

DRAFT CONCEPT REPORT

Infrastructure services
Sector 10 Social Housing

AECOM

DRAFT CONCEPT REPORT INFRASTRUCTURE SERVICES FOR SOCIAL HOUSING AT SECTOR-10, PALAVA PHASE-2, DOMBIVLI

Project Number	DELD _____
Project	SOCIAL HOUSING SECTOR-10 , PALAVA PHASE-2, DOMBIVLI
Document Title	DRAFT CONCEPT REPORT INFRASTRUCTURE SERVICES
Revision No.	R0
Prepared by	Naresh Goyal, Vijay Sharma ,Munish Vashistha, Kapil Chabbra, Shanam Bhan, Sikha Jindal , Deepika Raj , Sharad Rathore
Date	28-January 2016

Table of Content

EXECUTIVE SUMMARY 5
1 INTRODUCTION 6
1.1 OBJECTIVE 6
2 SITE APPRECIATION 7
2.1 LOCATION 7
2.2 MASTER PLAN 9
3 POPULATION 10
3.1 ASSUMPTIONS 10
3.2 DESIGN POPULATION 10
4 TRANSPORTATION 11
4.1 INTRODUCTION 11
4.2 ROAD NETWORK LAYOUT 11
4.3 DESIGN STANDARDS FOR ROADS 12
4.4 TRAVEL DEMAND ASSESSMENT 13
4.5 ROAD CROSS SECTIONS 15
4.6 PAVEMENT DESIGN 16
4.7 ROAD FURNITURE 16
4.8 MATERIAL SPECIFICATIONS 16
5 WATER SUPPLY SYSTEM 17
5.1 INTRODUCTION 17
5.2 DESIGN CRITERIA 17
5.3 DESIGN PERIODS 18
5.4 MATERIALS 18
5.5 TRUNK SUPPLY FROM MIDC 19
5.6 PEAK FACTOR 19
5.7 DISTRIBUTION NETWORK 19
5.8 VALVES AND FITTINGS 20
5.9 BEDDING 21
5.10 DESIGN ASSUMPTIONS 21
5.11 WATER DEMAND 22
5.12 PROPOSED WATER SUPPLY SCHEME 23

5.13 STORAGE RESERVOIRS & PUMP ROOM 24
6 SEWERAGE SYSTEM 26
6.1 INTRODUCTION 26
6.2 DESIGN CRITERIA 26
6.3 DESIGN PERIODS FOR VARIOUS COMPONENTS 26
6.4 HYDRAULICS OF SEWERAGE NETWORK 26
6.5 MATERIALS 27
6.6 PEAK FACTOR 27
6.7 MINIMUM AND MAXIMUM VELOCITY OF FLOW 28
6.8 MINIMUM SIZE OF SEWER 28
6.9 MANHOLE SIZE, DEPTH AND TYPE 28
6.10 SPACING OF MANHOLES 28
6.11 COVER FRAME 29
6.12 BEDDING 29
6.13 SEWAGE GENERATION 29
6.14 PROPOSED SEWERAGE SCHEME 29
6.15 SEWAGE TREATMENT PLANT 30
7 STORM WATER DRAINAGE SYSTEM 31
7.1 INTRODUCTION 31
7.2 INDICATIVE DESIGN STANDARDS, METHODOLOGIES AND SPECIFICATIONS 31
7.3 CALCULATION FOR DISCHARGE 32
7.4 COEFFICIENT OF RUNOFF 32
7.5 TIME OF CONCENTRATION (TC) 32
7.6 IMPERVIOUSNESS 32
7.7 RAINFALL INTENSITY (I) 33
7.8 HYDRAULICS OF DRAINS 33
7.9 COEFFICIENT OF ROUGHNESS 34
7.10 VELOCITY 34
7.11 FREE-BOARD 34
7.12 PROPOSED SCHEME: 34
8 ELECTRICAL SYSTEM 35
8.1 INTRODUCTION 35
8.2 CODES AND STANDARDS 35

8.3 LOAD NORMS FOR POWER DEMAND CALCULATION 35
8.4 SYSTEM OF SUPPLY 36
8.5 VOLTAGE REGULATION 37
8.6 POWER FACTOR 37
8.7 PROPOSED DISTRIBUTION SCHEME 37
8.8 HT/LT CABLES 39
8.9 EARTHING SYSTEM 39
8.10 ILLUMINATION LEVELS 40
8.11 STREET LIGHTING 40

List of Figures

Figure 1: Location of Palava wrt to Navi Mumbai *7*
Figure 2: Marking of Project Site sector 10 on Google Earth Image *8*
Figure 3: Sector 10 Master Plan *9*
Figure 4: Road Hierarchy Map *11*
Figure 5: Ductile Iron Pipe *18*
Figure 6: HDPE Pipe *18*
Figure 7: Water Balance Diagram *23*
Figure 8: POTABLE WATER SUPPLY SCHEME *23*
Figure 9: Recycled water supply scheme *24*

List of Tables

Table 1: Population Norms for Residential (EWS) 10
Table 2: Number of Dweling units Pocket wise as per Master Plan 10
Table 3: Summary of Design Population for Residential Clusters 10
Table 4 Road Length 11
Table 5 Design requirements (IRC 86 – 1983) 12
Table 6 Population calculation 14
Table 7 Estimation of Peak Hour Traffic 14
Table 8 Road Cross section Details 15
Table 9 : Assumption of Water Demand 21
Table 10 system losses 21
Table 11 Summary of Water Demand 22
Table 12 Water Demand for Irrigation (10 % of area to be considered) 22
Table 13 : Summary of UGT Sizing 25
Table 14 Summary of water supply networks 25
Table 15 : Design Period of Sewerage Components 26
Table 16 : Typical Manhole Sizing 28
Table 17 : Manhole Spacing 29
Table 18: Summary of Sewerage Generation 29
Table 19: Classification of Impervious Cover (in %) 32
Table 20: Load Norm 36
Table 21: Voltage Regulation 37

List of Annexures

Annexure 3.1	Population details
Annexure 5. 1	Water demand calculations
Annexure 8.1	Electrical load calculation summary
Annexure 8. 2	Forecasted load demand and transformer rating
Annexure 8. 3	Outdoor feeder calculation for Pocket c, b, a
Annexure 8.4	Selection of size of earth strip for body earthing of the transformer
Annexure 8.5	Dg panel for Pocket c

DRAWING LIST

S. No	Drawing details	Drawing number	Revision
1	Potable water supply	ACM-LODHA10-CP-PWS-01	R0
2	Recycle water supply	ACM-LODHA10-CP-RCW-01	R0
3	Sewage collection network	ACM-LODHA10-CP-SEW-01	R0
4	Storm water drainage network	ACM-LODHA10-CP-SWD-01	R0
5	Substation layout and outdoor feeder pillar location plan	ACM-LODHA10-CP-ELE-01	R0

EXECUTIVE SUMMARY

Palava City – The city of opportunity, is being developed by country's one of the largest group M/s LODHA Builders. The city which is planned to offer best facilities and ample of opportunities to the citizens to live and prosper, by meticulous planning of every aspect benchmarked against global criteria. The city will be developed in a phased manner. AECOM has been appointed as Infrastructural consultant to design the external infrastructural services for part of the development viz. social housing at Sector 10 over an area of about 40 acres.

The social housing in sector 10 is part of Phase II plan of Palava city. The sector has 3 residential pockets A, B, C and now pocket under consideration.

Road network of the sector will be having Main access road and collector roads. The main access road has 27 m ROW, secondary access and peripheral roads to various pockets are having ROW of 21. ROW of road dividing pocket B & C having ROW 24 m .Traffic planning is carried out using the model split received from M/s LODHA.

Water supply network is separately planned to meet the potable and non-potable water requirements. Source of potable water is treated water main from MIDC by tapping of new potable water pipe line (at main approach to sector 10) whereas non-potable requirements will be met by recycling the treated sewage effluent from the STP. The water is conveyed and stored in UGT's planned for each building overhead tanks.

The sewage collection network of the sector 10 is being planned to be convey sewage from housing area to a centralized STP, located near solid waste management / processing site. The entire sewer network will be running under gravity. Emphasis given in planning to treat each pockets independently and non-affecting others by trunk system

Drainage network design has been carried out wrt the rainfall intensity details received from M/s LODHA. Trunk drains all planned to be running along the main internal road. The trunk drains are designed to convey the storm water of sector 10 only and outfall to river stream (above of HFL 107 m)

The Draft concept report comprises of the population details, design guidelines, demand estimates, routing plans, tentative length of trunk networks, zoning/ capacities of UGTs, fire storage tanks. Flushing tanks, grouping of buildings for internal pocket services level utilities services, STP capacity, electrical loads , receiving stations capacity , HT network to pocket substations, DG capacity , typical ROW sections for decision making and approval by Lodha MEP team to move further on schematic Design stage

1 INTRODUCTION

Lodha Group, the country's largest developer, is in the process of developing Palava, Mumbai's sister city and the 'city of opportunity'. Palava is strategically located at the junction of Navi Mumbai and Dombivali. Palava is envisioned to become the largest ever private, completely planned development in urban India, and is designed to be amongst the world's top 50 most liveable cities, with every aspect of it being benchmarked against global criteria by 2020.

Apart from the "for sale" residential units of buildings and amenities, Lodha Group is required to hand over a certain set of buildings to MHADA. The envisioned approach therefore is to create a building typology plan which is economically viable and efficient in planning and which can be executed phase wise as per the sector completion. It shall be therefore handover to MHADA for overall residential development of Palava City.

AECOM has been appointed to provide the Infrastructure Consultancy Services for Lodha Group's for Social Housing Project at sector 10 is being developed under phase manner in three pockets A, B, C out of pocket C in under phase I.

1.1 OBJECTIVE

The purpose of this report is to provide initial Draft Design concepts/ alternatives/routing for both the wet and dry utilities. This report will address the following

- Infra design basis / criteria
- Understanding client requirement and project Frame work
- Study and Analysis of data inputs provided by client
- Infra Services draft concepts, strategy, List of Standards Used
- Water demand and water balance diagram ,
- Proposed routes of Infra services
- Capacities of STP / UGT / Sub stations and its calculations
- Electrical load calculations
- Power distribution strategy and space planning
- Route of HT networks
- Single line diagrams

2 SITE APPRECIATION

Project site- Sector 10 is a part of Palava city which is spread over thousands of acres. The city is a mixed use land development which comprises of residential group housing, retail, institutional, recreational and public and semi-public facilities. Sector 10 spreads over an area of about 40 acres.

2.1 LOCATION

Palava is strategically located at centre of economic triangle of Navi Mumbai, Thane and Kalyan which is connected to the other parts of Mumbai and other cities through a network of roads, rails, port and upcoming monorail.

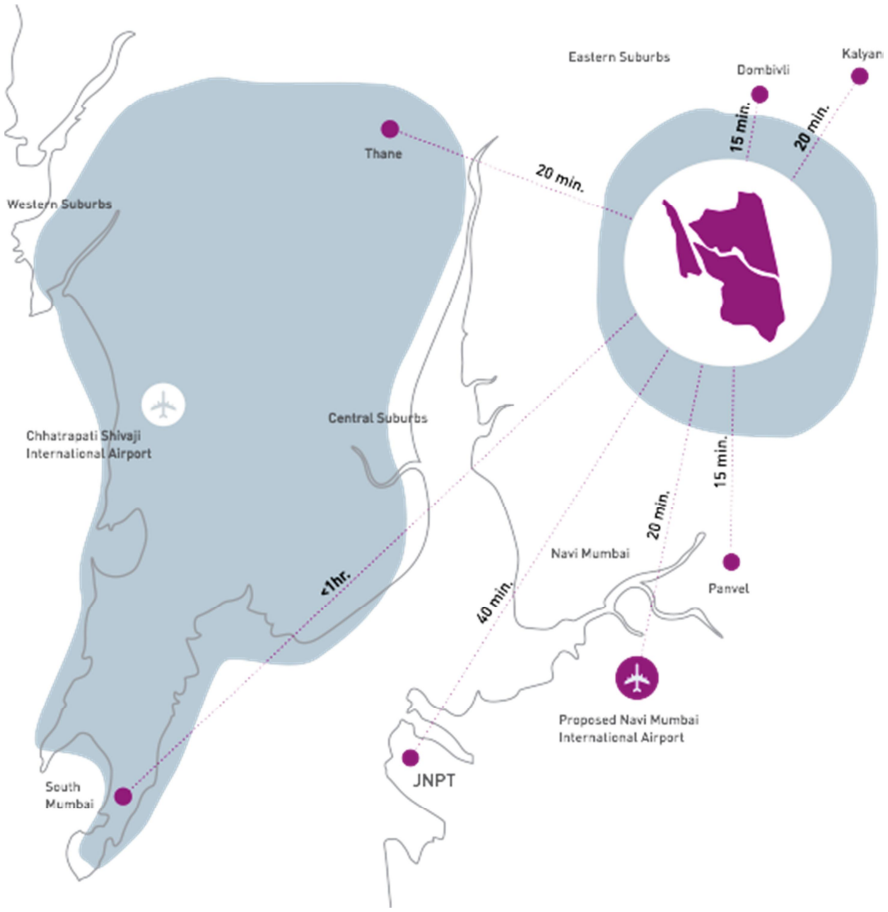


Figure 1: Location of Palava wrt to Navi Mumbai

Source: http://www.palava.in/overview/whereispalava

The project site is being developed in Nilje Goan located at approx. 36km from Chhatrapati Shivaji International Airport, approx. 21 kms from Navi Mumbai and approx. 46 km from CST Railway Station. Also Palava city can be approached by JNPT at a distance of approx. 50 kms. Site is also connected to other parts of region through SH 76, Pipeline road and Taloja Bypass road. Sector 10 of projected site is right site of Taloja bypass road, location of same marked in below shown map.

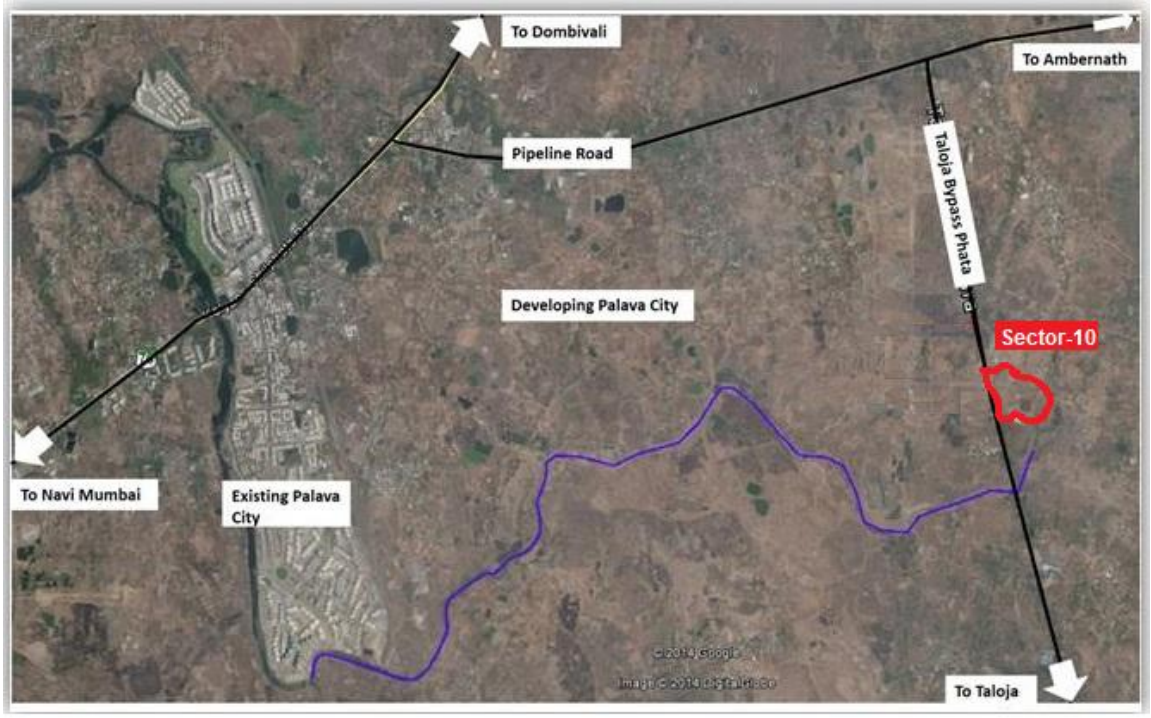


Figure 2: Marking of Project Site sector 10 on Google Earth Image

2.2 MASTER PLAN

Sector 10 will be having Residential development of Economically weaker section. As per the proposed Master Plan (shown in figure 3 below), there will be three residential pocket with multi-storey housing viz. Pocket A, Pocket B and Pocket C.

,

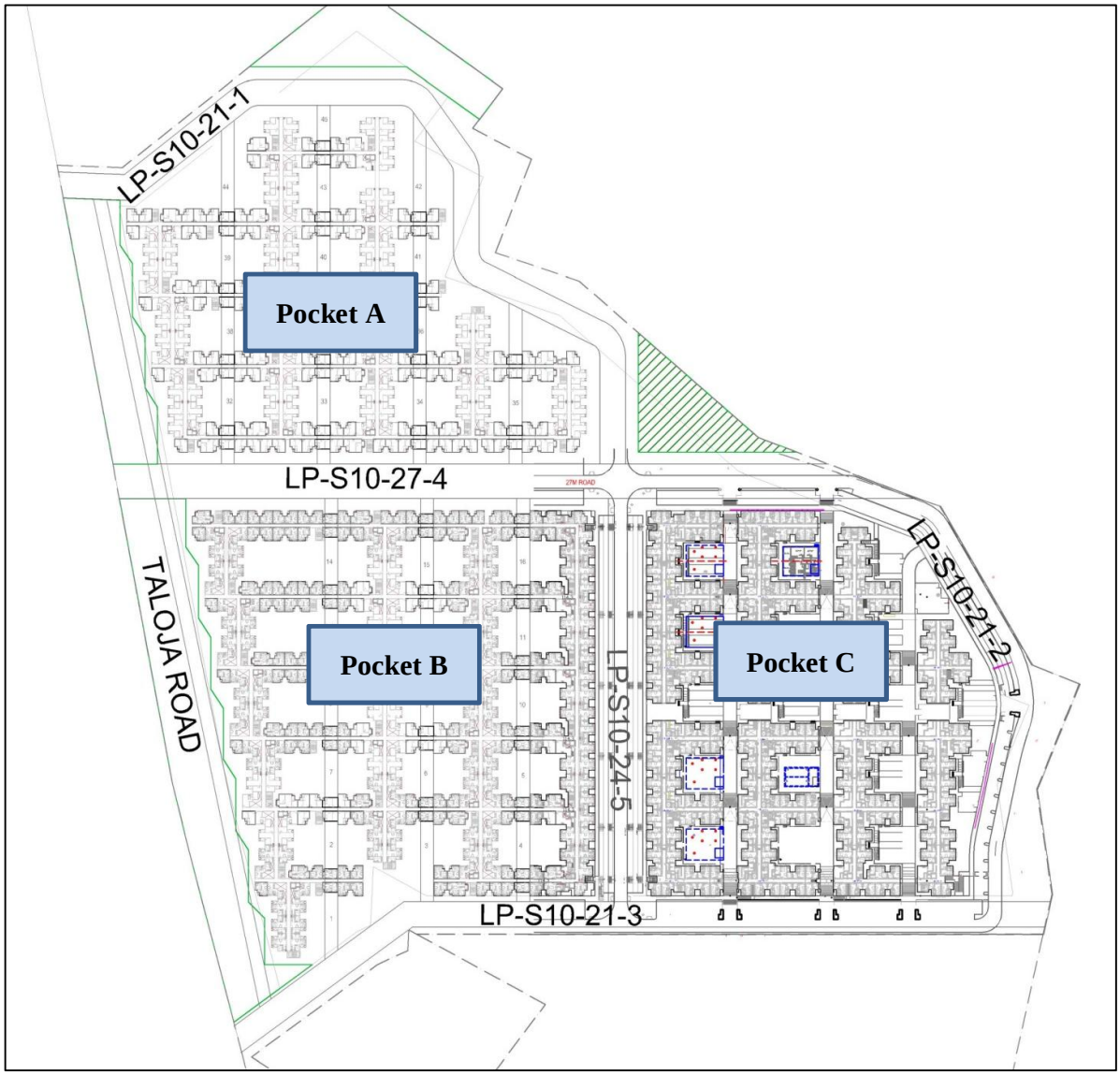


Figure 3: Sector 10 Master Plan

3 POPULATION

3.1 ASSUMPTIONS

Design population for Sector10, is considered as per Policy No. 25, Date W.E.F. 17/11/2009, Revision No. 6, Revision Date 11/12/2013.

Table 1: Population Norms for Residential (EWS)

Type	Persons per unit	Floating population
1 BHK (EWS)	5	10 %
2 BHK(EWS)	5	10 %

Table 2: Number of Dweling units Pocket wise as per Master Plan

Type	1 BHK	2 BHK	Total
Pocket A	2129	958	3087
Pocket B	2527	1332	3589
Pocket C	2014	1162	3176
Total	6670	3452	9852

3.2 DESIGN POPULATION

On the basis of assumptions mentioned in section 3.1, the design population has been calculated for building wise for pocket A, B, C . The detailed calculation is attached as Annexure 3.1 and summary of design population is given in table below:

Table 3: Summary of Design Population for Residential Clusters

Pockets	A	B	C	Total
Residential Population	15435	19295	15580	50610
Floating population 10 %	1547	1936	1590	5073

4 TRANSPORTATION

4.1 INTRODUCTION

The design of Road network and associated features shall be based on specifications and guidelines stipulated in relevant IRC codes, MORT&H & BIS.

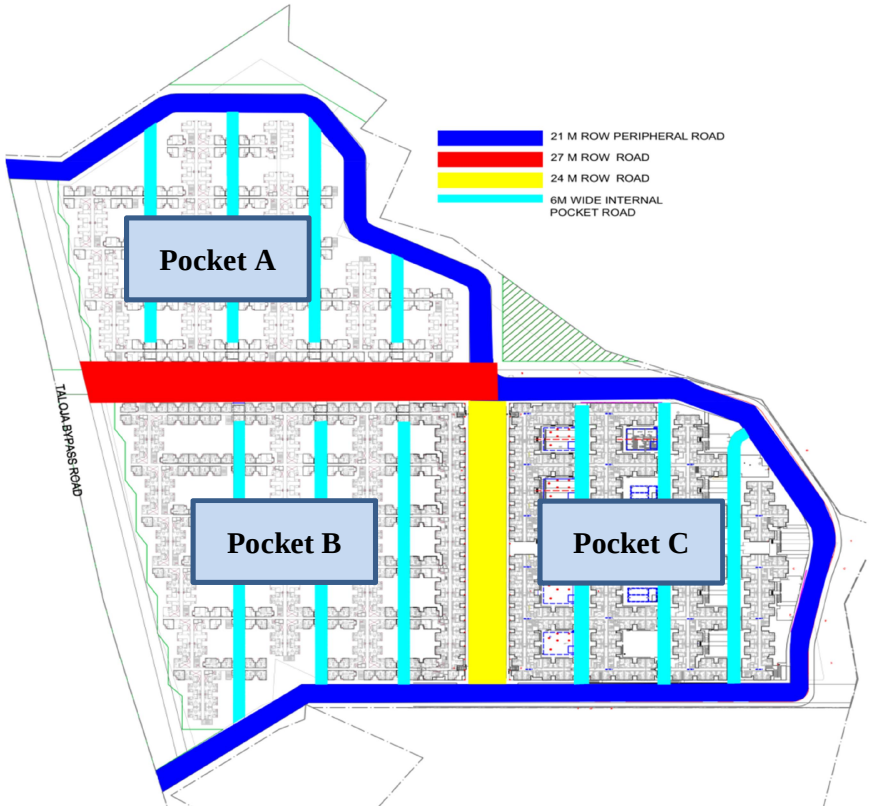
4.2 ROAD NETWORK LAYOUT

Road network layout of Sector 10 consists of Main Peripheral access road with 21 m ROW and other roads are 27 m ROW & 24m ROW (between clusters. Total Road Length for the sector 10 is approx. 3.3 Kms. The Table below describes the road length by each road type.

Table 4 Road Length

ROAD ROW	LENGTH (m)
27 m	236
24m	205
21m	1170

Figure 4: Road Hierarchy Map



4.3 DESIGN STANDARDS FOR ROADS

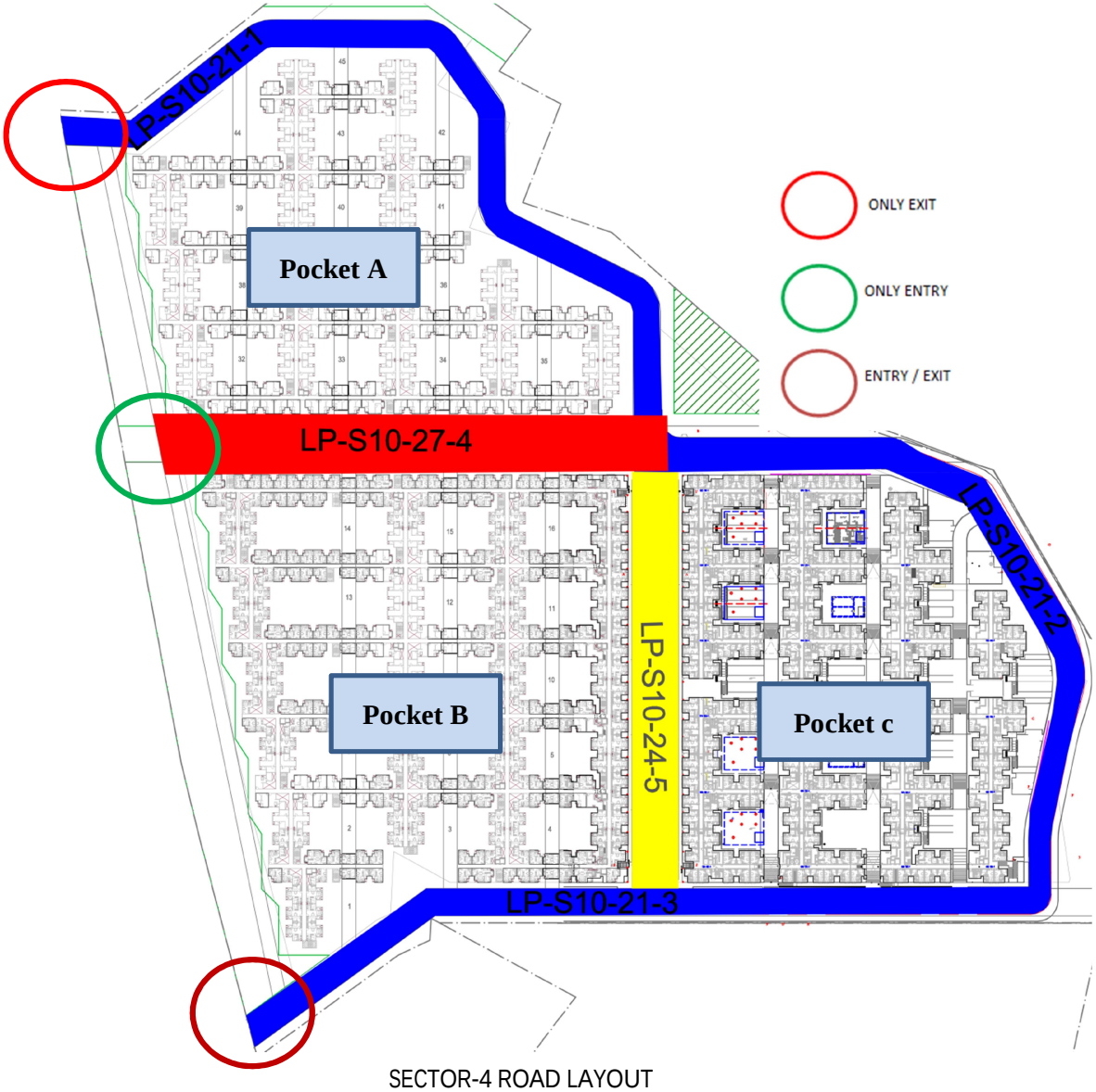
The detailed geometric design will be worked out as per standards and design requirements mentioned in the following table. Right of Way details have been considered as per typical Road cross sections provided by M/s Lodha. IRC:86-1983: guidelines will use for Geometric Design .

Table 5 Design requirements (IRC 86 – 1983)

Item	Design features/requirements
Ruling Design Speed	
• Plain terrain	30-40 kmph
Right of way width (ROW) • Main Peripheral Road • Access Road	 21 m 27 m & 24 m
Main Carriageway width • 21m Wide Road • 27m Wide Road • 14m Wide Road	 6.0 m 6.0 m 6.0 m
Camber (cross profile) • Concrete surface • Footpaths and Paver	 2.00 % 0.5 %
Super elevation	4%
Minimum radii of horizontal curve with Super elevation of 4% and Speed (kmph) of • 30 • 50 • 60 • 80	 30.00 m 90.00 m 130.00 m 230.00 m
Ruling gradient in plain and rolling terrain	3.30 %(1 in 33)
Minimum length of vertical curve	60.00m
Road Capacity • Road Capacity and Level of service (LOS) for traffic IRC : 106 – 1990	 'C'
Design of at grade intersections	IRC : SP : 41 - 1994
Design of pavement	
• Rigid pavement	IRC : 58 – 2002 , IRC:SP:62-2014
• Overlay design	IRC : 81 - 1997
Pavement marking	IRC : 35 - 1997
Road signage's	IRC : 67 - 2001
Road drainage	IRC : SP : 42 1994
Pick-up bus stops	IRC : 80 - 1981
Overhead sign, staggered	Cantilever
Reflective road studs	IRC : 67 - 2001
Road delineators	IRC : 79 – 1981

4.4 TRAVEL DEMAND ASSESSMENT

The road network is designed for capacity based upon the quantum traffic that will be flowing on the network. The traffic in residential area is normally estimated based on the population and vehicle ownership that will be using the roads in a given peak hour



SECTOR-4 ROAD LAYOUT

Traffic estimation based on population has been done by first estimating person trips and then converting them into number of vehicles. The quantum of traffic is expressed in the units of Passenger Carriage Unit (PCU). This is a uniform unit consisting of conversion factor for each of the vehicles type to convert them into one single type of vehicle which is car. In order to convert

population into trips, per capita trip rate of 1.0 has been adopted. The trips have been further converted into vehicles by using modal split as mentioned in table below:. As per information provided by M/s Lodha for the sector 10 only two wheeler traffic inside site will prevails.

Table 6 Population calculation

SECTOR 10	DU	Effective Pop	Visitors / Floating	Population considered for Design
POCKET A	3087	15435	155	15590
POCKET B	3859	19295	193	19488
POCKET C	3176	15880	159	16039
Total	10122	50610	507	51117

KEY ASSUMPTIONS:

- One vehicle for one household has been considered.
- Two wheeler occupancy factors of 2 have been considered.
- 100% two wheeler has been considered as per Discussion with M/s Lodha.
- 40% peak hour traffic has been considered
- Bus & IPT Traffic will move only on main outer road and shall not be considered for collector roads.
- Equivalency Factor is considered as per guidelines of IRC 86.

Table 7 Estimation of Peak Hour Traffic

CLUSTER	DU	No. of Vehicle	Person Trips	Equivalency Factor	Total PCUs	Total Peak Hour Traffic (40%)
				TW (0.5)		
POCKET A	3087	3087	3087	1544	1544	618
POCKET B	3859	3859	3859	1930	1930	965
POCKET C	3176	3176	3176	1588	1588	794
Total	10122		10122	5062	5062	2377

Traffic Impact Assessment:

- All roads fall in the category of Level of service 'B'.
- No Additional lane required.
- No Bus Traffic Inside the site.

4.5 ROAD CROSS SECTIONS

Table 8 Road Cross section Details

S. No	Road Type	Road Number	Road Length (m)	ROW (m)	Cross Section Details (m)		
					Carriageway	Median	Parking Lane/ Utility Corridor/ Foot path
1	Main Peripheral Road	LP-S10-21-1	452	21	6.0	-	15.0
2	Main Peripheral Road	LP-S10-21-2	523	21	6.0	-	15.0
3	Main Peripheral Road	LP-S10-21-3	195	21	6.0	-	15.0
4	Access Road	LP-S10-27-4	205	27	6.0	-	21.0
5	Access Road	LP-S10-24-5	236	24	6.0	-	18.0

4.6 PAVEMENT DESIGN

IRC: 58 :2002 / IRC SP 62 will be used for designing rigid and paver pavements for the project. Pavement composition / thickness is designed based on two factors

- Standard Axle Load
- CBR (California Bearing Ratio) of soil

CBR is the bearing capacity of soil which is determined by soil tests.

4.7 ROAD FURNITURE

Signages / Pavement marking / Pick up bus stops and Ancillary works

- provision of reflective thermoplastic pavement markings, cateye etc. (design basis : IRC : 35 - 1997)
- provision of retro-reflective road signage's (design basis : IRC : 67 - 2001)
- provision of overhead sign boards (design basis : IRC : 67 - 2001 - cantilever gantry)
- provision of staggered pick up bus stops (design basis : IRC : 80 - 1981)
- provision of reflective road studs (cateye) IRC : 67 - 2001
- provision of road delineators IRC : 79 - 1981

4.8 MATERIAL SPECIFICATIONS

Materials specifications to be used in the construction of road and structures will be based on the MORT&H "Specifications for road and bridge works" (Fourth Revision) 2001 published by IRC. Wherever technical specifications are not available in MORT&H, manufacturer specifications reference will be made available during in detail design stage.

4.9 PAVEMENT DESIGN

IRC: 58 :2002 / IRC SP 62 will be used for designing rigid and paver pavements for the project. Pavement composition / thickness is designed based on two factors

- Standard Axle Load
- CBR (California Bearing Ratio) of soil

CBR is the bearing capacity of soil which is determined by soil tests.

4.10 ROAD FURNITURE

Signages / Pavement marking / Pick up bus stops and Ancillary works

- provision of reflective thermoplastic pavement markings, cateye etc. (design basis : IRC : 35 - 1997)
- provision of retro-reflective road signage's (design basis : IRC : 67 - 2001)
- provision of overhead sign boards (design basis : IRC : 67 - 2001 - cantilever gantry)
- provision of staggered pick up bus stops (design basis : IRC : 80 - 1981)
- provision of reflective road studs (cateye) IRC : 67 - 2001
- provision of road delineators IRC : 79 - 1981

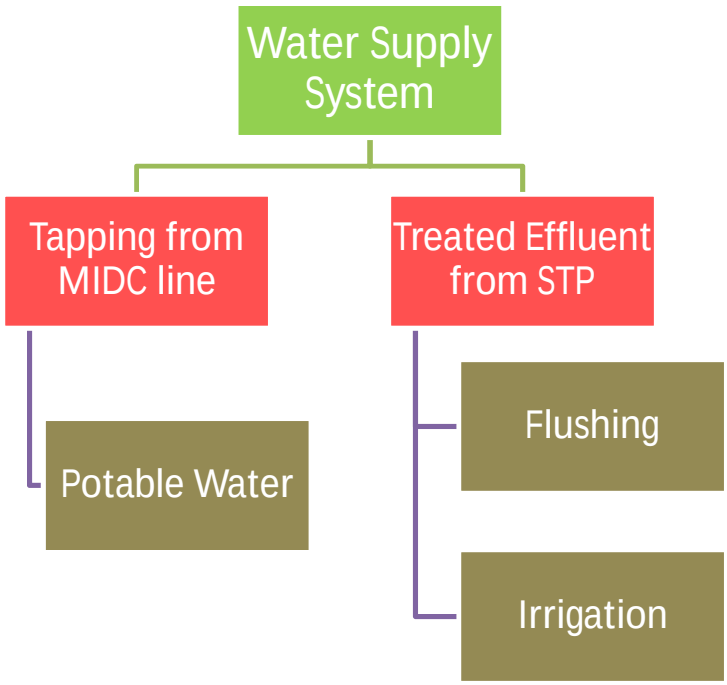
4.11 MATERIAL SPECIFICATIONS

Materials specifications to be used in the construction of road and structures will be based on the MORT&H "Specifications for road and bridge works" (Fourth Revision) 2001 published by IRC. Wherever technical specifications are not available in MORT&H, manufacturer specifications reference will be made available during in detail design stage.

5 WATER SUPPLY SYSTEM

5.1 INTRODUCTION

The Water Supply system for Sector-10, Palava City will have three components i.e. Potable, Flushing and Irrigation. Potable Water system is required to meet various usages drinking, bathing, washing, cooking and other domestic uses in residential. The required water demand will be catered by fresh water sources, i.e Municipal Supply by MIDC. Non Potable Water system for i.e flushing and irrigation for residential, Commercial, PSP demands etc shall be catered by Recycled/ Treated sewage Supply.



5.2 DESIGN CRITERIA

The design criteria water supply systems for SECTOR-10, PALAVA CITY will be framed as per the guidelines laid by

- CPHEEO Manual for Water Supply & Treatment 1999
- SP 7:2005 National Building code of Indian 1983
- Applicable IS Codes
- Urban Design Guidelines
- SP-35 (Handbook on Water Supply, Plumbing & Drainage)

- MOEF Construction Manual
- Lodha Policy Guidelines

5.3 DESIGN PERIODS

Water projects are designed to meet the stipulated design period. The design period of water supply system has been considered as 30 years considering useful design life of various components and future extensions of the infrastructure as per requirements

Components	Design Life
Civil structures	30 Years
Mechanical and Electrical components	15 Years
Distribution System	30 Years
Clear Water Reservoirs (Under Ground)	30 Years

5.4 MATERIALS

Selection of pipe material shall be based on the following considerations:

- The initial carrying capacity of the pipe and its reduction with use, defined, for example, by Hazen Williams Coefficient 'C'. The values of C vary for different conduit materials and their relative deterioration in service.
- The strength of the pipe as measured by its ability to resist internal pressures and external loads.
- The safety, economy and availability of manufactured sizes of pipe & specials.
- The ease of operations and maintenance.



Figure 5: Ductile Iron Pipe

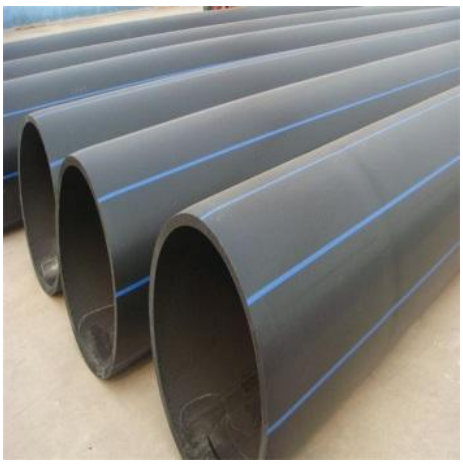


Figure 6: HDPE Pipe

As per the discussion and information provided, HDPE pipes (PE 100, PN 8) conforming to IS-4984 is proposed to be used for all water supply systems including Irrigation and TSE.

5.5 TRUNK SUPPLY FROM MIDC

Tapping from new Potable water main in front of approach road to sector – 10 from Taljoa bypass will be made.

5.6 PEAK FACTOR

As far as the design of distribution system is concerned, it is the hourly variation in consumption that matters. The fluctuations in consumption are accounted for, by considering the peak rate of consumption as rate of flow in the design of distribution system. The following peak factors shall be adopted as recommended in CPHEEO manual for water supply

Population	Peak Factor
For population less than 50,000	3
For population range of 50,000 to 2, 00,000	2.5
For population above 2, 00,000	2

The peak factor shall depend upon contributory population on respective lines of different clusters as shall be proposed during designing of distribution network.

5.7 DISTRIBUTION NETWORK

Modified Hazen William's formula will be used for calculation of velocities and head losses. Water distribution network shall be mostly closed network system so that uniform pressure is maintained at most Underground reservoir points. The Modified Hazen Williams formula for circular conduits is expressed as under:

$$V = 3.83 C_R d^{0.6575} (gs)^{0.5525} / u^{0.105}$$

Where,
V= Velocity of flow
C_R = coefficient of roughness
D = pipe diameter
G = acceleration due to gravity
S = friction slope
u = viscosity of liquid

For circular conduits, $u_{20}{}^{0}c$ for water = $10^{-6}m^2$ / s and g = $9.81m/s^2$
The modified Hazen Williams formula derived as

$V = 143.534\ C_R\ r^{0.6575} S^{0.5525}$
$h = [L(Q/\ C_R)^{1.81}] / 994.62D^{4.81}$

In which,
V = Velocity of flow in m/s.
C_R = pipe roughness coefficient, (1 for smooth pipes; < 1 for rough pipes);
r = hydraulic radius in m;
s = friction slope;
D = Internal diameter of pipe in m;
h = friction head loss in m;
L = length of pipe in m; and
Q = flow in pipe in m^3 / s

Velocity and head loss considerations shall be taken into account while designing the network:

Maximum velocity	=	3.0 m/s
Minimum Velocity	=	0.4 m/s
Head loss in Trunk supply	=	2 m -6 m /1000 m

5.8 VALVES AND FITTINGS

Type of valve and fittings	View
Sluice / NRV Valves Resilient seated sluice valve of standard make as per IS: 14846 and Non Return Valves of standard makes as per IS: 5312 shall be proposed at different locations as per requirements to control the flow or to segregate a portion for maintenance.	
Air Release Valves Double acting air release valves with EPDM of standard make shall be proposed at suitable locations in the rising mains and distribution network to protect the line from negative pressure and over loads due to the trapping of the air. Necessary valves shall be provided at suitable locations which are generally kept about 1/8th of size of pipe dia.	
Scour Valves/ Drain Valves Scour valves of standard make are proposed to be installed in the rising mains and distribution system at lower points in the line to drain silt and water from the line whenever required.	

Quick release coupler Watering for parks/open land as well as other requirements for landscaping has been dealt separately. Quick release couplers are proposed to provide in parks and other green areas. However for detailed landscaping, irrigation system shall be designed by landscape Architect.	

5.9 BEDDING

The class of bedding shall be designed taking into account the external loading conditions, geotechnical consideration such as sub soil water and bearing capacity of soil encountered , type, class, depth and material of pipe used for the laying purposes as per CPHEEO manual and relevant IS specifications.

5.10 DESIGN ASSUMPTIONS

- Rate of water Requirement for Residential and utilities area

On the basis of occupancy in Residential and social amenities the following assumptions have been considered for the calculation of total potable and non-potable water demand.

Table 9 : Assumption of Water Demand

Sl. No.	Type of water demand	Per capita demand (in LPCD)		
		Total	Potable	Flushing
I	Residential			
	Residents	135	90	45
	Floating	45	20	25
II	Utilities areas	15	5	10

- Water requirement for Landscape Area

  Water requirement for Landscape is considered as 5 litres/sqm/day

- System Loses

Table 10 system losses

System Loss/Generation rate	%
Distribution losses	1 %
Sewage Generation from potable	80 %
Sewage Generation from flushing	100 %
Ground water infiltration in sewage	5 %
% of TSE recyclable from sewage generated	99%

- Fire Fighting

  50 cum. Fire storage is required for each building as per the approval of firefighting department vide their letter no. MFS/51/2014/80, Dated: - 25/03/2015. For pocket C only. (No fire Fighting system For pocket A & B as per discussion with client on MOM dated 07.01.2016)

5.11 WATER DEMAND

On the basis of assumptions given in Table 9 above, the demand for potable and non-potable water has been calculated for domestic, flushing, firefighting & irrigation. The detailed calculation is attached as Annexure 5.1 and summary of the same is given in table below:-

Table 11 Summary of Water Demand

Pockets	Pocket C	Pocket B	Pocket A	Total
Dwelling Units	3176	3859	3087	10122
Population (including floating)	17470	21231	16982	55683
Potable Water Demand (Net)	1.46	1.78	1.42	4.66
Flushing Demand (Net)	0.75	0.92	0.73	2.40
Total Net Water Demand	2.22	2.69	2.15	7.06
Gross Water Demand (Including losses 1 %)	2.24	2.72	2.18	7.13
Gross Sewage Generation (80% from Potable and 100% from Flushing)	2.02	2.46	1.97	6.45

Table 12 Water Demand for Irrigation (10 % of area to be considered)

Pocket	Area (Sqm)	Irrigation area	Rate (L/sqm)	Total water Demand (MLD)
A	40615	4062	5	0.020
B	42860	4286	5	0.021
C	39300	3930	5	0.020
			Total	0.061

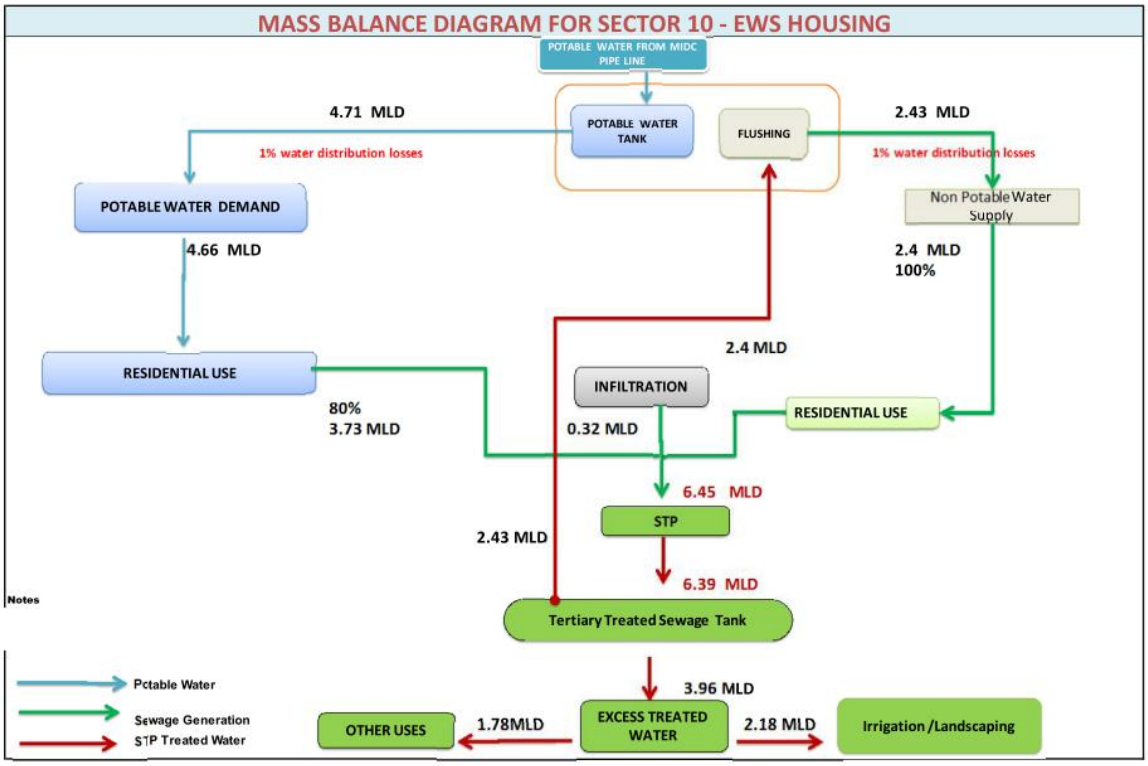


Figure 7: Water Balance Diagram

5.12 PROPOSED WATER SUPPLY SCHEME

- POTABLE WATER

Tapping from new Potable water main in front of approach road to sector – 10 from Tajola bypass will be made. Water supply network Scheme description:

- Pocket – C water to be conveyed to UGT's 1 to 5.
- Pocket – B water to be conveyed to UGT's 6 to 8.
- Pocket – A water to be conveyed to UGT's 9 to 11.

Schematic layout of Potable water scheme has been shown in Drawing ACM/LODHA10/CP/PWS001. Conveyance of potable water from UGT's to building rooftop tank is designed by MEP consultant.

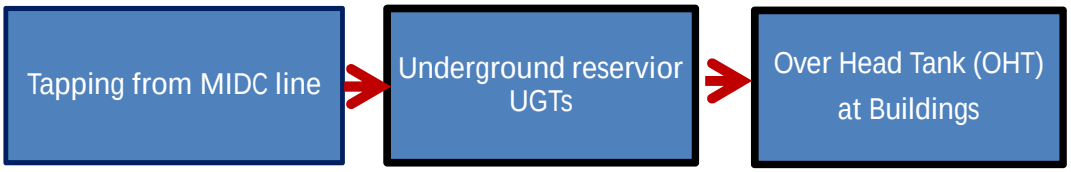


Figure 8: POTABLE WATER SUPPLY SCHEME

- RECYCLED WATER

Treated sewage from STP has been considered to meet the non-potable water requirements of Flushing & Irrigation. It is proposed to provide recycled supply mains from STP to convey treated sewage supply to flushing water tanks and garden hydrants to cater the water demand for road side & other green/park area. The proposed scheme is further depicted in figure below:

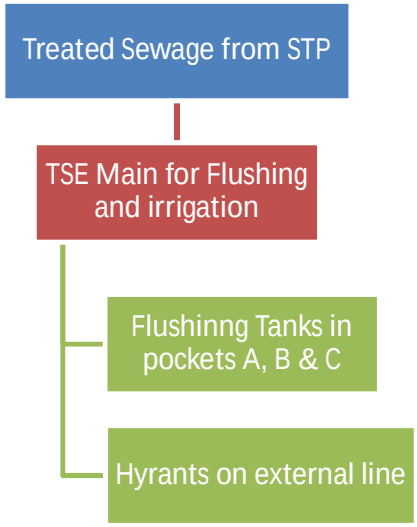


Figure 9: Recycled water supply scheme

5.13 STORAGE RESERVOIRS & PUMP ROOM

The underground storage reservoirs are sized for the half day storage for both Potable and flushing separately for group 4-7 of buildings in each pocket. Fire fighting water requirement @ 50 cum for each buildings (in pocket C) is proposed to be clubbed with respective potable water UGTs. The rectangular tank of RCC –M30 will be constructed with water storage capacity and machine room. The potable water tapped from MIDC line will be supplied to various UGT's located in clusters. The Domestic water and Flushing water tank are sized to store water equivalent to ½ day average demand. Following are the Pumping options:

Pockets	Descriptions
Domestic water supply	
Pocket C	Booster pumps (1 W + 1 S) for each building in respective UGT's
Pocket A & B	Booster pumps (1 W + 1 S) for two buildings in respective UGT's
Flushing Supply	
Pocket C	Booster pumps (1 W + 1 S) for two buildings in respective UGT's
Pocket A & B	Booster pumps (1 W + 1 S) for two buildings in respective UGT's

Pockets	Descriptions
Firefighting Water	
Pocket C	1 Diesel Pump and 1 Electric Pump + one Jockey for 04 buildings.
Pocket A & B	No Fire Fighting provision as per discussion with Client refer (ref MOM dated 07.01.2016)

Indicative Location of UGT's is depicted in drawing no. ACM/LODHA10/CP/PWS001 and ACM/LODHA10/CP/RCW001.

The Summary of Typical sizing of UGT is as follow:-

Table 13 : Summary of UGT Sizing

Pockets	Potable +Fire Tank			Flushing	
	UGT Nos.	Domestic Tank Capacity	Fire Tank Capacity	UGT Nos.	Flushing Tank Capacity
		Cum	Cum		Cum
Pocket C	UGT 1	161	200	F1	175
	UGT 2	174	250		
	UGT 3	171	200	F2	167
	UGT 4	150	200		
	UGT 5	91	200	F2A	48
Pocket B	UGT 6	285.5	NA	F3	220.5
	UGT 8	329	NA		
	UGT 7	277.5	NA	F4	245
Pocket A	UGT 9	255.5	NA	F5	134
	UGT10	216.5	NA	F6	113.5
	UGT 11	241.5	NA	F7	125.5

Table 14 Summary of water supply networks

Network	Length in meters
Potable water	1510 m
Recycled water	2410 m

6 SEWERAGE SYSTEM

6.1 INTRODUCTION

The sewage generation amounts to approximately 80 % of the potable water supply and 100 % of flushing water provided to the users. The infiltration rate has been considered as 5 % of total sewage generation.

6.2 DESIGN CRITERIA

The design criteria for the design of Sewerage system for SECTOR-10, PALAVA PHASE-2, Dombivali will be framed as per the guidelines laid by

- CPHEEO Manual for sewerage and sewage treatment 2012
- SP 7:2005 National Building code of Indian 1983
- Applicable IS Codes
- Urban Design Guidelines
- MOEF Construction Manual
- Lodha Policy Guidelines

6.3 DESIGN PERIODS FOR VARIOUS COMPONENTS

Sewerage projects are designed to meet the requirements stipulated design period. The design period of sewerage infrastructure has been considered as 30 years considering useful design life of various components and future extensions of the infrastructure as per requirements.

Design Period for various components has been represented as below:

Table 15 : Design Period of Sewerage Components

Design Component	Design Period
Sewer network	30 Years
Pumping mains	
Civil Works	
Sewage Treatment Plants	
Pumping Machinery	15 Years

6.4 HYDRAULICS OF SEWERAGE NETWORK

The Manning's formula for Gravity Flow will be used to design the sewerage network; The Manning's formula for circular conduits is expressed as under:

$$V = [(1/n)] \times [R^{2/3} S^{1/2}]$$

For circular conduits

$$V = (1/n)(3.968 \times 10^{-3}) D^{2/3} S^{1/2}$$

and

$$Q = (1/n)(3.118 \times 10^{-6}) D^{2.67} S^{1/2}$$

Where,

- Q : Discharge in l/s
- S : Slope of hydraulic gradient
- D : Internal diameter of pipe line in mm
- R : Hydraulic radius in m
- V : Velocity in m/s
- n : Manning's coefficient of roughness

6.5 MATERIALS

Selection of pipe material shall be based on the following considerations:

- The initial carrying capacity of the pipe and its reduction with use, defined, by Manning's coefficient of Roughness 'n', the values of n vary for different conduit material and their relative deterioration in service.
- The strength of the pipe as measured by its ability to resist internal pressures and external loads.
- The safety, economy and availability of manufactured sizes of pipe & specials.
- The ease in operations and maintenance.
- Usable design life of the pipes.

Considering availability, durability and capital cost of Pipe - HDPE PE 100 PN8 (IS 14333) of suitable dia. as per the design calculations shall be proposed for sewage collection network.

6.6 PEAK FACTOR

Fluctuation in sewage flow depends on water consumption and follows similar pattern except for the lag period of water usage in day time. The fluctuations in sewage generation shall be accounted by considering Peak factor. For the purposes of hydraulic design estimated peak flow shall be adopted. The peak factor or the ratio of maximum to average flows, depend upon

contributory population and the following values shall be adopted as suggested in sewerage manual.

Population	Peak Factor
less than 20,000	3.0
In range of 20,000 to 50,000	2.5
In range of 50,000 to 75,000	2.25
above 75,000	2.0

6.7 MINIMUM AND MAXIMUM VELOCITY OF FLOW

A velocity of 0.6 m/s would be required to transport sand particles of 0.09 mm size with a specific gravity of 2.65. Thus the sewers shall be designed on the assumption that although silting might occur at minimum flow, it would be flushed out during peak flows. Erosion of sewers is caused by sand and other grit material in the sewer and also by excessive velocity. Velocity in a sewer is recommended not to exceed 3 m/s.

6.8 MINIMUM SIZE OF SEWER

Minimum pipe diameter of sewer will be adopted as 150 mm.

6.9 MANHOLE SIZE, DEPTH AND TYPE

The channels in manholes at junctions and bends shall be smooth with gradual transitions to avoid turbulence and deposition of solids. They are circular, rectangular or square in shape. Manholes should be of such size that will allow necessary cleaning and inspection. Circular manholes are stronger than rectangular and arch type manholes and thus these are preferred over rectangular as well as arch type manholes. Therefore circular manholes have been proposed.

Table 16 : Typical Manhole Sizing

Range of Depths, m	Maximum Dia Up to	Manhole Size
above 0.90 m and up to 1.65 m	300 mm	900 mm dia.
above 1.65 m and up to 2.30 m	600 mm	1200 mm dia.
above 2.30 m and up to 9.0 m	900 mm	1500 mm dia.
above 9.0 m and up to 14.0 m	1200 mm	1800 mm dia.

6.10 SPACING OF MANHOLES

For inspection, cleaning and testing of sewers, manholes shall be provided at every change of alignment, gradient, diameter, and at junction of sewers. The maximum spacing of manholes varies from 30 m for smaller sewer dia. to 300 m for sewers above 2000 mm dia.

Table 17 : Manhole Spacing

Sewer size	Manhole spacing
Sewer < 600 mm	up to 30 m
Sewer > 600 mm	45 m to 60 m

6.11 COVER FRAME

The size of manholes shall be such that there should be a clear opening of not less than 0.56 m dia. Heavy Duty and Medium Duty precast SFRC Manhole covers shall be proposed.

6.12 BEDDING

The class of bedding shall be designed as per CPHEEO manual taking into account the external loading, geotechnical conditions such as sub soil water, bearing capacity of soil, depth of sewer, type, class and material of pipe used.

6.13 SEWAGE GENERATION

The sewage generation has been calculated, the detail calculation is attached as Annexure 5. 1 and pocket wise summary of the same is given in table below:-

Table 18: Summary of Sewerage Generation

Pocket	Pocket A	Pocket B	Pocket C	Total
Sewerage Generation Including Infiltration (MLD)	1.97	2.46	2.02	6.45

6.14 PROPOSED SEWERAGE SCHEME

Sewerage system for sector 10 consists of branch/cluster sewer and Trunk sewer. Owing to the topography, the gravitational flow of wastewater would be from West to East (for pocket A) and north to south (Pocket B & C) along the peripheral road (ROW 21 m), Central 24 m Spine , main approach Road (27 m ROW). However, as per the utility space planning, the Sewage Treatment Plant (STP) is located toward South Side of sector 10 in vicinity of solid waste management (SWM) site.

The proposed grading plan, building plinth and key road levels have been formulated and fixed by Project Architect. Therefore, in order to convey the sewage to sewage treatment plant location, some part of the network has to be laid against gravity. The sewerage system is conceptualized in drawing ACM-LODHA-10-CP-SEW-01. Indicative length of Trunk Sewage collection Network is about 980 m.

6.15 SEWAGE TREATMENT PLANT

STP is planned in the vicinity of SWM site. The ultimate capacity of STP for the wastewater load of Sector 10 has been estimated to be around 6.45 MLD. The STP may be built in modules depending on the expected occupancy and corresponding time frame. STP based on Membrane Bio Reactor (MBR) technology is being proposed. Further it is proposed that the storage and pumping facilities for Recycled water supply (tertiary Treated Sewage shall be accommodated within STP boundary.

7 STORM WATER DRAINAGE SYSTEM

7.1 INTRODUCTION

Owing to the topography of sector 10, the storm water will flow from the west (Tajljoa By-Pass road) to West (Natural drain/River channel in south eastern periphery of sector 10) and effectively from north to south. The highest flood level (HFL) of river near the proposed outfalls is about 107 m. Trunk drains are planned to be laid along roads having ROW of 21 m, 24 m and 27 m. Storm water runoff from proposed site area will be conveyed to trunk drain through clusters drains planned along 6 m wide internal roads.

Storm water drainage network has been conceptualized to be designed for gravity flow considering the fact that at outfall location (in river), the invert of drain shall be above the HFL.

Drainage network will comprise of Covered RCC Rectangular sections. For the drains located below parking area, the storm water shall enter the network through gratings planned at an interval of 15 meters. For trunk drain (along roads 21, 24 m and 27 m ROW) , storm water shall enter into catch basins.

7.2 INDICATIVE DESIGN STANDARDS, METHODOLOGIES AND SPECIFICATIONS

Storm runoff is that portion of precipitation which drains over the ground surface. Estimation of runoff reaching the storm drains therefore is dependent on intensity and duration of precipitation, characteristics of the tributary area and the time required for flow to reach the drain. The storm water flow for this purpose should be determined by using CPHEEO Manual on Sewerage and Sewage Treatment (Rational method, Hydrograph method, Rainfall-runoff correlation studies, Digital computer models, Inlet method or Empirical formulae).

The maximum run off, which has to be carried in a drain section, shall be computed for a condition when the entire basin draining at that point becomes contributory to the flow and the time needed for this is known as the time of concentration (tc) with reference to the concerned section. Thus, for estimating the flow to be carried in the drain, the intensity of rainfall which lasts for the period of the time of concentration has to be considered contributing to the flow of storm water in the drain.

Catchment for different portions of the drains shall be identified, based on the topography of the area. The detailed assessment shall be done on the proposed grading plan and development for the project area. The catchment of a drain shall be decided based on the natural flow of storm water into the nearby drains and the assessment of storm water.

7.3 CALCULATION FOR DISCHARGE

The estimation of runoff shall be determined by using rain fall intensity, contributing area and coefficient of runoff using rational method:

Q = 10 CIA

Where,

Q = Run-off in cum /hr

C = Coefficient of run-off

I = Intensity of rain fall in mm/hr

A = Area of drainage catchment in hectare

7.4 COEFFICIENT OF RUNOFF

As runoff is directly proportional to the value assigned to "C", the proper selection of this value is critical for storm water runoff calculations. The value of C is dependent on the hydrological extractions, surface imperviousness and antecedent conditions. The value for "C" has been considered as 0.65.

7.5 TIME OF CONCENTRATION (TC)

Time of concentration is the longest time required for water to travel from the watershed to the watershed outlet. The remotest point in each area shall be identified including the level difference between the remote point and the point of discharge. Estimation of time of concentration is critical in design of storm water drainage system as it is linked to the runoff reaching the storm water network. Time of concentration is equal to inlet time plus the time of flow in drain. Considering the development plan of sector 10 and catchment areas of drains typical Tc values for internal drains are estimated to be about 15 minutes and that for trunk drain about 30 minutes.

7.6 IMPERVIOUSNESS

The impervious cover percentage of the drainage area shall be adopted as per guidelines laid down in CPHEEO Manual on Sewerage and Sewage Treatment as below:

Table 19: Classification of Impervious Cover (in %)

Sl. No.	Type of area	% of impervious cover
1	Retail	70 to 90
2	Residential area	

	i) High Density	60 to 75
	ii) Low Density	35 to 60
3	Parks & Underdeveloped areas	10 to 20

7.7 RAINFALL INTENSITY (I)

Design rainfall intensity is considered for 2 years return period. The IDF curve for Thane station was available which shows that the design intensity for one hour rainfall, with 2 years return period is 67 mm/hr. However, the detailed calculations used for preparation of IDF curve were not available to establish the relation between Tc and I. The matter was discussed with M/s Lodha and it was suggested that design intensities for various time of concentration shall be used as mentioned in table below:

Time of Concentration (minutes)	Rainfall Intensity (mm/hr)
30	95
45	80
60	67
75	55

7.8 HYDRAULICS OF DRAINS

Type of flow: the hydraulic analysis of drain is simplified by assuming steady flow conditions.

- Manning's formula: The design practice is to use the Manning's formula for open channel flow.
- Hazen – Williams and Darcy- Weisbach formulae for closed conduit or pressure flow.

The Manning's formula is given as.

$V = 1/n\ R^{2/3}\ S^{1/2}$

Where,

n = Co-efficient of roughness

V = Velocity in m/sec.

R = Hydraulic mean radius in meters = A / P

S = Slope of hydraulic gradient

A = Area of cross- section of flow in m2

P = Wetted perimeter in m.

7.9 COEFFICIENT OF ROUGHNESS

The value of coefficient of roughness shall be adopted as per guidelines for different materials as given in CPHEEO manual.

7.10 VELOCITY

Velocity in section of the drain should not exceed 3.0 m/s. depending upon the type of material used in the construction of the drain. The minimum velocity in the drains should not be less than 0.4 m/s for internal drains depending upon the topography. However, minimum velocity can be kept as 0.3 m/s in extreme cases.

7.11 FREE-BOARD

To optimize the RCC sections, free board in drains is proposed as 150 mm for designing of storm water drainage in sector-10 Palava City.

7.12 PROPOSED SCHEME:

Three separate trunk drains are planned, two trunk drains across roads with 21 m ROW and one trunk main with 27 m ROW. Major part of the storm water runoff from Pocket A shall be carried by trunk drain along northern side peripheral road with ROW 21 m and remaining runoff shall be carried by trunk drain along road with ROW 27 m out falling into main peripheral drain ultimately discharging to the river at Outfall - 1.

Storm water runoff from Pocket B & C shall be carried by trunk drain along southern peripheral road with ROW 21 m out falling to river stream at Outfall – 2. (Refer ACM/LODHA10/CP/SWD - 01)

8 ELECTRICAL SYSTEM

8.1 INTRODUCTION

This section deals with the requirements of electrical power requirement & distribution for Sector 10 social housing. The details are based upon accepted standards and norms. The CONCEPT REPORT shall formalise the norms, guidelines and distribution scheme to be taken up during detail design stage.

The electrical system shall be designed to cover the following:

- Safety to personnel
- Minimum fire hazards
- Reliability of system.
- Ease of maintenance.
- Scope for future expansion.

8.2 CODES AND STANDARDS

The following standards and codes (latest editions/ revisions) shall be used to govern the design of the electrical system:

- BIS: Bureau of Indian Standard
- BS : British Standard
- IEC: International Electro technical commission
- IEEE: Institute of Electrical & Electronics Engineers
- Regulations laid down by Indian Electricity Rules
- Regulations laid by chief controller of explosives
- Any other regulations laid down by the local or government authorities.
- Regulations laid down by tariff advisory committee / Fire insurance regulations
- Norms laid down by MSEDCL/ State norms / Lodha/ Building Consultant.

8.3 LOAD NORMS FOR POWER DEMAND CALCULATION

The Sector 10 development comprises of plots of different sizes proposed to accommodate residences and shopping Centres etc. This report explains power demand for economically weaker section (EWS) Residential Plots. Each Residential Plot is a mix of 1 BHK, 2BHK, 1 BHK corner, 2BHK corner flats and as high as G+12 and G+11 Storeys.

For Load demand assessment, building loads as shared by LODHA have been considered. The same has been presented in table below:

Table 20: Load Norm

S.N	Type of Flat	Connected load (kW)	Maximum Demand Load (kW) @ 0.8 D.F	Infrastructure Demand Load (kW) @ 0.25 D.F
1	1 BHK	6.5	5.2	1.3
2	1 BHK CORNER	6.5	5.2	1.3
3	2 BHK	10	8	2
4	2 BHK CORNER	10	8	2

Based on these norms the Estimated Power Demand of Residential Area is approximately 23MVA. (Refer attached annexure-8.1, annexure8.2 and annexure-8.3 for load detail and transformer rating)

8.4 SYSTEM OF SUPPLY

As per MahaVitran's Electricity Supply code, following Voltage levels shall be referred within Development while designing.

a. Two wire, single phase, 240 volts – general supply not exceeding 40amps
b. Four wire, three phase, 240 volts between phase wires and neutral or 415V Phase to phase – general supply exceeding 40amps and sanctioned load not exceeding 80kW / 100kVA
c. Three phase, 50 Cycles, 11kV / 22kV – All installations with Contract demand above 80 kW/ 100kVA up to 1500 kVA
d. Three phase, 50 Cycles, 22kV – All installations with contract demand above 1500 kVA up to 3000 kVA
e. Three phase, 50 cycles, 33kV – All installations with Contract Demand above 1500 kVA up to 5000 kVA

However, as discussed with Client, 22kV voltage level shall be considered for HT distribution for Residential area in Sector 10.

8.5 VOLTAGE REGULATION

As per NEC 2011 section 6, subhead 3.1, the A.C. nominal system voltage shall be 230/415volt with tolerance of +- 10%. The following limits of voltage regulation as prescribed in the Section 54 of Indian Electricity Rules (IER-1956) and as per National electrical code (SP-30) have been considered:

Table 21: Voltage Regulation

SYSTEM RATED VOLTAGE (VOLTS)	MAXIMUM PERMITTED VARIATION %	SYSTEM RATED VOLTAGE (VOLTS)
Upto 650 V	±6	Upto 650 V
650 – 33000	+6/-9	650 – 33000
Above 33000	-12.5/+10	Above 33000

In accordance with Indian Standard and as stated in above table the maximum voltage drop considered for cable sizing shall be restricted to +6%. However for overall calculations the maximum voltage drop considered is 5%. For working out cable sizes, Maximum voltage drop considered are:

From transformer to meter board panel : 3%

From meter board panel to Flat DB : 2%

8.6 POWER FACTOR

As per MahaVitran supply code it is desired to maintain average power of 0.9 and for design purpose the same shall be followed.

8.7 PROPOSED DISTRIBUTION SCHEME

To have trouble free distribution system, which is aesthetically neat & clean, less prone to faults & accidents; it is proposed to have an underground distribution system for HT & LT power supply. It is proposed to have 22kV HT panel board, 22/0.415kV Transformers & LT Panel in a substation.

To have reliable power distribution system it is proposed to connect HT panel system in ring form, operating at 22kV level. Each 22kV HT panel board shall be feeding distribution transformers to supply LT power for consumer end. The Proposed distribution is as explained below and the detail design shall be taken up during design stage based on acceptance of one of the options proposed for Substation locations.

a. To cater the requisite load demand of EWS, two 22kV feeders shall be provided from 220/22kV Main switchyard till EWS Switching station. Each incoming feeder shall have three runs of 22kV XLPE Armoured cables. This 22kV switching station will comprise of two nos. 22 kV incomers, one no. 22kV bus coupler & 10 nos. 22kV Outgoings feeders. These outgoings

shall feed power to EWS clusters TYPE-A, TYPE-B, TYPE-C and STP. Out of these 10nos. 22kV outgoing feeders, three rings (6 Outgoing feeders) shall be provided to meet Residential load on Ring mains i.e. 1 Ring (2 Outgoings) for Type-A, 1 Ring (2 outgoings) for Type-B, 1 Ring (2 outgoings) for Type-C, & (1 outgoing) for STP transformer and three as spare. However, the exactness on numbers & ratings shall be finalised with complete understanding of number of 22kV receiving and outgoing feeders to be planned within development.

b. This 22kV switching station shall house, 13 HT Panel board. A 30V DC Battery bank shall be provided for Relays & associated distribution (if any). Appropriate space provisions shall be made for MSEDCL approved HT Meter.

c. To cater to buildings load demand 22/0.415kV two substations are planned for each type of cluster (i.e. Type-A, B & C) at suitable locations. Meters, substation and related panels shall be in accordance with MSEDCL requirement. . Refer drawing no. "ACM-LODHA SEC 10-CP-ELE-001" for substation location.

d. Based on maximum demand calculation, each substation shall house maximum 1250kVA, 22/0.415kV transformers as per requirement. The LT side of each transformer shall have one Main LT panel having MCCB's for Outdoor Feeder Pillars, Retail & Firefighting load of UGT etc. as required. The number of outgoings & ratings shall be finalised and refined during detail design.

e. Electrification to these substations shall be provided through underground 3 Core, 22 kV, UE Grade, XLPE, FRLS, Aluminium cables. Based on load & voltage drop the sizing of cable shall be carried out during Detail design stage.

f. Ring arrangement shall be planned to meet load demand of building cluster in such a manner that each ring caters to a maximum of 10MVA. Feeders of a ring shall be sized to cater to the total maximum demand of each ring. In case of failure of any one Ring feeder the other feeder shall maintain the supply continuity.

g. Outdoor Feeder Pillar (OFP) shall be planned at suitable location to meet the load requirement of common areas for approx. three or four nos. building of cluster. Power supply to these OFP's shall be supplied from Main LT panel.

h. Based on the No. of outdoor Feeder pillars and metering panels planned for buildings, Outgoings from Main LT panel shall be finalised.

i. From Main LT panel, two outgoing shall be provided for each Building Meter board panels. LT cables shall be taken up to Meter panel room and thereafter the distribution within building shall be carried out by Building consultant.

j. Outdoor feeder pillar shall house MCCB as incomer and MCB as outgoings.

k. All ratings of Circuit breakers shall be properly selected to give time & short circuit discrimination.

l. 415V, LT cables shall be laid in pipes in ground & in accordance with IS 1255.

m. HT & LT markers shall be provided along the cable route.

n. Space reservation for laying 2 runs of 150mm DwC pipes along ROW for telephone, fire alarm, street lighting & building BMS shall be kept.

o. Compatibility with SCADA system for EWS substations shall be provided in the main switching station's HT switchgears and relays.

8.8 HT/LT CABLES

The incoming power supply to 22kV switching station shall take place at 22 KV voltage level with 22KV (E) XLPE insulated armoured three core Aluminium conductor cables. These cables shall be laid in ducts with proper provision of manholes at 30mtrs interval. For LT distribution Up to 16 sq.mm copper cables shall be used & above 16sq.mm Aluminium cables shall be used. It is proposed to provide LT cables in ducts of appropriate dimensions for better operation & maintenance. In case cables are planned to be buried in ground, the as per IS 1255 following min. depth shall be maintained:

415V power cables & control cables`: 0.75 m

22kV power cables ``: 1.05 m

Cables at road crossing : 1.0m

8.9 EARTHING SYSTEM

Earthing system shall be designed in accordance with IS 3043 and IEEE-80. All non-current carrying metal parts forming part of the electrical system shall be connected to the grounding system. In all cases the relevant provisions of Rule 33 and Rule 68 of the Indian Rules, 1956 shall be complied with. Dedicated earthing pits shall be provided for neutral earthing of major substation equipment like Transformers & DG sets. Interconnected Earthing pits shall be provided for body earthing of major substation equipment like HT Panel, transformers, DG sets, MV panel etc. Distribution earthing shall be carried all along the MV distribution system, and effectively bonding the equipment. Safety in using electrical energy is of paramount importance considering its dangers.

As per LODHA guidelines, Plate earthing / chemical earthing shall be provided for transformer & other electrical equipment / switchgears.

Majorly following sizes have been considered based on earthing calculation; however these sizes may be changed during detail designing:

No.	Equipment	Earth Strip Size
1	HT Switchgear	2 x 50 x 6 mm GI
2	Transformer Neutral	2 x 50 x 6 mm Cu.
3	Transformer Body	2 x 50 x 6 mm GI
4	Outdoor Feeder Pillar	2 x 50 x 6 mm GI

Normally an earth electrode shall not be situated less than 1.5 m from any building. Care shall be taken that the excavation of earth electrode may not affect the column footing or foundation of the building. In such cases electrodes may be farther away from the building. As far as possible, entrances, pavements and road ways, are to be definitely avoided for locating the earth electrode. Refer attached annexure 8.4 for typical earthing calculation of transformer.

8.10 ILLUMINATION LEVELS

The lux levels for Substation building, pump house, treatment plants, road lighting shall be in accordance with National building code (NBC)/ BIS, 1981. Following Lux levels shall be maintained for:

a. Switch rooms, meter rooms, oil plant rooms, HV substations (indoor) — 150-200 Lux

b. Control rooms — 200 – 300 Lux

c. Pump houses, water treatment plant houses — 150 -300 Lux

8.11 STREET LIGHTING

415 volt feeders shall be planned from LT panels. Feeder Panels shall be planned at various locations for supply and connectivity of lighting poles. Cable route and space provision shall be planned from Feeder pillar to Street lighting poles.

a. Power Supply & Control System

Power supply to road shall be fed through underground XLPE insulated, armoured, Cu / Al conductor cables. Distribution of power shall be through 415V, 3 Phase 4 wire system and controlled through a self-powered synchronous timer. Power supply for the system shall be made available from the proposed feeder pillars for street lighting located at various places in the entire complex.

b. Operation & Maintenance

The street-lighting shall be operated with timers located in the MCB distribution boards and shall operate as follows:

Sunset to 10.00 PM - 100% Lights on

10.0 PM to 2.00 AM - 66% Lights on

2.0 AM to Sunrise - 33% Lights on

This system shall facilitate the energy saving. This shall also facilitate control of level of illumination with reference to the density of traffic. The distribution of street-lighting has been done on 3 phase system. The detailed street light Operation & control system shall be discussed & provided based on type of Luminaire i.e. LED.

The DG location / DG source can be one of the following; however the same shall be finalized during detail design stage.

a. Dedicated DG for street light (if required).

b. DG planned for building's Common areas loads.

c. DG planned for STP.

ANNEXURES

DRAWINGS

DRAWING LIST

S. No	Drawing details	Drawing number	Revision
1	Potable water supply	ACM-LODHA10-CP-PWS-01	R0
2	Recycle water supply	ACM-LODHA10-CP-RCW-01	R0
3	Sewage collection network	ACM-LODHA10-CP-SEW-01	R0
4	Storm water drainage network	ACM-LODHA10-CP-SWD-01	R0
5	Substation layout and outdoor feeder pillar location plan	ACM-LODHA10-CP-ELE-01	R0