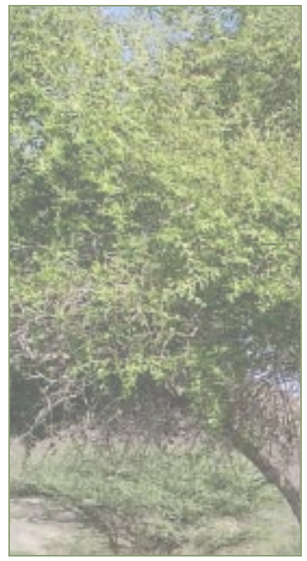


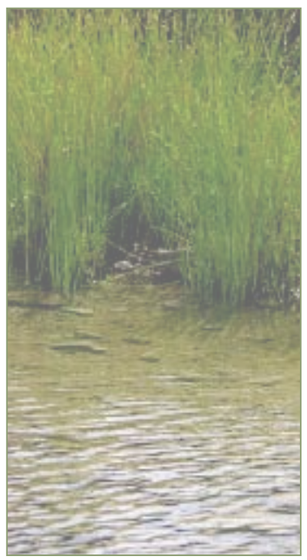
Al Wathba 2 Waste Water Treatment Plant

الوثبة فيوليا بيسكس للصرف الصحي

CONCEPT REPORT
13 / 04 / 2010

Al Wathba Veolia Besix Waste Water

GCLA
GREEN CONCEPTS LANDSCAPE ARCHITECTS

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1.0 Introduction & Scope

Introduction

This report sets out our approach to the project and our concept for the Al Wathba 2 Waste Water treatment plant Reforrestation Project.

A four hectare indigenous plantation at the Al Wathba 2 Waste Water Treatment Plant is a very significant step in the process of redressing the loss of biodiversity in the Abu Dhabi region.

This initiative will use treated effluent to help establish native vegetation as a habitat for many more insect, bird, reptile and indigenous mammal species than currently occupy the locality of the sewage treatment plant.

The dune site will be reshaped after substantial disturbance during construction of the treatment plant. The reshaped form will be similar to the surrounding less disturbed dunes.

Intensive animal grazing and the impact of vehicles means there is no part of this coastal dune region that is not disturbed by man.

The 'forest'is an further initiative of the ISTP 2 Project Company to use treated water to enhance biodiversity; the first being Al Wathba Lake which is well known as a bird habitat, especially flamingo.

Al Wathba 2 Forest will use treated water sparingly to establish a habitat comprising indigenous tree, shrub and perennial species. It will be unique as an island of complex indigenous vegetation in an otherwise disturbed dune field.

Highway plantations beside the Abu Dhabi –Al Ain road are floristically simple and not comparable with the proposed Al Wathba 2 Forest.

The Al Wathba 2 Forest would have a multifunction, primarily to encourage a wide range of species to live there and secondly to facilitate community interest and education.

The Developer

Al Wathba Veolia Besix Waste Water Company PJSC (ISTP 2 Project Company) is a joint venture owned:

- 60% by Al Wathba Waste Water Company (which is 100% owned by ADWEA)
- 20% by Veolia Water, the world leader in Water services
- 20% by Besix, one of the leading civil construction companies in the UAE

The ISTP 2 Project Company is developing the Al Wasthba 2 Waste Water Treatment plant and is driving this reforrestation project.

The HAYAT PROJECT

Wathba 2 Waste Water Treatment Plant is the name of the new sewage treatment plant being built in an open desert, approximately 45 km south east and 8.5 km south of existing Mafraq STP. It is part of the ISTP2 Project (Independent Sewage Treatment Plant 2) comprising a similar plant of 130,000 m3/day of treatment capacity located 40 km south west of Al Ain.

The Al Wathba 2 Waste Water Treatment Plant will have an average capacity of 300,000 m3/day of sewage and a tolerance capacity of 345,000 m3/day. The Project has three processing streams for the treatment of sewage: sewage treatment, sludge treatment and odor treatment. The Treated Sewage Effluent (TSE) will be piped to the existing Mafraq Plant, where it will directly be conveyed to the Abu Dhabi municipality's irrigation network. The project is currently at mid construction stage and the planned completion date is 20th August 2011.

The ISTP 2 Project Company is driving this reforrestation project as part of its Corporate Social Responsibility programme and as a means to involve the business and local communities in this vital infrastructure project.

As a firm concentrating solely on the use and reuse of our most precious resource - water - it is the hope of the ISTP 2 Project Company that this reforrestation project can help people to link responsible use of water to life and the process of combatting desertification.

The project will be an way to offset the Carbon Footprint of the construction and operation of the ISTP2 project and will include a range of measures such as:

- Very low water usage through careful selection of plants and innovative irrigation regimes
- Re-use of sludge by-product from the ISTP 2 as a rich soil conditioner and fertiliser
- Innovative nursery production of native plants suited to desert conditions;
- Use of Reed bed systems that sequester carbon, create biofuels and naturally treat water
- Substantially improves soil quality and its ability to sequester carbon dioxide
- Involves and educates the community on the value of water conservation

2.0 Deforestation - A 'Glocal' Issue

Deforestation is both a local and global issue.

It is one of the most significant contributors towards global warming and it is (unfortunately) a phenomenon that is increasing in its scope primarily because of our thirst for resources. Developed Nations like the UAE must accept their role in that process not only locally but globally.

The late HH Sheikh Zayed bin Sultan al Nahayan was a famous advocate of reforrestation being responsible for the planting of millions of date palm and ghaf tree plantations. In 2005 Sheikh Zayed was postumhously recognised for his efforts by the United Nations Environment Programme as a 'Champion of the Earth'. It is incumbent on us now to continue that legacy.

The need to "think globally, act locally" became a mantra which was crystallised in the term "Glocalisation" coined by Mandred Lange in 1989 during the preparations for the Global Change exhibition.

The term has been used to show the human capacity to bridge scales (local and global) and to help overcome small-scale, bounded, insular thinking.

'Glocals' is a term often used to describe a new social-economic class of people and multi-national companies that are both global and local. In a place as diverse as the UAE we all need to become 'Glocals' and take responsibility for our actions.

The Al Wathba 2 Forest is a perfect example of how we may 'think globally and act locally'. It is a wonderful exemplar of how we can make a local change that, together with education and interpretive programmes, will influence the attitude towards deforestation both regionally and globally.

As an excersise in Corporate Social Responsiblity and Education it will bring the most precious resources of water and vegetation to the forefront of our consciousness.

3.0 Design Concept - Environmental & Cultural Sustainability

The site, shaded green, is a very small area within a vast sea of coastal dunes and sabka. It sits to the immediate south of the Al Wathba 2 Sewage Treatment Plants which provide the water for the plantation.

The site was substantially disturbed by sand extraction and dumping during construction of the sewage plants so the first step in establishing the plantation will be to return the landform to a shape similar to the natural dune forms..

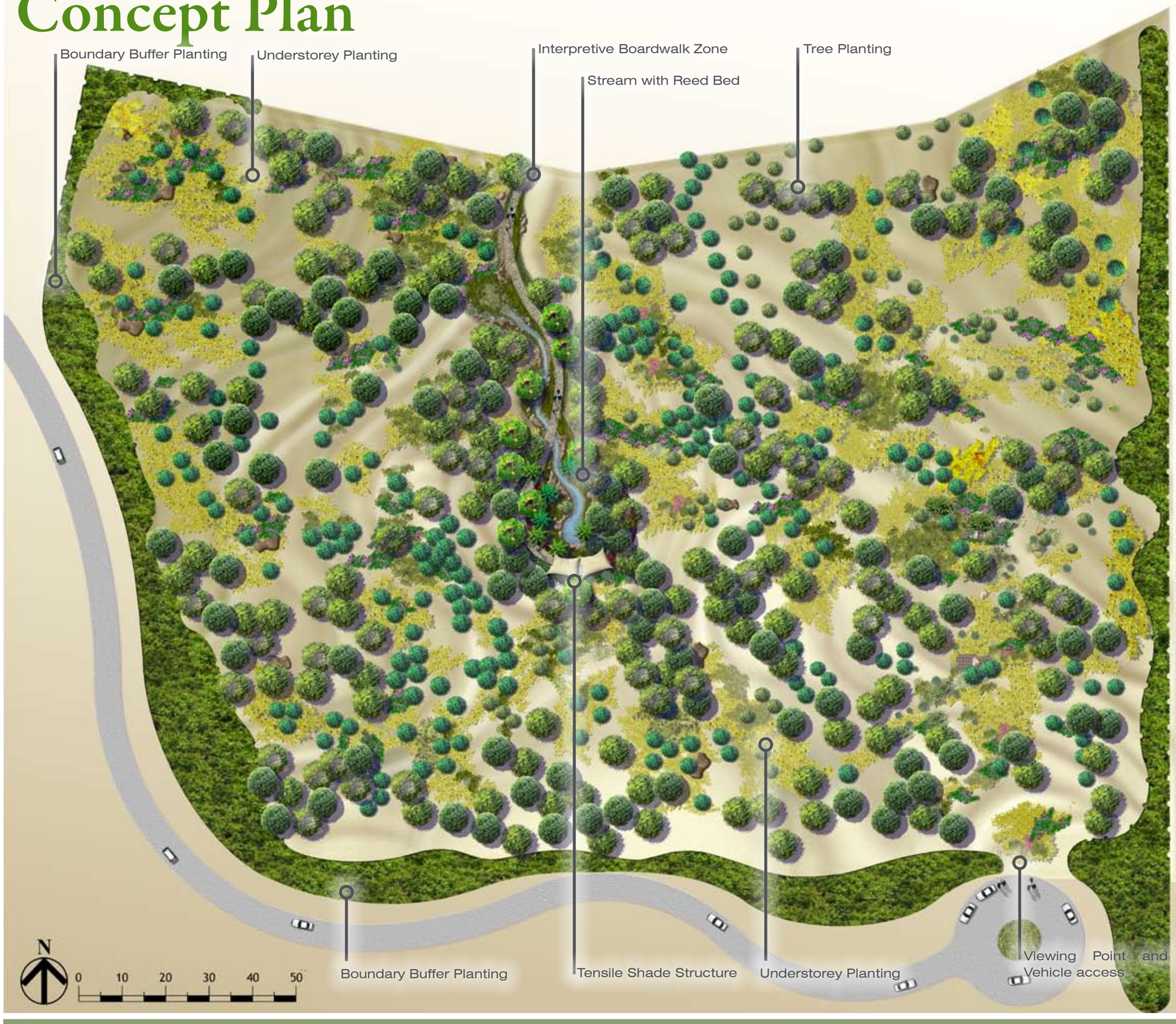
On the reshaped landform we propose planting species associations that will attract greater biodiversity. There would be approximately 45 species in the initial plantation, with a dominance of Ghaf (Prosopis cineraria), Tamarisk and Samr (Acacia tortilis). The species list is found in Appendix 1. Ghaf and Tamarisk occur naturally in the locality however Samr does not, nonetheless, Acacias are an important food source for several insect species, especially bees.

Trees will be planted in groups allowing spaces between the groups for growing shrubby species and perennial species such as tussocks and grasses..

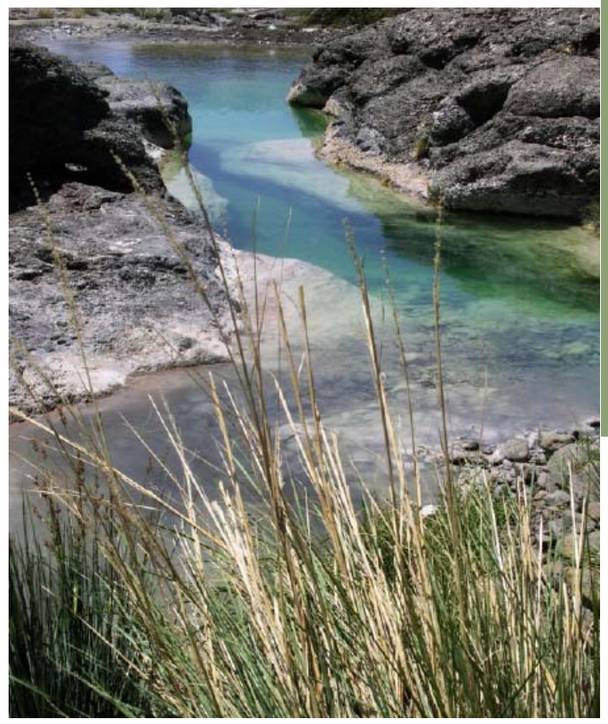
Given that a major role of the plantation is community education, the plantation would have a modest visitor shelter to be used as a education facility. The centre would be accessed via a boardwalk following a reed bed and stream to a place where irrigation water is discharged into the stream as a symbolic arrival point. The arrival of the water is a key feature in the story of man helping nature to revive. The story of bedouin culture and its connection to the landscape will be germaine to the interpretation of the site.

The plantation area will be fenced to prevent grazing animals from entering the site. Maintenance access will be limited to quad bikes and restricted to a defined perimeter trails.

Concept Plan

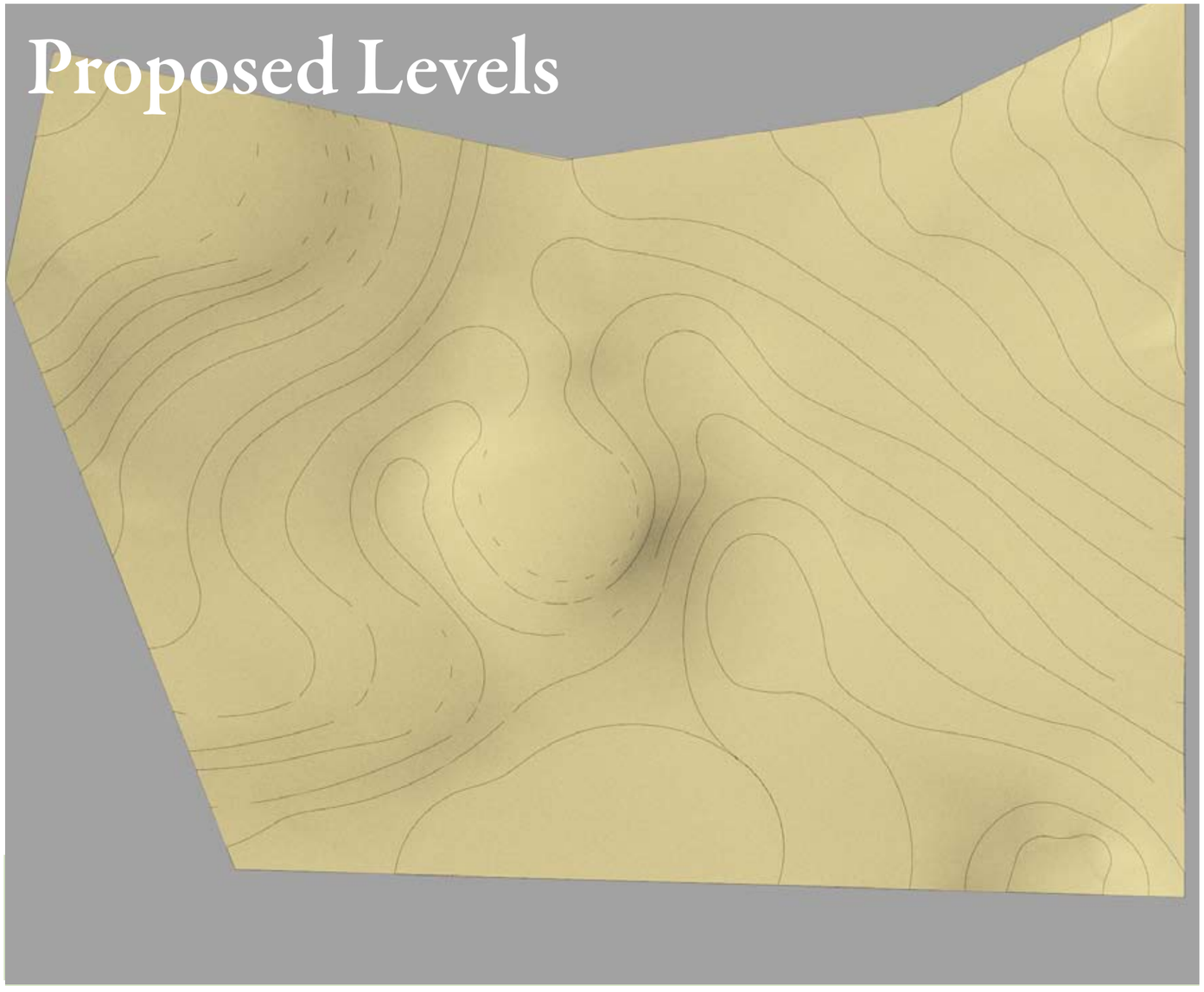


Interpretive Boardwalk Zone



Stream with Reed Bed

Proposed Levels



Elevation of the main boardwalk area

Central Area

Features of the Central area

Visualisation of central core

4.0 Vegetation Character

Selecting and growing plants for such a context must be experimental as many species would not respond well to the nutrient rich and slightly saline irrigation water; some species, on the other hand may surprise us and respond very well.

Vegetation patterns, colours and textures will be relevant to dune vegetation (where it is not subjected to intense grazing by goats or camels).

While the site is coastal dune, many of the species will be more likely found on older dune forms of inland Abu Dhabi and some will be from mountain wadis. The species that are not locally derived are chosen because they are a significant part of the culture of the region or they are a good sources of food or shelter for animal, bird and insect species.

We would expect over time, that some other species would be added and possibly some removed, as should occur in a dynamic but man made environment.

This will only occur if there is sustained scientific interest in the project, otherwise the need for modifications will not be observed. An example of such need would be a desired increase in habitat for a rare and endangered species should one be observed.

The selected plant species that would begin the plantation will be those for which seed is easy to source and easy to germinate. There is likely to be some residual seed in the dune sand and we expect some of this to germinate along with the introduced nursery plants and introduced seed.

Selecting species is open to conjecture as is the density of the plantation and the species associations, which are essentially unnatural. As best we can we have nominated plant species that supply a food source and shelter.

The man made nature of the vegetation is quite deliberate as a means of using a waste product to enhance biodiversity. Such a plantation is sustainable as it is supported in part by a waste product and in part by natural rainfall

The example this project will provide should encourage other similar use of indigenous vegetation to enhance biodiversity rather than provide comfort and aesthetic roles related to one species.....man. It may also encourage modification to the extensive roadside plantations by introducing many more plant species and thereby increase biodiversity.

5.0 Education and Interpretive Design

Public involvement will extend to education as it is expected the plantation will be of considerable interest to those involved with the science of environment and with sustainable societies.

From school children to University level post graduate studies, the use of waste water as a resource to enhance biodiversity is of major significance. The experimental nature of the project, especially the species attracted to the habitat and the changes that occur over time will enable a continued interest and a critical involvement of science.

Monitoring the movement of irrigation water, the change in the soil environment and the presence or otherwise of plant pathogens is part of its fascination.

The total species count and changes to the species is a more obvious aspect of the forest, one that should have appeal to scientists and amateurs alike. There are training possibilities that can also use the forest as a resource.

Training in vegetation management, irrigation of indigenous species and in species monitoring are some of the opportunities presented

The wider interest in waste management and the overall social responsibilities concerning waste and its recycling, as well as man's responsibilities for helping other species are obvious extensions to the role of the forest.

Key Considerations for Education / Interpretive Design for the Plantation:

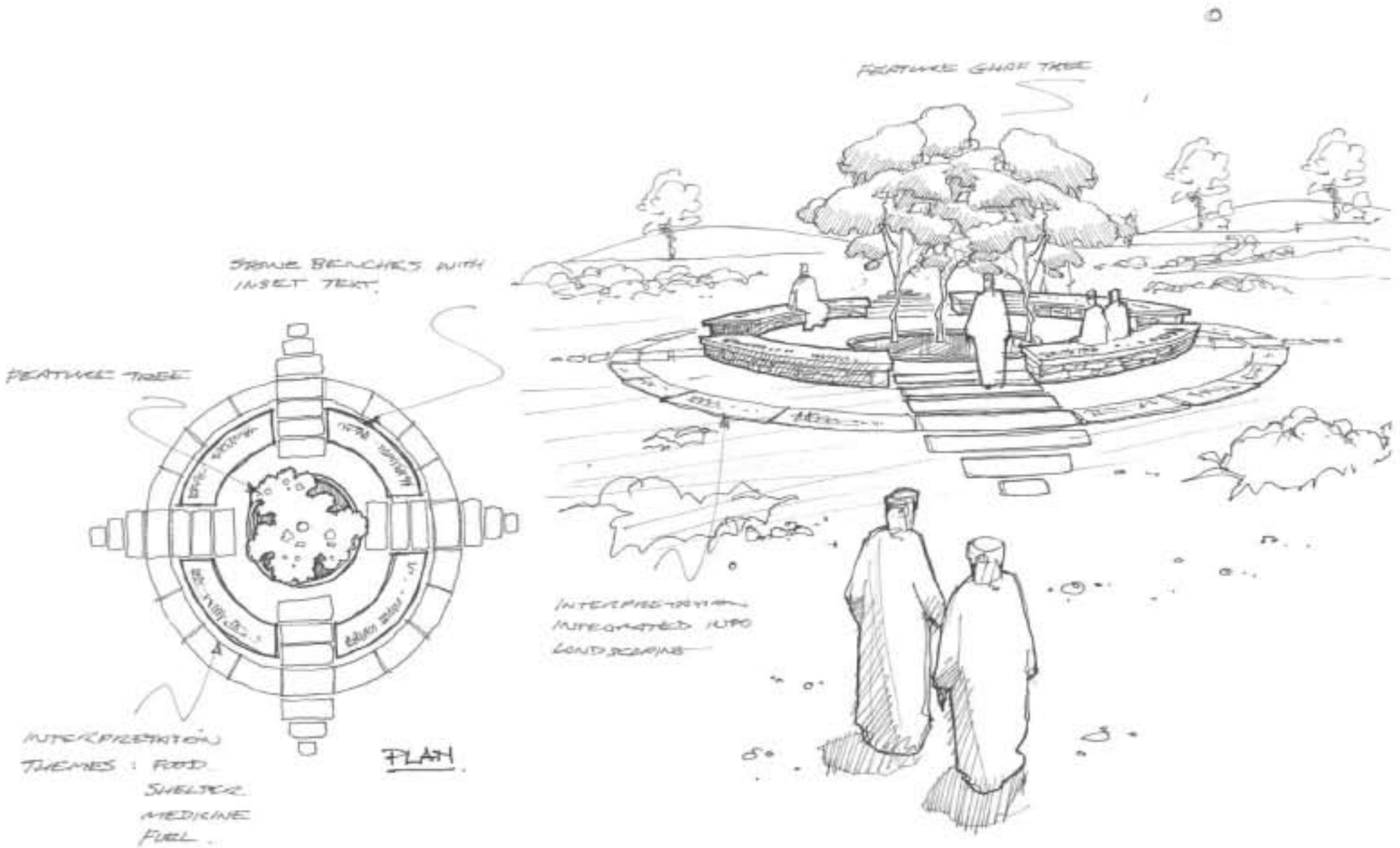
- Identify the Key Story lines ie what is unique about the flora and fauna, the revegetation scheme, the site and the reuse of waste-water and the landscapes role;
- Link the issues of deforestation, desertification and highlight the importance of revegetation;
- Understand the careful balance between lesuire, education and scientific requirements;
- Giving practical demonstrations of good practice; and
- Giving meaningful information about indigenous ecosystems and how they survive.

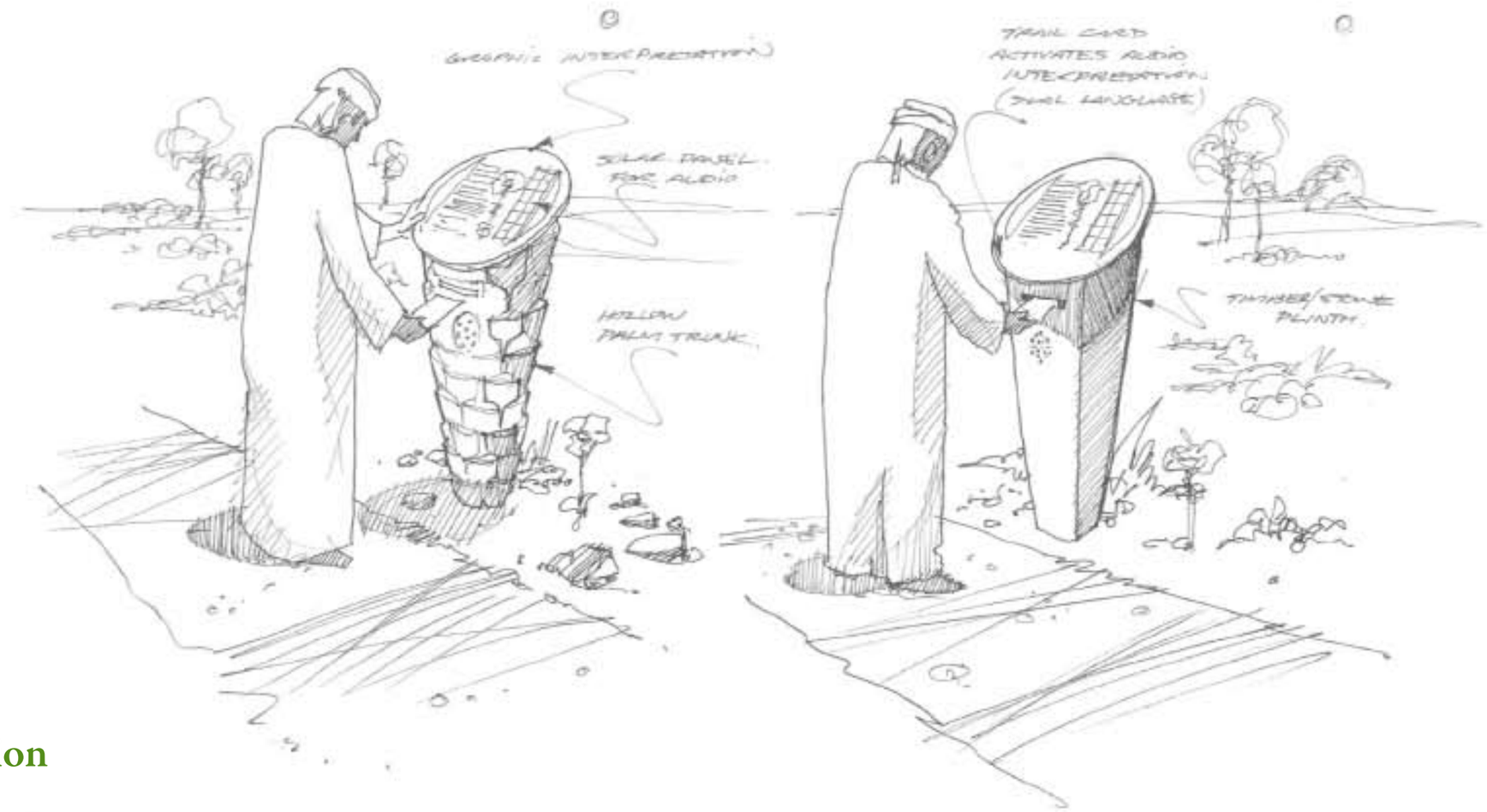
5.0 Education and Interpretive Design

The images which follow were prepared by our associate Interpretive Design firm Bright 3D as a primer for what the plantation interpretive trail could include. We recommend that the client engage an interpretive design consultant for the next phase of the works.

Raised Adventure trail

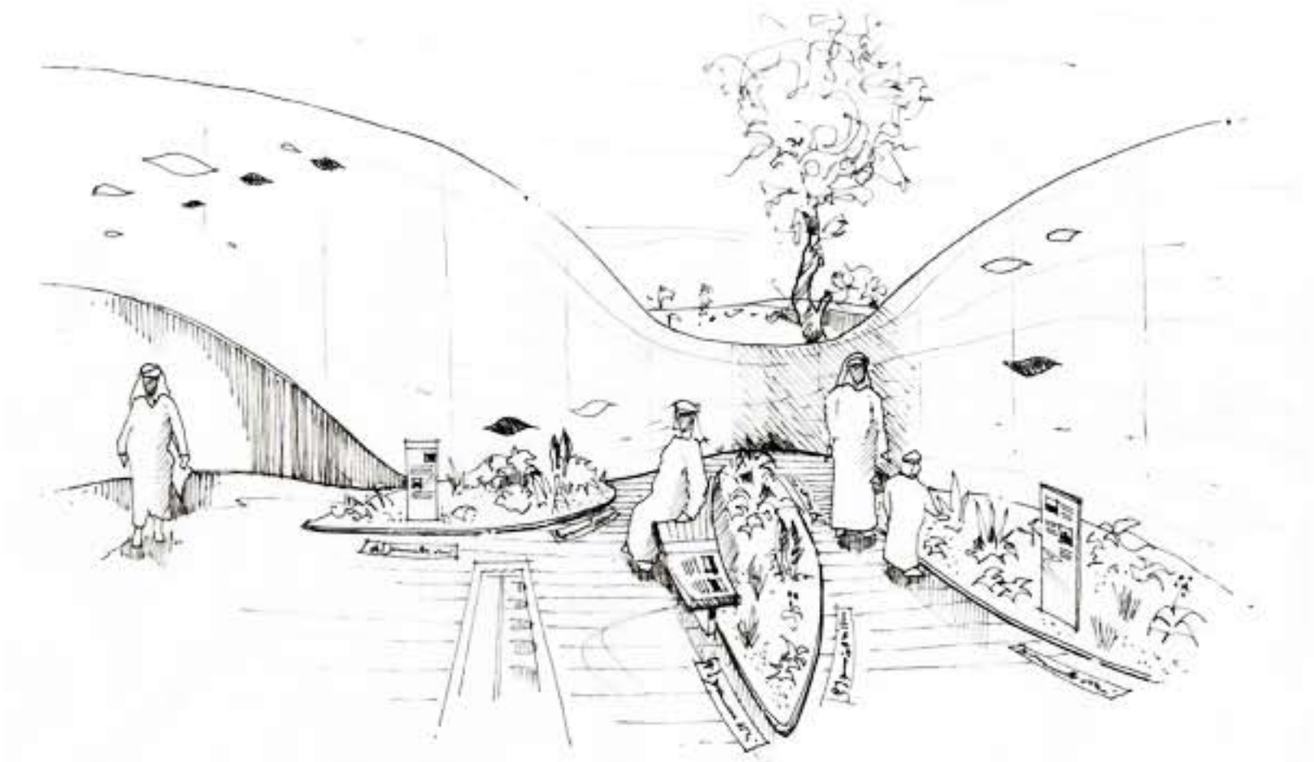
Feature Seating Area

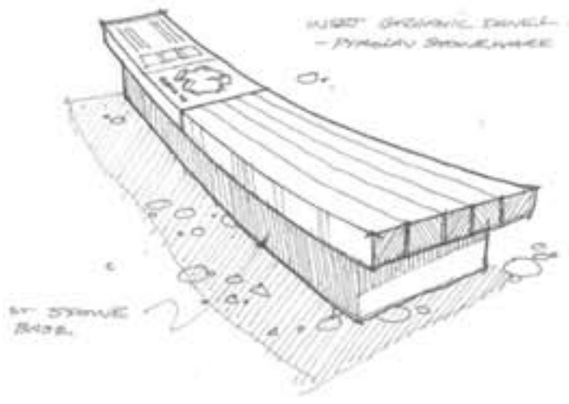


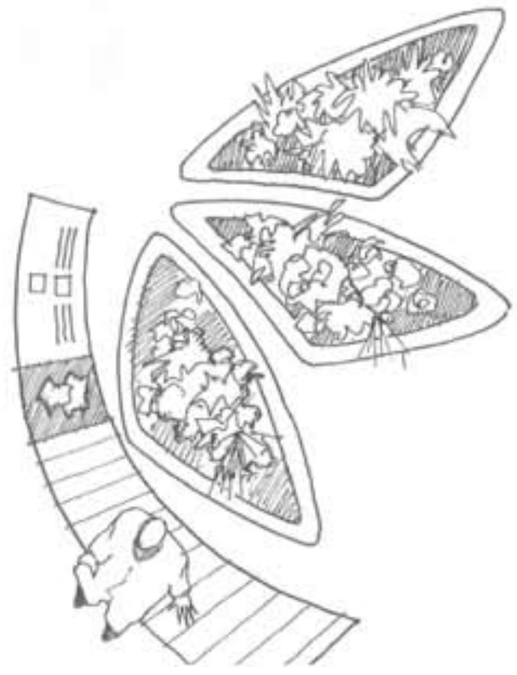


Interactive Trail Interpretation

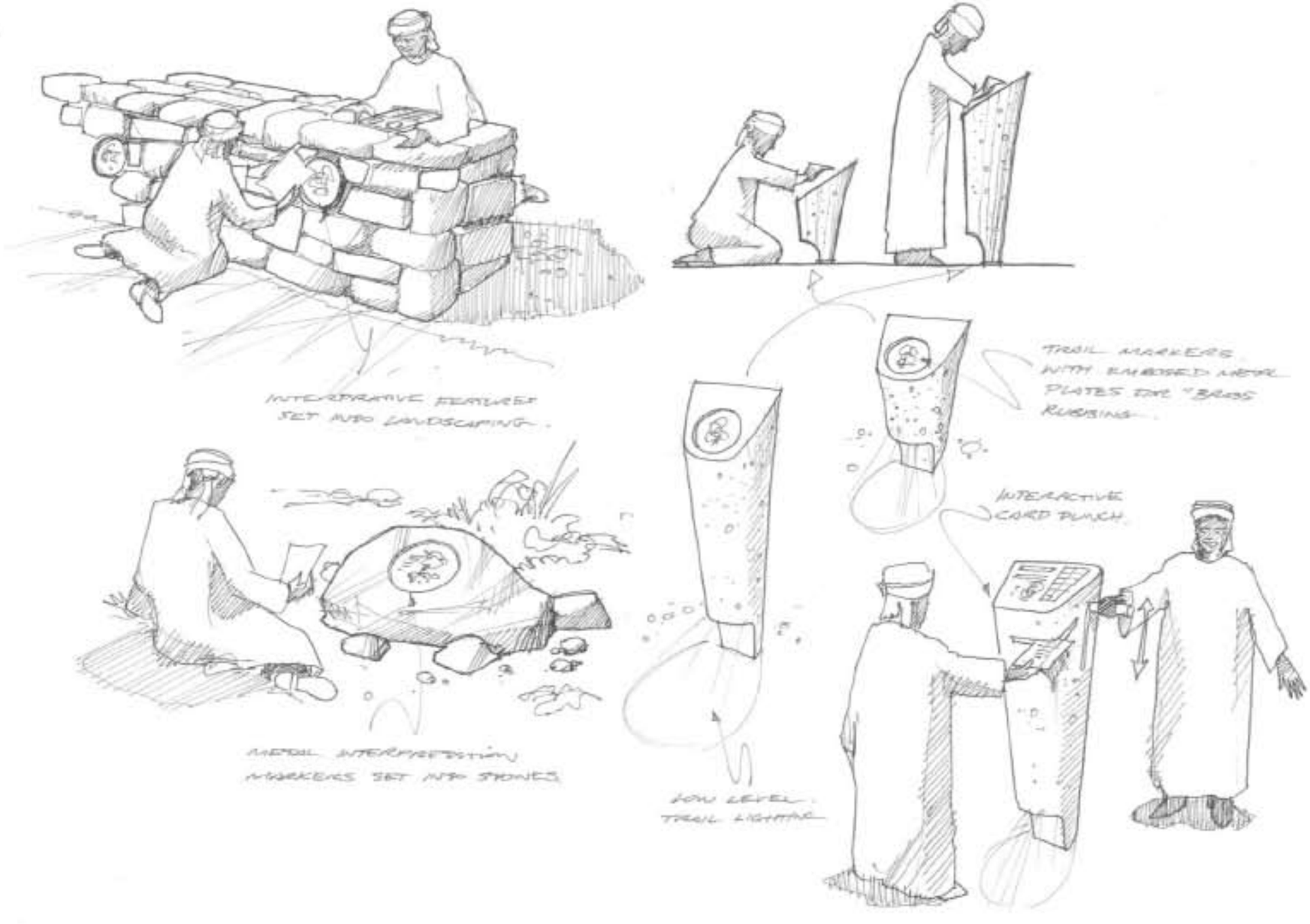
Seating with information & Plant display



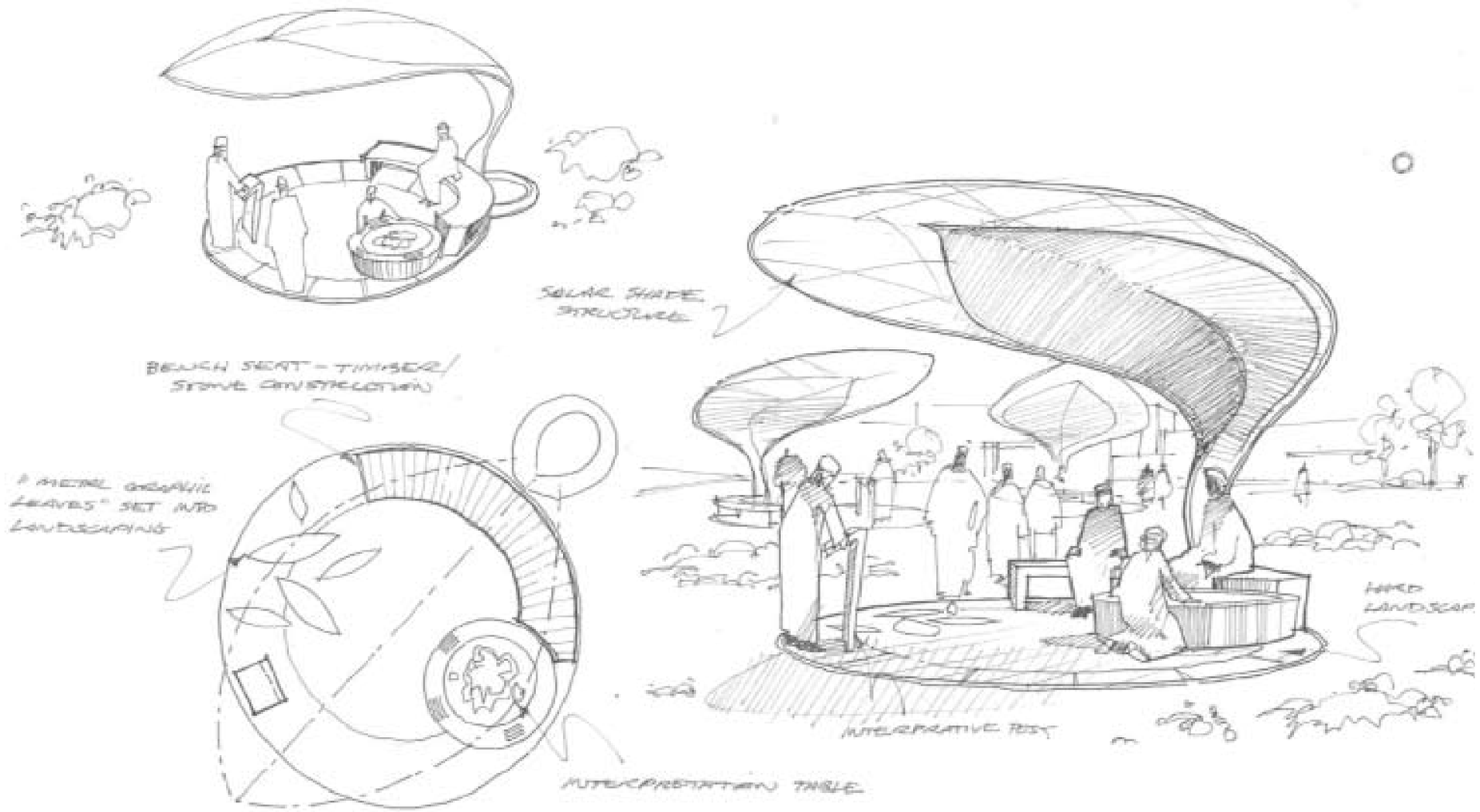




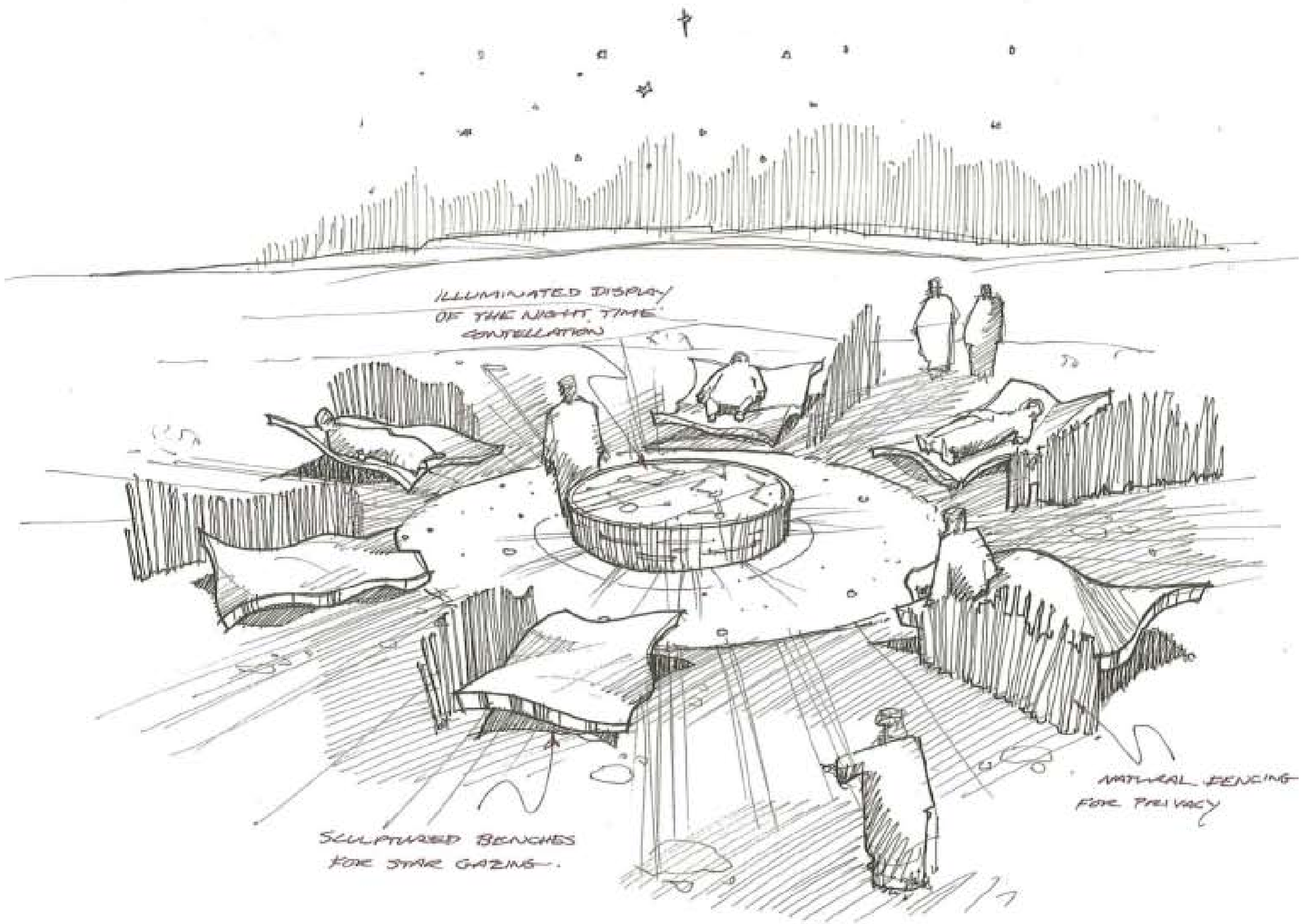
Trail Markers with Interpretation



Idea for a sponsored shelter with Interpretive Information



Star Gazing Circle



Education Strategies

The Education Strategy needs to be wide ranging and combine Academic Research (possibly in collaboration with Abu Dhabi University Landscape Architecture Programme) and have a multi- layered outreach strategy.

Al Wathba Lake 2
EDUCATIONAL STRATEGIES
promoting a greater understanding and stewardship of the UAE DESERT

VISTOR CENTER + PARK

+EXHIBITION CURATED TO MATCH DIFFERENT AGE GROUPS NEEDS AND TYPE OF VISITORS
+GUIDED TOURS OF THE EXHIBITION
+GUIDED TOUR OF THE BUILDING SUSTAINABLE COMPONENTS (architecture and landscape)
+GUIDED TOURS OF THE PARK
+INDIVIDUAL TOURS OF THE PARK USING INTERPRETATION DEVICES OR MAPS.

RESEARCH CENTER

+WORKSHOPS TO TAKE PART IN PARK PLANTING AND MONITORING AND MAINTENANCE
+PERSONALIZED CLASSES ON SUSTAINABLE LANDSCAPING
+CLASSROOMS IN RESEARCH FACILITIES ARE USED BY THE LOCAL SCHOOLS AND UNIVERSITIES TO CONDUCT LECTURES, EXPERIMENTS, AND INTERACTION WITH THE CENTER RESEARCHERS

COLLABORATION WITH EXISTING INSTITUTIONS

+UAEU BIOLOGY AND AGRI-CULTURE DEPARTMENTS
+ZAYED UNIVERSITY Emirates Centre for the Natural and Cultural Environment
+WWF
+LOCAL ENVIRONMENTAL NGOS (Emirate Environmental group)

6.0 Irrigation Design

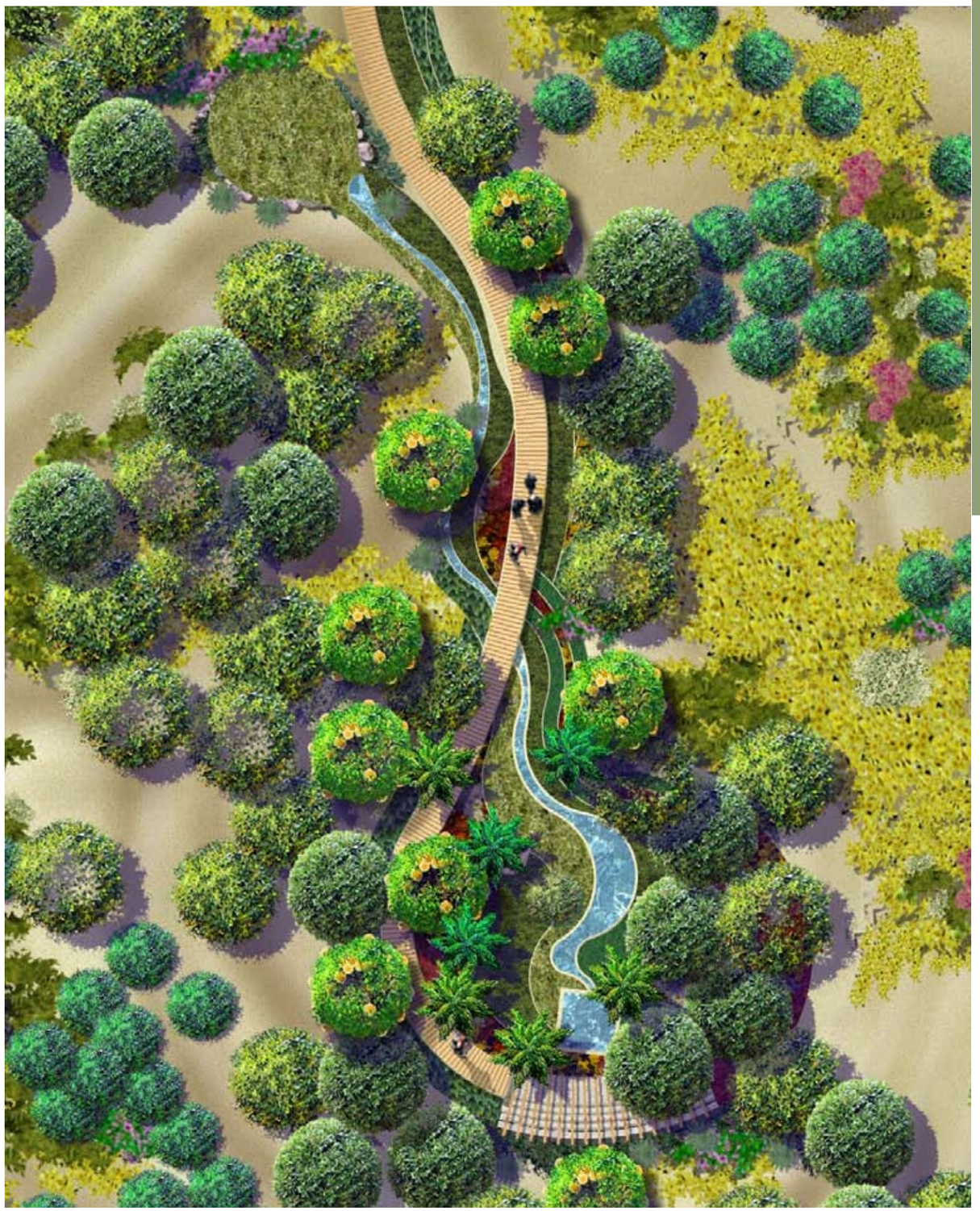
The central feature of the forest would allow visitors to see the treated water arrive at the site, discharge into a reed shrouded stream and proceed on to a irrigation network much as happens with oases.

The quantity of water delivered to the plants would vary depending on the species associations and on the season. Irrigation would aim to enhance the seasons when water is provided by rainfall or by fog.

Irrigation methods and scheduling would aim to encourage deep penetration by plant roots but not create a lush and unrealistic landscape character. Treated water will be used in conjunction with natural rainfall to germinate and support seedlings and nursery plants.

The frequency and depth of irrigation will be monitored to avoid excessive growth with the aim of establishing vegetation which has a natural appearance despite it clearly being man made and man sustained. Monitoring of electro conductivity (EC) testing of the soil would need to be frequent to ensure there is no build up of salt which could be very damaging to plants.

Irrigation methods maybe in several forms from removable water cannons to cover large areas of low shrubs and perennials to bubbler or drip irrigation to supply trees. As much as possible, evidence of the delivery of water would be hidden or obscured from visitor view.



7.0 Sponsorship

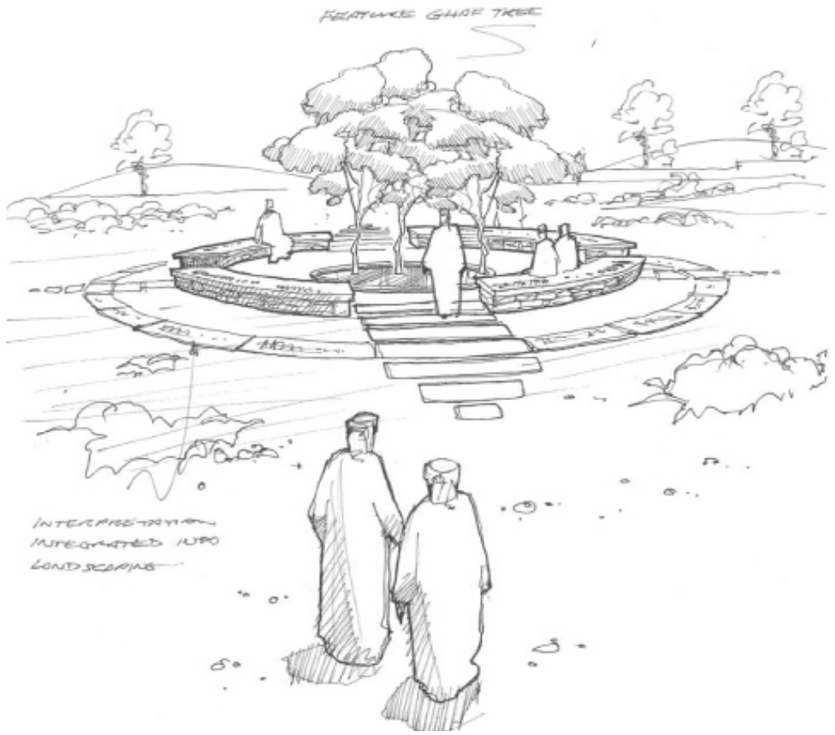
A key to success of the Al Wathba 2 plantation is public interest and public involvement.

The project team will encourage both corporate, institutional and individual opportunity to purchase a share in the plantation either as a carbon offset opportunity or simply as a contribution to the environment.

Promotion of the sponsorship idea would need to follow several formats to cover all forms of media, internet and direct contact with corporations, schools, universities and special interest groups. Establishing a web site to explain the project and to update its progress will be essential.

Use of a character such as a reptile, as below may be a way of encouraging wide appeal. GCLA has worked with Bright 3D of the UK on other similar interpretive and branding projects and their materials will provide resources and elements that could be successfully marketed as Sponsored elements.

Radio, Television, Internet, power point presentations and hard copy of different levels of technical content would be assisted by the resources we will make available including a draft press release.



Interpretive Features such as Seating areas could be sponsored ie the ADWEA circle

Flora and fauna could be employed as media characters

8.0 Project Methodology

Once approval is given for the Concept, we will progress to detail design and confirmation of plant species and numbers.

Plant Supply
Plant supply should then be tendered to enable the more easily obtained species to be sown in the nursery in the cooler months of 2010/2011. The remainder of species for which seed is not currently available would be grown during the spring of 2011 according to the available seed collected from naturally occurring plants.

Supply of plants via private nursery sources is recommended given the control of supply and quality that is critical to the success of the plantation.

We recommend planting in the cooler months of 2011/2012.

Site Works
GCLA will issue drawings for primary earthworks to be carried out by the present civil contractor. We will require existing spot levels to be confirmed before the earthworks drawings can be drawn and issued.

Such works would need to be completed by September 2010 followed by Installation of the boundary fence.

Tender documents will be prepared for the remaining site works. The site works contract would need to be let by September 2010.

Site works would include:
- Irrigation installation
- Soil amendments
- Water tank and stream installation
- Board Walk Installation
- Minor earthworks
- Planting, wind protection and direct seeding
- Maintenance

Plants will require protection from wind blown sand for the first two years, after which they should have grown to a size and strength able to withstand the sand blasting.

Maintenance
The site works contractor would maintain the plants and infrastructure for 12 months and hand over to a maintenance contractor.

The maintenance contractor would then be responsible for the health of the plantation as well as assisting monitoring of all species for a 3 year period subject to renewal for a further 3 year period.

The irrigation system and the wind protection will need most maintenance time.
Replacement of any plants which die, or additional planting should only occur in the cooler months

Appendix A - Plant Lists

Master List

	Plant Schedule	Irrigation Requirements	Plant Heights @ maturity	size	spacing	total quantity Garden	total quantity Mound	Evergreen	Native	Cultural Importance	Natural Importance	Comments
	Large Trees											
Aa	Acacia arabica	med	7m									
Pf	Parkinsonia florida. Pale Blue Verde.	med	5 to 8m									
Pp	Peltrophorum pterocarpum. Yellow Poinciana.	high	8 to 10m									
Pc	Prosopis cineraria. Ghaf Tree. Ghaf.	high	10m						√	√	√	
Tp	Thespesia populnea. Indian Tulip Tree	high	8m							√		
Zsc	Zizyphus spina-christi. Christ's Thorn. Sidr.	high	10m						√	√	√	wadis, palatable fruit and shade
	Palm											
Nr	Nannorrhops ritchieana. Dwarf Palm. Nakhl.	high	5m						√	√		
Pd	Phoenix dactylifera. Date Palm. Nakhl.	high	10m						√	√		
	Small Trees											
An	Acacia nilotica	med	5m									
At	Acacia tortilis. Thorn Tree. Samr.	low	5m						√		√	
Bl	Bauhinia lunarioides. Anacacho Orchid Tree.	med	3.5m	1.2m	3.5m							
Bv	Bauhinia variegata. Orchid Tree.	high	4m	1.2m	3.5m							
Br	Brachychiton rupestris. Queensland Bottle Tree.	med	5m									
Cv	Callistemon viminalis. Weeping Bottlebrush.	med	4m						√		√	
Cu	Coccoloba uvifera. Sea Grape.	low	6m							√		
Fs	Ficus salicifolia. Rock Fig.	high	6m						√		√	
Hat	Hibiscus tiliaeceus. Sea Hibiscus.	high	7m									
Ls	Lagestroemia speciosa. Crepe Myrtle.	high	4m					deciduous		√		
MaP	Morus alba 'pendulata' . Weeping White Mulberry.	high	6m							√		
Po	Plumeria obtusa. Frangipani.	high	5m									
Pg	Punica granatum. Pomegranate.	med	4m							√		
Tu	Tecomella undulata. Orange Tecoma. Farfar.	med	5m						√			
Tp	Thevetia peruviana. Lucky Nut.	high	4m							√		
Vac	Vitex agnus-castus. Chaste Tree. Arshad.	med	4m							√		
VacCB	Vitex agnus-castus 'Colonial Blue'. Chaste Tree. Arshac	med	4m							√		
	Large Shrubs											
26	Acacia ehrenbergiana. Samur.	low	high						√	√		
28	Caesalpinia gilliesii. Yellow Bird of Paradise.	med	high									
29	Caesalpinia pulcherrima. Red Bird of Paradise.	med	high								√	
31	Calotropis procera. Sodom's apple. 'Ushar.	low	high						√	√		
32	Dodonaea viscosa. Hopseed Bush. Shahus.	med	high						√			
33	Duranta repens. Sky Flower.	high	high									
35	Lawsonia inermis. Henna. Henna.	med	high						√	√		
36	Leptadenia pyrotechnica. Broom Bush. Markh	low	high						√			
39	Myrtus communis. Common Myrtle.	high	high									
40	Nerium oleander. Oleander. Defla.	med	high						√	√		
41	Ricinus commuis. Castor Oil Plant / 'Arash)	med	high						√	√		
42	Salvadora persica. Toothbrush tree. Suwak.	med	high						√	√	√	
44	Tamarix aucheriana. Tamarix. Tarfa'	low	med	0.6m					√			
45	Tamarix nilotica Tamarix. Tarfa'	low	med	0.6m					√			

	Medium Shrubs											
47	Adenium obsesum. Desert Rose.	low	med							√		
48	Aeonium arboreum. Aeonium.	med	med									
27	Atriplex nummularia. Old Man Saltbush.	low	med									
50	Carissa grandiflora. Natal Plum.	med	med									
30	Calligonum comosum . Arta.	low	med						√	√	√	
63	Datura stramonium. Datura. Datoora	med	med	0.7m	1m				√	√		
34	Ixora x Red. Red Ixora.	high	med									
37	Leucophyllum frutescens. Texas Ranger.	med	med									
38	Leucophyllum frutescens 'Green Cloud'. Texas Ranger.	med	med									
51	Leucophyllum langmaniae. Cimmaron Sage.	med	med									
52	Lycium shawii. Desert Thorn. 'Ausaj.	low	med	0.6m	1m				√		√	formindable thorns
72	Rhazya stricta. Harma.	low	med						√	√		
53	Ricinus commuis. Castor Oil Plant / 'Arash)	med	high									
73	Senna italica. Senna.	low	med						√	√		
46	Tecomaria capensis. Cape honeysuckle	med	med	0.7m	1.2m							
47	Tecoma Stans. Yellow Bells.	med	med	0.7m	1.5m							
54	Yucca ssp. Yucca.	med	high							√		
55	Yucca filimentosa	med	high									
56	Yucca baileyi "Navajoa"	med	high									
	Low Shrubs											
57	Aerva javanica. Al Ara'.	low	low						√	√		
58	Arthrocnemum macrostachyum. Hamadh.	low	low						√			
49	Atriplex canescens. Four-Wing Saltbush.	low	low									
59	Callistemon. "Little John".	med	low									
60	Capparis spinosa. Common Caper Bush. Kobar.	med	low						√	√	√	will self-seed PK
61	Caryopteris x clandonensis. Blue Mist.	med	low						√			
62	Crotalaria aegypitaca. Nzah.	med	low						√		√	
64	Dipterygium glaucum. Ailqi.	low	low						√	√		
65	Euphorbia larica. Isbaq.	low	med						√	√		difficult to propagate GS
66	Halopeplis perfoliata. String of Beads. Kharrazy.	low	low						√			
67	Halocnemum strobilaceum. Jointed Glasswort. Hantha	low	low						√			
68	Haloxylon salicornicum. Rimth.	low	low						√	√		
69	Limonium axillare. Sea Lavender. Qataf.	low	low						√			
70	Moltkiopsis ciliata. Callous-leaved gromwell. Halem.	low	low						√		√	
71	Pulicaria glutinosa. Thal.	low	low						√			
43	Suaeda vermiculata. Sea Blite. Suweda	low	low	0.3m					√	√		promising landscape plant MJ
74	Taverniera spartea. Alal.	low	low						√			
75	Tephrosia apollinea. Dhafra.	low	low						√	√		
76	Zygophyllum qatarense. Bean Caper. Haram.	low	low						√	√		now called: Tetraena qatarense
	Grasses											
77	Arundo donax "variegata".	high	high						√			
78	Cenchrus ciliaris. Foxtail Grass. Sabat.	high	low						√	√		
79	Cymbopogon commutatus. Incense Grass. Alklathgar.	high	low						√	√		
80	Cymbopogon commutatus "Kalam". Incense Grass. All	high	low						√	√		
81	Cyperus conglomeratus. Cyperus. Thenda.	high	low						√			
82	Dianella caerulae. Paroo Lily	high	low									
83	Herperaloe parviflora. Red Hesperaloe.	high	low									
84	Imperata cylindrica "Red Baron".	med	low						√	√		watersude, can be invasive, use c
85	Nolina microcarpa. Bear Grass.	high	low									
86	Panicum turgidum. Turgid Panic Grass. Thamam.	med	low						√	√	√	
87	Pennisetum divisum. Bristle Grass. Sabth.	med	low						√	√		
88	Pennisetum setaceum. Fountain Grass.	med	low						√			
89	Saccharum ravennae.	med	med						√			

	Perennials											
91	Abutilon pannosum. Gaagaan.	med	low						√			
92	Bacopa monnieri.	med	low						√			
93	Canna indica. Canna Lily.	high	med									
94	Citrullus colocynthus. Desert Squash. Shary.	med	low						√	√		
95	Geranium mascatense. Geranium. Ain Al-Waza.	low	low						√			
96	Helianthemum lippii. Ragroog.	low	low						√	√		
97	Reseda aucheri. Dhaub-nabmm.	low	low						√			
98	Suaeda aegypitiaca. Egyptian Seablite. Rajla.	low	low						√	√		
99	Tribulus arabicus. Zahar.	low	low						√			
100	Tribulus terrestris. Zahar.	low	low						√			
101	Verbena pulchella. Moss Verbena.	high	low									
	Ground Cover											
102	Acacia redolens 'Desert Carpet'.	med	low									
103	Anagallis arvensis. Blue Pimpernel. 'Ayn al-got.	med	low						√			
104	Calylophus hartwegii. Sundrops.	med	low									
105	Mentha ssp.	high	low									
	Mentha piperata. Mint.	high	low	0.15m	150mm							
	Mentha spicata. Mint.	high	low									
106	Ocimum forsskaolii. Basil. Rehan.	high	low							√		
107	Phyla nodiflora. Berbin al-jedi.	high	low									Neophyte? Verbena nodiflora, ca
108				0.1m	0.15m				√			
109	Thyme ssp ??			0.005	0.12							
	Annuals - Therophytes											
110	Arnebia hispidissima. Arabian Primrose. al hamra.	med	low						√	√		
111	Calendula arvensis. Field Marigold. Ain el Baqr.	med	low						√			
112	Cleome gynandra. Cleome. Abu Qarim.	med	low						√			
113	Melilotus indicus. Scented Trefoil. Zurairga.	med	low						√	√		
114	Portulaca olereaca. Edible purslane. Fargo.	med	low						√	√		
115	Senecio glaucus. Buck's horn groundsel. Qorreis.	med	low						√			
116	Silene villosa. Desert Campion. Turba.	med	low						√			
117	Zygophllum simplex. Abu.	med	low						√	√		
	Succulents											
118	Agave attenuata. Foxtail Agave.	med	med							√		
119	Agave deserti var. simplex	med	med									
120	Agave colorata	med	med									
121	Aloe arborescens. Krantz Aloe.	med	low							√		
122	Aloe striata. Coral Aloe.	med	low									winter flowering, coastal and arid
122	Aloe vera. Aloe. Sabar.	med	low						√	√		
123	Aloe vera "Yellow". Aloe. Sabar.	med	low						√	√		
124	Caralluma arabica. Khanasoor.	med	low						√	√	√	
125	Caralluma flava. dhag'a.	med	low						√	√		
126	Caralluma ssp.	med	low									
127	Crassula ovata. Dollar Plant.	med	low							√		
128	Echeveria elegans. Hen and Chick.	med	low									
129	Lampranthus spectabilis. Trailing Ice Plant.	med	low									
130	Mesembryanthemum nodiflorum.	med	low						√		√	
131	Rumex vesicarius. Sorrel.	med	low						√			
132	Sempervivum 'Woolcutts'	med	low							√		
	Sempervivum 'Oh My'	med	low									
1	Sempervivum 'Lamotti'	med	low									
	Sempervivum spp.	med	low									

	Trailing & Climbers											
1	Antigonon leptopus. Coral Vine.	high										
2	Bougainvillea ssp. Bougainvillea.	med										
3	Cestrum nocturnum. Queen of the Night.			0.7m	1.2m							
	Jasminum sambac. Arabian Jamsmin											
4	Jasminum ssp. Jasmin.	med										
5	Lantana montevidensis. Trailing Lantana.	med										
6	Lantana montevidensis "New Gold"	med										
7	Plumbago capensis. Cape Plumbago.	med										
	Bulbs											
	Crinum asiaticum. Crinum.	med	low									
	Hymenocallis latifolia. Spider Lily.	med	low									
	Ferns											
	Adiantum capillus-veneris.	high	low						√			
	Pteris vittata.	high	low						√			
	Reeds - Slow moving water											
	Juncus rigidus								√			
	Juncus socotranus								√			
	Schoenus nigricans								√			
	Typha domingensis. Bullrush								√	√		
	Water edge - Streams											
	Bolboschoenus maritimus								√			
	Cyperus laevigatus								√			moist alluvial and sandy soils, cana
	Eleocharis geneticulata								√			
1	Saccharum ravennae.	med	med						√			
	Oasis Plants											
	Musa paradisica. Banana.			1m	1m							
	Psidium guava. Guava.			1m	4m							
	Manilkara zapota. Sapodilla.			1m	5m							
	Mangifera indica. Mango.			1.2m	8m							
	Ficus carica. Fig.			1m	5m							
	Punica granatum. Pomegranate.			0.75m	5m							
	Carica papaya. Paw Paw.			1m	2m							
	Zizyphus jujuba. Jujuba Tree.			1m	5m							
	Mentha piperata. Mint.			0.15m	150mm							
	Jasminum sambac. Arabian Jasmin.			0.2m	0.4m							
	Ocimum basilicum. Basil.			seedling	0.3m							
	Saccharum officinarum. Sugar Cane.			1m	0.5m							
	Irrigation Channel Banks											
	Cyperus laevigatus								√			
	Eleocharis geneticulata								√			
	Mentha spicata. Mint.											
	NOTES:											
	Plant maturity is defined as in 25 years.											
	Shrubs: High (1.5 - 2.5) Medium (0.8 - 1.5) Low (0.0-0.8)											