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**معايير التنمية المستدامة في المناطق ذات الحساسية البيئية**

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**المخلص**

يُعد تحقيق التنمية السياحية المستدامة في مصر أمرًا بالغ الأهمية للحفاظ على الموارد الطبيعية التي تمثل عوامل الجذب الأساسية في المناطق البيئية الحساسة. فمنذ منتصف ثمانينيات القرن الماضي، ركزت التنمية السياحية في مصر على المناطق الساحلية مثل الساحل الشمالي والبحر الأحمر لما تتمتع به من إمكانات لتحقيق عوائد اقتصادية سريعة ومنافع اجتماعية. إلا أن هذا التركيز على النمو السريع غالبًا ما أغفل الاعتبارات البيئية، مما أدى إلى اختلالات في التنمية الاجتماعية والاقتصادية والثقافية للمجتمعات المحلية. على جانب آخر، تم إهمال العديد من المناطق الغنية بيئيًا، مثل واحة سيوة، الأمر الذي حدّ من قدرتها على المساهمة في تنشيط السياحة المحلية والدولية. ورغم ظهور بعض المبادرات السياحية الفردية في واحة سيوة، فإن العديد منها لم يراع مبادئ السياحة المستدامة، مما ترتب عليه آثار سلبية بيئيًا واجتماعيًا واقتصاديًا. وتتناول هذه الدراسة المبادئ والمعايير الأساسية اللازمة لتحقيق السياحة المستدامة في المناطق البيئية الحساسة، ولا سيما تلك التي يشكّل فيها النظام البيئي الطبيعي والمحميات أساس الجذب السياحي. كما تهدف إلى وضع إطار منهجي لتصميم منشآت الإقامة السياحية المستدامة يحقق التوازن بين الحفاظ على البيئة، والجدوى الاقتصادية، وتنمية المجتمع المحلي. وتسهم نتائج الدراسة في تعزيز الفهم لدور تصميم النُزل البيئية في دعم السياحة المستدامة في المناطق البيئية الهشة.

الكلمات المفتاحية: التنمية السياحية المستدامة، تصميم الفنادق البيئية، المناطق الحساسة بيئيًا، واحة سيوة

**Sustainable Development Standards in Environmentally Sensitive Areas**

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## Abstract

Achieving sustainable tourism development in Egypt is crucial for preserving natural resources, which are the primary attractions of environmentally sensitive areas. Since the mid-1980s, tourism development in Egypt has focused on coastal regions such as the North Coast, the Red Sea due to their potential for quick economic returns and social benefits. However, this emphasis on rapid growth has often overlooked environmental conservation, leading to imbalances in local communities' social, economic, and cultural development. Additionally, many ecologically rich areas, such as the Siwa Oasis, have been neglected in national tourism strategies, limiting their potential contributions to domestic and international tourism markets. While some individual tourism initiatives have emerged in Siwa, many have failed to incorporate the principles of sustainable tourism, resulting in adverse environmental and socio-economic impacts. This study explores the key principles and criteria necessary for sustainable tourism in environmentally sensitive regions, particularly where the natural environment and protected areas form the foundation of tourism appeal. The research aims to establish a methodological framework for designing sustainable tourist accommodations that balance environmental preservation, economic viability, and community development. The findings contribute to a broader understanding of how eco-lodge design can support sustainable tourism in ecologically fragile regions.

**Keywords:** Sustainability, tourism development, Eco-lodge design, environmentally sensitive areas, Siwa Oasis.

### 1. Introduction

Sustainable tourism development seeks to meet the needs of tourists and local communities while conserving natural resources, protecting the environment, and preserving archaeological sites, historical landmarks, and cultural heritage for future generations [1]. Achieving this objective requires balancing economic returns for tourism investors with social benefits through the involvement of local communities, in addition to safeguarding natural, historical, and cultural tourism assets to ensure their long-term sustainability. Protecting natural attractions and upgrading existing



resorts and services in accordance with sustainable development principles are also essential to maintaining the global competitiveness of tourist destinations.

The relationship between the environment and sustainable tourism development is based on several key axes, including maintaining ecological balance in natural tourism areas, ensuring the availability of qualified human resources capable of managing sustainable tourism development, and achieving harmony between natural resources and human activities through environmentally compatible planning and design, particularly in facilities such as eco-lodges [2]. Sustainable tourism development further relies on core pillars such as sustainability and continuity, stakeholder participation, and capacity building. Training and educating local communities are especially important in environmentally sensitive areas to promote responsible tourism practices that align with sustainability principles [2].

In contrast to traditional tourism development, which often overlooked environmental considerations and resulted in resource depletion, sustainable tourism follows an integrated and systematic process. This process includes environmental assessment, legislative review, strategic formulation, eco-sensitive planning, effective implementation, and continuous monitoring and evaluation to ensure environmental balance and long-term sustainability [3]. Egypt is characterized by a wide diversity of natural attractions, including marine, desert, and ecological environments, which has led to the emergence of numerous environmentally sensitive areas. To protect these valuable ecosystems and ensure their sustainable development as tourist attractions, the state has designated several protected areas that preserve their natural components and support their role in attracting tourists, researchers, and nature enthusiasts [4].

**1.1. Research Problem:** Despite Egypt's abundant natural and ecological resources, tourism development in environmentally sensitive areas has largely relied on traditional, growth-driven approaches that emphasize quick economic gains at the

expense of environmental protection and social sustainability. This has led to environmental degradation, inefficient resource use, limited involvement of local communities, and the inability of many tourism projects to achieve long-term sustainability, especially in fragile ecosystems such as the Siwa Oasis. In addition, the absence of a clear and integrated planning and design framework defining sustainability standards for eco-lodges highlights the need to assess existing practices and develop scientifically based criteria to support sustainable tourism development while preserving environmental and cultural values.

**1.2. Research Hypothesis:** The research assumes that adopting integrated standards for environmental planning, architectural and landscape design, efficient infrastructure, and local community participation in eco-lodge development improves the sustainability performance of tourism projects in environmentally sensitive areas. It also posits that eco-lodges designed in harmony with local environmental conditions, traditional building practices, and community involvement can achieve a balanced relationship between environmental conservation, economic viability, and socio-cultural development.

**1.3. Research Aims:** This research aims to establish comprehensive environmental planning and architectural design standards appropriate for tourism development in environmentally sensitive areas, assess the compliance of existing eco-lodge models with sustainable tourism principles, and analyze the relationship between eco-lodge design and its environmental, climatic, and cultural context. It also seeks to evaluate the role of local community participation in achieving sustainable tourism development and to develop a methodological framework and design criteria to guide architects, planners, and decision-makers in creating sustainable eco-lodges in fragile ecosystems, with particular emphasis on the Siwa Oasis.

**1.4. Research Methodology:** The research follows a descriptive–analytical approach that combines theoretical study with applied case analysis. Relevant

literature on sustainable tourism, environmental planning, eco-lodge design, and community participation was reviewed to identify key sustainability criteria. Based on these criteria, a set of urban, architectural, environmental, and operational evaluation standards was developed and applied to a case study of Tazriy Eco-lodge in the Siwa Oasis. Data were gathered through field analysis and a structured questionnaire administered to specialists in architecture, urban planning, and environmental design, using a five-level assessment scale. The data were then statistically analyzed to assess sustainability performance and to develop a methodological framework for eco-lodge design in environmentally sensitive areas.

## **2.Sustainability standards of an eco-lodge in environmentally sensitive areas**

### **2.1. Environmental planning standards**

#### **2.1.1. Choosing a Location for Sustainable Tourism Development**

When selecting a location for sustainable tourism development, several factors must be considered to ensure its success and long-term viability. Proximity to tourist activities that rely on natural attractions, Accessibility via main routes, allowing for easier development and visitor access, Potential for future expansion, including additional accommodations and services, Remoteness from noise and disturbances typically caused by major transport networks, Availability of necessary infrastructure to facilitate supply and development [4].

#### **2.1.2 Respect for contour lines at the location**

- Exploit natural gradients at different levels in the general location formation process to preserve visibility.
- Preservation of natural land formation and location's homogeneity with block formation.
- Separation and distribution of different uses of tourist facilities.
- Optimal exploitation of contour gradients in designing infrastructure networks and pedestrian paths and reaching different levels, car routes, and service routes [5].

### **2.1.3. Used urban texture and its compatibility with climate characteristics**

In sustainable urban development, the design and arrangement of urban textures must account for climate characteristics to enhance both environmental performance and the comfort of its inhabitants. Several key factors need to be considered to ensure urban textures are compatible with climate conditions:

- **Shading and External Spaces:** Urban texture must provide adequate shading for external spaces to protect users from direct sunlight and heat, improving thermal comfort and reducing the need for artificial cooling. This can be achieved by strategically placing structures and vegetation that block excessive sun exposure.
- **Reduction of Solar Radiation:** The design of facades and rooftops should minimize the impact of solar radiation. Techniques such as reflective materials, green roofs, or solar shading devices help to reduce heat gain on buildings, improving energy efficiency and reducing the urban heat island effect [6].
- **Air Movement Consideration:** Air circulation is essential in urban design. Properly planned urban textures enhance natural ventilation, especially in pedestrian paths and public spaces, promoting comfort and reducing the need for mechanical ventilation systems [7].
- **Separation of Different Uses:** Effective urban texture design ensures clear zoning and separation between different uses—residential, commercial, recreational to reduce conflicts noise, and improve the overall functionality of the urban environment.
- **Provision of External Spaces:** Urban textures should provide functional and aesthetic external spaces that support social interaction, recreational activities, and pedestrian movement. These spaces must be flexible and cater to the community's needs, enhancing the area's overall livability.

- Incorporating these considerations into urban texture design leads to more sustainable, energy-efficient, and comfortable urban environments, improving the quality of life for residents and visitors alike.

#### **2.1.4. Sustainability bases of landscape elements**

Landscape elements are crucial in shaping an eco-lodge's final form, especially in vast, remote areas away from tourist attractions. These elements must be chosen carefully to ensure ecological compatibility with the location and support the overall sustainability of the site. Key principles include [8]

- **Ecological Compatibility:** Landscape elements should harmonize with the local environment, particularly in remote areas. This ensures that the design is aesthetically pleasing and environmentally responsible.
- **Maintenance and Viability:** Landscape elements must be easy to maintain and renovate without disrupting the functions or activities carried out in these spaces. This ensures long-term sustainability and minimal environmental disruption.
- **Use of Native and Desert Plants:** Using local, drought-resistant plants suited to the area's climate is crucial for maintaining biodiversity, reducing water consumption, and ensuring that the landscape is in tune with its natural surroundings.
- **Natural Materials:** The use of local raw materials in gathering spots and main paths helps reduce environmental impacts and ensures that the materials are compatible with the surrounding natural landscape.
- **Protection of Pedestrian Paths and External Spaces:** Proper design of pedestrian pathways and external spaces protects these areas from wear and tear, ensuring their functionality and aesthetic value are preserved over time.

- Environmental Benefits of Landscape Elements: Landscape elements can help improve environmental quality by directing and purifying air, reducing dust, and cooling the air before it reaches the building. This helps create a comfortable microclimate and reduces energy needs.
- Integration with Building Design: Landscape elements are key to the comfort and attraction of the eco-lodge, enhancing the guest experience by providing relaxing, natural spaces that complement the architecture and overall design.
- Environmental Equilibrium: Green spaces, including plants and green areas, help form a cohesive, sustainable unit between built structures and the surrounding natural environment. These elements are essential in creating balanced urban spaces that enhance environmental and social sustainability.

## **2.2. Environmental design standards [9]**

Building blocks orientation (Residence units-restaurants-recreational closed spaces)

- There is a need to provide good natural ventilation inside external spaces.
- Reducing thermal transmission from the external ambient to the internal ambient.
- Visibility and ascertaining that residence units are oriented towards distinct visibility elements inside the location.
- Natural lighting should be provided to reduce the use of artificial lighting for energy consumption rationalization.

Construction materials [10]

- Selecting construction materials from the local environment, rationalizing the transportation process, and using traditional energy sources are also important.
- Use of construction materials with substantial thermal capacity.
- Considering the expended energy needed to produce and operate construction materials,
- Reuse, recycling, and substitution potentials.

Designing the building's external envelope [11].

- Choice of thermal insulation and construction materials capable of reducing thermal transmission.
- Cladding from local construction materials is used.
- Connected walls reduce the number of facades subjected to solar radiation.
- Light colors should be used on exterior facades to reduce absorption of solar radiation.
- treatment of surfaces and facades to reduce the surface exposure to direct solar radiation.
- Considering the design of openings ratios: Ratio of air inlet opening to the outlet opening.

#### Consideration of standards for preserving the architectural aspect

- The eco-lodge's architectural aspect reflects the area's cultural and civilizational background.
- This aspect considers the area's climate elements and the building's character through the eco-lodge's external envelope elements.
- Taking into account this aspect during the design of open urban spaces and interior design of spaces.

#### Respect for construction requirements and laws set by the State

- Percentage of the building density and the built surface from the total surface of the plot of land on which the building is constructed.
- Respect the natural environment and do not establish any immovable or movable facilities that have an adverse effect on the natural environment.
- Taking into account the permitted and licensed heights, which depend on the location's nature, respecting the specified requirements according to each area, and respecting the urban aspect surrounding tourist facilities.
- Respect for the building's fire, security, and safety code requirements.

#### Sustainability of designing and operating infrastructure networks

- Using renewable energy sources: Solar energy is used in electricity generation works, water heating, and wind energy to generate electrical energy.
- Infrastructure networks: Obtain the main requirements (Water and electricity) from the public network and provide sewage networks.
- Recycling wastes: Sewage treatment, recycling and using greywater in irrigating crops, and safe disposal of black water without any negative impact on ecosystems.
- Treatment of waste resulting from tourist facilities: Following up the principle of waste separation during usage and dealing with specialized companies in sorting, recycling, and transporting waste.

#### Local community participation

Participation in the tourist development process is essential for ensuring that local communities are actively involved in shaping the outcomes of tourism projects. This process starts with the location specification, where local input is crucial to ensure the area's suitability for tourism while respecting its natural and cultural characteristics. During the design phase, the local community should be consulted to share their opinions on the proposed plans, enabling the tourism developers to incorporate their insights and concerns into the design. In the operation phase, local communities' benefit through training programs such as schools, institutes, and courses, which prepare them for jobs in the tourism sector, ensuring sustainable employment opportunities. Additionally, developing tourism infrastructure, such as roads, airports, and public services, provides long-term benefits to local communities, enhancing the area's sociocultural and economic development. This inclusive approach fosters local support and contributes to the sustainability and success of the tourism project [12]

#### Environmental feasibility studies

- Preliminary studies of the project during the design and evaluation phase after the end of the design phase.

- Evaluation in the different execution phases after project completion and during operation.

### **3. Analytical study of one of the eco-lodge's models (Tazriy Hotel-Siwa-Egypt)**

One of the local experiments of an eco-lodge in an environmentally sensitive area in Swia will be analyzed and evaluated according to the required sustainable development standards to reach an evaluation of the sustainable touristic development standards to establish a design framework and sustainable environmental design criteria.

#### **3.1. Methodology followed in the analysis**

The study analyzes Tazriy Hotel in areas that have special ecosystems. The following methodology has been used in the analysis:

##### **3.1.1 Basic information about the hotel**

-Hotel location and general description-Hotel Components-Hotel space

##### **3.1.2 Questionnaire form design**

-Questionnaire form preparation includes the hotel's description, location, basic information, and main and secondary evaluation standards to measure how far they achieve sustainable development. These forms were addressed to specialists (Officials working in urban and architectural design offices, consultancy experts, and university professors). 300 forms were prepared for the previous authorities. The statistical analysis of all data obtained from the questionnaire revealed an evaluation of how far these hotels realize the most significant principles of sustainable tourist development, as shown in Table (3). Then, a methodology was developed for designing hotels in natural areas.

#### **3. 2 Structure clarifying evaluation standards**

The following structure (Table 1) shows the primary and secondary standards concluded from the theoretical study, which was used in the questionnaire form to evaluate how far Tazriy Hotel-Siwa-Egypt realizes sustainable touristic development concepts.

Table (1) Urban and Architectural Design Evaluation Criteria

<b>Primary Standards</b>	<b>Secondary Standards</b>
<b>First: Planning considerations</b>	<ul style="list-style-type: none"> <li>– Respect for contour lines at the location</li> <li>– Urban texture compatibility with climate characteristics</li> </ul>
<b>Second: Environmental design considerations</b>	<ul style="list-style-type: none"> <li>– Orientation</li> <li>– Construction methods and materials</li> <li>– Building's external envelope design</li> <li>– Preservation of the architectural aspect</li> </ul>
<b>Third: Sustainability bases of landscape elements</b>	<ul style="list-style-type: none"> <li>– Exterior spaces' suitability to the function</li> <li>– Viability for maintenance and renovation</li> <li>– The extent of landscape elements' compatibility with the local environment</li> </ul>
<b>Fourth: Design sustainability and operation of infrastructure networks</b>	<ul style="list-style-type: none"> <li>– Use of renewable energy sources</li> <li>– Efficiency of infrastructure networks</li> <li>– Recycling wastes</li> </ul>
<b>Fifth: Local community participation</b>	<ul style="list-style-type: none"> <li>– In choosing and determining the location</li> <li>– In design-execution-operation phases</li> </ul>

### 3.3 Reasons for choosing the model:

- Eco-lodge's presence in an area unique for its biodiversity.
- Presence of a local community with unique cultural characteristics and social customs
- Distinct architectural and urban aspects of tourist facilities

#### **4.Tazriy Hotel, Siwa:**

Siwa Oasis is a unique and historically significant location in Egypt's Western Desert (Fig 1), near the Libyan border, known for its rich cultural heritage and natural beauty. Famous for the ancient Temple of the Oracle of Amun, where Alexander the Great consulted the oracle, Siwa is home to the Siwan Berbers, whose culture, language, and traditions remain largely intact. The oasis features natural salt lakes, therapeutic hot springs, and fertile land supporting agriculture, particularly date palms and olives. Key attractions include the Shali Fortress, Cleopatra's Bath, and the traditional mud-brick architecture of the Siwan people. With its distinct blend of history, culture, and ecology, Siwa is a hub for sustainable tourism, offering a rare glimpse into both ancient Egyptian history and Berber traditions.

#### **4.1. Basic information about the hotel:**

**4.1.1Location:** The hotel is 16 km far from the city center in Siwa, Marsa Matrouh, where it lies at the foot of the Red Mountain, opposite Adrere Amellal (Gaffar Mountain), overlooking the central lake at Siwa (fig2).

#### **4.1.2Execution time:**

2007 till 2009 (Hotel building)

2010: Training of the team at the hotel and preparing work plans

2012: Hotel renovation (Modern techniques were followed for managing waste, such as marketing local products, vegetables, and fruits locally and preparing a program to develop the local community culture).



Figure (1) Siwa location on Egypt's map [15]

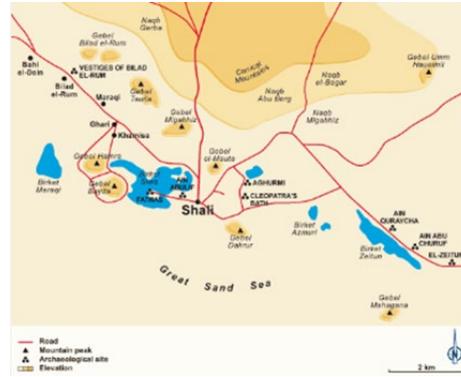


Figure (2) Siwa oasis Map of Egypt [16]



Figure (3) Taziry-ecolodge layout

#### 4.1.3 Hotel Climate Field

Siwa lies in the desert area which is characterized by a significant increase in temperatures in summer (45° C in the morning) and extreme coldness in winter (10° C at night). The considerable temperature range between summer and winter is thus clear. Additionally, this area suffers from high solar density on facades and horizontal surfaces (Fig 4). The prevalent winds are northern and northwestern, laden with dust and fine sands. It is also characterized by scarce rain.

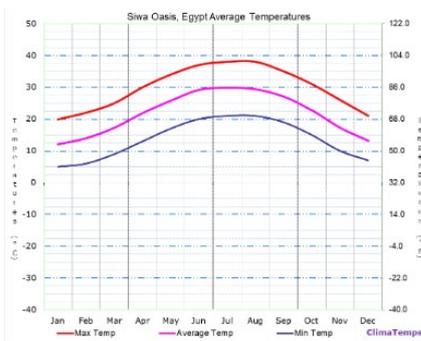


Figure (4): Average Temperatures in Siwa Oasis, Egypt across the year

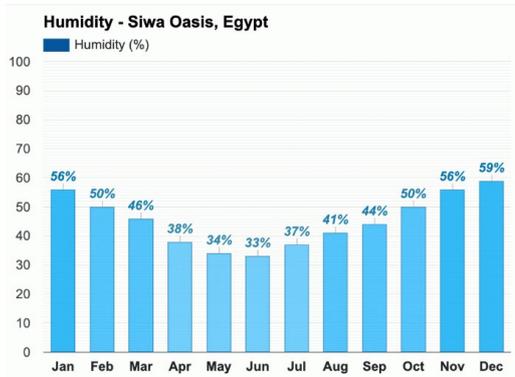


Figure (5): Average Humidity in Siwa Oasis, Egypt across the year

It is clear from the above figure the mean temperatures across the year while clarifying the relationship between these temperatures and the thermal comfort zone. The highest recorded temperatures range between 40-45°C. Average Humidity range between 33%-59% (Fig 5)

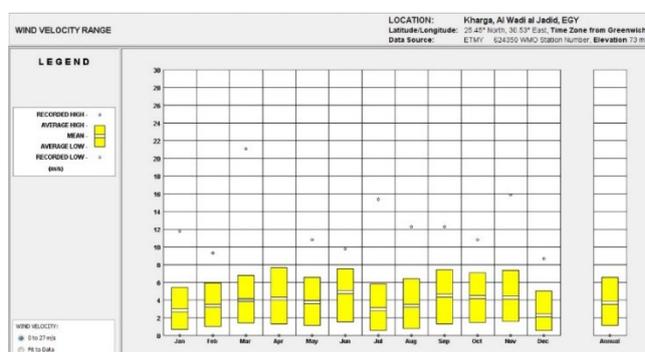


Figure (6): Wind Speed Means Across the Year (Climate Consultant Program)

The above figure shows wind speed means, and it is clear that the highest recorded wind speed mean during June is 7 m/s, while the annual wind speed mean is 6 m/s.9 (Fig6)

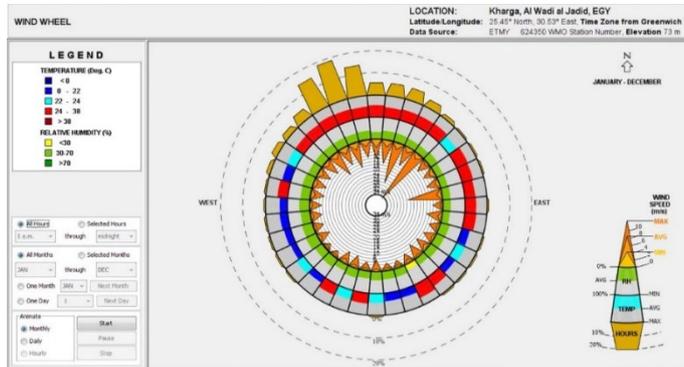


Figure (7): Wind rose of prevalent wind directions across the year (Climate Consultant Program)

The previous figure (Fig 7) shows that the preferred wind direction is northwest, where the highest speeds were recorded in this direction.

**4.1.4. Purpose of establishing the hotel:**

Siwa represents one of the most ancient communities. Its geographical location led to its relative isolation from the surrounding communities since ancient times. This led to the Siwa community's unique, strong identity, which is evident in all aspects of life there, whether in housing, clothing, jewelry, tools, or products from the local community. Due to the previous factors, Siwa has become a tourist destination for non-traditional tourism seekers to enjoy a culture that is different from their own traditional cultures. Accordingly, a group of eco-lodges expressing the Siwan local style and offering Siwan food and Siwan art have been established. Tazriy Hotel is considered one of those hotels.

**4.1.5 Hotel components:**

Residence units: 30 residence units (Chalets-double rooms-triple rooms-royal suites). Residence units contain windows and terraces overlooking the pool at the center of the village.

*Services available at the hotel:* A huge library (containing a large number of books and manuscripts that help in learning Siwan crafts, such as poetry and handwriting)- a unique gallery for handmade arts and crafts-a market (a special market for selling Siwan local products)-a garage-a track for practicing the walking sport-a swimming pool-Azul restaurant (A Siwan food restaurant)-a café-a farm for vegetables and fruits of the hotel.

*Maximum capacity:* 60 guests

#### **4.2 First: Environmental Planning Considerations:**

##### *4.2.1. Respect of Contour Lines at the Location*

-The land is flat, and there is no contour (Fig 8). The designer distributed residence units around the lake area at the center and constructed service buildings at the back.

-Different project uses were distributed; residence units were located near the lake (Fig 9), followed by the hotel main building, and the service buildings were constructed near the mountain foot.



Figure (8): The hotel and its relation to the contour lines in the surrounding environment [18].



Figure (9): The designer distributed residence units around the lake area & the Swimming pool [18].

#### **4.2.2 Compatibility of the used urban texture with climate characteristics**

-The hotel lies in an area with a hot climate, and the residence units are designed adjacent to each other to reduce external envelope elements' exposure to solar radiation, leading to reduced thermal transmission inside residence units (Fig 10).

-Shaded urban spaces are designed to protect visitors from solar radiation in the morning.

-The mountain provides the background of the hotel and the amount of shade it produces, which is used to place open spaces in this shaded area (Fig 11).



Figure (10): the residence units are designed to reduce external envelope elements' exposure to solar radiation [18].



Figure (11): The hotel and its relation to the contour lines in the surrounding environment [18].

### 4.3 Environmental design considerations

**4.3.1. Orientation:** Residence units are oriented towards the central lake. The pool is located in the central area to increase air cooling before it enters residence units.

**Effect of orientation on thermal transmission:** Units were designed facing favorable winds and oriented towards the central lake, helping to cool air before it enters residence units.

**4.3.2 Effect of orientation on natural ventilation:** *Residence units:* Openings are in the northern direction, facing openings in the opposite direction. This leads to good ventilation inside units (Fig 12).

#### 4.3.3 Effect of orientation on natural lighting:

**Residence units:** During morning periods, natural lighting is the basis. The openings were designed to include A lower part and an upper part that can be opened without violating the space user's privacy (Fig 12).



Figure (12): Openings in residence units composed of two parts [19]

**4.3.4Effect of orientation on visibility:** All buildings, especially residence units, were oriented to allow for lake visibility from all buildings.

#### 4.4 Construction methods and materials

*Choosing construction materials and its relation to the thermal transmission process*

**4.4.1 Construction materials:** Construction materials available and appropriate to the environment in Siwa are used, depending on a silt-building material called Karshif (Salt block). These bricks are bonded with a type of loam that acts as mortar and is characterized by high thermal resistance, leading to a reduction of thermal

transmission between the external and internal mediums (Fig 13). -Palm tree wood taken from palm garden trunk wastes was used, cut, prepared, and treated with salt to prevent infection with weevils which cause ceiling damage. It is then covered with loam mortar, to which olive leaves are added to act as insulators (Fig 14).

**4.4.2 Construction methods:** Load-bearing walls were used in construction, followed by the same construction method in Gaffar village. This construction method allows for cold air currents due to the presence of yards and domes, as well as methods of building windows. The village's location is 18 m below sea level, reducing the temperature.

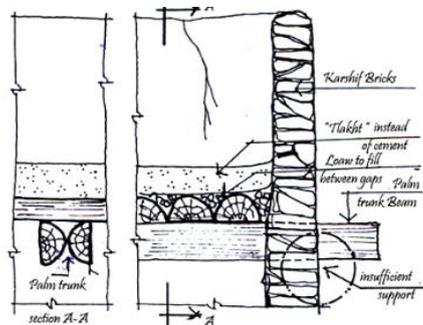


Figure (13) :Construction material used in wall

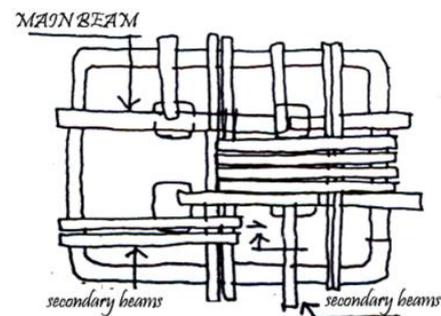


Figure (14) :Looking up view of palm tree trunks roof

#### 4.4.3 Choosing sustainable building materials (Eco-friendly local building materials)

-Using local materials, such as Karshif (Salt blocks manufactured from local materials), and palm tree wood in construction, which are all local materials (Fig 13).

-Olive timber was used to design windows.

-Palm leaves made furniture, including beds, chairs, and tables. Moreover, manual fabric and local carpets were utilized, granting the place a local aspect.

#### 4.4.4 Possibility of reusing-recycling-substitution

All construction materials used in the hotel can be easily maintained if any damage occurs. Moreover, waste from demolished buildings is recycled, and new building materials are made.

#### **4.5 Design of the building's external envelope:**

Insulation and choice of building materials that are capable of reducing thermal transmission, -Clay was used as a base in manufacturing the building material (Karshif) in walls, reducing transferred heat from the outside to the inside.

Thermal conductivity to it reaches  $J/m^2 S ^\circ C$ , and its thermal capacity reaches 0.8 to  $1.2 J/g \cdot ^\circ C$ . Its time lag can range from 6 to 12 hours [ 10], where the time lag of the material is directly proportional to thermal resistance and wall thickness.

##### **4.5.1 Use of colors in facades:**

Colors that are homogenous with the surrounding environment are used in exterior facades. Limestone and sandstone are used to clad some internal walls. These stones are considered local building materials that help reflect direct solar radiation, reducing thermal transmission through the building's external envelope.



Figure (15): Residence unit façade colors homogenous with the surrounding environment [18].

##### **4.5.2 Treatment of roofs to reduce surface exposure to solar radiation:**

Residence units: Due to the scarcity of rain in the area, ceilings were designed to be horizontal, composed of palm tree wood covered with a layer of Karshif to insulate the heat

and prevent its transmission inside residence units (Fig 16).



Figure (16): Horizontal ceilings of residence units covered with a layer of Karshif [18]

#### 4.5.3 Façade Treatments in the form of sun breakers and formations in facades:

-Residence units: Facades are smooth without protrusions or sun breakers. Shades formed from the distribution of hotel buildings was utilized (Fig17).

#### 4.5.4 Effect of horizontal projection formation on air movement pattern:

-Residence units: All residence units were designed with a rectangle projection to reduce the amount of direct solar radiation on residence units.



Figure (17): Connection between residence units [19].

#### 4.5.5 Effect of opening ratios on natural ventilation at residence units:

-Openings are oriented towards the northern direction, with openings in the opposite southern direction for constant cross ventilation (Fig18).

-Openings are designed to be low to admit air at the level of human livelihood, with added upper openings that help hot air exit.



Figure (18): Shape of openings in the residence units at the hotel [18].

#### 4.5.6 Consideration of standards for the preservation of the architectural aspect:

-its distinct local aspect characterizes Siwa. The hotel was designed by local community members using the same local construction materials and methods. This is how the cultural and civilizational background of the local community in Siwa is expressed.

-Interior furniture and interior design elements in the local community in Siwa are used



(Fig19).

Figure (19): Use of local heritage elements in interior design [18].

#### **4.5.7 Respect for construction requirements and planning standards set by the State**

- The designer respected the construction laws and requirements pertaining to the area, where the capacity did not exceed the maximum of 30 guests.
- The height of hotel buildings did not exceed two floors, and the height of residence units close to the lake was only one floor.

#### **4.6 Sustainability bases of landscaping:**

- Palm trees are used in the location because they need a small amount of water, which suits the water scarcity at the hotel.
- Passages linking hotel buildings are shaded to protect visitors from direct solar radiation.
- Local materials are used to finish external paths, represented by floor stones and palm tree wood as pillars in covered passages.



Figure (20): Landscape elements at the hotel [19]



Figure (21): Passages hotel is

hotel [19]

### Use of renewable energy sources:

- Electricity: None
- Oil lamps and candles are used in the rooms (Fig 22,23). Renewable energy, especially solar energy, is recommended for use at the hotel for heating water.
- Use of solar energy: None
- Use of wind energy in generating electrical energy: None



Figure (22): Oil lamps used in the hotel from the outside.



Figure (23): Use of candles and oil lamps in interior lighting.

- Water networks: The hotel is supplied with water through the public water network in Gaffar village.
- *Recycling wastes: Sewage treatment:* Disposal is through septic tanks. A natural idea is followed in sewage disposal, which is a wetland. This idea depends on collecting all waste in the sewage, then moving it to a closed tank, then moving it to a wetland of 40x20 m surface, divided into several rooms of gravel soil. In this soil, pipes with holes lead to a garden of a specific type of plant (reed, lotus, papyrus), Treatment of solid wastes: There is a specific part for managing and collecting solid waste. Organic and non-organic wastes are recycled while guaranteeing safe disposal of non-organic substances.
- *Local community participation:* Members of the local community executed the hotel. During the different execution phases, their experiences were sought to make the building more resistant to the area's climate conditions. Furthermore,

local community members were engaged in the hotel's management and operation process.

- *Environmental feasibility studies:* Environmental assessment studies are continuously conducted to measure the impact of the visitors' different activities on the ecosystems in the area.

### 5. Analysis of the questionnaire form to assess the Tazriy Hotel

After reviewing the standards of achieving sustainable development in the previous part of the research paper, an assessment questionnaire form was prepared to assess architectural models.

The assessment method was based on five assessment levels:

- 1- Poor (1/5) points out of 5 points.
- 2- Moderate (2/5) points out of 5 points.
- 3- Good (3/5) points out of 5 points.
- 4- Very good (4/5) points out of 5 points.
- 5-Excellent (5/5): All standards are available

Table (2): Overview of questionnaire analysis results of eco-lodges according to sustainable development standards

Primary Assessment Standards	Secondary Assessment Standards	Tazriy Hotel				
		Poor	Moderate	Good	Very Good	Excellent
First: Environmental Planning Standards	1-Respect of contour lines at the location					
	Use of contour gradients in landscaping to preserve visibility	•				
	Preservation of natural land formation and homogeneity of location formation with the natural environment					

	Separation and distribution of different uses of tourist facilities					
	Using contour gradients in designing infrastructure networks				•	
	Optimal use of contour gradients in designing pedestrian paths and reaching different levels, car routes and service routes				•	
	<b>Total</b>	<b>1</b>			<b>2</b>	<b>2</b>
	<b>2-Compatibility of the used urban texture with climate characteristics</b>	<b>Poor</b>	<b>Moderate</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
	Extent of urban texture's consideration of the amount of projected solar radiation, especially at dry hot regions (Providing shading in exterior spaces)			•		
	Reduction of the amount of solar radiation projecting on facades and roofs					
	Extent of Urban texture's consideration of air movement, especially inside urban spaces and pedestrian paths				•	
	Urban texture's compatibility in separating between the different uses to separate tourists' movement from the service movement				•	•
	Ability of the urban texture to provide exterior spaces to achieve optimal functional exploitation of such spaces by guests					•
<b>Total</b>			<b>1</b>	<b>2</b>	<b>2</b>	

<b>Primary Assessment Standards</b>	<b>Secondary Assessment Standards</b>	<b>Tazriy Hotel</b>				
<b>Second: Environmental Design Considerations</b>	<b>1-Buildings Orientation (Residence units- restaurants-recreational spaces)</b>	<b>Poor</b>	<b>Mod erat e</b>	<b>Goo d</b>	<b>Ver y Goo d</b>	<b>Excell ent</b>
	Natural ventilation					•
	Thermal transmission					•
	Visibility					•
	Natural lighting				•	
	Functional aspects					•
	<b>Total</b>				<b>1</b>	<b>4</b>
	<b>2-Construction methods and materials</b>	<b>Poor</b>	<b>Mod erat e</b>	<b>Goo d</b>	<b>Ver y Goo d</b>	<b>Excell ent</b>
	Construction materials from the surrounding local					•
	Construction materials with huge thermal capacity					•
	Energy expended in producing and operating construction materials					•
	Construction materials appropriate to the building's function and the required performance					•
	Reuse, recycling and substitution potentials					•
	<b>Total</b>					

	<b>3-Design of the building's external envelope</b>	Poor	Moderate	Good	Very Good	Excellent
	Insulation and choice of construction materials capable of reducing thermal transmission					•
	Use of colors in facades					•
	Treatment of roofs to reduce surface exposure to solar radiation		•			
	Treatments in facades in the form of sun breakers and formation					•
	Opening ratios: Considering the design of entrance to exit opening ratio to achieve good ventilation					•
	<b>Total</b>		<b>1</b>			<b>4</b>
	<b>4-Consideration of standards for preserving the architectural aspect</b>	Poor	Moderate	Good	Very Good	Excellent
	The hotel's architectural aspect expresses the cultural and civilizational background of the area					•
	The architectural aspect takes into account the natural and climate conditions of the area					•
	The architectural aspect takes into account the building's character through the external envelope elements					•
	Interior design and furniture items that take into consideration the					•

	architectural aspect of the area;					
	Consideration of the architectural aspect during the design of open urban spaces	•				
	<b>Total</b>	<b>1</b>				<b>4</b>
<b>Primary Assessment Standards</b>	<b>Secondary Assessment Standards</b>	<b>Tazriy Hotel</b>				
<b>Third: Sustainability bases of landscaping</b>		<b>Poor</b>	<b>Moderate</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
	Urban space suitability to the function and activities practiced in it.					•
	Viability to maintenance and renovation without affecting the activities practiced in it					•
	Performing passages shaded with materials appropriate to the surrounding environment					•
	Use of local and desert plants homogeneous with the nature of the area					•
	Use of natural materials at gathering areas and main paths					•
	<b>Total</b>					<b>5</b>
<b>Primary Assessment Standards</b>	<b>Secondary Assessment Standards</b>	<b>Tazriy Hotel</b>				
<b>Fourth: Sustainability for designing and operating infrastructure networks</b>	<b>1-Use of renewable energy sources</b>	<b>Poor</b>	<b>Moderate</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
	1-Use of solar energy	-	-	-	-	-
	In electricity generation works	-	-	-	-	-
	In water heating					•
	In sea water salination	-	-	-	-	-

	2-Use of wind energy in generating electrical energy	-	-	-	-	-
	<b>Total</b>					<b>1</b>
<b>Primary Assessment Standards</b>	<b>Secondary Assessment Standards</b>	<b>Tazriy Hotel</b>				
<b>First: Environmental Planning Standards</b>	<b>2-Recycling wastes</b>	<b>Poor</b>	<b>Moderate</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
	<b>Sewage Treatment</b>					
	Recycling greywater and using it in irrigating crops					•
	Black water drainage safely without any adverse impact on ecosystems					•
	<b>Treatment of wastes resulting from tourist facilities</b>					
	Following the principle of separation of wastes during use					•
	Dealing with companies specialized in the field of sorting and recycling	•				
	Contracting with specialized companies to transport wastes from tourist facilities			•		
	<b>Total</b>	<b>1</b>		<b>1</b>		<b>3</b>
<b>Fifth: Participation of the local community</b>	<b>2-Compatibility of the used urban texture with climate characteristics</b>	<b>Poor</b>	<b>Moderate</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
	Participation in the touristic development process and taking the decision of participation starting from:					
	Specification of location	•				
	<b>Design:</b> Local community participation and taking its opinion in the design process					•

	by the authority or the touristic development company					
	<b>Participation in execution:</b> Benefiting from the expertise of the local community in the execution phases					•
	<b>Operation:</b> Training of the local community through establishing specialized schools and institutes, or holding training courses to rehabilitate local communities in the operation process					•
	The local community's benefit from the touristic resort in developing infrastructure networks of the area (routes-airports), as well as the sociocultural development of the area					•
	<b>Total</b>	<b>1</b>				<b>4</b>

### 7-Results of the Questionnaire Analysis for Evaluating the Tiziri Hotel.

In the previous part of the study, the basic information for each Tazriy Hotel Siwa, Egypt, was reviewed (Table 1). Additionally, an analytical examination of the primary standards was conducted to assess the extent to which the hotel realizes the standards of sustainable tourism development and analyze questionnaire forms (Table 2). The following conclusions were reached:

- The eco-lodge must respect the location's characteristics and benefit from the location's natural potential and different resources. It must also consider the environmental dimension in design and prevent any adverse impact on the surrounding environment.

- Urban texture was incompatible with the climate circumstances and elements impacting the location. Blocks were formed as strips parallel to the visibility elements (Central Oasis in Siwa).
- Orientation played an essential role in the hotel in terms of providing distinct thermal comfort and natural ventilation inside spaces and realizing distinct visibility of the natural attraction elements.
- Traditional construction methods and local construction materials were used in building the hotel, leading to a homogeneity between the hotel's formation and the natural environment.
- Building materials, such as stones or Karshif material, were used with significant thickness, which helped reduce thermal transmission to spaces inside residence units.
- Roofs of the Tazriy Hotel were not treated or protected from direct solar radiation.
- The external envelope of the hotel buildings was designed attentively, taking into account the process of thermal transmission between the external medium and the internal medium by choosing construction materials suitable for the climate of the area in the hotel are situated, as well as the air inlet and outlet ratios to guarantee natural ventilation inside interior spaces.
- The architectural aspect of the hotel and their compatibility with the local aspect of the area were preserved, especially in the Tazriy Hotel in Siwa, where the local architectural aspect of the traditional building style in Siwa was preserved. Furthermore, the traditional interior furniture style was used to furnish all residence units.
- The sustainability of all landscape elements was considered by using plants and trees from the local environment and using finishing materials for pedestrian paths from local finishing materials and raw materials.
- Renewable energy sources should have been used in the process of energy rationalization. However, the two hotels did not succeed in that.
- The waste recycling principle was followed.

-The local community played a crucial role in participating and realizing sustainable tourism development concepts. Moreover, both hotels positively impacted the local community socially and economically.

### **8. Conclusion:**

Conservation of natural attraction factors positively impacts the sustainable development process. Activation of the participatory role of all parties involved in the sustainable touristic development process, including governmental organizations, civil society organizations, local community individuals, and hotel operators, since this helps realize the success of touristic projects in environmentally sensitive areas. Without trained and experienced human cadres, sustainable touristic development cannot be achieved. No development can occur in environmentally sensitive areas without the environmental awareness of cadres and parties contributing to the development process. Eco-lodges and camps are subject to a group of specific requirements that are different from traditional tourist facilities because their purpose is that visitors directly deal with nature. Recreational activities in nature are represented in the sports of (walking, safari, mountain climbing, bird watching). Their capacity is less than that of traditional tourist facilities. Environmental planning and design strategies must be followed while designing these facilities, starting from choosing the location for establishing the hotel, its appropriateness, and the ease of development. The contour at the location must be respected, and elements with an urban aspect must be utilized. Moreover, environmental aspects must be taken into account during the design, such as orientation to benefit from lighting and natural ventilation in residence units, use of local building methods and materials suitable to the surrounding environment, good design of opening places to allow for ventilation and natural lighting at the units, availability of infrastructure (Electricity, water, sewage) at the location, which are accessible in terms of a method for treating resultant wastes and following the principle of sorting and separation of wastes, and finally conducting an environmental feasibility study of the resort constantly to ensure the safety of ecosystems at the location surrounding tourist facilities.

## 9.Recommendations:

Recommendations at the State level:

- It is necessary to realize sustainable touristic development concepts in Egypt to conserve natural resources, which are considered the main attraction element of environmentally sensitive areas.
- Raising social awareness about the importance and benefits of sustainable touristic development and the importance of establishing and expanding the establishment of such eco-lodges in the natural attraction spots.
- Issuance of legislation that specifies the type of hotel facilities in touristic development areas.
- Care for training distinct human cadres responsible for managing the sustainable touristic development process, conserving environmentally sensitive areas, and operating eco-lodges.

Recommendations at the academic level:

- Incorporation of subjects in the university education stages to connect design and environmental planning curricula and realize sustainability principles and touristic development processes.
- Research institutions should seek to develop the existing planning and design standards in tourism development.

Recommendations at the level of architects and planners:

- There is a need to follow the principles and concepts of sustainable development and green architecture, as well as the environmental planning and design strategy, and use renewable energy sources. Recycling and treating sewage when planning and designing tourist facilities in environmentally sensitive areas.

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