SABAH AL-AHMED SEACITY

www.k-almarzouq.com/seacity.htm

CORPORATE BROCHURE

Rewriting the textbooks

La’ala Al-Kuwait Real Estate is proving that urban development and ecological protection can go hand in hand. Ian Williams talks to Gay Sutton about the symbiotic relationship between engineering and the environment at the new Sabah Al-Ahmed Sea City

A

new and beautiful city is rising from the salt flats of Kuwait. In a part of the world renowned for groundbreaking architectural development, the Sabah Al-Ahmed Sea City is a vision like no other. It doesn't emulate the extensive ornamental land reclamation and glittering architectural glass tower blocks that are being built at breakneck speed in other Gulf States. It has turned all those concepts on their heads. Instead, Sea City is an imaginative, creative and environmentally sensitive solution that is rewriting many of the textbooks on urban development and environmental engineering.

The original concept dates back to 1986 and was the dream of Khalid Yousuf Al-Marzouq, father of the current chairman of La'ala Al-Kuwait Real Estate. "He was a visionary," says project director Ian Williams. "He introduced many firsts to Kuwait, including the first multi-storey car park and the first western-style apartment blocks." But invasion, liberation, reconstruction and government changes postponed the project. Eventually, through the perseverance and determination of his son Fawaz Khalid Al-Marzouq and the backing of the current Emir Shaikh Sabah Al-Ahmad Al-Sabah, whom the new city is named after, in 2002 approval to commence was given.

Today, with most of Kuwait's 120 kilometre-long sandy coastline developed—either as part of Kuwait City, occupied by the oil industry, or private leasehold beach chalets—the vision is to extend the coastline and create a city of marinas and beach villas for the sea-loving Kuwaiti people.

At first sight, the single most striking feature of Sea City is that it has extended the coastline by bringing the sea inland. "Rather than pouring millions of cubic metres of sand into the Gulf and impacting an already existing fragile ecosystem, we have taken extremely impoverished land known as Sabkha, or salt bog, and we're transforming it into a new and thriving ecosystem of lagoons and beautiful beaches, with all the facilities you could want."

The development will eventually extend some eight kilometres inland, provide homes for over 100,000 people and occupy some 64 square kilometres—an area larger than Manhattan. Already two of the initial five land development phases have been completed, all 2,300 land lots have been sold and many developed into beach villas.

From a land development perspective, this could only be achieved by solving a monumental engineering challenge—devising a method for flushing seawater through the proposed series of inland canals and lagoons, and breathing life back into this dead salt marsh.

"We modelled the water flow using sophisticated computer software, and the models demonstrated that by the time the tide had penetrated half way into the project it would have turned, therefore failing to flush the innermost depths of the lagoon system." Quickly dismissing solutions such as pumping and artificial aeration as they were contrary to the environmental ethos of the project, as well as being unsustainable in terms of maintenance and power consumption,

Bell Equipment

Bell Equipment currently has 47 of its highly fuel-efficient ADTs operating on the Sea City project for La'ala Al-Kuwait Real Estate, including six B50Ds, the largest ADT in the world. Since 2007, the trucks have worked 24/7 shifts and jointly passed the one million hour mark this year, averaging around 22,000 hours per truck.

The superior build quality, parts availability and production capability of the Bell ADTs has allowed La'ala to avoid downtime and keep this enormous project on schedule. The Bell machines adapt perfectly to working in the harsh, hot, abrasive conditions of Sea City, having no trouble traversing the soft ground on the average five kilometre haul cycles.

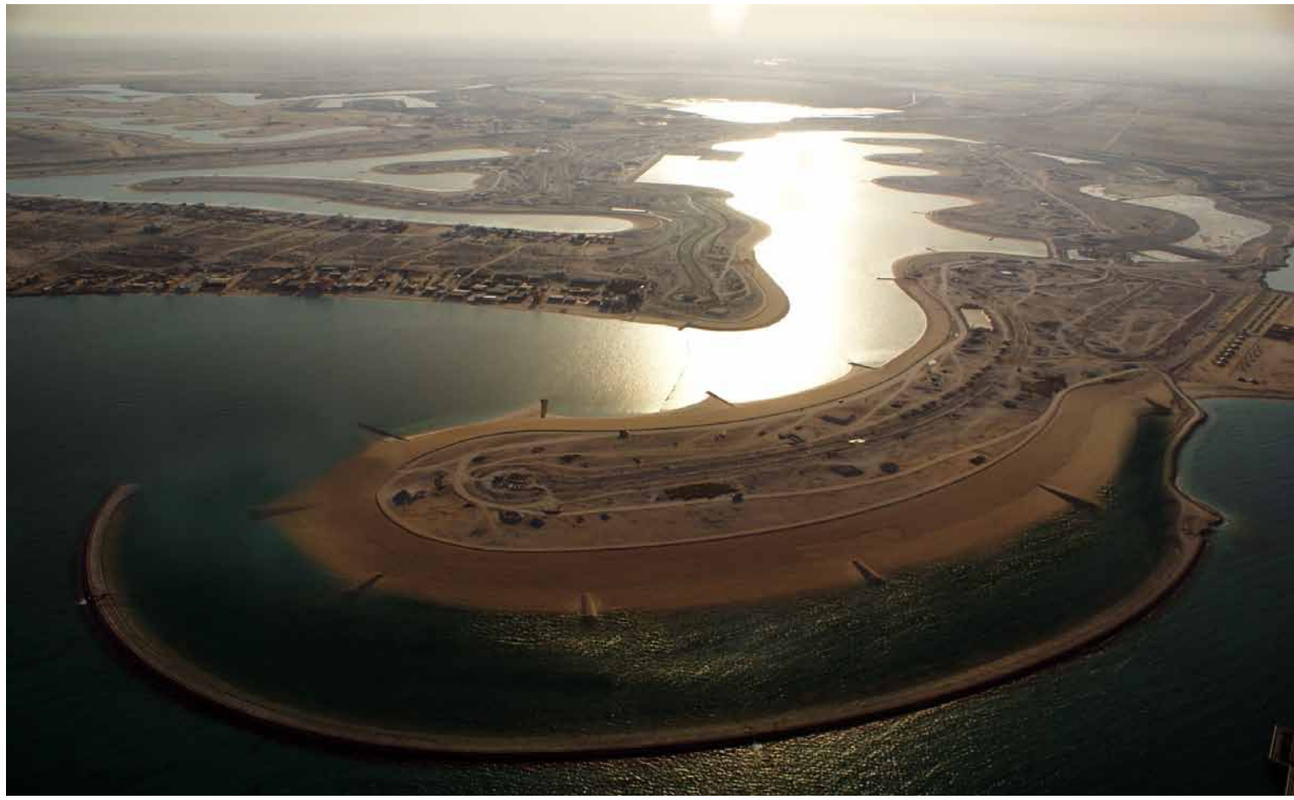
For more information, please see our ad and visit our website.

the engineering team set to work developing a completely new solution.

"Their idea was to create a unidirectional flow through the system by introducing a set of tidal gates to selected points within the lagoon layout thus creating an embayed body of water that would act like a huge natural hydraulic pump. I was fairly sceptical of the concept at this stage," Williams admits. "But when we modelled the flow, the models showed 80 per cent of the water would be exchanged every 10 days, which far exceeds the minimum internationally recognised requirements."

AlMailem Group

Established in 1960, AlMailem Group is the leading distributor and retailer for tires and automotive spare parts in Kuwait. The company offers a wide range of tires for diverse applications from top international brands including Toyo of Japan. AlMailem is proud to be associated with the Sea City Project of La'ala Al-Kuwait as the major supplier of tires for their fleet of articulated dump trucks, loaders and other equipments.



Specialist hydraulic designers calculated that six gates would be required, each measuring 50 square metres and weighing over 10 tonnes. Costing around £2 million, the gates were manufactured from mild steel in Cardiff, UK, and then thermally coated with aluminium to resist rusting in the highly saline water. Positioned in specially designed culverts in 2010, they have been operational since April 2011, and daily water analysis shows that water quality is equal to

that of the Gulf itself, and indeed corals have begun to grow within the project.

Every decision in the construction project has been made with the ecology of the area in mind. An in-depth environmental impact assessment of the area identified 124 indigenous species of flora around the two existing tidal inlet creeks. However it also showed that the low-lying Sabkha itself consisted of a salt-encrusted mixture of saturated silt and sand that is not only prone to flooding but is considered unsuitable as a foundation for construction.

The theory behind the city's development model was that the material excavated to create the lagoon system would be used to raise ground level above the predicted sea levels for the next century. However, near the coast this saturated silt and sand could extend to a depth of up to eight metres before reaching material regarded as suitable for foundations.

Rather than remedying the problem using techniques such as piling, the company stayed true

Sabah Al-Ahmed Sea City

to its development ethos by completely removing the unsuitable material—at times down to eight metres—then replacing it with higher quality sand obtained from further inland, finally raising the land level to the required height.

Time, in the construction industry is, however, of the essence. "Had we chosen to then prepare the land for construction using conventional roller compactors we would still be at it today," Williams says. "Instead, we introduced a method called dynamic compaction, whereby a 100-tonne crane repeatedly drops a 15-tonne weight from a height of 10 metres, driving the soil down with huge force and compacting it so that it can bear the weight of a villa. We dropped the weight 15 times on each spot on a 10 metre grid until we ended up with a landscape that looks like a big waffle, with regular indentations," Williams comments. "In some cases

the craters were up to 1.5 metres deep. We then filled in the indentations and dropped the weight a further five times at the centroid of the grid. Sophisticated electronic penetration equipment was used to verify the success of the densification."

During the first phase of development a significant material deficit with a considerable amount of material had to be brought from further inland parts of the project. The second phase reached a stage of material equilibrium where the material removed to create the lagoons was sufficient to raise the ground level. Now, in the third and fourth phases, more material is being excavated than can actually be used. "So we are using it to create a hillside development that will fringe the site."

The first two phases, which were partially built around man-made lagoons fed from the existing

KCCEC
KCC ENGINEERING & CONTRACTING CO.
شركة كي سي سي للهندسة والمقاولات

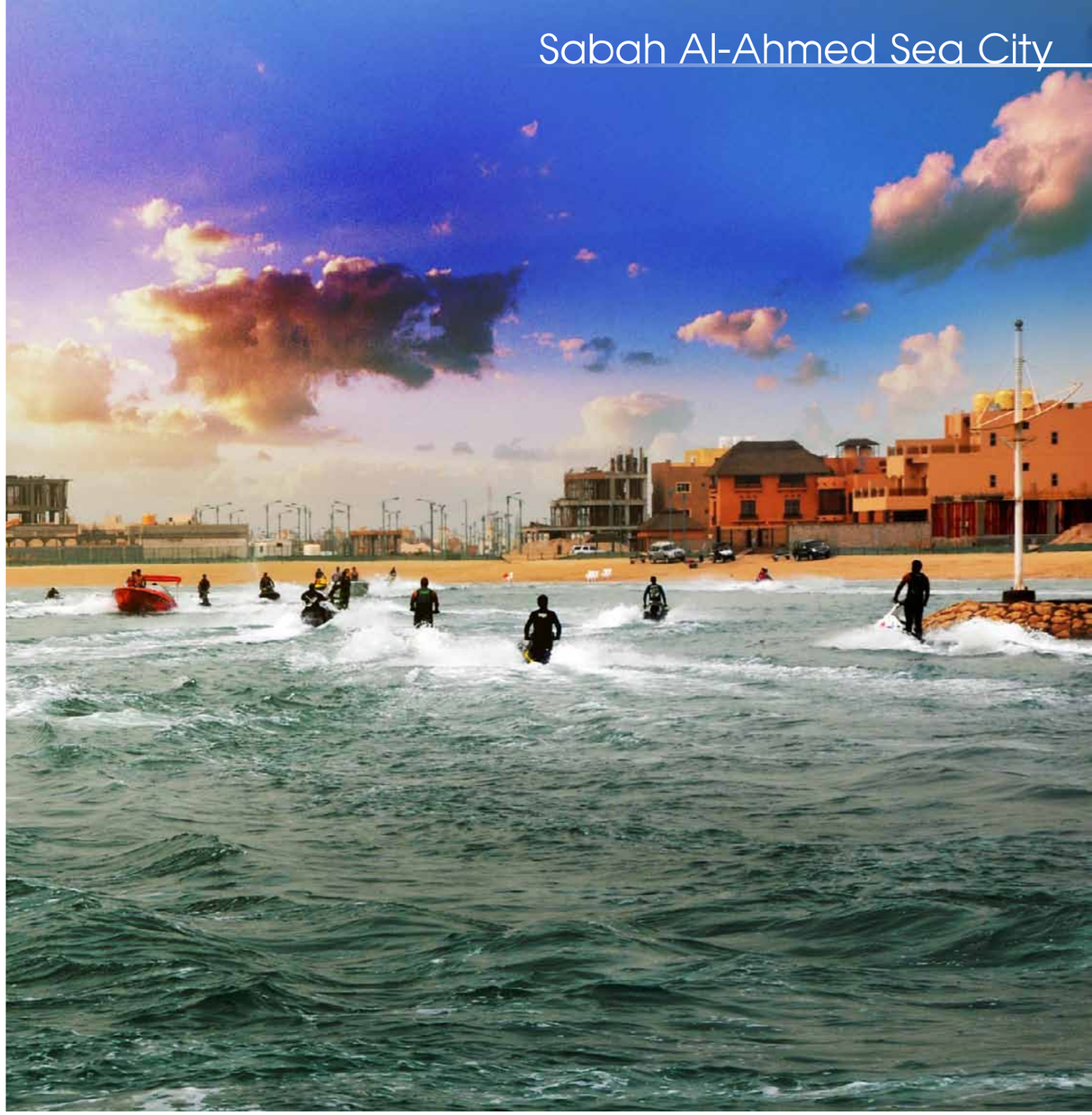
'Leading the Way in Contracting and Trading'

KCCEC is contractually approved company which enhances its reputation amongst the leading governmental authorities and oil companies such as CTC, MEW, MPW, KOC, KNPC and PIC. KCCEC specializes in the Design Engineering, Procurement, Construction, Testing, Commissioning and Maintenance of medium to large size projects covering the fields of Electricity, Instrumentation, Control, Telecommunications, Automation, Pipelines, Mechanical and Civil works.

Tel: +965 222 543 00/ 222 637 00
Fax: +965 222 543 30/ 222 543 32
Email: mail@kccec.com.kw

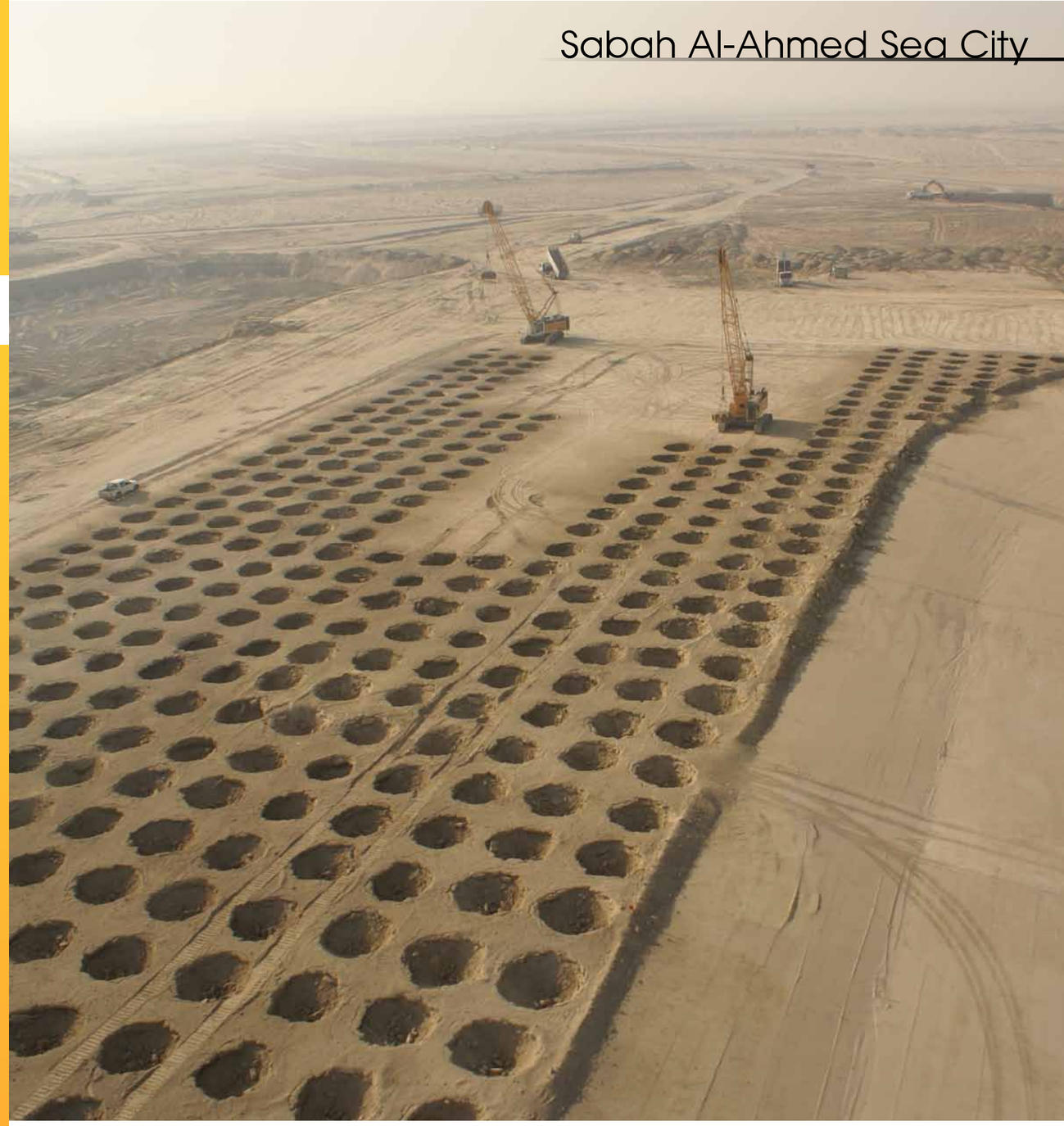
www.kccec.com.kw

40 yrs continuous growth



inland creeks, were subject to some unique constraints. Firstly, it was important that the lagoon systems did not greatly increase the volume of water entering and leaving the creeks with the tide, as this would create dangerous currents and potentially cause erosion.

"This is where the engineering and the environment on this project have a genuinely symbiotic relationship," Williams says. "The solution we came up with was to create four islands within the entrance to the creek to



Sabah Al-Ahmed Sea City

displace water and reduce the flow going in and out. We've also built inner tidal channels within the islands to replace any habitats that we may have disturbed during construction."

Turning these man-made islands into a teeming habitat for the existing indigenous and migratory species, as well as for species new to the area has been a major focus. The first initiative was to introduce mangroves at the waterline, to provide a great environment for small aquatic creatures and to anchor the soil and stabilise the new structures. "Our first attempt to introduce mangroves was disastrous, though, and they all died," Williams admits. "Mangroves naturally thrive in salt water, but

they're not native to this part of the Gulf. So we brought in an expert on mangroves, imported seeds from Abu Dhabi and began germinating them on potable water in our nursery. When they reached seedling stage, we began slowly weaning them off potable water until they became totally sufficient on salt water. At that stage, we successfully transplanted them to the islands and now we have a thriving mangrove population."

The inner reaches of the islands, meanwhile, have been planted with salt- and drought-resistant species such as eucalyptus and acacias from Northern Australia, where the climate and ecology are similar—the aim being to be able to walk away from the islands and let them become self-sustaining micro environments. "Since opening the waterways of the first two phases five years ago, we have recorded over 1,000 species of marine macro biota, with over 100 species of fish and shellfish, including one new to science. And that is quite an achievement."

Meanwhile, even providing the highly desired beaches throughout the complex has been something of an engineering marathon. "You'd have thought that in a country like Kuwait, the one thing we would have is sand for the beaches. In fact the opposite is true. Good beach sand consists of single sized grains laid down by the wave action. The desert sand here contains multi-sized grains of material, so sea water gets trapped in the matrix. If we used that, we would end up with an anoxic black smelly mass."

So far, it has required six sand washing plants working 24 hours a day to remove the fine particles from the local sand and produce over two million cubic metres of golden beach sands needed for the first three phases of development.

Throughout the project, engineering for the environment has very much driven the urban context. "We have not been able to take textbook examples or previously defined urban rules. Instead, we're creating a one-off urban environment suited to the ecosystems," Williams says. Moreover, lessons learned in one phase of development can be applied to subsequent phases, not only rewriting the textbooks, but enabling the new methods to be prototyped, honed and perfected. www.k-almarzouq.com/seacity.htm BE

> "Since opening the waterways of the first two phases five years ago, we have recorded over 1,000 species of marine macro biota, with over 100 species of fish and shellfish"

SABAH
AL-AHMED
SEACITY
www.k-almarzouq.com/seacity.htm