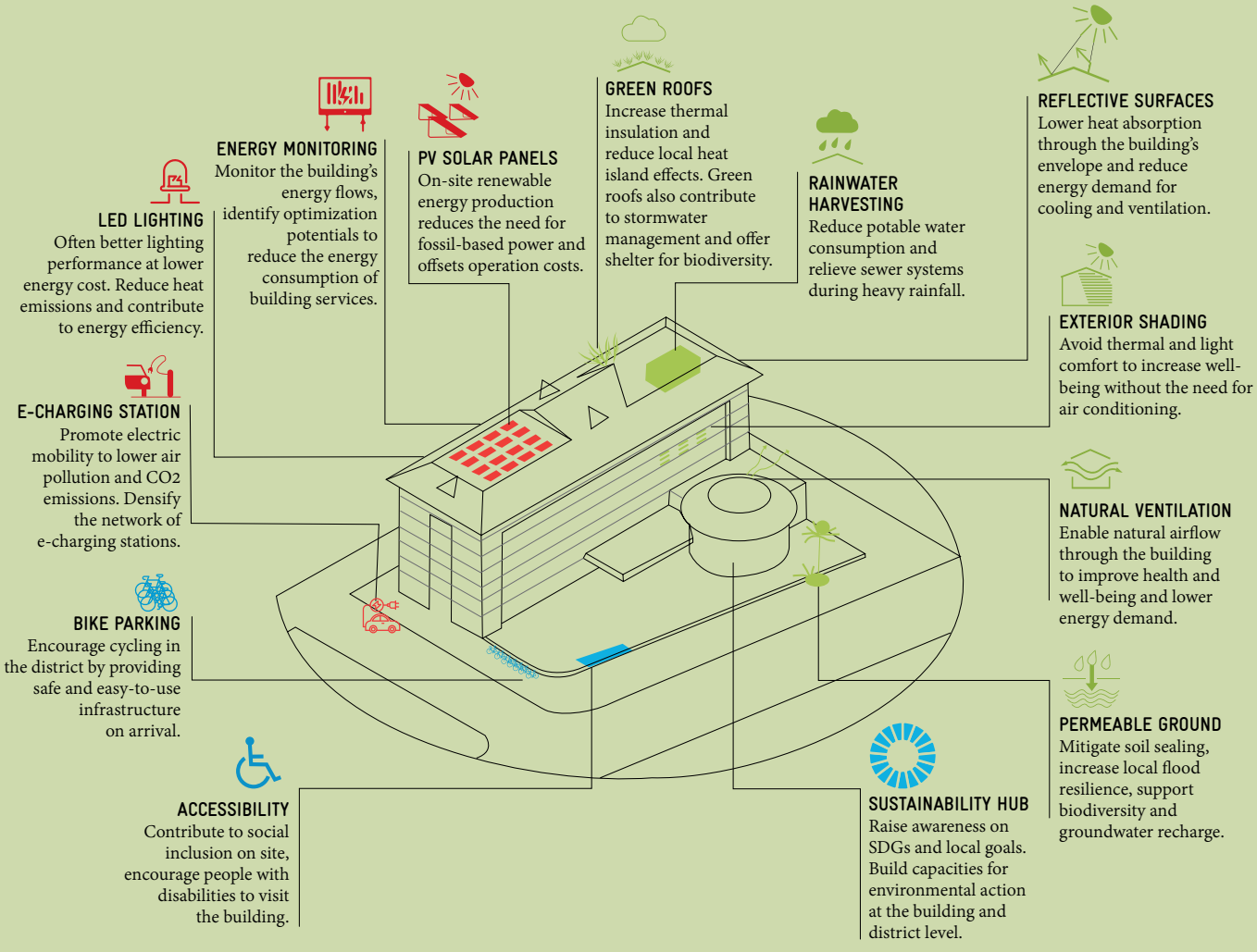

Green Building Checklist

A Guide For Preparation of RFP's for New Buildings in Kochi

January 2022

In Cooperation of
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Background

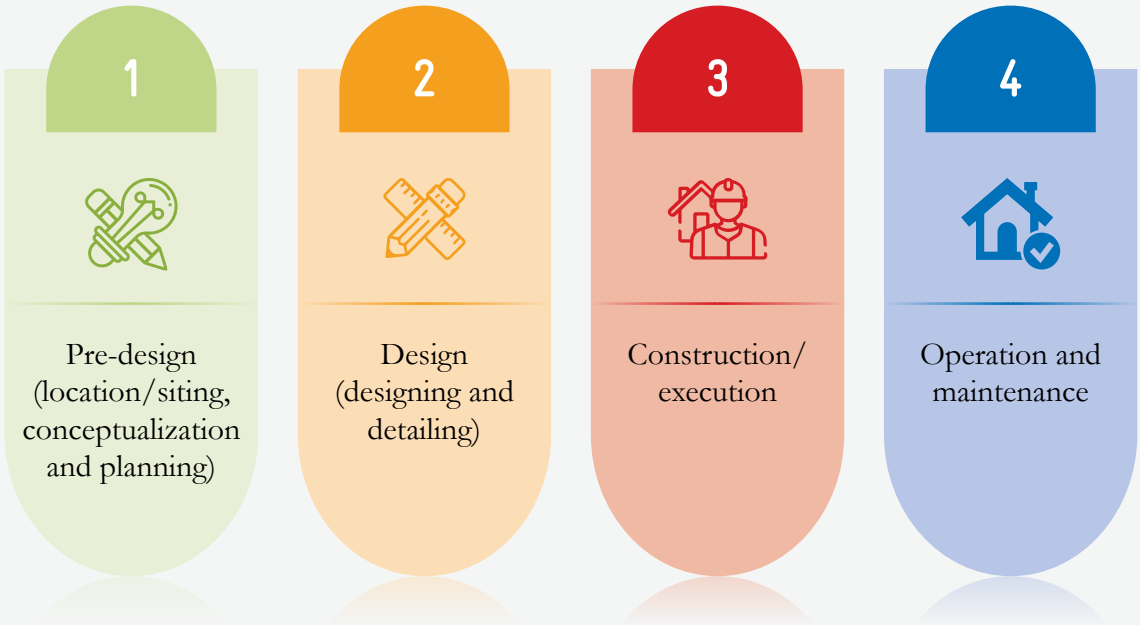
Buildings account for 39% of all carbon emissions in the world. Out of this, 28% are the operational emissions from energy used to heat, cool and light buildings while the remaining 11% are embodied carbon emissions that are associated with materials and construction processes throughout the whole building lifecycle. The average life of a building is about 60 years, so, whatever efficiency we design it for will be locked-in for that duration. Hence, it is extremely important to design the building and building services with utmost care.

About the checklist

The intent of this checklist is to ensure that relevant technical criteria pertaining to green building are included in the contract during the time of award of work to the selected agency. This checklist is designed for new commercial and institutional projects that will come up in Kochi city. Adhering to this checklist will help the project to comply with the Energy Conservation Building Code (ECBC 2017), National Building Code (NBC) 2016, Chapter 11 – Approach to sustainability.

The checklist is divided in four sections based on the stages described below.

A building project and the built facility during its service life comprises the following major stages:



An Integrated Approach is crucial to make a green building

Each stage necessarily requires professionals of many disciplines who should work together as a well-coordinated team to achieve the desired product delivery with quality and safety and other objectives, in an effective manner. It is recommended to constitute an appropriate multi-disciplinary team to successfully meet the requirements of different stages.

It is important that leaders and members of the design team, project management/construction management team, and operation and maintenance team, depending on the size and complexity of the project, are carefully selected considering their qualification, experience and expertise in these fields.

Checklist for New Construction – Institutional & Commercial Buildings

Pre-design Stage

Clause 1.1 Minimize the impact of new construction on existing site features

The responsible design professional shall prepare an assessment of the onsite natural resources and pre-site conditions. The person shall,

1.1.1 Establish, if there are any protected areas such as floodplains; forest department areas; water bodies such as sea, lakes, rivers, wetlands, tributaries and/or streams; coastal regulation protected areas; and agricultural land and demonstrate that no critical natural resource is impacted by the project and/or dredging operations.

Refer:

- ESZs- Eco-Sensitive Zone regulation[1]
- Ecologically Fragile Lands[2]
- CRZ- Coastal Regulation Zones 2019 Notification[3]

1.1.2 Conduct a hydro-geological study, soil permeability and natural drainage study of the project site. Establish the degree to which the existing soil at site and hydrology has been disturbed prior to development and ensure that best practices are implemented for water management during design.

1.1.3 Conduct a site evaluation and analysis to identify existing infrastructure and services such as entry and exit points, transportation services, electrical services and drainage lines. Avoid diversion of existing water, power, communication, sewerage lines. Ensure saving/replanting of old trees, removal of existing invasive vegetation on-site and that no invasive vegetation is planted post completion.

1.1.4 Identify and ascertain the natural resources available onsite and surrounding areas and ensure optimum utilisation of the same in construction and post occupancy. Examples of such resources include but are not limited to: excavated rocks, fertile top soil, clay for making earth blocks.

1.1.5 Collect weather and climate data such as annual temperatures, humidity, wind direction, detailed rainfall data. Ensure optimum utilisation of this information while designing.
Refer: Annexure 1

A detailed site assessment report for the building/development project shall be prepared comprising all the points mentioned in sub-clauses 1.1.1 to 1.1.5.

Clause 1.2 Integrate the development into existing or planned networks of multimodal transportation.

1.2.1 Encourage a choice of location that offers access to reduced motor vehicle use. Locate the building in a walkable or bikeable distance to existing or planned public transportation stops.

1 Mangalavanam Bird Sanctuary is the only ESZ identified in KMC area. The detailed regulations regarding this are still in draft format with the NGT. Eco-sensitive zone regulation can be accessed at: http://moef.gov.in/rules-and-regulations/esz-notifications/
2 http://www.forest.kerala.gov.in/images/efltest.html
3 http://keralaczma.gov.in/pdfs/CRZ%20Notification%202019.pdf

1.2.2 Encourage cycling in the district by providing safe an easy-to-use infrastructure in the area related to the building.

1.2.3 Promote electric mobility by locating the project within or where necessary further densifying a network of e-charging stations.

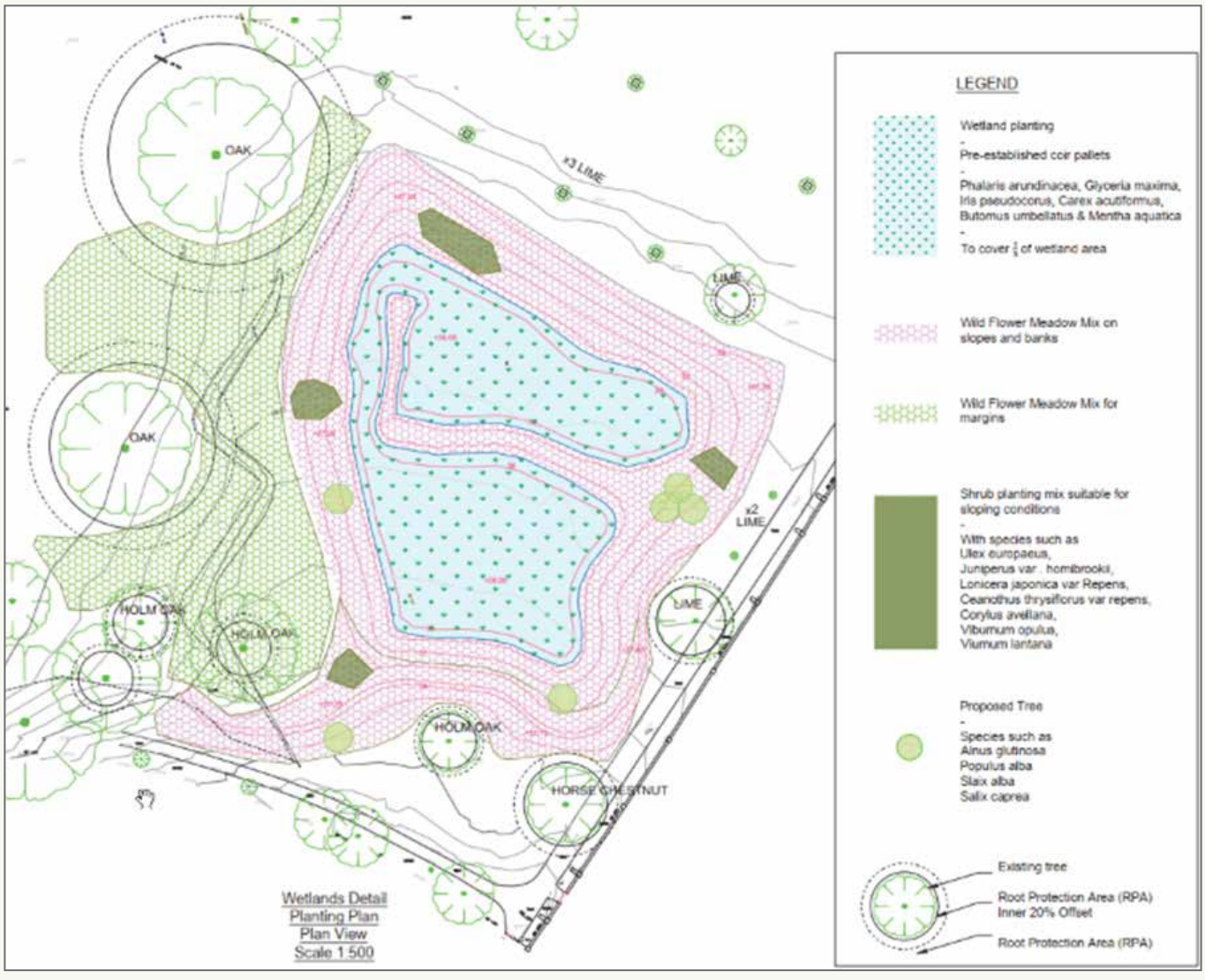


Figure 1: Sample Vegetation Survey Plan

Design Stage
Architectural Design requirements

Clause 2.1 Site planning must be done in a manner that has minimum impact on the site and the surroundings.

2.1.1 Maintain the natural contours on the site by minimising cut and fill, so that soil erosion can be prevented, and the natural rainfall run-off pattern is not disturbed.

Refer:

National Building Code 2016, Part 10 – Landscape Development, Signs and Outdoor Display Structures, Section 5– General Landscape Development Guidelines and Section 11– Protection of Landscape during Construction

2.1.2 Plan the building footprint to preserve maximum number of existing trees on site.

2.1.3 Preserve the eco-sensitive zones, water bodies and wetlands.

Refer:

- ESZs- Eco-Sensitive Zone regulation[4]
- Ecologically Fragile Lands[5]
- CRZ- Coastal Regulation Zones 2019 Notification[6]

2.1.5 Develop a rainwater management strategy for the project site to reduce rainwater runoff post development. A combination of the following strategies can be implemented to achieve it:

a) Sustainable Urban Drainage System (SuDS) to minimise rainwater run-off post development
b) Rainwater recharge design based on site hydrology and rainfall data
c) Rainwater storage and re-use strategy

Refer:

- Manual on Storm Water Drainage Systems, Volume -I, Part A: Engineering, Chapter 10: innovative Storm Water Management Strategies[7]
- The SuDS Manual 2015, Construction Industry Research and Information Association, CIRIA[8]

2.1.5 Conduct a disaster risk assessment for the site as per Kerala State Disaster Management Authority (KSDMA) guideline.

Refer:

KSDMA (Kerala State Disaster Management Authority) Guidelines[9]

2.1.6 Reduce urban heat island effect post development. The following strategies or a combination of them can be implemented to achieve the same:

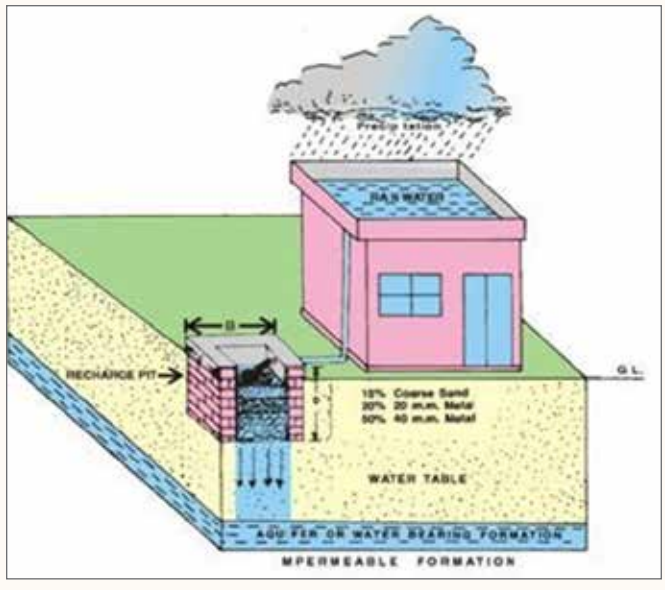


Figure 2: Recharge-pit method

4 Mangalavanam Bird Sanctuary is the only ESZ identified in KMC area. The detailed regulations regarding this are still in draft format with the NGT. Eco-sensitive zone regulation can be accessed at: http://moef.gov.in/rules-and-regulations/esz-notifications/
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6 Link: http://keralaczma.gov.in/pdfs/CRZ%20Notification%202019.pdf
7 Link: http://cpheeo.gov.in/cms/manual-on-storm-water-drainage-systems---2019.php
8 Link: https://www.ciria.org//Memberships/The_SuDs_Manual_C753_Chapters.aspx
9 Link: https://sdma.kerala.gov.in/guidelines/

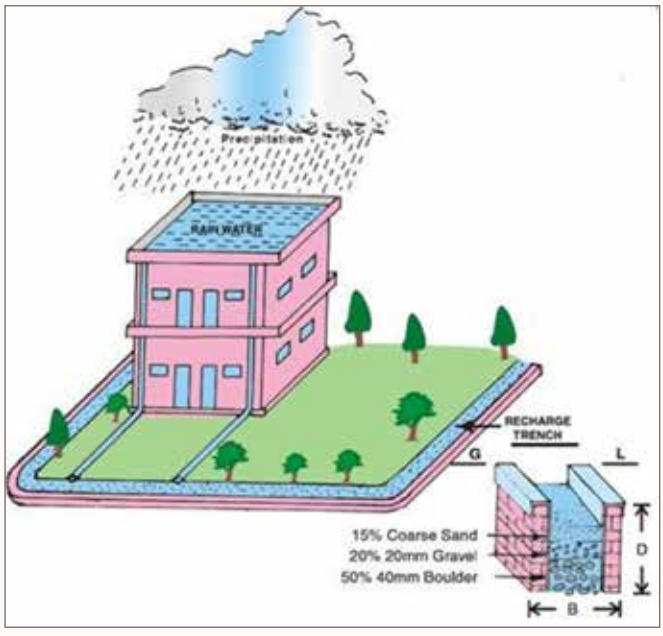


Figure 3: Recharge Trench method

a) Minimising building footprint.
b) Maximising green cover on-site (use native and adapted species).
c) Minimising hard paved surfaces exposed to direct solar radiation.
d) Using high SRI (Solar Reflective Index) finishes on hard surfaces exposed to direct solar radiation such as roofs, roads and pavements.
e) Shading the hard-paved surfaces with vegetation.
f) Green roofs

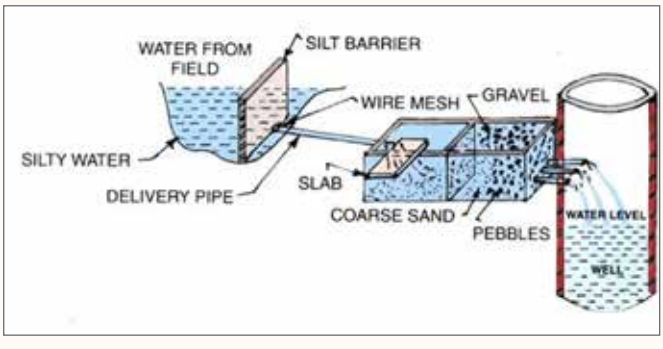


Figure 4: Dug-well recharge method

Clause 2.2 Adopt passive design principles to minimise energy consumption and enhance comfort.

2.2.1 Reduce energy consumption and enhance thermal comfort by adopting vernacular design elements such as verandas, courtyards and semi-open spaces such as Charupadi.

2.2.2 Incorporate traditional design elements such as sloping roof, recessed windows and horizontal shading for protection from heavy rainfall.

2.2.3 Reduce energy consumption for cooling in the building by minimising heat gain via optimum orientation, optimum window to wall ratio, building massing for mutual shading, and shading design for openings.

Refer:

- NBC 2016[10]
- SP-41 Handbook on functional requirements of buildings (other than industrial buildings)[11]

2.2.4 Design the building openings to enhance natural ventilation.

Refer:

Eco-Niwas Samhita

2.2.5 Reduce energy consumption for lighting by integrating daylight in the indoor spaces by keeping the floor plates narrow and optimising openings in the façade while at the same time avoiding direct solar radiation and glare.

Refer:

- SP-41 Handbook on functional requirements of buildings (other than industrial buildings)
- ECBC 2017

10 Link: https://www.bis.gov.in/index.php/standards/technical-department/national-building-code/
11 Link: https://law.resource.org/pub/in/bis/S03/is.sp.41.1987.pdf

2.2.6 Incorporate flood resistant design features such as elevation of the lowest inhabitable floor by use of stilts or columns above Base Flood Elevation (B.F.E.), the use of flood resistant materials such as concrete, brick or stone, and the design of wet or dry flood proofing of the lower levels of the building.

Refer:

- SP-41 Handbook on functional requirements of buildings (other than industrial buildings)
- BMTC Guidelines - Improving Flood Resistance of Housing[12]

Clause 2.3 Reduce the environmental impact and negative health impacts of the building by using sustainable and healthy building materials.

2.3.1 Adaptively re-use old buildings.

2.3.2 Consider doing a Life Cycle Assessment (LCA) study for building materials.

2.3.3 Prioritise regionally available alternate building materials/ technology such as compressed earth blocks, laterite stones, on-site excavated rocks and boulders, filler slabs.

Refer:

- Costford (Centre of Science and Technology for Rural Development)
- KESNIK

2.3.4 Utilize recycled materials such as C&D waste-based bricks, ceiling and flooring tiles with recycled content, metal components with recycled content as much as possible.

2.3.5 Utilize recycled and rapidly renewing alternatives for hard wood such as bamboo-based products, coir-based products and composite wood boards like medium density fibre board (MDF).

2.3.6 Use salvaged materials like doors, door frames, door handles, latches, window frames, furniture, from demolished buildings.

2.3.7 Use low emitting materials such as zero VOC paints, non-formaldehyde based bunders for interiors and furniture.

Clause 2.4 Design inclusive and accessible buildings by considering different personal situations and eliminating architectural barriers.

Refer, for all points under clause 2.4:

- National building code 2016, Annexure-D
- Central public works department (CPWD) – Guideline and Space standard for Barrier Free Environment[13]
- Guideline of Barrier Free Environment by Chief commissioner[14]

2.4.1 Plan accessible building entrances by offering barrier-free alternatives such as ramps, lifts or elevators.

2.4.2 Plan vertical connections within the building to be integrative and accessible by offering alternatives to stairs.

2.4.3 Contribute to social inclusion within the building by locating all common spaces on routes accessible for persons with mobility impairments.

Mechanical, Electrical & Plumbing (MEP) Design requirements

Clause 2.5 Design the electrical systems for energy efficiency.

Refer:

- ECBC 2017, for all the points under clause 2.5

2.5.1 Reduce dependence on grid power supply by installing on-site renewable energy.

2.5.2 Reduce energy demand for Heating, Ventilation & Air-conditioning (HVAC) by adopting the following measures:

12 Link: https://bmtpc.org/DataFiles/CMS/file/Flood_Guidelines_BMTPC_2010.pdf
13 Link: https://punarbhava.in/index.php/resources/guidelines?layout=view&id=550
14 Link: https://cdn.nic.in/SJ/PDFFiles/PlanningForBarrierFreeEnvironment.PDF

a) Enhance the thermal performance of building envelope (walls, windows and roof) by using high U-Value wall materials, glazing, and incorporating insulation layers.
b) Make provision for natural ventilation via operable windows and fans so that thermal comfort requirements can be met on moderately hot days.

2.5.3 Reduce the energy consumption of HVAC system by:
a) Selecting high-efficiency equipment, namely high Energy Efficiency Ratio (EER) window and split AC units, higher Coefficient of Performance (COP) of chillers, efficient fans.
b) Install controls such as occupancy controls, fan controls, and dampers

2.5.4 Reduce the energy consumption of artificial lighting by:
a) Reducing the lighting power density (LPD) of artificial lighting by using high efficacy luminaires such as LED based lighting fixtures.
b) Use of daylight sensors and automatic lighting controls.

Refer:

- National Building Code 2017, Part 8-Section 1

2.4.5 Install meters and submeters to monitor electrical energy consumption by various processes and components. Consider installation of advanced building energy management system (BMS) for better monitoring during building operations.

2.4.6 Use non-Ozone Depleting Potential (ODP) and low Global Warming Potential (GWP) refrigerants and coolants. Avoid the use of both HCFCs and HFCs. Promote the use of natural coolants, wherever possible (e.g. propane, isobutane, ammonia, carbon dioxide)

Refer:

- HCFC Phase-out and Energy Efficiency in Buildings Manual 2017 by Ozone Cell India Clause 2.5 – Design for comfort and well-being.

2.5.1 Design for thermal comfort of the occupants either through the active cooling or through Indian Adaptive thermal comfort Standard. Air conditioning systems for interior spaces intended for human occupancy shall be designed for not more than 26°C for cooling.

Refer:

- National Building Code 2016, Part 8 – Building Services, Section 3 – Air Conditioning, Heating and Mechanical Ventilation
- ECBC 2017, Chapter 2 – Fundamentals, Part 2.2 – Thermal Comfort
- Indian Adaptive Thermal Comfort Standard

2.5.2 Design for visual comfort.

Refer:

- National Building Code 2016, Part 8 – Building Services, Section 1 – Lighting & Natural Ventilation
- ECBC 2017, Chapter 2 – Fundamentals, Part 2.3 – Visual Comfort
- Useful Daylight Index (UDI)

2.5.3 Design for Acoustic comfort to create an environment that is conducive to speech intelligibility, low distractions and annoyance, and improved concentration.

Refer:

- ASTM standards C423, E90, E1414, E1573

2.5.4 Design for healthy Indoor Air Quality (IAQ) by controlling the sources of air contamination sources, proper ventilation to manage CO2 levels, humidity management, and adequate filtration for managing the particulate matter.

Refer:

- National Building Code 2016, Part 8 – Building Services, Section 3 – Air Conditioning, Heating and Mechanical Ventilation

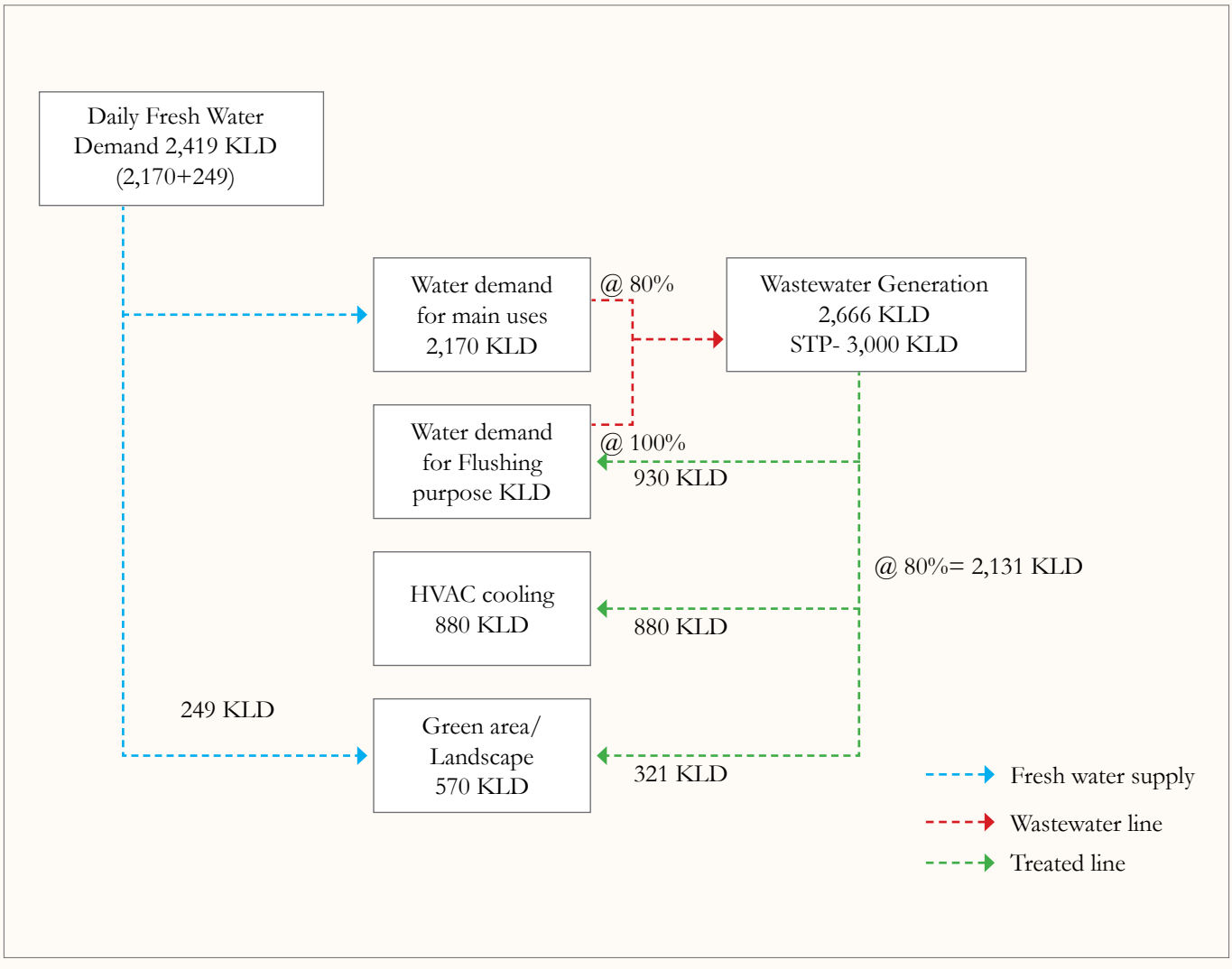
Clause 2.6 Develop and implement an integrated water management strategy to optimise water consumption in the building.

2.6.1 Make an exhaustive water balance chart for the project to identify all the water supply sources and consumption requirements. Sources may include municipal, natural water bodies, ground water, rainwater, and on-site treated water whereas consumption may include drinking water, bathing water, washing, cleaning, flushing, cooling tower, and irrigation.

2.6.2 Minimise the dependence on municipal water sources by re-using treated water on-site and rainwater collection.

2.6.3 Identify and optimise building water demand through the installation of water efficient fixtures and climate-appropriate vegetation.

2.6.4 Install water meters and sub-meters to monitor water consumption for various processes.



Construction stage

Clause 3.1 Control erosion and sedimentation during construction.

3.1.1 Prepare and implement an erosion and sedimentation control plan. The following strategies or a combination of them can be implemented:

a) Minimise land disturbance and leave maximum green cover.
b) Excavation work must be planned during the dry season when the potential for erosion is the lowest.
c) Construct a sedimentation basin in the lowest point on-site to allow sediments to settle before the runoff leaves the construction site.
d) Mulch the loose soil with organic material such as straw, grass, hay, coco-peat, wood shavings, and compost.
e) Cover loose soil with coir mats to prevent erosion.
f) Contour trenches or ridge & channel can be made can reduce the run-off velocity during construction on steep slopes.

Clause 3.2 Make provisions to minimise pollution due to construction activity.

3.2.1 Prepare and implement an air pollution prevention plan during construction. The following strategies or a combination of them can be implemented:

a) Keep the construction material covered to prevent the particles from becoming air-borne due to wind.
b) Use a dust screen on the perimeter of the construction site.
c) Sprinkle water regularly on the construction site.
d) Make provision for a wheel washing facility at the entry/exit point of the site.
e) Avoid using diesel generators if possible. In case diesel generators are used, then the exhaust must be designed as per the Central Pollution Control Board (CPCB) guidelines.

3.2.2 Prepare and implement a noise pollution prevention plan during construction. Stay within the Central Pollution Control Board (CPCB) defined noise levels for construction activity. The following strategies or a combination of them can be implemented:

a) Use quieter equipment or modify noisy equipment by using sound mufflers and dampeners wherever possible.
b) Make enclosures to limit noise pollution.

3.2.3 Avoid using harmful chemicals for construction activity wherever possible. All necessary hazardous chemical material such as diesel, water-proofing compounds, paints, varnishes, must be stored on concrete platform to prevent leaching into the ground.

Completion Stage

Clause 4.1 Conduct an extensive building system commissioning before handover for occupancy to ensure that all mechanical, electrical and plumbing systems are operating smoothly as per design.

Clause 4.2 Develop a detailed operations and maintenance protocol.

4.2.1 The Operations & Maintenance protocol must include the following:

a) Waste management plan with designated location of bins and segregation area.
b) Electrical and mechanical equipment maintenance protocol
c) Plumbing and sanitation equipment maintenance protocol
d) Standard Operating Procedure (SOP) for water management
e) Protocol and schedule for systems and equipment testing

Notes

Notes

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