GSAS 2019
DESIGN & BUILD
GUIDELINES MANUAL

Building Sustainably

FOR PARKS

Dr. Yousef Alhorr, Founding Chairman

4th Edition

GORD
المنظمة الخليجية للبحث والتطوير
Gulf Organisation for Research & Development

اللجنة العليا للمشاريع والإرث
Supreme Committee for Delivery & Legacy

GSAS
PUBLICATIONS SERIES

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Supported by:

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GSAS 2007

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A MESSAGE FROM

Founding Chairman

The UN Urbanization Prospects Report 2014 states that 54% of the world's population is residing in urban areas, and by 2050, 66% is predicted to be urbanized. Continued population growth and urbanization are projected to add a further 2.5 billion people to the urban population of the world by 2050.

To put this urbanization issue into a GCC context, close to 90% of the population in Gulf countries will be in cities by 2050.

Cities are the hub of human life. It is critical to ensure that while we focus on the comforts of living, the cities remain sustainable, resilient and low-carbon. Sustainability is a way of life, which apart from reducing the environmental, social and economic burden, also determines the quality of life and how human wellbeing is taken care of. As most of our time is spent in buildings using associated infrastructure, they are the most common denominators that determine how sustainable the cities are and can be. Worldwide, regional and international organizations are tirelessly working and cooperating to make cities better places to live with a special focus on the built environment.

Out of a deep concern on unsustainable urban living – especially in the Central and Western Asian continent –in 2007, GORD developed and implemented the green building and infrastructure certification system. This initiative recognizes the pioneering efforts of the developers, contractors, practitioners and the entire construction community that has assumed responsibility to care for the cause of sustainability. GORD has come a long way since stewarding the Global Sustainability Assessment System (GSAS), formerly known as (QSAS), the Middle East's first integrated and performance-based assessment system. Our mission is to encourage the development and implementation of sustainability principles and imperatives, which stems from our vision for sustainable development regionally as well as globally. Over the last few years, we have established a clear link of what we are doing in GSAS with the achievement on multiple Sustainable Development Goals of the United Nations. GSAS draws from top-tier global sustainability systems and adds new facets and dimensions to the current practices in assessing the sustainability of the built environment. Over the years, GSAS has become one of the most comprehensive systems to date, that addresses the built environment from a macro level to a micro level, targeting a wide range of building typologies and infrastructure projects.

GSAS Certifications now cover all the dimensions to assess and certify the sustainability of the built environment, be it design, construction or operation of projects. This performance based dynamic system, equipped with ever updated benchmarks and best practices, is a great tool in the hands of the building community to continually improve the sustainability standards of the built environment.

I would like to acknowledge the efforts and contributions from the State of Qatar, all our members, international partners and the associated consultants who helped in establishing the system and taking it to new horizons Finally, the continuous support from Qatari Diar Real Estate Company (QD) and the Supreme Committee for Delivery & Legacy (SC) are highly appreciated, and without their support, GSAS would not be able to achieve what it has done in such a short span of time.

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PREFACE

Global Sustainability Assessment System (GSAS) is the first performance-based system in the Middle East and North Africa (MENA) region, developed for assessing and rating the buildings and infrastructures for their sustainability impacts. The primary objective of GSAS is to create a sustainable built environment that minimizes ecological impact and reduces resources consumption while addressing the local needs and environmental conditions specific to the region. GSAS adopts an integrated lifecycle approach for the assessment of the built environment including design, construction and operation phases.

The 4th Edition of GSAS launched in 2019 has capitalized on 10 years of experience and 'hands-on' implementation of GSAS, richness and capacity gained from the assessment of numerous and various building typologies totaling more than 217,000,000 square feet of built-up area and more than 1,872,000,000 square feet of district master planning, and multi-disciplinary research projects conducted in collaboration with renowned world-class institutes on various aspects of sustainability in the built environment.

GSAS supports project stakeholders with manuals and tools to aid projects in the implementation of the certification processes throughout the various phases of project development from predesign to post-occupancy.

The purpose of this manual is to provide recommendations and guidance for the effective implementation of the sustainable goals of each of the criteria identified within GSAS Design & Build Certification for Parks Scheme. Each criterion has associated guidelines to provide designers with descriptive information for consideration to help attain the targeted level. These suggestions are in the form of recommended strategies, methods and measures. Individual developments should consider and assess the potential advantages and benefits of the recommended design guidelines in relationship to the specific goals, requirements and conditions of the development.

The guidelines are not intended to provide specific or explicit instruction on how to design a sustainable built environment, but rather to provide guidance and recommendations on how to approach the design issues within each criterion. Furthermore, these guidelines are by no means inclusive of all possible recommendations. Thus, all developments are ultimately expected to perform the research and analysis necessary for their specific conditions and goals to meet the sustainability requirements of the design assessment system.

This manual should be read in conjunction with all other relevant GSAS manuals and publications.

CRITERIA SUMMARY

The table below summarizes the weights of GSAS Design & Build criteria and incentives for Parks scheme:

NO	CATEGORY / CRITERION	LEVELS		WEIGHTS (%)	INCENTIVE WEIGHTS
		MIN	MAX		
UC	**URBAN CONNECTIVITY**				
UC.1	Proximity to Infrastructure	0	3	2.36%	-
UC.2	Neighborhood Connectivity	0	3	0.82%	-
UC.3	Load on Local Traffic Conditions	0	3	1.04%	-
UC.4	Public Transportation	0	3	2.41%	-
UC.5	Green Transportation	0	3	1.37%	-
			Total	**8.00%**	**0.00%**

S	SITE				
S.1	Land Preservation	-1	3	2.96%	-
S.2	Waterbody Preservation	-1	3	2.28%	-
S.3	Biodiversity Preservation	-1	3	2.85%	-
S.4	Vegetation	-1	3	2.92%	-
S.5	Drain & Stormwater Contamination	-1	3	1.93%	-
S.6	Desertification	-1	3	2.48%	-
S.7	Heat Island Effect	-1	3	1.45%	-
S.8	Shading	-1	3	1.71%	-
S.9	Accessibility	-1	3	2.45%	-
S.10	External Lighting	-1	3	1.02%	-
S.11	Walkability	-1	3	1.45%	-
S.12	Bikeability	-1	3	1.65%	-
S.13	Construction Practices	-1	3	2.85%	10.00%
			Total	**28.00%**	**10.00%**

NO	CATEGORY / CRITERION	LEVELS		WEIGHTS (%)	INCENTIVE WEIGHTS
		MIN	MAX		
E	**ENERGY**				
E.2	Energy Use Performance	-1	3	7.36%	-
E.3	Primary Energy Performance	-1	3	4.83%	-
E.4	CO_2 Emissions	-1	3	4.81%	-
E.5	Energy Sub-Metering	0	3	-	2.00%
E.6	Renewable Energy	0	3	-	2.00%
			Total	**17.00%**	**4.00%**

W	WATER				
W.1	Water Demand Performance	-1	3	8.00%	-
W.2	Water Reuse Performance	-1	3	14.00%	-
W.3	Water Sub-Metering	0	3	-	2.00%
			Total	**22.00%**	**2.00%**

M	MATERIALS				
M.1	Locally Sourced Materials	-1	3	1.30%	-
M.2	Materials Eco-Labeling	-1	3	2.30%	2.00%
M.3	Recycled Content of Materials	-1	3	1.90%	-
M.4	Materials Reuse	-1	3	1.05%	-
M.5	Cut & Fill Optimization	-1	3	0.70%	-
M.6	Design for Disassembly	-1	3	0.75%	-
M.7	Responsible Sourcing of Materials	0	3	-	1.00%
			Total	**8.00%**	**3.00%**

CE	CULTURAL & ECONOMIC VALUE				
CE.1	Heritage & Cultural Identity	-1	3	1.62%	-
CE.2	Support of National Economy	-1	3	2.38%	-
			Total	**4.00%**	**0.00%**

NO	CATEGORY / CRITERION	LEVELS		WEIGHTS (%)	INCENTIVE WEIGHTS
		MIN	MAX		
MO	**MANAGEMENT & OPERATIONS**				
MO.1	Systems Commissioning	0	3	0.92%	2.00%
MO.2	Waste Management	0	3	3.95%	2.00%
MO.3	Facility Management	0	3	1.23%	2.00%
MO.4	Leak Detection Systems	0	3	0.49%	-
MO.5	Safety & Security	0	3	1.92%	-
MO.6	Landscape Maintenance	0	3	1.81%	-
MO.7	Sustainability Awareness	0	3	2.68%	-
			Total	**13.00%**	**6.00%**

1.0 URBAN CONNECTIVITY

The Urban Connectivity [UC] category is concerned with the design of the proposed development having a direct impact on adjacent buildings, properties, neighborhoods and the larger urban community.

Sustainable urban practices improve the development of neighborhoods and communities, in addition to minimizing the impacts on the surrounding environment including; climate change, fossil fuel depletion, water depletion and pollution, air pollution, land use and contamination, and human comfort and health.

CRITERIA IN URBAN CONNECTIVITY CATEGORY:

UC.1 Proximity to Infrastructure

UC.2 Neighborhood Connectivity

UC.3 Load on Local Traffic Conditions

UC.4 Public Transportation

UC.5 Green Transportation

1.1 [UC.1] PROXIMITY TO INFRASTRUCTURE

1.1.1 PURPOSE

To minimize the amount of new infrastructure required by the park.

1.1.2 CONTEXT

An increasing percentage of the world's population is predicted to be urbanized within a few decades with an increasing number of people living in cities rather than rural areas. Cities are facing the challenges of rapid and unprecedented levels of growth requiring the delivery of adequate utilities (water, wastewater, roads and transit) to people. Meeting the infrastructure requirements of a rapidly increasing population can overcome the capacity of a city to finance new infrastructure while maintaining the existing network of roads, water and wastewater facilities, schools and other public facilities and services. Therefore, it is critical to ensure that cities remain sustainable and resilient by fully utilizing the existing infrastructure and reducing the need for planning and delivery of new infrastructure.

Carefully considered and effective site selection is a crucial component of green building practice, and the proximity to infrastructure is critical for developers and building occupants as it affects the value of the development, the value of adjacent premises and the health, comfort and wellbeing of people. The presence of nearby civic facilities increases the appeal of a development and enhances the development appraisal. Development sites in previously developed areas, which are already served by effective infrastructure, reduce the need for new streets, utility lines, water supply, sewer, drainage and other infrastructure requirements. It can also inspire and lead to the reuse and renovation of existing structures. Moreover, historic buildings, vacant properties and brownfield sites can be transformed into green developments that support the local economy and strengthen the character of a community. There may be no significant additional buildings and services costs associated with new infrastructure requirements in comparison with building on previously undeveloped land.

1.1.3 GUIDELINES

- Select sites in areas where the required infrastructure is already available.
- Identify future infrastructure requirements for the selected site and undertake feasibility studies.
- Consider the proximity to existing infrastructure, including but not limited to HV and LV electricity, gas, water, drainage, road networks, transportation networks and communication networks.
- Use existing infrastructure or eliminate the need for new infrastructure connections, to reduce the overall costs and environmental impacts associated with infrastructure construction.
- Connect to the treated sewage effluent (TSE) water networks to be used for the irrigation of golf courses, greenway or park, where possible.
- Implement efficiency improvements or measures which may eliminate the need for new infrastructure development, if the existing infrastructure is insufficient to meet the development needs.
- Consider the capacity of each of the required infrastructures.
- Consider alternative on-site infrastructure provisions to mitigate the need for new infrastructure, for example on-site renewable energy generation and waste treatment facilities, etc.
- Establish utility corridors adjacent to roads and major walkways to enable easier maintenance.
- Plan utility locations and the associated installation requirements with proposed soft landscaping and soil designs to avoid compromising the construction and maintenance conflicts in the longer term.
- Combine green stormwater infrastructure with upgrading works to the park and in new park developments.

FURTHER RESOURCES

Website:

1. "A Resource Guide for Planning, Designing and Implementing Green Infrastructure in Parks". *National Recreation and Park Association*, 2017, https://www.nrpa.org/.

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10. Röller, Lars-Hendrik, and Leonard Waverman. "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach." *The American Economic Review,* vol. 91, no. 4, 2001, pp. 909–23.
11. *Sustainable Infrastructure Action Plan 2009-2011.* World Bank Group, 2008.

1.2 [UC.2] NEIGHBORHOOD CONNECTIVITY

1.2.1 PURPOSE

To allocate parks to best serve intended users within the neighborhood and surrounding areas.

1.2.2 CONTEXT

The concept of spatial distribution of parks, accessible for the targeted population and intended users, has been recently considered as an important element in planning urban green spaces. Planning for appropriate distribution of different sizes of parks within the urban fabric according to the park type, park area, catchment area and per capita park area is of great significance for urban sustainable development and physical and psychological health and wellbeing. It allows inhabitants to interact with nature and with each other and reduce the density of ecological footprint caused by urbanization. Small-scale parks, mini and neighborhood parks – can be allocated within small areas to accommodate users within a relatively small range, allowing them to reach the park on foot or by bicycle. Parks can socially connect the neighbors of small urban areas and have them introduced to each other. Large-scale parks and metropolitan parks can serve larger areas and can accommodate diverse amenities to attract users from greater distances.

Locating parks in proximity to the maximum number of users can contribute to the fulfillment of their recreational needs and provide them with better air quality and views. Therefore, surveying the local density prior to site acquisition is important to evaluate the expected benefit of different site alternatives.

1.2.3 GUIDELINES

- Select a site close to the maximum number of users to serve larger groups of users, to minimize vehicular transport, fossil fuel emissions and stressful traffic conditions.
- Conduct a field survey to determine the density of urban settings around the proposed site, to evaluate the viability of the park.
- Design a network of mixed-use, pedestrian friendly nodes connected together by mass transit systems, with ease of access from surrounding neighborhoods for pedestrians and cyclists.
- Provide a connected network of pathways, sidewalks, bike lanes and streets accessible to users within a walking radius.
- Encourage highly interconnected footpath networks within the wider neighborhood, providing choices of walking and/or cycling routes that lead to the park.
- Ensure the ability to reach the maximum number of users within the shortest possible time through interventions on surrounding road networks, including traffic signals, zebra crossings and underpasses.
- Ensure the proposed site plan and layout of the park, including the location of entrances, walkways and roads, has considered the available connections to entrances with existing footpath and bike path networks to enable accessibility.
- Develop an interconnected system between pedestrian trails and bike paths throughout the neighborhood and within the park.
- Encourage the connection of parks with the wider neighborhood through bicycle and pedestrian route master planning.

FURTHER RESOURCES

Website:

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7. *Our Built and Natural Environments.* US Environmental Protection Agency, 2001.
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1.3 [UC.3] LOAD ON LOCAL TRAFFIC CONDITIONS

1.3.1 PURPOSE

To minimize the impact of the park on the local traffic conditions.

1.3.2 CONTEXT

One of the primary causes of traffic congestion is the construction of new developments without an analysis of the existing traffic conditions and the implementation of adequate mitigation measures. Congestion covers several traffic aspects, such as queuing, reduced speeds and an increase in travel time, which negatively affect the economic growth and generate multiple impacts on the urban environment. Other impacts include poor quality of life, stress, health and safety issues. Factors to be considered in traffic management include congestion reduction, points of conflict, continuity of traffic flow, unmanageable traffic loads and road safety improvement.

New developments tend to improve traffic behavior and land-use patterns. Two types of measures can be implemented to mitigate the impacts on traffic:

a) Those related to land-use policies which are, in many countries, used to ensure growth control often by a form of zoning regulations, to decrease or restrict development in urbanized areas and to control the types and densities of development.

b) Those related to site-specific transportation measures, which include adequate accesses, internal roads and parking areas to facilitate on-site traffic flow and avoid queues disrupting the traffic of adjacent and nearby roads, and adjacent and nearby road network capacity improvements by modifying the geometry and/or signing.

All these mitigation measures must be based on the conclusions of a traffic impact study implemented to assess if the surrounding road network of the new development would be capable of handling the increased traffic generated while maintaining an acceptable level of service. The primary functions of the traffic impact study are: to determine the existing traffic conditions on the road network surrounding the proposed development; to estimate the additional traffic likely to be generated by the proposed development; to assess the impact of additional traffic on the existing and future road network system, and to identify roadway improvements and alterations in the site plan of the proposed development considered necessary to minimize traffic impact.

Based on the findings of the traffic impact study, transportation measures are identified and recommended to mitigate the traffic impact on the surrounding road network. Primarily, these improvements are related to the traffic flow within the site, and can include access locations, internal circulation and parking facilities. Financial measures, funding or co-funding by the developer may also be proposed and recommended as a source of funding for additional infrastructure facilities and other improvements that are required on the road network to manage the traffic generated by the new development.

1.3.3 GUIDELINES

Improvements within the site

- Improve access to manage the traffic flow entering or exiting the development site. Potential improvements include a widening of entrance and exit points or the provision of exclusive lanes for turning maneuvers. Queues should not restrict internal circulation within the development site or out-of-site movements. Entrance and exit lanes should have sufficient capacity to ensure that the performance and safety of operations issues are not compromised.
- Improve circulation internally to manage the traffic flow within the development site. Proper footpath markings must be made with signage located to ensure the safety of all users. The radii of curves should be adequate to satisfy the turning requirements of larger vehicles. Bridges and other landscaping elements or features should be able to withstand the additional stress of heavy vehicles.
- Include parking facilities and loading docks for the regular loading and unloading of goods as appropriate for the specific development. Providing zones for loading and unloading for both guests and goods on the site relieve traffic loads on the local infrastructure, minimizing the impact of congestion on the larger community.
- Ensure that the design of loading/unloading ramps is carefully considered. They should satisfy requirements, be spacious and, if possible, concealed from public view, thereby enhancing visual appearance.
- Apply, if applicable, demand management methods to reduce the number of vehicles using the road network going to the development site and using the internal road network and parking spaces. Cooperate with the relevant transit authority to reroute buses to stop at the site, and facilitate rides for matching commuters, in addition to incentives for ride sharing. For example, bonuses, free parking and special permission to park closer to the entrance have the potential to reduce the number of vehicles on-site.
- Ensure an adequate parking arrangement to reduce points of conflict within the development site and reduce the accumulation of vehicles at access points. The provision of adequate signage is necessary to manage vehicles in the parking areas.
- Provide an appropriate amount of parking on the site and reduce parking needs by providing alternative modes of transportation.
- Ensure that parking layouts permit sufficient space for the maneuvering of heavy vehicles. Vertical clearances should be designed to satisfy the requirements for oversized vehicles.
- Encourage bicycle transit by providing designated road space for cyclists with care given to road junctions and other zones that may cause conflicts for various vehicles.
- Enhance pedestrian travel by providing safe, well-marked sidewalks and path systems.

Improvements of road network capacity

- Coordinate, where possible, with transit authority the intersection operation by redesigning traffic signal timing and phasing, cycle length and coordination of timings, etc.
- Explore, where possible, the opportunity to improve the intersection layout and geometry by including additional lanes, widening and moving the central reservation, etc. When additional lanes are not feasible, an overpass or underpass can be constructed to decrease traffic at the intersection close to the development.
- Coordinate, where possible, with the transit authority for the installation of traffic signals at intersections where signals do not currently exist to manage the increased traffic generated by the development.
- Coordinate with the transit authority for arterial road improvements which may include the provision of pedestrian crossings, making U-turns possible, provision of walkways and other facilities to supplement the improvement.
- Coordinate with the transit authority for highway interchange improvements if the site is close to a highway facility by introducing new access ramps or improved existing ramps, together with proper traffic management in the merging and weaving areas.
- Ensure that the existing roads and intersections have the capacity to handle additional traffic loads, especially during peak times. Peak times are during events, weekends and public holidays.

FURTHER RESOURCES

Website:

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1.4 [UC.4] PUBLIC TRANSPORTATION

1.4.1 PURPOSE

To select a site in proximity to public transportation networks.

1.4.2 CONTEXT

Public transportation can transform communities and the lives of people living in them by promoting sustainable lifestyles and stimulating economic development. Public transportation is a benefit to all sectors of the society, including individuals, families, communities and businesses. From a safety perspective, it is evident that traveling by public transportation is 10 times safer than traveling by car. Hence, by using public transportation, a person can reduce the chance of being involved in an accident by more than 90% as opposed to commuting by car. In countries where people rely on public transportation as the main mode of transport, a household can make significant financial savings using public transportation. In addition, public transportation reduces fuel consumption and consequently reduces carbon footprint. Furthermore, public transportation enhances personal opportunities as it enables mobility and freedom to people from every walk of life and promotes a healthy lifestyle as many users choose to walk to the stop or station. Social isolation and loneliness are a serious concern for those who do not have access to private transport: the disabled, poor, elderly and unemployed. It is generally recognized that public transportation is often a lifeline to maintain interactions and engagement with the wider community. A well-planned open space and public domain for walking and cycling and public transportation that works for everyone make communities vibrant, stronger and more cohesive by providing many additional opportunities for social interaction than driving. Selecting a site near existing transportation networks encourages the use of public transportation and reduces the need for private transportation. Transit stops should be easily accessible from the development site by pedestrians and cyclists. Transportation services accessible to the development should be assessed for adequate frequency, especially during peak hours of the day. Analysis of the projected usage patterns of park users is necessary to ensure that the schedule and frequency of the transportation services will accommodate the future needs.

Transportation networks through parks can themselves be a form of recreation. They offer visitors primary opportunities to appreciate and experience the natural and cultural landscapes embodied in the park. For example, planning iconic roads within large-scale parks can be a pleasure for riders and can encourage the use of public transportation.

1.4.3 GUIDELINES

- Consider the location of accessible entrances to the development relative to the location of transportation stops for the ease of reaching the stops for development users.
- Provide, where possible, direct paths and walkways from site entrances to the nearby transit stops.
- Ensure that paths and walkways are clearly marked and shaded from direct sunlight to encourage the use of public transportation and ensure convenient access for pedestrians and cyclists.
- Plan to directly connect varying routes of travel to ensure access to transportation leaving the development site.
- Provide necessary provisions for the use of shuttle services from the development site to a nearby transport stop if a public transport stop is not located within walking distance to the park entrance.
- Consult with local planning authorities to determine alternative sustainable transport solutions for users of the development. Future transportation networks that are planned and funded by the completion of the development may also be considered for this criterion.
- Encourage roadway designers to designate sections of road for public transportation to expedite travel, promote the functionality of public transportation and encourage the use of alternative fuels.
- Consider alternate forms of transportation, such as buses, streetcar trolleys, subways and trains/railways to provide efficient and expedited travel over short and long distances.
- Locate, if possible, stations within or near the development site or major transit hubs.
- Provide, if possible, informational guides or shuttle transportation to and from the development site to the nearest transit station. Separating railway transportation, either above or below roadways through elevated or subterranean structures, can alleviate traffic congestion and expedite both private and public transit.
- Create rate programs that reduce fees depending on the duration of the pass or the number of trips per pass.
- Consider, during the operational phase, creating incentive programs to encourage the use of public transportation, for example: reduced satellite parking fees and subsidized or complimentary transit passes for regular employees.
- Choose a location that offers multiple transportation options and a variety of nearby destinations.

FURTHER RESOURCES

Website:

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1.5 [UC.5] GREEN TRANSPORTATION

1.5.1 PURPOSE

To provide facilities supporting the use of alternative transportation modes.

1.5.2 CONTEXT

Greenhouse gas emissions in the transport sector continue to increase and are projected to increase further in the coming years. As there is no simple and immediate solution to the challenge of meeting significant CO_2 reductions in transportation, it is evident that a large range of effective and efficient CO_2 reduction measures will have to be implemented. Statistics indicate that over 90% of all road transportation relies on fossil fuel.

The number of people using cars has grown over the recent years. This increased use of private transportation continues to generate several environmental, social and economic concerns. Besides contribution to global warming, the local air pollution resulting from emissions of toxic and harmful substances in urban areas is threatening both human health and ecosystems. The use of private cars is also threatening the quality of urban life with increasing noise levels and accidents.

Various actions can be implemented to manipulate and control the use of private cars including financial measures, legal requirements and physical changes to the built environment. Individual developments can also introduce measures to limit private car use and make it a less attractive form of transport while promoting the use of more sustainable forms of transport. Such measures include the provision and incentive for green transportation, including shuttle buses, preferred parking or car-pooling, parking fees, transport passes, bicycle racks, locker and shower facilities for cyclists and shared cycle use.

Park visitors are encouraged to use alternative fuels which are more environmentally friendly than traditional gasoline and diesel fuels. Alternative fuels are clean-burning fuels which can power most forms of transport. They produce fewer harmful emissions, help to improve air quality, decrease noise, preserve natural resources and enhance the experience of the park for visitors.

1.5.3 GUIDELINES

- Promote diversity of green transportation modes and on-site support facilities to serve alternative transport.
- Encourage the use of low- emission vehicles, including hybrid vehicles or vehicles that use electricity or compressed natural gas (CNG) by providing adequate infrastructure.
- Provide preferred parking for vehicles using alternative fuels.
- Encourage visitors to use shuttle services where provided.
- Provide charge points on the development site to enable the use of electric vehicles.
- Encourage the use of bicycles by providing bike racks near the park entrances.
- Consider providing changing rooms, shower facilities and lockers within the development to promote cycling and pedestrian activity among park visitors. These facilities can also be made accessible for users coming to the park by bicycle.
- Plan for accommodating the surrounding community who can come to the park on foot or by bicycle, to reduce GHG emissions due to transportation.
- Consider providing bicycles lockers which are weather protected, enclosed and secured.
- Provide separate, dedicated bicycle ramps into parking areas, with no obstacles like stairs or steep slopes.

FURTHER RESOURCES

Website:

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2.0 SITE

The Site category is concerned with the design of the proposed development having a direct impact on both the site of the development itself as well as any adjacent sites.

Sustainable landscaping and site design practices can improve the quality of the existing site and landscape and minimize the impacts on the surrounding environment including climate change, fossil fuel depletion, water depletion and pollution, air pollution, land use and contamination, and human comfort and health.

CRITERIA IN SITE CATEGORY:

S.1 Land Preservation

S.2 Waterbody Preservation

S.3 Biodiversity Preservation

S.4 Vegetation

S.5 Drain & Stormwater Contamination

S.6 Desertification

S.7 Heat Island Effect

S.8 Shading

S.9 Accessibility

S.10 External Lighting

S.11 Walkability

S.12 Bikeability

S.13 Construction Practices

2.1 [S.1] LAND PRESERVATION

2.1.1 PURPOSE

To enhance the ecological value of the park site.

2.1.2 CONTEXT

Parks and green public spaces have long been the optimal places that provide environmental, aesthetic and recreational benefits in cities. Historically, architects and urban planners have acknowledged green spaces as the focal elements of cities. However, many cities are now having to deal with density issues and urban growth with less consideration for green spaces. Therefore, the retention of existing parks and ensuring an equal distribution of green spaces is becoming a challenge.

Large-scale developments present an opportunity to remediate and build on land that has been contaminated through industrial waste or other human activities, in order to prevent further contamination of the surrounding region. Furthermore, it is important to maintain, restore or improve the land to combat desertification, prevent further decline of water quality and preserve overall ecological health. The conservation of the natural condition of the site should account for and consider the existing topography, soil, trees, plants, groundcover, water features and wildlife habitats.

Preserving, restoring or enhancing the site's soil conditions help to ensure healthy vegetation and wildlife habitats. The site assessment should identify critical areas in the development, for example: steep slopes, areas of high-water flow and vegetative or wetland buffers. Additionally, the assessment should identify the depth and quality of the existing soils and determine appropriate remediation or conservation techniques. Consequently, strategies to maintain, restore or improve the land can be developed. Such strategies may include protecting zones where the existing soil and vegetation will not be disturbed, identifying zones of lower quality that will be enhanced with organic material and preventing soil erosion and compaction.

Previously developed land includes buildings, roads, parking lots or land that has been graded or altered directly by human activities. All fixed structures and surfaces to be constructed within the site boundaries are considered part of the proposed development including buildings, hardscapes, parking lots, roads and pathways. Temporary structures and surfaces, including construction-related offices, storage, parking and roads can disturb sensitive land areas and, if possible, should be located on previously developed land.

Reducing unnecessary disturbance of soil is important for conserving the natural resources of the site. Healthy soils can effectively cycle nutrients, store carbon as organic matter, maximize water holding capacity and provide a healthy rooting environment and habitat to a wide range of organisms.

Excessive soil disturbance actions can include excavating for the construction of buildings, landscaping, infrastructure, man-made waterbodies, dredging for new coastline or infilling for man-made islands.

Excavation or fill required on-site does not only decrease the ecological value of the site but also increases the need for transport and contributes to the depletion of fossil fuels. Soil disturbance may also release natural Volatile Organic Compounds (VOCs), which leads to air pollution. Additionally, the excavation of soil to create man-made waterbodies requires a significant amount of water and therefore increases the demand for sea water desalination.

In addition, preventing erosion is important on the site as it can cause degradation to the habitat of plants and animals and strip the soil of valuable nutrients. Erosion may also cause scour in bearing soils which can undermine and cause instability of both above and below grade structural features, including earthen embankments, built structures and roadways. Therefore, developments should employ erosion control practices, including preserving natural vegetation where possible, directing the runoff away from exposed soils, planting temporary groundcover and permanently revegetating areas at risk for erosion damage.

2.1.3 GUIDELINES

- Select a site that has been previously developed. Building on a previously developed site reduces the impact on the environment and prevents more valuable, undeveloped land from being disturbed.
- Ensure, in cases where the selected site contains both developed and undeveloped land, that the footprint of the proposed development occupies those areas that have been previously developed.
- Conduct an investigation, by a specialized party, of the contaminated land to test for hazardous levels of pollution on the site. The specialist will determine strategies to remediate contaminated areas to prevent further risks to the environment and to human health.
- Ensure the implementation of remediation strategies for the contaminated land before construction begins on the proposed site.
- Determine strategies based on the type and degree of contamination, natural site features, level of short- and long-term effectiveness, available funds and timeframe for completion. All remediation strategies should have minimal disruption to the site, including underground features.
- Continuously monitor the land after remediation takes place to ensure that all hazardous substances have been completely cleared from the site.
- Remediate contaminated groundwater using pump-and-treat technologies, where the water is pumped to the surface and treated using physical or chemical processes.
- Use multiple techniques to remediate contaminated soils such as in situ applications, off-site disposal, use of bioreactors and solar detoxification technologies. The implications of all remediation techniques should be considered to minimize negative environmental impacts.
- Minimize soil compaction by identifying pathways and areas during construction for heavier equipment, in order to localize affected areas.
- Minimize the length of time soil remains barren or uncovered to avoid erosion due to wind or water. Use groundcover, mulch and/ or sand berms in landscaped areas to prevent soil movement.
- Minimize the amount of soil that is transported into or out of the site and design the development to take advantage of natural features. Limit grading on the site and plan construction machinery routes to minimize the amount of soil compaction.
- Import, when necessary, higher quality topsoil to mix with existing soil or to replace soil of lower quality.

- Avoid soil disturbance as the best method for minimizing erosion. Erosion rates are directly proportional to the type and density of groundcover on the site. Preservation of the natural vegetation is the most efficient and inexpensive form of erosion control, greatly reducing the need for revegetation. Disturbed areas require additional means of erosion prevention and sediment control, because they are more prone to erosion and invasive weed species.
- Create buffer zones and setbacks to reduce the amount of erosion and runoff from the site.
- Restrict activities in areas with erosive potential by creating undisturbed areas with natural vegetation or areas that are suitable for revegetation with native plant species. Buffer zones and setbacks may be used to protect streams and waterways, environmentally sensitive habitats, neighboring properties, structures, roadways and pathways. Buffer zones and setbacks require low maintenance and are easy to visually inspect. Additionally, they aid the filtration of sediment and absorption of runoff and provide habitats for native flora and fauna.
- Replant non-vegetated areas which are prone to erosion with native species to prevent further damage. Revegetation helps prevent erosion by slowing down runoff drainage on hillsides and protects soil from wind erosion. The roots of plants serve to stabilize soils and revegetation enhances water infiltration in the soil, reduces runoff and traps sediment.
- Identify and preserve any major environmental and ecological resources and natural areas found within the site boundary.
- Avoid the disturbance of sensitive ecological areas or landscape features and utilize them as a part of the public green space design and/or incorporate a network of trails and pathways within these areas.
- Retain the pre-existing landscape as far as possible when undertaking new construction works, including the soil, any native vegetation, wetlands and site contours. This will minimize disturbance and can mitigate the potential for invasive species to flourish. It can also be cost-effective, as fewer new plants, soil movements and habitat enhancements will be needed.
- Use high quality soils to hold water and provide plants with proper nutrients they need. During construction works, leave as much existing topsoil as possible. When new soil is necessary, ensure that it is certified as being weed free. This will prevent the potential spread of new invasive species.
- Use compost and other natural products for mulch and fertilizer as this will help enhance the soil structure and feed the native plants. A good quality soil will also reduce the need for fertilizers and supplementary watering.

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2.2 [S.2] WATERBODY PRESERVATION

2.2.1 PURPOSE

To minimize ecological degradation of waterbodies affected by the park.

2.2.2 CONTEXT

Waterbodies are defined as any area that holds surface or groundwater including but not limited to streams, rivers, lakes, estuaries, bays, gulfs and aquifers. These waterbodies are home to a variety of flora and fauna. Coastline development not only affects the quality of nearby waterbodies, but also the overall ecological health of the habitats dependent on them. Furthermore, in a region with limited precipitation and shrinking groundwater levels, it is especially important to conserve the remaining amount of naturally available fresh water.

Developments should protect all-natural waterbodies on the site, including coastlines and groundwater, to prevent degradation to these limited resources. In addition, new developments should reduce activities that have the potential to harm the ecological diversity of waterbodies.

Many large-scale parks include wetlands which can have a very positive impact on the health of aquatic and terrestrial ecosystems. Wetlands act as a natural flood control system by slowing down stormwater and recharging groundwater and trapping sediment, fertilizers and pollutants before they enter the water cycle. Parks should efficiently manage watersheds to protect, conserve and restore the stream corridors. An efficient management also contributes towards riparian forest buffers, wetlands, floodplains, aquifer recharge areas and their associated hydrologic and water quality functions.

2.2.3 GUIDELINES

- Prepare conservation, restoration and/or enhancement strategies and guidelines for natural waterbodies on or near the development site.
- Consider including a water quality report which determines the presence of metals and hydrocarbons and other contaminants in the waterbodies present.
- Restore and rehabilitate the contaminated waterbody, if the existing water contamination is found on site.
- Preserve wadis to provide greenways and to maintain their important natural functions.
- Prepare a geotechnical investigation report to check the presence of groundwater in the site area.
- Protect the quality and quantity of groundwater aquifers.
- Maintain sufficient buffers from all perennial and intermittent streams to provide adequate environmental protection.
- Avoid infilling, which requires dredging areas in or near bodies of water to create new land. Dredging creates excess silt and debris in the existing waterbodies in addition to destroying marine life and habitats.
- Avoid dredging on the site to protect coastlines and soils in the gulf. Also, precautions should be taken to ensure that pollutants from runoff or direct dumping from construction and industrial developments do not contaminate the water supply.
- Retain natural slopes and the topography of the site and protect existing trees and significant vegetation to maintain the direction of groundwater flow if it exists on site.
- Preserve all waterbodies by collecting and removing all toxic or harmful materials to prevent contaminants from reaching waterways.
- Specify surface water management measures such as permeable surfaces, filter drains, sand filters, swales, filter strips and infiltration devices for runoff drains located in areas that have a low risk of surface water pollution. These methods treat surface water using natural processes of physical filtration, sedimentation, biological degradation and absorption into materials and soils. The degree of treatment varies with each system and should be selected based on the specific needs of the development, including the amount of water available onsite for these systems.
- Avoid the use of methods of biofiltration as they are likely to require larger quantities of water to function effectively. Therefore, it is recommended to use other filtration devices to decontaminate runoff.

- Collect, store, and reuse runoff where possible to conserve water on the site and reduce the burden on public treatment facilities.
- Adhere to the coastal protection regulations which mandate provision of buffer between the boundaries of a development site and the waterbody. These regulations protect the coast from erosion and serve as a natural filter to limit the contaminants that reach the water.
- Ensure that beaches, if available within parks, are not destructive to habitats and the impact on the shoreline is minimal. Avoid construction works near the shoreline to avoid disturbing natural ecological barriers and prevent waterbody contamination.
- Create natural stormwater management systems and/or other green infrastructure, including rain gardens and swales with native grasses. Such systems can help to minimize downstream flooding, recharge and filter groundwater, and can be more cost-effective and environmentally beneficial than piped networks and storage tank systems.
- Protect areas of wetland from disturbance and fill. Avoid construction projects, active recreation areas and roads or car parking near or in wetlands.

FURTHER RESOURCES

Websites:

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2.3 [S.3] BIODIVERSITY PRESERVATION

2.3.1 PURPOSE

To preserve and enhance the natural biodiversity of the park site.

2.3.2 CONTEXT

The increasing rate of development is placing significant stress on the richness of our biodiversity. Lands of habitat for wildlife species are converted into residential, commercial developments, infrastructure and other uses. Alterations to the terrain can negatively impact the ecosystems and biological diversity. The fast-paced development of land destroys and fragments the habitat of a site, impacting its quantity and quality. Development eliminates and significantly changes many important habitat features, thereby altering the habitat value of the site.

Ecologically sensitive habitats are not limited to the development site and usually extend into adjacent areas and beyond. Therefore, actions taken within the development site should consider consequences that extend well past the boundaries. Furthermore, linear developments are generally responsible for fragmentation of habitats. When habitat of ecologically sensitive species is separated by distance, their movement from one area to another can become impossible which in turn affects their health and the ability to reproduce resulting in fewer species. Examples of sites with high ecological value include areas containing rare and endangered wildlife species, sites with a high representation of indigenous biodiversity, key biological sites such as wetlands, seagrass beds and mangroves, and areas that could be easily rehabilitated to provide a suitable habitat for wildlife.

Biodiversity conservation aims to protect and restore habitat areas for wild plants and animals. This especially applies to conservation reliant species to prevent their extinction, fragmentation or reduction in range.

Endemic species have a greater risk of extinction relative to those that are common since they only exist in one geographic region. Rare species of organisms are those that are very uncommon, scarce or infrequently encountered in their area of occupancy. They have small populations more likely to be adversely impacted by chance demographic or environmental events. Therefore, endemism and rarity are the factors that confer the greater risk of extinction and thus the rarer and more endemic the species is, the higher the preservation conservation value.

Species richness is an analysis of the number of different species of organisms present in a specific area. Diversity depends not only on richness, but also on evenness and evenness compares the similarity of the population size for each of the species present.

The number and size of ecosystems and wetlands present in an area is an indication of the complexity of the habitat. Diversity of the ecosystem reflects the extent to which regional ecosystems are “packed” within an area, such as an area with a high ecosystem diversity will have in relative terms many regional ecosystems and ecotones.

Naturalness is one of the most significant factors in nature’s conservation. The naturalness of the site can be defined as the degree to which an area is pristine and characterized by native species. It has no human intervention and modification. Developments should protect all-natural habitats, natural vegetation and wildlife on the site to prevent degradation to these limited resources. In addition, areas of the site that have been identified as ecologically relevant or valuable should be preserved.

Parks can provide outstanding opportunities to understand and experience a rare combination of near-pristine natural, scientific and historic resources. Parks are important resting spots for migrating birds, providing unique opportunities to see tropical birds. In addition, the restoration of native plant habitats in parks is vital to the preservation of biodiversity, as each area of habitat becomes a part of a collective effort in nurturing and sustaining the living landscape for birds and other animals. Managing biodiversity in parks is not limited and requires working to improve the ecological qualities of the wider neighborhoods and cities to maximize the opportunities for people to experience the nature close at hand.

2.3.3 GUIDELINES

- Conduct a site assessment and employ construction processes and practices that protect all habitats, natural vegetation and wildlife on the site to prevent degradation of biodiversity.
- Protect from damage all the existing features of ecological value, as identified in the site assessment study.
- Designate, where applicable, an ecological zone to protect habitats from the impact of construction processes.
- Develop, in the cases where habitats and vegetation are to be disturbed during construction, a plan to restore the native ecology by replanting the disturbed vegetation and reintroducing the same species and habitats after construction is complete.
- Create a habitat conservation plan to maintain and enhance habitats and ecosystems on the site. The plan should catalog all species on-site before and after construction to preserve the biodiversity and encourage the use of native plants. The plan outlines methods to maintain, enhance and protect a given habitat type required to protect species. The plan normally includes measures to minimize any impacts, makes provisions to permanently protect land, restore habitat and relocate plants or animals to another area.
- Reduce, if possible, the development footprint by sharing facilities, access roads and walkways within clustered developments and with existing and future buildings on adjacent sites.
- Connect new landscape features and components with surrounding native vegetation to create larger contiguous habitat areas.
- Consider enhancing habitat quality and improving the biodiversity potential by effective planning and management of plant and animal populations.
- Select native plants to attract birds and other wildlife, such as butterflies and native bees. The nuts, seeds and fruits produced by these native plants are essential food sources for all forms of wildlife.

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2.4 [S.4] VEGETATION

2.4.1 PURPOSE

To vegetate the park using native, adaptive and non-toxic plant species.

2.4.2 CONTEXT

Parks act as destinations and offer the opportunity for people to walk, cycle and be active. Their vegetation has positive and restorative mental health benefits, making parks a place for social interaction to flourish. Parks with open public spaces are a key factor in promoting an active lifestyle. They provide important physical, psychological and social health benefits for individuals, groups and the wider community.

Native and adapted plants are indigenous to a specific region or are adapted to the local climate. They have a higher chance of survival than exotic species and provide habitats for local wildlife. Furthermore, native plant species require nominal maintenance, minimal irrigation and little to no chemical inputs such as fertilizers, pesticides and herbicides. Local and regional governmental agencies and/or consultants should be able to provide a list of approved and recommended tree and plant species that are appropriate for the region.

Native plants usually offer beautiful flowers, require little maintenance and less water, and provide protective shelter for the natural habitat. Large expanses of lawn are notorious for requiring significant amounts of water, artificial fertilizers and synthetic chemical pesticides and herbicides. By choosing native plants, a healthier place for individuals, families and communities can be established.

Landscaping plans in a hot, dry climate should strive to reduce heat, glare and desiccation to conserve moisture, and to control temperature for human comfort and horticultural success. In such climates, it is important to design for water-efficient landscaping, to be mindful of conserving water, and to protect the environment. Refer to the plants encyclopedia, published by GORD for a list of recommended trees, shrubs, vines and groundcovers well-suited for hot subtropical climates. The included plants are by no means inclusive of all possible recommendations, and if necessary, each development should conduct their own research for additional options. Plant species listed as ‘dry condition’ and ‘minimum’ are the hardiest plants for a desert environment and require the least amount of water. Plants that are labeled as having ‘moderate’ water requirements may necessitate some irrigation, but their inclusion is meant to provide designers with a wider selection of species that are appropriate for the region.

Native vegetation that is non-invasive and adapted to the local climate supports biodiversity, combats desertification and helps to reduce the carbon footprint of the development. Non-native, invasive plant species can displace or hybridize with native species. They can also change the structure of the vegetation category, the competitive regimes or the function of the ecosystem

they invade. These species have one or more characteristics that enable them to displace native plant species and sometimes the entire vegetation categories. Non-native species have effective reproduction and dispersal mechanisms, often a competitive ability superior to that of native plants in the original or modified system, few or no herbivores or pathogens especially in herbivore-controlled communities, the ability to occupy a "vacant niche" and the ability to alter a site by significantly altering the availability of resources or disturbance regimes or both. Three main methods are used to control invasive species, which are mechanical, biological and chemical:

- Mechanical Treatment Methods: Mechanical treatment includes methods that physically destroy, disrupt growth or interfere with the natural reproduction of noxious and exotic plants.
- Biological Treatment Methods: Biological control utilizes the natural predators of the plant to limit its population.
- Chemical Treatment Methods: Chemical treatment methods involve the use of herbicides to destroy a target plant species, usually an exotic plant.

2.4.3 GUIDELINES

- Specify and locate plants to compliment the various micro-climate and soil conditions for the site. The aesthetic and functional objectives can be met by using compatible plants.
- Promote plant survival through plant selection and location, associating plant requirements with the available water resources, using zones, appropriate soil types and mulch.
- Vegetate any area of the proposed site that is not occupied by buildings and roads and provide shade to the greatest extent possible.
- Develop a landscaping plan that provides for an appropriate amount of new vegetation on the site.
- Weigh the benefits and potential drawbacks of selecting plants that may require more maintenance and irrigation to thrive in a desert environment.
- Create an efficient landscaping plan by grouping vegetation by soil, solar and water needs.
- Select native and/or adapted trees, plants and groundcover that are specified for the landscape plan as they may require little water, pest control and/or fertilizers.
- Consider the amount of water the landscape design demands especially in a region where fresh water contains a large amount of embodied energy.
- Develop a landscaping strategy to minimize the amount of lawn used as vegetative cover to lower irrigation demand. Instead, increase the amount of vegetation that is ecologically sensitive to an arid climate to increase the long-term viability of the landscaping.
- Specify, where turfgrasses are used, species that require less water and are adapted to the region.
- Avoid long with narrow areas of lawn as they are difficult to mow and irrigate efficiently.
- Provide landscaped areas with adequate soil depth, proper ventilation and appropriate levels of sunlight to encourage healthy vegetation.
- Consider the soil conditions, plant groupings, microclimate and topography when selecting the appropriate irrigation technique. Avoid using sprinkler irrigation and other above-ground systems where possible. Instead, consider utilizing drip irrigation systems which slowly apply water to the plant's roots and have little chance of waste.
- Avoid noxious weeds and any other vegetation that can be destructive to the site.
- Prevent the introduction of new invasive species to the site and control any existing invasive species to allow the desired vegetation to regain an ecological advantage.
- Use gravel, mulch and/or stones around plants to protect the soil from solar heat gain and water loss.

- Avoid the use of inefficient irrigation techniques as it tends to waste water through runoff and evaporation. While spray irrigation is an efficient and easy method of watering, it can be wasteful in hot climates as a considerable amount of the water will evaporate before reaching the ground.
- Consider the use of a drip irrigation system as it creates no overspray, blocked spray or runoff and can be installed on top of the soil or below the surface to minimize water loss due to evaporation. Additionally, it is very efficient in terms of water conservation because water is introduced directly to the roots of the plant.
- Design the irrigation systems to collect and take away excess water from the plants below grade to recycle and reuse as much water as possible.
- Consider the use of vegetated roofs to enhance the site and building. Besides providing green spaces to occupants above ground level, vegetated roofs can provide habitats for wildlife and create additional shade for the development and building users. In addition, the benefits of vegetated roofs include reduced energy costs, reduced heat island effect, extended roof life, insulation and sound absorption.
- Limit the use of harmful fertilizers, regularly remove weeds, and prune bushes and shrubs as needed.
- Reduce turf or lawn to only those areas which are essential for recreational and other human activities. Turf and lawn offer very little habitat benefit and are not as effective as many native plants in pollution filtration, flood prevention and erosion control. Furthermore, lawns can have negative impacts on the surrounding environment and can require a lot of maintenance, cutting, watering and fertilizing. When possible, replace non-native turfgrasses with native warm season grasses, which, once they are established, require less maintenance.

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2.5 [S.5] DRAIN & STORMWATER CONTAMINATION

2.5.1 PURPOSE

To prevent the contamination of drain and stormwater discharged from the park site.

2.5.2 CONTEXT

Parks generate different types of contaminants, including solids, sludge, sediment, floating debris, oil, detergents, pool and spa chemicals, pesticides, herbicides and scum. These contaminants should be collected and removed to prevent them from reaching public utilities. In many communities, there are two separate and independent drainage systems: one for wastewater collection – a sewer system that carries sewage from buildings, and a second independent system for rainwater, or stormwater. The stormwater is often sent directly to the sea, lakes, artificial lagoons or rivers, if they exist, while domestic sewage is transported to wastewater treatment plants for treatment to remove pathogens and other contaminants.

During periods of heavy rainfall, the overall volume of wastewater traveling through the collection network can greatly exceed the capacity of the sewer system or treatment plant. These overflows can contain not only stormwater but also pollutants. These pathogens pose a serious risk to human health, threaten aquatic habitats and life, and can impact the use and enjoyment associated with waterways.

Practices to prevent contamination should include pollution prevention in addition to treatment devices and methods at source, i.e. at a development level, to reduce the adverse environmental and health impacts. The degree and type of treatment may vary depending on the specific contaminant conditions, the development type and the public infrastructure available at the site.

Today, parks can implement green infrastructure principles as a complete and adaptive method to meet their environmental and sustainability goals. Green infrastructure is adaptable and offers a multifunctional approach to stormwater management and climate resiliency. Plants, soils and nature can be used to manage stormwater and create healthier urban environments. Green infrastructure practices are used to reduce the need for expensive traditional infrastructure, comprising pipes, storage facilities and treatment systems, as plants and soils absorb, store and use the rainwater. In addition, drainage and infiltration areas can be designed and planned to enhance the topography of the park and provide picnic and play areas, and act as visual or physical barriers creating special areas for rest, meditation or wildlife viewing.

2.5.3 GUIDELINES

- Consider utilizing source control systems and oil separators where necessary to prevent sewer and waterway contamination.
- Specify for runoff drains located in areas that have a low risk of surface water pollution, surface water management measures, such as permeable surfaces, filter drains, sand filters, swales, filter strips and infiltration devices, to prevent contamination of waterways. These methods treat surface water using natural processes of physical filtration, sedimentation, adsorption into materials and soils, and biological degradation. Select the degree of treatment according to the specific needs of the development, including the amount of water available on the site for such systems. The degree of treatment varies with each system and should be selected based on the specific needs of the development, including the amount of water available on the site for such systems.
- Assess the adequacy of using the various forms of biofiltration as they are likely to require larger quantities of water to function effectively, and hence other forms of filtration devices can be selected to decontaminate runoff.
- Collect, store and reuse runoff where possible to conserve water on the site and reduce the burden on public treatment facilities.
- Specify oil/petrol separators or their equivalent to minimize the risk of further contamination for runoff drains located in areas that have a high risk of surface water pollution from substances, such as oil and petrol.
- Provide bunding or other spill prevention barriers around exterior areas in the development that contain liquid materials potentially hazardous to health.
- Clean paved areas regularly to reduce pollution from oil, gasoline and other automotive fluids.
- Properly maintain and clean exterior areas in the development that contain waste or recycling facilities to avoid contaminating waterways with harmful substances.
- Implement an effective stormwater management system to reduce stormwater and pollution runoff.
- Use the natural processes of soils and vegetation to absorb, capture, slow down and filter rainwater runoff. Consider effective techniques, such as permeable pavement surfaces, bioswales, rain gardens, vegetated or “green” roofs, rain barrels and cisterns.
- Use designed curb cuts to redirect water away from roadways towards landscaping or other pervious areas.

- Create a vegetated embankment along the perimeter of the site with ornamental shrubs, grasses and other landscaping elements designed to collect and infiltrate rainwater from run-on or on-site runoff.
- Construct a rain garden to capture rainwater runoff and include feature plants that attract insects or birds
- Reduce the amount of impervious surface in the park as impervious surfaces generate the most runoff.
- Grade walkways and open plazas to drain toward lawn areas, natural areas and other more pervious areas.

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2.6 [S.6] DESERTIFICATION

2.6.1 PURPOSE

To reverse, prevent or minimize desertification and protect the park from sandstorms.

2.6.2 CONTEXT

Desertification and land degradation are the most severe ecological threats facing the region. It is formally defined as land degradation in arid, semi-arid and dry sub-humid areas, and is the result of various factors, including variations in climate and human activity. Desertification enables wind erosion and sand and dust storms from the development of degraded and exposed, dry surfaces over large arid areas, with a large capacity wind volume.

Desertification tends to reduce agricultural productivity and contributes towards the loss of biodiversity in arid regions. In many such areas, the spread of invasive plants leads to a loss in ecosystem services and groundwater depletion. Desertification is caused by a number of human activities and climatic conditions, such as unsustainable land management, overgrazing, irrigation with high saline water, deforestation, extended periods of drought and wind erosion. In addition, sand and dust storms can be hazardous for land in numerous ways, including soil loss, seed and fertilizer loss, nutrient loss, crop root exposure and the undermining of structures. Protection against such phenomenon should be taken seriously by urban planners and policy makers.

2.6.3 GUIDELINES

- Develop plans to minimize, prevent and reverse desertification through the provision of water and the enrichment of soil on the site. Build and modify soil to restore its fertility through the addition of appropriate organic compounds.
- Establish irrigation measures to provide appropriate levels of water to the site and promote the restoration of vegetation.
- Counter erosion through terracing, fixating the soil with protective shelterbelts, windbreaks and sand fences, reintroducing and restoring selected wildlife species on the site, and planting groundcover such as native and/or adapted, non-invasive vines.
- Select drought-resistant plants with minimal water demand.
- Integrate land and water management in order to protect soils and vegetation from erosion, salinization and other forms of degradation.
- Plant a diverse range of species including drought-resilient and ecologically appropriate plants, reduce tillage and apply organic composts and fertilizers.
- Maintain vegetation and mulch cover to avoid exposed areas.
- Avoid and reduce the occurrence of dust and sandstorms where possible, by applying sand dune stabilization techniques, and construct palisade fencing barriers to prevent the movement of sand and reduce sand build-up on infrastructure.
- Control wind erosion by erecting protective barriers to act as windbreaks.

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Websites:

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2.7 [S.7] HEAT ISLAND EFFECT

2.7.1 PURPOSE

To reduce heat island effect of the park on the surrounding environment.

2.7.2 CONTEXT

The Urban Heat Island (UHI) effect is the expression associated with localized increased temperatures experienced in urban environments when compared with the temperatures of the surrounding space. This effect occurs when natural surfaces are replaced with hard, dark colored solid surfaces that absorb large amounts of solar radiation. In general, building facades, roads, paved areas and roofs are the most common forms of hard urban surfaces which are generally significant in area in the urban environment.

Hard, dark colored surfaces have relatively low Albedo values, the fraction of incoming radiation reflected by a body and high thermal conductivities. They typically absorb and re-radiate approximately 90% of the total incident solar radiation. This can result in an increase in summer temperatures by 4 – 7°C when compared with adjacent vegetated areas.

The heat island effect has an adverse impact on energy consumption due to an increased demand on air conditioning which impacts peak electricity demand and energy costs. Typically, electricity use in cities increases between 2 – 4% for every increase of one degree Celsius. It is anticipated these costs will increase further if global temperatures continue to rise, and increasing urbanization contributes to the Urban Heat Island effect even more significantly.

Cool surfaces reflect sunlight and emit heat more efficiently and are considered as a potential strategy to reduce the heat island effect. Therefore, materials with high solar reflectance (albedo) help reduce indirect solar gain in buildings and positively reduce the urban heat island effect. For example, roofs finished with a light-colored coating will have a lower temperature under sunny conditions when compared to a similar dark colored roof.

To a certain extent, parks and green infrastructure can mitigate urban warming. However, the cooling effect is primarily determined by vegetation species group, canopy cover and the size and shape of parks. Hence, appropriate choice of species and spatial design improves efficiency of urban warming. Additionally, trees and vegetation can help reduce urban heat island effects by shading building surfaces, deflecting radiation from the sun, and releasing moisture into the atmosphere.

Fountains and reflecting pools or lakes are common in parks. These features can help reduce the heat island effect in the park. Water features absorb solar radiation more effectively than many solid building materials and can have a positive impact on cooling spaces passively. However, water features should be used sparingly or designed for use with saltwater or recycled water, as this will reduce the load on freshwater demand due to the high evaporation rate prevalent in the region.

2.7.3 GUIDELINES

- Mitigate the impact of heat islands on the environment in the design and planning of the development.
- Consider materials with high solar reflectance (SR) values to reduce the amount of heat absorbed.
- Select light-colored paving surfaces or use paving materials of low heat capacity to minimize the amount of heat absorption from the sun.
- Provide shading with vegetation, trees and architectural features and devices in areas with hard, impervious materials.
- Limit the area of hard surfaces that may absorb heat from the sun.
- Ensure that the development layout utilizes the site in an efficient manner by minimizing parking surfaces and sharing roads and facilities with neighboring properties when possible.
- Limit the amount of exposed parking pavement on the site by providing well-ventilated underground parking or covering parking with high-reflectance materials or vegetation.
- Install roofs with high-albedo values or are vegetated to reduce heat absorption.
- Use materials that are light in color to reflect the heat of the sun rather than absorb it. Materials that are of high reflectance or have low solar absorption rates will help alleviate the thermal environment.
- Maximize green space and provide an appropriate amount of vegetation and groundcover to help mitigate the effects of heat islands by cooling the air through evapotranspiration and shading the building and pavement on the site.
- Ensure that a trade-off exists between the benefits of having abundant vegetation on a site and the amount of water it takes to sustain the vegetation. Specify an appropriate level of vegetation to minimize the demand on the limited water resources of the region.
- Encourage air movement on the site.
- Consider the direction of prevailing winds when planning the proposed building placements within the park, orientation, forms and heights.
- Ensure continuity between open spaces on the site and provide gaps between park buildings to encourage airflow.
- Use recycled water or saltwater for exterior water features, such as fountains and pools.

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2.8 [S.8] SHADING

2.8.1 PURPOSE

To provide shading for commonly used outdoor areas.

2.8.2 CONTEXT

The sun is a source of life. The sun's rays provide our bodies with vitamin D. However, excessive heat and/or sun exposure may result in sunburn, skin cancer, heat illnesses and irritability. Therefore, avoiding direct sunlight and restricting sun exposure can mitigate the adverse impacts of over exposure through the use of properly designed landscaping and shading devices.

Parks and open spaces are recreational spaces ideal for gathering, exercising and sitting, if comfort is extended. Shade structures and tree canopies enhance outdoor areas by providing cooling and protection from harmful solar UV rays, and can extend the lifespan for shaded equipment below. Providing adequate vegetated and shaded areas promote community development and recreation, improve the health and wellbeing of the visitors and increase ecological benefits including reduced heat island effect, greater stormwater control and wildlife habitats.

Shade is a significant factor in the design of pedestrian-friendly outdoor spaces in hot regions. Well-designed solar control and shading devices, either artificial or natural, are very effective means for climatizing commonly used outdoor areas. They reduce the temperature of the shaded area and provide protection from the effects of ultraviolet radiation. Outdoor shading can also block the harmful effects of glare and dust and provide privacy while enhancing the effects of cooling breezes.

Shade from objects will vary based on the time of the day, i.e. morning versus afternoon times and seasonal variations. The degree of protection also varies with the angle of the sun in relation to the object. As such, the shade structure may have shade cast that is not always directly beneath the structure and in such instances no protection is provided to the object under consideration. Analysis and identification of where and when shade is needed in advance is crucial for ensuring that appropriate locations and forms of outdoor shade structure are addressed.

Hence, due to the hot temperatures and intense solar radiation in hot climates, any commonly used areas of the proposed site that are not occupied by buildings and roads should be vegetated and shaded to the greatest extent possible.

2.8.3 GUIDELINES

- Utilize shading devices and/or trees over sidewalks, walkways and bicycle paths to protect pedestrians and cyclists from the sun.
- Provide shaded paths and walkways between parking zones, green spaces and shared facilities.
- Protect open spaces from direct sunlight using various architectural and landscaping methods. For example, shading devices, such as trellises, pergolas, awnings, canopies or built structures, can be used to create shade. Trees, shrubs and other forms of vegetation can also provide shade to the site.
- Ensure that picnic and seating areas can benefit from permanent shading structures, such as pavilions or fabric canopies that provide full-time coverage.
- Consider, when designing outdoor shelters and shaded areas, the time of the day when the spaces are used to determine appropriate shading coverage.
- Consider the durability of materials used for architectural shading devices and all related operational, maintenance and safety issues.
- Conduct technical assessments related to sun angles on the site and utilize sun path diagrams and computer simulations to determine appropriate shading strategies for the site.
- Use computer simulations when designing a sheltered area to determine the influence of the time of the day, location and orientation affecting thermal comfort.
- Ensure the provision of appropriate shading devices for entrances, parking lots, pedestrian pathways, picnic areas and other common areas to reduce heat gain, mitigate heat island effect and encourage pedestrian activity on the site.
- Ensure that shade from tree canopies does not block the view of drivers or pedestrians.
- For shading, use native vegetation which contributes to the local ecological system. Native vegetation generally requires little maintenance once established.
- Use durable, attractive and colorful shade structures to enhance visitors experience and comfort.
- Use easy to assemble, wind and water resistance structures.
- Provide shade that blocks out harmful solar UV radiation.
- Protect certain surface finishes, such as concrete or sand and children's playgrounds from heating up.
- Consider the arrangement of shading structures with proper design.
- Consider using temporary built structures until trees mature to provide shade.

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2.9 [S.9] ACCESSIBILITY

2.9.1 PURPOSE

To maximize accessibility to and within the park for all users, particularly those with special needs.

2.9.2 CONTEXT

People are diverse and variable in their functional capacities, size and age. Moreover, disability and illness, whether temporary or permanent, can also affect human capabilities including mobility, reach, balance, strength, sight, knowledge or sense of direction.

Accessibility can be considered as the "ability to access" and to benefit from systems or provisions to enable access. The intent is focused on enabling access for people, especially those with disabilities or special needs, or to enable access by providing assistive technology where necessary.

Development sites that are well-connected to residences, offices and amenities promote accessibility and convenience to users. Additionally, increasing pedestrian and bicycle access reduces the demand for vehicular transportation, thereby reducing the harmful emissions that adversely affect human health and contribute to global climate change.

Sustainable sites create an environment that makes it easy for use of all users, including those with disabilities, to orient themselves and navigate from place to place. Sites that are easy to navigate enhance the users' sense of safety, minimize anxiety and improve environmental awareness.

Developers, building owners, designers and consultants have a responsibility to ensure that the built environment is accessible to all, wherever it is practical to do so, including but not limited to wheelchair users, their caretakers, people with walking difficulties, those visually impaired and the elderly. Design of pathways and bike tracks in the development should allow people of varying abilities to use open space, buildings and places with comfort and safety, as independently as possible without the need for special assistance. The design strategy should also allow people to be able to find their way easily, provide information to identify and use the development facilities and understand where they may encounter traffic.

Long distances to reach parks can be a clear barrier to walkability, and a lack of physical infrastructure to enable walkability is also a deterrent to park use. Incomplete and disconnected streets present difficulties for pedestrians, making walking to parks an unattractive choice. Many neighborhoods either lack pedestrian crossings, bridges, paved shoulders, pedestrian signals, road medians, visible crossing places, warning signals, appropriate signage, maps, landscape cues and adequate footpath lighting.

Parks perform an important ecological and socio-economic function in communities. They should be suitable for people with disabilities, slow walkers, elderly or families with young children to safely visit and spend time in. Restrictive participation of people with disabilities occurs when parks are not designed to accommodate their situation or provide for their needs. Urban planners and designers should ensure equitable use, flexibility in use, adequate entrances and readily approachable facilities for all users.

Safe routes to a park must reflect various levels of mobility. Proper design is a benefit for all users and allows everyone to use these safe routes to access parks. All walkways at intersections must also be designed and reviewed against the ADA standards for compliance purposes. Important elements of access and design include effective wayfinding systems, use of landmarks, signage, distance to destination markers and points of interest to assist in navigating the available routes easily.

2.9.3 GUIDELINES

- Ensure that there are multiple access points around the park where possible, as pedestrian access to the available entrances often results in longer walking distances due to the limited number of entrances, especially when there is fencing and other barriers around the boundary of the park.
- Design pathways to provide direct and safe connections for pedestrians and cyclists to maximize convenience for occupants and other users of the site.
- Design pathways, if possible, to be visible from other areas on the site to foster a sense of security and promote a safer environment for pedestrians.
- Plan pathways to avoid loading zones, mechanical equipment and other unpleasant spaces for pedestrians.
- Create a network of pathways, including pedestrian trails, bicycle paths and accessible paved pathways, on the development site.
- Consider existing pathways on adjacent sites when designing the layout of the proposed development to ensure appropriate and efficient connectivity for pedestrians, cyclists and users with disabilities.
- Ensure that pathways are designed to provide direct and safe connections. Building frontages and entrances should face the street to promote active pathways and streetscapes.
- Ensure that all pathway and bike path surfaces are of solid firm construction, free of trip hazards or obstructions and have an appropriate slip resistance, able to withstand inclement weather regardless of the specific material used.
- Provide sufficient space for the anticipated foot traffic considering the presence of other features on the pathways, for example, signage.
- Separate pathways from roadways and bike paths with the use of raised sidewalks, curbs or bollards to clearly identify the path.
- Provide accessible pathways, including sidewalks alongside roadways and accessible paved pathways between all building entrances, throughout the development site.
- Design parks and playgrounds for use by all people and especially those with varying abilities and disabilities.
- Ensure that paved pathways meant for users with disabilities meet the requirements and standards of the Architectural and Transportation Barriers Compliance Board, Architectural Barriers Act (ABA) Accessibility Guidelines for Outdoor Developed Areas, or equivalent.

- Provide accessible pathways with appropriate surface materials, including tactile surfaces where recommended, proper width and slope with an appropriate lighting scheme to ensure user comfort and safety. At instances where the path is not wide enough, provide passing spaces, as recommended by the accessibility guidelines, to accommodate users with disabilities.
- Consider the use of benches and other programmed elements, including shaded accessible rest areas, where necessary.
- Use design features, including signage, awnings and identifiable entrance areas, to assist with wayfinding and walkability.
- Label pathways and building entrances clearly to allow for convenient wayfinding between facilities within the site and to adjacent properties or public transportation nodes.
- Ensure that, when vehicular traffic is anticipated to cross pathways, additional street markings, bollards and signage are used to clearly mark traffic patterns.
- Place signage at regular intervals along pathways in a position where it is visible to all the intended users without impacting the required width of pathway.
- Use clear and noticeable signs to promote recycling. Use both graphics and words to communicate each type of material that can be recycled.
- Provide vehicular directional signage, pedestrian directional signage, labels for pathways, safety and advisory warnings and accessible signage for pathways intended for use by people with disabilities.
- Incorporate sidewalks and bicycle lanes into the design to ensure sufficient pedestrian and bicycle access along circulation routes and from roads around the perimeter of the park.
- Design the park to include additional pedestrian and bicycle pathways, separate from roadways, to provide direct access for pedestrians and cyclists between sites of interest.
- Create user-friendly open spaces that become points of interest in themselves by separating the dedicated pedestrian pathways from roadways.
- Use pedestrian pathways in conjunction with the design and layout of plazas, picnic areas, monuments and other site features.
- Ensure that pathways provide direct and safe connections for pedestrians and bicyclists to maximize convenience to building occupants and other users of the park.
- Ensure that pathways adhere to universal design standards for handicap accessibility, such as providing a minimal slope and easily accessible ramps.
- Support the bicycle network by providing proper infrastructure that includes bicycle parking facilities, showers and changing spaces.

- Design a bicycle pathway network that includes different types of bicycle pathways for different road conditions and user demand and allows for maximum access to the park from the surrounding community.
- Provide bicycle pathways with the appropriate surfacing to ensure that the pathways are smooth and free of obstacles such as sewer drains, potholes or other obstructions.
- Ensure that the traffic paint is of a bright color and contains reflective pigments to make it more visible at night.
- Place signage at regular intervals along bicycle pathways in a position where it is visible to both vehicular and bicycle traffic.
- Ensure that the design of pathways safely accommodates bicycles at intersections and provides dedicated spaces for cyclists to wait at traffic lights or well-marked turning lanes. When vehicular traffic has the potential to cross bicycle paths, additional street markings and signage should be used to clearly mark traffic patterns.
- Ensure that when bike paths and footpaths are not physically separated from each other or are a part of a shared surface, proper signage and lane markings are available to alert all users using this space.
- Ensure that traffic paint clearly marks the bicycle path with wide paint stripes, or a painted buffer between pedestrian and bicycle traffic provides a better visible separation.
- Mitigate the risk of collision between pedestrians and cyclists by implementing safety measures and signage at places where pedestrians and cyclists might have to interact.
- Ensure compliance with the international standards of Accessibility Guidelines for Outdoor Developed Areas (AGODA) by the Access Board.

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2.10 [S.10] EXTERNAL LIGHTING

2.10.1 PURPOSE

To meet the minimum compliance requirements for external lighting and avoid over-lighting of outdoor areas.

2.10.2 CONTEXT

In external lighting, the illumination quality is normally determined by the ability to perform a visual task and general visual comfort. The degree of illumination and the reflection properties of an illuminated surface influence the visual performance. In general, surfaces with light colors, for example white, have a reflection degree of up to 85%, while darker colors, a red facing brick facade has only up to 25%. Therefore, to compensate for potentially low visual performance in the case of the dark surfaces, the degree of illumination must be adjusted to ensure an optimal level of visual performance and comfort. Areas which are adequately lit will help maintain visual comfort and deter crime and vandalism.

Parks often include natural habitats and these habitats can respond in a variety of ways to artificial light in their environment. Artificial outdoor lighting affects the ecology by disrupting the food chain, animal biology and behaviors. In the longer term, the impacts of light and changes in the ecosystems can also have a dramatic effect on humans as a result of the impact on natural ecosystems.

2.10.3 GUIDELINES

- Provide light levels in accordance with those recommended in the IESNA Lighting Handbook, or other applicable standards related to a specific environment or task.
- Ensure that light levels do not significantly exceed the recommended minimum illumination levels.
- Identify where and when lighting is needed and choose the most efficient light sources that meet the visual task requirement.
- Optimize illumination intensity and energy use by selecting energy efficient lamps and fixtures.
- Use shielded and full cutoff fixtures, with efficient lamps, which prove to be more cost-effective due to the reduced energy use and optimized geometry which helps to focus the light directly towards the ground. These types of fixtures also reduce light trespass and glare.
- Contain light within the site by carefully selecting, locating, mounting and aiming the luminaires to reduce light pollution and make the system more efficient.
- Coordinate the light fixture layout with outdoor street furniture and dedicated picnic areas to maximize lighting efficacy.
- Consider the location of trees and shrubs growth when locating lighting fixtures, as these may obstruct the intended light distribution.
- Consider paving material properties and reflectivity when calculating light levels.
- Ensure that the lighting system meets security and safety requirements in a public setting, where facial identification may be required. The following factors should be considered when specifying fixtures to improve light quality and reduce shadows: luminance ratio limits, veiling reflections, reflected glare, shadows, color and intensity.
- Control the lighting within parking lots, signage and buildings within the park.
- Provide good illumination in the most popular walking routes in the park.
- Do not illuminate large areas of open space unless these spaces are used for organized nighttime activities. Locate illuminated activity areas along major pathways and at the edges of the park.
- Use lighting fixtures that are full cutoff to illuminate a pathway or seating area without causing glare.
- Use only full cutoff wall pack fixtures on park buildings and mount at an appropriate height.
- Manage sports lighting installations to have a minimum impact on the lighting of the surrounding park areas.

- Illuminate pathways with passive fluorescent pads as these fixtures absorb light during the day and re-radiate light at night.
- Introduce flexible monitoring and lighting control systems for parks with their own independent lighting layouts.
- Consider accessibility for maintenance when designing the lighting system.

FURTHER RESOURCES

Websites:

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3. *Public Lighting Strategy 2013.* City of Melbourne, 2013.

Publications:

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2.11 [S.11] WALKABILITY

2.11.1 PURPOSE

To maximize the availability of efficient and user-friendly pedestrian pathways throughout the park.

2.11.2 CONTEXT

Walking is a non-expensive mode of transportation and can be very convenient if proper provisions are provided. It involves physical activity and promotes human health and wellbeing. Walking helps in avoiding cardiovascular diseases and obesity and diabetes which have become a major concern associated with our lifestyle nowadays. Unlike biking and other modes of transportation, walking takes a longer time, and therefore provides a person with the ability to experience and interact with the surrounding and enjoy the environment. For the same reason, it helps in social interactions among inhabitants of the same neighborhood. Walking can enhance security and safety in open spaces according to the 'eye on the street' principle.

Parks have ample opportunities to accommodate walking and other physical activities. They invite visitors to experience and interact with nature and ecosystems they offer, while also attracting them to walk by offering appropriate walkways and associated features like green areas, kiosks, playing areas and drinking fountains, etc. Walkability is an indicator for the ability of a park to motivate users to walk within their boundaries. In a neighborhood park, walkability also extends to motivating people to arrive at the park on foot.

For convenient walkability in parks, designers need to consider associating footpaths with amenities, features and fixtures. Food and beverage, for instance, is considered as one of the most attractive amenities people would move for. Attaching basic fixtures, like trash bins, benches and drinking fountains along footpaths, helps users continue walking, whether to reach a specific target or for the sake of health and fitness.

2.11.3 GUIDELINES

- Communicate with local authorities to ensure proper accessibility using walkable footpath networks from the surrounding neighborhood to the park.
- Provide long and closed loops of footpaths within parks to ensure the continuity of walking activity, and to provide users with the best exposure to park amenities.
- Ensure proper connection between multiple footpath networks and places of interest and park amenities, to provide alternatives for users to arrive at the targeted amenity.
- Provide basic features and fixtures along the footpaths and at convenient intervals. These include seating benches, trash bins, drinking fountains, ground covers, trees, canopies and lighting poles and bollards.
- Consider adding features associated with other forms of physical activity, such as cycling paths and outdoor gyms, to complement walking activities and to further promote human wellbeing.
- Provide pathways with the appropriate surface materials, accessible width and slope, and an appropriate lighting scheme to ensure pedestrian comfort and safety.

FURTHER RESOURCES

Websites:

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2.12 [S.12] BIKEABILITY

2.12.1 PURPOSE

To maximize the availability of efficient and user-friendly bicycle pathways throughout the park.

2.12.2 CONTEXT

Cycling represents one of the practical sports people use daily for transportation, recreation and even for business. Similar to walking, cycling is a convenient mode of transportation if proper provisions are provided. It involves physical activity and promotes human health and wellbeing. Cycling is also done for leisure, which complements the role of parks. Bikeability is an indicator of a park's ability to motivate people to cycle within their boundaries. In a neighborhood park, bikeability extends to motivating people to commute to the park by bicycle.

Parks can accommodate the required features for cycling, primarily through properly designed cycling paths. Designers need to consider providing cycling paths which are long enough for an immersive experience. Other amenities can be provided for the sport and may include showers and changing facilities. Developments containing sports complexes together with the park can allocate accessible facilities for cyclists without compromising the overall space program.

For convenient cycling in parks, designers need to consider associating cycling paths with amenities, features and fixtures. Food and beverage, for instance, is considered as one of the most attractive amenities people would move for. Attaching basic fixtures like trash bins, benches and drinking fountains along footpath helps users continue cycling, whether to reach a specific target or in the interest of health and wellbeing.

2.12.3 GUIDELINES

- Communicate with local authorities to ensure proper accessibility to the park using safe cycling networks from the surrounding neighborhood to the park.
- Provide long and closed loops of cycling paths within parks to promote an immersive and continuous cycling activity, and to provide users with the best exposure to park amenities.
- Ensure safe and proper connection between multiple cycling path networks and places of interest and park amenities, to provide an alternative for users to arrive at the targeted amenity.
- Provide basic features and fixtures along the cycle paths and at convenient intervals. This may include bike racks, showers and lighting poles for illumination at nighttime.
- Consider adding features associated with other forms of physical activity, such as footpaths and outdoor gyms, to complement cycling activities and to further promote human health and wellbeing
- Link bike facilities (trails and lanes) to the wider city networks and/or networks located in the adjacent neighborhoods to the park.
- Support the bicycle network by providing a proper infrastructure that includes bicycle parking facilities, showers and changing areas.
- Provide bicycle pathways with the appropriate surfacing to ensure that the pathways are smooth and free of obstacles. Traffic paint should be of a bright color and contain reflective pigments to make it more visible at night.
- Use proper signage and lane markings to alert drivers about the presence of bicycles if bicycle pathways are not physically separated from vehicular traffic.
- Use design features, including signage, awnings and prominent entrance areas, to assist in wayfinding.

FURTHER RESOURCES

Websites:

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6. Singelis, Nikos, et al. "Lots and Lots of Parking Lots." *Stormwater Solutions,* Feb. 2008.
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2.13 [S.13] CONSTRUCTION PRACTICES

2.13.1 PURPOSE

To adopt responsible construction practices and mitigate the adverse impacts of on-site construction activities.

2.13.2 CONTEXT

Construction activities can often result in significant environmental impacts, including construction waste taken to landfill or incineration, dust generation noise pollution, CO_2 emissions related to electricity generation and increased traffic congestion on nearby roads, water depletion and soil and waterways contamination.

GSAS-Construction Management (GSAS-CM) scheme provides a systematic approach for evaluating the sustainability impact of building or infrastructure projects over the course of the construction phase. The scheme assesses the aspects of the construction processes and on-site practices that have a lasting sustainability impact, provides a framework to perform measurements in line with normative standards and accepted practices, and considers which impacts a project can mitigate.

For a contractor, it is possible to target selected categories and criteria to achieve the desired GSAS star rating. In order to incorporate the targeted GSAS-CM framework categories and criteria and to outline how a construction project will plan human, organizational and communication resources and processes to meet the requirements of targeted GSAS criteria, a GSAS Construction Management Plan (GSAS-CMP) has to be developed by the contractor. GSAS-CM framework is based on eight categories, including Urban Considerations [UC], Site [S], Energy [E], Water [W], Materials [M], Outdoor Environment [OE], Socio-Cultural Dimension [SD] and Management & Operations [MO]. The categories are then broken down into specific criteria that measure and define individual issues related to environmental aspects.

2.13.3 GUIDELINES

- Develop and implement strategies to reduce the adverse impacts from on-site construction activities as outlined in GSAS Construction Management Guidelines & Assessment manual.
- Register the project for obtaining GSAS-CM certification, with the targeted rating, during the construction phase.
- Refer to GSAS Construction Management Guidelines and Assessment for guidance on the requirements to meet the criteria objectives and obtain GSAS-CM certification.

FURTHER RESOURCES

Websites:

1. "NAAQS Table." *United States Environmental Protection Agency,* 2016, https://www.epa.gov/criteria-air-pollutants/naaqs-table.
2. "Water Pollution." N*atural Resources Defense Council (NRDC),* 2019, https://www.nrdc.org/issues/water-pollution.

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1. Adler, David, editor. *Metric Handbook: Planning and Design Data.* 2nd ed., Architectural Press, 1999.
2. *BS EN 752-4 Drain and Sewer Systems Outside Buildings. Hydraulic Design and Environmental Considerations.* British Standards Institution, 1998.
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17. *Maryland Stormwater Design Manual.* Vol. 1 & 2, Maryland Department of the Environment, Water Management Administration, 2000.

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3.0 ENERGY

The Energy category is concerned with improving the design and energy performance of the development having a direct and positive impact on both the consumption of resources and environmental quality, including climate change, fossil fuel depletion, air pollution and human comfort, health and wellbeing.

CRITERIA IN ENERGY CATEGORY:

E.2 Energy Use Performance

E.3 Primary Energy Performance

E.4 CO_2 Emissions

E.5 Energy Sub-Metering

E.6 Renewable Energy

3.1 [E.2] ENERGY USE PERFORMANCE

3.1.1 PURPOSE

To minimize the energy use through the establishment of GSAS energy use performance.

3.1.2 CONTEXT

EPC_{use} is a building performance indicator that is sensitive to the changes in a building's HVAC systems and other equipment.

3.1.3 GUIDELINES

Implementing control techniques when using on-site cooling generation equipment, such as chillers is necessary, for example: variable volume flow, primary/secondary pumping, frame-and-plate heat exchangers use for water-side economizer or use of chillers with de-superheating availability for use of wasted heat in chillers to warm up any domestic water heating (in cases where this is required).

- Use energy-efficient HVAC equipment such as inverter type wall-mounted split units, VRF units or such units for indoor spaces to reduce the amount of energy consumption.
- Use variable-speed-driven secondary pumps. This reduces pump energy by allowing each pump to operate at total system head. This also improves balancing of the system and creates better part load performance.
- Design and specify the equipment based on operation near their maximum efficiency performance levels based on manufacturer data.
- Use an energy recovery system to recover the heating or cooling from the exhaust air before discharging it to the outdoors, especially in the case of restaurants or cafés located inside the park development.
- Use variable air volume systems to reduce the chance of over-cooling or over-heating a space when it is not at its peak load conditions. For particular applications, constant volume systems like fan coil units can be used to provide better performance. Such systems are more efficient due to their smaller size, multiple units and limited control requirements. Before selecting a system, a study must be conducted to specify which type of system is more appropriate for the specific application.
- Use direct digital control systems to optimize start-up or shutdown of the irrigation and other systems.
- Use innovative on-site energy generation methods, such as photovoltaic cells, to decrease the consumption of energy from public utility sources.
- Specify and enforce commissioning supervision for implementing all the above-mentioned improvements during the design phase.

3.2 [E.3] PRIMARY ENERGY PERFORMANCE

3.2.1 PURPOSE

To reduce the dependence on fossil-based primary energy supply and delivery network through the establishment of GSAS primary energy performance.

3.2.2 CONTEXT

The energy performance coefficient for primary energy sources (EPC_{pri}) is a performance indicator sensitive to changes in the method of energy delivery. It is subject to different types of energy delivery, using different types of energy supply networks including electricity, gas and district cooling. These factors are largely dependent on the city infrastructure, and in the region the prevalent networks are of electricity from large, gas-fired power plants and chilled water delivered by district cooling plants.

3.2.3 GUIDELINES

- Use the primary energy factor (PEF) after calculating the consumed energy at the building site to account for the efficiency of producing and delivering different types of energy to the site. For countries where the natural gas is used as the main source of electricity generation, which is delivered to the doorstep of a building, the PEF is calculated as follows:
    - Assume a 15% loss for extracting gas from the ground, a 55% loss for converting gas to electricity, and a 10% loss for delivering the electricity to the building site. These numbers are completely based on how the infrastructure is designed in different countries, and a detailed study will have to be performed to determine usable numbers. For example, the PEF would then be calculated as (1-0.15) * (1-0.55) * (1-0.1) = 34.4%. Another example for the calculation of purchased chilled water depends on both chiller coefficient of performance (COP) and electricity resource utilization factor. Therefore, for a chiller with COP of 4 and 30% electrical resource utilization factor, the purchased chilled water resource utilization factor will be (4) *(0.30) = 120%.
    - These numbers only provide indicative figures. Specific PEFs for energy carriers of electricity and thermal energy for any country must be calculated using local data.

3.3 [E.4] CO_2 EMISSIONS

3.3.1 PURPOSE

To establish CO_2 emissions performance associated with the primary energy supply and delivery network.

3.3.2 CONTEXT

The energy performance for CO_2 emissions (EPC_{CO2}) is a performance indicator sensitive to changes in the method of energy delivery. It is subject to different types of energy delivery, using different types of energy supply networks including electricity, gas and district cooling. These factors are largely dependent on the city infrastructure and in the region the prevalent networks are of electricity from large, gas-fired power plants and chilled water delivered by district cooling plants.

3.3.3 GUIDELINES

- Use CO_2 emission coefficient to estimate the impact of emissions from the energy delivered. Emission coefficients are factors to measure emissions resulting from the primary resource inputs during fuel combustion at power plants. They vary depending on the type of resources used for electricity generation and the type of delivered energy as secondary energy from power plants. Emission coefficients represent the combination of conversion inefficiencies and the transmission and distribution losses from the generation sources to the point of use. The conversion inefficiencies include the effects of pre-combustions, which are associated with extracting, processing and delivering the primary resources to the point of conversions in the power plant or directly in the building. The EPC_{CO2} value can be improved to have less emitting power supplies (which have less emission coefficient value) as an example introduced in the EPC_{pri} improvement.

3.4 [E.5] ENERGY SUB-METERING

3.4.1 PURPOSE

To install sub-meters for monitoring the major energy consuming systems.

3.4.2 CONTEXT

The use of energy submetering generates awareness of energy conservation among users as they will be aware of the exact consumption profile and costs associated with their behavior.

Energy sub-metering will also facilitate the development of strategies to help improve performance, thereby ensuring the overall efficiency of systems operations. In addition, users can apply consumption data to implement conservation or renovation projects to lower usage and costs and meet government regulations.

Sub-metering devices are installed to monitor and evaluate energy performance and consumption during the operational phase. Major energy systems should be metered and monitored in conjunction with data logging to enable continued accountability of energy consumption over the lifespan of the development. Consumption data provides users with the information to locate high-consumption areas.

3.4.3 GUIDELINES

- Provide monitoring devices that display and record the energy consumption data of major systems in the building.
- Provide energy sub-meters for all major energy-consuming systems, such as lighting, water pumps and for individual tenants.
- Ensure the energy sub-metering is properly and clearly labeled, easily accessible and convenient for regular access by the facility operators.
- Specify the appropriate location of energy sub-meters, for example, in the plant room, distribution room or control room.
- Determine the optimal quantity and specific locations of energy meters according to the types and complexity of systems to be monitored.
- Consider utilizing energy simulations or engineering analysis to predict the overall energy consumption and evaluate major energy system performance.
- Determine measures and strategies for continued improvement of energy efficient building operations throughout the design of the development and during the operational phase of the park.

3.5 [E.6] RENEWABLE ENERGY

3.5.1 PURPOSE

To install on-site renewable energy generation systems.

3.5.2 CONTEXT

The use of renewable energy reduces the use of primary fossil-based energy sources, thereby reducing the associated environmental footprints. Using photovoltaic cells to generate electricity can be an effective method for the generation of onsite electricity. PV cells are sources of renewable energy that convert the energy directly into electricity using semiconductors. PV cells produce a direct current, which needs to be converted to an alternating current before it can be used in buildings. The common technique is to store direct current from PV cells in batteries and change it to an alternating current using an inverter. The major advantage of an alternating current created by the inverter is that the alternating current is compatible with the city utility grid. If the local PV system can generate additional electricity, the excess electricity can be transferred to the main utility grid and sold to the city's electric provider, specifically when the city grid experiences high demand from customers during certain times of the day.

Similarly, solar water heating and thermal or electrical energy generation using other renewable sources such as mini windmills, renewable biomass or geothermal sources help to reduce the environmental impact of primary fossil-based energy.

The best use of renewable systems is to generate electricity, for example, using photovoltaic (PV) panels or wind turbines. PV cells are sources of renewable energy that convert sun energy directly into electricity using semiconductors.

3.5.3 GUIDELINES

Solar energy and photovoltaic (PV) cells

- Use solar energy systems passively or actively to supply part of the heating needs of the park.
- Manage PV system installation in the development.
- Store energy from PV cells in batteries and change it to an alternating current using an inverter.
- Transfer the excess electricity to the main utility grid, where applicable, if the local PV system can generate additional electricity.

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4.0 WATER

The Water category is concerned with water conservation for indoor and outdoor use. The natural water cycle is a system in which water resources are continuously exchanged between the atmosphere, soil water, surface water, ground water and plants. This cycle treats and recharges freshwater supplies. Human consumption of fresh water outpaces the natural cycle and under these circumstances, water cannot be considered as a renewable resource.

Sustainable practices for the efficient use of water, collection, recycling and reuse of water mitigate the environmental impacts associated with water scarcity and depletion.

CRITERIA IN WATER CATEGORY:

W.1 Water Demand Performance

W.2 Water Reuse Performance

W.3 Water Sub-Metering

4.1 [W.1] WATER DEMAND PERFORMANCE

4.1.1 PURPOSE

To reduce the indoor and outdoor water demand of the park.

4.1.2 CONTEXT

A reduction in the overall water demand and consumption can be achieved by adopting water conservation strategies for indoor and outdoor uses within the development. For indoor water use, the most effective approach is through the specification of efficient sanitary fixtures, for example: dual flush toilets and low flow fixtures incorporating aerators and timers. In addition, the specification of water efficient appliances can further reduce water demand and consumption.

To reduce outdoor water demand and consumption, effective landscape management practices can be employed. Landscape design can be developed and implemented to include the use of native vegetation or species with a low water demand. In addition, the use of efficient irrigation methods, including automated techniques and systems, with managed cycles, timing and overall control should be specified.

4.1.3 GUIDELINES

Water-efficient equipment and fixtures

- Specify water efficient fixtures, such as low flush toilets, vacuum toilet flush systems, dual flush toilets, flow-controllers, water-saving valves and fixtures on faucets and showerheads and low flush urinals.
- Specify water efficient equipment and appliances, including dishwashers, washing machines or similar machines.
- Specify automatic shutoffs, electronic sensors and aerators on faucets.
- Consider the use of dry fixtures, such as composting toilets and waterless urinals to reduce water demand.
- Install leak detection systems to quickly and efficiently identify and locate water leakage points.

Water-efficient irrigation

- Design landscape for water efficiency by specifying native plants that are more tolerant to local soil and rainfall conditions.
- Shade the site where possible to minimize water loss due to evaporation.

- Minimize the use of potable water for irrigation by using harvested/recycled rainwater and greywater where feasible.
- Group plants with similar water needs for the most efficient use of water and develop and implement appropriate watering schedules.
- Consider efficient, low-water irrigation systems, such as drip feed subsurface systems, and utilize weather-based irrigation strategies, such as rain shutoffs, moisture sensors and evapotranspiration/smart irrigation controllers.
- Consider the use of irrigation techniques for greywater, including drip feed subsurface systems, traditional evapotranspiration systems and shallow trench systems that allow for subsurface irrigation of plant roots.
- Merge, if feasible, the greywater reuse system with the irrigation system to reduce the need to treat greywater on site and to reduce the need for potable water for irrigation use.
- Specify a subsurface irrigation system when using greywater to avoid possible risks to human health. Avoid the activation of irrigation systems during the day and utilize mulch and/or gravel to prevent water evaporation from the soil.
- Landscaped areas used for recreational activities and competition should adopt landscape management practices that conserve water, and course design should reflect water conservation policies, such as limiting lawn areas and eliminating water hazards. For irrigation, use non-potable water sources such as harvested water or greywater recycled from hotel and/or facilities use. Further reduce the need for irrigation by installing water retention systems underneath the soil and cover putting greens with tarps during evening hours to trap condensation.

4.2 [W.2] WATER REUSE PERFORMANCE

4.2.1 PURPOSE

To maximize water recycling and reuse in the park.

4.2.2 CONTEXT

Reuse of water from on-site sources can further reduce the demand for fresh water. An on-site alternative water source is water sourced, collected, treated, stored and utilized as recycled water.

Sources for reclaimed water include rainwater, condensate water, greywater and community treated sewage effluent (TSE). Recycled and treated water can be reused indoors, in a restricted manner, or outdoor applications. Indoors, recycled treated water can be used where no contact with human beings is expected. For example, greywater for toilet flushing. There are a wider range of applications in outdoor use, including landscape irrigation, washing and general cleaning purposes.

The quality of reused water from on-site sources is of prime importance. Where there is a possibility of human exposure to the recycled water, additional treatment is necessary and it is critical to ensure that the quality of the recycled water is appropriate according to local regulations.

4.2.3 GUIDELINES

Rainwater and condensate reuse

- Design the development to collect, store and redistribute rainwater and condensate on the development site to reduce potable water consumption. The treatment of rainwater and condensate depends on the quality of the water. They do not necessarily have to be treated prior to redistribution.
- Collect water generated by the operation of air conditioners, dehumidifiers and refrigeration units. Condensation does not necessitate a stringent treatment process but can contain contaminants, residual chemicals and bacteria.
- Harvest and collect rainwater using devices such as cisterns or underground tanks. Rainwater collected from roofs and other impervious surfaces on the site can be filtered using various methods, including screens and paper filters. Water collected from paved surfaces such as roads and parking lots may require oil separators and further treatment to eliminate oils, fuels and other harmful substances.
- Reuse on-site condensate and rainwater for non-potable applications, including toilet/urinal flushing, landscape irrigation, custodial/janitorial uses, fire protection and car wash.

Greywater reuse

- Design the development to collect, store and redistribute greywater in the development to reduce potable water consumption.
- Ensure proper treatment of greywater collected in the development. Greywater includes water discharge from park operations, such as bathroom and kitchen sinks and water fountains.
- Ensure that greywater generated from kitchen and catering facilities is stored and treated separately from other sources as oils and fats are difficult to remove. Dual plumbing lines can be used to separate greywater from sewage water and should be installed during the initial construction.
- Reuse on-site greywater for non-potable applications including toilet/urinal flushing, landscape irrigation, custodial/janitorial uses, fire protection, cooling tower make-up water and car wash.

Treated Sewage Effluent (TSE) reuse

- Use, where applicable, the communal TSE for outdoor applications in the development.
- Treat, if possible, sewage on site to produce water that can be used for non-potable uses, depending on the type of treatment. Sludge may be taken to appropriate disposal facilities or biologically digested on site to produce methane. Use separate plumbing lines for sewage to isolate water from other wastewater systems.

Water features

- Limit water features in and around the park to conserve water and use recycled water for recirculation.
- Design water features with trickling or cascading fountains as they lose less water to evaporation than those spraying water into the air.
- Consider using salt water in water features to reduce the need for desalinated water and ensure that the water feature materials such as tile and stone can withstand the corrosive properties of salt.

4.3 [W.3] WATER SUB-METERING

4.3.1 PURPOSE

To install sub-meters for monitoring the major water consuming systems.

4.3.2 CONTEXT

The use of water submetering in buildings generates awareness of water conservation among users, including landlords and tenants, as they will be aware of the exact consumption profile and costs associated with their behavior.

Water sub-metering also facilitates the development of strategies to help improve performance, thereby ensuring the overall efficiency of systems operations. In addition, users can apply consumption data to implement conservation or renovation projects to lower the usage and costs and meet government regulations.

Sub-metering devices are installed to monitor and evaluate energy performance and consumption during the building operations phase. Major water systems should be metered and monitored in conjunction with data logging to enable continued accountability of energy consumption over the lifespan of the development. Consumption data provides users with the information to locate leaks and high-consumption areas.

4.3.3 GUIDELINES

- Install water meters on the main water supply to each building in the proposed development.
- Provide water sub-meters for all major water-consuming systems, such as bathroom fixtures, hot water heaters, boilers, cooling towers, chilled water systems, competition-related equipment and largescale food service equipment.
- Ensure that water meters are clearly labelled, easily accessible and convenient for facilities' operators.
- Provide means for monitoring irrigation systems to control over-watering and to detect the build-up of nutrients like nitrogen, calcium, potassium, and sodium.
- Consider connecting the water meter to the building monitoring system using a pulsed output to ensure detection of inefficiencies in water use and consumption.
- Provide monitoring devices that display and record the water consumption data of major systems in the building.

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5.0 MATERIALS

The Materials category is concerned with the conservation of natural resources and the use or reuse of materials and structure to have the least environmental impact. The construction sector has a significant impact on the environment. It accounts for the consumption of approximately 40% of the raw stone, gravel and sand used worldwide annually, 25% of the raw timber, and the associated embodied carbon emissions for such materials.

Eco-friendly construction materials can contribute to reduce the adverse impacts on the environment, and create sustainable buildings promoting the health and wellbeing of occupants.

CRITERIA IN MATERIALS CATEGORY:

M.1 Locally Sourced Materials

M.2 Materials Eco-Labeling

M.3 Recycled Content of Materials

M.4 Materials Reuse

M.5 Cut & Fill Optimization

M.6 Design for Disassembly

M.7 Responsible Sourcing of Materials

5.1 [M.1] LOCALLY SOURCED MATERIALS

5.1.1 PURPOSE

To maximize the use of local materials and reduce the impact of long-distance transportation.

5.1.2 CONTEXT

The concept of a local circular economy in the built environment creates a more sustainable, efficient and resilient economic growth. Procuring goods and services originating from the local market helps fuel economic growth and provides opportunities for employment. The construction industry contributes significantly to the national economy as it encompasses the utilization of versatile supply chain elements that include material procurement, workmanship provision, manpower supply and the use of resources.

For materials to be considered as locally sourced, loose materials and assembled finished products must be available and procured from within the country borders.

5.1.3 GUIDELINES

- Procure locally sourced materials to reduce the transportation distance which will mitigate the environmental impacts of transportation.
- Investigate the availability of locally produced products and develop a materials logistic plan to identify manufacturers in the local market.
- Develop a procurement program to ensure the availability of materials according to the development timeline. These considerations should take place early in the design process to assess which locally sourced materials will be most appropriate and feasible in terms of the development design and budget.
- Where possible, source locally available primary building elements, such as aggregate, concrete, masonry, sand and steel since heavier materials require more energy to transport and have a greater impact on the environment if sourced from outside the country.
- Consult the tools and guidance section provided by the Waste and Resources Action Programme (WRAP) in the United Kingdom for more information on materials logistics planning.

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5.2 [M.2] MATERIALS ECO-LABELING

5.2.1 PURPOSE

To use certified products and materials with enhanced environmental, health and resources conservation attributes.

5.2.2 CONTEXT

Environmental labels or eco-labeling has emerged as a useful tool for the society and offers a valuable contribution to the development and implementation of sustainable procurement practices. There are several objectives for pursuing eco-labeling, including the following:

- Protecting the environment.
- Encouraging environmentally considered innovation and leadership.
- Developing consumer awareness of environmental issues.
- Linking eco-labelled materials with life cycle environmental assessment and embodied energy.

There are three main types of widely adopted eco-labeling programs, guided by internationally recognized standards. Each serves a different purpose and addresses different attributes:

- **Single-Attribute Labels**

  A single-attribute label identifies an individual environmental attribute associated with the product. An example of a single attribute label is the representation of recycled content or the energy efficiency performance of the product.

- **Multi-Attribute Labels**

  In contrast to single-attribute labels, multi-attribute labels/standards represent collective characteristics of the product with an aim to set criteria for the range of environmental impacts that the product category should tend to minimize or avoid. This is typically done by focusing on life cycle environmental impacts of the product categories, e.g. energy saving, carbon footprint reduction, recycle or reuse of material and impact on the ecosystem and public health. These labels are good indicators of the "greenness" of the product category and are awarded when all the criteria of the standard are met by the product category.

- **Environmental Product Declaration Labels**

  Environmental Product Declaration (EPD) labels are awarded to a product for declaring its environmental impacts over its life cycle. The award of this label requires a thorough life cycle assessment study, which helps the comparison of the product with other products in the same category in terms of their life cycle environmental footprints. EPD label helps users to compare the relevant data among products and make an informed decision.

5.2.3 GUIDELINES

- Procure eco-labelled materials and products which have enhanced environmental attributes.
- Investigate the availability of eco-labelled materials and products and develop a materials logistic plan to identify suppliers and manufacturers.
- Develop a procurement program to ensure the availability of eco-labelled materials and products according to the development timeline. These considerations should take place early in the design process to assess which eco-labelled materials and products will be most appropriate and feasible in terms of the development design and budget.
- Ensure the appropriateness and validity of material and product information and certification.
- Develop a matrix to identify the potential environmental impacts of materials and products to inform the decision-making process and specify alternative eco-labelled materials and products wherever possible.

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5.3 [M.3] RECYCLED CONTENT OF MATERIALS

5.3.1 PURPOSE

To use products and materials with recycled content.

5.3.2 CONTEXT

The use of materials with recycled content reduces the environmental impact arising from the extraction and processing of non-renewable and virgin materials. Materials, components, products and fixtures and fittings made with recycled content can contain post- or pre-consumer content. Post-consumer content is waste which is recycled after the consumer has used the product. This can include construction or debris from demolition, such as recycled aggregate, aluminum and steel building elements and components; materials sorted for recycling purposes including aluminum cans and glass bottles; and landscaping waste comprising branches and leaves. Pre-consumer waste is raw material that has never been used by the consumer, for example, wood chips and sawdust. Pre-consumer materials are often the byproducts of a manufacturing process which can be recycled for future reuse.

5.3.3 GUIDELINES

- Procure materials and products with recycled content to reduce the need for the use of virgin materials.
- Investigate the availability of materials and products with recycled content and develop a materials logistic plan to identify suppliers and manufacturers.
- Develop a procurement program to ensure the availability of materials and products with recycled content according to the development timeline. These considerations should take place early in the design process to assess which materials and products with recycled content will be most appropriate and feasible in terms of the development design and budget.
- Ensure the appropriateness and validity of material and product information and certification where applicable.
- Develop a matrix to identify the potential environmental impacts of materials and products to inform the decision-making process and specify alternative materials and products with recycled content wherever possible.
- Ensure that the materials and products with recycled content selected for the development are of high quality, have no detrimental environmental impacts, and will not hinder construction in any way.
- Use insulation, acoustic wall panels and ceiling tiles made from materials with recycled content as they are widely available.

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5.4 [M.4] MATERIALS REUSE

5.4.1 PURPOSE

To reuse building materials recovered from on- or off-site sources.

5.4.2 CONTEXT

The reuse of salvaged or refurbished materials and products recovered on- or off-site prevents diversion of such materials into the waste stream and reduces the environmental impacts associated with producing new materials and products. Salvaged materials are the materials taken from existing buildings and reused in new buildings and developments. Salvaged materials include steel structural elements, flooring, paneling, windows, doors and frames, cabinetry and masonry. They can be purchased from suppliers or recovered and relocated directly from an existing building

5.4.3 GUIDELINES

- Identify salvaged materials and products for reuse to reduce the need for the procurement of virgin materials and develop a materials logistic plan to identify suppliers and manufacturers.
- Develop a procurement program to ensure the availability of salvaged materials and products for reuse according to the development timeline. These considerations should take place early in the design process to assess which salvaged materials and products for reuse will be most appropriate and feasible in terms of the development design and budget.
- Ensure the appropriateness and validity of salvaged material and product information where possible.
- Develop a matrix to identify the potential environmental impacts of materials and products to inform the decision-making process and specify alternative salvaged materials and products for reuse wherever possible.
- Ensure that the salvaged materials and products for reuse selected for the development are of high quality, have no detrimental environmental impacts, and will not hinder construction in any way.

FURTHER RESOURCES

Publications:

1. Anderson, Jane, et al. *The Green Guide to Specification.* Blackwell Science Ltd, 2002.
2. *Construction Site Best Management Practice (BMP) Field Manual and Troubleshooting Guide.* Department of Transportation, State of California, 2013.
3. Coventry, S., et al. *The Reclaimed and Recycled Construction Materials Handbook: C513.* Construction Industry Research and Information Association, 1999.
4. *Field Guide for Sustainable Construction.* The Partnership for Achieving Construction Excellence, The Pennsylvania State University, 2004.
5. Fleming, Tim, et al. *Guide to Best Practice for Safer Construction: Principles.* Cooperative Research Centre for Construction Innovation, 2007.
6. National Academies of Sciences, Engineering and Medicine. *Guidebook for Construction Management Practices for Rural Projects.* National Academies Press, 2013. www.nap.edu, doi:10.17226/22633.
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8. *Pollution Prevention by Building Green.* Office of Pollution Prevention, Ohio EPA, No. 86 2001.
9. *Sustainable Construction: Simple Ways to Make It Happen.* bre, 2008.

5.5 [M.5] CUT & FILL OPTIMIZATION

5.5.1 PURPOSE

To minimize transportation and disposal of soil through reuse and optimization of cut and fill balance.

5.5.2 CONTEXT

The term "cut and fill" is used to describe the process of profiling the landform for the project, earthwork excavation (cut) in some parts, and earthwork embankment (fill) in other parts. Earthworks construction activities have a significant environmental impact associated with the excavation and backfill activities and the transportation of soil. The machinery involved in the excavation and backfilling works is usually run by fossil fuels, producing large quantities of CO2 emissions. The movement of high volumes of soil involves heavy vehicles running on fossil fuels and emitting significant quantities of CO2. Soil represents a great percentage of the construction and demolition waste taken to landfill, which requires vast areas for disposal and poses a health risk to the population.

Mitigation measures to minimize these impacts can be implemented to reduce the earthworks volume, balancing the "cut and fill", and the on-site or off-site reuse of surplus soil.

5.5.3 GUIDELINES

- Reduce the earthworks volume by adjusting the project design to the actual land topography and conditions on site. This requires a comprehensive survey study to be conducted prior to the commencement of the construction works.
- Optimize the "cut and fill" balance by adjusting the project design to the actual land topography and conditions on site. Redesign landscaping works to accommodate surplus soil whenever possible.
- Reuse as much excavated soil as possible on site. This requires testing of the excavated material to ensure it meets the physical and chemical requirement of the backfill material for the project. If needed, treat the excavated soil to modify its features to match the project backfill material specifications. This can be achieved by crushing, sieving and adding sand and/or aggregates as required.
- Reuse surplus suitable excavated soil on another project or facility off site. If there are no available destinations for immediate reuse, projects can stockpile the soil in temporary facilities for further reuse. Some clients have dedicated plots for this purpose.
- Reuse material from other development sites rather than extracting material from a quarry.
- Utilize trenchless technologies for pipelines when technically feasible.

FURTHER RESOURCES

Publications:

1. *Capachi, Nick, and John Capachi. Excavation & Grading Handbook. Craftsman Book Company*, 1987.
2. *Caterpillar Performance Handbook. Caterpillar Tractor Company,* 1984.
3. *Cook, Michael, and John King. Construction Cost and Erosion Control Effectiveness of Filter Windrows on Fill Slopes. Forest Service, US Department of Agriculture,* 1983.
4. *Dietz, Peter, et al. Walderschliessung. Paul Parey*, 1984.
5. *Erosion & Sediment Control: Guidelines for Land Disturbing Activities in the Auckland Region. Auckland Regional Council,* 1999.
6. *Erosion & Sediment Control: Guidelines for Soil Disturbing Activities. Environment Waikato Regional Council,* 2003.
7. *Explosives in Roadworks: Users' Guide. National Association of Australian State Road Authorities,* 1982.
8. *Garland, J. Road Construction on Woodland Properties. Oregon State University extension service,* 1983.
9. Goktepe, A. Burak, and A. Hilmi Lav. *"Method for Optimizing Earthwork Considering Soil Properties in the Geometric Design of Highways." Journal of Surveying Engineering,* vol. 130, no. 4, 2004.
10. Haber, Donald, and Teresa Kadoch. *Costs of Erosion Control Construction Measures Used on a Forest Road in the Silver Creek Watershed in Idaho.* University of Idaho, 1982.
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13. Nichols Jr., Herbert L., and David A. Day. *Moving The Earth: The Workbook of Excavation. 5th ed., McGraw-Hill Education,* 1999.
14. Pearce, J. Kenneth. *Forest Engineering Handbook: A Guide for Logging Planning and Forest Road Engineering. Bureau of Land Management, Oregon State Office, US Department of Interior,* 1961.
15. *Standard Specification for Urban Infrastructure Works. Territory and Municipal Service, Australian Capital Territory (ACT) Government,* 2002.

5.6 [M.6] DESIGN FOR DISASSEMBLY

5.6.1 PURPOSE

To design building elements for ease of disassembly and to facilitate future reuse.

5.6.2 CONTEXT

Design for disassembly is a practice to benefit and simplify the deconstruction processes and procedures through forward planning and design. It also changes the traditional waste management process and conserves raw materials. Design the building to facilitate future disassembly of components for reuse to extend the life of materials and conserve natural resources. Building elements and components – including structure, finishing materials and equipment – should have the ability to be easily separated and disassembled. Elements that qualify for consideration for disassembly exclude consumables, elements indicating significant signs of wear and tear and electro-mechanical components and systems.

5.6.3 GUIDELINES

- Consider the use of modular components, movable partitions and bolted connections or fastening systems for the structure and/or building envelope to facilitate future disassembly.
- Minimize, where feasible, the use of composite or bonded materials that cannot be separated or reused.
- Design finishes to be easily removable to enable refurbishment and remodeling.
- Specify, where feasible, the design of standard components and assemblies to enable faster and simpler future disassembly and reuse.
- Adopt innovative strategies for the integration and connection of construction elements and components where feasible to enable easy and fast future disassembly.
- Develop and submit a manual and all necessary documentation outlining the disassembly instructions for various systems and components in the development to ensure that transfer of knowledge is retained for future use.

FURTHER RESOURCES

Publications:

1. Crowther, Philip. *Design for Disassembly to Extend Service Life and Increase Sustainability.* Edited by Michael A. Lacasse and Dana J. Vanier, Durability of Building Materials and Components 8: Service Life and Asset Management conference, 1999, pp. 1983–92, https://eprints.qut.edu.au/2471/.
2. John, Geraint, et al. Stadia: *A Design and Development Guide.* 4th ed., Taylor & Francis, 2007.
3. Rios, Fernanda Cruz, et al. "Design for Disassembly and Deconstruction - Challenges and Opportunities." *Procedia Engineering,* vol. 118, Jan. 2015, pp. 1296–304, doi:10.1016/j.proeng.2015.08.485.
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5.7 [M.7] RESPONSIBLE SOURCING OF MATERIALS

5.7.1 PURPOSE

To use certified responsibly sourced materials.

5.7.2 CONTEXT

Responsible sourcing is a commitment by the society to go beyond economic considerations and to account for social, ethical and environmental considerations when managing relationships with the supply chain of construction materials.

The growing practice of specifying and procuring responsibly sourced materials is promoting the conservation of natural resources, reducing the environmental impacts associated with the extraction and processing of non-renewable materials in addition to improving social and labor conditions.

In the case of timber, responsible sourcing helps mitigate the over-harvesting of forests that has led to the extinction of many tree species and the depletion of wood as a natural resource.

5.7.3 GUIDELINES

- Procure responsibly sourced materials and products which have enhanced environmental attributes.
- Investigate the availability of responsibly sourced materials and products and develop a materials logistic plan to identify suppliers and manufacturers.
- Develop a procurement program to ensure the availability of responsibly sourced materials and products according to the development timeline. These considerations should take place early in the design process to assess which responsibly sourced materials and products will be most appropriate and feasible in terms of the development design and budget.
- Ensure the appropriateness and validity of material and product information and certification.
- Develop a matrix to identify the potential environmental impacts of materials and products to inform the decision-making process and specify alternative responsibly sourced materials and products wherever possible.

Timber Products

- Use timber and wood products originated from sustainably managed forests.
- Use timber supplied by companies that hold Forest Stewardship Council (FSC) Chain of Custody Certification.
- Use products originated from forest management companies that comply with local regulations, demonstrate long-term land tenure and use rights, recognize the rights of indigenous people, maintain the ecology and biodiversity of the forest, enhance economic viability, and conduct adequate management, planning and monitoring of operations.

FURTHER RESOURCES

Websites:

1. "Convention on International Trade in Endangered Species of Wild Flora and Fauna." *Cities.Org*, https://www.cites.org/eng/disc/what.php. Accessed 4 Sept. 2019.
2. "ILO Declaration on Fundamental Principles and Rights at Work and Its Follow-Up." *International Labour Organization (ILO)*, http://www.ilo.org/declaration/thedeclaration/lang--en/index.htm. Accessed 4 Sept. 2019.
3. "The Global Conservation Organization." *World Wildlife Federation (WWF)*, http://wwf.panda.org/. Accessed 4 Sept. 2019.
4. "Universal Declaration of Human Rights." *United Nations (UN)*, 6 Oct. 2015, https://www.un.org/en/universal-declaration-human-rights/index.html.

Publications:

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2. *Environmental Impact of Building and Construction Materials.* CIRIA, 1995.
3. *ICC Guide to Responsible Sourcing.* International Chamber of Commerce, 2008.
4. International Labour Office. *Tripartite Declaration of Principles Concerning Multinational Enterprises and Social Policy.* 5th ed., International Labour Organization, 2017.
5. *ISO 9001:2008 Quality Management Systems - Requirement.* International Organization for Standardization, 2008.
6. *ISO 14001:2004 Environmental Management Systems - Requirements with Guidance for Use.* International Organization for Standardization, 2004.
7. *ISO 26000:2010 Guidance on Social Responsibility.* International Organization for Standardization, 2010.
8. *Sourcing Reclaimed Material for Use in FSC Product Groups or FSC Certified Projects.* Forest Stewardship Council, 2011.

6.0 CULTURAL & ECONOMIC VALUE

The Culture & Economic Value category is concerned with the cultural impacts in the design of the built environment and support of the national economy.

The architecture of the built environment can contribute towards the preservation of local cultural identity and heritage. Design expression should align with and integrate the development into the existing cultural fabric. In addition, the use of local materials and local workforce contributes towards the growth of the national economy.

CRITERIA IN CULTURAL & ECONOMIC VALUE CATEGORY:

CE.1 Heritage & Cultural Identity

CE.2 Support of National Economy

6.1 [CE.1] HERITAGE & CULTURAL IDENTITY

6.1.1 PURPOSE

To encourage design expression in alignment with heritage and cultural identity.

6.1.2 CONTEXT

Several countries have experienced tremendous growth in the development of their built environment in the past several decades. With this rapid growth and change of cities and landscapes, countries must address how to preserve their cultural identity, heritage and resources and define the role each plays in the formation and continuity of a cultural and national identity. Vernacular architecture is an architectural style developed based on local needs and the availability of building materials, and reflects local traditions. In this context, the conservation of heritage in the region is not a new pursuit. In the spring of 1985, the Arab Urban Development Institute (AUDI) worked with the Arab Towns Organization (ATO) and the Union of Municipalities of Marmara Region to discuss many of the pressing questions facing the region today. During "The Conference on the Preservation of Architectural Heritage of Islamic Cities", participants raised questions regarding city planning, historic preservation and new architecture and development. The conference addressed methods of conservation and focused on the question of cultural and national identity.

While past studies have laid much of the conservation framework for addressing architectural and urban scale, it is important to learn from the limitations of prescriptive preservation systems. Preservation is the process of maintaining living contact with the past through identification, transmission and protection of that which is considered culturally valuable and therefore worthy of retaining. Often, the emphasis is on formal concerns, for example, architectural style and the result can be superficial. Central to any system of cultural preservation should be an understanding of the plurality of the culture within the region and the identification of cultural values. Not only will cities have culturally distinct regions and neighborhoods, but there will be architectural diversity within individual districts. Complexity and diversity within a culture underlines the need for a careful review on a case-by-case basis, rather than a restrictive overarching approach. According to Aga Khan, "The loss of [this] inheritance of cultural pluralism – the identity it conveys to members of diverse societies, and the originality it represents and stimulates in all of them – will impoverish our societies now and into the future."

A common method of preserving cultural identity in some cities is through the creation of "historic districts". At best, these protected areas are highly successful livable neighborhoods; in the worst cases, they can resemble "reconstructed villages" – protected enclaves that draw much tourism but ultimately are little more than theme parks. Urban designers now agree that cities, like living organisms, grow incrementally and are most successful when their growth is diachronic, including both old and new. It is equally important for any urban plan to be flexible and adaptable to accommodate change. It is a fine balance of preserving the old, encouraging the new, including

the traditional and the modern, that makes urban life socially, economically and aesthetically vital while maintaining cultural continuity and prosperity.

Architectural context

The style of the architectural heritage is similar throughout the region. The Qatari or Gulf style is a hallmark of the identity of the place known as the Gulf, which specifically includes the countries that border the Arabian Gulf to the east or west, Iran (or what is known as Fariss) and countries on the west of the Arabian Peninsula's shores bordering the Gulf.

The local style is distinct and has characteristics and an identity that cannot be mixed with the styles that surround it. For example, venturing deep into the Arabian Peninsula (the area of Najd specifically), differences in style, construction materials, climate and culture can be observed. This change also occurs in Iran, where a different culture and style emerges travelling inland from the Persian shore.

The architectural style in Qatar and around the region is the result of a group of influences, factors and forces that shaped the local style over many years. These agents can be divided into two realms: social, cultural, religious or spiritual influences, and climatic, geological nature or materialistic components.

After centuries of development, the Gulf style attained a distinct identity during the middle of the twentieth century. In the mid-twentieth century, new influences emerged due to the economic boom from oil production in the area, and the arrival of architects and contractors from different cultures that introduced new construction technologies and materials such as cement.

The character and the cultural, social and religious values of the Arabic-Muslim community in the Gulf have contributed to the space planning and layout of a typical house. For example, Al-Majlis, where the owner of the house meets his guests, is an important component that provides the guests with hospitality and lodging in this space without compromising the privacy of his family. Al-Majlis is located near the entry and separated from the house by a bent entrance (named Dehleez) that serves to block the guests from the yard of the house while still allowing the guests to freely enter and exit the space, as necessary.

Climate in the Gulf area

At the Tropic of Cancer, the climate is dry and humid depending on the time of year, and the wind direction most of the year is North-Western, delivering heat and humidity during the summer. The summer breeze blows during May and June, hot and dry with dust. The Autumn season (known as Al-Sfari season) starts in October, bringing rain. Winter follows with a sharp drop in temperature and cooler northerly winds (Shamal).

The seasonal climate has clearly influenced the planning of the region's typical house. The orientation of the house and the openings are designed to attract the desired breeze, while

protecting the house from the hot breeze and the dust in the summer, or the cold northerly winds in the winter. Climatic awareness is equally shared among the Gulf residents and users of the buildings, and the architects and contractors who design and build them. The exploitation of the positive climatic conditions, while protecting areas from the negative climatic effects, resulted in highly efficient space planning and the lack of electricity was not a hindrance in making the region habitable.

Geological nature and building materials

The geological nature and properties of the building materials in this part of the world greatly affected the formal language of the buildings. For centuries, architects and masons honored the practice of building with local stone and mud mortar, transferring their technological expertise to future generations of builders. Due to the properties of stone and mortar, builders could not build walls more than one meter high in a single day. Instead, they had to wait for the mortar to dry and then proceed higher in daily increments.

Later, column and beam technology emerged, saving both time and construction materials. This method clearly expressed the structural nature of the columns and beams, allowing them to remain visible on the interior and exterior of the building. The column (50 cm x 50 cm) was the optimum size for stone and mud infill, but the use of horizontal beams (Jussur) was essential to stabilize the columns and prevent the walls from collapsing. After reaching a height of two meters, the mason would place wood beams that at the time were imported from East Africa, to horizontally brace the wall. This process was repeated up the wall and a top crossbeam helped stabilize the roof. The spaces between the columns were usually between 90 and 100 cm and had different uses depending on the homeowner's budget.

The structural form and nature of the construction materials lend a unique aesthetic to the architecture of the region. Therefore, the Gulf architectural style can be called "structural architecture" as the columns and beams are clearly visible and define the structural plan. The interpretation of this style in many new works has resulted in unintended misrepresentation and distortion, due to the lack of accurate scientific references for architects and designers.

Gypsum used in plaster is expensive to mine and import. Therefore, it was used according to the owner's budget. Sometimes, it was used in important spaces, such as Al-Majlis (the male guests' reception area) and the entryway of the house, or it was used for the decoration of columns and parapets. The elements of decoration and ornamentation in Gulf architecture are distinct and have features that cannot be confused with the arts of the surrounding areas. Nevertheless, the scarcity of scientific examples required to create an elaborate and objective reference of ornamental motifs in the Gulf style often results in confusion and cultural misappropriation.

Regional architecture is lacking color except for the color resulting from the gypsum plaster on the walls of the house. The coloration that is seen is the result of the interaction of the gypsum with the natural elements

Despite the lack of variations in color, the façades of the buildings are enriched with alternating recesses and protrusions. The shaded verandah, or Al-Laywan, is recessed deep (about three meters) from the exterior sunlight and creates a very dark shadow. The walls built between the columns are recessed about 10 centimeters from the face of the columns, casting shadows that create elegant lines over the building façades.

Cultural park

A cultural park is an area which can be defined and distinguished by historic resources, and the land related to these resources and that which comprises an educational, interpretive and recreational resource for the active participation of the public at large. Cultural parks' purposes are different from most existing parks. They can be archaeological, natural or other types of land and open-air parks and museums. The main goals of a cultural park are the promotion and conservation of the heritage values (natural and man-made) in an articulated form, and in a cultural landscape context.

A cultural landscape embraces a range and diversity of manifestations from the interaction between mankind and the natural environment. The preservation planning for the protection of cultural landscapes should involve historical research; an inventory and documentation of existing conditions; a site analysis and evaluation of integrity and significance; the development of a cultural landscape preservation approach and treatment plan; the development of a cultural landscape management plan and future management philosophy; the development of a strategy for ongoing maintenance; and the preparation of a record of any treatments undertaken and future research recommendations.

6.1.3 GUIDELINES

Urban level

- Urban Form and Structure: This includes the street pattern and forms of development. Consider the scales, alignment and hierarchy of the buildings – for example, the use of compact, urban form. It is also important to study areas of enclosure and convergence. Both form and structure may be affected by the natural topography of the area.
- Uses and Patterns of Activity: This is the range and nature of activity. Consider the anticipated uses and activities the park is intended to serve.
- Neighborhood Dimension: Consider pedestrian and cycle traffic and the scale of experience. Factors to consider include the width of footpaths and bike paths, street furniture, landscaping and whether any vehicular traffic should be allowed within the park.
- Open Space: Consider the role of open/public space and the purpose it can serve as places for people to gather and interact.
- Archaeological Sensitivity: Consider if there are any specific subjects on the site which are historically protected or need historical protection. Determine if the site is of archaeological importance and assess the extent of permissible new development to form the park.
- Urban Response to Natural Environment: Assess how wind and sunlight are regulated at an urban scale. Consider the direction of prevailing winds and solar position. Shade can be provided with narrow streets and strategically placed buildings and vegetation.
- Cultural Resources: Practice stewardship to ensure that cultural resources are preserved and protected and receive appropriate treatments, including maintenance, to achieve optimal conditions.
- Cultural Parks: Support projects, infrastructures and activities that do not damage environmental values (natural and cultural). Ensure a population management participation program to mitigate any impacts on the park.
- Cultural Landscape: Ensure a thorough and shared understanding of all stakeholders, and allocate the necessary resources for the effective management, planning, implementation and monitoring. The focus of management is to guide change and retain the values of the cultural landscape.

Building level

- Facades: Consider the rhythm of buildings within the park, massing and facilities, windows and openings. This should influence the design and composition of the façade and other elements along the street.
- Height: Consider the height of new buildings relative to the existing streetscape.
- Scale: Consider the form and scale of the new development relative to the form and scale of the existing buildings. This is related to but distinct from height as it is relative to the size of the human body and experience of the user. It can be affected by proportion, massing, composition and the setback from the street. Review the scale and proportion of building elements (arches and columns, etc.) and how they relate to each other and the overall composition and space of the building as a whole.
- Lighting: Assess how the building or development will appear at night. Consider the intensity, placement and color of light. Carefully consider what aspects of the architecture are to be highlighted.
- Style: Review how the building relates to the architectural style of the region and surrounding buildings. It does not need to replicate the style but there should be a sensitive response to the style of the existing architectural context.
- Material/Color: Consider the material and color of buildings and surfaces; how the material and color will age, and if this will affect how the building continues to relate to the surroundings. Using local materials and trades is preferable to maintain both cultural and economic value.
- Space: Consider using open space, for example, courts and liwans (galleries), and assess how these spaces relate to more private spaces and to the entry sequence.
- Building Response to Natural Environment: Assess how wind and sunlight are regulated at a building scale. The orientation and placement of buildings in relation to the direction of prevailing winds and solar position greatly influences how they react to the natural environment. Ways to regulate the environment include natural ventilation, use of courtyards and strategic shading.
- Encourage elements that add to the neighborhood's identity.

Innovation

- Outstanding contemporary design can be influenced by and based on an understanding of local vernacular planning and architecture.

National parks, archaeological sites and landscapes

- Protect historical and cultural resources in a natural setting.
- Ensure that adequate resources are allocated for the long-term protection and management of all natural and cultural assets.
- Involve historians, architectural historians, archeologists and interested stakeholders to define, review and revise the historic contexts, goals and priorities.
- Conserve the heritage value and character-defining elements when creating any new additions to an historic place.
- Establish a sense of place by reinforcing place character.

FURTHER RESOURCES

Publications:

1. Birnbaum, Charles A. *Focus on Landscape Preservation*. National Trust for Historic Preservation, 1992.
2. Birnbaum, Charles A. "Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes." *National Register Preservation Briefs*, no. 36, Sept. 1994.
3. Fowler, P. J. *World Heritage Cultural Landscapes 1992-2002*. UNESCO World Heritage Centre, 2003.
4. Holod, Renata, and Hasan-Uddin Khan. *The Contemporary Mosque: Architects, Clients, and Designs since the 1950s.* Rizzoli International Publications, 1997.
5. Jaidah, Ibrahim, and Malika Bourennane, editors. *The History of Qatari Architecture 1800-1950*. Skira, 2010.
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7. Mascarenhas, José M., and Filipe T. Barata. "The Cultural Park as a Platform Connecting Human Ecology with Cultural Landscape Management." *Journal of Mediterranean Ecology,* vol. 6, no. 1, 2005, pp. 11–18.
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6.2 [CE.2] SUPPORT OF NATIONAL ECONOMY

6.2.1 PURPOSE

To maximize the value of construction expenditures benefitting the national economy.

6.2.2 CONTEXT

Procurement of goods or services delivered or manufactured and assembled within the country contributes towards economic growth and provides opportunities for employment.

The concept of a circular economy in the built environment creates a more sustainable, efficient and resilient economy. The construction industry contributes significantly to the national economy as it encompasses the utilization of versatile supply chain elements, including the procurement of materials, workmanship provisions, manpower supply and use of resources.

Domestic sources are, in general, more accessible to end-users than 'imported sources'. Products or services can be delivered in less time compared to external foreign sources. Communication with local businesses for aftersales, exchange or refund of faulty merchandise can be easier than that with international suppliers. Less transportation between the supplier and end-user can also result in cost benefits due to lower transportation costs and environmental benefits due to less GHG emissions and fossil fuel depletion.

Employment opportunities for local people increase as a result of domestic sourcing due to the growth of demand for local goods and services which, in turn, create increased job opportunities to meet the new demand.

The national economy benefits from the increase in domestic sourcing for labor force and goods due to the increase of the circular flow of income. An increase in demand for domestic sourcing can result in more people being hired by local suppliers to meet the increasing demand. These new workforces will spend more money in the local economy, thereby producing a positive multiplier effect. In addition, local sourcing encourages more entrepreneurs to start small businesses which again contribute to the growth of the economy.

6.2.3 GUIDELINES

- Develop a plan to utilize and employ local companies and firms where possible and investigate the availability of products and services in the local market.
- Procure construction-related products, materials and equipment from domestic sources to support the local economy.
- Procure construction-related services that include contracting, consulting, project management and other professional services from domestic sources to benefit the local economy.
- Ensure that the procurement practice provides opportunities to engage local entrepreneurs and new businesses in the delivery of the development.
- Ensure that priority is given to locally manufactured/assembled products over similar products manufactured abroad.
- Increase local suppliers' participation. The positive impacts generated by local businesses include the increased hiring of local labor, higher distribution of profits from operations locally, and a strong likelihood of local reinvestment through the purchase of goods and services.
- Select native trees, plants, groundcover and seeds. Purchase native plants or seeds from local reputable nurseries, botanical gardens or organizations that specialize in propagating native plants.

FURTHER RESOURCES

Publications:

1. Adjei, A. B. "Sustainable Public Procurement: A New Approach to Good Governance." *Proceedings of Green Procurement,* International Public Procurement Conference, 2010.
2. Appiagyei, Ama, et al. "Environmental Considerations in Procurement Decisions: A Literature Review." *Sustainability in Environment,* vol. 1, 2016, p. 40, doi:10.22158/se.v1n1p40.
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7.0 MANAGEMENT & OPERATIONS

The Management & Operations category is concerned with the design of the development for use during the operational phase. The development should plan for and implement sustainable and effective building management and operations practices.

Sustainable building management and operations can mitigate environmental impacts such as water depletion, materials depletion and human comfort and health.

CRITERIA IN MANAGEMENT & OPERATIONS CATEGORY:

MO.1 Systems Commissioning

MO.2 Waste Management

MO.3 Facility Management

MO.4 Leak Detection Systems

MO.5 Safety & Security

MO.6 Landscape Maintenance

MO.7 Sustainability Awareness

7.1 [MO.1] SYSTEMS COMMISSIONING

7.1.1 PURPOSE

To develop and implement a commissioning process that ensures the delivery and performance of the systems within the park.

7.1.2 CONTEXT

Commissioning (Cx) is a process to verify all or a number of subsystems for electromechanical, plumbing, fire/life safety, building envelope, interior systems, utility plants, lighting, wastewater, controls and building security to achieve the project requirements as determined by the development owner and the consultant's design team. Commissioning is quality-focused and necessary in construction projects as it ensures that systems are planned, designed, installed, tested for future operation and work to the best of their ability. Commissioning, when introduced at the start of the design process, is most effective and is one of the most significant factors to ensure long-term success.

The commissioning plan can include the following key commissioning activities:

- Establishment of Commissioning Scope
- Establishment of Commissioning Program
- Establishment of Commissioning Schedules
- Establishment of Testing and Inspection Plans
- Development of Commissioning Specifications
- Determination of Special Testing Needs
- Determination of Operational Staff Training Needs

Commissioning is now a common practice as owners and developers demand more from their investment. The primary objective of the commissioning process is to improve the development from design through to post construction and occupancy.

The commissioning authority or commissioning agent (CxA) is often directly contracted to the development owner to ensure an unbiased performance of the CxA. The CxA may be an employee of the development owner or a subcontractor, architect, engineer, test and balance contractor, or other trade contractor for specific trade testing. Best practice recommends that the CxA be contracted and maintained throughout the design, construction and handover of the development to identify possible operational, installation, testing and performance issues before they become a potential construction issue. The CxA works closely with the owner, design team, principal contractor and subcontractors and is responsible for leading and managing the project commissioning process, working closely in a co-operative work environment focusing on teamwork throughout the design, construction and post-construction phases.

Typically, the CxA prepares the commissioning specification and commissioning plan during the development design phase. The commissioning plan is a live document to outline the commissioning processes and expectation based on the Owner Project Requirements (OPR), the Basis of Design (BOD) and the construction documentation including drawings and specifications.

7.1.3 GUIDELINES

- Consider introducing a commissioning program at the commencement of the project as this can be one of the significant factors for the long-term success in the post-occupancy operational phase.
- Appoint a qualified commissioning party to be responsible for leading the commissioning process, coordinating with the development team throughout the design and construction phases to ensure proper implementation.
- Develop the OPR in conjunction with the project owner and ensure the requirements are quantifiable and measurable to verify that the development objectives will be achieved.
- Ensure that the commissioning plan covers all major building systems, including but not limited to:
    - HVAC systems
    - Lighting systems and controls
    - Electrical systems
    - Water-use systems
    - Renewable energy systems
- Undertake all necessary measures to ensure that all systems are planned, designed, installed, tested and operated to work to the best of their ability under projected occupancy loads and conditions.
- Develop a plan to ensure coordination between team members of all phases, including design, installation and operation. Coordination between phases is necessary to maintain the performance of the building's systems at the maximum efficiency throughout the life of the building.
- Ensure that the commissioning process addresses the performance criteria for each system. The appointed party should review the necessary documents, such as design documents, submittals and field-testing reports, to verify that the building systems are properly designed and installed to perform efficiently.
- Review and verify that the commissioning requirements have been included within the construction documents and development specifications.
- Prepare a commissioning report documenting necessary observations and evidences for the outcomes of the commissioning processes and procedures implemented as determined in the OPR.

FURTHER RESOURCES

Websites:

1. "Building Commissioning." *WBDG - Whole Building Design Guide*, 12 Nov. 2016, https://www.wbdg.org/building-commissioning.

Publications:

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4. *CCL Commissioning Code L: Lighting.* The Chartered Institution of Building Services Engineers, 2003.
5. *CCW Commissioning Code W: Water Distribution Systems.* The Chartered Institution of Building Services Engineers, 2003.
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7. *Commissioning of VAV Systems in Buildings (AG 1/91).* Building Services Research and Information Association (BSRIA) Ltd, 1991.
8. *Commissioning Water Systems Application Principles (AG 2/89.3).* Building Services Research and Information Association (BSRIA) Ltd, 2002.
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11. *HVAC & R Technical Requirements for the Commissioning Process - ASHRAE Guidline 1.1-2007.* American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1996.
12. *Installation and Commissioning of Refrigeration Systems - GPG 347.* The Carbon Trust, 2003.
13. *Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems - ASHRAE Standard 111-2008*. American Society of Heating, Refrigerating and Air-Conditioning Engineers, 2008.
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17. *Pre-Commission Cleaning of Pipework Systems (AG 1/2001).* Building Services Research and Information Association (BSRIA) Ltd, 2001.

18. *Pre-Commission Cleaning of Pipework Systems: Including Advice on Fit-out Works.* 2nd ed., Building Services Research and Information Association (BSRIA) Ltd, 2004.

19. Teekaram, Arnold, and Anu Palmer. Variable Flow Water Systems: *Design, Installation and Commissioning Guidance (AG 16/2002).* Building Services Research and Information Association (BSRIA) Ltd, 2002.

20. *The Commissioning Process - ASHRAE Guideline 0-2005.* American Society of Heating, Refrigerating and Air-Conditioning Engineers, 2007.

21. *The HVAC Commissioning Process - ASHRAE Guideline 1-1996.* American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1996.

22. Welsh, Terry, and Ken Butcher. *CCR Commissioning Code R: Refrigerating Systems.* The Chartered Institution of Building Services Engineers, 2002.

23. Wild, J. *Commissioning HVAC Systems: Guidance on the Division of Responsibilities (TM 1/88.1).* Building Services Research and Information Association (BSRIA) Ltd, 2002.

24. Wilson, J. *CCA Commissioning Code A: Air Distribution Systems.* The Chartered Institution of Building Services Engineers, 1996.

7.2 [MO.2] WASTE MANAGEMENT

7.2.1 PURPOSE

To provide measures for the implementation of waste management best practice during the post-occupancy phase.

7.2.2 CONTEXT

Solid waste management (SWM) is one of the important health and environmental issues the world is currently facing. The primary causes of waste production include an increasing population combined with an expanding rate of resource consumption.

Society can opt to reduce the amount of waste taken either to landfill or for incineration by adopting a solid waste hierarchy as follows:

- Reduce
- Reuse
- Recycle/composting
- Disposal, when none of the other options are feasible

Organic waste is material that is biodegradable from plant or animal sources. Organic waste is usually broken down over time by other organisms and is often referred to as wet waste. Generally, organic waste comprises vegetable and fruit debris, paper, poultry, fish/meat remains and human waste which quickly disintegrate. Organic waste, the mainstream of waste generated, accounts for 50% to 60% of the municipal solid waste with very little being composted. Composting is a practice that can significantly mitigate the health and environmental issues associated with waste generation. Organic waste is more biodegradable than inorganic materials, and the byproducts produced after organic waste has been broken down can be used for composting and enriching the soil.

The growth in the industrial sector has caused an increase in the generation of hazardous waste. This also poses a risk to human health and habitat contamination. Deviation of hazardous waste from landfill is essential to avoid such major health and environmental impacts.

Waste management and/or the generation of waste by visitors, park operations and concessionaires, and the impact it has on both protected areas and adjacent communities is a specific and increasing concern.

7.2.3 GUIDELINES

Organic waste

- Develop an organic waste management plan for the collection, storage, composting and/or recycling of the various organic waste streams.
- Provide sufficient space for sorting and storage of the various organic waste streams.
- Provide sufficient collection points for organic waste throughout the building, especially near concessions and other food service locations where most of the waste is produced.
- Provide collection bins for various waste streams to ensure that building users can easily separate organic waste.
- Consider specifying self-closing airtight systems in areas containing organic waste to prevent risks to human health. These systems can be designed to be operated either automatically or manually, depending on user preference and their intended use.
- Allocate a central sorting and storage area for waste materials.
- Ensure that the sorting and storage areas are properly contained and ventilated to avoid the dispersion of noxious fumes and odors into occupied spaces of the building, which can present a possible health risk or discomfort to building occupants and users.
- Position the organic waste storage spaces close to a vehicular access to facilitate collection and removal.
- Consider, if feasible, on-site composting of organic waste.
- Identify off-site facilities where organic waste can be transported. These off-site locations can be municipal facilities that handle and distribute large quantities of organic material and other smaller facilities that can reuse the material themselves.
- Ensure that all the organic waste material that is generated and collected can be used on or off site.
- Consider using the biomass of generated organic waste as energy. Organic waste generates heat as it is broken down and this energy can be harnessed to provide heat and power for the building.
- Consider, if feasible, the recycling of kitchen generated cooking grease. This grease is not easily disposed of in sewers or landfills and can instead be reused for various processes. For example, vegetable-based kitchen grease can be used in biodiesel-run machines, or other useful applications.
- Increase leaf composting efficiency in parks by installing O_2 composters.

Non-organic and non-hazardous waste

- Facilitate the collection of recyclable materials such as glass, plastics, paper, cardboard and metals.
- Provide facilities for the collection and storage of recyclable materials generated during the operational phase of the development to reduce the amount of waste taken to landfills or for incineration.
- Consider the size of equipment and facilities to be used for recycling management, for example, compactors and wheeled bins, when allocating and designing the collection and storage spaces.
- Consider various recycling management equipment and strategies, including recycling chutes, compactors, balers and individual collection bins located throughout the building to promote and encourage recycling activities.
- Ensure that the collection and storage spaces are clearly labeled for recycling, easily accessible to occupants and facility operators, and situated close to vehicular access to facilitate collection and transport.
- Design properly contained and ventilated sorting and storage areas to mitigate the impact on the building's indoor environmental quality in terms of unwanted odors and disruptive noises from recyclable materials.
- Ensure that the signage within recycling facilities demarcate the bins for various materials to avoid contamination and improper sorting.
- Evaluate possible security measures in cases where recyclable materials are of high value.
- Ensure that the storage capacity is sufficient for the anticipated amount of recyclable materials generated during normal building operations.
- Develop an instruction manual/booklet to educate building occupants and facilities operators on appropriate recycling procedures to maximize recycling rates.
- Include contract clauses for concessions and vendors that require their participation in the recycling program, such as, only selling beverages in recyclable bottles and cans, rather than disposable cups. Otherwise, encourage the use of plastic cups only if they can be recycled.
- Create recycling signs which are clear and noticeable. Use both graphics and words to communicate the types of materials for recycling and ensure that park visitors are aware of the location of the recycling and trash facilities to encourage proper disposal.

Hazardous waste management

- Provide hazardous waste sorting and storage areas in a secure space separate from nonhazardous waste and away from any sources of ignition.
- Provide separated storage areas for different types of hazardous waste to avoid adverse chemical reactions and potential accidents.

FURTHER RESOURCES

Websites:

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3. Division of Planning and Standards. *Best Management Practices for Grass Clipping Management.* Bureau of Waste Management, Department of Environmental Protection, State of Connecticut, 1999.
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7.3 [MO.3] FACILITY MANAGEMENT

7.3.1 PURPOSE

To provide measures for the implementation of facility management best practice during the operational phase.

7.3.2 CONTEXT

The International Facility Management Association (IFMA) defines Facilities Management (FM) as a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology. It is a process of managing and maintaining the facilities, which includes but is not limited to office/living complexes, physical resources, site and any other electro-mechanical systems and utilities for the welfare of building occupants and users.

The benefits of adopting best practice in FM include financial savings related to avoiding costs due to the ignorance of adequate preventive maintenance and increase in return on investment, personnel retention by maintaining a safe, comfortable and pleasant environment, and core business performance due to well-maintained and uninterrupted business operations.

FM is focused on the efficient and effective delivery of support services and is a vital component in the support of an organization to undertake its core business by providing a safe and effective environment to operate in.

The necessary provisions for the implementation of adequate FM in the post-occupancy phase include but are not limited to environmental health and safety, fire safety, security, maintenance and testing, maintenance and cleaning of building fabric and janitorial services.

Parks' FM must invest wisely in the facility portfolio to avoid any failure of critical assets and simultaneously ensure that the necessary processes are in place to adequately and properly sustain the investments, and the assets themselves for future generations. The FM team should directly support the day-to-day operations of the park, park management, contracts/agreements, safety, security, emergency response and support the park employees' ability to perform park operations.

7.3.3 GUIDELINES

- It is recommended that a clear process and collaboration system for planning, design, implementation, management and maintenance is established.
- Increase coordination between local authorities for parks and park maintenance team to identify any gaps or required assistance.
- Consider a commitment to GSAS Operations if the level of facilities management services cannot be established during the design and construction phases.
- Consider the storage of chemicals and cleaning products associated with janitorial services.
- Provide easily accessible space of adequate area for general or specific storage.
- Ensure that all fire systems are adequately designed and implemented with required provisions for maintenance, inspection and testing.
- Ensure that necessary security provisions are implemented for CCTV, access control and general security requirements based on the operational phase needs.
- Develop the Operations & Maintenance (O&M) manuals for all systems and equipment specific to the development.
- Provide adequate provisions to facilitate the works associated with maintenance which may include all preventative, remedial and upgrade works required for the upkeep and improvement of buildings in the park and their components.
- Provide adequate janitorial storage space in terms of area and ventilation.

FURTHER RESOURCES

Websites:

1. "Green Purchasing Guide." *UC Santa Cruz*, https://financial.ucsc.edu/Pages/Purchasing_GreenPurchasing.aspx. Accessed 5 Sept. 2019.
2. "Tertiary Education Facilities Management Association." *Tefma.Com,* https://www.tefma.com/. Accessed 5 Sept. 2019.

Publications:

1. *Facility Management Good Practice Guide.* Facility Management Association of Australia Ltd, 2012.
2. Hodges, Christopher P. "A Facility Manager's Approach to Sustainability." *Journal of Facilities Management*, vol. 3, Dec. 2005, pp. 312–24, doi:10.1108/14725960510630498.
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7.4 [MO.4] LEAK DETECTION SYSTEMS

7.4.1 PURPOSE

To install leak detection systems for major water supply and refrigerant pipes.

7.4.2 CONTEXT

Owners and managers face many unique problems related to undetected water leaks. With buildings and outdoor spaces often being unoccupied overnight, the potential for catastrophic water damage, high insurance claims and reduced revenue is very real.

Water damage is one of the leading causes of insurance claims exceeding, in some cases, fire and theft claims combined. However, the latest advancements in water leak sensing and shutoff technology can divert the potential risk. With air-conditioning refrigerants, fire water pipes, pantries, windows and ceilings, etc, the potential leak sources are both inside and outside the rooms. Occasionally, the leak of water or refrigerant can be dramatic while in other instances the leak can be slower and over an extended period of time, often in hidden or concealed spaces.

Aside from the adverse environmental effects of water and refrigerant leaks, the provision of water and refrigerant leak detection systems help with property (damage) protection and the maintenance of critical systems (continuous) operation. In addition, the detection systems should assist the facility manager and maintenance staff to establish a precise location of the leak, ideally within a short time of detection.

Effective leak detection systems must be capable of detecting major leaks which otherwise might go undetected, thereby reducing the impact on water consumption and depletion and reducing the emission of refrigerants to the atmosphere.

7.4.3 GUIDELINES

- Undertake an assessment for the water and refrigerant networks in the development to determine the potential locations for leaks and identify the associated leak detection mitigation measures.
- Provide a leak detection system to cover the site's incoming/outgoing water supply lines and specific areas within the building where a major water leak might go undetected.
- Provide a refrigerant leak detection system to cover all refrigerant based cooling systems containing more than 200g refrigerant charge.
- Specify systems that offer the advancements in wireless and monitoring technology in addition to capabilities that work well within the specific building portfolio being considered
- Consider automated shutoff valves. Automatically shutting off a water valve when a leak is detected can be very valuable if the property does not have 24/7 monitoring or if the potential water source is close to critical equipment.
- Identify problematic areas where wireless leak detection can be of most benefit. Wireless water leak sensing ensures any development can be fitted with sensors.
- Consider cloud-based sensors to be placed at sites of potential risk. Cloud technology supports the combination of data from all units into a single portal that can be monitored by building operators. Additionally, cloud-based management is not be interrupted by power outages.
- Ensure that the leak detection systems are BMS connectable.
- Select leak detection systems that are not prone to false alarms.
- Consider the installation of leak detection systems that are capable of signaling an alarm through the BMS to ensure the building facility operators are alerted about the leaks.
- Ensure that the water detection system can detect higher than normal flow rates for longer than a pre-set period.
- Consider combining water leak and water sub-metering systems into one system
- Consider, if feasible, the use of a dedicated built-in refrigerant detection system as opposed to using a signal generated by refrigerant auxiliary (pressure loss) contacts.
- Consider, if feasible, specifying a system with an automatic isolation and containment of the remaining refrigerant facility (auto pump-down) in addition to the leak/no-leak detection alarm.
- Ensure that both duty and standby refrigerant based cooling systems are covered by the refrigerant leak detection system.
- Ensure that leak detectors are installed for large landscape areas, for example, golf courses.

FURTHER RESOURCES

Publications:

1. Department of Water. *Guidelines for Water Meter Installation*. Government of Western Australia, 2009.
2. Lahlou, Zacharia M. "Leak Detection and Water Loss Control." *Tech Brief - National Drinking Water Clearinghouse, West Virginia University,* May 2001.
3. Mays, Larry W. *Water Distribution System Handbook*. 1st ed., McGraw-Hill Education, 1999.
4. Satterfield, Zane, and Vipin Bhardwaj. "Water Meters." *Tech Brief - National Environmental Services Center, West Virginia University*, vol. 4, no. 2, 2004.

7.5 [MO.5] SAFETY & SECURITY

7.5.1 PURPOSE

To provide a safe and secure environment for all park users.

7.5.2 CONTEXT

Projects should consider factors that affect the comfort and safety of the users and the surrounding community. Design pedestrian pathways and streetscapes to have clear visibility on each side as well as in open spaces. One of the most important ways the built environment can deter crime is by providing clear sight lines and adequate lighting. The safety of a park is an important aspect of sustainability because it is related to the economic and social vitality of the surrounding community and is vital to the utilization of the site. Therefore, efforts taken to prevent crime within the park serve to further enhance the economic viability and quality of life of its users and the surrounding community.

7.5.3 GUIDELINES

- Locate buildings, spaces and activity areas in relation to one another to maximize visibility and to promote social interaction between users.
- Control access and have a clear distinction between public and private areas of the park.
- Maximize the surveillance of parks and recreational facilities.
- Locate the park in an area that includes mixed-use development to increase passive surveillance of the site.
- Plan small parks or play areas to be clearly visible from adjacent streets. Small parks or edges of larger parks should be overlooked by restaurants, shops, services, housing or offices which increase the volume of foot traffic through and close to the park. Crime and vandalism occur more often in areas that are hidden from adjacent buildings as they do not provide a sense of surveillance.
- Design the project so that open spaces are visible from interior pathways and from the exterior of the park to create a sense of natural surveillance.
- Avoid creating pockets of open space that are not visible from adjacent buildings, pathways, gathering spaces and plazas.
- Ensure visibility and accessibility of entrances and exits of on-site facilities from parking lots and pedestrian pathways to ensure public safety.

- Avoid isolation by positioning benches, trails and play areas adjacent to the perimeter of the park or along the most used paths. An additional method for increasing foot traffic through the park is to incorporate activity generators, such as food kiosks, information centers and areas for events, into the park's plan.
- Place activity generators within the park that draw users to the site at a variety of times during the operating hours of the park, to create a continuous level of passive surveillance throughout the site.
- Design a lighting scheme for all pathways, gathering spaces, plazas and hardscaped areas that provides adequate and uniform light levels, as stated in the IESNA Guidelines. It is important to provide adequate lighting for parking lots and transit stops as well.
- Provide closed-circuit cameras with a central command area to monitor areas of high crime. Additionally, projects can provide trained security professionals to patrol the park and respond to incidents when required. Neighborhood organizations and citizen watch groups can be encouraged to provide additional surveillance for the park. In addition, projects should communicate regularly with municipal crime prevention offices to coordinate crime prevention measures.
- Avoid creating hidden and difficult-to-access areas which can result in security problems or vandalism.
- Enhance the safety of park users by selecting efficient lighting, fencing, building materials and other design components.

FURTHER RESOURCES

Publications:

1. Food for the *Parks: A Roadmap to Success.* Institute at the Golden Gate, 2012.
2. New York. NYC Parks. "A Plan for Sustainable Practices within NYC Parks". web. 07 March 2012. http://www.nycgovparks.org/sub_about/sustainable_parks/Sustainable_Parks_Plan.pdf

7.6 [MO.6] LANDSCAPE MAINTENANCE

7.6.1 PURPOSE

To encourage landscape planning for the ongoing ecological management of habitats and species to protect the natural environment.

7.6.2 CONTEXT

Landscape reflects the relationship between people and place. It is a product of the interaction of the natural and cultural components of the environment, and how they are understood and experienced by people. Maintaining landscape aims to conserve and enhance the value and essential character of the park while continuing to provide and improve facilities and activities for the local community and wider visiting public and engage them in the process. A Landscape Maintenance Plan provides the framework and information describing how the park's landscape will be managed and maintained during the operational phase of the park. It is a tool which enables the ability to capture issues and opportunities for more effective management.

The management of the park should be reviewed on an annual basis and it is intended that the implementation of the Landscape Maintenance Plan will help to fulfil the design objectives over the first five years. The review process is to ensure that the aims and objectives of the scheme are being achieved, and maintenance operations should be refined over the period to respond to improvements in local standards and by incorporating any additional operations required.

Each annual review should be coordinated and completed by a suitably qualified representative. The review should include advice from specialist consultants as required, such as a qualified arboriculturist, ecologist and the Landscape Management Contractor. The review should identify any changes to the condition of the park and circumstances and identify where changes are required in the existing management practices and timeframes.

Any strategic enhancements, including new planting, should be identified and priorities should be established to undertake these works. Within one calendar month of the review, a revised Landscape Maintenance Plan should be produced, if appropriate, and circulated.

7.6.3 GUIDELINES

- Undertake all necessary measures to ensure that the landscape will be properly managed and maintained.
- Ensure that the landscape design is maintained, enabling the planting to mature into a balanced, attractive and mature landscape.
- Develop a plan to include maintenance tasks, including weed control, pest and disease control, thinning, splitting perennials, pruning, planting replacement, fertilizing, mulching, watering, tree firming, stake removal and crown pruning and tree lifting.
- Undertake conservation and enhancement measures for the natural and built environment, historic landscape and biodiversity.
- Include strategies for ensuring the early establishment and healthy growth of all planted trees and the health and structure of mature trees.
- Identify watering requirements and irrigation schedules taking into consideration the needs of each plant species.
- Define strategies and practices undertaken to keep planting areas generally free from weeds, litter and debris.
- Set guidelines for the use of appropriate herbicides to control weed growth, in line with the standard horticultural practice.
- Outline pruning and trimming measures to avoid the obstruction of pathways and signs. Encourage plants to grow to their natural shape unless stated otherwise.
- Maintain grass for a healthy vigorous sward free from disease, fungal growth, discoloration, scorch, wilt, moss, excessive thatch, weeds, worm casts and mole hills.
- Describe the removal of tree protection guards once trees are sufficiently established. Larger trees with support stakes to be checked and adjusted on a regular basis to prevent instances of chafing damage to barks. Removed tree stakes and ties once trees are sufficiently established.
- Describe strategies and procedures for the replacement of dead trees or those felled, but which are not removed as part of a program of thinning or coppicing. Replace trees with an appropriate species and stock size.
- Use an integrated pest management (IPM) strategy to minimize the use of chemical pesticides for the control of plant and insect pests. IPM represents an ecologically based approach for pest control.

FURTHER RESOURCES

Websites:

1. "Escalators & Moving Walkways: Keeping People Moving in Busy Environments." *Stannah*, https://www.stannahlifts.co.uk/products/escalators-moving-walkways. Accessed 5 Sept. 2019.
2. "Escalators and Travelators: What Are Their Advantages in the Modern World?" *Conner Pincus Group*, 30 Apr. 2015, http://www.cpgroup.com.au/escalators-and-travelators-what-are-their-advantages-in-the-modern-world.php.

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2. Clarke, David. *CIS Vertical Transportation Standard.* Engineering & Sustainability Team, The University of Sydney, 2015.
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4. *ISO 25745-1:2012 Energy Performance of Lifts, Escalators and Moving Walks - Part 1: Energy Measurement and Verification.* International Organization for Standardization, 2012.
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7.7 [MO.7] SUSTAINABILITY AWARENESS

7.7.1 PURPOSE

To promote and educate employees, visitors and the wider community about sustainable initiatives and programs associated with the park.

7.7.2 CONTEXT

Parks present a unique opportunity to showcase sustainability efforts and promote environmental awareness. Parks draw a large number of visitors from the surrounding community, with many large parks often drawing users from entire metropolitan regions as well as international travelers. Due to this large visitor base, parks can make a strong case for sustainability and present this information in context.

7.7.3 GUIDELINES

- Incorporate the input and feedback from a range of interested parties to ensure that the project is designed to meet the needs of the intended users of the park and the surrounding community.
- Conduct planning meetings with relevant stakeholders to determine the potential impacts of the project and how to mitigate them.
- Conduct outreach and educational programs to ensure that the project's planning is transparent and understood by the community. Include a range of inputs from relevant stakeholders including residents, organized community groups, environmental advocacy groups, business associations and other interested parties.
- Create a program to promote and educate park users about the sustainable initiatives and features in park design.
- Plan educational programs and seminars that not only focused on the sustainable features of the project but also on the principles of sustainability in general.
- Plan to host park tours for interested parties, including school groups, community organizations and the general public to further educate people about the sustainable design features and initiatives.
- Establish training programs for the park's staff, inspectors and/or contractor to promote and increase knowledge. Alternatively, consider training provided by external sources, local or regional environmental agencies, universities, extension agencies or watershed groups.
- Engage park employees and the public through sustainability education and outreach by appointing and launching "green pledge" campaigns.

FURTHER RESOURCES

Publications:

1. Envirosax: Sustainability Education Resources. San Diego: Envirosax LLC, 2004. Web. 12 April 2011. <http://www.envirosax.com/education_resources>.
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TERMS AND ABBREVIATIONS

A	
ADPI	Air Diffusion Performance Index
ADT	Average Daily Trips
ASHRAE	The American Society of Heating, Refrigerating, and Air-Conditioning Engineers
B	
BOQ	Bill of Quantities
C	
Carcinogenic	Material substances agents with properties known to promote cancer.
CDA	Conformance to Design Audit
CDA stage	The stage of GSAS certification for obtaining the final certificate.
CIBSE	Chartered Institution of Building Services Engineers
Criterion level	The established level of the assessed criterion for meeting the requirement of Level (-1), (0), (1), (2), or (3).
D	
Development	The real estate development or the site development or the building project.
DGI	Daylight Glare Index
DNL	Day-Night Sound Level
E	
Eco-labeling	Labeling of products and materials with enhanced environmental, health and resources conservation attributes.
ETS	Environmental Tobacco Smoke
G	
GORD	Gulf Organisation for Research & Development
Green transportation	Mode of transportation that does not rely on fossil fuel.
GSAS	Global Sustainability Assessment System

GSAS commissioning plan	In systems commissioning, it means a comprehensive document that outlines the commissioning process and the facilities to be commissioned.
GSAS-CM	GSAS Construction Management

I	
IESNA	Illuminating Engineering Society of North America
Illuminance	The measure of the amount of light received on a surface.
Indicator	(X), (Y) and (Z) in the criterion level.
Indicator result	The values of (X), (Y) and (Z) indicators.

L	
Light trespass	Obtrusive light which causes annoyance, discomfort, distraction, or reduction in visibility.
LOC	Letter of Conformance
LOC stage	The stage of GSAS certification for obtaining the LOC.

M	
MDS	Material Data Sheet
MEP	Mechanical, Electrical and Plumbing
MEPF	Mechanical, Electrical, Plumbing and Fire Protection

P	
PMV	Predicted Mean Vote
Project, the	The project stakeholders including client, design team and consultants.

R	
Reflectance	The ratio of the amount of light reflected by a surface over the total amount of light incident on the surface.

S	
Sustainable approach	In facility management plan, it means there is a comprehensive model followed for strategic planning.
Sustainable parking spaces	In eco-parking, it means parking types are designed and built with sustainable techniques.

Sustainable techniques	In eco-parking, it means techniques that mitigate the negative impacts of heat island effect, rainwater runoff and other open hardscapes with no shadings

T	
TAB	Testing, Adjusting and Balancing
T&C	Testing and Commissioning
Transmittance	The ratio of the amount of light passing through the surface over the total amount of light incident on the surface.

U	
ULE	Upward Light Emission

V	
VOC	Volatile Organic Compound

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Building Sustainably

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