10 PHYSICAL INFRASTRUCTURE

10.1 INTRODUCTION

Chandigarh’s sectoral grid has a well-designed system of piped water supply and sewerage disposal. Under the city’s Water Bye-laws, every planned dwelling unit has to have water and sewerage connections. With the formation of U.T in 1966, all the works for the city’s physical infrastructure were handled by the respective departments of the Chandigarh Administration. After creation of the Municipal Corporation of Chandigarh in 1994, the city’s water supply, sewerage system, storm water drainage, solid waste management & sanitation, have been transferred to the Municipal Corporation. The Ministry of Urban Development (MOUD) has formulated benchmarks for service delivery in four areas as mentioned in Table at ANNEXURE-P.1. The purpose of formulating these benchmarks is to shift the focus from infrastructure creation to service delivery.

Water supply - sources of water
When Chandigarh was planned, the good availability of sub soil water was considered adequate for meeting the city’s requirements as the yield of tubewells was sufficient. With increase in the city’s population, many tubewells started drying up. It was decided to tap surface water of the Bhakra Main Line flowing at a distance of 27.5 Kms. from Chandigarh to meet the city’s growing water requirements. The first phase of augmentation of water supply from the canal was commissioned in 1983. It was decided by the Government of India that this quantity of water will be shared by Punjab, Haryana, Chandigarh Administration and Chandimandir Cantonment in the following ratios:

- Union Territory Chandigarh : 29 cusecs. (14.5 mgd)
- Punjab (for Mohali) : 5 cusecs ( 2.5 mgd)
- Haryana (Panchkula) : 3 cusecs ( 1.5 mgd)
- Chandimandir Cantonment : 3 cusecs ( 1.5 mgd).

Present availability of water
At present the city has access to 87 MGD of water which includes 20 MGD from 200 tube wells and 6 MGD and 3 MGD water share of Haryana and Chandimandir respectively.

The city taps groundwater from the deep confined aquifers, which do not get naturally recharged. Hence recharging these aquifers is a must. At present Chandigarh is pumping out more water from its aquifers than is being recharged. However, the city not only has a declining deep water table but also has a rising water table in shallow aquifers in the southern sectors creating problems and water logging conditions as per Plan for shallow aquifers at P2 and deep aquifers at P3. (Source: Rainwater harvesting plan for Chandigarh, Centre for Science and Environment, New Delhi, 2011).

To meet the city’s future requirements of water, under JNNURM, Government of India had approved Phases V & VI of water supply scheme from Kajauli. The Punjab Government had initially agreed to release 40 mgd raw water out of which U.T’s share was to be 29 mgd. However, Government of Punjab now wants to use this water exclusively for Mohali area themselves and yet another phase of bringing more water to Kajauli is being negotiated.

With continuously increasing demand for water and uncertainty and disputes plaguing augmentation of canal water supply, Chandigarh needs to develop a comprehensive rain water harvesting plan to ensure long term sustainability of water sources for the city.

Existing Transmission, Distribution and Storage Capacities
The transmission mains carry water from the raw water source Kajauli, Punjab to the Water Treatment Plant in Sector 39, Chandigarh. The water pumped to the treatment plant is treated, disinfected and stored. This is further pumped to five distribution water works which in turn pump the clear water to the city’s distribution system for use by the consumers. The performance indicators for maintaining the water supply are mentioned at ANNEXURE-P.2.
PLAN P2 - WATER WORKS LOCATION PLAN

Save Each!

LEGENDS
Water Works
Distribution of water supply in Chandigarh and Manimajra
The city has been divided into 7 zones for the purpose of distribution including the town of Manimajra. The zoning of the city has been done keeping in view the north to south slope of the land. Each zone has a headwork named after its sector. A plan showing the location of tube wells and boosters in the city is at Plan 3 and the plan showing the water supply network is at Plan 4.

Manimajra area
Manimajra is mainly dependent on tubewells for water supply. The two water works at Manimajra are fed by 25 tubewells and canal water from Sector 26 Waterworks, Chandigarh.

Recycling of waste water
The Government of India has agreed to the proposal of Chandigarh Administration for recycling of treated wastewater. Institutions like PGI, colleges, schools, technical institutions and Punjab University have been asked to disconnect the potable water supply from irrigation of lawns and obtain connection of tertiary treatment water to save precious potable water. The Municipal Corporation has received good response to the proposal. Accordingly, MC has executed a project under JNNURM for supply for treated tertiary water having biochemical oxygen demand (BOD) less than 10 mg/l. Further efforts are being made to utilize tertiary treated water in all green belts and houses having area of over one kanal (500 square yards).

10.2 STORM WATER DRAINAGE

The natural slope of Chandigarh’s site facilitates easy disposal of storm water through Sukhna Choe, N-choe and Patiala ki Rao. Due to the provision of proper road gullies and good slope of pipes, the storm water drainage of Chandigarh is in good condition. The city however experiences the choking of drains due to plastic bags and other solid waste during heavy rains especially near roundabouts.

Reasons for Floods in Chandigarh
The key reasons for this situation are assessed as follows:-
- Some areas of city experience floods due to inadequate drainage system, which was designed for rainfall of 12 mm/hour excessive concentration of flood due to heavy down pour.

Disappearance of flood absorbing ‘N’-choe because of urbanisation.
- Dumping of debris and garbage into the open nullahs / N-choe.
- Illegal encroachment of natural water courses.
- Indiscriminate laying of service lines all along and across natural courses.
- Filling of ‘N’-choe in Chandigarh which decreases the drainage capacity.
- Diversion of natural water courses to accommodate habitations.
- Increased run off due to increase in impervious areas.

10.3 SEWERAGE SYSTEM

Sewerage Network
The first phase (sector 1-30) of Chandigarh’s sewerage system was laid during 1952 to 1965, the second phase (sector 31 to 47) from 1965 to 1976 and the third phase from 1976 onwards. There are separate sewer and storm water drainage systems in Chandigarh. The sewerage and storm water is discharged by gravity flow due to good natural slope from north east to south west. The slope also helps the sewers to be naturally cleaned due to the good self cleansing velocities. There is a well organized network of main and branch sewerage drains. The egg shaped brick trunk sewers offshoot into 18 inches dia stoneware pipe branch sewers of each sector at major junctions of V3 roads. The main sewage runs from west to east with inter connection of sewer line from south to north. No pumping is involved because of the city’s topography. The length of stoneware sewage pipe network is 742 km. The population catered to by the sewerage system is 95%.

Quantum of sewage generation
At present 65.25 million gallons of sewage is generated per day in Chandigarh. Out of this, 45 MGD is treated at sewage treatment plant (STP) at Diggian, Phase X1 Mohali and the remaining at Raipur Khurd (1.25 MGD), Raipur Kalan (5 MGD), 3 BRD (5MGD), Sector 47, Chandigarh. Another 10 MGD STP is under construction at 3 BRD. After commission of this STP, total sewerage generated will be treated upto required standards.
10.4 POWER SUPPLY POSITION

- Union Territory of Chandigarh came into existence with effect from 01.11.1966 after re-organization of erstwhile state of Punjab. The Local distribution of electricity in Chandigarh was taken over by the Chandigarh Administration, from the PSEB on 2nd May, 1967 and is responsible for distribution of power supply up to consumer’s doorstep for making quality and continuous power supply available to each and every resident.

- The UT of Chandigarh has no power generation of its own and the power requirement is met through firm share as well as unallocated quota from the Central Generating Stations. At present, UT Chandigarh has availability of power of approximately 200-270 MW of power from Central Generating Stations during different hours against the present summer demand of 275-350 MW. Accordingly, to meet with the demand gap, the Electricity Department is purchasing additional power from open market/ banking arrangement/power exchanges.

- UT Chandigarh has been working towards expanding and strengthening its power infrastructure to meet the increasing consumer demand in various sectors of the economy and presently it has one 220 KV Sub Station, 13 -66 KV Sub Station, 5- 33 KV Sub Station, 1813- 11 KV indoor and pole mounted Sub Station, 54 Kms. of double ckt. 220 KV lines, 103 Km. of 66 KV line, 28 Km of 33 KV line, 860 Km of 11 KV lines and 1234 Km of LT lines.

- Per capita consumption of electricity in the UT Chandigarh has increased from 253 Kwh in 1967-68 to 1068 Kwh in 2009-10 against the national figure of 700 Kwh and accordingly electricity consumption has increased from 1.38 LU per day to 66 LU on a particular day.

- The total transformation capacity in 1967-68 was 15.6 MVA which has increased to 636 MVA.

- The number of consumers in 1967-68 was 27821 which have been increased to approximately 2 Lakhs.

- The present connected load is 1136 MW.

- The peak power demand in 1967-68 was approximately 14 MW which has been touched to 350 MW during this year i.e. on dated 21.06.2012. The T&D loss in 1967-68 was 25% which has been reduced to approximately 17%.

- The number of employees in 1990-91 was 1540 which has been presently decreased to 1085 against the sectioned post of 1790 numbers. The units purchased in 1967-68 were 57 MUs which has been increased to approximately 1682 MU. The units billed in 1967-68 were 43 MUs which has been increased to approximately 1300 MU. The revenue realization in 1967-68 was Rs 0.84 Cr which has been increased to approximately Rs 530 Cr.

- To meet with the growing demand of power, the power purchase agreements have been tied up with future upcoming thermal/ hydro power plants. Load flow studies are being got conducted to strengthen the distribution infrastructure and two 220 kV sub-stations and six 66 kV sub stations are under planning.

- To reduce the T&D loss further, R-APDRP programme of Government of India/Ministry of Power is being implemented and the work will start shortly.

- Further, the working of the Electricity Department is being regulated by JERC. The first two ARR for the FY 2011-12 and FY 2012-13 have been filed and the same have been approved by the JERC and stands implemented.

- Gas based energy source to be tapped in view of land / space constraints

- SCADA based power monitoring of street lights.

- 11 KV and 66 KV lines to be laid underground in future and existing overhead lines to be made underground.
PLAN P3 - EXISTING POWER MAP OF CHANDIGARH

Chandigarh Electricity Department
### POWER SYSTEM INFRASTRUCTURE

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Chandigarh Electricity Department
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10.5 SOLID WASTE MANAGEMENT

Existing solid waste management in Chandigarh
The garbage is collected in small cycle carts during road sweeping by the safaiwalas of the corporation and is collected from house to house in large cycle carts. The collected waste is deposited in community Sehaj Safai Kendras from where it is transported to the dumping ground regularly through hydraulic fitted vehicles. In response to protests against the smell and poor maintenance of Sehaj Safai kendras, the corporation recently attempted to change the system. This, however, got stalled by protests of the sweepers working on contract.

Treatment of garbage with solution and dumping of disposal
The city Corporation has earmarked 45 Acres of low lying land situated in the west of Sector 38 near Dadumajra rehabilitation colony where the garbage is disposed of through ‘Land-Filling’. Government of Punjab has been requested to identify 100 acres for a new dumping ground.

Garbage processing unit
MC has set up a Garbage Processing Unit based on ‘pelletisation’ technology as a joint venture with M/s Jaiprakash Associates Limited on 10 acres of land for the processing of Municipal Solid Waste of the city on BOOT basis.

Central pollution control board’s sponsored demonstration project
The Central Pollution Control Board has allotted one demonstration project to the Municipal Corporation of Chandigarh for the management of Municipal Solid Waste and to demonstrate implementation of Municipal Solid Waste (Management & Handling) Rules, 2000.

The following 3 important components are not covered under the Demonstration Project:

1. Disposal of domestic hazardous waste
   - The practice of disposal of hazardous household waste like used batteries, pesticides etc. along with solid waste is contrary to the provisions of the rules which inter-alia state that separate arrangements should be made for the disposal of hazardous household waste in the prescribed scientific manner to protect the environment.
   - E-waste facility by DOST.

2. Disposal of slaughter house waste
   The Municipal Corporation Chandigarh is according top priority for the collection and transportation of waste from the slaughter house, meat market and fish market etc. due to its peculiar nature. At present the waste from these places is dumped along with other municipal solid waste leading to problems. Biomethanation plant also exists in slaughter house.

3. Disposal of carcasses
   At present the disposal of dead animals is being done at 2-3 open spaces, which is creating unhygienic conditions and is also inviting public criticism.

   It has been observed that undeveloped fringe areas of the city village hinterland, and areas along the choes are being used as dumping grounds.

   A site measuring 1 acre has been finalized for carcasses near garbage processing unit in Dadumajra.
10.6 MASTER PLAN PROPOSALS

WATER SUPPLY

The following provisions shall be made for augmentation of water supply:

- Providing Supervisory Control and Data Acquisition (SCADA) System & upgradation of water supply structures.
- Conservation of drinking water by harvesting treated sewage upto tertiary level and using it for horticulture.
- Augmentation of Water Supply Scheme Phase-V & VI.
- Replacement of old distribution pipe lines of Phase-I sectors.
- Recharging Deep Aquifers.

1 & 2 have already been approved by Ministry of Urban Development after finalization of City Development Plan and are under execution.

Proposals for water conservation & increasing water security use of re-cycled water

The use of potable domestic water shall be restricted to kitchen uses including drinking, bathing and washing clothes. Recycled water, should be used for non-potable uses such as watering parks, gardens landscapes, golf courses, use for construction, industrial process, flushing, washing roads etc.

Use of recycled water will be compulsory for all non-potable uses for all large buildings with an area of more than 2000 sq. m. in all new developments. If such water is not supplied by the MC then the building should set up its own water treatment plant within its premises for reuse of waste water.

All apartments or group housing complexes with more than 20 tenements and commercial, institutional and industrial complexes with an area of more than 2000 sq.m should make plumbing and infrastructure provision for enabling localized sewage treatment, use of recycled water for flushing, washing and for watering gardens.

Implementation

All building plans and land development plans with an area of more than 2000 sq. m. now have to indicate the onsite wastewater treatment and disposal arrangements and water reuse infrastructure including the plumbing plans etc. Separate systems have to be provided for sewage and sludge treatment to facilitate reuse of sludge water for gardening and washing purposes. This may require suitable storage facilities that are to be indicated on the building plans.

Reduce consumption of water

Consumption of potable water in all new buildings can be reduced by using water efficient fittings. At least 25% reduction in water consumption can be achieved from all sources.

Implementation

Replacement of old flush toilets and faucets with new low-flush and water efficient taps, shall be phased in through rebates in water bills and then made mandatory. To start with public institutional buildings and large commercial buildings such as malls shall be targeted.
Recharging deep sub-soil aquifers
The storm water network receives more than 70% of the total rainfall falling in the city. Harvesting rainwater from the storm water drain network to recharge the confined aquifer, through structures all along the network is a simple solution to access the city’s endowment of rainwater. This will be an effective way to augment the city’s water resources.

Areas suitable for rainwater harvesting in the city are roads and roundabouts, all green areas, institutional areas such as Punjab University, Capitol Complex, commercial areas, schools, colleges, religious places, industrial areas and airport.

The Municipal Corporation has decided to undertake systematic rainwater harvesting in Sector 26 on a trial basis as per a comprehensive rain water harvesting plan prepared by the Centre for Science & Environment (CSE), New Delhi. This plan has proposed recharging of the deep aquifers by constructing recharge structures along the city’s storm water drain network for tapping the rain water flowing through it. This should be combined with building surface or underground water storage structures for landscaping/ horticultural use. The city’s building bye-laws now also require all new buildings above 1 kanal to undertake rainwater harvesting.

However, due to the higher water table, however in view of the higher water table and shallow aquifers in the Southern sectors (CSE REPORT). The mandatory rain water harvesting needs to be reviewed.

Mal functioning of water meters:
Unauthorized water connections and mal functioning of water meters should also be checked regularly to avoid illegal and excessive use of water.

Water audit for existing buildings
A comprehensive water use audit shall be undertaken to examine all of the major aspects of water use in buildings, including sanitation, maintenance, mechanical systems, building processes, landscaping etc. A culture of water conservation amongst the residents through rainwater harvesting, recycling and reusing water and reducing water use will be promoted.

STORM WATER MANAGEMENT
Developing a storm water drainage master plan
The Municipal Corporation has undertaken a study to prepare a storm water drainage master plan to alleviate the problems of flooding. The study recommended deepening and widening of the nallahs for the sections affected by encroachments, modification to cross drainage works, some soft measures such as prevention of dumping of waste into the nallahs to prevent clogging and the provision of retaining walls at critical sections.

Zero drainage of Storm Water for large development sites (>30 Acre)
All large developments, housing and institutional campuses etc. with a total site area of over 30 acres must adhere to zero storm water runoff from the site. The possibility of implementing this in existing campuses such as P.G.I, C.S.I.O., IMTECH, P.U., PEC, GMCH, Sector 17, Sector 34 also needs to be explored and if found feasible, steps taken to implement it as early as possible.

Ban on construction in the catchment areas except as applicable in the zoning plan.
MAP M3 - LOCATION OF TUBEWELLS

MUNICIPAL CORPORATION CHANDIGARH

GUIDE MAP OF CHANDIGARH
PLAN P5 - STORM WATER DRAINAGE SYSTEM IN CHANDIGARH

PLAN SHOWING OF STORM WATER DRAINAGE SYSTEM FOR CHANDIGARH TOWN

LEGEND

1. EXISTING METALLED ROAD
2. EXISTING CHOWK
3. EXISTING RAILWAY LINE
4. CHANDIGARH BOUNDARY
5. CHOET
6. EXISTING S.W. DRAINAGE LINE
7. EXISTING TAIL ENDS
8. PROPOSED CHANNEL LINE
9. EXISTING RAILWAY LINE

MUNICIPAL CORPORATION, PUBLIC HEALTH DIVISION NO.4 CHANDIGARH

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Integrated implementation of sustainable urban drainage systems (SUDS)

Some of the components of the SUDS are pervious pavings, green roofs, filter drains, filter strips, swales, detention basins & retention ponds, infiltration devices, pipes and accessories, constructed wetlands.

Implementation

Sites with less than 10,000 sq.m. area shall implement rain water harvesting and SUDS Source control and infiltration instruments such as green roofs, permeable paving, infiltration trenches, infiltration basins, etc.

Larger sites (area greater than 10000 sq.m) shall implement integrated SUDS techniques as feasible that would effectively reduce runoff.

Still larger sites (with area greater than 20 acres) should go for soil infiltration rate testing before implementing SUDS infiltration devices & passive treatment techniques to enable successful implementation of “zero” storm water drainage from the site.

Sewerage system

There should be zero discharge into nallahs/choes/rivers. It is further recommended that:

• FAB Technology should be used.
• Large campuses should have decentralized sewerage treatment plants.
• Tertiary treated water should be used intensively.

GAS SUPPLY

Currently, there is neither an existing piped gas distribution network nor there is any nodal agency in the region catering to such a facility. However, the GAIL can be considered to be the nodal agency which shall be responsible to decide the planned implementation of gas pipe line to bring gas to Chandigarh.
SOLAR CITY – VISION FOR ACHIEVING SELF SUSTAINABILITY

Chandigarh to be developed as a Solar City

MNRE has identified Chandigarh as one of the 60 cities in the country to be developed as solar cities by 2012 as part of the National Mission of Solar Energy. The objective is that after cost effective efficiency and demand response, the city relies on renewable sources of energy, to the extent possible. The underlying philosophy of the concept of Solar City is to ensure that Chandigarh energy demand is met in affordable, technologically advances, and environmentally friendly manner. It means that after cost effective efficiency and demand response, the city relies on renewable sources of power and distributed generation, to the extent possible. It is proposed that Chandigarh will generate its own power by harnessing solar energy for which following has been proposed:

- The endeavour shall be to enable each house in the city to produce enough power for its domestic requirement.
- 10MW solar PV based roof top power generation 5 MW solar PV based power plant in landfill site of the city, this has of late been ruled out due to capping of the site.
- 25 MW large solar PV based power plant in Patiala ki Rao choe.

Utilizing Central Government schemes and CREST, the Municipal Corporation may initiate installation of solar-based LED traffic lights, solar street lights, building integrated solar PV, and other relevant solar products on a priority basis.

A renewable energy park could be set up to promote use of renewable energy.

Provision of solar powered lights and fountains in prominent public gardens and parks and battery operated vehicles for intra-complex transportation.

Creation of accredited certifiers who can be engaged by house owners/builders/developers for obtaining energy conservation compliance certificates.

Solar Park

Solar Park for setting up of solar power plant for generating 25 MW solar power has been proposed along a stretch of large open track of land along seasonal Patiali Ki Rao where water flows only during 2 to 3 months.
SOLID WASTE MANAGEMENT
To overcome the problems observed in the existing set up for Municipal solid waste management an attempt shall be made to manage and treat the waste in a decentralized way as far as possible in the following manner:

WASTE SEGREGATION AND MANAGEMENT AT SECTOR LEVEL
All residential and commercial establishments shall be motivated to segregate biodegradable and non-biodegradable waste and, where possible, to compost biodegradable waste on site. Recyclable non-biodegradable waste shall be sold to waste pickers and only the remaining non-biodegradable waste sent for disposal. Public-private alliances between local bodies, NGOs, RWA’s and CBO’s for developing innovative models for managing solid waste at the neighbourhood level and undeveloped areas including villages shall be encouraged. Some of the methods to be promoted include OSI, bio-sanitizer, composting, vermi-composting and composting with bio culture. As per Bio Medical Waste Rules (Management & Handling) in cities having population above 5 lakh, carcasses are to be disposed off by incineration.

WASTE MANAGEMENT IN APARTMENTS & SOCIETIES:
In order to reduce the waste that finally goes into the land fill sites, it is proposed that Group Housing Societies with more than 20 households and apartments with similar strength in each sub-sector shall provide segregated solid waste management facilities within the site in a sustainable manner.

- All waste going to land fill site should be processed before final disposal.
- Treatment options for biodegradable waste: Composting and bio-methanation are among the treatment options available for treating bio-degradable waste at a smaller scale.
- All markets shall be asked to have arrangements for composting the organic waste (coming from fish / slaughterhouses / vegetable/ fruit/ flower markets) they generate.
- A bio-gas plant of 3000 Kg. capacity is installed for scientific disposal of slaughter house waste.
- All hotels and restaurants should have in-house arrangements for treating biodegradable waste.
- All offices and commercial buildings should have arrangements for recycling of items such as paper and cardboards, toner cartridges, batteries, mobile phones and e-waste.

A carcasses incineration/utilization centre is proposed to be set up over an area of 1 acre of land identified in Dadumajra. An annual waste audit report should be made mandatory for all commercial establishments, offices, restaurants, hotels, educational institutions etc. to be submitted to the MOH/ Municipal Corporation as per details to be specified by the concerned Deptt.

E-WASTE SUPPORT SYSTEM TO BE PROVIDED BY CHANDIGARH ADMINISTRATION/MC
Electronic waste such as PCs, faxes, mobile phones, etc. better known as e-waste is being recycled by the informal sector and/or dumped with regular municipal solid waste causing serious environmental problems.

E-waste should be handled by registered e-waste handling agencies following the guidelines framed by the concerned department.

THE MANAGEMENT OF BIOMEDICAL WASTE
Biomedical waste forms about 0.4% of the total municipal waste generated in Chandigarh. If this waste gets mixed with the municipal waste without any segregation, disinfection and treatment, all the waste becomes infected and poses a serious threat to the health of workers, waste handlers, people in general and the environment. The Chandigarh Administration shall endeavour to take measures to follow Bio Medical Waste Management and Handling Rules 1998.

A mandatory Waste Management and Recycling Plan for construction and demolition projects for all new and existing buildings with the intent to minimize the generation of waste due to construction activity and manage the generated waste in a sustainable manner shall be made a compulsory requirement for plan approval.

- In case of demolition projects, if a minimum of 20% of the existing structure (walls, roofs and floors, windows, doors, etc. excluding the hazardous materials) is reused, incentive/rebate shall be given.
- A minimum of 4% of the total site area should be allocated for storage of the waste. This storage area should be covered and the pollutants from the waste should not affect the surrounding.
GARBAGE STREWN ALONG THE OUTER PERIMETER OF THE RAJINDRA PARK-TOWARDS NAYA GAON.

Recommendations – the edge of the park needs to be clearly defined by a boundary wall - matter needs to be taken up with the State Government of Punjab

GARBAGE TREATMENT PLANT ALONG PATIALI-KI-RAO, DADUMAJRA