Dedication
Our great parents who dedicate their lives for us;
All our family, the symbol of love and giving;
All our friends who encourage and support us;
All the people in our life who touch our hearts and made us who we are today;
I dedicate this book.
Acknowledgement
First people we want to thank is our team; the three team members, Ahmed, Hatem and Shahad for giving us an opportunity to complete this work. We would like to always remember the long nights, concept fights and crazy laughter.

We are grateful our Prof. Rafael Pizarro, who has been always generous during all stages of the workshop. We would like to take this opportunity to say warm thanks to all UPC Members, who have been so supportive along the way of producing this proposal and book.

Last but not least, deepest thanks go to all people who took part in making this book real.
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1.0 Executive Summary

1.1 Executive Summary

Within the framework of a Memorandum of Cooperation signed between the Abu Dhabi Urban Planning Council and the American University of Sharjah in 2016 the project was born out of a request by ADUPC to address, via urban design and planning, the development of a model neighbourhood for contemporary Emirati families on an existing site, situated in the main island of Abu Dhabi.

The fundamental of the project was set in the kick-off meeting with ADUPC. Therefore, the project aims to develop a proposal which explores ideas and alternatives in order to adapt the changes that Emirati communities go through over time; to understand the needs of Emirati families regarding; family size, plot size, the potential of living in duplex apartments and to design upon them. It also aims to design using alternative standards that response to the unique site and demand challenges, as well as to use common practice where applicable to meet people's needs.

The first stage of the project was to have further understanding of the site, through conducting several site visits, questionnaire and interviews.

The site has an area of (80ha) and surrounded by mixed land use, including; military camp, school, governmental entities, hospitality, commercial and residential area known as “E25”. Thus, the proposed project aims to integrate the adjacent land uses and provide pedestrian and vehicle connection to take advantage of them, which will serve the projected population. It also takes into consideration the privacy issues related to the adjacency to sensitive land uses; for example; military camp and the high-rise mixed use development “E25”.

One of the projects objectives is to design for people and to promote walkability. Therefore, the core of the project is designed to accommodate mainly the pedestrian boulevard which runs along the entire site and aims to connect pedestrian to all surrounded land uses. Furthermore, public realm program consists of Barahas and sikkas which aim to link residents and visitors to all parts of the site and to serve as recreational centres. Moreover, community facilities, including; mosques, nursery, early learning centre (as per ADUPC design manuals) are distributed along the boulevard and based on 350m walkable distance catchments to serve as hubs and social interactions centres.

The proposed project aims to promote public transit network. Thus, it looks at the planned public transportation network as per AD 2030 plan, where Metro and LRT routes are planned to be located adjacent to the site. The proposed project, also proposed a bus route, which runs through the site and on both sides of the boulevard. Bus stops are proposed to be located in adjacent to the social hubs and community facilities to serve more users.

Furthermore, the project targets to reduce the significant impact on water and energy and its high demand in Abu Dhabi, through using innovative solutions that suit the design objectives. Hence, international and local case studies were conducted to have further understanding of the demand and adoption of sustainable approaches. This is planned to be achieved by installing different types of solar panels such as solar roads. Therefore, roads are functioned as access routes and to generate energy.
Project Background
2.0 Project Background

2.1 Project Background

UPC Kick-Off Meeting & Mandate

Within the framework of a Memorandum of Cooperation signed between the Abu Dhabi Urban Planning Council and the American University of Sharjah in 2016, the project was born out of a request by ADUPC to address, via urban design and planning, the development of a model neighbourhood for contemporary Emirati families on an existing site, situated in the main island of Abu Dhabi.

Urban Planning Council plays a fundamental role in ensuring that private and public development projects across the Emirate are aligned with the Strategic Framework and associated plans and policies and in doing so will continue to advance the Government’s vision.

During the kick-off meeting with ADUPC, the project’s mandate was set to proceed with the project and to consider the following aspects:

- Proposal for a contemporary Emirati mixed-use neighbourhood, that responds to the rapid changes that the Emirati communities go through;
- Out of the box approach; meaning to understand the current mindset and needs of Emirati Families and provide a proposal with respect to that;
- Critically review UPC manuals for application in projects. Going through UPC manuals that address all aspects of establishing a master plan, including: community facility, public realm, safety & security and so on, to adapt the necessary standards which are associated with the proposed project.
2.2 Context Plan

Regional Context

Al Salam Community site is located in the Emirate of Abu Dhabi, the capital of the seven state federation which makes up the United Arab Emirates (refer to Figure 1.4). Situated directly on the Arabian Gulf, the UAE is central to the majority of the Middle East with most countries within a two-hour flight time radius of Abu Dhabi.

Abu Dhabi City is the federal capital and seat of Government of the UAE, located on and adjacent to a series of islands in the south-eastern corner of the Arabian Gulf. The city has experienced significant growth over the past two decades, and its population of 1.3 million is expected to grow to a projected 2.6 million by 2030.

Its prime location within the Middle East, coupled with its central geographic global position, has assisted in making the UAE a competitive business environment and a leading emerging economy.

Key
- Population
- Air Travel Time

* (Source: UN World Urbanisation Prospects 2009 Update)

Numbers indicate the Populations of Urban Agglomerations in 2009 only
District Context

As shown in Figure 1.5, Al Salam Community is located on the main Island of Abu Dhabi, along the eastern coast and facing important new developments including; Al Reem Island and Al Maryah Island.
Neighbourhood Context

Al Salam Community site extends along Al Salam Road from the eastern side and Al Muroor Road from the western side. These two roads are considered two of the four primary roads that connect the island of Abu Dhabi. Also, the site is surrounded by two secondary roads from the northern and southern part. The unique location of the site provides easy vehicular access for the proposed development.

The site is also surrounded by major landmarks and recreational facilities within the city of Abu Dhabi, including: Al Bahar Towers, Al Jazira Stadium and Delma Park. The aim of the proposed project is to be integrated with the surrounding land uses that will serve the projected population.

Moreover, the site is facing the eastern mangroves waterfront, which offers potential views and connectivity to future activities and facilities that might take place there.
Existing Conditions - Site Photos

The following images are from a site visit conducted in February 2017. They detail the current condition of the site.

Images present the main adjacent existing land uses and developments, including:

- **School**, refer to Figure 1.7 (A): located to the North side of the site. The school is considered as an opportunity due to its proximity to the site; and considered as a challenge due to traffic it generates;

- **Military Camp** refer to Figure 1.7 (B): North-Western the site & Governmental Entities refer to Figure 1.7 (C): South Eastern the site. The proposed project prevent locating high-rise buildings in adjacent to the camp, for privacy as well as safety and security concerns.

- **Sector E25**: refer to Figure 1.7 (D): mixed use community with high-rise towers adjoining with the boundary of the site from the South-Western. The proposed project aims to integrate the adjacent development to serve the projected population.

- **Bahar Towers** refer to Figure 1.7 (E): located to the North Eastern side of the site and it is considered one of the most important landmarks in Abu Dhabi, refer to Figure 1.7.
Towards Military Camp (on the right) & E25 (on the left)

Road Adjacent to E25

View Towards E25 Facade

Access Road to the Existing School and Potential Access to Site.

View Towards the School

View Towards Al Bahar Towers

View Towards the School

View Towards Al Reem Island

View Towards Al Reem Island

Figure 1.116 Site Images
During the kick-off meeting with UPC, several issues, opportunities and challenges have been highlighted; including the following:

### ISSUES

- Proposed project shall consider the site location close to residential villas, governmental entities, business and commercial areas in the heart of Abu Dhabi;
- Project shall address potential traffic increase generated by future development;
- High-rise development, known as “E25” shall be integrated with the proposed project;
- Privacy of residential area adjacent to E25 shall be carefully addressed;
- Project design shall take into consideration multi-generation housing approach.

### OPPORTUNITIES

- School location within a walkable distance;
- Accessibility to the surrounding and adjacent public facilities;
- Visual and physical proximity to Mangroves;
- Easy Access from major thoroughfares, (Al Salam St., Al Muroor St., Delma St., Shakhboot bin Sultan St.).

### CHALLENGES

- The proposed project shall accommodate to designing for multi-generation accommodating population growth and density;
- The proposed project shall take into consideration the existing school adjacent to the site, which generates more traffic;
- The proposed project shall consider the heavy traffic around the site, which hinders the possibility of creating a walkable environment;
- The proposed project shall consider the element of privacy, in particular; the height of vertical block, in adjacent “E25”;
- The proposed project shall take into consideration changing the mind set of emirates who desire plots, to be living in smaller plots as well as apartments instead.
2.3 Bio-Physical Conditions

As a first stage of the project the studio engaged in an analysis of Abu Dhabi climate and weather, solar radiation and vegetation. This will help in the second stage of the project, to develop design strategies which address response to the climate conditions.

Abu Dhabi Climate & Weather

The climatological condition affecting the project is the characteristic of the UAE harsh climate. Abu Dhabi climate is hot arid due to its location in the northern desert belt sub-region. The humidity ratios are high throughout the year and especially at the coastal areas. The average temperature is around 35°C during the months of June until September. Sunny clear skies are probable throughout the whole year.

From April to October the averages temperature are above thermal comfort temperatures and it reaches 47°C in the summer peak and drops to 5°C in few hours for few days a year.

Figure 1.117  Daily Dry Bulb Temperatures, Abu Dhabi (IES VE2012)
Solar radiation

Sky cover range has direct impact on solar radiation and heat transaction as it affects their direct impacts on buildings' envelope and internal spaces. Figure 1.11 shows sky cover averages in Abu Dhabi. The annual average cloud cover is less than 20% which increases the challenging solar exposure conditions in the area.
Vegetation

The vegetation cover in the Abu Dhabi Emirate is scattered due to its harsh climate and limiting soils. The high fluctuation in temperatures, coupled with the aridity of Abu Dhabi coast, partially explains both the widespread occurrence of carbonates and evaporates, and the current restricted character of the vegetation in the region.

The most dominant vegetation type is Mangrove (Mangrove National Park). The natural vegetation has been considerably damaged and nearly destroyed in some places because of the misuse and the lack of proper management. However, it could be predicted that all the coastal lagoons along the coast of the UAE will eventually be filled naturally or by man driven reclamation.
Figure 1.13 illustrates the location of the mangroves right across the site. It is considered one of the site opportunities; in which the proposed project aims to maintain a visual and physical proximity to Mangroves. Visual connection is maintained as part of the design intend, and physical connection is achieved by proposing pedestrian bridge which aims to connect pedestrian with the mangrove national park, in order to integrate and activate this area with the future development.
As explained in the former section, the Abu Dhabi region features a variety of native plant species. In addition to those species two other types of vegetation are commonly found in the city, including: local and foreign trees and flowerbeds used for street landscaping, and gassy lawns typically used in public squares, round about and parking lots. The project, however, will avoid foreign species and instead use native species in all public landscapes. Doing so will result in many advances such as:

- Lower water consumption (More water available for other usages);
- Less time and work (Decreases manpower and saves energy);
- Preserve the NPS especially that are disappearing due to urbanization;
- Maintain the natural habitat for local wildlife;
- Retain the Emirat’s unique horticultural identity;
- Strengthening capacities for drought & climate change impacts management.
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<td><strong>Ornamental Plants</strong></td>
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<tr>
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<td>Malvaceae</td>
</tr>
<tr>
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</tr>
<tr>
<td>Arundo donax L.</td>
<td>Gramineae</td>
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<tr>
<td>Caralluma spp.</td>
<td>Asclepiadaceae</td>
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<tr>
<td>Convolvulus arvensis L.</td>
<td>Convolvulaceae</td>
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<tr>
<td>Dianthus spp.</td>
<td>Caryophyllaceae</td>
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<tr>
<td>Leptadenia pyrotechnica (Forssk.) Decne</td>
<td>Asclepiadaceae</td>
</tr>
<tr>
<td>Moringa peregrina (Forssk.) Fiori</td>
<td>Moringaceae</td>
</tr>
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<td>Rumex vesicarius L.</td>
<td>Polygonaceae</td>
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<td><strong>Aromatic plants</strong></td>
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<td>Cymbopogon commutatus (Steud.) Stapf</td>
<td>Poaceae</td>
</tr>
<tr>
<td>Cymbopogon schoenanthus (L.) Spreng</td>
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<tr>
<td>Ductrosia anethifolia (DC) Boiss.</td>
<td>Apiaceae</td>
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<td>Pulicaria glutinosa Jaub. &amp; Spach</td>
<td>Asteraceae</td>
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<td><strong>Poisonous Plants</strong></td>
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<td>Calotropis procera (Alton) W.T.Alton</td>
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<td>Chenopodium album L.</td>
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<td>Solanum nigrum L.</td>
<td>Solanaceae</td>
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*Figure 1.126 Native Vegetation Scientific Names*
2.4 Socio-Cultural Conditions

Abu Dhabi Demography

Abu Dhabi city total population consists of 2,784,490 where 1,831,741 of them are males and 952,749 of them are females, refer to Figure 1.13 Population Statistic for Abu Dhabi City on page <OT>. In fact, males are double the number of females that is sensible due to the large number of men-power in construction fields. 20% of Abu Dhabi's population comprised of citizens while the remaining 80% is expatriates.

Abu Dhabi Economy (Employment)

According to the Household Expenditure and Income Survey (HEIS) in 2007, the annual average household consumption expenditure in 2007 for national households was AED 29,904 annually on average, compared to AED 25,228 spent by non-national household and AED 12,026 by collective households, refer to Figure 1.20.

Figure 1.21 shows the percentage distribution of employed population by work sector and gender in a bar chart and by main occupation, refer to Figure 1.20.

Having a knowledge about all the information discussed, would help us to identify an estimated number of jobs required for the project's residents, the type of jobs and the expected average monthly salary. Therefore, housing affordability and financing can be determined from this information. According to the above data, the expected monthly income per Emirati household is AED 22,000 while this amount is AED 12,000 for expatriates. This offers a mixed-income housing development that includes diverse types of housing unit's i.e. single and multi-family housing units and apartments for both citizens and non-citizens with different income levels.
Figure 1.128 Annual Average per Capita Consumption Expenditure 2007

Figure 1.129 Percentage Distribution of Employed Population (15 Years and over) by Work Sector & Gender
3.0 Development Vision

3.1 Development Intend

This section highlights the overall vision of the development, and some of the key themes and objectives which have been integral to the formation of the Master Plan Stage.

VISION STATEMENT

Al Salam Community project vision is to allow residents to live in a unique community, and to have a memorable experience by creating an attractive, sustainable, vibrant and healthy destination for the city of Abu Dhabi.

Al Salam Community aims to reflect an understanding of the Emirati values, traditions and culture. The Emirati Neighbourhoods aim to encourage and maintain the social interaction between the families. Thus, it aims to inherit those precious values, with a contemporary approach.
The vision for Al Salam Community reflects an understanding of the Emirati values, traditions and culture. The Emirati Neighbourhoods aim to encourage and maintain the social interaction between the families. Thus, the vision aims to inherit those precious values, with a contemporary approach.

The vision for Al Salam Community aims to create axial green linkages which provide different experience for pedestrians and cyclists. Those green linkages aim to attract people and function as social hubs, to create interactive and vibrant community. Green linkages have different and unique character, including meydan, sikka and mosque public plazas, however they all work to enhance the natural and the built environment.

The vision for Al Salam Community aims to promote contemporary and healthier lifestyle through an integrated movement system. This cohesive system focuses on pedestrian movement, cycling network, future public transit, including; metro and LRT route as well as bus route. The vision also intends to provide shared streets on all local roads to give priority to pedestrian instead of vehicles. This will improve the community health and will create a more efficient system that attracts Emirati and expats to live in.
The project focuses on enhancing connectivity with the surrounding land uses. This has been achieved through some design principles; first, through interface with the mixed use development adjacent to the site “E25”, by providing a medium dense mixed use apartments, to create an active façade, facing E25. Second by offering a recreation facility, which the existing Delma Park in adjacent to the site. This aims to create an active and vibrant edge to the project and functions as extension to Delma Park. Lastly connectivity to mangrove, across the site through a pedestrian bridge which aims to connect pedestrian with the mangrove national park, in order to integrate and activate this area with the future development.

The project aims to provide a mix of uses that serve the projected population. The project offers a range of residential typologies that targets Emirati families as well as expats. Thus, the majority of the project is covered with residential land use. The project also offers commercial facilities; including retail as well as food and beverage, in addition to community facilities to meet people needs. Another essential land use is recreational and open space facilities, which aim to attract people and create an interactive and vibrant community.

The project provides a variety of recreational facilities and open space. It aims to create surrounding land uses, as an opportunity to axial green linkages across the entire site in serve the future population. Moreover, the order to create a sufficient pedestrian and project provides community facilities that cycling network. As part of the project public are compliant with AD UPC Community realm strategy objectives is to offer Facility Manual. Thus, it offers three pedestrian, cyclists and drives unique mosques, neighbourhood centre, nursery experiences throughout the site. Hence, the and early learning centre, as well as some site proposed different open space retail, food and beverage facilities. typologies, including: Meydan, Baraha and Community Facilities are distributed on a sikkas as well as streetscape typology within walkable distance of 350m the project ROWs. Furthermore, the open space treatment within the site aims to be used to provide shading and cooling effects to improve the hot weather condition.
One of the most important design drivers is providing a pedestrian boulevard that runs along the entire site. The project also aims to integrate different public transit modes (future Metro and LRT as well as Bus network) which will serve the projected population and decrease generated traffic. Furthermore, the primary road network which connects the site with the surrounding main roads while the local road network are designed to be shared streets, which provide accessibility to plots and promote walkability as the project’s main objective.

The project aims to offer a range of housing typologies that respond to the rich social Emirati values and meet their needs as well as provide all comfort aspects. Those typologies comprise of courtyard typology, which includes 2, 4 and 6 small units within the same plot. The four units’ configuration forms a courtyard in the middle that is used as a shared space for the four units. The proposed layout targets big Emirati family and cherishes the social values. Another typology is the apartment typology which targets the Emirati new married couples or a small family. Those apartments are situated at the eastern western side of the site, overlooking the boulevard and in distance from the mixed use development (E25), for more composed purposes.

The project’s objective also is to offer two apartment typologies for expats that is proposed to be located in adjacent and facing the E25, and seek higher levels of services and amenities. The other typology is proposed to be located along Al Salam Road, which aim to create a gateway and an edge to the site.

The project aims to integrate basic sustainable approaches and innovative technology solutions to reduce the high dependency on energy, and to generate energy. Thus, the project aims to have solar panels, which is planned to be located on parking and pedestrian shading structures, as well as road solar panels. Road solar panels allow using roads as a source of generating energy, instead of having them for vehicles movement only.
3.2 Proposal

As shown in Figure 1.127, the proposed concept divided the site using a rigid system, due to the irregular site area and boundary, which aims to reduce the site inefficiency. This was driven by introducing a green boulevard, which runs along almost the entire site. It functions as the main pedestrian spine and the focal point and element for the site. It works to activate the development with retail, food and beverage as well as recreational and community facilities. The green spine has some green fingers that extend to different parts of the development, which creates a stronger pedestrian network and work to direct people to the main spine, as well as, it creates pocket parks which serves the population on the local level.

Community Facilities are calculated as per UPC standards and all are distributed on a walkable distance of 350m catchment. Both recreational and community facilities work to provide a more exciting pedestrian experience.

Land use mix and distribution is driven by multiple aspects, including; adjacency to high-rise development (E25), where the proposed development offers a mixed use mid-rise apartment facing (E25), to form as a barrier and provide privacy for the low-rise residential units within the site.

Furthermore, the plan focuses on the connectivity and integration; site connectivity and integration to the surrounding, through connectivity to the mangroves and recreational facilities including; Delma Park, as well as connectivity within the site, by improving pedestrian experience along public realm.

On the housing level, the idea of the multi-generation Emirati family which aims to preserve the rich social Emirati values is introduced by having small units; where built form layout creates a central open space or a courtyard. This configuration offers an Emirati housing of 2, 4, 6 units; each depends on the family size. Another typology approach which targets small Emirati Families or new Emirati married couples is the apartment typology.
3.3 Character Zones

The proposed concept consists mainly of seven character zones, which are the results of the plan rigidity and the project objectives. Character zones aim to provide users with diverse and unique experiences throughout the entire site, where each zone offers certain urban architectural and public realm characteristics. The character zones are as follow:

1- Boulevard; mixed use (Residential / Retail / Food & Beverage / Community Facility)
2- Apartment adjacent to E25
3- Apartment adjacent to Bahar towers
4- Apartments facing Al Salam Road
5- Residential Courtyards
6- Community Facility
7- Park (Extension to the existing Delma Park)
Emirati Neighbourhood
4.0 Emirati Neighbourhood

4.1 Emirati Housing Analysis

Good planning is a practice that spans past, present and future. Learning from the past, interrogating present urban developments, and critically drawing on diverse resources and community vision to plan for future generations must be conscientiously observed before any development.

It is only after a thorough research that one could start planning a place, ensuring a traditional and ordinary pathway that everyone enjoys; mixed with the practicality the future has to offer. Hence, three distinct Emirati historic neighbourhoods have been selected in order to satisfy the past studies and analyses; Heart of Sharjah in Sharjah, Jazira Al Hamra in Ras Al Khaimah, and Bastakiya in Dubai.

Historic Neighbourhoods

Looking at the three locations, their similarities are what come to mind. First, the Heart of Sharjah's house structures closely resembles Al Bastakiya's. They both focus on courtyard houses, as the communities were designed for predominant and prosperous individuals. However, Jazira Al Hamra is a much quieter, aged neighbourhood, with Arish housing built out of Palm fond with flat roofs. These houses were mostly considered as Emirati summer houses, as they provided natural ventilation. While studying these figure ground relationships, several typologies are found repeated.

Figure 1.24 represents the three different areas were chosen to be to studied:
In the Heart of Sharjah, the housing typologies predominantly use figure grounds that usually have one side of the wall open, either towards the outside or a wider doorway. Figure 1.25 (1) demonstrates three sides of the house having walls, while one side is open to a larger area.

In Jazira Al Hamra, even though there were slight typologies of completely bare walls, the prominent ones ended up having four-side structures, with one true courtyard. Although it was a temporary Arish house, they still ended up having a courtyard.

Back in Bastakiya, patterns identical to Sharjah can be spotted, having central courtyards surrounded by heavy structures, refer to Figure 1.25 (1).

The analysis shows that Emirati housing typology configuration in the three cities, Sharjah, RAK and Dubai went through multiple alteration phases, however, the final outcome consists of the one design principle is to form a central courtyard or an open space that functions as the heart of the typology. This courtyard is either surrounded by three sides or four sides mainly for privacy purposes.
Barahaat

Barahaat are spaces between homes that are located in a small number of key positions throughout the Fareej. There are usually a small number of Barahaat to create focal points for residents to come and interact with one another, ensure maximum use and provide a focus for a larger number of people. Layout allows the community to interact better with each other and build long-term chemistry along the way.

The heart of Sharjah’s predominant locations consisted of large, open blocks with several houses surrounding them. While in Jazira Al Hamra, a narrow and longer stretch of openings could be observed. Bastakiya, being similar to Sharjah, has larger openings as well, but are connected by thinner pathways.
Sikka

The smallest elements of public space, Sikkas are narrow streets that link neighbourhoods together. More specifically, they link each home both to neighbours and to community facilities. Shaded by the buildings they run along, Sikkak provide cool, safe, walkable routes to destinations, allowing for more practical routes for people to take into consideration when commutating around the city.

By observing sikkas in the three areas, they all seem to share identical typologies amongst them. They all are narrow with thin corridors that meet at different angles. They usually never met at a 90-degree geometric setting with each other.
4.2 ADUPC Mandate

As part of the study and investigation about the definition and the original form of the Emirati neighbourhood, the group examined ADUPC Manuals as requested and advised by UPC team. Below is the definition of Emirati Neighbourhood, according to ADUPC Manuals;

“A group of homes large enough to accommodate an extended Emirate family clustered around a courtyard or park.”

This concept is based on:

- The traditional organization of Emirati settlements which reflects the high importance of family relationships
- Families to share the central courtyard
- Privacy is ensured by the cul de sac entrance that keeps out through traffic.

As shown in Figure 1.28, the Emirati neighbourhood is illustrated as group of stands alone villa, which are clustered around a public courtyard of open space. Privacy factor was determined by the internal walls of the built form in comparison with the historical Emirati neighbourhood analysis in the formal section, typology shift has occurred over time and lead to a new housing typology which is identified as central built form that is surrounded by open space, where privacy is secured by external boundary walls.
3.3 Emirate Neighbourhood as per the Proposed Project

Based on the historical Emirati neighbourhood analysis and Emirati neighbourhood as per ADUPC, the project has taken into considerations the elements of the Emirati neighbourhoods and it is designed upon them. Refer to Figure 1.29,

**Courtyard Typology**

The units configuration forms a courtyard in the middle that is used as a shared space for the four units. The proposed layout targets big Emirati family and cherishes the social values.

**Central Open Space / Courtyard /Community Facility**

Recreational and open space facilities as well as community facilities are distributed on a walkable distance of max. 350m. Those facilities are situated in the centre of the neighbourhood so that all residential typologies are clustered around it to create a focal point or an activity node within each neighbourhood.

**Baraha & Sikka**

The proposed Emirati neighbourhood offers a network of green wide baraha and linear narrow sikkas, which are surrounded by houses to enhance and encourage pedestrian movement. It also works to connect users to adjacent neighbourhoods within the site, in addition to connection to surrounding land uses.
Urban Form
4.0 Urban Form

4.1 Urban Context

Existing Site Axis Spatial Analysis

Four major landmarks create an axial alignment across the entire site, were observed as part of the site structural analysis. Its purpose is to maintain the visual connection to each of these landmarks, as illustrated in the adjacent diagram.
Four major landmarks create an axial alignment across the entire site. Its purpose is to maintain the visual connection to each of these landmarks, as illustrated in the adjacent diagram.
4.2 Existing Built Form Analysis

During conducting the site analysis stage, it was observed that the study area has variety of urban forms; from villas (local housing) to high rise towers. Most of residential communities which consist of central open. At the same time none of the surrounded blocks/typology seem adequate for the residential neighbourhood to be developed on the site.

The study area contains five types of urban form:
**Area A:**
It contains residential villas community located at the west side of the site and it has the VIP housing community with closed compound of villas urban fabric and it has an open space used as an area of asphalt for car parking.

**Area B:**
It is a high-rise towers community with a grid any open space. The street pattern is a grid shape and without any open space

**Area C:**
It contains an apartments with 3 to 7 stories heights. Clustered as U shape with a middle spaces used as a parking for the resident of the apartment

**Area D:**
This type of urban form closed site of residential villas with a fence as a gated community

**Area E:**
Also is contains villas apartments with 3 stories heights. Clustered as U shape with a middle spaces used as a parking for the resident of the apartment

To sum up, finding an urban form & building typology for the proposed project, in which response to the surrounding typologies will be challenging. Furthermore, one of the main challenges is the Adoption of contemporary traditional urban form typology that responses to the existing urban form.
Existing Building Height Analysis

Building heights in the study area have been controlled. Study area has variety of building heights from G+2 (villas) to G+27 high rise towers and most of the high rise towers Site has an edge of high rise towers from south.

Main challenge is the privacy issue, it shall be study later on design stage by design a primary development controls to manage the scale of development so that it relates to the context and desired future character of an area and manages impacts on surrounding development. Primary development controls should include building height, floor space ratio, building depth, building separation and setbacks. When applied together, the primary development controls create a building envelope.

Figure 1.143 Existing Building Heights
4.3 Proposed Built Form

Proposed Figureground Plan

The urban form “figureground” shows the proposed development as medium density. It also illustrates that density distribution within the development, where it is denser at the corners and edges of the site to create a smooth transition in height and gradually density gets lower towards the heart of the site. The master plan includes 6 housing typologies, where 4 types are apartments, one residential courtyard and others for community centres.
Form A: Residential Courtyard Villa
Height: G+2
Number of Units: 2 or 4 or 6
Emirati Families

Form B: Apartments Facing E25
Height: G+7
Expats
Form C: Residential Apartment Facing Al Salam Road
Height: G+7 to G+9
Expats

Form D: Apartment Adjacent to Bahar Towers
Height: G+6
Duplex Apartments
Young Emirati (Small Family/New Married Couple)
Form E: Boulevard Apartment Buildings
Height: G+2
Mixed Use Apartments (Residential/Retail/Food&Bevarge/Community Facility)
Mixed of (Emirati & Expats)

Form F: Community Centre
Height: G+1
Mixed Use Community Facility/Retail
Existing Building Height Analysis

Proposed development has a variety of building heights ranging from G+2 (for residential villas) to a Max. of G+11 for high-rise apartments. The design aims to respond to one of the main challenges of this project, adjacency to high-rise development (E25), throughout creating mid-rise apartments to provide more privacy for the private villas.
4.4 Considerations for Outdoor Spaces

Geometry

Four different street ratios were simulated to validate the effect of H/W ratio in relevance with the sky view factor ‘SVF’ shown in Figure 4 which is basically the openness of the cluster to the sky. An inverse relation has been approved between the H/W ratio and the air temperature. Whereas the lower H/W ratio (0.5 and a SVF of 0.87) contributes to higher air temperature levels than that H/W of 4 and SVF of 0.37 with maximum difference of 3 degrees Kelvin. Yet the H/W ratio of 2 achieved the most appropriate balance in relation to the SVF of 0.54. Furthermore, the more shade is provided within the spaces the dimmer they become, and hence the more energy is needed for lighting especially for the surrounding structures. Therefore, Toudert and Mayer (2006) accompanied the SVF with the analysis of the H/W ratio.

Orientation

The orientation factor appears to be less sensitive to the air temperature variations when compared to the W/H ratio of the space. Furthermore, orientations with higher solar exposure require deeper spaces (larger H/W ratio).

Figure 9. Various orientations tested through simulation by standardizing the H/W ratio.

Source: Toudert and Mayer, 2006
Figure 1.157 Orientation (Sun Analysis)

- Streets have to be oriented to the east-west direction (Angle 185)
- The H:W ratio is 2:1 in order to provide convictent shadow
- The building wide facade has to face the sun direction (Angle 275)
- Narrow sikkas to provide shade

Figure 1.158 Recommended Orientation (Sun Analysis)
Wind Analysis

The wind blows on Abu Dhabi comes from different direction:

Northwest: cool wind blows most of the year (the most favourable)  East: strong wind blows rarely (has to be avoided)  Southwest: carries dust most of the time (has to be avoided)

The most challenging aspect is to provide an ideal street orientation in order to maximize shade and cooling; which are not subjected to the same orientation.

Figure 1.159 Wind Analysis
Figure 1.160 Orientation Analysis & Recommendation (Wind Analysis)
Building & Climate
Climate varies around the globe and indigenous architecture used to respond to local climate through the use of natural heating and cooling methods that were not reliant on mechanical systems, as well as natural and local materials.

By understanding climatic conditions that are specific to a project's location, design & planning teams are able to develop climate responsive building/Urban designs. The result is a neighbourhood that utilizes less energy and provides a high quality and comfortable environment for the occupants.

Microclimate
Due to the high humidity and temperature levels, wind and shading are the two main factors required to enhance the environment. The main goal is to create shaded spots within various parts of the space with high wind breezes that enhances the thermal comfort sensation of the users. The main concern in hot climates generally is the solar exposure, which increases the heat absorption within the space. The wind factor is the aspect differentiating the climatic needs of hot humid and hot dry climates in which wind is highly recommended when designing urban spaces in humid climates.

Bio-climatic Design
A bioclimatic approach for design is based upon integrating the microclimatic factors surrounding a building or a space to minimize the energy consumption on various levels and enhance the comfort conditions of an individual within such space (Centre for Renewable Energy Sources and Savings, 2010).

Achieving a bioclimatic approach for the design of outdoor spaces primarily depends on a deep understanding of all the parameters of the surrounding natural environment. Two factors need to be considered regarding a green design initiative are (Gaitani et. al., 2005):

- The natural factor such as the microclimate of the space
- The man-made factor which is the urban setting surrounding the space.

Both of these two factors are responsible for achieving a passive design.

The objectives of Bio-Climatic design are:

- Minimizing pollution and CO2 absorption.
- Providing a dense green buffer zone along the periphery of the site to act as a wind shelter and enhance the microclimate.
- Locating plants along streets to enhance the cooling effect through shading.
- Providing greenery in all open spaces in and around the site with various densities.
- Applying a central water source in the park to increase the cooling sensation during hot summer days.
- Choosing carefully hardscape and construction materials to match the microclimate.
Noise Analysis

The site is surrounded by major vehicular network and variety of mixed-use developments and public facilities. Each generates different level of noise, which has an impact on the future development. Figure 1.4, illustrates the levels of noise with percentages in relation to the source of the noise. It highlights the scale of the noise from (0 to 100), which is estimates as follows:

- 20%-40%: low noise, generated by the governmental and educational developments, south the site;
- 40%-60%: mid noise, generated by the mixed-use developments, south-west the site;
- 60%-80%: high noise, generated by the high vehicular network, through Delma Road, west the site;
- 80%-100%: high noise generated by the high vehicular network, through Al-Salam Road, north the site.

To sum up, several strategies need to be taken into considerations when designing the future developments, to reduce the noise caused by the existing heavy vehicular network and adjacent developments. These strategies can include, buffering, planting and landscaping along the major source of noises to minimize its undesirable impact.

Figure 1.161 Noise Analysis
The site is surrounded by highways, primary road network and mixed use developments. This generates various levels of noise that have an impact on proposed future developments within the site boundary.

Recommendations

The proposed future development will provide noise buffers with landscaping (tree planting along the heavy noise areas).

Very High Noise Source

High Noise Source

Mid Noise Source

Low Noise Source

Governmental & Educational Development

Road

Figure 1.162 Noise Analysis due to Site Location
Master Plan
6.0 Master Plan

6.1 Estimated Project Program

The integral size of the site area consists of 80 hectares, which is about 800,000 sq.m. According to the UPC mandate and survey results, which were conducted in stage 1 of the project, the project identifies residential area of 65% of the total project area with several residential typologies (between Villas and apartments). Thus, projected population of 4434 is calculated upon the above information, refer to Figure 1.54.

All community and recreational facilities is calculated as per AD UPC Manuals and Standards that is triggered by the total projected population, refer to Figure 1.54.
6.2 Land Use Plan

Existing Land Use Plan

The site is located in a rich vitality area with many facilities, offices, hospitals, malls, schools and residential area which provides housing for higher and middle-income earners. The residential area serves both Emirati nationals in private villas or VIP communities and non-Emirati nationals in apartments, district hotels and high-rise towers (Figure 1x).

The study area is divided approximately into Thirty four percent (34%) of residential, twenty five percent (25%) of mixed use residential-commercial, three percent (3%) of mixed-use offices commercial, three percent (3%) of educational, seven percent (7%) of governmental, four percent (4%) of healthcare and hospitals, two percent (2%) of industrial and eight percent (8%) of institutional. The rest of the study area fourteen percent (14%) considered as recreation and divided into open spaces and stadiums with percentage of ten percent (10%) and four percent (4%) respectively (Figure 2x).

In conclusion, the study area has a good balance of land use in proximity of the site. Moreover, proposed location will be served by offices, retails and community facility.
Proposed Land Use Plan

The proposed project offers mixed uses that serve the projected population. The project offers a range of residential typologies that targets Emirati families as well as expats. Thus, the majority of the project is covered with residential land use. The project also offers commercial facilities; including retail as well as food and beverage, in addition to community facilities to meet people needs. The majority of the commercial facilities are along the boulevard, to create an active frontage hence interactive community.

Another essential land use is recreational and open space facilities, which aims to create axial green linkages across the entire site in order to create a sufficient pedestrian and cycling network. As part of the project public realm strategy objectives is to offer pedestrian, cyclists and drives unique experiences throughout the site. Hence, the site proposed different open space typologies, including: Meydan, Baraha, sikkas , sport facilities, as well as streetscape typology within the project ROWs.

The project also provides community facilities that are compliant with AD UPC Community Facility Manual. Thus, it offers three mosques, neighbourhood centre, nursery and early learning centre. Community Facilities are distributed on a walkable distance of 350m and aim to serve the future population.
6.3 Community Facility

Community Facility Analysis

To ensure that appropriate community facilities are designed and provided for all, the UPC have set some standards through “Abu Dhabi Community Facility Planning Standards” document. Referring to this document, the number of these facilities as well as the gross floor area for each can be determined. For instance, the minimum number of residents served by each neighbourhood centre is 6,000 therefore; this proposal with total population of 12,000 needs maximum two neighbourhood centres. Every neighbourhood centre requires a community centre with minimum GFA of 750 sq.m. Hence, this proposal needs two community centres. Similarly, it needs two early learning centres (nurseries) and two police stations.

For development proposals with a population of 12,000 – 29,999 residents, one medium clinic can be provided.

As for parking lots, considering the real-life situation for car ownership in the UAE as well as sustainability guidelines, dedicating two car parks per family, requires 3,710 parking lots within the project that would take up 92,750 sq.m area.

The diagram below illustrates the possible facilities’ catchment areas for a sustainable town. It splits the town into home place (local), neighbourhood, district and city level. It reflects the degree of permeability for both walking and cycling by showing the distance of each facility from home.

Following the two guiding concepts of the UPC manuals and the principles of a sustainable neighbourhood, the accessibility criteria reflect them jointly. Both concepts have been merged, updated and adjusted in a way that the sustainable neighbourhood principles are considered and adapted to the local UAE neighbourhood facilities principles.

According to the diagram, within the local distance which is not more than 600 meters, there should be facilities such as Barahas, nurseries, shops, daily mosques, bus stops, local parks, community centres, tram or light rail stops, primary schools and clinics. As shown in figure 3, implementation of the concept on the site demonstrates both the existing and missing facilities. It is evident that practically all the mentioned facilities are missing in the 600-meter proximity. This indicates the necessity for providing the essential facilities within the local distance all over the site.
Similarly, within the neighbourhood distance which is not more than 2000 meters, facilities such as playing fields, Friday mosques, Maydans, secondary schools, district centres, leisure centres and major natural green spaces should be accommodated. Studying the surrounding areas of the site reveals the missing facilities such as playing fields, Friday mosques, Maydans and leisure centres. Noticeably, there are some educational institutions from primary schools to university level within the neighbourhood distance.

In district level that is not exceeding more than 8000 meters, a technical college, general hospital and an Eid mosque should be provided. A general hospital is the only missing facility amongst all.

Within the city level, which is not more than 15000 meters, a city hall and major theater should be accommodated.

Figure 1.171 Community Facility within Neighbourhood Context (Outside Project Site)
Proposed Community Facility Plan

The project also provides community facilities that are compliant with AD UPC Community Facility Manual. Thus, it offers mosque, social centre, nursery and clinic. Community Facilities are distributed on a walkable distance of 350m and aim to serve the future population.
6.4 Master Plan
Figure 1.173 Al Salam Community Master Plan
Figure 1.174 Al Salam Community
Figure 1.176 Renders for Emirati Villas within Al Salam Community
Mobility
7.0 Mobility

7.1 Transport Network

Existing Transportation Network

Transit, vehicular circulation and pedestrian movement are best integrated to support a more cohesive urban form and block structure. This chapter highlights the comprehensive existing as well as proposed transportation, pedestrian and cycling network serving the future development.

Vehicular Network Analysis

Figure 1.65 illustrates street figure ground around the site. It highlights three different types of road network, including primary roads with heavy traffic vehicular network; secondary roads with medium traffic vehicular network; and lastly local roads with low traffic vehicular network. This explains how the development is highly dependent on cars and vehicles.

The site is surrounded by two primary roads, which are considered important links to the island of Abu Dhabi; to the North is Al-Salam Highway; and to the South is Al-Muroor Road. Whereas, Delma Street and Shakhboot Bin Sultan Street are considered secondary roads, that link the site with the major roads and generate medium traffic vehicular network around the proposed development. Local roads are distributed around the urban blocks and provide access points to the different land uses and developments around...
the site refer to Figure 1.66. The site is accessible through three existing access points. One from Al-Salam Roads and the other two access points are through Delma Street.

Potential vehicular network shown in Figure 1.66 will connect the various existing neighbourhoods around the site with the proposed development. Potential continuation of the existing road network is projected to connect the site with the surrounding developments. Moreover, strategic connection points through the primary, secondary and local roads are proposed to access the proposed development.

As previously explained in the Master Plan Chapter, the site is located in adjacent to Block E-25, which is one of the most important mixed-used developments around the site; it consists of residential, retail, offices and community facility land uses. Therefore, four potential access points are proposed to connect E-25 to the proposed development, refer to site images in Figure 1.66. The main purpose is to offer and serve the future population and provide variety of services. In addition, anticipated access points are located directly through Al-Salam Road; one is to connect existing school with the future development and the other is opposite to the Mangroves zone. Other potential points are distributed to the east of the site to provide access from the variety of governmental entity.

In conclusion, the proposed vehicular network aims to connect the site with the various neighbourhoods and centres of the surrounding developments, through an effective and efficient hierarchy of roads. It seeks smooth vehicular flows and prevents traffic congestions, due to the existing heavy vehicular traffic network, which is generated by the existing facilities; and the projected traffic network due to the projected population.

Public Transportation Network Analysis

Figure 1.66 demonstrates the network for multi-model transportation Network through the island of Abu Dhabi, according to Abu Dhabi 2030 Plan. There are two modes of public transportation; which are planned to be located around the site; Metro, Light Rail Transit (LRT) in addition to the existing bus network. The Metro corridor is planned to run through Al-Muroor Road south to the site, along with two stations. One of the Metro stations is planned to be located in adjacent to the Jazira Stadium, which is considered one of the landmarks within the study area. Whereas, LRT corridors is planned to run through Airport Road, in parallel to Al-Muroor Road. Existing efficient bus network runs through the major roads of Abu Dhabi, including Al-Muroor and Airport Road. The stops are strategically spaced to ensure maximum catchment of the city and minimize walking times. The city-wide bus network provides interconnected and permeable routes throughout. Thus, the proposed public transportation network plan follows three themes:

- Public transport provision at key community facilities
- Fully integrated transit system with multiple interchange opportunities between modes
- Public transport stop/station provision within 350m for the vast majority of the resident and employee population.

To sum up, the planned and existing public transportation network aims to reduce vehicle usage and hence traffic volumes and pressure on parking demands.
Future Public Transportation includes Metro alignment, which is planned to be located on Sultan Bin Zayed First Street, adjacent to the site. Two metro stations are proposed to be located on the same road. Metro alignment is considered as an opportunity to the site and its future development.

Due to potential heavy vehicular traffic through the site, the future proposed parking will be located at the perimeter of the site to avoid any congestion.
Public Parking Analysis

As illustrates in Figure 1.67, the car oriented city of Abu Dhabi, demands a big parking provisions. The figure demonstrates all public and semi-public parking within the study area, in the form of surface and structure parking. It also shows surface parking within the site boundary. This is a temporary parking, which will be removed.

In conclusion, site proximity to many job places such as; offices, governmental entities, educational facilities, retail and education facilities, offer the opportunity to reduce surface parking standards within the future development.
7.2 Public Transport Network

Proposed Vehicular & Public Transit Network

Figure 1.68 illustrates the proposed vehicular network, which is characterized by primary road around the boulevard, which connects the development with Al Salam and Al Muroor Road, and local roads that connect each neighbourhood with the primary road. The figure also demonstrates the public transit network around and within the site, that includes future metro route, LRT route (as per AD 2030 Plan), and proposed bus route which is planned to be located around the boulevard to serve all visitors and reduce traffic impact.
7.3 Proposed Street Cross Sections

Figure 1.181 Arterial Road – (36m) ROW

Figure 1.182 Local Road – (20m) ROW
Figure 1.183 Street View (Primary Road Network)
Figure 1.184 Street View (Secondary Road Network)
Public Realm
8.0 Public Realm

8.1 Pedestrian Movement

Existing Pedestrian Movement

Figure 1.73 highlights the existing pedestrian network around the site, which is characterized by the sidewalks along the streetscape within the primary and secondary road network, as well as local roads. It also illustrates pedestrian bridges, which are situated along Al-Muroor Road.

The existing development is highly dependence on vehicles, thus it is essential to plan for a provision of high quality walking corridors around and throughout the entire future development. Potential pedestrian connection is shown in Figure 1.73, to connect the existing pedestrian movement with the proposed development and to establish a hierarchy of pedestrian network, which aims to create a pedestrian friendly environment. Moreover, it plans to connect the major recreational sites within the study area with the future development, through a series of pedestrian crossing in the format of pedestrian bridges across the main roads and signalized or raised table across the secondary road network.

Those sites include:

- Mangroves area opposite to the site, where activities take place, such as kayaking;
- Delma Park to the west of the site, which is a new neighbourhood park with several play grounds;
- Mushroof Park to the south of the site; it’s a new destinations for family, young and kids. It hosts several activities such as; outdoor cinema;
- Al Jazira Stadium

To sum up, potential pedestrian network will link predominantly to the key trip generators and attractions such as residential areas, neighbourhood centre, mosques, schools, recreational areas, and public transport facilities. Furthermore, all future roads within the development will be configured with pedestrian facilities with dedicated pedestrian paths along key links.
The site is surrounded by mixed use developments, governmental, educational and other public facilities which will foster pedestrian movement into and around the site. Potential pedestrian movements are highlighted in the adjacent diagram, to connect the site with all the above amenities.

Figure 1.185 Existing & Potential Pedestrian Network
8.2 Proposed Pedestrian Movement Plan

Figure 1.74 illustrates pedestrian network within the development. It identifies the boulevard area as a primary pedestrian network, while all other connection from and to the boulevard as secondary pedestrian connection.
Figure 1.187 Primary Pedestrian Movement through the Main Boulevard (Adjacent to Villas)
Figure 1.188 Primary Pedestrian Movement along the Main Boulevard
Figure 1.189 Secondary Pedestrian Movement
Figure 1.190 Pedestrian Movement along Streetscape
Figure 1.191 Pedestrian Movement along Streetscape
8.3 Proposed Open Space Plan

Figure 1.80 highlights the open space within the development. It consists of the main pedestrian boulevard that accommodates active frontages with commercial facilities as well as special landscape treatment with water feature. It also demonstrates the Meyaden, Barahas and sikkas within the development. Sketches and 3Ds in the following pages illustrate the landscape design for some area of the proposed project.
Figure 1.193  Section A-A (through Delma Park Extension)
Figure 1.195 Sketch along the Boulevard
Figure 1.197 Sketch through the Proposed Lake
Figure 1.198 Proposed Sport Facilities within the Development
Figure 1.199 Proposed Baraha (Park/Open Space) to Serve Apartments Adjacent to Al Bahar Towers
Figure 1.200 Proposed Baraha (Park/Open Space) to Serve Apartments Facing Al Salam Road
Figure 1.201 Proposed Baraha (Park/Open Space) to Serve Residential Villas
Figure 1.202 Proposed Baraha (Park/Open Space) within Community Centres
Sustainability
9.0 Sustainability

9.1 Infrastructure Analysis

Vision

Abu Dhabi being the capital and located by the sea, has been of great importance for its rich identity and culture, therefore its future is carefully visioned in Abu Dhabi's Plan 2030. According to Plan Abu Dhabi 2030, the water and energy is of great importance for the country to develop and serve the people with their basic demands.

It is already known that water is threat for its high consumption and its dependency on limited sources at the current time. “As a desert city, Abu Dhabi faces a significant resource imperative related to water. While desalination represents an obvious solution to future water needs given Abu Dhabi’s proximity to the Gulf, it is expensive both in terms of energy and dollars, as well as its potential cost to the environment due to the production of brine concentrate that must be disposed of. Only 4% of the water in use today is reclaimed from wastewater streams, a logical source of future irrigation. As Abu Dhabi moves forward in its planning, a water balance model must be established and managed rigorously.

In order to overcome these challenges placed ahead, it is important to understand the current conditions, the proposed sustainable conditions, and then recommend solutions for water and energy for the future of Abu Dhabi.

Current Water Conditions

First of all, FEDWA states that there are two main water sources in Abu Dhabi where the people’s water demand comes from: ground water and desalinated water. The water allocation in Abu Dhabi [Figure 1-1] is rigid where only 51% of ground water is used for agriculture and irrigation uses, 37% from desalinated water is used for industrial and domestic, and 12% of recycled water goes to Landscaping and irrigation. With that being said, there is a big gap that cant be left unnoticed with recycled water. The total unused recycled water is up to 45%, whereas wasted recycled water is 55%, refer to Figure 1.94.

![Figure 1.203 Water Allocation in Abu Dhabi](image)
Moreover, a detailed view to what people are currently consuming from water is shown in Figure 1.95, to understand in depth where Abu Dhabi stands today compared to the world with water consumption per capita. The world water consumption differs from one region to another with a maximum of 300 litres per day per person and an average of 250 litres per day.

Today, Abu Dhabi consumes twice as much, side by side to the world, with a maximum of 695 litres per person, and an average of 622.5 litres per day. As known, water consumption is a global concern and is estimated to rise more due to population growth etc. Abu Dhabi is heading to a water crisis in the near future if actions aren’t implemented.

In addition to where Abu Dhabi stands today with the consumption, Figure 1.96 explains the high demand is on desalinated water. To get a more accurate over look, Abu Dhabi is compared to other two regions: Al Ain and Al Gharbia, which also rely on desalinated water. The obvious result ends with Abu Dhabi estimated being twice as much as the other two regions together. This gradual rise from 2011-2015 emphasis how Abu Dhabi itself should consider sustainable water approaches. (ADWEC)
Sustainable Water Conditions

Now that the existing conditions are stated, the following step to see what are the sustainable conditions or proposed factors to water consumption in the world is necessary. Abu Dhabi is at 695 litres per person, where as an average of 100 litres per person Figure 1.97 is where water stands in countries like Australia, London, and Africa. This number sets an average to what people actually need and how much water should be consumed for drinking, washing, and showering.

For our project, the proposed population living on the site will be 12,000 people. With a current water consumption of 695 litres a day, the total amount will be 8,340,000 litres per day, on the contrary to being 1,200,000 based on the sustainable world consumption of 100 litres only.

The consumption of water in a household averagely around the world falls under several categories to clarify how we use water. Figure 1.98 demonstrates that a household, averagely consisting of 5 people, are using 1325 litres per day for the following: Toilet 26.7%, shower 16.8%, faucet 15.7%, clothes water 21.7%, leaks 13.7%, and others 5.3%.

According to ADWEC, we can save about 30% of water consumption in Abu Dhabi by just using grey water instead of potable water for household usages. Figure 1.99 visualizes how this minor replacement can make a difference from 695 litres per day to 530 litres per day.

Sustainable Water Solutions

There are several initiatives that can be approached to water efficiency. In order to develop our project we can refer to these solutions. First of all, grey water recycling which has several benefits to how it can replace potable water for household uses. Because the groundwater in Abu Dhabi is high in salinity, grey water reduces the need of using potable water, which is currently the direction. It also reduces the amount of wastewater that enters the sewage, which aids in the vision of Plan Abu Dhabi 2030, for a better ecosystem and conservation. It helps as well is irrigation as it increases plant growth, refer to Figure 1.100.
A second approach is to have traditional wetlands (Figure 1.101) working as the mangrove, the identity of Abu Dhabi, implemented in the project as green spaces of wetland.

The benefits of the wetland are various. First, it helps to cool down the environment, an urban heat island. Also they store water and buffer common ties from bad impacts of floods. It will support diverse wildlife in the community as well. In addition, it is a great design in itself that serves as landscape and a recreational element. It will provide open space that will enhance the residential/community value.

Furthermore, ADWEC explains the average electricity consumption per person in Abu Dhabi is 20.39 Megawatts (Mwh/Y), whereas the global average is 2.89 Megawatts (Mwh/Y, which is shocking to be seven times higher, refer to Figure 1.103.

Current Energy Conditions

In the region of Abu Dhabi, Al Ain, and Al Gharbiya, the electricity demand all together shown in Figure 1.102 demonstrates how Abu Dhabi has a high demand from 2010 – 2014. Abu Dhabi alone consumes 32,575,456 megawatts per hour per year. It is a huge gap, more than double the consumption of Al Ain 10,390,745 Mwh/Y and Al Gharbiya 9,874,836 Mwh/Y (ADWEC). To know why the electricity consumption in 2010 was 24,850,010 and in just four years it had a big rise, we should see how other people in the world are consuming energy. (ADWEC)
Sustainable Energy Conditions

The United Arab Emirates' demand has been increasing in comparison with other developed countries. In comparison to other countries in the world: Kuwait, Qatar, United States, Australia, and the United Kingdom (Figure 1-14), the UAE is considered to be neutral in its consumption. There are means that can decrease usage similar to the United Kingdom for a better sustainable project.

Sustainable Energy Solutions

As seen in Abu Dhabi’s Masdar City, there are energy efficient systems for a sustainable living. One of the known approaches is solar energy replacement, refer to Figure 1.105. It is recommended to have solar energy because it can help decrease the energy consumption when it is installed as panels in the house, or used as a special land use underground.

An important and interesting approach is the micro wind turbine demonstrated in Figure 1.106. Not only are they practical and don’t take a lot of space on a house, it will convert the kinetic energy in wind into clean electricity and drive the generator.
Last, is the conversion of waste to energy that can be implemented in the project to collect waste, such as providing waste bins throughout the project for specific type, and later transformed to energy that will be used according to demand, refer to Figure 1.107.

All in all, this project located on a strategic and central location in Abu Dhabi, will attract many residents with promoting sustainable, efficient low energy designs.

9.2 Proposed Infrastructure Strategy

Energy Solutions

The project aims to generate energy according to the demand needed. In order to achieve that, several solutions have been chosen during the design phase of the project. These are as follows:

• Solar panels on paved road & cycle path
As we all know, roads and carriageways are mainly used by vehicles and all local roads function as an access to the residential units. Thus, in order to make a real use of these lands, it should accommodate for multi-functional land. Having solar panels will function to generate energy for the proposed project and projected population. These panels are coated in a special silicon film that helps protect them from the weight of trucks.
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Same case applied for the cycle paths.
Figure 1.217 Solar Panels on Roads and Cycle
• Shading structure with solar panels

Any project in this region; and due to the weather conditions, aims to provide shaded pedestrian paths to encourage walkability and to create vibrant communities. Thus shading devices and structures are needed all the time. The project introduces a variety of shading structures which consists of solar panels and function as shading structure and as energy generators. Those structures can be installed for car parking shading structures and for pedestrian shading devices which also considered as an aesthetic element to the environment.
Figure 1.218 Solar Panels on Shading Structure
References
10.0 References

Abu Dhabi 2030 Plan
Abu Dhabi Urban Planning Council Manuals
Abu Dhabi Statistics Centre