KMRC
KOLKATA METRO RAIL CORPORATION LIMITED
(A GOVERNMENT OF INDIA AND GOVERNMENT OF WEST BENGAL JOINT VENTURE)
HRBC BHAWAN,
(4th & 5th floor)
Munshi Prem Chand Sarani
Kolkata-700 021
Phone/Fax: 2213 4350

No. KMRCL/CE-II/58/CPD/10 **Dated: 28 April 2010**

To:

1. **GAMMON INDIA LIMITED**
2. **SIMPLEX INFRASTRUCTURES LIMITED**
3. **AHLUWALIA CONTRACTS (INDIA) LIMITED**
4. **LARSEN & TOUBRO LIMITED**
5. **SENBO ENGINEERING LIMITED**
6. **IVRCL INFRASTRUCTURE & PROJECTS LIMITED**
7. **MFAR CONSTRUCTIONS PRIVATE LIMITED**
8. **CONSOLIDATED CONSTRUCTION CONSORTIUM LIMITED**
9. **ENGINEERING PROJECTS (INDIA) LIMITED**
10. **SHAPOORJI PALLONJI & COMPANY LIMITED**
11. **PATEL ENGINEERING LIMITED**
12. **KEC INTERNATIONAL LIMITED**
13. **IRCON INTERNATIONAL LIMITED**
14. **MCNALLY BHARAT ENGINEERING COMPANY LIMITED**
15. **TANTIA CONSTRUCTION LIMITED**
16. **PUNJ LLOYD**
17. **GEODESIC TECHNIQUES PVT. LTD**

Dear Sirs,

Reg: CPD Tender - Design, Manufacture, Supply, Construction and Commissioning of Central Park

1. It is decided to issue one more Tender Addendum No. 4 to Contract CPD (Design, construction, manufacturing, supply, installation, testing, and commissioning of Central Park Depot for East-West Metro Rail Project, Kolkata). You are advised to collect the Tender Addendum No. 4 from the office of General Consultants to KMRC, 4th Floor, HRBC Bhavan Annexe, Munshi Premchand Sarani, Kolkata 700021 from the FN of 29 April 2010.

2. This Addendum document shall for part of the tender documents.

Contd.....

3. The date and time of opening of tenders in above case stands postponed as under:

a)	Last Date & Time of Submission of Tenders	-	15/05/2010 up to 10:30 hours.
b)	Date & Time of Opening of Tenders hours	-	15/05/2010 at 11:00

28.4

(K. Gangopadhyay)
Chief Engineer-II

Pre-Tender Meeting	10/12/2009 at 13.00 hour at KRMCL Conference Room Kolkata Metro Rail Corporation Limited, HRBC Bhawan (4th & 5th floor), Munshi Prem Chand Sarani, Kolkata-700 021 India
2nd Pre-Tender Meeting	19/02/2010 at 11.00 hour
Last Date for Seeking Clarification	20/03/2010
Last Date & Time of Submission of Tenders	15/05/2010 up to 10:30 hours.
Date & Time of Opening of Tenders	15/05/2010 at 11:00 hours

3. The attached Tender Documents comprise:

A: **5** (five) Volumes for the Contractual, Technical and Financial matters and related information

Volume 1

- **Notice of Invitation to Tender**
- **Instructions to the Tenderers (including Annexures)**
- **Form of Tender (including Appendices)**
- **General Conditions of Contract**
- **Special Conditions of Contract (including Schedules)**

Volume 2

- **Employer's Requirements – General**
- **Employer's Requirements – Functional**
- **Employer's Requirements – Design**
- **Employer's Requirements – Construction**
- **Employer's Requirements – Appendices**

Volume 3

- **Functional Specifications**
- **General Specifications**
- **Particular Specifications**

Volume 4

- **Tender Drawings**
-
- **Volume 5**
- **Pricing Document**

. D. SUBMISSION OF TENDERS

D1. Sealing and Marking of Tender

D1.1 The Tenderer shall seal the 'Tender Security' in a separate envelope duly marked "Tender Security for Contract CPD.

D1.2 The Tenderer shall seal the original and copies of the Eligibility Package in separate envelopes, duly marking them as "Original" and "Copy 1, Copy 2". All the envelopes of the Eligibility Package shall then be sealed in an outer envelope.

D1.3 The Tenderer shall seal the original and copies of the Technical Package in separate envelopes, duly marking them as "Original" and "Copy 1, Copy 2". All the envelopes of the Technical Package shall then be sealed in an outer envelope.

D1.4 Likewise, the Tenderer shall seal the Original and Copy of the Financial Package in separate envelopes duly marking the envelopes as "Original" and "Copy". Both envelopes of the Financial Package shall be sealed in an outer envelope.

Thus, there shall be one envelope containing only Tender Security, a second containing the original and two (2) copies of the Eligibility Package, a third containing the original and two (2) copies of the Technical Package and a fourth containing both original and one (1) copy of the Financial Package. All four envelopes shall be put in an outer envelope and sealed.

All the inner and outer envelopes shall be addressed to the Employer at the following address:

The Managing Director,

Kolkata Metro Rail Corporation Limited,
HRBC Bhawan (4th & 5th floor),
Munshi Prem Chand Sarani,
Kolkata-700 021,
India;

(a) bear the following identification for Tender Security

TENDER SECURITY

Tender Reference Number: CPD

DO NOT OPEN BEFORE 11:05 hrs. on 15 May 2010.

(b) bear the following identification for the Eligibility and Technical Proposals:

ELIGIBILITY or TECHNICAL PACKAGE as appropriate

Tender Reference Number: CPD

DO NOT OPEN BEFORE 11:05 hrs. on 15 May 2010.

Kolkata East-West Metro Rail
Central Park Train Maintenance Depot

Sustainable Design Guidelines

Kolkata Metro Rail Corporation
Volume 3 - Appendix 3-3-01

Mission Statement

The purpose of these guidelines is to establish a process for the creation of an environmentally responsible maintenance depot that complements the global trend of green and sustainable building design that addresses the urgent need of carbon reduction and climate concerns. More so, there is the need to create a building that services and complements local and urban sustainability, and which values and minimizes its eco-footprint on its community.

Central Park, situated in Bidhan Nagar, is the second largest open field in the city of suburban Kolkata. Estimated about 100 acres (0.40 Km^2), it is regarded as a vital ecological and recreational resource to the local region.

Because of the need to expand mass transit in Kolkata for future growth and sustainability, encroachment of one sustainable attribute (mass transit) onto another (ecology) has become inadvertent. For this reason, it becomes necessary that green design be a fundamental goal and deliverable for the design and construction of the Central Park Maintenance Depot.

The building created by this effort will beacon as a model in India and globally for healthier, ecologically responsible planning and development, where building occupants and community residents collectively enjoy the mutual benefits of a safe and healthy living and working environment, and the outlook of a sustainable city.

Sustainable Design
Sustainable design is "meeting the needs of the present without compromising the ability of future generations to meet their own needs." In most instances this is a "common sense" approach to building that prevents further depletion of natural resources (during construction and life-cycle operations), and impact to air pollution, water pollution and global warming. This approach decreases dependency on non-renewable resources while improving opportunities for more efficient and more economical alternatives that are self-sustaining.

Market Strategy
The following guidelines adhere to the most current thinking with respect to sustainable design strategies and are a vehicle for the development of maintenance depot facilities that are environmentally friendly. The guidelines respond to increased public awareness of environmental conservation and increased demand for high quality and healthier environments for living as well as in the workplace. Incorporating sustainable principles in the design of the new KMRC Central Park Maintenance Depot will be a benchmark for global mass transit facilities around the world.

Total Systems Approach
A total systems approach is the backbone of the guidelines and the best approach to achieving the desired result in a cost effective manner over the life of the building. Therefore, the guidelines are grouped into five major categories – each comprised of requirements that share a common environmental goal. One of the financial goals of a total system approach is to minimize the impact on First Costs (construction costs) by offsetting increases from some requirements with decreases from others, and by considering life cycle costing in financial decision making. For example, the cost of improving the performance of the exterior envelope of the building may be offset by a reduction in the size and subsequent cost of mechanical ventilation and cooling equipment. Additionally, life cycle cost analysis and life cycle financial assessment are conducted to rationalize a specific investment that delivers specific values during operations of a facility.

Execution
The guidelines represent a framework of design concepts that may be interpreted and refined to achieve the best mix for desired result. Successful execution of the guidelines depends on all members of the design-build team, including the KMRC and contractors to begin their dialogue at the earliest stages to ensure the proper and cost effective realization of sustainable solutions.

These guidelines represent a living document, as technologies, financial strategies, global warming policies, and an array of sustainable demands and services are consistently evolving. While some of the requirements are prescriptive, most are purposely goal oriented to provide for creative solutions and to not preclude rapidly changing technologies or conflict with evolving policies, regulations, and building codes.

1.1 Maximize Energy Efficiency

Intent:

Increase energy performance, reduce energy demand, reduce operating costs, reduce the environmental impact associated with energy consumption and carbon emissions, and improve the overall quality of the indoor workplace environment.

Requirement:

Minimize Building's Energy Use Index against benchmarked non-green like-facilities

.1 Set goal to minimize building energy use index (BEUI or BEU) (Btu's per square feet/square meter per year) by 50% against the average BEU of like depot maintenance facilities for hot/humid climate. This target will include the combine of energy needed to sustain building comfort, safety and health, and the energy needed for process operations.

Maximize natural lighting to reduce daytime artificial lighting

.2 Increase natural lighting using daylight harvesters or skylights, to reduce daytime electrical energy demand for artificial lighting. Incorporate into the design the use of natural lighting designs, clerestories, or other architectural innovations, to minimize the need for artificial illumination during the day.

.3 Provide lighting dimming systems in the shop and motion detectors in stairs, mechanical rooms, and storage rooms, and photocell controls for outdoor, to turn lights on and off automatically.

.4 Provide daylight dimming in shop and office areas.

.5 In all offices, locker rooms, gym, and the lunchroom, provide dimmable light fixtures so that lighting levels can be manually adjusted.

.6 All light fixtures to use energy saving ballasts and long-life, recyclable lamps.

.7 The minimum standard for all windows and exterior glazing will be double-glazed units with Low-E glass (.33 R-value center of glass), or latest window insulating technology to maximize entry of daylight while minimizing solar heat gain.

Maximize plug load energy efficiency

.1 Use energy efficient appliances in the lunchroom - See Appendix for "List of Energy Efficient Appliances."

Maximize natural ventilation

.2 Incorporate into the design the use of natural ventilation techniques to minimize the need for mechanical ventilation in shop and office areas.

.3 Model natural ventilation design using computational fluid dynamics

Other design approach

.1 Incorporate into the design the use of low embodied energy materials.

.2 Incorporate into the design of the exterior building envelope materials or designs that will greatly reduce heat gains and thermal transfer into building, such as, green walls, green roofs, solar shading and insulator, etc.

.3 High efficiency motors and variable speed systems.

.4 Occupancy sensors in rooms coupled with thermostats to allow temperature demand control in unoccupied rooms.

.5 Specific heatpipe technology to maximize energy efficiency of dehumidification process.

Technologies/Strategies:

- Use of high performance glazing, and other measures to maximize shading coefficients and insulating qualities.
- Optimize insulation of cavity wall masonry/roof construction techniques and limit infiltration in wall constructions.
- Use window treatments (i.e., solar shades, curtains, etc.) to minimize heat gain.
- Investigate the most energy efficient cooling mechanical systems.
- Investigate application of ground source heat pump as alternative technology to provide highest coefficient of performance (COP) for meeting cooling demand
- Investigate the potential use of water misting cooling towers for providing cooling demand needs
- Maximize the efficiency of process/industrial energy loads (operational process optimization study to complement design target BEU for operational cost minimization).
- Consider process load and process optimization study to complement buildings reduced demand for energy

1.2 Modeling for Energy Performance

Intent:

Use United States Department of Energy - 2 or similar latest computer models as an important interactive design tool to forecast energy performance, reduce operating costs, subsequently reduce the environmental impact associated with energy consumption, and to help “right size” mechanical systems.

Requirement:

- The design build contractor will create an initial model and add data as the new design progresses in order to evaluate and achieve the energy efficiency goals for the building. In order to achieve the
- Maximize total building systems energy efficiency design (electrical, mechanical, envelop) by 50% or greater compared to base Energy Conservation Building Codes 2007. Use International Energy Conservation Codes 2009, or better standards to aid in achieving this goal.
- The design team will baseline for use the most energy efficient design for information technology/data storage facilities, including rail control and centralized controlled facilities.

Technologies/Strategies:

- Utilize computer modeling to facilitate an interactive process by which the owner, architect, engineer, and contractor team can adequately explore opportunities for energy conservation.
- Rely on current research for data center energy efficiency designs published by the United State Oak Ridge National Labs.

1.3 Renewable Energy

Intent:

Employ to the maximum extent that is economically feasible, the use of on-site, non-polluting, technologies to reduce pollutants in the atmosphere, reduce operating costs, and reduce the environmental impact associated with energy consumption. The future goal would be to ultimately generate 100% of the electrical energy on site, or alternatively use electricity generated by renewable sources (hydro, biogas, wind, etc).

Requirement:

.1 Plan for incorporation of future fuel cell technology by allocating space (approx. 500 SF) that is convenient to gas and electrical systems. Plan for a readily accessible pathway to heating and electrical systems and for possible use of water or thermal byproducts.

.2 Provide integrated Photovoltaic (PV) panels for both roof, façade, yard area surfaces that contribute a minimum of 50% of the building electrical load. Applications of PV which are real time and storage equipped are preferred for offsetting peak grid demand.

.3 Specify adaptable equipment that can accept multiple fuel sources (i.e. Bio fuels versus Natural Gas).

.4 Conduct a wind survey to see if wind generated energy is feasible.

Technologies/Strategies:

- Fuel Cell technology is advancing rapidly and by providing space and infrastructure (natural gas supply, electrical connection to switchgear room) it will be possible to utilize this technology at a later date without increased cost.
- Employ specialized photovoltaic thermal and wind computer programs for analyses.
- Explore public-private partnership arrangements that are emerging to finance and maximize the scale of application of renewables. All fixed transient sun exposed area (rail yard and right of way) can be considered in conducting assessment.

1.4 Green Power Sources

Intent:

Reduce environmental impact by utilizing alternative and/or renewable power sources. Purchase power from energy providers that utilize water, wind, solar and fuel cell sources to generate power.

Requirement:

.1 Use best efforts to fulfill power needs from alternative fuel sources and higher efficiency technology.

.2 Analyze potential for geothermal energy sources and ground water heat pumps

Technologies/Strategies:

- Negotiated power agreements with local utility providers to meet these needs.
- Explore onsite higher efficiency combined heat and power application technologies

2.1 Indoor Air Quality (IAQ)

Intent:

Employ architectural and HVAC design strategies to enhance the IAQ to positively impact the overall indoor environment, health, and well being of the occupants.

Requirement:

.1 Provide ducted outside fresh air by means of mechanical ventilation.
   a. Provide dedicated (24 hours, 7 days-a-week) central ducted outside air system that provides tempered dehumidified air during the summer.
   b. Ventilation supply air to exceed total exhaust provided to maintain pressurization balance.

.2 Provide a filtering system that removes 85% of particulates from the fresh air to all spaces.

.3 Provide dedicated ventilation systems of 100% outside air for maintenance areas associated with chemical use, paint storage, or other potentially harmful pollutants.

.4 Provide mechanical exhaust for all toilets, locker rooms, and food areas.

.5 All exhaust must be ducted with full sheet metal linings.

.6 Provide walk-off grilles at all building entrances to catch potential contaminants and dirt and decrease maintenance requirements.

.7 Provide humidity stabilization throughout the year to all offices, toilets, locker rooms, gym, and lunchroom. Provide 68°F 30% RH in winter and 78°F 50% RH in summer.

Technologies/Strategies:

- Provide a thermally comfortable environment with humidity levels that are responsive to the local climate conditions and reduce health related issues for occupants (i.e., mold).
- Locate building fresh air intake away from loading areas, building exhaust fans, cooling towers, and other sources of contamination.
- Utilize best practices for interior pest management (i.e., properly sealing cavities, walls, and joints; properly detailing and maintaining trash areas; limiting the use of insecticides).

2.2 Select Low Emitting Materials

Intent:

Specify materials that contain no known carcinogens, have low levels of volatile organic compounds (VOC's), and are non-toxic and chemically inert to reduce the amount of indoor air contaminants that are odorous and irritating to occupants.

Requirement:

.1 All adhesives, sealants (used as "Filler" as opposed to a "Coating"), paints and coatings must meet the VOC limits set forth in the Appendix.

.2 All interior finishes must meet the VOC limits set forth in the Appendix.

Technologies/Strategies:

- Select only products and adhesive compounds with no or low VOC's that comply with the requirements of this section. This provides a health benefit to construction workers and tenants. Reference the *AIA Environmental Resource Guide*.

2.3 Controllability of Systems

Intent:
Increase occupant control of HVAC and natural ventilation systems to support optimum health and comfort.

Requirement:

.1 Provide programmable controls for HVAC systems.
.2 Provide computerized Building Management Systems (BMS) for building operation.
.3 Consider control of ventilation systems based on occupancy, CO_2, CO, and VOC's.

Technologies/Strategies:

- Provide programmable thermostats to allow building personnel to set air conditioning of operation and temperature settings. Consider thermostats that may be accessed remotely via phone or Internet.

2.4 Lighting & Daylighting

Intent:

Implement design strategies to maximize access to daylight and views to the outdoors in a glare-free way and whenever possible integrate indoor space with the outside environment to improve IEQ for building occupants.

Requirement:

.1 Increase natural light in all spaces.

.2 Minimum floor to ceiling height to be 8'-6" in offices, gym, locker rooms, and lunchroom.

Technologies/Strategies:

- Increase floor to ceiling heights and decrease distance of habitable spaces from windows.

2.5 Indoor Pest Control

Intent:

Unwanted pests (such as cockroaches, mice, and rats) and their excrement may be a source for asthma, allergies, and other health concerns for building occupants. In addition, the use of toxic chemicals to rid buildings of these pests can have an adverse affect on Indoor Environmental Quality.

Requirement:

.1 Develop a "Pest Management Plan" as part of the required "Maintenance Manual" (see §4.3) that strongly recommends the requirements of this section.

.2 Use best efforts to seal, caulk, and repair points of entry, habitation, and breeding areas to mitigate against pest occurrences within the building.

.3 In the base building, use Boric Acid powder for insect control as opposed to the practice of extermination with toxic chemicals.

Technologies/Strategies:

- Properly seal all penetrations (i.e. around water pipes, steam risers, electrical conduits, etc…) with copper mesh and caulking or plaster.
- Properly seal cracks and joints at tile floor/wall joints, baseboard/wall interfaces, and window frame/wall interfaces.
- Provide properly fitting door sweeps at all exterior doors and hallway doors – undercut exterior doors with less than ¼ inch clearance and provide vinyl or brush sweeps.
- Cover all ventilation portals with insect mesh (metal window screen) and ¼ inch wire mesh (hardware cloth).
- Encourage prompt repair of leaky faucets, condensation on pipes, or other sources of water in the "Maintenance Manual."

3.1 Storage & Collection of Recyclables

Intent:

Facilitate the reduction of waste and the diversion of materials congruent with markets for recycling within the community that otherwise would be hauled and dumped into landfills.

Requirement:

.1 Provide a dedicated “Trash & Recycling” room that is a minimum dimension of 5’x5’ containing integrated storage bins that are clearly labeled for recyclable matter consistent with KMRC requirements.

.2 “Trash & Recycling” room will be ventilated and maintained within the building with adequate access to the exterior.

.3 Provide separate temporary controlled facilities for wet trash.

Technologies/Strategies:

- The easier it is to recycle, the more people will participate.

3.2 Construction Waste & Resource Reuse

Intent:

Reduce the amount of construction waste and conserve resources through reuse or recycling to reduce the environmental impact from material manufacturing and transport.

Requirement:

.1 During construction develop and implement a waste management plan and quantify materials diverted by weight so that a minimum of 60% of waste material is recycled.

.2 Use best efforts to utilize recycled or salvaged materials during construction.

Technologies/Strategies:

- Identify licensed haulers and processors of recyclables.
- Recycle cardboards, metals, concrete, brick, asphalt, beverage containers, clean dimensional wood, plastic, glass, gypsum board, and carpet.
- Evaluate the cost-effectiveness of recycling rigid insulation, engineered wood products, and other materials.

3.3 Recycled Content

Intent:

Reduce the use of raw materials by replacing them with recycled materials or materials with recycled content.

Requirement:

.1 Use a minimum of 50% of materials (based on cost) listed in United States EPA's Comprehensive Procurement Guidelines (CPG) and for materials not contained within the CPG, a minimum of 50% recycled-content (at least 20% post-consumer).

Technologies/Strategies:

- Use of recycled materials or materials with recycled content will reduce the burden on already over harvested materials.

3.4 Local/Regional Materials

Intent:
Reduce the impact of building materials transport and support the local economy.

Requirement:

.1 Use a minimum of 40% of all building materials (based on cost) that are manufactured within a 500-mile (by air) radius.

Technologies/Strategies:

- Strengthening a local supply chain will reduce costs and build local building technology and infrastructure.

3.5 Renewable & Rapidly Renewable Materials

Intent:
Reduce the use of finite raw materials by replacing them with renewable materials.

Requirement:
.1 Use best efforts.

Technologies/Strategies:
- Bamboo finishes, and furnitures

3.6 CFC Elimination

Intent:

Eliminate the use of CFC-based refrigerants in HVAC systems, the use of insulation materials that utilize CFC's during production, and solvents that contain CFC's – all of which contribute to ozone depletion.

Requirement:

.1 Use HVAC equipment with no CFC's.

.2 Avoid the use of insulation materials that utilize Chlorine-based gasses in their production process.

Technologies/Strategies:

- No new equipment is installed that uses CFC's.

3.7 Alternative Transportation

Intent:

Limit contributions to pollution and the use of non-renewable energy sources for transportation by encouraging the use of public transportation and bicycles.

Requirement:

.1 Provide enclosed bicycle storage for a minimum of 20 bicycles.

Technologies/Strategies:

- If bicycle storage is available and easily accessible, then employees will be more likely to own and use bicycles for commuting needs.
- Utilize electric powered vehicles for on site transportation.

4.1 Full Commissioning

Intent:

Test and calibrate building systems to be certain they can be operated as designed in order to achieve and maintain energy performance and Indoor Environmental Quality (IEQ) requirements.

Requirement:

.1 Prepare a Building Commissioning plan and submit to KMRC and its representative for approval.

.2 Prepare a detailed operating manual for systems and equipment.

.3 The design-build consultant must establish an independent third party "Commissioning Team" at the beginning of Preliminary Engineering to participate in the design process with continued involvement for one full year beyond construction an initial occupancy.

Technologies/Strategies:

- Typically, fans, pumps, motors, and other equipment are installed that don't meet design specifications. The result is inferior performance, reduced indoor air quality, and increased energy consumption.
- Introduce standards and design strategies into the design process early.
- Incorporate and clearly state design intentions and requirements in the project construction documents.
- Tie contractor final payments to documented system performance.
- Provide a detailed training program for operating engineers(s) and staff.
- Provide periodic retraining for existing and new staff at 6 months, 1 year, and 2 year intervals.

4.2 Building Systems Monitoring

Intent:

Design and specify equipment to be installed in the building to provide feedback for comparison, management, and optimization of actual vs. estimated energy performance over time and Indoor Environmental Quality.

Requirement:

.1 Install and maintain a permanent monitoring system that tracks the IEQ and energy performance of the building systems and allows operators to make adjustments to maintain targets (See § 2.3.2).

.2 Provide air quality profile for each space at time of initial occupancy that meets the following criteria:

< 50 ppb of Formaldehyde
< 200 um^3 total volatile organics

Technologies/Strategies:

- Use Internet communication technologies to monitor systems

4.3 Maintenance Accountability

Intent:

Provide for maintenance and operational continuity by establishing a system that guarantees accountability for maintaining performance standards.

Requirement:

.1 A "Maintenance Manual" will be prepared in conjunction with the operating manual required in 4.4 and submitted to the KMRC and it representative for review. It will subsequently be made available to all maintenance staff. The manual will include best practices for maintenance and housekeeping, building systems descriptions (include model numbers if applicable), manufacturers' literature, and best practices for pest management (refer to §2.0, Indoor Environmental Quality) and will assign accountability for maintenance.

.2 Persons responsible for maintaining building systems are to be involved in the design, selection, and commissioning of all equipment.

.3 Establish educational programs to accommodate staff turnover.

.4 Institute a preventive maintenance program.

Technologies/Strategies:

- Regularly replace filters and calibrate equipment to maintain energy performance targets.
- Use environmentally responsible cleaning materials that minimize the impact to indoor air quality.

5.1 Storm Water Management

Intent:

Minimize the use of potable water for maintenance and landscaping purposes by treating and recycling water and minimize the impact of storm water on Kolkata's storm water system.

Requirement:

.1 Provide for 100% of all roof and setback rainwater to be collected for maintenance, car washing, and landscape irrigation by providing on site storage, treatment, and infrastructure.

.2 Provide an oil and grease separating system for runoff collected at all auto parking areas.

.3 Design for more ground water recharge

.4 Provide metering and sub-metering of water collection and distribution to car wash facility.

Technologies /Strategies:

- By conserving this precious resource less water will be used and less wastewater will need to be treated.
- Ensure high efficient car wash design for optimizing water use.

5.2 Innovative Water Technologies

Intent:

Minimize the impact on Kolkata's storm water system and sewer system and minimize the use of potable water by treating and recycling Graywater.

Requirement:

.1 Use Graywater to flush toilets, for cooling tower make-up (if applicable), for Car Washer, and for irrigation.

.2 Provide separate supply infrastructure and (if applicable) waste infrastructure for Graywater system – separate piping, pumps, and valves.

.3 Graywater systems and components to be located on site. Provide adequate space within the building for storage, treatment, and necessary infrastructure.

.4 Provide only clearly labeled Graywater taps at the exterior of the building for building maintenance, sidewalk washing, and landscaping needs.

Technologies/Strategies:

- Capture Graywater from lavatories, showers, sinks, for treatment and reuse.
- Capture Graywater from the car washing facility for reuse.

5.3 Water Use Reduction

Intent:
Minimize the use of potable water by reducing water needs.

Requirement:

.1 Install fixtures that are water saving and high efficiency
.2 Recycle all water from the Car Washer (if applicable) to Graywater system.
.3 Consider using existing Kolkata surrounding wetlands as a “living machine” to naturally filter wastewater in lieu of discharging into Kolkata sewer system.

Technologies/Strategies:

- Specify Low water volume/conserving fixtures and toilets. See Appendix for “List of Energy Efficient Appliances” and “Schedule of Low Flow Rates.”
- Electronic flush of urinals and water closets.
- Electronic lavatory fittings.
- Self closing taps.
- Low flow inserts for faucets.
- Low flow shower heads.

5.4 Water Efficient & Responsible Landscaping Practices

Intent:

Minimize the use of potable water for building and grounds maintenance, and avoid using pesticides, herbicides, or fertilizers that may pollute the environment.

Requirement:

.1 Specify 100% of plantings to be those that (depending on Graywater availability) require low amounts of water and that are pest and disease resistant to the Kolkata region.

.2 Specify naturally occurring plants and trees that are maintenance free over the long term and that are beneficial to the micro-climate.

.3 Use non-toxic pesticides, herbicides, and fertilizers.

Technologies/Strategies:

- Employ best practices for landscape development by properly establishing plantings, using pesticides as a last resort with an Integrated Pest Management program, and by avoiding highly water-soluble pesticides.

5.5 Landscape and Roof Design to Reduce "Heat Islands."

Intent:
Minimize contribution to "Heat Islands" (thermal gradient differences between developed and undeveloped areas) and reduce the amount of heat gain/loss through the roof.

Requirement:

.1 50% of all open roof area to be planted or "green" roof garden (i.e., grass or other vegetative material).

.2 All other roof areas to use roof materials with an Albedo value of at least 0.3.

Technologies/Strategies:

- Provide vegetated surfaces such as green roofs and/or grass paving systems that are water efficient.
- Provide trees to shade exposed surfaces.
- Use low Albedo roofing and roof paving materials.

Schedule of Limits on VOC Emissions

Requirements for Adhesives

Limits on VOC's in grams per liter, less water and exempt compounds, used for welding and installation.

Non-vinyl backed indoor carpet installation	150
Carpet pad installation	150
Wood flooring installation	150
Ceramic tile installation	130
Dry wall and panel installation	200
Subfloor installation	200
Rubber floor installation	150
VCT and asphalt tile installation	150
PVC welding	510
CPVC welding	490
ABS welding	400
Plastic cement welding	350
Cove base installation	150
Adhesive primer for plastic	650
All other	250

Limits on VOC's in grams per liter, less water and exempt compounds, applied to the following substrates.

Metal to metal	30
Plastic foams	120
Porous material except wood	120
Wood	30
Fiberglass	200

Requirements for Sealants

Limits on VOC's in grams per liter, less water as applied, or in grams per liter of low-solids products.

Sealants:	
Architectural	250
Roadways	250
Roofing material insulation	450
PVC welding	480
Other	420
Sealant Primer:	
Architectural – nonporous	250
Architectural – porous	775
Other	775

Requirements for Architectural Coatings

Limits on VOC's in grams per liter, less water.

Group I	
Bituminous pavement sealer	100
Bond Breaker	600
Concrete curing compound	350
Dry fog coating	400
Industrial maintenance primer or topcoat	450
Mastic texture coating	200
Metallic pigmented coating	500
Non-flat architectural coating	380
Primer, sealer, and undercoater	350
Roof coating	300
Swimming pool coating	600
Traffic coating	250
Waterproof mastic coating	300
Wood preservative coating	550
Group II	
Fire retardant coating (opaque)	500
Fire retardant coating (all others)	850
High heat resistant coating	650
Lacquer	680
Multicolored coating	600
Quick-dry primer, sealer, undercoater	500
Shellac (clear)	730
Shellac (pigmented)	550
Sign Paint	450
Stain (semi-transparent)	550
Stain (opaque)	350
Tile-like glaze coating	550
Varnish	450
Waterproof sealer	600
All other architectural coatings	250

Reference to Energy Efficient Appliances

American Council for Energy Efficient Economy web site

Top-Rated Energy-Efficient Dishwashers

Brand	*Model*	*Label Usage (kWh/yr)*	*Annual Energy Cost ($)*
Best available efficiencies			

Top Freezer, Automatic Defrost, 18.5-20.4 Cubic Feet

Brand	*Model*	*Volume*	*Energy Use (kWh/yr)*	*Annual Energy Cost ($)*
Best available efficiencies				

Please note that an asterisk (*) appearing in a model number indicates a digit or letter that varies with features of the appliance not affecting efficiency or capacity (for example, color).

Schedule of Low Flow Rates
(Rates are 10% less flow than the Energy Policy Act of 1992)

Showerheads	BAT
Lavatory Faucets	BAT
Lavatory Replacement Aerators	BAT
Kitchen Faucets	BAT
Kitchen Replacement Aerators	BAT
Metering Faucets	BAT
Gravity Toilets	BAT
Urinals	BAT

Glossary of Terms

Albedo: The ratio of reflected light to the total amount falling on a surface. A high Albedo indicates high reflectance properties.

Building Commissioning: A systematic process beginning in the design phase, lasting at least one year after construction, and including the preparation of operating staff of ensuring, through documented verification, that all building systems perform interactively according to the documented design intent and the owner's operational needs.

Chlorofluorocarbons: CFCs are a family of chemicals used in refrigeration, air conditioning, packaging, insulation, or as solvents and aerosol propellants. Because CFCs are not destroyed in the lower atmosphere they drift into the upper atmosphere where their chlorine components destroy the earth's protective ozone layer.

Energy Modeling: A computer model that analyzes the buildings energy related features in order to project energy consumption.

Fuel Cell: A technology that uses an electromagnetic process to convert energy into electrical power. Often powered by natural gas, fuel cell power is cleaner than grid-connected power sources. In addition, hot water is produced as a by-product that can be utilized as a thermal resource for the building.

Graywater: Wastewater that does not contain sewage or fecal contamination and can be reused for irrigation after simple filtration.

Hydrochlorofluorocarbon: HCFCs are generally less detrimental to depletion of stratospheric ozone than related chlorofluorocarbons (CFCs). HCFCs are generally used to replace CFCs where mandates require CFCs to be eliminated. A total ban on CFCs and HCFCs is scheduled effective 2030.

Integrated Pest Management: A coordinated approach to pest control that is intended to prevent unacceptable levels of pests by the most cost-effective means with the least possible hazard to building occupants, workers, and the environment.

Life Cycle Cost: The amortized annual cost of a product, including capital costs, installation costs, operating costs, maintenance costs, and disposal costs discounted over the lifetime of the product.

Low-E windows: "Low-E" (low-emissivity) windows reflect heat, not light, and therefore keep spaces warmer in the winter and cooler in the summer.

Operations & Maintenance: Operations refers to how equipment or systems are run, e.g., when a system should be turned on,

temperature ranges, set points for boiler pressures and temperatures, thermostat set points, etc. Maintenance refers to servicing or repair of equipment and systems. "Preventive maintenance" performed on a periodic basis to ensure optimum life and performance is designed to prevent breakdown and unanticipated loss of production or performance. "Corrective" or "unscheduled" maintenance refers to repairs on a system to bring it back "on-line." "Predictive" maintenance is performed on equipment monitored for signs of wear or degradation, e.g., through thermography, oil analysis, vibration analysis, maintenance history evaluation.

Photovoltaic Panels: PV devices use semiconductor material to directly convert sunlight into electricity. Power is produced when sunlight strikes the semiconductor material and creates an electric current.

Post-consumer Recycled Content: Post-consumer material is material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item.

Pre-consumer Recycled Content: Pre-consumer material is material diverted from the waste stream following an industrial process, excluding reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process. Synonyms include post-industrial and secondary material.

R-value: A measure of the thermal resistance of material.

Recycling: The series of activities, including collection, separation, and processing, by which products or other materials are recovered from the solid waste stream for use in the form of raw materials in the manufacture of new products other than fuel for producing heat or power by combustion.

Renewable Energy: Energy resources such as wind power or solar energy that can keep producing indefinitely without being depleted.

Urban Heat Island Effect: The additional heating of air over city as the result of the replacement of vegetated surfaces with those composed of asphalt, concrete, rooftops and other man-made materials. These materials store much of the sun's energy, producing a dome of elevated air temperatures up to 10°F greater over city compared to air temperatures over adjacent rural areas. Light colored rooftops and lighter colored pavement can help to dissipate heat by reflecting sunlight, and tree planting can further help modify the city's temperature through shading and evapotranspiration.

Volatile Organic Compounds: VOCs are chemicals that contain carbon molecules and are volatile enough to evaporate from materials surfaces into indoor air at normal room temperatures (referred to as off-gassing). Examples of building materials that may contain VOCs include, but are not limited to: solvents, paints, adhesives, carpeting, and particleboard. Signs and symptoms of VOC exposure may include eye and upper respiratory irritation, nasal congestion, headache and dizziness.

GREEN BUILDING CHECK LIST
Volume 3
Appendix 3-3-02

Site Design and Management			
Site Selection	Observe	Partly	Don't
1. Consider the need for, and availability of public transportation facilities.			
2. Identify the site with the most potential for sustainable design based on temperature, humidity, wind, solar orientation and water availability.			
3. Consider each site's potential for producing alternative forms of electricity, such as solar, wind, and geothermal.			
4. Identify which sites are most suitable for the proposed improvements.			
5. Consider the soil characteristics as well as drainage and water contamination issues.			
6. Select a site which minimizes disturbance to the existing ecological balance.			
7. Locate building within ¾ km of a fixed rail station or within 2km or more bus lines.			
Site Impacts	Observe	Partly	Don't
1. Synchronize landscape design with building envelope design.			
2. Incorporate the use of solar power for exterior lights, telephones, and pumps if conditions allows.			
3. Study solar access conditions and plan for strategic design of site, building, and adjacent areas.			
4. Consider the regional impacts of the proposed development on natural and built systems such as surface drainage, geology, and infrastructure.			
5. Determine methods to mitigate any negative impacts described in 4.			
6. Design building, parking and roadways to match existing site contours and limit cut and fill.			
7. Include watersheds, drainage areas, stream corridors, wetlands, aquifer recharge zones, special vegetative areas, and a tree survey.			
8. Identify locations and develop appropriate response to sites that have threatened and endangered species sites.			
9. Consider connecting adjacent open spaces with the site's green space to increase positive effects of microclimates and recharge areas.			
10. Produce a complete soil report to understand the physical and chemical soil characteristics of the proposed site.			
11. Identify all erosion hazard zones and protect existing vegetation within those zones.			
12. Provide respective designers with any existing environmental, noise, air and water quality studies if available.			

13. Evaluate need for any new air or water permits and/or requirements for emissions control devices, oil/water separators, etc.			
14. Test site for radon levels if the region has the potential for radon contamination.			
Transportation	Observe	Partly	Don't
1. Provide suitable means for securing bicycles for at least 5% of building occupants.			
2. Provide transit and pedestrian-friendly physical linkages to mass transit.			
3. Provide preferred parking to high occupancy vehicles (HOV) to support carpooling.			
Built Features	Observe	Partly	Don't
1. Use rooftops as gardens and for water collection.			
2. Employ solar principles and passive architectural design.			
3. Design landscaping that allows optimal selection and positioning of plants for sun and shade.			
4. Maximize the benefits of natural light, air flows, and interesting views when orienting building, windows, and outdoor spaces.			
5. Reduce cooling loads in the building by using shade trees and exterior structures such as louvers, arbors, and trellises.			
6. Decrease the urban heat island effect by employing tree planting and pavement selection strategies.			
7. Design to reduce potentially harmful conditions such as eroded slopes, slippery soils, high water table, and undue exposure to storms.			
8. Avoid hostile impacts on near-by properties, such as reflected glare, light at night, shading of adjacent green space, noise, and air pollution.			
9. Select light fixtures to minimize, or eliminate the effects of light pollution on adjacent sites and the sky.			
10. Use light colored or reflective edges along driveways or walks to reduce the use of high-wattage electrical lighting at night.			
11. Provide 50% of all open roof area to be planted or "green" roof garden.			
12. All other roof areas to use roof materials with an Albedo value of at least 0.5.			
13. Liquid or gaseous fueling facilities must be separately ventilated or located outdoors.			
14. Reduce the development footprint to exceed the open space requirement for the site per local zoning by 25%.			
15. Limit the construction disturbance to 15 metres beyond the building perimeter for earthwork, site utility lines, and surface parking.			
16. Coordinate site design with architectural design so that site related noise is isolated from sensitive areas, and desired solar access is preserved.			
17. Preserve and/or plant at least one (1) tree on the site located within every 75 square Metres of impermeable surface on the building lot.			

18. Consider integrating photovoltaic panels into parking lot light poles or outdoor shading devices.			
19. Do not shade solar collectors.			
20. Develop on-site wastewater sewage treatment if possible.			
21. Design "green" sites by choosing sustainable materials such as fungicide- &-biocide free paint and materials made from recycled content.			
22. Provide Self-cleaning Façade System			
23. Use of recycled material for construction eg: Storm water drains			
Landscaping	Observe	Partly	Don't
1. Prioritize on plant diversity; use plants that are native to the region and microclimate.			
2. Avoid allergy-causing plantings and those requiring chemical treatment for areas near to building openings.			
3. Avoid invasive species; those which threaten local native ecosystems.			
4. Provide enough root space for plants, and especially for street trees.			
5. Examine planting soil and investigate on-site soil remediation measures.			
6. Use recycled, renewable, and locally available materials such as recycled timber, plastic, and rubber tires when constructing landscape features.			
7. Specify naturally occurring plants and trees that are maintenance free over the long term and that are beneficial to the microclimate.			
8. Implement a preservation plan for topsoil and existing trees.			
9. Restore a minimum of 50% of degraded habitat areas on the site.			
10. Reduce areas proposed for water-intensive plantings.			
11. Evaluate the possibility of eliminating permanent irrigation systems through use of plants that are appropriate for site's climate, soil, and water availability.			
12. Consider precipitation and evaporation rates when planting on south facing slopes.			
13. Retain and protect native soil. Stockpile all disturbed soil for redistribution after construction.			
14. Avoid development of floodplains as it may increase the risk of flooding by raising the elevation of the floodplain.			
15. Refer to local ordinances for plant lists to develop a working knowledge of native plants for the region of development.			
16. Consider species diversity when selecting plant materials as it better maintains an ecological balance and diminishes future biological problems.			
17. Create larger but fewer planting islands as this type of planting promotes large common root systems for protection from wind, sun, and heat.			
18. Utilize plant materials that provide food and/or cover for native wildlife species.			
19. Consider a plant's root system and allow for growth as the design of buildings, utilities, and site features are developed.			
20. Consider the microclimate of the streetscape when selecting street trees.			
21. Utilize trees to act as a channel for summer breezes or to shield winter winds.			

22. Consider utilizing existing natural features to form boundaries and connections between properties and land uses.			
23. Shade west facing walls in order to reduce air-conditioning needs in late afternoon and evenings.			
24. Employ Integrated Pest Management, a strategy utilizing biological control to combat pests.			
25. Explore soil amendment options including organic compost, mulch, humus, sand or gravel, lime, or pH modifiers.			
26. Consider constructed wetlands for wastewater treatment.			
27. Use recycle Compost from horticulture waste.			
Irrigation	Observe	Partly	Don't
1. Avoid excess reliance on plant species that require frequent irrigation and maintenance.			
2. Consider drip irrigation and other water efficient irrigation systems.			
3. Use mulch to conserve soil moisture, restore soil fertility, and reduce the need for fertilizers.			
4. Leave grass clippings, small plant debris, and fallen leaves to decompose on the ground.			
5. Decrease fertilizer dependence by using plants that contribute nitrogen to the soil.			
6. Use non-toxic pesticides, herbicides, and fertilizers.			
7. Limit water use by grouping plants with similar water requirements.			
8. Zone irrigation systems and clearly identify them on the site plan drawings.			
9. Design the irrigation system to make the most of the natural flow of water along topographic planes.			
10. Avoid irrigation steep slopes to discourage additional runoff.			
11. Avoid high pressure misting sprinklers because they are inefficient due to a high evaporation rate and wind.			
12. Consider automated irrigation system to increase efficiency.			
13. Factor in the topography, surrounding structures, water bodies, soil types, direction, height, and coverage of spray source when designing the system.			
14. Sub meter large irrigation systems that use potable water.			
15. Consider the use of harvested water for irrigation.			
16. Consider use of a gray-water system for landscape irrigation by collecting, filtering, and reusing gray water from sinks and showers.			
Construction Administration	Observe	Partly	Don't
1. Employ an urban forester to assist in tree preservation techniques.			
2. Provide the community with an opportunity to come on site and "adopt" unwanted plants.			
3. Protect the soil from compaction or contamination due to construction activities.			

4. Consider milling wood from land-clearing debris into building materials and/or furnishings and shredding wood waste for use as mulch.			
5. Use rubble, recycled glass, or catch basins to remove heavy sediment loads from runoff waters leaving the disturbed area.			

Building Energy Efficiency			
Site Evaluation	Observe	Partly	Don't
1. Gather information on climatic data for design analysis. These data include temperature, humidity, insulation, wind, and weather patterns.			
2. Analyze the local site. Identify features such as topography, vegetation, water-bodies, built forms and soils that will impact energy conservation strategies.			
Energy Modelling	Observe	Partly	Don't
1. Identify and schedule energy studies, including computer analysis and physical models.			
2. Consider computer analysis on building energy, lighting / day lighting, water conservation / energy, and renewable energy.			
General Design	Observe	Partly	Don't
1. Increase energy efficiency by 35% over current ECBC requirements.			
2. Use energy efficient appliances in canteen block			
3. Incorporate the use of low embodied energy materials.			
4. Use high efficiency motors.			
5. Use window treatments such as curtains and solar shades.			
6. Consider fuel cell technology.			
7. Negotiate power agreements with local providers.			
8. Utilize onsite renewable resources such as photovoltaic panels and fuel cells.			
9. Provide inviting, pleasant staircases to encourage use of stairs instead of elevators in low-rise buildings.			
10. Select office equipment with the Energy Star label.			
11. For computers, consider liquid crystal display screens in lieu of conventional monitors.			
12. Use harmonic filters to minimize the distortion effects of non-linear loads. (Personal computers, etc).			
13. Improve the power factor by specifying appropriate equipment as required.			
14. Consider application of videoconferencing between agencies to eliminate energy/emission costs and productivity losses by transportation.			
15. Consider using solar hot water technologies to supplement domestic hot water heater reservoirs.			
16. Consider geothermal heat pump technologies.			
17. Consider using lighter grades of oil for oil burning equipment.			

18. Employ developing technologies for alternate energy sources such as methane from biological processes.			
19. Generate energy consumption profiles that identify occurrences of peak loads and develop responsive strategies for reducing utility bills.			
Boiler	Observe	Partly	Don't
1. Consider operating dual fuel boilers on natural gas to reduce air pollution.			
2. Consider oxygen trim controls for larger boilers to improve combustion efficiency.			
3. Consider draft control inducers which reduce off-cycle losses for boilers.			
4. Consider demand control for larger boilers.			
5. Consider water reset control keyed to outside air temperature for boilers.			
6. Consider burner flame control for boilers.			
7. Provide a time clock for night and weekend setbacks for boilers on small renovation projects.			
Building Envelope	Observe	Partly	Don't
1. Minimum standard for windows and exterior glazing will be double-glazed units with Low-E glass.			
2. Incorporate the use of exterior envelope materials that will greatly reduce heat loss in winter and heat gain in summer.			
3. Optimize insulation to prevent unwanted infiltration.			
4. Use thermal breaks at windows.			
5. Use insulated spacers at windows.			
6. Provide adequate air barrier and vapor retarder at points where cool surfaces meet warm, moist air to prevent microbial contamination.			
7. Consider the use of roof monitors and high clerestory windows.			
8. Consider using photovoltaic (PV) panels in place of exterior wall and roof panels.			
9. Incorporate interior shading devices such as insulating shutters, opaque & semi-opaque shades, film shades, draperies and venetian blinds…etc.			
10. Minimize unintentional or uncontrolled thermal bridges.			
11. Use light colored roofing.			
12. Consider dynamic building envelope components such as motorized shading for walls, windows or skylights that adjusts to outdoor sky conditions.			
VAC Design	Observe	Partly	Don't
1. Incorporate the use of natural ventilation techniques.			
2. Occupancy sensors in rooms coupled with thermostats.			
3. Consider a variable speed drive HVAC system. Wherever chillers are to be provided, use high efficiency water cooled chillers			
4. Explore heat recovery systems from exhaust air systems.			
5. Investigate the most energy efficient cooling mechanical Systems.			
6. Group similar program functions in order to concentrate similar Cooling demands and simplify HVAC zoning loads.			

7. Investigate possible techniques of radiant cooling.			
8. Consider using energy management systems that control fresh air supply ventilation fans by using CO2 sensors.			
9. Set up the Intelligent building Management System to operate based on need.			
10. Establish temperature and humidity set points based on occupancy patterns, scheduling, and outside climate and seasonal conditions.			
11. Consider alternatives to the use of HVAC equipment that contains HCFCs, such as natural gas chillers.			
12. Use the highest efficiency transport system, such as electric wiring or fuel piping that complements other system parameters.			
13. Eliminate or reduce the amount of reheating or mixing of conditioned air streams for comfort control.			
14. Explore options to reclaim waste heat from equipment, and return air and water.			
15. Locate mechanical equipment to maximize the efficiency of distribution.			
16. Consider technology-forcing specifications requiring use of the upper 25% efficiency or at least 10% more efficient than minimum standard level.			
17. Use efficient drift eliminators and better cycles of concentrations in Cooling Towers.			
18. Achieve stipulated Indoor Air Quality			
19. Provide refrigerant leak detection system			
20. Integration of Smoke control system with air-conditioning and mechanical ventilation system			
Lighting	Observe	Partly	Don't
1. Provide lighting dimming systems and motion detectors to turn lights on and off automatically.			
2. Provide daylight dimming in shop and office areas.			
3. Provide dimmable light fixtures in all offices, locker rooms, recreational and the canteen area			
4. All light fixtures to use energy saving high frequency ballasts and long life, recyclable energy efficient lamps.			
5. Use high performance glazing.			
6. Incorporate the use of interior and/or exterior light shelves to reflect natural light deeper into interior spaces.			
7. Incorporate courtyard, atrium, or other daylight-enhancing techniques to bring light into the interior.			
8. Consider the use of fibre-optic techniques that can transmit natural light deep into interior spaces.			
9. Use outdoor lighting fixtures with cut-off angles that prevent light from going upward or too far beyond the intended area of illumination.			
10. Reduce the height of luminaries relative to property boundaries to prevent light from straying to adjoining properties.			
11. Install lumen maintenance controls to ensure lamp efficiency.			

12. Consider lighting fixtures that provide significant illumination of ceilings and walls.			
13. Provide efficient light source distribution.			
14. Provide different circuits for lighting such that they could cater 100% during peak load, 66 % during off-peak load and 33 % during non-working period,			
Electrical systems	Observe	Partly	Don't
1. Use K-Rated transformers to serve non-linear equipment.			
2. Utilize direct current (DC) rather than conversion to alternating current (AC).			
3. Isolate high concentrations of electricity from building occupants/personal and install electromagnetic field shielding (EMF) if necessary. Ensure Electro-magnetic Compatibility is achieved.			
4. Provide an economical alternative to electric equipment during periods of high demand for electric power, gas powered equipment.			
5. Consider using thermal storage systems to shift electric power consumption.			
6. Limit electrical demand during peak hours by turning off non-essential equipment.			
7. Size transformers and generating units as close to the actual anticipated load as possible.			
8. Use the exhaust of the Generators to generate low pressure steam in waste heat boilers and use this steam in Absorption chillers to generate chilled water. Also hot water thus generated can be used in the workshop. Alternatively can explore for combined cycle power generating system			
9. Campus road and are lighting could be achieved using solar cells mounted on road lighting poles.			
10. Lifts and escalators shall be provided with VVVF drive motors, sleep mode for elevators. Adjusting the speed of escalators to slow down up to 30% when not in use			
Plumbing	Observe	Partly	Don't
1. Maximize efficiency of service water heating.			
2. Consider use of solar hot water heating.			
3. Consider use of water efficient labelled fittings and flushing system			
Energy Management & Control Systems	Observe	Partly	Don't
1. The use of a direct digital control energy management and control system should be considered in any building exceeding 40,000 SF of gross area.			
2. Provide simple back-up controls so that equipment can function if the energy management system goes down.			
3. Provision of Pneumatic Waste Conveyance System			
4. Use Cool Paints on the roof and exterior of the building.			

Materials and Resources	

General	Observe	Partly	Don't
1. Use a minimum of 20% of building materials manufactured locally			
2. Carefully evaluate materials and systems for use, balancing the product's total life cycle impact with the performance benefits to be gained.			
3. Dimension materials carefully, including designing in standard-sized modules, to minimize construction off-cutting waste.			
4. Avoid the use of finish materials where not necessary for performance or aesthetics.			
5. Design for disassembly and reuse of materials where possible, particularly in interior and landscape applications that will likely change frequently.			
6. Design for retrofit, where applicable, assuming a longer building life-span and plan for occupant adjustments over time.			
7. Design to minimize energy and water usage and mechanical needs.			
Material Selection	Observe	Partly	Don't
1. Use material with standards approved by the national standards codes			
2. Use a minimum of 40% of all building materials (based on cost) that are manufactured within a 500-mile radius.			
3. Avoid the use of insulation materials that utilize Chlorine-based gasses in their production process.			
4. Consider life cycle cost when selection products.			
5. Provide specification criteria for environmentally preferable materials selection and for appropriate methods of installation.			
6. Specify salvaged or refurbished materials for 5% of total building materials.			
7. Review products available and select manufacturers whose products meet performance requirements and also limit environmental impacts.			
8. Evaluate traditional performance requirements of all alternatives.			
9. Document all environmental requirements in the specifications and require submittals from manufacturers to certify their compliance with requirements.			
10. Choose products with compatible maintenance requirements to the greatest extent possible.			
11. Carefully review construction materials to limit use of materials that will result in hazardous waste due to the hazardous nature of the material itself.			
12. Verify that no materials contain asbestos.			
13. Specify maximum VOC content for all applicable materials and products.			
Paving	Observe	Partly	Don't
1. Specify use of broken concrete rubble as sub-base fill for pavement.			
2. Choose reusable brick or concrete unit pavers from local sources.			
3. Consider using rubber modified asphalt (RMA) with a crumb rubber content no greater than 20%.			
4. Use pervious paving materials whenever possible to allow water to enter soil and limit storm water runoff.			

5. Look for pervious products with a recycled content.			
Site Furnishings	Observe	Partly	Don't
1. Consider specifying furnishings made from recycled plastic, such as trash containers, benches, wheel stops and deck timbers.			
Irrigation	Observe	Partly	Don't
1. Use drip irrigation or bubbler systems to reduce water waste from surface evaporation.			
2. Equip irrigation systems with rain sensor overrides.			
3. Avoid line pressure misting sprinklers when possible.			
4. Use soaker hoses made from recycled rubber.			
Landscape Work	Observe	Partly	Don't
1. Use plants that are native to the site in order to reduce need for soil amendments or excessive water.			
2. Use bio solids and sludge from waste water treatment facilities as a soil amendment.			
Concrete	Observe	Partly	Don't
1. Utilize many of the positive aspects of concrete such as fire resistance, thermal mass, and longevity.			
2. Specify 20% fly ash or 30% ground granulated blast furnace slag in cement.			
3. Inquire about use of scrap steel in manufacture of reinforcing steel.			
4. Specify a biodegradable form release agent where removable formwork is used.			
5. Use products that have less than 160 grams/litre VOCs.			
Masonry Units	Observe	Partly	Don't
1. Choose locally manufactured products wherever possible.			
2. When using brick masonry, take advantage of its multi-function capabilities.			
3. Consider using bricks made from oil contaminated soils.			
4. Consider using adobe or pressed-soil-cement, or other natural, low-embodied energy masonry technologies.			
5. When using concrete masonry units (CMUs), look for products with high recycled content aggregate as much as technically feasible in an application.			
6. Consider using specially designed insulating polystyrene for CMUs.			
7. Consider use of interlocking CMUs for landscape retaining walls, particularly when disassembly is likely.			
Metal	Observe	Partly	Don't
1. Consider designs that will facilitate recycling of aluminium later.			
2. Give preference to factory finishing rather than site-finishing wherever possible.			

3. Consider metal finishing based on physical processes such as abrasive blasting, grinding, buffing, and polishing rather than coatings, where applicable.			
4. Where metal coatings are required, specify powder coated fabrications.			
5. When plating is necessary, ensure that the process does not use cadmium or chromium as the plating material.			
6. Consider less energy-consuming alternative materials in applications where the advantageous characteristics of aluminium are not needed.			
7. Reduce on-site steel waste by ordering pre-fabricated materials.			
Wood and Plastics	Observe	Partly	Don't
1. When using wood, choose products that are made from smaller-sized wood pieces and specify sustainable harvested wood wherever possible.			
2. Consider using reclaimed wood products from demolition salvage.			
3. Consider wood-plastic composite products, where both materials are recycled-content, for exterior applications such as benches and fencing.			
4. Do not use CCA (copper chromium arsenate) treated wood.			
Rough Carpentry	Observe	Partly	Don't
1. To relieve pressure on timber supplies, seeks alternatives to dimensional lumber and other wood products that are made from whole trees.			
2. Minimize use of large timbers by using glue-laminated beams and other prefabricated assemblies.			
3. Minimize use of plywood by using composite boards, including paper and wood/paper building boards.			
4. When using composite boards, look for products that do not use urea-formaldehyde binding resin.			
5. Specify structural fibreboard with a minimum of 85% post-consumer waste material.			
Architectural Woodwork	Observe	Partly	Don't
1. Require use of tropical and domestic woods from certified sustainable forestry operations.			
2. Do not use endangered wood species.			
3. Use lesser known sustainable species to prevent over-exploitation of more popular woods.			
4. Minimize the use of hardwood plywood is required.			
5. Use formaldehyde-free alternatives for woodwork substrates, including straw fibreboard, honeycomb cardboard and medium density fibreboard.			
6. Limit use of solvent-based adhesives with high VOC emissions.			
7. Install plastic laminates with low-emitting adhesives to minimize indoor air impacts.			
8. Require sealing all edges, ends, and holes or other penetrations in plastic laminate covered particleboard casework, countertops, and panelling.			

9. For wood finishing, use stains and transparent finishes and floor coating less than 200 grams/litre, 250 grams/litre, and 300 grams/litre, respectively.			
10. For flooring, consider using beech, oak, hard maple, and pecan as alternatives to uncertified rainforest woods.			
11. For Veneer, consider using alder, oak, birch, and red gum as alternatives to uncertified rainforest woods.			
Structural Plastics	Observe	Partly	Don't
1. Consider using plastic lumber for exterior decking, fencing, parking appurtenances, and outdoor site furnishing.			
Plastic Fabrications	Observe	Partly	Don't
1. Avoid using polyvinyl chloride (PVC) plastic whenever possible; it creates toxic by-products in manufacture and gives off highly toxic compounds in fire.			
Building Insulation	Observe	Partly	Don't
1. Specify that insulation materials manufactured using chemical compounds with ozone depleting potential such as CFCs or HCFCs are not allowed.			
2. When plastic board insulation is used, look for products with over 10% recycled material by weight.			
3. Use spray-foams that are not blown with HCFCs.			
4. Ensure that appropriate installation procedures are followed when using cellulose insulation.			
5. Consider using fibreglass that does not contain formaldehyde.			
6. Avoid the use of un-faced material that is not encapsulated by other construction in areas where it will come in contact with the air stream			
Membrane Roofing	Observe	Partly	Don't
1. PVC should be avoided for various environmental and human safety reasons.			
2. Choose lighter colour membranes where building will experience a net cooling load.			
3. Avoid insulation products manufactured using CFCs or HCFCs, or containing formaldehyde.			
Joint Sealants	Observe	Partly	Don't
1. Schedule installation of sealant as early as possible in the sequence of finish installation.			
2. Choose products having less than 50 grams/litre VOCs.			
3. For polyurethane, choose products with less than 100 grams/litre VOCs.			
4. Avoid sealant made from aromatic solvents, halogenated solvents, fibrous talc, asbestos, formaldehyde, mercury, lead, cadmium, chromium.			

5. When using acrylic latex sealant for interior applications that cure by evaporation of mineral spirits, schedule a month for complete curing.			
Steel Doors	Observe	Partly	Don't
1. Where insulated steel doors are used, specify alternatives to insulating cores made with ozone-depleting chemicals, such as fibreglass or EPA.			
Wood Doors	Observe	Partly	Don't
1. Specify wood doors made with certified sustainably harvested solid or veneer wood.			
2. Consider using mahogany doors, which is now certified by Scientific Certification Systems.			
3. Look for wood doors with alternative core materials, such as honeycomb cardboard or straw board.			
4. Consider using wood-composite doors made with waste wood material.			
Glass and Glazing	Observe	Partly	Don't
1. Study climatic and building program data to determine whether high R-value or low shading coefficient is preferred to reduce heat gains inside building.			
2. Provide thermally efficient exterior glazing units throughout building.			
3. Consider using "Cloud Gel", a new energy-control glazing system.			
4. Consider using integrated photovoltaic curtain wall assemblies.			
Lath and Plaster	Observe	Partly	Don't
1. Use plasters with no VOC-emitting additives, such as epoxy or other resins.			
2. Use lathing board made with higher percentages of recycled gypsum from construction waste.			
Gypsum Drywall Construction	Observe	Partly	Don't
1. Where possible, plan spaces in standard sized modules to reduce wallboard waste.			
2. Specify that drywall facing paper be manufactured from 100% recycled newsprint including post-consumer waste.			
3. Where locally available, specify 75% or greater "synthetic gypsum" content in drywall.			
4. Look for gypsum board manufactured with at least 20% recycled gypsum.			
5. Consider paper-faced compressed straw panels as an alternative for interior wall partitions.			
6. Ensure that any sound attenuation insulation is completely encapsulated within partitions when it is used in gypsum construction.			
7. Screw attaches multi-layer gypsum board applications. Do not laminate with adhesives.			
8. Consider use of joint compound that is free of antifreeze, biocide, and pesticides.			

Acoustic Panel Ceilings	Observe	Partly	Don't
1. Use ceiling tiles with a minimum 65% recycled content where possible.			
2. Choose ceiling tile products that are free of formaldehyde.			
3. Specify that painted finish for mineral composition tiles be of water-based, low-VOC (<10 grams/litre) interior paint.			
4. Do not specify vinyl-faced ceiling tiles because vinyl has great environmental impacts in manufacture and may create a fatal health risk in a fire.			
5. Use USDA approved fibre-reinforced plastic panels for food service areas.			
6. Consider metal pan ceiling systems, which are washable, very durable, and free of particulate.			
7. Consider straw panels for areas with low acoustical requirements.			
8. Use steel suspension systems for general use in dry areas.			
9. Use aluminium systems in humid areas or where subject to frequent washing.			
10. Install tiles after "wet" finishes have been installed and solvents have cured.			
11. Do not use un-faced fibreglass batt insulation loosely laid over the top of a suspended ceiling for acoustic control.			
Wood Flooring	Observe	Partly	Don't
1. Specify certified sustainably harvested wood species or use salvaged wood flooring from demolition waste.			
2. Use floor coatings that have less than 300 grams/litre VOCs.			
3. Consider using bamboo flooring, which is available by several			
Manufacturers, though it is typically imported.			
4. Consider installation techniques that minimize the need for adhesive, such as steel-track, floating and nail-down systems.			
Resilient Flooring	Observe	Partly	Don't
1. Use resilient tile rather than sheet flooring to minimize waste in replacing worn or damaged areas.			
2. Consider linoleum made with linseed oil polymer because linoleum is biodegradable, comes from renewable resources & emits no dangerous gas.			
3. Consider other low-emission resilient flooring, such as cork and cork composition materials.			
4. Consider using rubber flooring made with a minimum of 90% post consumer rubber.			
5. Choose products made with high recycled content where solid vinyl tile must be specified.			
6. Consider alternative synthetic products, such as non-vinyl flooring			
7. During installation, use low-VOC (<100 grams/litre) adhesive.			
Carpet	Observe	Partly	Don't

1. Use carpet tile rather than broadloom to minimize waste in replacing worn or damaged areas.			
2. Consider area rugs instead of wall-to-wall carpeting.			
3. Keep carpet away from entrances where toxins tracked in from outside can collect.			
4. Look for "green label" as an indicator of low-emitting carpet, adhesive, & carpet cushion.			
5. Seek carpet that is fusion bonded, needle-punched and low pile with tight loop construction.			
6. Avoid carpet backing systems made with styrene butadiene (SB) latex which is a primary emitter of 4-phenylcyclophexene (4-PC).			
7. Avoid carpet backing systems made from vinyl since it highly toxic during a fire.			
8. Consider wool fibre carpet with jute backing, both of which are renewable resources that are biodegradable.			
9. Consider sea grass, coir, jute, cotton and sisal as alternative carpet raw materials from renewable, biodegradable, natural resources.			
10. When specifying synthetic fibre carpet, such as nylon and polyester, look for products that are solution-dyed rather than piece-dyed.			
11. Look for recycled content in polyester carpet.			
12. Consider an integral cushion backing system when carpet cushion is required.			
13. Where non-integral carpet cushion is used, choose products with high recycled content material, such as bonded urethane and rubber.			
14. Consider carpet recyclability in selecting carpet systems.			
15. During installation, allow carpet to off gas by unrolling and cleaning in a well ventilated area.			
Wall Coverings	Observe	Partly	Don't
1. Avoid use of vinyl wall coverings because of high emission rates of material and multiple negative environmental impacts in manufacture and disposal.			
2. Consider using natural wall coverings, such as sisal or jute.			
3. Consider polychromatic finish coating as an alternative to wall coverings.			
4. During installation, use only water-based adhesive having no more than 50 grams/litre VOCs.			
Acoustical Wall Panels	Observe	Partly	Don't
1. Avoid the use of vinyl-faced acoustical wall panels.			
2. Avoid acoustical wall panels manufactured with formaldehyde.			
3. Look for acoustical wall panels that have high recycled content.			
4. Consider using fabric-or cork-faced panels in areas with low acoustical requirements.			
5. Consider paper-faced compressed straw panels as an integral sound absorbing interior wall system.			

6. During installation, do not use adhesives to install acoustical wall panels.			
Paint	Observe	Partly	Don't
1. Use water-based, zero- or low-VOC (< 10 grams/litre for interior paints, < 50 for exterior) latex paints and primers.			
2. Water-based paints mustn't be formulated with aromatic hydrocarbons, lead formaldehyde, halogenated solvent, mercury, cadmium, chromium & antimony.			
3. Do not use paint formulated from chemicals which pose varying threats to human health, such as ethyl benzene, vinyl chloride, methyl chloride, etc.			
4. Consider using natural or "alternative" paints in interior applications where possible.			
5. Use solvent-based paints (alkyds) only when necessary, such as for high resistance to weathering.			
6. Where indoor air quality and colour selection are not concerns, consider using paints and primers with 50-100% recovered content.			
7. Consider special orders and deliveries of fresh paint to minimize the need for in-can preservatives and freeze-thaw protection.			
Stain and Varnish	Observe	Partly	Don't
1. Use water-based stains and transparent finishes wherever possible.			
2. Consider using natural stains and varnishes, which are made without the use of petrochemical products.			
3. Choose products having less than the following VOC content where conventional stains and transparent finishes are specified.			
Decorative Finishes	Observe	Partly	Don't
1. Specify water-based multi-colour finish that has less than 130 grams/litre			
VOCs & that is free of all or most of the hazardous chemicals listed for paints.			
Specialties	Observe	Partly	Don't
1. Consider solid plastic toilet compartments fabricated from recycled high density polyethylene (HDPE) from plastic milk jugs.			
2. Where metal toilet compartments are used, specify powder coated steel compartments w/ a honeycomb cardboard core that's at least 30% recyclable.			
3. Specify multi-purpose dry chemical or CO2 fire extinguishers.			
Equipment	Observe	Partly	Don't
1. Specify recycling systems such as Hi-Rise Recycling Systems, Inc., Miami, Florida to facilitate recycling by multi-story building users.			
Furnishings	Observe	Partly	Don't
1. Consider shading devices for sun control and insulated shutters or shades for thermal control.			
Furniture and Accessories	Observe	Partly	Don't

1. Consider the environmental impacts of individual material components in furniture.			
2. Consider refurbishing existing systems instead of buying new.			
3. Choose furniture products that are easily disassembled for recycling.			
4. Seek wood furniture manufacturers that use wood from a certified sustainable source.			
5. Avoid metals that are coated with spray-applied, solvent-based paints.			
6. Select leathers processed in a region with substantial environmental regulations of tanneries.			
7. Look for low-toxic fabrics and with foam made without CFCs and containing no toluene.			
8. Consider natural fibre fabrics, which are fully biodegradable and, in many cases quite durable.			
9. Consider synthetic fabrics made with recycled content, such as products from Guilford Textiles.			
10. Seek more environmentally sensitive adhesives, such as polyvinyl acetates (PVA's), hot melts, and water-based adhesives.			
11. Consider alternative surfacing materials, such as "Environ" bio composite, "Syndecrete" recycled lightweight concrete, or linoleum tops.			
Solar Equipment	Observe	Partly	Don't
1. Invest in solar power while reducing costs.			
2. Consider wiring photovoltaic (PV) panels to the utility grid.			
3. Consider building integrated PV systems as curtain walls and roofing systems.			
Elevators	Observe	Partly	Don't
1. Consider using high-speed elevators with AC variable frequency drives since they consume less energy and operate more cleanly than DC systems.			
Pipes and pipe fittings	Observe	Partly	Don't
1. For no pressure pipes and fittings for drainage, seek those that have 40-100% recycled content.			
2. Avoid use of polyvinyl chloride (PVC) piping, which is banned from use in municipal projects in Europe.			
Plumbing	Observe	Partly	Don't
1. Specify low water consumption toilets, urinals, faucets, and shower heads.			
2. Specify water saving appliances where possible.			
3. Consider self-closing, slow-closing or electronic faucets, particularly in high- use public areas where faucets may be carelessly left running.			
4. Consider new dual flush toilets that use either a low or ultra-low flush setting, such as those made from Kohler.			

5. Consider composting toilets and waterless urinals as zero-water use alternatives.			
6. Consider an on-site wastewater treatment system for the reclamation of wastewater.			
Air Distribution	Observe	Partly	Don't
1. Design for minimal use of exposed internal fibreglass duct liner.			
Lighting	Observe	Partly	Don't
1. Specify the most efficient lighting system appropriate to the given application.			
2. Choose lighting fixtures with high light efficacies, such as 65% if possible.			
3. Specify fluorescent rather than incandescent lighting for interior lighting.			
4. Specify metal halide or high pressure sodium lamps for general-purpose exterior lighting.			
5. Specify LED exit signs.			
6. Utilize timers or sensors with lighting systems that operate 8 hours per day or longer, such as office lighting.			
7. Utilize incremental controls, allowing certain areas of a space to be individually illuminated as needed.			
8. Choose lamps that are accepted by recycling programs.			
Indoor Environmental Quality			
General	Observe	Partly	Don't
1. Clearly document program requirements, especially in multi-use or multi- tenant situations where the use of the space is likely to change over time.			
2. Develop an IAQ management plan for the construction process.			
3. In the specifications, require contractor to include construction related IAQ procedures in the agendas for pre-construction and progress meetings.			
4. Specify construction sequencing: application of wet and/or odour-emitting material before dry/sink materials.			
5. Make temporary ventilation a requirement in the General Conditions of the construction contract.			
6. Specify the use of separate filtration media for any use of the permanent equipment during construction.			
7. Consider specifying pre-occupancy ventilation.			
8. Specify requirement to conduct baseline air quality tests immediately prior to occupancy, if agreed to by owner.			
9. Protect occupied areas from contamination during renovation or phased construction.			
10. Utilize best practices for interior pest management.			

11. Select only products and adhesive compounds with no or low VOC's that comply with the requirements.			
12. Provide programmable controls for HVAC systems.			
13. Provide computerized Building Management Systems for building operation.			
14. Consider control of ventilation based on occupancy (I.e. sensors).			
15. Consider programmable thermostats that may be accessed remotely via phone or Internet.			
16. In the base building, use boric Acid powder for insect control as opposed to the practice of extermination with toxic chemicals.			
17. Reduce potential pollution sources through effective moisture control.			
18. Perform cleaning and pest control activities when building is largely unoccupied.			
19. For spaces designated in the Environmental Program Matrix, locate CO2 or other IEQ sensors.			
20. Ensure that carbon dioxide sensors are operating in a reliable manner when demand control ventilation (DCV) systems are used.			
21. Prevent storage of soft products on site during wet processes, unless separated and sealed.			
22. Schedule installation of wet materials (sealant, adhesives, caulking) and allow them to dry or cure before installing dry materials.			
23. Flush the building with 100% outside air for a period of not less than 30 days beginning as soon as systems are operable.			
24. Select mechanical and plumbing devices, ductwork, and piping that generate less noise and dampens the noise generation.			
25. Prevent noise transmission by absorbing noise and vibrations at the source.			
26. Consider wrapping or enclosing rectangular ducts with sound insulation materials.			
27. Consider the use of sound attenuators and acoustic plenums to reduce noise in ductwork.			
28. Protect ventilation system components from contamination.			
Site Design	Observe	Partly	Don't
1. Employ setbacks to prevent vehicle emissions from entering the building.			
2. Use landscaping to buffer buildings from off-site sources of pollution.			
3. Evaluate sources of contamination from neighbouring buildings and soil contamination.			
Building Design	Observe	Partly	Don't
1. Develop building envelope design to provide adequate air barrier and vapour retarder to control air and moisture flow through the exterior wall.			
2. Determine with owner if radon prevention measures should be taken.			
3. Isolate indoor pollutant generating activities.			

4. In buildings with internal parking, provide a pressurized air lock at access to building elevators, or stairways continuing up through building.			
5. If bake-out procedures are raised as a possibility, recommend against them.			
6. Provide walk-off grilles at all building entrances to catch potential contaminants and dirt.			
7. Increase natural light in all spaces.			
8. Minimum floor to ceiling height to be 8'-6" in offices, locker rooms, and canteen.			
9. Properly seal all penetrations with copper mesh and caulking or plaster to minimize or eliminate pest occurrences within the building.			
10. Locate sensors to cover areas of similar load conditions.			
11. Place acoustic buffers between noise-producing and noise-sensitive spaces.			
12. Prevent transmission of sound through the building structure through use of floating floor slabs and sound-insulated seals.			
13. Situate mechanical room doors across from non-critical building areas.			
15. Prohibit smoking in all areas of the building.			
16. Design all chemical storage and mixing areas for housekeeping products to allow for secure product storage.			
HVAC Design	Observe	Partly	Don't
1. Carefully locate outside air intakes, including both louvers and intakes on packaged equipment.			
2. Develop de sign to maximize ventilation effectiveness and minimize potential for contamination of air supply.			
3. Incorporate flexibility into the HVAC design to allow for ease of future change in the building layout, use patterns and occupancy types.			
4. Design for easy access to and maintenance of HVAC equipment.			
5. Design for minimal use of internal duct liner.			
6. In hot humid climates, design HVAC system to effectively remove moisture loads.			
7. Provide ducted outside fresh air by means of mechanical ventilation.			
8. Provide ventilation air supply to exceed total exhaust to maintain pressurization balance.			
9. Provide a filtering system that removes 85% of particulate from the fresh air to all spaces.			
10. Provide ventilation systems of 100% outside air with a heat recovery system for maintenance areas.			
11. Provide mechanical exhaust for all toilets, locker rooms, and food areas.			
12. All exhaust to be ducted with full sheet metal linings.			
13. Provide humidity stabilization throughout the year to all offices, toilets, locker rooms, recreational area and canteen. 680F 30% winter & 780 50% summer.			

14. Provide thermally comfortable environment with humidity levels that are relative to local climate conditions.			
15. Separate building fresh air intake from loading areas, building exhaust fans, cooling towers, and other sources of contamination.			
16. Evaluate opportunities for heat recovery for the outside air system.			
17. Design at least 0.00508 m3/(s•m2) air movement to avoid stagnant air in occupied spaces.			
18. Consider supplying ventilation air primarily to occupied zones using distribution systems such as under floor air ducting.			
19. Avoid rooftop units due to inaccessibility for maintenance.			
20. Install air handling units in accessible locations.			
21. Use rainproof louvers and limit intake air velocities to discourage water intrusion.			
22. Select proper air velocities through cooling coils and humidifiers to prevent wetting downstream surfaces.			
23. Provide filtration capable of 60% dust spot efficiency to intercept all make-up and return air.			
24. Consider using low pressure drop, high efficiency air filters.			
25. Avoid the use of fibrous duct liners and loose mineral fibre for internal ductwork insulation.			
26. Avoid use of ozone-generating devices to clean or purify indoor air.			
27. Sensors for relative humidity, temperature, and carbon dioxide should be installed as close as possible to where occupants are located.			
Materials Evaluation & Testing	Observe	Partly	Don't
1. Propose a thorough evaluation of building materials and products to ensure that toxic and/or irritating compounds are not introduced into the building.			
2. Request Material Safety Data Sheets from manufacturers & eliminate from consideration products with toxic, flammable, or corrosive material.			
3. Request and evaluate available emission and total organic compound test results for high priority materials and furniture items.			

Water Management			
Storm Water Management	Observe	Partly	Don't
1. Preserve native vegetation, which naturally absorbs and filters runoff.			
2. Reduce the use of impervious paving materials and design to maximize groundwater recharge.			
3. Consider bio retention to reduce or eliminate storm water drain piping.			
4. Consider the use of bio retention plantings in medians to naturally filter contaminants.			
5. Consider methods to pre-treat runoff from surface parking areas, which can produce a burst of petroleum contaminants during a rainfall.			
6. Provide onsite storage, treatment, and infrastructure of all roof and setback rainwater.			
7. Provide water/oil separator for runoff collected at all paved areas.			
8. Use gray water to flush toilets, for cooling tower make-up if applicable, and for irrigation.			
9. Use gray water for car washer.			
10. Provide separate supply infrastructure and waste infrastructure for gray water system.			
11. Locate gray water systems and components on site.			
12. Provide only clearly labelled gray water taps at the exterior of the building for building maintenance, sidewalk washing, and landscaping needs.			
13. Recycle all water from car washer to gray water system.			
14. Install a gray water water-recovery system that uses a roof or ground water collection system.			
Wastewater Treatment	Observe	Partly	Don't
1. Install an on-site biological waste water treatment system that is capable of treating both gray water and black water to local prevailing health standards.			
2. Consider constructed wetlands as wastewater treatment.			
3. Consider sand filters, which is a low-cost technology that is now re-emerging.			
4. Consider anaerobic wastewater treatment, which uses microorganisms to process food waste, sewage, and landscape waste without oxygen.			
5. Consider dry toilets.			
6. Check with local regulations regarding the use and treatment of gray-and- black-water.			
7. Consider using existing wetlands as a "living machine" to naturally filter wastewater in lieu of discharging into NYC sewer system.			
Equipment and Plumbing Systems	Observe	Partly	Don't
1. Meet or exceed fixture requirements of Energy Policy Act of 1992.			

2. Consider lower LPM requirements for lavatory faucets and showerheads.			
3. Consider using aerators on lavatory faucets that reduce water flow to 1.89 – 3.79 LPM.			
4. Specify water-saving appliances such as dishwashers that use 35 litres/cycle or less and front-loading washing machines.			
5. Specify alternatives to traditional faucets for water conservation, such as infrared sensor faucets, or delayed action shut-off valves.			
6. Avoid automatic flush toilets and urinals, except for large, high volume public facilities such as stadiums, airports, etc. where their use may be justified.			
7. Consider dual-flush toilets.			
8. Consider the use of waterless urinals.			
9. Consider the use of composting toilets in remote locations.			
10. Consider using seawater for toilet and urinal flushing.			
11. Consider composting organic waste as an alternative to in-sink garbage disposals, which waste water.			
12. Consider reducing water pressure to lessen the likelihood of leaks.			
13. For hot water conservation, consider recirculation or point-of-use heating systems to avoid hot water travelling long distances to point-of-use.			
14. Avoid cooling units that heat potable water and discharge it to a drain such as those used for computer room installations and supplementary cooling.			
15. Minimize blow down for cooling towers through the use of industrial water treatment programs.			
16. Install cooling tower systems designed with delimiters to reduce drift and evaporation.			
17. Consider the use of ozone as an alternative system for the treatment of cooling tower water.			
18. Zone water-using program areas.			
19. Consider installing filters at taps and/or at the service line(s).			
20. Use filtered tap water for drinking instead of bottle water.			
21. Recover excess groundwater from sump pumps for use as a source of recycled water.			
22. Consider a 'vacuum-assist' system for flushing of water closets and urinals.			
General	Observe	Partly	Don't
1. Develop a plan to protect the watershed both during and after construction.			
2. Specify all of plantings to be those that require low amounts of water.			
3. Collect and use utility district steam system condensate for non-drinking uses (applies to Manhattan projects only)			
4. Install cooling tower systems designed with delimiters to reduce drift and evaporation.			
5. Comply with the Department of Energy's International Performance Measurement and Verification Protocol for water consumption.			

# Operations and Maintenance			
Building Demolition and/or Reuse	Observe	Partly	Don't
1. Explore opportunities to reuse and renovate existing structures in lieu of demolition.			
2. Explore opportunities to salvage materials for reuse prior to demolition.			
3. Identify materials to be recycled in all demolition plans.			
4. For demolition projects with carpet, consider carpet recycling programs.			
5. For demolition projects with large amounts of ceiling tiles consider			
Armstrong World Industries Ceiling Reclamation Program.			
Operational Waste	Observe	Partly	Don't
1. Determine specific design requirements for recycling.			
2. Develop requirements for separation, baling, compacting and shredding for each type of recyclable.			
3. Allocate space for waste storage, handling, and recycling.			
4. Consider using recycling chutes in multi-story buildings.			
Construction Waste	Observe	Partly	Don't
1. Compare cost of landfill disposal with recycling and determine which is more cost-effective.			
2. Three possible methods of recycling are: on-site separation of recyclable materials, phase-based separation by hauler, & off-site sorting of mixed waste.			
3. Develop construction waste specifications.			
4. Specify reuse of on-site materials to the greatest extent possible.			
5. Specify reusable concrete formwork to the greatest maximum extent economically feasible.			
Composting	Observe	Partly	Don't
1. Ensure that proper access is provided to on-site composting area for landscaping waste.			
2. If off-site composting of food waste is accommodated, provide refrigerated storage at pick up location.			
Hazardous Materials Disposal	Observe	Partly	Don't
1. Evaluate requirements for hazardous waste handling, such as oil, paint, lighting, and medical waste.			
2. Ensure that leftover paint is transported to municipal paint recycling facilities.			

3. Ensure proper disposal or recycling of lighting waste.			
Landscaping	Observe	Partly	Don't
1. Reduce the amount of water used for lawn and plant irrigation.			
2. Encourage root growth and drought tolerance by applying at least 12.7mm of water only on designated irrigation days.			
3. Require proper pruning of shrubs and trees.			
4. Maintain landscape to protect wildlife habitats.			
5. Provide a composting area on site to provide organic soil amendments.			
Energy	Observe	Partly	Don't
1. Offer to provide a comprehensive Operations and Maintenance Manual for the facility.			
2. Offer to assist with on-going monitoring to verify that projected energy savings are being met.			
3. Assure required personnel have been properly trained on equipment operation and maintenance on the specific equipment in the facility.			
4. Recommend that owner establish educational and promotional programs that encourage staff to turn off lights and all equipment whenever practical.			
Indoor Air Quality	Observe	Partly	Don't
1. Develop an operations and maintenance plan for the building owner that minimizes indoor air quality hazards from cleaning and maintenance products.			
2. Recommend that the Owner designated IAQ manager remain active in			
Managing an on-going IAQ program once the facility is occupied.			
Water Conservation	Observe	Partly	Don't
1. Assist the Owner in developing a maintenance program that reduces			
impacts on the environment as well as operating costs for water.			
2. Educate facility users about water conservation devices and systems.			
3. Inform owners and users of actual and potential water savings and their role in achieving them.			
General	Observe	Partly	Don't
1. Prepare a Building Commissioning plan and submit to NYCTA for approval.			
2. Prepare a detailed operating manual for systems and equipment.			
3. Establish a "Commissioning Team" at the beginning of Preliminary Engineering.			
4. Install a permanent monitoring system that tracks the IEQ and energy performance of the building systems and allows parameter adjustments.			
5. Provide air quality profile for each space at time of initial occupancy that meets: a) 50 ppb of Formaldehyde. b) 200 um3 total volatile organic.			
6. Prepare a "Maintenance Manual" in conjunction with the operating manual			

7. Persons responsible for maintaining the building systems are to be involved in the design, selection, and commissioning of all equipment.			
8. Establish educational programs to accommodate staff turnover.			
9. Institute a preventive maintenance program.			
10. Simplify building systems design to promote ease of maintenance.			
11. Design for adequate access to building systems.			
12. Ensure weather-tightness through a building envelope maintenance program that minimizes thermal bridging.			
13. Schedule regular window cleaning to maximize the benefits of day lighting.			
14. Perform re-lamping using the most energy efficient lamps.			
15. Actively engage client agency's O&M staff.			
16. Provide O&M staff with adequate training in systems operations and maintenance to assure optimum performance.			
17. Develop procedures for reporting and documenting IAQ complaints and subsequent actions taken.			
18. Run a system purge during morning start-up and/or during maintenance and cleaning.			
19. Perform adequate system maintenance, including periodic cleaning, oiling, and minor repairs.			
20. Review energy consumption on a quarterly basis.			
21. Select textured paving for outside approaches, so that soils are scraped off shoes prior to building entry.			
22. Minimize introduction of dirt with appropriately sized, recessed metal grating within vestibules.			
23. Design kitchen areas and restrooms for ease of maintenance.			
24. Design janitor's closets or central storage facilities with adequate space for cleaning product storage & mixing of concentrated cleaning solutions.			
25. Select healthy and environmentally preferable cleaning products.			
26. Consider the use of portion control devices such as mechanical dispensers.			
27. Coordinate housekeeping and custodial operations with building ventilation schedules to ensure that adequate ventilation is provided.			
28. Select a vacuum with high-efficiency vacuum bags or high efficiency particle air(HEPA) filters.			
29. Develop an Integrated Pest Management Plan.			
30. Ensure that custodial staff are adequately trained and educated in the use			
31. Institute procedures to prevent occasional or chronic water damage.			
32. Ensure that custodial staff are adequately trained in the management and handling of hazardous materials.			
33. Educate client agency on recycling and waste reduction measures.			
34. Follow the Mayoral Directive on Waste Prevention and Efficient Materials Management Policies of 1996.			
35. Provide maintenance staff with any necessary training to support gray water management.			
36. Provide space and bins for composting of landscape materials.			

37. Provide sufficient space for operational recycling and maintenance.			