide at least one licensed working software copy being used by DDC to NMRC maintained for the entire contract period.

The DDC shall provide desk space in its offices for intermittent use by NMRC staff. NMRC may regularly inspect/oversee the working of the DDC.

5.2 Performance

Notwithstanding any review of its organisation structure, staff or manning schedules, the DDC shall remain wholly responsible for providing the services. If, in the opinion of NMRC, the progress or performance of the DDC's work is seen to be at any time inadequate to meet those requirements, the DDC shall take the necessary steps to improve them on being so notified. If within a reasonable period the DDC has not improved its progress or performance, the NMRC may by written notice require it to take additional measures, including changes in its organisation, at no additional cost to NMRC. Such notice shall be in no way deemed to constitute a waiver of NMRC's rights to terminate the Agreements by reason of the DDC's breach of contract. Failure by the NMRC to issue such a notice shall not relieve the DDC of its obligation to achieve the required rate of progress and quality of work.

6 STANDARD OF SERVICES

6.1 General

The DDC shall be responsible for the correctness and technical merit of its designs, calculations, drawings and all other documentation prepared by it in carrying out the services.

The DDC shall ensure that qualified and experienced staffs are employed in sufficient number and that accurate, consistent, clear and easily read drawing and documents are produced in time.

The DDC shall comply with the provisions and procedures covering standards and codes, drawings and calculations outlined in Section 6.2 below. The DDC shall also comply with the checking procedures in Section 7 hereof.

6.2 Standards and Codes

The standards and codes referred to in the design criteria, drawings, outline specifications and documents issued by NMRC to the DDC shall be used in its design and, where appropriate, shall be quoted on drawings and other documents by it. Normally the DDC shall use the Standards given in this document for design requirements in preference to other national standards except when higher standard or better quality is required. Standards quoted in the **Annexure 3** will take preference over those indicated elsewhere. Should the DDC propose to adapt other standards or codes for its designs, it shall submit to NMRC copies thereof, together with a statement as to the cost implication of adoption and substantiation that substitution is necessary. The DDC shall also demonstrate that other standards are equivalent or superior to those they intend to replace and it shall obtain the written approval of NMRC prior to adoption.

6.3 Extent of Information

All designs and documentation produced by the DDC shall provide sufficient information and detail for contractors to determine accurately the extent of the Works during construction and execute and maintain the Works.

Drawings, Specifications and other information produced by the DDC for construction, or revisions of such documents, shall be submitted to NMRC, in sufficient time for review and further issuance of a comprehensive package to the contractor. The DDC shall ensure that these documents are produced in a timely manner such that the construction contractor is able to plan and execute its works in accordance with the contract, including the construction programme.

Drawings for construction shall be in such detail as not to require further design or detailing to be carried out by the construction contractor except as provided under Section 6.5 hereof. The DDC's drawings shall show or include details of any unusual features of construction or detailing.

6.4 Calculations

Calculations shall be prepared according to the best professional standards and compiled into sets that relate to particular aspects of design.

Each set of calculations for E&M systems including OHE, Power Supply (both traction and auxiliary)and Remote control (SCADA) system design shall include, but not limited to:

- Load calculations, equipment rating and cable sizing;
- Rating of protection devices; and
- Lighting levels and calculation for luminaries.
- Equipment and component sizing for Batteries, Diesel fuel tank, MCC’s, Panel boards, Switchboards including calculation of connected load, maximum demand and short circuit level at each panel & Distribution Board.
- Load Flow Analysis including Load Study Calculation, Power Factor Correction, Protection co-ordination, Selection of Switchgear and Short circuit calculations.
- Calculation for Earthing and Lightning Protection System including earthing current / resistance, lightning protection and Step / touch voltages
- Calculation for Cable Duct / Cable Trunking System including Cable pulling tension calculation, Cable tray sizing, Provision of Conduits, Conduit / tray fill calculation, Manholes / draw box sizes
- Lighting System Calculations including Indoor lighting calculation, Outdoor lighting calculation, Viaduct lighting calculation.
- Water supply, water treatment system
- Fire detection, fire suppression scheme
- Seepage and Sewage scheme
- Pressure drop calculation for fans

- Heat load calculation for each room/ area for air-conditioning Each set of calculations for VAC systems shall include:
- Equipment and component sizing for MCCs, MDBs, PLCs, etc. including calculation of connected load, maximum demand and short circuit level at each panel & Distribution Board;
- Load Flow Analysis including Load Study Calculation, Power Factor Correction, Protection co-ordination, Selection of Switchgear and Short circuit calculations;
- Cable sizing calculations;
- Sizing calculations for all VAC equipments;
- Pressure drop calculation for Ventilation fans; and
- Heat load calculation for each room/ area for air-conditioning.
- Calculation of connected load & maximum demand for normal, DG & UPS supplies.
- Power & Voltage at farthest ends of the Aqua Line extension corridor taking feed from each TSS & AMS of existing NMRC Aqua Line at normal &extended feed conditions are within acceptable limits for trains and Auxiliary system.
- A brief description of the OHE and Auxiliary substation structure design.
- Size of equipment foundation.
- Size of cables, traction conductors, earthing conductors/busbars.
- This would give due consideration in laying method, derating factors, voltage drops & other such factors before working down the final result.
- Capacity of transformers of ASS's, circuit breaker, interrupters, disconnecting switches booster transformers, Instrument transformers and other equipment.

Due consideration should be given to the load cycle based on the Train operation, and the transformers to be designed for maximum efficiency accordingly. All other associated equipments & items are also to be designed accordingly.

- Power factor correction equipment in substations.
- A brief statement/description of the method of analysis used.
- A brief statement/description of the method of design.
- Details of the computer programme used
- A key to symbols used and
- A design summary
- Any other relevant calculation pertaining to design work.

Each set of calculations shall be bound and shall include a cover sheet and index.

A statement certified by the DDC's Authorized and Approved Project Manager that

the accepted checking procedures, as defined in Section 7, have been carried out in full shall be attached to each set of calculations submitted to NMRC.

NMRC may require the submission of applicable software including in house software programme / worksheets developed by the contractor, computer input and programme logic for its review prior to the acceptance of the computer output.

Original calculations shall be submitted to NMRC for proof checking. Each sheet shall be signed in accordance with the requirements of Section 7. Original calculations shall be returned and retained by the DDC and shall be produced at such times as may be required by NMRC. The original calculations shall then be handed to NMRC on completion of the services.

6.5 Drawings Prepared by DDC

Preliminary and Contract Drawings required for construction shall be prepared and issued by the DDC in accordance with the current requirements issued to it by NMRC (refer to Section 9 for submission of documents).

All drawings shall be prepared in A-1 size and shall be produced by CADD graphic system compatible with the NMRC system and as approved by NMRC. Drawings are defined as:

- **Preliminary drawings** are drawings prepared by the DDC prior to their acceptance by NMRC as Tender or Contract Drawings;
- **Tender Drawings** are drawings prepared by the DDC and approved by the NMRC which, with other relevant documentation, contain all the information necessary for tendering purposes; and
- **Combined Services Drawings (CSD)** are drawings prepared by the DDC and approved by the NMRC, showing the locations, layouts and sizes of all services including those of other Contractors, co-ordinated, so as to eliminate all clashes.
- **Strcutural, Electrical, Mechanical drawings (SEM)** are drawings prepared by the DDC and approved by the NMRC, showing the location, sizes and details of opening in structural elements for Mechanical and Electrical facilities and other related contracts.
- **Contract Drawings** are drawings that have been prepared by the DDC from Tender Drawings that have been approved by NMRC and which, together with other relevant documentation, will form the Construction Contract. The Contract Drawings shall be stamped "Issued for Construction" and will be added or revised as noted in Section 4.1.
- Drawings excluded from the DDC's scope of drawings include:
    - Shop drawings and working drawings;
    - Fabrication drawings;
    - As-Built drawings; and

- Details of elements of proprietary systems.

DDC shall submit to NMRC as part of a progress register, a list showing drawing numbers, titles, scales and the progress status of all drawings planned for inclusion in the documents for obtaining tenders. The format of the progress register shall be as directed by NMRC. The DDC shall update the register as required. All drawings shall be checked for compliance with design specifications and for accuracy by the DDC's design staff and shall also be subjected to the checking procedures as detailed in Section 7 hereof.

6.6 Drawings Prepared by Construction Contractors

Drawings prepared by the Construction Contractors are defined as:

- **Shop Drawings** contain information related to the permanent works. The DDC's concerned staff shall check these drawings and a report shall be furnished to NMRC.
- **Working Drawings** contain information related to temporary works details for the construction of the permanent works. The DDC's concerned staff shall check these drawings and a report furnished to NMRC.
- **As-Built Drawings** depict the completed works that have been certified complete. These drawings shall have been reviewed by the DDC and a report furnished to NMRC.

6.7 Documents

Documents shall be prepared by the DDC in accordance with the requirements issued by NMRC. Documents produced by the DDC shall be listed as part of the Progress Register.

6.8 Computer Programs

The DDC shall submit details and verification of all computer programs it intends to use to NMRC for acceptance prior to use in making calculations. These shall include the computer program manuals, input and output printout of a typical example and previous records of its use by the DDC. The DDC may also be required to perform test calculations using the program so that the results may be compared with those obtained by other means.

7 CHECKING PROCEDURES

7.1 General

The DDC shall establish a Quality Assurance Plan (QAP) and a system of internal checking and approval of all designs, including calculations, drawings and other documents prepared and issued by it, to NMRC for acceptance.

The purpose of the checking shall be to ensure accuracy and consistency, as well as compliance with current requirements, standards, codes and the requirements of this document. Certification of such a check has been carried out shall be issued to NMRC with each batch of documentation for acceptance at the final submission and subsequent submissions.

Internal checks shall be carried out by personnel who have experience and competence equal or superior to the originator, but who have not been involved in producing the original design.

The plan should cover record keeping method of the inputs/requirements given by NMRC from time to time. The team lead shall be responsible for compliance to NMRC instruction/observation/input and holistic co-ordination of services.

7.2 Design Calculations

Each page of design calculations, including any amendments thereto, shall be endorsed as checked and approved prior to issuing to NMRC by being initialled and dated by both the originator and the checker. The checker shall append a statement explaining the method of checking used.

7.3 Drawings and Documents

Each document and drawing, including any revisions thereto, shall be endorsed as checked and approved prior to issue to NMRC by being initialled and dated by both originator and checker. In addition to compliance with the requirements of the documentation, each drawing, where appropriate, shall be checked to ensure compliance with the DDC's certified design calculations.

7.4 Certification

A certificate signed by the Project Manager of the DDC or his accredited representative stating that all drawings and documents have been checked and approved in accordance with the DDC’s approved Q.A. Plan shall accompany all documents and drawings issued by the DDC to NMRC for acceptance.

7.5 Quality Assurance Plan

The Quality Assurance Plan (QAP) shall be submitted by the DDC to NMRC for approval before any work is submitted by the DDC for approval by NMRC.

The QAP shall identify the personnel, procedures, instructions, records and forms necessary to implement the plan with the following minimum requirements:

- Certification process of drawings and documents for issue;
- Organisational structure;
- Design control - including study and design input/analysis;
- Checking of documents;
- Document control;
- Subcontractor control;
- Internal quality audit; and
- Corrective action.

The DDC shall also identify the requirement of Quality Level and incorporate a Quality Level List in the QAP for each construction contract.

7.6 Quality Audits/Monitoring

Quality Audits and monitoring of the DDC's QAP will be conducted by Employer's Representative at intervals commensurate with the DDC's activities.

7.7 Responsibility

Notwithstanding acceptance by NMRC, the DDC shall remain responsible for the quality of the documents.

8 DESIGN SUBMISSION AND REVIEWS

8.1 Inception Report

The DDC on mobilization would submit an inception report indicating the details of manpower deployment (project-wise) and strategy for delivering the work as per required time frame and comparative study as required. A detailed methodology and action plan will also be submitted.

8.2 Design Alternatives and Architectural Review

Design Alternatives and a preliminary Architectural Review of the DDC's design proposals will be held 8 weeks after the Date of Commencement of the Contract. The DDC shall prepare and present drawings describing the architectural design which shall, at a minimum, include:

- Site plans;
- Plans at each station level;
- Reflected ceiling plans at each level;
- Sections and elevations;
- Perspective sketches;
- Plans, sections, elevation and sketch design studies of all typical features. Typical repetitive conditions to be noted as such and located; and
- Landscape conceptual design.

8.3 Design Submission for OHE Traction & Auxiliary Supply.

The DDC shall prepare and present calculations and drawings describing the design which shall at a minimum include –

- Report on power supply arrangement
- Detailed Design Consultant will submit detailed feasibility cum techno economic comparative studies for:
    - With 25 kV BT/RC (OHE & PSI)
    - Without 25 kV BT/RC (OHE & PSI)

  DDC to submit the detailed comparative study report for all the above 2 options and submit its recommendations for the best option, with drawings based on which NMRC may decide the system to be followed for OHE and Power Supply.
- Sectioning diagram for main line
- Auxiliary supply schematic .This would include design of the run and installation of 33kV
- auxiliary power cables along the corridor.

- The design calculations as detailed at item 4.4
- OHE pegging plan, OHE layout drawing & OHE profile drawings.
- OHE configuration in via duct, at grade and stations
- Arrangement of OHE termination at anchor points
- Earthing & bonding arrangement
- Switching station layout and their connection to OHE
- BT layout if placed in gantry on via duct or at platform end or under deck to located BT
- and switching stations at one end of the platform.
- Design of auxiliary power substations (ASS) at each station
- Design of the overall protection scheme for OHE, power supply and auxiliary network.
- Design of SCADA system.

8.4 Progress Review Meetings

The DDC will attend progress review meetings and the Monthly Progress Reports will be prepared and provided by DDC. The DDC will be required to produce:

- An updated copy of the computerized project schedule and a design chart showing scheduled and actual start and finish dates and estimated percentage completion for each major design activity;
- An updated copy of the Progress Register showing the titles and status of all drawings and documents;

8.5 First Review Submission

When the design, including preliminary drawings and drafts of the Bill of Quantities and specifications is substantially developed to define the Works, including locations, shapes and sizes, it shall be submitted to NMRC for the First Review.

Indicative costs are to be prepared for all designs alternatives proposed by the DDC. Detailed cost estimates will be required for those design alternatives approved / adopted by NMRC.

After review the documents required for submission by NMRC to obtaining necessary clearances/ permissions or obtaining NOCs from the concerned Ministry, Authority or Department for the construction of the 03 extension corridors of Aqua Line .

The First Review Submission shall include, but not be limited to:

- Documents required for obtaining clearances/permission/approvals/NOCs.
- Design calculations to reflect the scope of the Works to be executed;

- Drawings detailed to define the scope of the Works to be executed;
- Bill of Quantities for all the works in sufficient accuracy to be able to proceed to construct;
- Technical specifications in sufficient detail of materials and workmanship to permit contractors to work;
- A design brief for E&M services covering the basis / principles / norms followed for various activities. Draft drawing of all drawings to be submitted in final review/ submission.
- An environmental impact mitigation action plan;
- Identification of conflicts within the right-of-way of the Indian Railways/ Civic bodies, and resolutions to problems identified;
- An outline Construction Program with consideration of construction methods, if appropriate;
- A draft description of assumed construction methods, if considered appropriate;
- Initial construction cost estimates and estimate reconciliation with the estimate and, if appropriate;
- Comments, if any, on the documents supplied by NMRC;
- Any other documents that may have been requested by NMRC.
- DDC shall be present, for discussion and explanation, of all design submissions for approval of NMRC, through meetings and presentations.

8.6 First Review Procedure

NMRC will complete the First Review of all details submitted within approximately 7 working days, and furnish the DDC with his review comments either in writing or on marked up drawings. Within 3 days of receiving the comments the DDC shall meet with NMRC to discuss the review comments such that further actions can be determined for the DDC to proceed with its services in a timely and efficient manner. Within seven (7) days of this meeting the DDC shall deliver to NMRC 6 copies of the minutes of the meeting together with its responses to all comments.

8.7 Delivery of Tender Drawings, BOQ's, Cost Estimates and Specifications for E&M and other Building Services Works

These documents will comprise material for inclusion in the tender documents issued to Construction Contractors for tendering purposes by NMRC. The documents will be complete and incorporate the First Review comments. It shall not be necessary to make adjustments to the BOQ's at a later date to accommodate changes in quantities or bill items.

8.8 Final Review

When the design, including preliminary drawings and other details for the Contract Documents for construction, is substantially complete, the DDC shall submit the documents for the Final Review. The quality of this submission shall be such that the Contract Documents can be completed by incorporation of NMRC's review comments.

8.9 Final Review Submission

The Final Review submission shall include, but not be limited to:

- Design calculations which are indexed and checked;
- Drawings sufficiently detailed to define the Scope of Works, complete and checked;
- Combined Service Drawings; (CSDs);
- Structural-Electrical-Mechanical Drawings (SEMs);
- Systems Erection Drawings;
- Design basis report, Design report and geotechnical design summary report including specific actions which are necessary to complete the design;
- A factual report on additional geotechnical investigations;
- A Property Development Report (if applicable);
- A detailed construction program;
- A detailed description of the assumed construction methods;
- Construction cost estimates, estimate reconciliation with prior estimates, and back-up data;
- Bill of quantities with quantity take of sheets
- A detailed implementation Schedule detailing the various interfaces during construction stages with other contractors
- All Particular (Technical) specifications and other details required for tender invitation
- General specifications, General & Special conditions of contract. These will be prepared by reviewing Existing Aqua Line corridor jointly with NMRC.

The Final Review Submission shall include the following documents and products of its architecture and urban design work:

- Property development proposals in accordance with the Master Plans. Such proposals shall include typical floor plans, sections, elevations, perspective sketches, landscaping, environmental mitigation, and interfaces with stations and ancillary facilities.

- Site Plans for each station, ancillary facility, or property development proposal, including surrounding land uses, roads, landscaping, existing or proposed buildings and infrastructure, as well as any proposed additions, modifications, or required demolition.
- Station Floor Plans for all levels, including all public and non-public areas. Indicate vertical circulation elements; access and parking; load bearing and partition walls; fire separation walls; Automatic Fare Collection (AFC) equipment layouts, ancillary facilities and equipment rooms; facilities and spaces for station commercial trading functions; and any other required furniture, fixtures, and equipment.
- Station Sections and Elevations, keyed to the plans, including all major structural elements; vertical circulation elements; track bed and drainage; mechanical and electrical equipment; provisions for secondary and tertiary building systems and elements; walls and ceilings; doors, windows and other significant openings; and general materials and finishes.
- Station Reflected Ceiling Plans, indicating layouts and integration of ceiling mounted services, structural and architectural elements, electrical and mechanical equipment, HVAC system wide components, signs and graphics, and the like.
- Plans and sections of sufficient size and scale to indicate proposed construction interfaces; methods of construction; and relationships between structures, finishes and services.

Calculations and Miscellaneous Schedules and Tables comprising:

- ❖ Schedules of Accommodations, indicating room and space dimensions, functions, and requirements for stations, ancillary facilities and property development.
- ❖ Schedules of Finishes for stations, indicating materials and finishes, type and extent for each station room or space.
- ❖ Schedule of Electrical fixtures, wiring, utilities, pumping, E & M and control systems.
- ❖ Tables of Vertical Circulation Equipment for stations, including escalator and lift numbers, types, landing elevations, runs and rises.
- ❖ Tables of Automatic Fare Collection (AFC) Equipment for stations, including Automatic Ticket Machines (ATMs) and Automatic Ticket Gates (ATGs).
- ❖ Schedule of Electrical fixtures, wiring, utilities, pumping, E & M and control systems.
- ❖ E&M drawing comprising as a minimum of the following:

  (i) Single line diagram of electrical system including Panels and DB's, Cable Sizing etc.

(ii) Wiring layout floor wise and external. This shall include location of DB's, Lighting fixtures, sockets, fans etc and wiring details.

(iii) Cable tray layouts showing section of cable tray at different places, number of cable, spacing, spare capacity etc.

(iv) Equipment layout of Generator room. UPS room, ASS, Pump Room, Tanks and Water Treatment Room and other such equipment room showing layout of equipments, cable tray / trenches / ladders / raceways, clearances and spacing.

(v) Earthing single line diagrams. The location of earth mats / pits may be shown on electrical layout.

(vi) Lighting protection layout.

(vii) Lighting Layouts including fixture mounting arrangements

(viii) Other details as may be necessary for proper execution of requisite E&M works

(ix) Ducting and piping Layout, if any

(x) BMS and OCC SCADA Architecture

❖ Fire drawings comprising as a minimum of the following:

(i) Fire detection single line diagram

(ii) Fire detection system layout floor wise

(iii) Fire suppression single line diagram

(iv) Fire suppression layout floor wise and external layout.

(v) Details of various sub-systems, sprinkler layout, automatic gas flooding (as applicable)

- Integrated Services Drawings, indicating both existing and proposed services, utilities, structural and architectural elements, electrical and mechanical equipment, HVAC system wide components and other infrastructure as required to support the stations, ancillary facilities and property development. From these drawings shall be derived sizes of holes and other penetrations through structural and non-structural elements together with any cast in items required for the installation of services and utilities during the construction of the station.
- In addition to final modified first review submissions of E & M items, the DDC shall furnish cost estimates, construction sequencing and programme indicating critical items.
- Pedestrian circulation models calculating and detailing pedestrian flows, vertical and horizontal circulation and passageway requirements, platform size, and emergency evacuation times for the stations and property development sites. NFPA 130/NBC 2016 & amendments shall be generally followed as a standard. Passenger Pek Hour Boarding & Alighting Figures (forecasted) are provided in DPR.

- Outline specification for all architectural elements
- Property development programme and its implementation programme.

8.10 Final Review Procedure

NMRC will complete the Final Review of all details submitted within approximately 21 working days, and furnish the DDC with his review comments either in writing or on marked up drawings. Within 7 days of receiving the comments the DDC shall meet with NMRC to discuss the review comments such that further actions can be determined for the DDC to proceed with its services in a timely and efficient manner. Within seven (7) days of this meeting, the DDC shall deliver to NMRC 6 copies of the minutes of the meeting together with its responses to all comments.

The responsibility of obtaining approval from Local Authorities is that of the NMRC. DDC will assist in the approval process.

8.11 Design Report

The Design Report shall include, but not be limited to:

a. Work Description;

b. Drawing Index;

c. Site Plan;

d. Structural Configuration;

e. Construction Description;

f. Design Criteria; and

g. Technical Descriptions

h. Protection plan from floods during construction (if required).

i. Concept plans for diversion and support (or protection) of existing utility services; remaining work of maintenance etc. (if required).

j. A program for all utilities involved in the works, listing the following:

   i. Proposed methodology;

   ii. Allocation of responsibility for the work to the contractor or others;

   iii. Critical dates for completion of temporary and permanent diversions;

   iv. Test pit requirements.

8.12 Property Development Report

A Property Development Report shall be prepared to include, but not be limited to:

- General description;

- Planning data;
- Architectural design;
- Details of fire separation;
- Constructability aspects; and
- Outline drawings.

8.13 Submission of Originals

When all the comments of the Final Review submission are incorporated, the submission of originals shall be made to NMRC. This will consist of all documents prepared by the DDC including the Design Estimate Procedures for review shall follow those of the Final Review Procedure.

8.14 Delivery of Documents

After NMRC has accepted the submission of the Originals, the DDC shall deliver in electronic format on CD-ROM all Documents prepared by it to NMRC. Original full size Tender Drawings shall be ready for reproduction. The original documents, typed but not bound, shall have been proof read, reviewed, approved and certified, and be ready for reproduction. The DDC shall furnish a complete set of CAD CD-ROM prepared in accordance with requirements within 60 days of the submittal of the original drawings. A CAD File Control Log, which describes the contents of the CAD CD-ROM, shall also be furnished.

8.15 Delivery of Contract Documents

The DDC shall issue the documents, as specified in **Section 9**, to NMRC for issuance to the contractor "For Construction".

8.16 Final Design Summary Report

The Final Design Summary Report shall include, but not be limited to:

- Scope of Work;
- Work Description;
- Drawing Index;
- Key Design Drawings from all disciplines;
- Site Plan;
- Structural Configuration;
- System Operation;
- Construction Description;

- Design Criteria; and
- Technical Descriptions
- Statutory Complaint Certificates

The purpose of this report is to provide a convenient reference to the design and operation of the system. The report shall cover the service stage scenario.

9 SUBMISSION OF DOCUMENTS

The DDC shall deliver the drawings and documents produced / prepared in connection with this contract except the rough note/ draft etc. They will be packaged as directed by NMRC.

The submissions of these drawings and documents in connection with the 03 extension projects shall be delivered separately for each project to NMRC in the following manner.

9.1 Quality Assurance Plan

4 copies of the Quality Assurance Plan

9.2 First Review Submission

1 full size (A-1) sets of mylar reproducible;

One full size (A-1) sets in CD-ROM;

5 full size (A-1) sets of drawings (including 5 additional sets of full size (A-1) utility drawings);

5 half size (A-3) sets of drawings;

5 copies of the Construction Program;

5 sets of utility drawings.

5 sets of additional topographical surveys and field survey (if any)

5 sets of BOQ's

5 sets of Specifications

5 sets of design calculations;

5 sets of Construction Cost Estimates

5 copies of the Design Report;

9.3 Final Review Submission

One full size (A-1) set of mylar reproducible;

One full size (A-1) sets in CD-ROM;

5 full size (A-1) sets of drawings (including 5 additional sets of full size (A-1) utility drawings);

5 half size (A-3) sets of drawings;

5 sets of design calculations;

5 copies of the Design Report;

5 copies of the Construction Cost Estimates;

5 copies of the Property Development Report.

9.4 Submission of Tender Drawings, BOQ's, Cost Estimates and Specifications

One full size (A-1) set of mylar reproducible;

1 full size (A-1) set of CD-ROMs;

10 sets of full size (A1) drawings

10 half size (A-3) sets of drawings;

10 sets of Bills of Quantities

10 sets of special specifications

4 sets of Cost Estimates

9.5 Submission of Originals

1 half size (A-3) sets of prints of drawings;

1 copy of Construction Cost Estimates;

1 copy of Final Design Summary Report (Vol. 1);

2 sets of CD in AutoCAD format of all drawings;

2 sets of Property Development Report;

3 sets of Quantity Take off Sheets; and

3 sets of CD/DVD for construction cost estimates.

9.6 Submission of Construction Drawings

7 sets of all conformed drawings marked "Good for Construction". (A1)

9.7 Submission of "As-Built" Drawings

5 sets of "As-Built" drawings prepared by the contractor endorsed by the DDC. (A1)

5 sets of final design summary report.

1 Revit/Navis work file for each BIM model generated.

9.8 Submission of Combined Services Drawings (CSDs)

5 sets of drawings with 6 No. Soft copies in Auto Cad and PDF Format.

9.9 Submission of Services Electrical and Mechanical Drawings (SEMs)

5 sets of drawings with 6 No. Soft copies in Auto Cad and PDF Format.

9.10 Design Certificate

All submissions shall be accompanied by two original copies of a 'Design Certificate' as set out in **Attachment D1** hereto and signed by the Contractor and the Designer.

NOTE: The above list is not exhaustive and shall also include revisions in drawings as required in consideration of specific coordination issues and site constraints

ATTACHMENT D1
DESIGN CERTIFICATE

This Design Certificate refers to design submission no. ..... which comprises of Definitive Design submission / Construction Reference Drawings submission, working drawing submission scheduled in the attached transmittal, in respect of:

(Description of Permanent Works to which the submission refers)

DESIGNER'S STATEMENT:

We certify that:

a) the outline designs, design briefs and performance specifications of those elements of the Permanent works as illustrated and described in the documents scheduled in the attached transmittal, complies with the Outline Design Specification (ODS) and other contract provisions.

b) an in-house check has been undertaken and completed in accordance to approved Quality Assurance Plan (QAP) to confirm the completeness, adequacy and validity of the design of the Permanent Works as illustrated and described in the documents scheduled in the attached transmittal.

c) all necessary and required approval relating to the design of the Permanent Works, as illustrated and described in the documents listed in the attached transmittal, have been obtained.

d) all effects of the design comprising the submission on the design of adjacent or other parts of the works have been fully taken into account in the design of those parts.

e) The Certifies that all design has been performed utilizing the skill and care to be expected of a professionally qualified and competent designer, experienced in work of similar nature and scope. This further certifies that all works relating to the preparation, review, checking and certification of design has been verified by us and the design proposed by the designer has been accepted by us.

Signed by Designer's Authorized Representative

Name : .....

Position : .....

Date : .....

SAMPLE DRAWING TEMPLATE

(a) 'Design Quality Assurance' by designer consultant:

DESIGN QUALITY ASSURANCE			
The responsibility of control, check and verification of accuracy, correctness, completeness, integration and full compliance of contract provisions in respect of design analysis and drawings rests with the design consultants.			
By Designer			
Sig. :	Sig. :	Sig. :	Sig. :
Date. :	Date. :	Date. :	Date. :
Name :	Name :	Name :	Name :
Designed by	Checked by	Approved by	Accepted By

(b) Notice of 'No Objection' from Employer's ~~representatives :~~representatives:

Notice of 'No Objections' from Employer's Representative			
Notice of "No Objections" from Employer is being accorded for design Principles. However, the overall responsibility for the detailing and design accuracy lies with Design and Build Contractor.			
	REMARKS	**Date**	**Signature**
AE/XEN (Design)	Reviewed		
Dy. CE (Design)	Reviewed		
CE (Design)	~~Reviewed &~~Reviewed & comments as marked on drawing		

Engineer (CRE)	Reviewed & No objection issued with comments as marked on Drawing		