



Artificial lakes at Nad Al-Sheba



Artificial lakes in Al-Quoz

## Construction of a new modern plant for treatment of Dubai City's wastewater

The expansion of the drainage and sewerage network meant that there was a need to expand sewage treatment facilities. The old plant, at the inner end of Dubai Creek, could no longer cope, and lacked the space to expand, while it was also a source of complaints from local residents. In 1984, therefore, plans were drawn up for the building of a new plant, with a treatment capacity of 130,000 cubic metres a day or 330 gallons per second, and allowing for an expansion to 250,000 cubic metres a day.

A site for the new plant was selected 15 km. outside Dubai on the road to Al-Aweer. This location, on a raised area, was selected because a contour survey showed that it would be possible to construct the plant in such a way that the wastewater would flow naturally through the various stages of treatment, as a result of gravity, so that no pumps would be needed. The plant was designed to use the Activated Sludge System. 14 Emirati engineers were trained to run the project.

The project for the new plant also included five main pumping stations on the drainage and sewerage network, to pump wastewater to the plant.

Overall, the project cost Dh 700 million, of which Dh 400 million was for the plant itself, (Project No. DS/51) and the remaining Dh 300 million for the pumping stations (Project No. S/52).

The new sewage treatment plant and the associated works on the drainage and sewerage network were designed with several objectives in mind. One was that of keeping pace with the population growth in Dubai, to allow for the linking of around 70 per cent of the area of greater Dubai to be linked to the network.

By doing this, it would then be possible to reduce health hazards and threats to the environment caused by the contamination of groundwater or beaches by liquid untreated waste.



Remote Control System

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The plant was designed to ensure high quality treatment of the wastewater so that all of it could be safely used in sprinkler and drip-feed systems for agriculture and irrigation.

Thus providing water to help to meet the objective of having eight per cent of the overall area of Dubai planted with parks, gardens, trees and woodlands.

The remaining waste was then treated with heat to permit its use as organic fertiliser, free from germs, parasites or dangerous impurities.

### **Implementation of the Plant Project**

Work on the computer-controlled plant, which covered an area of 420,000 sq. metres, began in 1985, with the cost of the first phase, as noted above, being Dh 400 million. Operational capacity was 130,000 sq. metres a day, with a maximum average hourly flow of 10,800 cubic metres an hour.

Wastewater first began arriving at the plant on 5th March 1989, and the Municipality took delivery of the plant from the contractors on 8th December 1991, then becoming fully responsible for its operation and maintenance.

### **Treatment System**

As noted previously, the location of the plant was selected so that wastewater would flow naturally from stage to stage, without the need for pumps.

The three-stage system includes mechanical treatment, biological treatment and then filtration and sterilisation, the end result being treated water suitable for irrigation. A laboratory for carrying out tests is included in the plant, as well as workshops for maintenance.

Offices, accommodation for the workforce, a recreational building, playing fields and a mosque were built as part of the complex while back-up generators were also installed, to provide an alternative source of power in the event of a breakdown in supplies from the Dubai Electricity and Water Authority, DEWA.

With the plant in full operation, it registered an average daily flow in September 1994 of 116,000 cubic metres a day, or 89 per cent of designed capacity.

### **Plant Development**

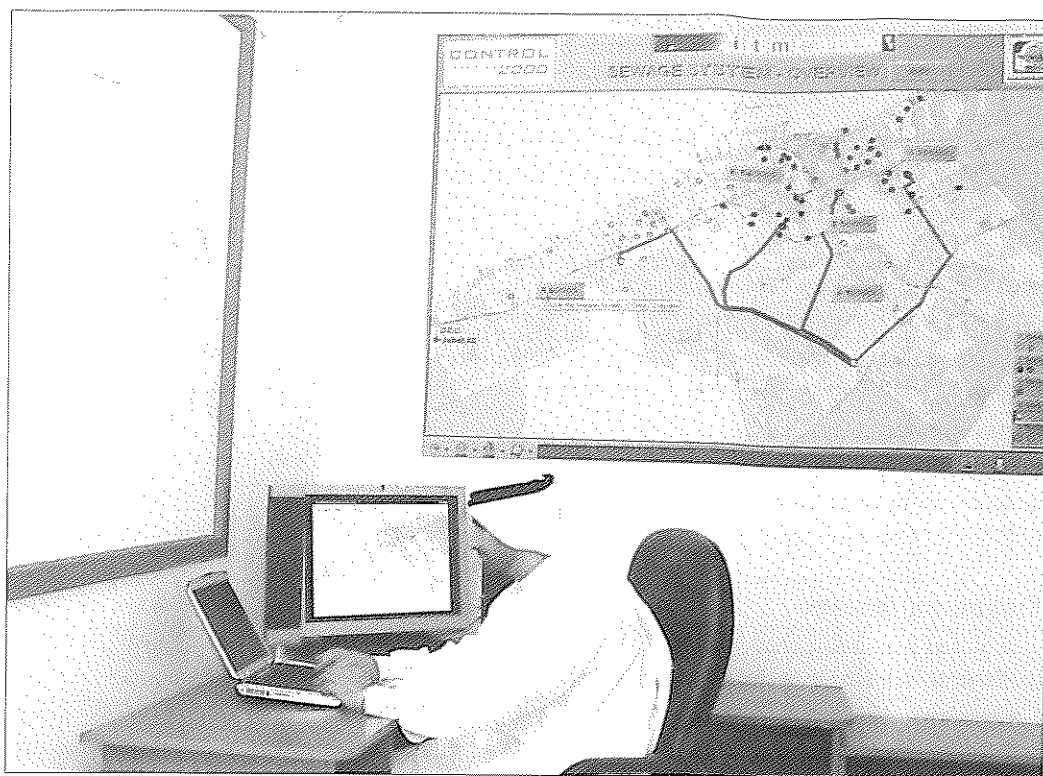
On 7th January 1995, in response to the continued projected increase in Dubai's population, the Municipality commissioned an initial study on the expansion of the plant to an overall capacity of 250,000 cubic metres a day, sufficient to meet the needs of around 1.2 million people.

Work on implementing the Phase Two expansion, (Project S/100), began on 31st August 1998 and was completed in March 2001, at a cost of Dh 295 million.

The Municipality has now prepared plans to take account of planned population growth and the consequent increase in demand for drainage, sewerage and irrigation projects up to the year 2020.

### **Remote Control System**

The first Remote Control System in the Drainage and Irrigation Department was completed in 1992 at a cost of Dh 2.9 million, and was designed to control the flow of wastewater by alter-



Remote Control System

ing it automatically when main wastewater stations reach their installed capacity, it also identifies whether pumps are or are not working, and pinpoints blockages and electrical and mechanical malfunctions.

In 2002, the system was upgraded at a cost of Dh 5.8 million, to cover a total of 138 drainage and irrigation pumping systems, providing information on any malfunctions and on the status of all stations and their daily operations. It also permitted constant monitoring of the working of the system and planning of regular maintenance.

### Treatment Efficiency

The treated wastewater has a high degree of purity, exceeding all international specifications for all biological, chemical and physical indicators approved for the measurement of quality level of water produced from wastewater treatment plants.

### Re-cycling of Treated Water

By the end of 2002, the amount of treated wastewater being produced by the plant had reached an average of 230,000 cubic metres a day, while the annual production had risen from 3,650,000 cu. m. to 84 million cu.m. This water is used for irrigation throughout the city.

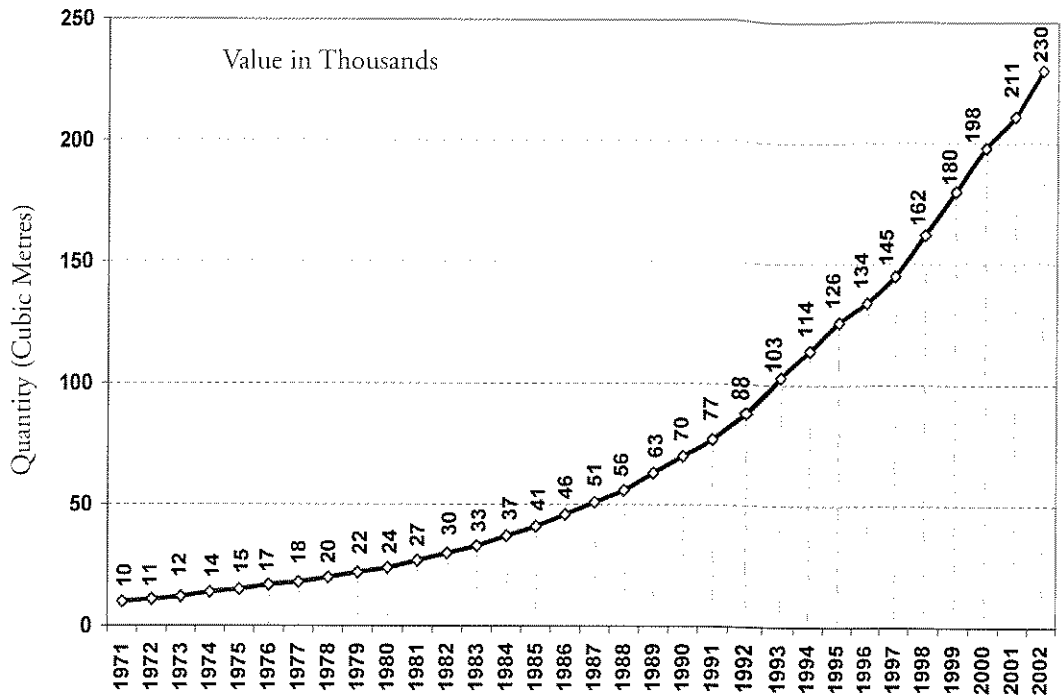
The increase in production over the last three decades is illustrated in Table No. 2.

Table No. 2. Treated water produced by the Wastewater Treatment Plant, 1971- 2002

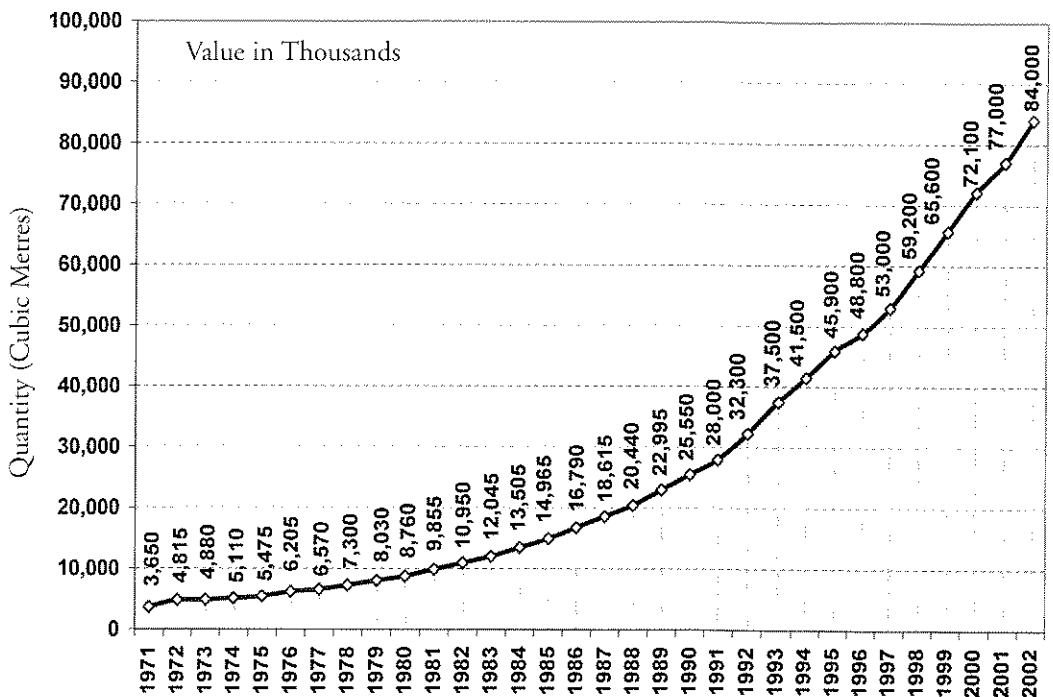
Year	Daily Average Cubic Metres *	Annual Quantity Cubic Metres *	Percentage of annual increase against the base year in 1971	Percentage of increase com- pared to the previous year
1971	10,000	3,650,000	-	-
1972	11,000	4,815,000	32%	32%
1973	12,000	4,880,000	33.7%	1.3%
1974	14,000	5,110,000	40%	4.7%
1975	15,000	5,475,000	50%	7%
1976	17,000	6,205,000	70%	13%
1977	18,000	6,570,000	80%	5.9%
1978	20,000	7,300,000	100%	11%
1979	22,000	8,030,000	120%	10%
1980	24,000	8,760,000	140%	9.1%
1981	27,000	9,855,000	170%	12.5%
1982	30,000	10,950,000	200%	11.1%
1983	33,000	12,045,000	230%	10%
1984	37,000	13,505,000	270%	12.1%
1985	41,000	14,965,000	310%	10.8%
1986	46,000	16,790,000	360%	12.2%
1987	51,000	18,615,000	410%	10.9%
1988	56,000	20,440,000	460%	9.8%
1989	63,000	22,995,000	530%	12.5%
1990	70,000	25,550,000	600%	11.1%
1991	77,000	28,000,000	667%	9.6%
1992	88,000	32,300,000	785%	15.4%
1993	103,000	37,500,000	927%	16.1%
1994	114,000	41,500,000	1,037%	10.7%
1995	126,000	45,900,000	1,158%	10.6%
1996	134,000	48,800,000	1,237%	6.3%
1997	145,000	53,000,000	1,352%	8.6%
1998	162,000	59,200,000	1,522%	11.7%
1999	180,000	65,600,00 (?)	1,697%	10.8%
2000	198,000	72,100,000	1,875%	9.9%
2001	211,000	77,000,000	2,109%	6.8%
2002	230,000	84,000,000	2,301%	9.1%

\* 1 cubic metre = 220 gallons

Daily Average Treated Water in Cubic Metres, 1971 – 2002



Annual Average Treated Water in Cubic Metres, 1971 – 2002





Irrigation using wastewater

### The Irrigation Network

The expansion of wastewater treatment facilities, and the fact that the treated water being produced is of high quality, without germs or parasites, made it possible for it to be used for irrigation without harming public health or the environment.

The Municipality was, therefore, able to lay extensive irrigation networks throughout the city, these being supplied with pumping stations to ensure regular and even distribution. The irrigation systems themselves use sprinklers and drip-feed techniques that require high quality treated water.

### Development of the Irrigation System

During the 1970s, around 5,500 cubic metres of treated water a day were used for irrigating trees, along with around 4,000 cubic metres a day drawn from wells in the Al-Mizhar area. This cost approximately Dh 250,000 a year, and only hoses could be used, since it was not possible to introduce modern irrigation systems.

With the improvement of wastewater treatment, however, it became possible to lay modern electronically-controlled irrigation networks, with a consequent reduction in the number of manual labourers who formerly handled the process of watering. The new system also reduced

**Table No. 3. Average Pollution Indicators in wastewater inside the Plant, before and after treatment, in 2002**

Pollution Indicators	Concentration of incoming water milligram/	Concentration of Treated water milligram/ Litre	Actual percentage of removal	Percentage of removal according to the Plant design
Biochemical Oxygen Demand BOD5	Litre	2.1	99.2%	96%
Suspended Solids SS	251	2.3	99%	97%
Chemical Oxidation Demand COD	251	34.6	94%	94%
Ammonia NH3	571	6.9	80%	95%

wastage. By 2002, around 190,000 cubic metres a day of treated wastewater were being used, which would have been worth around Dh 345 million a year had it been necessary to use fresh water suitable for human consumption.

All of the parks in Dubai now have automated irrigation systems, with sprinklers for open, grassed areas, and drip-fed irrigation for trees and plants, all being controlled electronically and connected to a main monitoring centre:

This system allows for around 60 per cent of the watering to be done at night and 40 per cent during the day, thus balancing the demand on the system.

It also means that most watering at night can be done after midnight, when the parks are closed, permits watering to be undertaken in accordance with the needs of the plants, trees and grassed areas.

Electricity is also saved, by programming watering times while the automated system, means that all watering can be shut off in case of emergency or during periods of rainfall.

In order to ensure that the appropriate quality of treated water is produced and used, regularly laboratory analysis is carried out of liquid, solid and gaseous samples, collected throughout the day. Table No. 3 provides an indication of the efficiency of the wastewater treatment plant in terms of meeting international specifications.

In order to ensure that as much as possible of the treated wastewater is used, the Municipality has made use of it for public, as well as private projects. In 2002, it was estimated that there was a saving of around 69 million cubic metres of drinking water that would have been used if the treated wastewater had not been available, this representing a considerable contribution towards the Municipality's objectives of protecting the environment and of achieving sustainable development.

The Municipality also made use of the treated wastewater for other projects. Of these, one

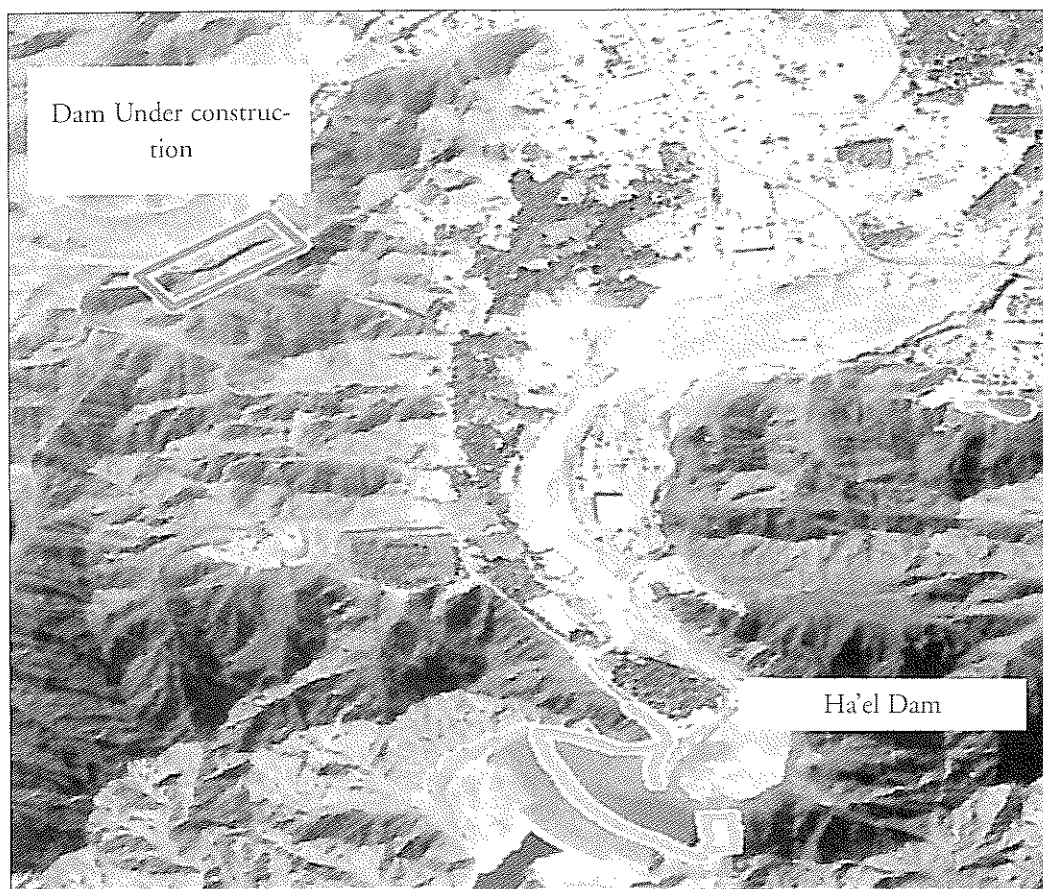


was an 80-hectare farm using Rodus grass for fodder production. Using around 12,000 cubic metres of treated water a day, the farm produces approximately 50,000 bales of fodder a year for sale to consumers.

In the long term, the Municipality hopes to bring planting to around eight per cent of the total area of the Emirate of Dubai, including the cultivation of roadside verges and central reservations, parks, gardens and woodlands. The potential for the supply of treated water at a nominal price to projects such as the Dubai Internet City, the Dubai Investment complex and projects being built by Emaar is also being studied.

### Production of Organic Fertiliser from Waste Residue (Sludge)

The sludge, or waste residue from the various stages of treatment in the plant, is used to produce around 35 tons a day of high quality organic fertilizer, particularly suitable for use in sandy soils. Chemical analysis shows that it contains a concentration of 5.2% of nitrogen compounds, 6.2% of phosphorous compounds and 60% organic matter. This heat-treated fertiliser is classed as a Grade A fertiliser by the relevant authority in the United States.



Hatta Dams Project

## Hatta Dams

In line with the directives of H.H. the late Sheikh Rashid bin Saeed Al-Maktoum, UAE Vice President and Ruler of Dubai, plans were made to construct a number of small dams in Hatta during the 1970s and 1980s. Construction of these was planned and supervised by the Ruler's Office, at a cost of around Dh 7.8 million.

In 1997, the Drainage and Irrigation Department supervised the construction of a much larger dam, which cost Dh 58 million and was completed in February 1998.

The Municipality is now studying the possibility of building a further dam, which is estimated to cost Dh 36 million.

## Expenditure on drainage and irrigation projects

The following tables provide data of expenditure on drainage and irrigation projects.

Table No. 4 shows expenditure on sewerage and rainwater projects, including those which were completed before 1970, sewerage and rainwater drainage projects. Allowing for an average of five per cent as costs for consultants, the total amount spent has been around Dh 4.192 billion.

Table No. 5 covers irrigation projects from 1980 – 2002, as well as projects carried out before 1980. Total cost was Dh 391,591,378.

Table No. 6 and the associated graph shows the total expenditure on sewerage, rainwater drainage and irrigation projects between 1970 and 2002, and also shows those projects completed before 1970.

**Table No. 4. Sewerage and rainwater drainage projects, 1970 – 2002**

No	Project No.	Project	Contract Value (in Dhs.)	Date of Completion
1	D1	Drainage Network for Dubai (Phase One)	37,856,551	April 1974
2	D2	Drainage Network for Dubai (Phase Two)	97,784,785	August 1976
3	D7 (1:6)	Treated Wastewater Lines	9,889,570	February 1978
4	D2A	Drainage Network for Dubai (Phase Two) Continuation	147,865,851	January 1979
5		Drainage Network for Dubai (Phase Three)	14,865,852	January 1979
6	D10	Drainage Lines for Al-Shabab and Al-Wasl Clubs	1,293,428	July 1979
7	D3 (1:9)	Additional Works – Expansion of Treatment Plant	15,420,000	April 1980
8	D4	Additional Works – Expansion of Treatment Plant	972,725	June 1980
9	D8	Drainage Network – Deira	48,686,522	September 1980
10	DM1	Development of Treatment Plant in Al-Garhoud	10,309,976	January 1981
11	DS13	Drainage Networks in Al-Ra's	1,710,120	March 1981
12	M01/80	Fermentation Tanks in the Treatment Plant	1,269,463	April 1981

Table No. 4.

No	Project No.	Project	Contract Value (in Dhs.)	Date of Completion
13	D12	Drainage Networks for Dubai	25,309,959	July 1981
14	D11	Drainage Networks for Dubai Zoo	128,370	September 1981
15	D3	Expansion of the Sewage Treatment Plant	50,406,908	November 1981
16	D11	Drainage Lines for Port Saeed and Al-Khebaishi areas	14,633,368	August 1982
17	DS14	Expansion of the drainage project in Deira	10,703,942	August 1982
18	DS	Additional works – expansion of the Treatment Plant	6,404,944	September 1982
19	DS19	Drainage line for Al-Garhoud Street showrooms	546,625	November 1982
20	DM2	Maintenance work for the Treatment Plant	9,029,326	February 1983
21	DS50	Soil Tests for the Sewage Treatment Plant Project	4,767,565	February 1983
22	DRI50	Rainwater Network in Al-Sabkha Market	2,790,729	March 1983
23	D8(1:38)	Pump Station for Deira	17,271,961	July 1983
24	DS22	Construction of crossing points for drainage lines	1,956,707	September 1983
25	DS16	Expansion of sewage treatment plant in Al-Garhoud	10,104,772	October 1983
26	DS15	Drainage Network for Zabeel	8,696,555	May 1984
27	DS9	Drainage lines for Al-Wasl and Al-Safa Streets	30,243,663	September 1984
28	D2AC	Drainage Network for Dubai	268,937,935	January 1985
29	DS18	Construction of a tank and pump station for treated water	10,957,795	March 1985
30	DS23	Drainage network for Dubai Police headquarters	1,432,859	April 1985
31	DS24	Drainage network for Al-Wasl Street	4,844,051	July 1985
32	DS30	Drainage network for Hor Al-Anz	66,000,000	July 19 85
33	DS31	Drainage network for Hor Al-Anz	63,000,000	July 1985
34	DS26	Construction of crossing point in Al-Dhiyafa Street	274,909	September 1985
35	DS27	Drainage Network for Khaled Bin Al-Walid Street	1,062,044	September 1985
36	DS29	Settlement work for Al-Rashidiya	2,700,883	November 1985
37	DS25	Drainage network for Al-Wasl Hospital and Al-Wasl Club	3,405,932	December 1985
38	DS33	Labour Housing in Al-Qusais	517,251	January 1986
39	MO2/80	Repairs to units in the treatment plant	658,028	May 1986
40	DS34	Drainage network for Al-Dhiyafa Street	3,751,284	September 1986
41	DS42	Urgent drainage work	22,291,896	January 1987
42	DS32	Water pipelines for the Municipality building	342,422	April 1987

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No	Project No.	Project	Contract Value (in Dhs.)	Date of Completion
43	DS43	Drainage point for groundwater and rainwater in Al-Quoz	1,566,641	July 1987
44	DS28	Connections to homes and small works	34,311,531	August 1987
45	DS36	Drainage point for rainwater in Al-Khor	5,160,272	November 1987
46	DS40	Pump station in Al-Murar district & a drainage point for rainwater	1,760,761	November 1987
47	DS52	Main pumping stations	301,310,990	February 1989
48	DS45	Residential connection and urgent works	23,266,020	May 1989
49	DS62	New (B) Pumping Station	1,918,311	June 1989
50	DS46	Rainwater drainage for Dubai Airport	5,842,596	September 1989
51	DS 48/3	Drainage networks for Al-Rashidiyah	7,500,000	October 1989
52	DS 41	Drainage network for Al-Kafaf	9,861,325	November 1989
53	DS 35/1	Maintenance of Municipality building	3,500,000	June 1990
54	DS39	Pump station and drainage network	7,812,992	June 1990
55	DS39/2	Development of treatment plant system	7,931,644	July 1990
56	DS 80	Residential connections and urgent works	25,551,029	November 1990
57	DS54	Rainwater drainage in Al-Karamah	43,085,531	March 1991
58	DS53	Drainage network in Al-Safa	41,000,000	June 1991
59	DS48/1	Drainage network in Al-Rashidiya	47,000,000	August 1991
60	DS49	Drainage network in Al-Tawar	27,000,000	October 1991
61	DS70	Sewage drainage line from Al-Sadiya roundabout to pump station (E)	30,058,424	October 1991
62	DS48/2	Drainage network in Al-Rashidiya	31,000,000	December 1991
63	DS51	Wastewater treatment plant in Al-Aweer	399,929,336	December 1991
64	DS69/1	Drainage network in Al-Satwa (first phase)	3,811,000	April 1992
65	DS72/1	Rainwater drainage in Al-Shandagha - first phase	12,450,092	August 1992
66	DS90	Residential connections and urgent works	15,929,378	July 1993
67	DS83/1/A	Maintenance and development of drainage networks in Bur Dubai	36,474,460	July 1993
68	DS 83/B	Maintenance & develop. of drainage network in Bur Dubai (second phase)	41,500,000	July 1993
69	DS85	Remote control system	2,780,638	November 1993
70	DS64/1	Drainage and rainwater network in Al-Mankhool	28,380,217	June 1994
71	DS95/2	Rainwater drainage line for the Government Garage	2,332,684	June 1994
72	DS61/1	Rainwater and Drainage network in Al-Zabeel - first phase	3,699,813	February 1995

Table No. 4.

No	Project No.	Project	Contract Value (in Dhhs.)	Date of Completion
73	DS69/3/A	Main pumping station for rainwater drainage in Al-Satwa	22,164,682	May 1995
74	DS68/1	Rainwater drainage in Jumeirah and Al-Safa – first phase	31,270,941	July 1995
75	DS69/2	Drainage network in Al-Satwa (second phase)	114,687,400	December 1995
76	DS95	Residential connections and urgent works	18,754,534	March 1996
77	DS67	Drainage project for Al-Mamzar and Al-Wahida areas	32,251,780	June 1996
78	DS68/2	Sewage & rainwater drainage in Jumeirah & Al-Safa – second phase	38,405,000	February 1997
79	DS83/2A	Develop. & maintenance of drainage networks in Deira (second & third phase)	20,000,000	March 1997
70	DS71/1	Drainage of rainwater in Al-Riqqa and Al-Mateina areas	38,056,224	April 1997
81	DS71/2	Drainage networks in Al-Riqqa and Al-Mateina areas	37,500,000	April 1997
82	DS6/3	Sewage & rainwater drainage in Jumeirah and Al-Safa – phase three	43,998,854	May 1997
83	77DS77	Sewage and rainwater drainage in Al-Tawar – second phase	34,913,923	June 1997
84	DS87/3	Hydrological study for Dubai City, storage of irrigation water	1,700,000	July 1997
85	DS105	Residential connections and urgent works	13,499,240	August 1997
86	DS83/2-1	Develop. & maintenance of drainage networks – Deira section (B) first phase	15,877,440	October 1997
87	DS83/3-2&3	Develop. & maintenance of drainage networks – Deira sections 2&3	14,808,240	December 1997
88	DS87/1	Hydrological Study	1,794,888	December 1997
89	83/3-1	Develop. & maintenance of drainage networks – Deira, part 3/1	16,800,000	December 1997
90	DS105/1	Residential connections and urgent works	4,047,554	January 1998
91	DS96	General plan for drainage networks	2,000,000	January 1998
92	DS57	Sewage and rainwater drainage – Al-Garhoud	29,243,666	February 1998
93	DS75/3	Construction of dams in Hatta	54,890,047	June 1998
94	DS68	Sewage and rainwater drainage in Jumeirah and Al-Safa	50,000,000	July 1998
95	DS32/2	Development of drainage networks – second phase	30,000,000	July 1998
96	DS68/5	Sewage and rainwater drainage in Jumeirah and Al-Safa – fifth phase	54,634,956	October 1998
97	DS68/4	Sewage & rainwater drainage in Jumeirah & Al-Safa – fourth phase	50,000,000	March 1999
98	DS69/3A	Drainage networks in Al-Satwa – phase three A	21,678,217	June 1999
99	DS103	Sewage and drainwater project for Al-Quoz residential area	48,856,299	June 1999
100	DS69	Drainage for Al-Satwa	26,270,071	June 1999
101	DS107	Sewage and rainwater drainage project for Port Saeed	18,400,000	July 1999
102	DS110	Residential connections and urgent works	20,994,060	August 1999

Table No. 4.

No	Project No.	Project	Contract Value (in Dhs.)	Date of Completion
103	DS104	Sewage & rainwater drainage project for Nad Al-Sheba & Ra's Al-Khor	52,607,302	January 2000
104	DS68/6	Sewage & rainwater drainage project for Jumeirah & Al-Safa – sixth phase	54,172,244	May 2000
105	DS64/2B	Sewage and rainwater drainage project for Al-Mankhool B	35,503,247	June 2000
106	DS68/9	Sewage & rainwater drainage project for Jumeirah a& Al-Safa – ninth phase	25,700,000	June 2000
107	DS64/2A	Drainage of sewage and rainwater – Al-Mankhool 2	39,831,887	July 2000
108	DS68/1A	Sewage & rainwater drainage project for Jumeirah & Al-Safa – first phase A	19,440,000	July 2000
109	DS68/8	Sewage & rainwater drainage project for Jumeirah & Al-Safa – eighth phase	44,161,242	September 2000
110	DS68/7	Sewage & rainwater drainage project for Jumeirah & Al-Safa – seventh phase	87,333,858	January 2001
111	DS108	Rainwater drainage for Al-Ramool Industrial area	28,452,300	February 2001
112	DS100	Expansion of treatment plant in Al-Aweer	294,960,193	March 2001
113	DS68/12	Sewage & rainwater drainage project for Jumeirah & Al-Safa – twelfth phase	13,019,375	April 2001
114	DS61/2	Rainwater lakes at Camel Racetrack – Nad El-Sheba	40,140,000	June 2001
115	DS163	Drainage in Zabeel – second phase	4,741,000	September 2001
116	DS86	Main lift station for pump station E	48,570,465	September 2001
117	DS120	Residential connections and urgent works	19,800,000	October 2001
118	DS68/10	Sewage & rainwater drainage project for Jumeirah & Al-Safa – tenth phase	19,779,000	November 2001
119	DS109	Sewage and rainwater drainage project for Al-Qusais (232)	24,312,000	December 2001
120	DS111	Sewage and rainwater drainage project for Al-Qusais (232)	12,750,089	March 2002
121	DS106B	Sewage and rainwater drainage project for Nad Al-Sheba area B	41,757,043	May 2002
122	DS85/3/4	Development of drainage networks – third phase, part 4	34,856,480	June 2002
123	DS106	Sewage and rainwater drainage project for Nad Al-Sheba area A	55,163,121	October 2002
124	DS119	Expansion of remote control system	5,654,360	December 2002
125	DS172	Adjustments to pump lines	47,308,000	December 2002

Table No. 5. Irrigation Projects, 1980 – 2002

No	Project No.	Project Name	Contract Value	Date of Completion
1	Internal	Irrigation system for Maydan Al-Itihad Park – Deira	1,440,000	November 1980
2	IR – 11	Irrigation water line – Zabeel	4,328,754	April 1981
3	Internal	Irrigation system for Mushrif Park	1,200,000	December 1984
4	Internal	Irrigation system for Naif Park	250,000	June 1985
5	Internal	Irrigation system for Zabeel Park	250,000	September 1985
6	IR – 5	Irrigation System for Port Rashid	800,000	June 1987
7	IR – 6	Irrigation system for Zabeel Street 2	2,124,152	October 1987
8	IR – 9	Irrigation system for Al-Wahida Street	2,500,000	November 1989
9	IR -11	Irrigation system for Oud Maitha Street	1,681,455	February 1990
10	IR -13	Drilling Wells on Al-Aweer Road	1,650,000	January 1990
11	IR -17	Irrigation system for Al-Mankhool Street	1,215,000	November 1990
12	IR -18/1	Irrigation system for Al Ain Road (first phase)	2,800,000	December 1990
13	IR -21	Irrigation system for Abu Hail Road	2,366,071	July 1991
14	SAFA P.	Development of Al-Safa Park	48,244,654	July 1992
15	IR -14/5	Irrigation system for Mushrif nature reserve (first phase)	2,313,308	October 1992
16	IR -10	Irrigation system for Al-Khaleej Street	2,356,398	December 1992
17	IR -28	Irrigation system for Oud Maitha Street (first phase)	1,463,000	October 1992
18	IR -18/2	Irrigation system for Al Ain Road (second phase)	2,415,587	November 1992
19	IR -12	Irrigation system for Al-Rashid Street	996,000	August 1993
20	IR -18/3	Irrigation system for Al Ain Road (third phase)	1,871,600	April 1994
21	IR -19	Irrigation system for Al-Aweer Street	2,897,000	April 1995
22	IR -26	Irrigation system for Al-Qusais Street	3,951,572	August 1995
23	IR -32	Irrigation system for Sheikh Zayed Road (first phase)	3,280,000	May 1996
24	IR -34	Irrigation system for Sheikh Zayed Road (second phase)	3,923,185	May 1996
25	DS81/1	General Plan for irrigation networks (first phase)	16,120,937	July 1996
26	IR -14/6	Irrigation system of Mushrif nature reserve (second phase)	2,639,382	November 1996
27	IR -37	Irrigation system for Jumeirah Street	3,255,824	January 1997
28	IR -30	Irrigation system for Al Ain Road	5,300,000	March 1997
29	DS20	Main irrigation network for Deira	27,709,802	March 1997
30	IR -35	Irrigation system for the Municipality's fodder farm in Al-Aweer	3,041,120	March 1997

Table No. 5.

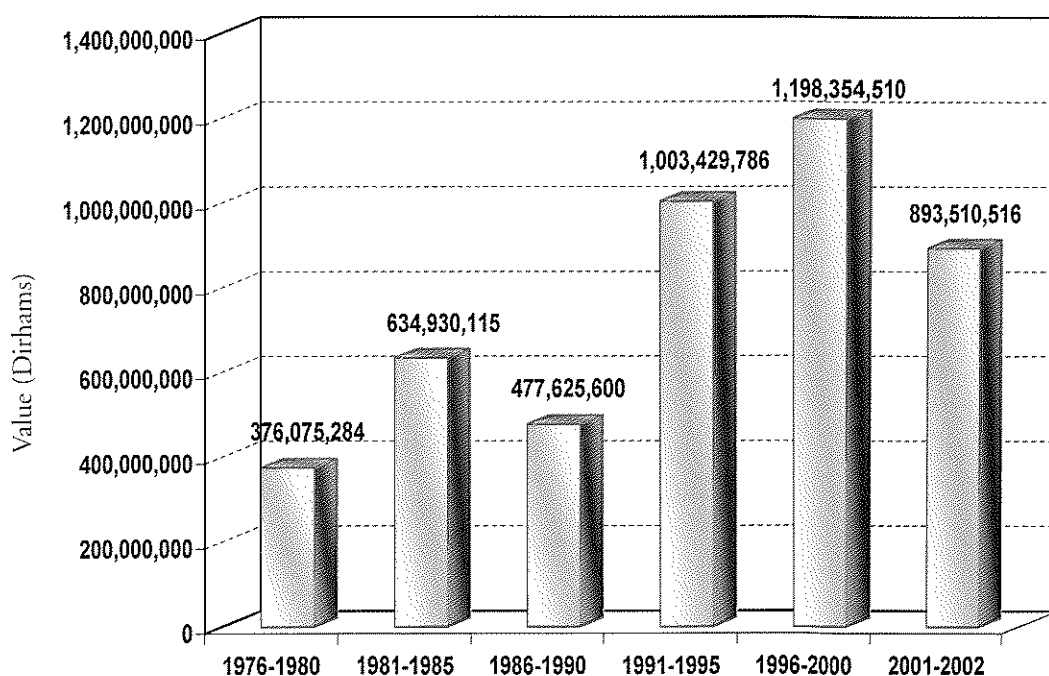
31	DS19	Main irrigation network in Bur Dubai	41,705,288	June 1997
32	IR -41	Irrigation system for Commercial Centre Street, between Burjuman interchange & Sana interchange	1,537,409	June 1997
33	IR-42	Irrigation system for Oud Maitha Street	1,639,852	July 1997
34	IR -43	Irrigation system for Street	1,779,057	July 1997
35	IR -45	Irrigation system for Sheikh Zayed Street between Trade Centre roundabout and Holiday Inn Hotel	2,118,320	June 1997
36	IR -33	Irrigation system for various areas in Dubai	4,372,035	August 1997
37	IR -38	Irrigation system for Al-Wasl Street	2,348,000	October 1998
38	IR -48	Irrigation system for entrance of Zabeel Palace	1,518,530	January 1999
39	IR -81/2	General Plan for irrigation networks (second phase)	45,492,632	January 1999
40	IR -46	Irrigation system for Al-Ramool Street	2,952,000	March 1999
41	IR -49	Irrigation system for Al-Qataiyat Street	4,141,400	October 1999
42	IR -50	Automatic irrigation system for Oud Maitha – Al-Qataiyat Street interchange	3,153,000	October 1999
43	IR -54	Irrigation system for Shooting Club	650,000	August 1999
44	IR -39	Main irrigation network for Zabeel Street 2	1,448,400	November 1999
45	IR -47	Irrigation system for Trade Centre Road between Burjuman interchange and Sana interchange	2,650,772	January 2000
46	IR -51	Irrigation system for various areas in Dubai (first phase)	4,786,650	November 2000
47	IR -62	Irrigation system for Airport Road	5,014,717	December 2001
48	IR -24	Irrigation system for Nad Al-Hamar Road – first phase	4,282,145	June 2001
49	IR -40	Irrigation system for Nad Al-Hamar Road – second phase	4,440,000	March 2001
50	IR -44	Irrigation system for Al-Abraj Street	4,831,092	July 2001
51	IR – 52	Irrigation system for Al-Ittihad Street	3,725,697	December 2001
52	IR -53	Irrigation system for Al-Qusais Street	4,359,100	March 2001
53	IR -59	Irrigation system for Sheikh Zayed University Street	1,862,214	January 2001
54	IR -61	Irrigation system for Zabeel streets	2,100,000	April 2001
55	IR -67	Irrigation system for nature reserves	1,060,000	November 2001
56	IR -149/1	Main irrigation system for Jebel Ali (1)	34,315,915	July 2002
57	IR -149/2	Main irrigation system for Jebel Ali (2)	41,389,680	July 2002
58	IR -55	Irrigation system for Dubai Ring Road	3,202,197	July 2002
59	IR -85	Irrigation system for Nad Al-Sheba Nursery	988,246	July 2002
60	IR -69	Irrigation system for the Emirates Road – phase 4	3,342,229	September 2002
Total Cost			391,591,378 Dirham	



Table No. 6. Expenditure on Irrigation and Sewage and Rainwater Drainage Projects

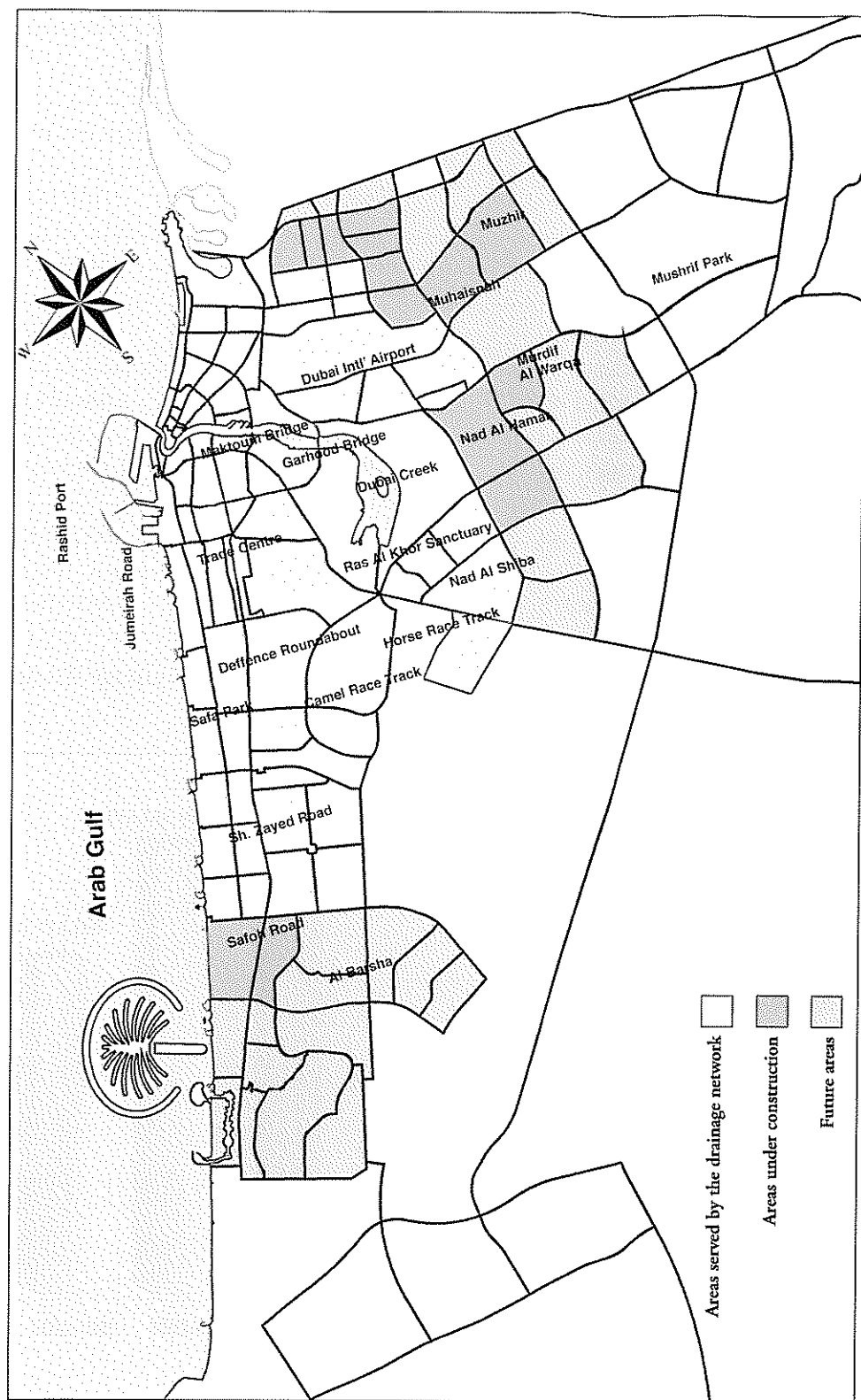
Year	Irrigation Projects	Sewage and Rainwater Drainage Projects	Total (in dirhams)
1976-1980	1,440,000	374,635,284	376,075,284
1981-1985	6,028,754	628,901,361	634,930,115
1986-1990	12,770,607	464,854,993	477,625,600
1991-1995	68,875,190	934,554,596	1,003,429,786
1996-2000	187,563,595	1,010,790,915	1,198,354,510
2001-2002	114,913,232	778,597,284	893,510,516
Total Expenditure	391,591,378	4,192,334,433	4,583,925,811

Expenditure on Irrigation and Sewage and Rainwater Drainage Projects, 1976 – 2002



Total expenditure up to 2002: 4,583,925,811 Dirhams.

# Drainage Projects



**Historical  
Development  
of the Public Parks  
and Horticulture  
Department**

by **John W. ...**

The Horticulture Section of the Dubai Municipality, as it was then known, was set up in 1972 to take responsibility for the management of afforestation and of maintaining and increasing other planted areas, in association with other units of the Municipality. Help was sought from an Iranian agronomist who advised the planting of roadside verges with trees that could survive both the harsh weather and a limited water supply.

Making use of the limited resources available, the department began a programme of planting, using imported seeds and irrigating with groundwater extracted from wells. Among the work undertaken was the planting of the first two large parks, Mushrif Park, planted in 1974 and Al-Safa Park, planted in 1975. Trees were also planted along some roadside verges.

At the beginning of the 1980s, the completion of the Sewage Treatment Plant provided ample supplies of treated wastewater that was suitable for sprinklers and drip-feed systems. This made it possible to increase the extent of planted areas substantially, while the organic fertiliser produced by the plant was also put to good use. More employees were taken on, dealing both with horticulture and landscaping, while in 1982 the Hor Al-Anz nursery was established to produce tree saplings, shrubs, succulents and flowering plants, these being selected for their adaptability to local climatic conditions.

In the same year, a dedicated Horticulture Section was established, which succeeded in completing 65 new projects over the subsequent five years, including landscaping of streets, cultivation of playing fields and roundabouts and establishment of gardens in residential areas.

## 1 - Landscaping of Streets and Roundabouts

Landscaping of streets and roundabouts included work in Al-Riqqa Street and Al-Muragabat Street, and adjacent to traffic underpasses, while the Trade Centre roundabout was also planted at the time of the 1986 Chess Olympics.

## 2 - Parks

Two important parks were also completed, in Maydan Al-Itihad (Al-Itihad Square) in 1982 and Nayef Park in 1985.

## 3 - Playgrounds

At the beginning of February 1985, work also began on the cultivation of playing fields at the Al-Ahli, Al-Nasr and Al-Shabab Clubs.

The development of the Municipality's own nurseries played an important part in facilitating the work of the section.

4 - Nurseries

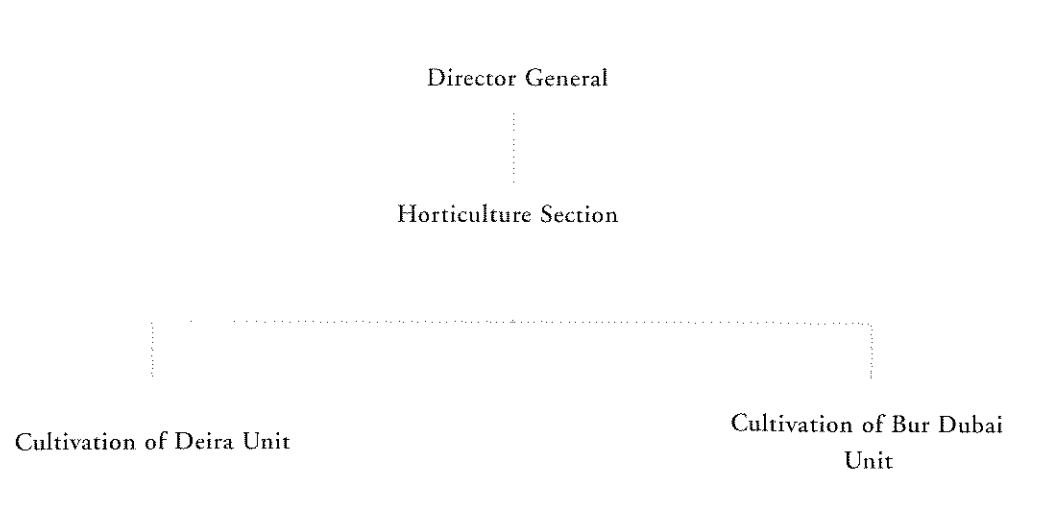
In 1985, approval was given for the setting up of a greenhouse while shaded areas for cultivation of plants were also increased.

By the end of this year, the planted area in Dubai had risen to 334,911 sq. metres, an increase of 42.6 per cent from over the figure at the end of 1982, while a total of 485,009 trees had been planted, an increase of 85.3 per cent over the December 1982 figure.

Administrative Development

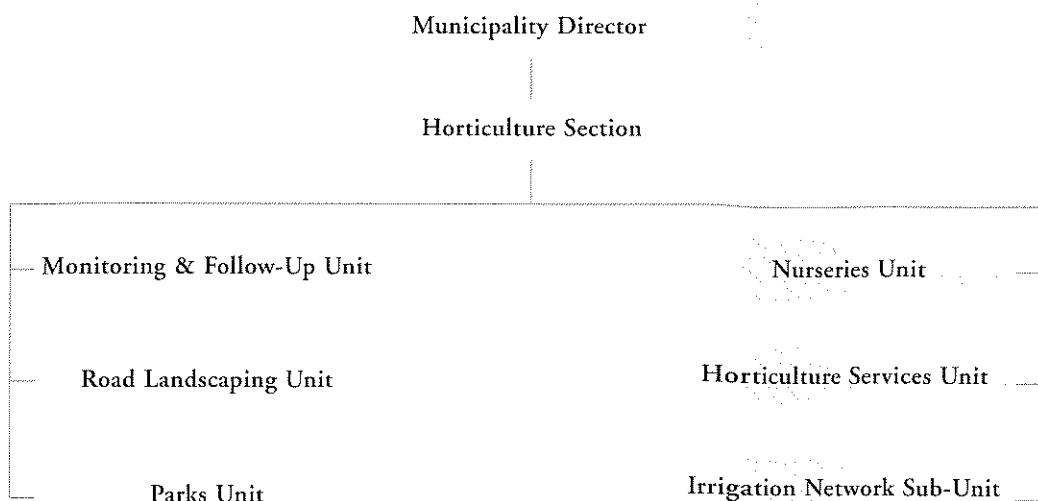
As noted above, the Horticulture Section was first established in 1972, then being directly under the office of the Municipality Director, and being given responsibility for horticulture and tree-planting in Bur Dubai and Deira. As shown in Chart No. 1, it had two separate Units.

Chart No. 1. Horticulture Section in 1972



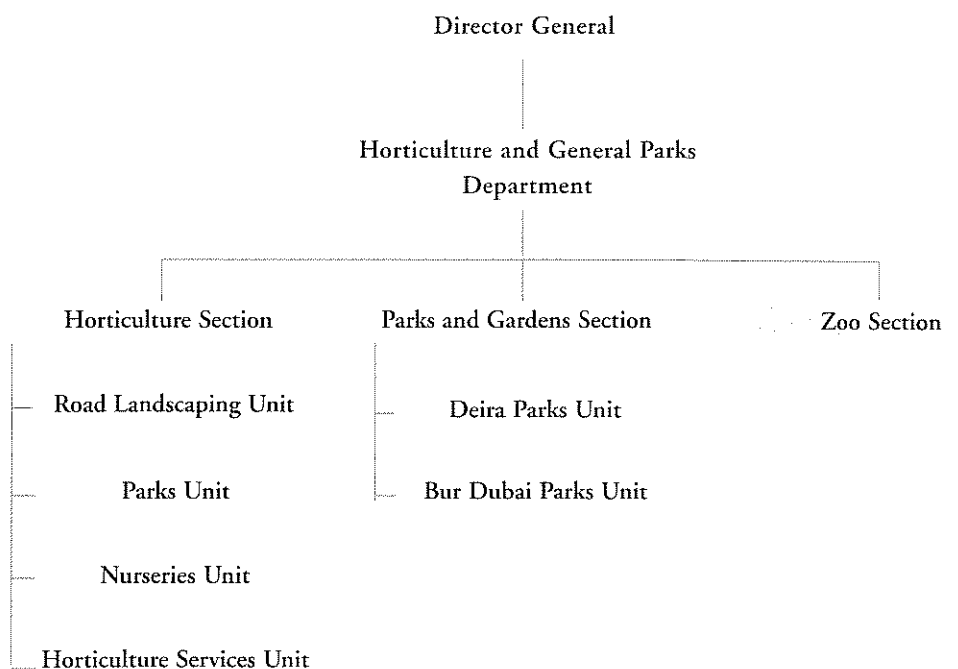
In 1987, the organisational chart was revised, with six separate units being established, although the Section remained directly affiliated to the Director's office. Five main Units were created as well as an Irrigation Network sub-unit, as shown in Chart No. 2.

Chart No. 2. Organisation Chart in 1987



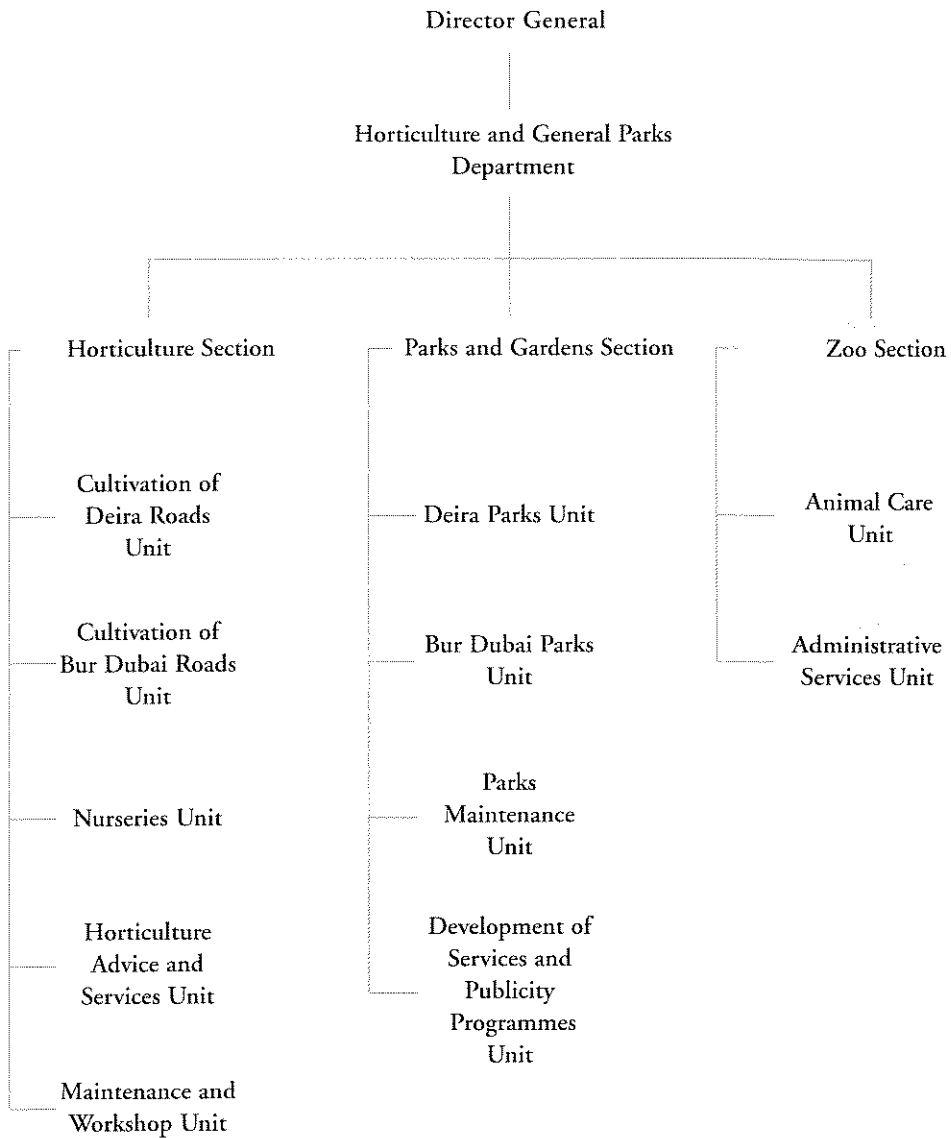
In 1991, there was a further revision to the structure, with the establishment of the Horticulture and General Parks Department, as shown in Chart No. 3.

Chart No. 3. Horticulture and General Parks Department in 1991



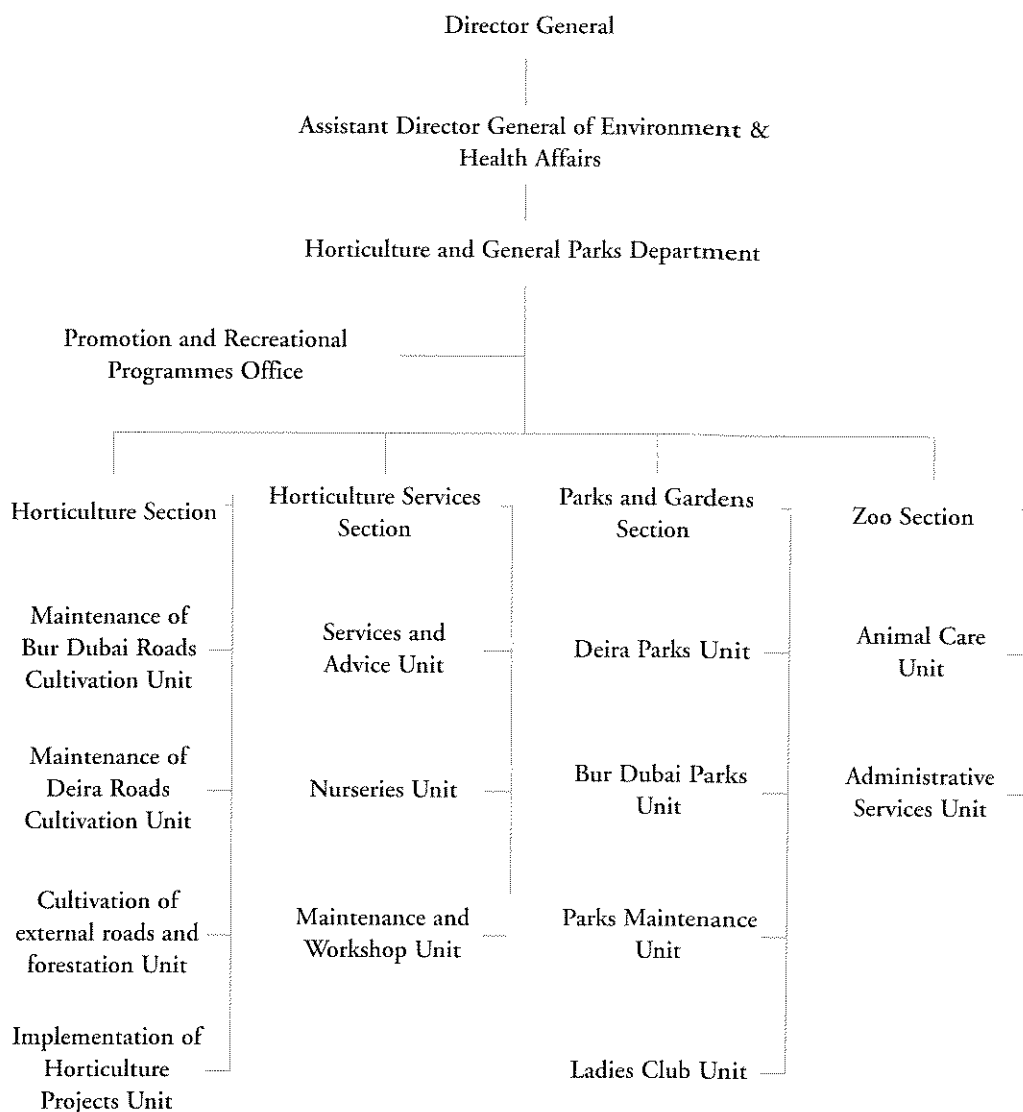
In 1993, new Units were added, and the organisation chart was revised, as shown in Chart No. 4.

Chart No. 4. Horticulture and General Parks Department in 1993



A further amendment to the Organisation Chart took place in 1997, with the addition of new units, as shown in Chart No. 5.

**Chart No. 5. Horticulture and General Parks Department in 1997**



In 1998, the Department's title was changed to the Public Parks and Horticulture Department.

In 2000, the Children's City was built in Dubai and was added as a separate Unit to the General Parks Section while in May 2002 the Ladies Club was made independent and was removed from the Section.



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## The main duties of the Public Parks and Horticulture Department:

The Public Parks and Horticulture Department is responsible for planning, planting, developing, operating and maintaining gardens, general parks, public parks, Children's City, recreational services and the Zoo. The responsibilities of the various sections and Unit are as follows.

### Promotion and Recreational Programmes Office

This is responsible for promoting use of the public parks, the Children's City and the Zoo, through advertising, and through organisation of recreational events with the private sector. It also organises various events related to the department, and ensures that the necessary services are available for the public in all of these locations.

### Horticulture Section

The Horticulture Section is responsible for all of the gardens programme in the Emirate and for tree-planting. It undertakes planting of areas which were formerly cultivated as well as tree plantations and nature reserves, making use of native tree species.

### Horticulture Services Section

This Section propagates and raises the plants used in the gardens programme and provides the necessary top-soil and fertilisers, it also undertakes pest control and maintains horticultural tools and equipment and provides carpentry, welding and construction services for landscaping. It is also responsible for licensing and monitoring the work of horticultural companies in Dubai.

### Parks and Gardens Section

The Parks and Gardens Section is in charge of administering, developing, operating and maintaining the parks and their recreational services, as well as of Children's City. Its duties with regards to the recreational services, such as children's play areas, include responsibility for health and safety and for ensuring that the facilities are used in an orderly manner.

### Landscaping in Dubai

During the 1970s, tree-planting in Dubai was carried out in a somewhat erratic and unplanned way. In 1982, however, a new and scientifically-planned approach was adopted. This included:

- 1- Working with the Municipality Planning Section to prepare designs for new planting projects.
- 2- The careful selection of plants that were well-adapted for survival in the local environment.
- 3- Improvement of soil quality.

- 4— Upgrading of irrigation systems.
- 5— The introduction of new horticultural techniques.

By the end of the 1980s, the section had succeeded in transforming tree-planting and horticulture throughout the Emirate.

In 1987, following the decision to create the Horticulture Section, as well as the increased amount of treated wastewater available for irrigation, it was decided to establish a permanent committee to oversee plans to expand the amount of greenery throughout the Emirate. The committee was headed by the Director General with the head of the Planning Section, the head of the Drainage and Irrigation Section and the head of the Horticulture Section as members.

The committee drew up a plan to have a total of eight per cent of the urban areas of the emirate planted with trees, flowering plants, shrubs and grass.

Its tasks also included the studying of new planting projects, to choose designs and planting plans that were best suited to local conditions and would also improve the appearance of the streets and roads of Dubai, planning for the introduction of automatic irrigation systems in parks and gardens, to replace the manual watering that that previously been undertaken, the upgrading of existing gardens and parks and the approving of an annual plan for landscaping projects.

It was also charged with overseeing the appropriate horticultural research to select suitable plants and the development of links with local and foreign organisations in the field of horticulture and afforestation.

As part of this process, a research unit was set up as part of the Nurseries Section and a fully-equipped laboratory was established at the Al-Garhoud Nursery.

The Nursery was upgraded to become the first proper nursery in the UAE and the Gulf. Besides a building for the administration of the Nursery section, it was also provided with an air-conditioned greenhouse with an area of 1500 sq. metres, shaded areas, a workshop and stores. This helped the Section to attain self-sufficiency in terms of producing plants and saplings.

A programme was also put in place for the training and recruiting of personnel with the appropriate Bachelors and Masters degrees and with suitable work experience.

In order to ensure that the work of the Section was carried out in accordance with the best international practices, an arrangement was made with the United Nations Development Programme during 1988-1990 for the provision of the services of a qualified agronomist for periods of one to two months a year.

All of this planning yielded useful results.

Several major parks were established, including Al-Wasl Park in 1987, Al-Hamriyyah Park and Al-Rashidiya Park in 1988 and the Jumeirah Beach Park in 1989, while there was also a major programme of landscaping along the roads within the city as well as of the road from Dubai to Al Ain, this being carried out in three phases, in 1990, 1992 and 1997.

Automated irrigation systems were also installed in many areas, covering 31.4 per cent of the total planted area along the roads, 69 per cent of the roundabout and 87.5 per cent of the area of the parks.

As a result, it was possible for the Horticulture Section to reduce its labour force, since less

manual labourers were required for watering. The automated watering system also reduced water consumption, since it could be set to deliver only the amount of water actually required.

Further parks were established in the 1990s, including Al-Khor Park, covering 96 hectares, and Al-Mamzar Park, covering 99 hectares, both of these being completed in 1994.

In terms of afforestation and tree plantations, the Al-Qusais plantation was planted in 1991, the Mushrif plantation, covering 400 hectares, in 1992 and the Al-Rashidiya Hills plantation in 1997. In some cases, fruit trees were planted at part of the projects, although care was also taken

Period	Number of Projects	Grass Area*	Ground Covered*	Flowers*	Palm Trees **	Other Trees **
1981-1985	48	390,095	-	-	1,785	552,889
1986-1990	84	394,063	129,585	-	5,207	683,440
1991-1995	126	935,696	295,930	52,608	8,175	432,410
1996-2000	201	1,326,653	318,382	110,147	5,477	159,890
2001-2005	182	1,448,657	174,834	209,306	6,253	167,940
TOTAL	641	4,495,164	918,731	372,061	26,897	1,996,569

\* Square Metre

\*\* Number



Local production of seeds and saplings

to preserve existing native species such as Ghaf trees.

In 1995, Dubai was awarded the City Plantation Award of the Arab Towns' Organisation – the first year that this award was given.

By 2002, automated irrigation systems had been installed in all of the parks, in the Mushrif and Al-Rashidiya tree plantations and along the roads outside the city. 99 per cent of the city roads were also covered, as well as 2000 trees, of about half the total amount, in the Al-Qusais plantation.

Between 1981 and 2002, a total of 521 landscaping projects were completed, covering urban roads, private and public parks, public squares, tree plantations and nature reserves. The following table gives summary details of the projects completed as well as those due to be completed up to the end of 2005.

In 1999, the Department introduced the laying of turf lawns, making use of a special machine, ten of which are now in operation. Turves of 60 cm by 150 cm are prepared in advance and then laid, following which fertiliser is applied and the area is rolled, producing a ready-made, mature lawn.

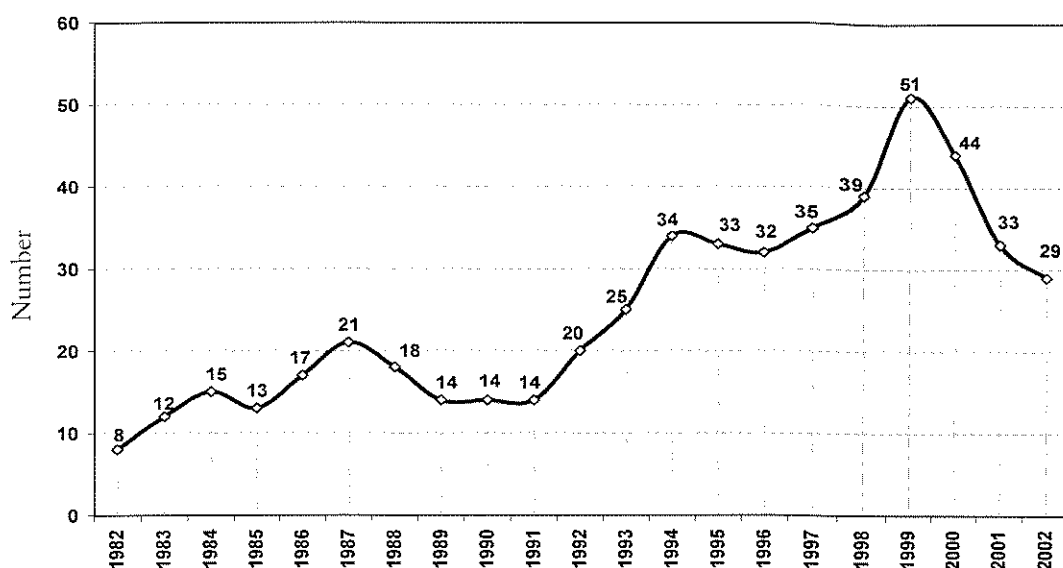
Lawns of this type were laid at Al-Saif Street, where the 2000 Dubai Shopping Festival was launched, at Gateway No. 4 to the Creek Park and outside the main entrance of the Creek Park, following the completion of the bridge linking the former site of Global Village to the Park, since the original planted area had been destroyed during the construction work. This last pro-

### Number of horticultural projects, 1982 – 2002

No.	Year	Number of Projects completed
1	1982	8
2	1983	12
3	1984	15
4	1985	13
5	1986	17
6	1987	21
7	1988	18
8	1989	14
9	1990	14
10	1991	14
11	1992	20
12	1993	25
13	1994	34
14	1995	33
15	1996	32
16	1997	35
17	1998	39
18	1999	51
19	2000	44
20	2001	33
21	2002	29
TOTAL		521

ject was completed in three days – but the resulting lawn looked as though it had been established for years.

Overall, the amount of planted areas in Dubai increased from 620,367 sq. metres in 1981 to around 4 million sq. metres in 2002, the number of trees planted rose from 423,886 to 2,287,562 and the number of palm trees, counted separately, rose over the same period from 4,184 to 27,988. The following tables provide statistical data on this expansion.



Laying a turf lawn

## Growth of planted areas, 1981 – 2002

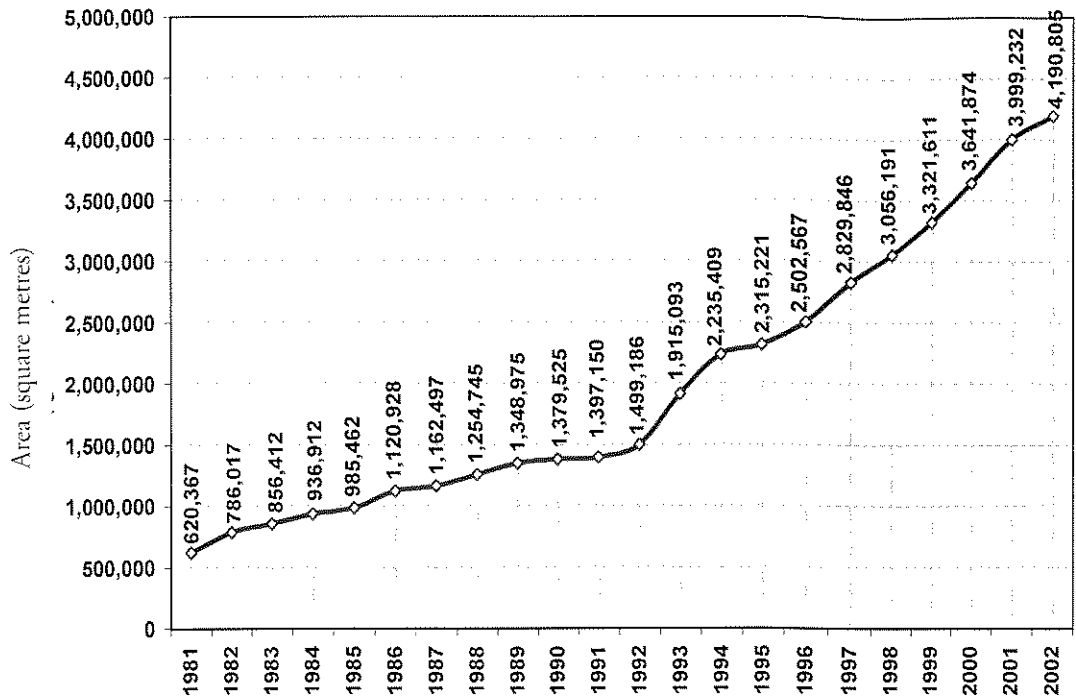
Years	Green Areas (in square metres)				Number of Trees		Fences (metres)
	Grassed Area	Ground Cover	Flowering plants	Total	Palm Trees	Trees & Shrubs	
1981	620,367	-	-	620,367	-	423,886	-
1982	786,017	-	-	786,017	-	568,486	-
1983	856,412	-	-	856,412	4,184	672,927	-
1984	936,912	-	-	936,912	5,397	781,527	-
1985	985,462	-	-	985,462	5,969	926,775	-
1986	1,120,928	7,763	-	1,128,691	6,637	1,053,495	-
1987	1,162,497	43,779	-	1,206,276	7,583	1,175,494	-
1988	1,254,745	83,766	-	1,338,511	8,696	1,353,322	-
1989	1,348,975	113,821	-	1,462,796	9,659	1,514,527	-
1990	1,379,525	129,585	-	1,509,110	11,176	1,610,215	-
1991	1,397,150	151,334	52,632	1,601,116	12,311	1,682,835	-
1992	1,499,186	172,094	56,319	1,727,599	13,202	1,813,561	-
1993	1,915,093	308,137	64,120	2,287,350	16,690	1,983,916	153,925
1994	2,235,409	372,536	81,837	2,689,782	17,792	2,024,331	166,849
1995	2,315,221	425,515	102,870	2,843,606	19,351	2,042,625	173,145
1996	2,502,567	446,488	109,720	3,058,775	20,517	2,068,373	174,502
1997	2,829,846	525,561	130,795	3,486,202	21,519	2,136,438	193,717
1998	3,056,191	600,664	155,595	3,812,450	23,020	2,159,606	200,121
1999	3,321,611	704,966	179,548.7	4,206,125.7	24,236	2,186,798	205,586.5
2000	3,641,874	743,896.7	213,016.7	4,598,787.4	24,828	2,202,515	207,090.25
2001	3,999,232	793,849.4	262,839.5	5,055,920.9	25,794	2,257,744	216,867.8
2002	4,190,805	809,866.22	305,132.5	5,305,803.73	27,988	2,287,562	228,315.13

(1) Every six ground cover plants cover an area of one square metre

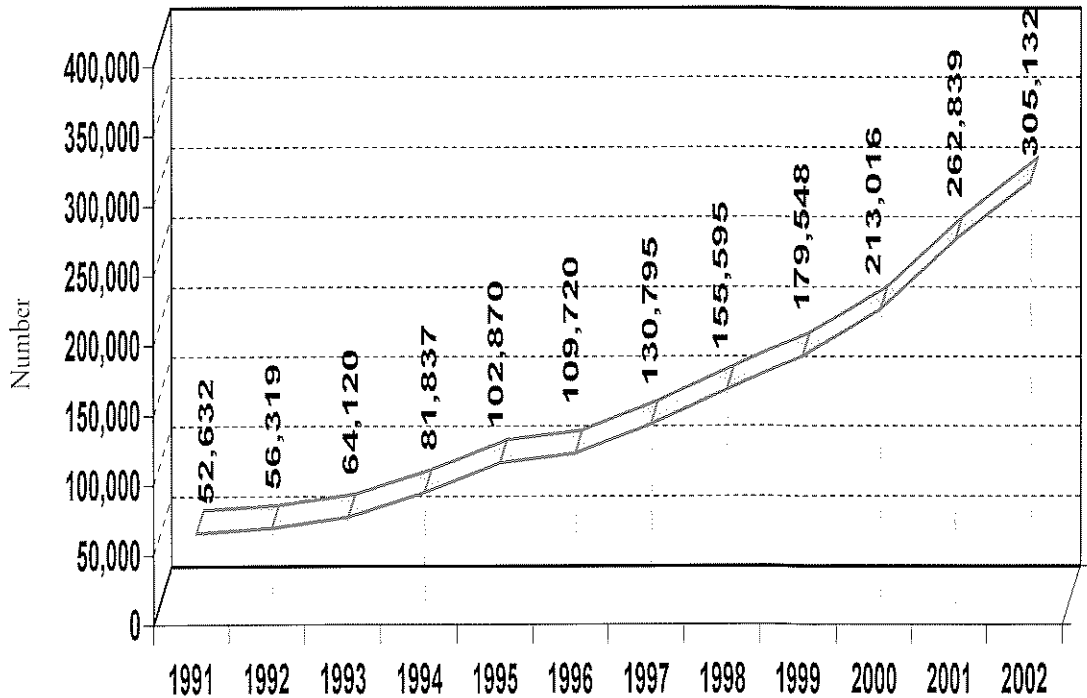
(2) Every 10 flowering plants cover an area of one square metre

- Total area planted in Dubai City in 2002 is 19,510,000 square metres
- The population of Dubai city in 2002 was 960,950 (Source: Census Centre)
- Cultivated area per capita is  $19,510,000 / 960,950 = 20.3$  square metres

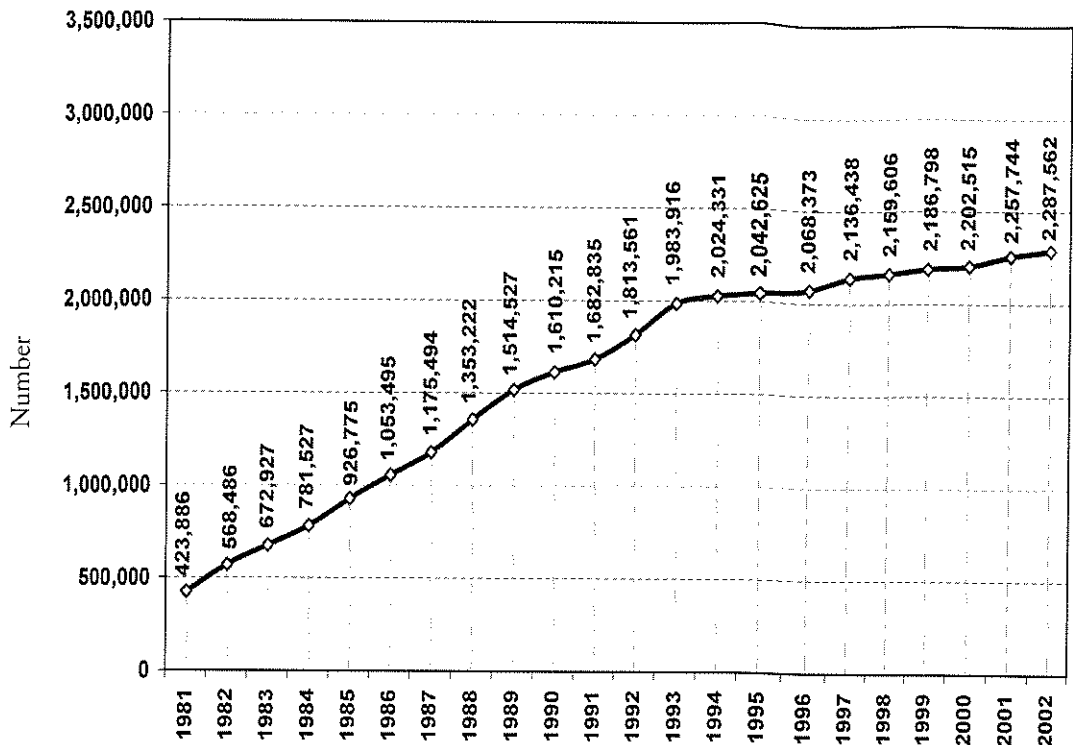
Increase in planted areas, 1981 – 2002



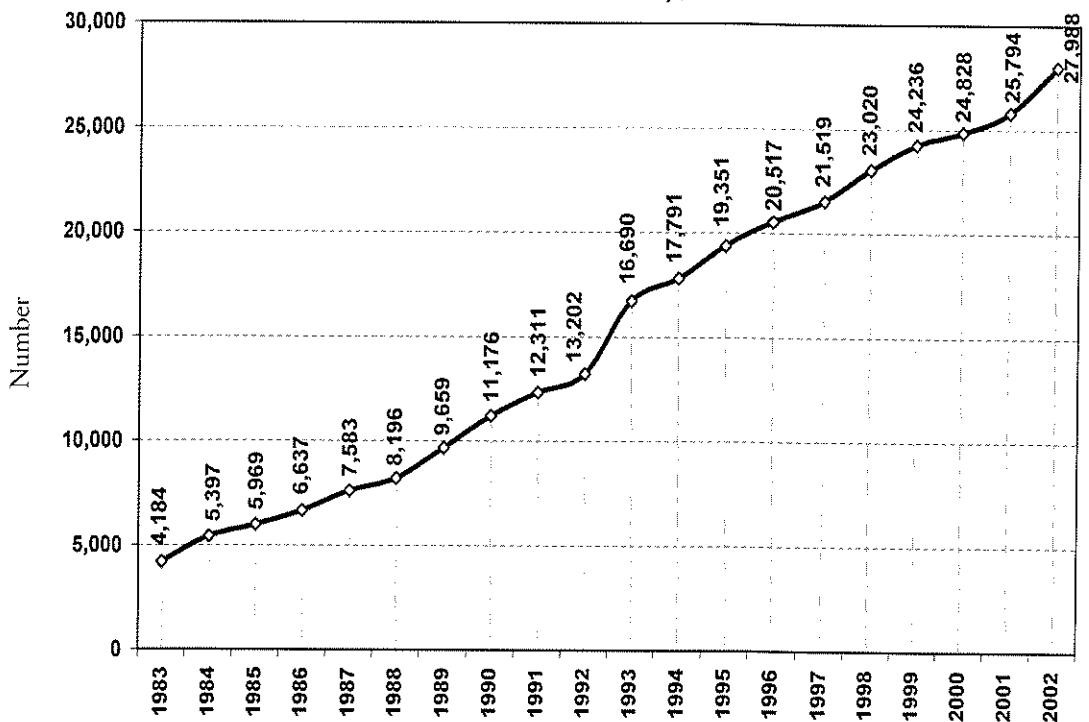
Flowers planted annually, 1991 – 2002



Trees and shrubs planted annually, 1981 – 2002



Palm trees planted annually, 1981 – 2002



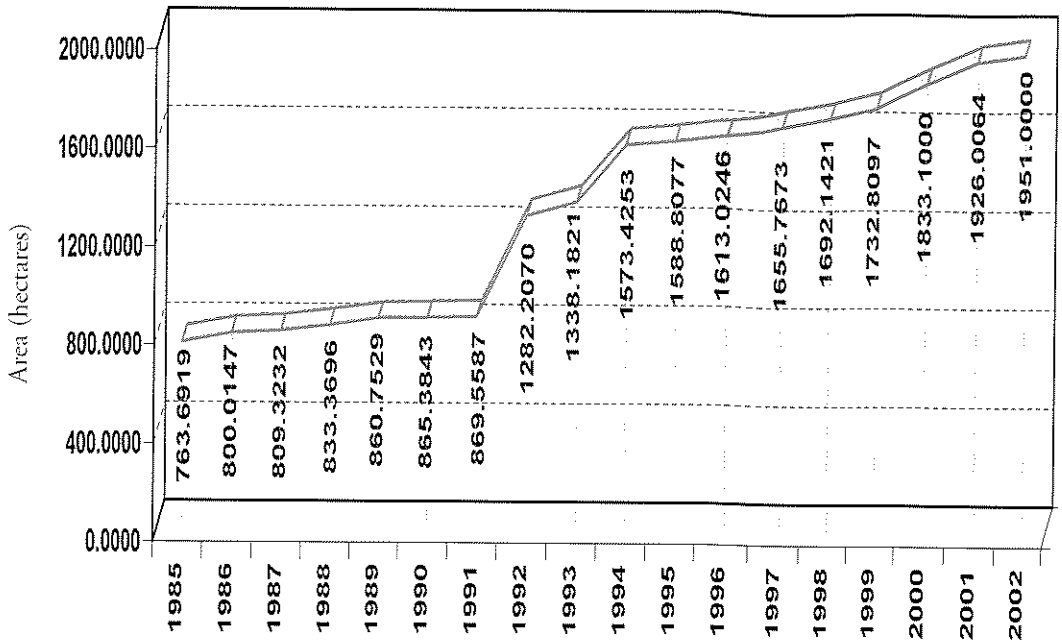


Increase in cultivated areas and annual increases between 1985 and 2002,  
showing progress towards the planned target of an 8 per cent total of planted  
land in urban areas in the Emirate of Dubai.

Year	Total area at end of year in hectares *	Annual increase in hectares	Annual increase	Total cultivated area as a percentage of total urban areas
1985	763.6919	6.3550	0.8%	1.20%
1986	800.0147	36.3228	4.8%	1.30%
1987	809.3232	9.3085	1.2%	1.34%
1988	833.3696	24.0464	3%	1.38%
1989	860.7529	27.3833	3.3%	1.42%
1990	865.3843	4.6314	0.5%	1.43%
1991	869.5587	4.1744	0.5%	1.44%
1992	1282.2070	412.6483	47.5%	2.12%
1993	1338.1821	55.9751	4.4%	2.2%
1994	1573.4253	235.2432	17.6%	2.6%
1995	1588.8077	15.3824	1%	2.63%
1996	1613.0246	24.6169	1.5%	2.67%
1997	1655.7673	42.7427	2.6%	2.74%
1998	1692.1421	36.3748	2.2%	2.80%
1999	1732.8097	40.6676	2.4%	2.9%
2000	1833.1	100.2903	5.8%	3.03%
2001	1926.0064	92.9064	5.1%	3.18%
2002	1951	24.9936	1.3%	3.23%

\* Hectare = 10,000 square metres

Increase in cultivated areas and annual increases between 1985 and 2002, showing progress towards the planned target of an 8 per cent total of planted land in urban areas in the Emirate of Dubai.



Creek Park

## Horticultural maintenance

Horticultural maintenance is one of the most important tasks carried out by the Department, since it is essential in order to keep the grassed areas in top condition throughout the year, even during the hot summer months.

From the time that the first Horticultural Section was established until 1997, there was a single unit in charge both of maintaining gardens and of new projects.

In that year, however, the organisation chart was amended and two separate Units were created, the Road Cultivation Unit and the Parks Unit, permitting the production of separate reports on a daily, weekly and monthly basis both on maintenance and on the progress being made on new projects.

As noted above, the organisation chart for the Public Parks and Horticulture Department was amended in 1993 with the setting up of separate Units covering Bur Dubai and Deira. Another new Unit in the Horticulture Section to handle maintenance of areas already planted, including tree plantations and roads outside the city, was also established. In the same year, a Parks Maintenance Unit was set up as part of the Parks and Gardens Section. One result of this re-organisation was the promotion of competition between the different Units, this having a positive effect on the appearance of the parks and other areas.



Using machinery to maintain grassed areas

## Introduction of modern machinery

The increasing mechanisation of horticulture in Dubai reflects the way in which the industry is developing and has also, of course, had a positive impact on labour costs. It has helped in the preparation of new areas and in the maintenance of already-established parks and gardens, while improved training and an increase in productivity has also reduced the need for labour. Between 1988 and 1989, the total workforce of labourers and gardeners fell from 1,047 to 709, a 32 per cent reduction.

Overall, the equipment introduced helped to save time and effort, allowed a reduction of manpower, and, therefore, cost, ensured that work could be completed more rapidly and also helped in the development of a preventative maintenance programme.

Over the years, the Department has worked hard to upgrade the quality of public horticulture in Dubai.

One result of this work has been a changing in the nature of planting. During the 1990s, as the expansion of parks and gardens got under way, the plants used were chosen on the basis of providing cover during winter and summer but without co-ordination in terms of the appearance of the floral displays. From 2000 onwards, however, flowering plants were chosen that, when matched, would present a co-ordinated and colourful display at selected locations. The use of other plants suitable for providing ground cover was also introduced, permitting the laying-out of displays that permitted geometric and other aesthetically-pleasing designs to be planted. Dubai was the first city in the United Arab Emirates and the Arabian Gulf to introduce plants of this kind.

Where possible, native species of plants, shrubs and trees were used for landscaping projects, such as Ghaf, Samar, Arak and Markh. These require less maintenance than introduced ornamental trees and bushes, thus reducing costs. A special booklet on the trees used for afforestation was issued in 2001.

Another major focus of the Department was a campaign to eradicate pests. This was undertaken using methods which posed no health hazards to humans and had no adverse impact on the environment. Insect light traps and pheromone traps were used to attract and trap pests while a natural pesticide derived from the seeds of the Neem tree, *Margosa* sp. was also used. The Department began in 1993 to produce its own pesticide from Neem, having considerable success in reducing numbers of Tervis worms, plant lice, spiders and nematodes. A small production plant for Neem extract was set up in 1995, at a cost of eleven thousand dirhams, while more Neem trees were planted to ensure an adequate supply of seeds.

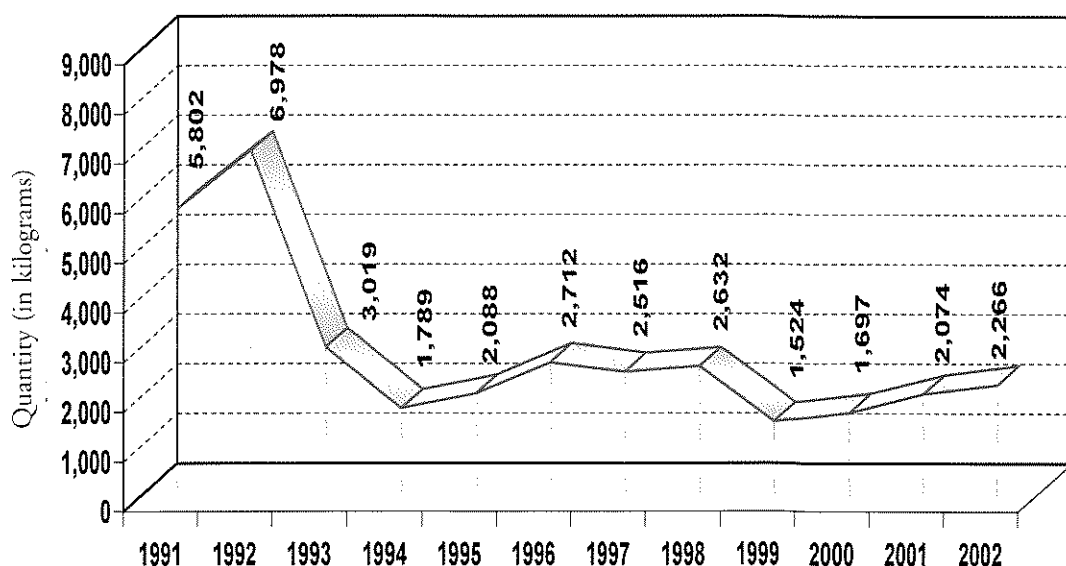
The results of this work were publicised during the 'Healthy Cities Conference' for the Arabian Gulf countries in 1995, with a leaflet being produced, in both Arabic and English, to explain the benefits of Neem-based pesticide.

This was followed by a joint project developed with the Federal Environmental Agency, FEA, on the establishment of a larger-scale plant to produce Neem extract to supply to the agricultural and horticultural sector throughout the country, as part of a drive to reduce the use of pesticides that could be harmful to people or to the environment.

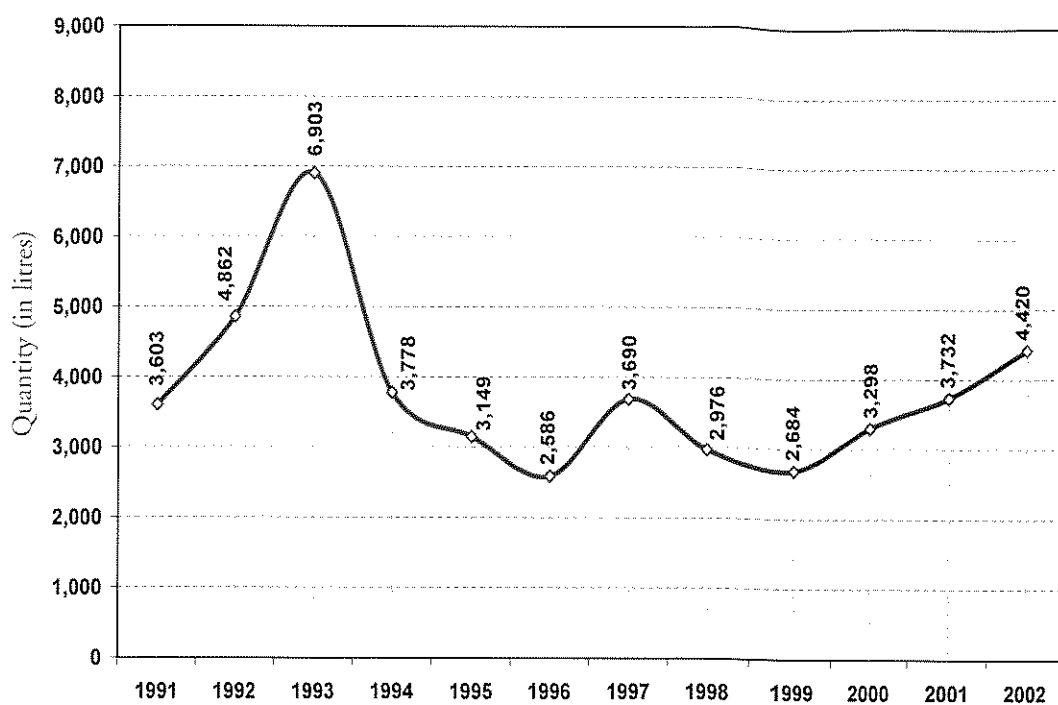
The following table gives the quantities of pesticides used against agricultural pests during the period from 1991 to 2002, illustrating the reduction in use achieved as a result of the success of the campaign, even though the area planted increased annually over the same period.

Year	Pesticides Used		NOTE
	Dry and Granular, in Kilograms	Liquid, in Litres	
1991	5,802	3,603	The table shows that despite the increase in the areas planted, the amount of pesticides being used has declined since 1993, owing to a well-planned campaign of pesticide application and also to the successful introduction of Neem extract.
1992	6,978	4,862	
1993	3,019	6,903	
1994	1,789	3,778	
1995	2,088	3,149	
1996	2,712	2,586	
1997	2,516	3,690	
1998	2,632	2,976	
1999	1,524	2,684	
2000	1,697	3,298	
2001	2,074	3,732	
2002	2,266	4,420	

Quantity of dry and granular pesticides, 1991 – 2002



Quantity of liquid pesticides used, 1991 – 2002



The use of *Margosa* sp., (Neem), seeds and the financial savings are shown in this table.

Year	Quantity of Margosa (Neem) seeds used, in kilograms	Value, in Dirhams	Notes
1996	707	17,675	<p>The market price of one kilogram of Neem seeds is 25 dirhams.</p> <p>The amount of money saved annually represents the use of Neem powder as a pesticide against worms, plant lice, Tervis, spiders, white fly and nematodes.</p> <p>The powder is used at the rate of 1.5 to 2 grams per litre of water.</p>
1997	3,287	82,175	
1998	6,308	157,700	
1999	7,961	199,025	
2000	5,482	137,050	
2001	13,438	335,950	
2002	7,099	177,475	



A sprinkler system in operation

### Booklet on horticultural maintenance

This booklet, prepared in 1999, includes a description of how to maintain all kinds of garden plants, such as palm trees, trees, shrubs, plants for ground cover, flowers and climbing plants used on fences. It also provides advice on how to ration the use of water for irrigation and on machines used in horticulture, including routine maintenance, operating them and a guide to cost.

The booklet was distributed to Head of Units, Agronomists and Supervisors.

### Automated Irrigation

The introduction of automated irrigation techniques has speeded up the completion of new projects and has reduced the amount of time needed for irrigation, thanks to the elimination of manual watering. Labour costs have also been reduced. The first automated watering systems were introduced in 1982, and by 2001 these had been extended to all parks, gardens and other areas needing irrigation.

### Committees and Working Groups

In order to promote the development of team work and to improve performance, a number of special committees and working groups were established, as follows:

## Committees

No.	Name of Committee	No.	Name of Committee
1	Agricultural Projects Committee	3	Agricultural Tools and Equipment Committee
2	Agricultural Research and Studies Committee	4	Quality and Excellence Committee

## Working Groups

No.	Name of Working Group	No.	Name of Working Group
1	Quality and Excellence	8	Parks Marketing and Advertising
2	Development of Computer Systems and e-Government	9	Coordination of Agricultural and Irrigation Works
3	Agricultural Research and Studies	10	Creative Thinking
4	Agricultural Design	11	Suggestions System
5	Equipment and Tools	12	Customer Satisfaction
6	Supervision of Children's City	13	Performance Evaluation
7	City Landscaping		

## Celebrations of Afforestation

Former UAE President His Highness Sheikh Zayed bin Sultan Al Nahyan was well known for his interest in afforestation, and frequently urged the various Municipalities throughout the country, as well as other bodies, to devote effort to planting more trees. He also gave instructions that an annual 'Tree Day' should be celebrated.

This later became 'Tree Week', which is marked annually under the aegis of the General Secretariat of the UAE Municipalities.

The Dubai Municipality marks the event with a series of workshops and other activities designed to promote participation by individuals, organisations, companies and schools. Tree-planting programmes are organised while trees, shrubs and flowers are distributed free to residents of the various areas of the Emirate.

During the week, staff of the Municipality also become involved in organising seminars, talk-





Al-Garhoud Nursery

ing to the media, preparing and distributing leaflets and supporting the organisation of horticultural shows.

### The role of greenhouses

Greenhouses have played an important role in the propagation and supply of saplings and seedlings used for planting programmes.

In 1982, the Municipality had only one greenhouse, at the Hor Al-Anz Nursery.

In 1989, however, a 1,500 sq. metre greenhouse was completed at the Al-Garhoud Nursery,

### Nurseries and other areas for plant propagation established between 1985 and 1997

No.	Name of Nursery	Year of Establishment	No.	Name of Nursery	Year of Establishment
1	Mushrif Nursery	1985	6	Propagation plot at Al-Garhoud Nursery	1992
2	Nad Al-Sheba Nursery	1986	7	Al-Khor Park Nursery	1994
3	Zabeel Nursery	1987	8	Al-Mamzar Park Nursery	1994
4	Al-Garhoud Nursery	1989	9	Palm Tree propagation plot in Al Mushrif Park	1995
5	Al-Safa Nursery	1992	10	Al-Rodis Farm, Al-Aweer	1997

along with a head office for the Horticulture Section, which moved to Al-Garhoud from the main Municipality building in 1990.

In the same year, other facilities were completed at the nursery, including a laboratory, a workshop for machines, stores for agricultural and horticultural materials, a cold store, shared areas and an open-door area for plant propagation.

By mid 1995, with the completion of a date-palm propagation plot in Mushrif Park, the department had a total of nine nurseries, while in 1997, the 80-hectare Al-Rodis Farms project in Al-Aweer was completed.

By 1995, the Department was producing around three and a half million saplings and seedlings a year.

### Dubai Municipality nurseries, 1982 – 2001

No.	Year	Total Number	Comments
1	1982	1	Hor Al-Anz Nursery
2	1984	2	Al-Safa Nursery added
3	1985	3	Mushrif Park Nursery added
4	1986	6	Nad Al Sheba, Zabeel, Al-Garhoud and Al-Safa Nurseries added
5	1994	8	Al-Khor Park and Al-Mamzar Park Nursery added
6	1997	6	Hor Al-Anz Nursery becomes a park and Zabeel Nursery is grassed over
7	2001	6	Studies for a new 18-hectare nursery in the Al-Warsen area

In 1997, there was a re-organisation of the nurseries. The old Hor Al-Anz nursery was transformed to become a public park while the Zabeel Nursery was turned over to grass. Despite this reduction in the area being cultivated, however, the introduction of more efficient technology meant that the number of saplings and seedlings being produced continued to rise, reaching 17, 874, 374 in the year 2002, as shown in the following table. Production is projected to continue to increase and will contribute to meeting the target of having eight per cent of the total urban area of Dubai planted in various ways.

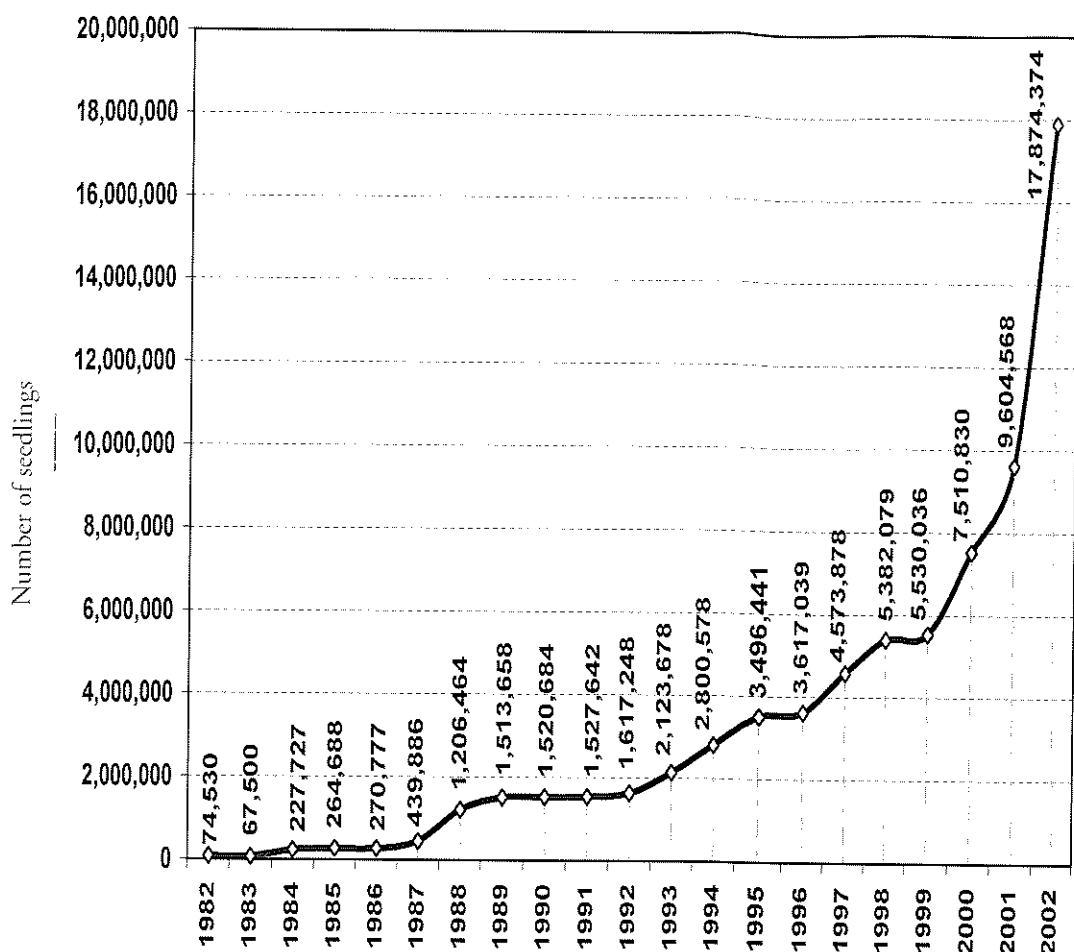
The increase in output from the nurseries, as well as the higher quality of seedlings produced, was due to a number of factors. Of particular importance was the increased professionalism of nursery work, made possible by the setting up of a trials station for new species and varieties of plants and of a laboratory. Tissue culture propagation was also introduced, while a highly-trained horticulturalist was appointed to oversee research.

This was complemented by other innovations, such as the careful selection of the proper envi-

### Production of Nurseries, 1981 – 2002

Year	Production/ Seedlings	Comments and annual rates of increase
1981	Nil	All requirements purchased from the market
1982	74,530	First year of production from the Municipality greenhouse
1983	67,500	Production reduced by 9.44% due to lack of space
1984	227,727	Production increase of 237%, due to opening of Al-Safa Nursery
1985	264,688	Production increase of 16.23%
1986	270,777	Production increase of 2.3%
1987	439,886	Production increase of 62.45%, as new nurseries completed, bringing total to six
1988	1,206,464	Production increase of 174.3% due to expansion of Al-Garhoud Nursery
1989	1,513,658	Production increase of 25.46% due to further expansion
1990	1,520,684	Production increase of 0.5%
1991	1,527,642	Al-Safa Park Nursery suspended activity, due to a re-planning of the whole park. Total production still increased slightly.
1992	1,617,248	Increase of 5.8%
1993	2,123,678	Increase of 31.3%
1994	2,800,578	Increase of 31.9%
1995	3,496,441	Increase of 24.8%
1996	3,617,039	Increase of 3.4%
1997	4,573,878	Increase of 26.5%
1998	5,382,079	Increase of 17.7%
1999	5,530,036	Increase of 27.5%
2000	7,510,830	Increase of 35.8%
2001	9,604,568	Increase of 27.9%
2002	17,874,374	Increase of 86.1%

Production of Nurseries, 1981 – 2002



## Horticulture Laboratory

The Laboratory was established in 1990. Besides carrying out a variety of experiments, it also seeks solutions for problems encountered in the field during work by Department staff.

Amongst its work is the testing of seeds and germination patterns, the carrying out of chemical and physical tests on soils, including their salinity, pH and nutrient and calcium carbonate and analysis of samples of irrigation water to check salinity, pH content and concentration levels of soluble chemicals. Fertilisers are analysed to measure the presence of elements such as nitrogen, phosphorus, potassium, iron, copper and cobalt and to check humidity, the percentage of organic matter and the degree of electric conductivity. Plant samples are checked to measure the content of nutritious elements and chlorophyll.

Other duties include the preparation of special solutions for nurseries and inspections, by microscope, for diseases.

ronments for propagation and early stages of growth, sterilisation of cuttings, using growth regulators, providing effective fertilisation by supplying soluble fertilisers through tanks connected to the irrigation network in greenhouses, plant propagation plots and shaded areas and the provision of automated irrigation in the shaded areas of the Al-Garhoud and Nad Al-Sheba Nurseries.

The introduction of machinery to move plants around, rather than wheelbarrows, helped to protect the young plants, while modern machinery was also introduced for the packaging and bagging of plants.

A number of these innovations also proved to have a beneficial impact on costs, since increased mechanisation made it possible to reduce the amount of manpower required.

## Introduction of new species

An important part of the work of the Horticulture Section has been the identification of species and varieties of plants which are suited to local conditions, so as to build up a database that would permit a wide range of plants to be used, thus varying the appearance of parks, gardens and other planted areas.

Plants identified as being suitable were kept as stock in the Al-Garhoud Nursery, so that they could be used for propagation, as and when required.

The increase in the number of nurseries made it easier to introduce new species and varieties while use of the latest propagation techniques helped to ensure that the required number of seedlings and cutting could be produced. In all, a total of 650 new species and varieties were introduced.

The annual horticultural shows in Dubai, in which other Municipalities as well as private companies also take part, also provides staff of the Horticultural Section with an opportunity to evaluate other plants that may be suitable for use.

The Nursery Unit was an important part of the Horticulture Section from the time that it was established.

In 1997, a restructuring of the Section saw it being divided into two, the Horticulture Section and the Horticultural Services Section and the Nursery Unit was placed in the Horticultural Services Section, as shown in the organisation chart for 1997 (above).

In 2001, studies began for the setting up of a modern nursery in the Al-Warsen area, near the sewage treatment plant. This was to include offices for the Unit, a showroom for the sale of plants, greenhouses, shaded areas, areas for propagation of seedlings and raising them, a soil and water laboratory, a tissue propagation laboratory, a workshop and cold stores.

Over the years, particularly since the establishment of its plant propagation and cultivation plots, the Al-Garhoud Nursery has become a popular place to visit for university and school students, with students at the Agriculture College at the Emirates University having gained particular benefit. Besides organising scientific fieldtrips, nursery staff have also run training courses for students studying agriculture production, landscaping and plant protection.

In December 1996, visiting scientists attended a conference on mangroves at the Emirates University made a special trip to the Nursery to look at its cultivation of young mangroves.

### Plant species and varieties introduced, 1986 – 2002

Item	Year	Number of new species and varieties
1	1986	21
2	1989	57
3	1991	110
4	1992	34
5	1995	102
6	1996	119
7	1997	23
8	1999	41
9	2000	162
10	2001	201
11	2002	217
TOTAL		1,087



The Horticulture Laboratory

## Tissue Propagation Laboratory

Tissue propagation is used in the nurseries with the objective of producing large numbers of plants with identical genes similar to the mother plant. Initially, a small laboratory was built in Mushrif Park Nursery in order to produce superior palm tree varieties, until the main Tissue Propagation Laboratory is completed as part of the new Municipality Nursery project in the Al-Warsen area. The production cycle lasts for five years starting from the planting of plant tissues in the laboratory until the seedlings are ready to plant.

## Agricultural Services offered to the Public

Since 1976, Dubai Municipality has provided horticultural services to the public in order to encourage them to take an interest in planting and to take part in increasing the planted areas in the Emirate. The following table on page 552, illustrates the services provided to the public by the Horticulture Section and Horticulture Services Section during the period 1981 – 2002. Data for the period from 1976 – 1980 is not available.

### The Laboratory's equipment at the end of 2002

Item	Equipment and functions
1	Seed Germination Apparatus
2	Growth Chamber
3	Incinerator
4	Oven
5	Digestion Apparatus
6	Apparatus to measure elements of nutrition
7	Shaking Apparatus
8	Filtration Apparatus
9	pH Measuring Apparatus
10	Salinity Measuring
11	Water Bath Apparatus
12	Microscope
13	Programmed Apparatus to measure percentage of Seed Germination
14	Centrifuge
15	Magnetic Movement Apparatus
16	Filtration Apparatus
17	Gas Centrifuge
18	Scales
19	Grinder
20	Spectral Absorption Apparatus
21	Measurement of calcium carbonate
22	Measurement of Nitrogen
23	Atomic Absorption Apparatus
24	Ionisation Analysis
25	Preparation of saturated soil paste

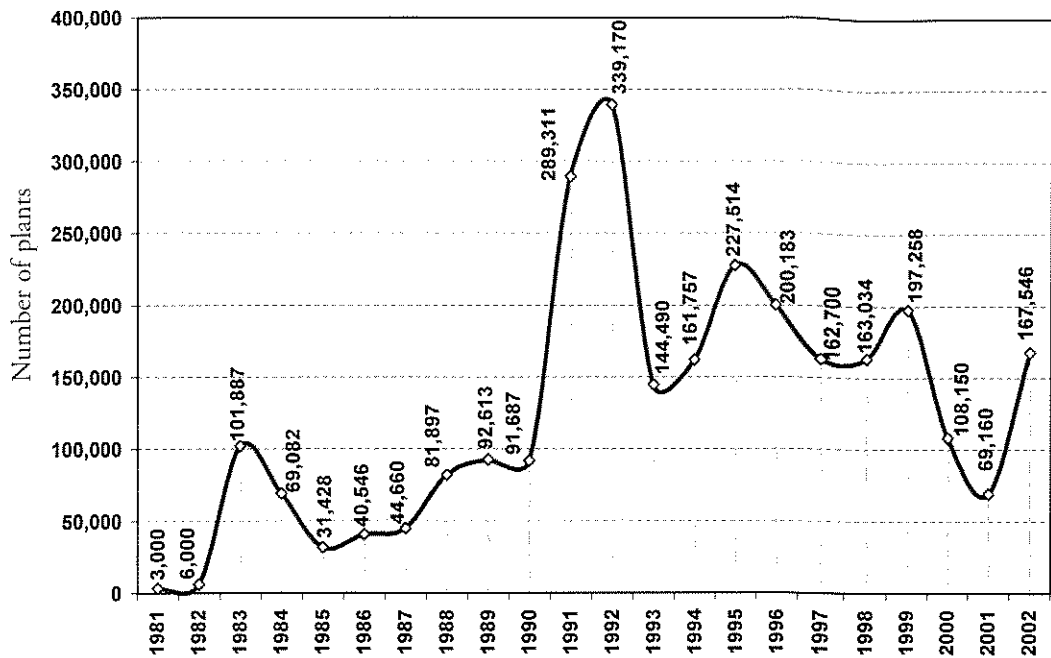
## Services provided to the public, 1981 – 2002

No.	Year	Number of Plants	Agricultural soil in Cubic Metres*
1	1981	3,000	15,000
2	1982	6,000	45,540
3	1983	101,887	56,160
4	1984	69,082	11,520
5	1985	31,428	21,600
6	1986	40,456	24,075
7	1987	44,660	41,805
8	1988	81,897	64,730
9	1989	92,613	78,260
10	1990	91,687	73,360
11	1991	289,311	45,890
12	1992	339,170	85,752
13	1993	144,490	29,120
14	1994	161,757	23,550
15	1995	227,514	38,310
16	1996	200,183	41,510
17	1997	162,700	50,640
18	1998	163,034	106,624
19	1999	197,258	231,924
20	2000	108,150	173,978
21	2001	69,160	63,154
22	2002	167,546	66,945
TOTAL		2,793,073	1,389,447

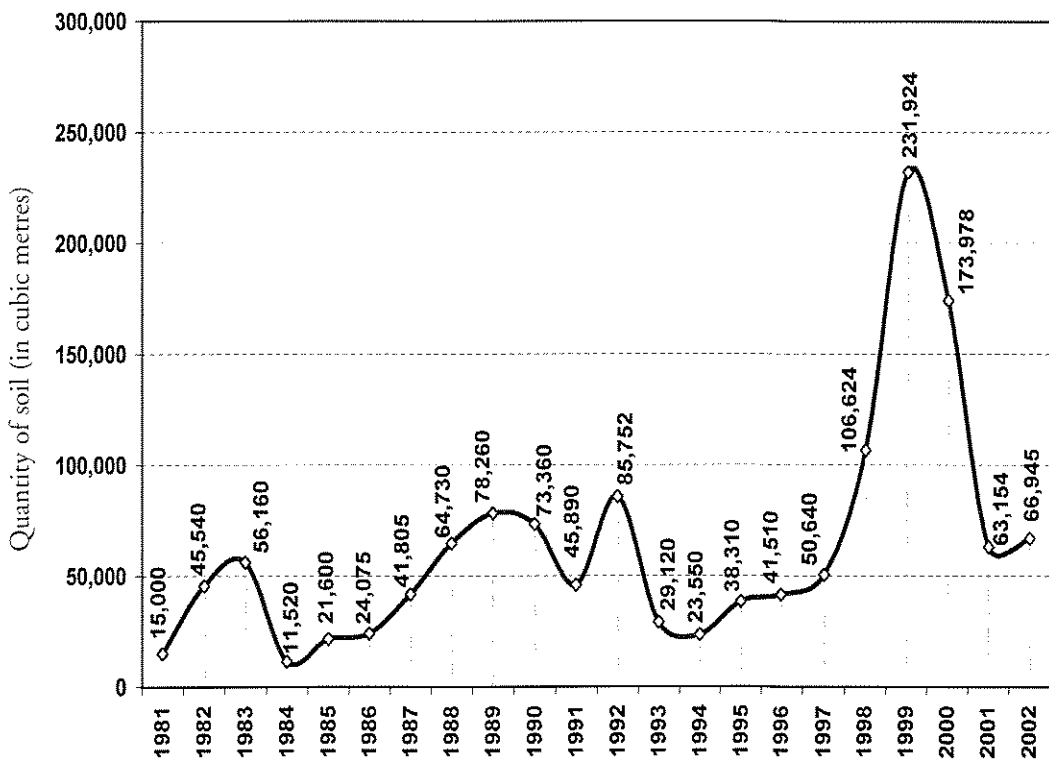
\* During the period 1976-1981, agricultural soil and seedlings were provided according to availability .



Plants supplied to the public, 1981 – 2002



Agricultural soil provided to the public, 1981 – 2002



**Agricultural soil transported from Al-Khawaneej area,  
1988 – 2002, in cubic metres**

Year	By the Section		By private companies, in cu. m	TOTAL in cu. m
	Section in cu. m	Assistance in cu. m		
1988	36,950	64,730	86,270	187,950
1989	62,350	78,260	56,210	196,820
1990	58,270	73,360	43,950	175,580
1991	65,730	45,890	248,472	360,092
1992	47,736	85,752	386,834	520,322
1993	40,940	29,120	143,280	213,340
1994	85,840	23,550	140,850	250,240
1995	74,490	38,310	245,140	357,940
1996	52,650	41,510	343,420	437,580
1997	25,780	50,640	608,300	684,720
1998	36,260	106,624	331,324	474,208
1999*	30,394	231,924	382,046	644,364
2000	37,632	173,978	356,257	567,867
2001	40,502	63,154	421,760	525,416
2002	79,830	66,945	391,752	538,527
TOTAL	775,354	1,173,747	4,185,865	6,134,966

\* From 1999, the Environment Department was in charge of the transportation of soil for agricultural use.

**Number of trees planted in residential areas**

Item	Area	Number of Trees	Types of tree planted
1	Al-Rashidiya	2,447	Ghaf, <i>Margosa</i> (Neem) and Ficus
2	Al-Tawar	425	<i>Margosa</i> (Neem)
3	Al-Mamzar	125	<i>Margosa</i> (Neem)
4	Al-Jafliya	120	<i>Margosa</i> (Neem)
	TOTAL	3,117	

No.	Name of Booklet	Language	No.	Name of Book	Language
1	Mushrif Park	Ar. - Eng.	1	Dubai Parks	Ar. - Eng.
2	Al-Mamzar Park	Ar. - Eng.	2	Wild Cats in the Emirates	Ar. - Eng.
3	Al-Safa Park	Ar. - Eng.	3	Local Trees in the United Arab Emirates	Ar. - Eng.
4	Jumeirah Beach Park	Ar. - Eng.	4	Grass areas	Arabic
5	Al-Khor Park	Ar. - Eng.	5	Local Plants used in afforestation	Arabic
6	Dubai Ladies Club	Ar. - Eng.	6	Public Service Manual (prices of plants in the nurseries)	Arabic
7	Jet Skies	Ar. - Eng.	7	New decorative plants for landscaping projects	Arabic
8	Safety Manual for Visitors to the Beach	Ar. - Eng.	8	Children's City	Ar. - Eng.
9	Animal Colouring Booklet	Ar. - Eng.			
10	Zoo Animals Guide	Ar. - Eng.			
11	Miniature map of the Zoo	Ar. - Eng.			

## Provision of Guidance

The guidance programme is intended to transfer knowledge of landscaping and gardening to the public living in the city as well as to farmers, of all nationalities, educational levels and age groups, so that they can use the knowledge in their gardens and farms. It also helps to encourage people to take care of public gardens.

The programme also provides a way in which staff of the Section can transfer their own experience to the public at large, and helps in promoting a greater awareness of the importance of parks, gardens and other open green spaces in terms of public health and protection of the environment.

The Section has made good use of the media to spread information and gives away plants to the public to encourage their participation in the general programming of trying to increase greenery in Dubai.

Another focus of activities has been involvement with schools. The Section has helped a number of schools to cultivate their own gardens and has carried out various other activities to introduce students to gardening. Schools have also been invited regularly to take part in the 'Tree Week' celebrations held over the course of the last 21 years.

Since 1987, the Section has issued 12 guidance leaflets, 11 booklets and 8 books, as shown in the following table.

## Guidance Leaflets

Item	Name of Leaflet	Language
1	Fruit Fly	Arabic & English
2	Nematoda	Arabic
3	Annual and Perennial Flowers	Arabic & English
4	Maintenance of grass areas	Arabic & English
5	Indoor Plants	Arabic & English
6	Chrysanthemums	Arabic & English
7	Carnations	Arabic
8	Diseases and pests affecting grass areas	Arabic & English
9	Comprehensive eradication of horticultural pests	Arabic
10	Bougainvillea	Arabic
11	<i>Margosa</i> (Neem) Tree	Arabic
12	Citrus Leaves Tunnel Worms	Arabic & English

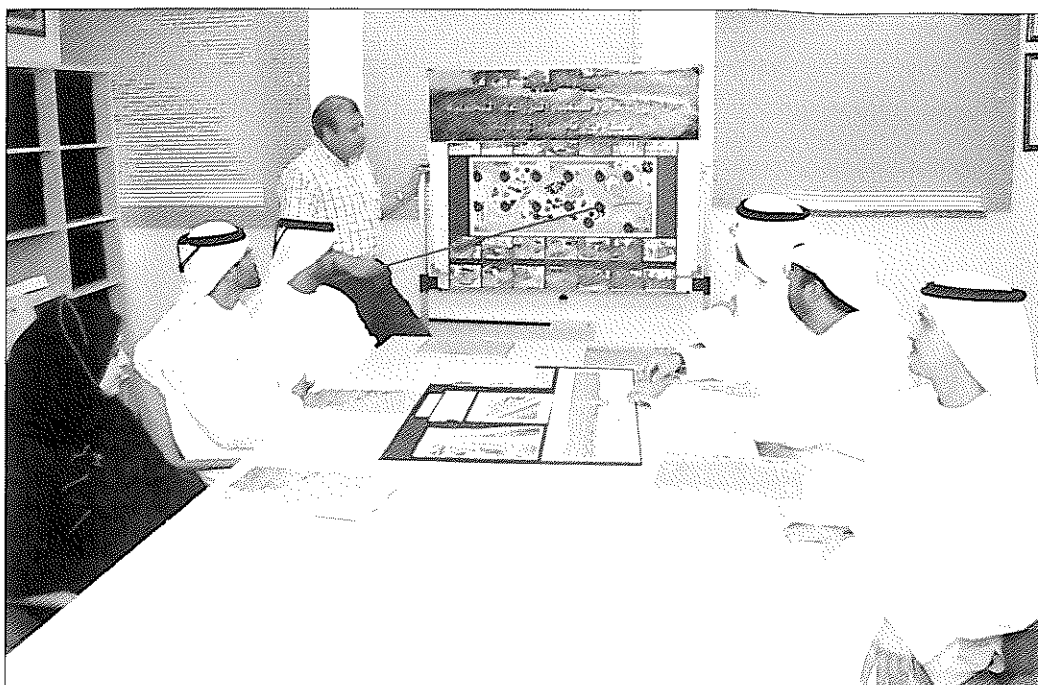
## Development of Manpower

During the 1970s, the manpower used for horticulture was untrained and lacking in experience. From the beginning of the major planting campaign in 1982, however, the Section set out to attract new employees with both scientific training and practical experience.

For the first decade, the focus was on people with experience in planting orchards and decorative plants, and with a knowledge of safety procedures. Three of the newly-recruited employees were agronomists with Master's degrees and with practical experience who had previously held supervisory posts. All Agronomist posts were filled by people with experience in orchards or in agriculture. A special programme was devised to attract UAE citizens.

An extensive series of training courses for supervisors and gardeners was begun. Two month-long courses were held in 1989 and 1991 for supervisors and another, two-week, course for gardeners in 1989 while other courses were also held for engineers and for Unit Heads.

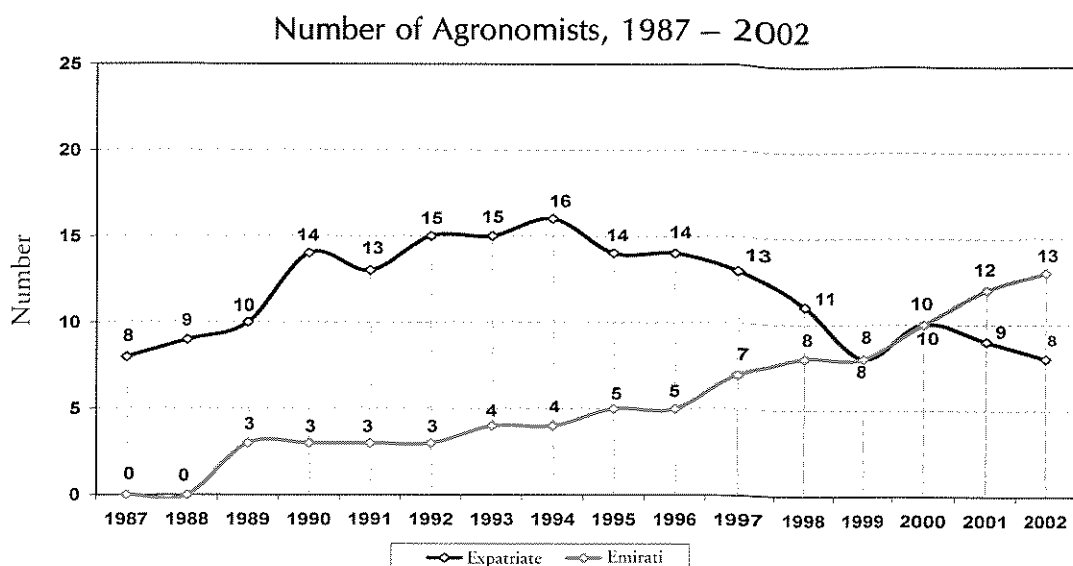
Seven graduates from the Agricultural College of the Emirates University were recruited, one eventually becoming the Head of the Section with the others holding posts of Heads of Unit and Agronomists. When recruited, these were given good training and their work was continually monitored, to encourage them to refine their skills. A process of over-rapid promotion was avoided.



Training Course for Agriculture Graduates

#### Number of Agronomists in the Public Parks and Horticulture Department, 1987 – 2002

Year	Number of Agronomists				Comments
	Expatriate	Emirati	Total	Percentage of UAE citizens	
1987	8	-	8	0%	The increase in the level of Emiratisation, even though most posts require specialist training, shows the success of the programme. Section and Unit Head posts are only open to trained personnel.
1988	9	-	9	0%	
1989	10	3	13	23%	
1990	14	3	17	17.6%	
1991	13	3	16	18.7%	
1992	15	3	18	16.6%	
1993	15	4	19	21%	
1994	16	4	20	20%	
1995	14	5	19	26.3%	
1996	14	5	19	26.3%	
1997	13	7	20	35%	
1998	11	8	19	42%	
1999	8	8	16	50%	
2000	10	10	20	50%	
2001	9	12	21	57%	
2002	8	13	21	62%	

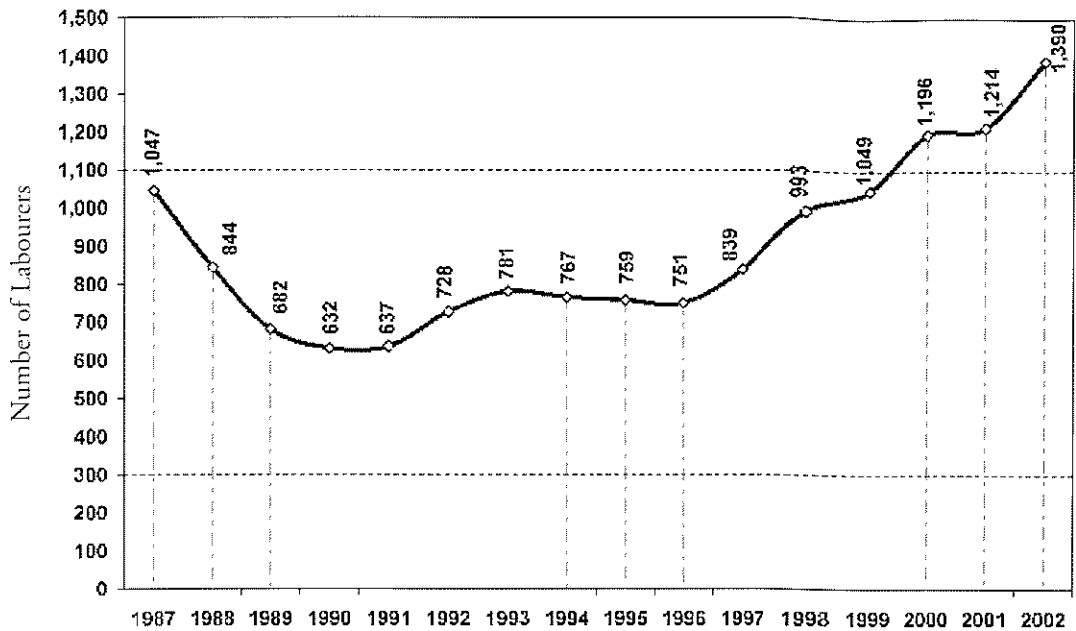


Following the introduction of an automated irrigation system, in the streets and parks of Dubai and the use of modern horticultural machinery, the Department was able to reduce the number of manual labourers from 1,047 in 1987 to 637 in 1991, a reduction of 39.2 per cent. This took place despite the rapid increase in the cultivated area over the same period, with the number of trees and shrubs increasing by 43 per cent, areas under grass by 20 per cent and the number of ground cover plants that had been planted by 245 per cent.

### Manual labourers employed, 1987 – 2002

Year	Number of Labourers	Percentage of reduction compared to base year	Comments
1987	1,047	—	During this period the cultivated areas increased by 416.6%, palm trees increased by 274.4% and trees and shrubs increased by 192.1%.
1988	844	19.4%	
1989	682	34.9%	
1990	632	39.6%	
1991	637	38.2%	
1992	728	30.5%	
1993	781	25.4%	
1994	767	26.7%	
1995	759	27.5%	
1996	751	28.3%	
1997	839	19.9%	
1998	993	5.2%	
1999	1,049	Increase of 0.2%	
2000	1,196	Increase of 14.2%	
2001	1,214	Increase of 16%	
2002	1,390	Increase of 14.5%	

### Manual Labourers employed, 1987 – 2002



This allowed the Section to make older manual labourers redundant, helping to increase productivity and, thence, the costs of maintenance.

Salaries and benefits paid by the Section fell from 17,017,822 dirhams in 1987 to 14,396,049 dirhams in 1990 despite the fact that in 1990 salaries were increased for employees in the Department and they were also provided with a housing allowance, at a rate of 60% of their basic salary as well as a transport allowance.

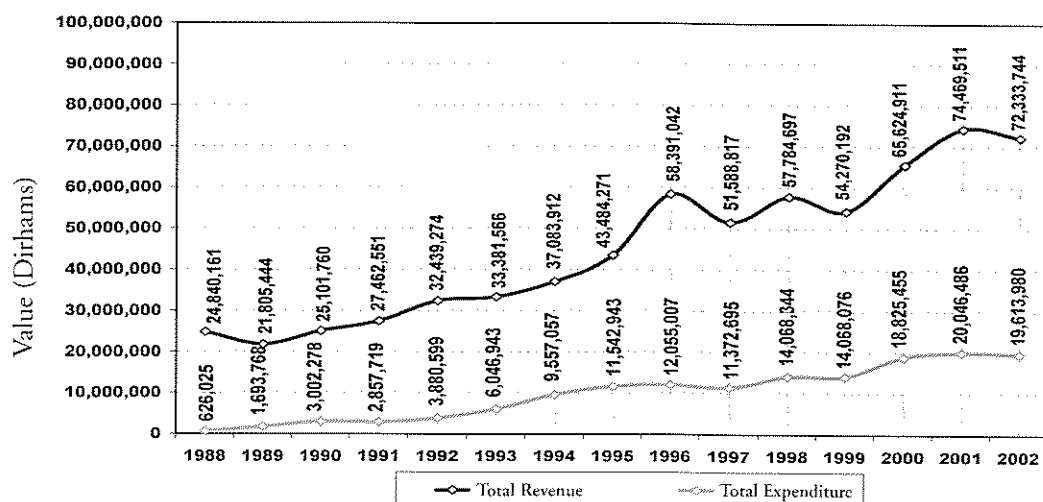
### Vehicles and machinery in the Public Parks and Horticulture Department, 1992 – 2002

Item	Year	Number of Vehicles and other Machinery	Item	Year	Number of Vehicles and other Machinery
1	1992	29	7	1998	158
2	1993	31	8	1999	187
3	1994	50	9	2000	194
4	1995	63	10	2001	222
5	1996	89	11	2002	236
6	1997	127			

### Public Parks and Horticulture Department Expenditure and Revenue, by Chapter, 1988 – 2002 (in dirhams)

Year	Salaries	Current Expenditure	Capital Expenditure	Total Expenditure	Total Revenue
1988	18,727,377	3,541,321	2,571,463	24,840,161	626,025
1989	16,735,668	4,348,955	720,821	21,805,444	1,693,768
1990	18,133,049	4,724,004	2,244,707	25,101,760	3,002,278
1991	20,846,831	5,653,449	962,271	27,462,551	2,857,719
1992	22,565,212	5,832,809	4,041,253	32,439,274	3,880,599
1993	26,104,564	6,832,703	444,299	33,381,566	6,046,943
1994	29,560,982	5,794,968	1,727,962	37,083,912	9,557,057
1995	32,014,666	8,261,793	3,207,812	43,484,271	11,542,943
1996	33,072,965	11,512,248	13,805,829	58,391,042	12,055,007
1997	35,480,985	10,550,571	5,557,261	51,588,817	11,372,695
1998	39,391,327.77	12,604,718.69	5,788,651.04	57,784,697.50	14,068,344
1999	39,488,261.68	11,635,163.10	3,146,767.52	54,270,192.30	14,068,076
2000	42,368,105.80	19,643,251.45	3,613,553.76	65,624,911.01	18,825,455
2001	47,005,678.00	18,453,724.94	9,010,108.22	74,469,511.38	20,046,486
2002	47,957,992.00	19,740,548.37	4,635,202.71	72,333,744.06	19,613,980
Total	469,453,665.45	149,130,227.55	61,477,961.25	680,061,854.25	149,257,375.24

### Public Parks and Horticulture Department Expenditure and Revenue, 1988 – 2002





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## Vehicles and Machinery

The increasing workload of the Department was matched by an increase in the number of its vehicles and other machinery. These are used to transport Agronomists and Supervisors to and from locations as well as to transport labourers, agricultural tools, fertilisers, seedlings, agricultural soil and agricultural waste, as well as for other purposes. The following table, on page 560, illustrates the increase in number of vehicles and machinery used by the Department.

## Revenue and Expenditure

The expenditure of the Public Parks and Horticulture Department includes the cost of manpower, including salaries, allowances, housing benefit and transportation. This amounts to around 75-80% of the total expenditure. The reduction in manpower after the introduction of modern horticultural techniques led to a significant reduction in the Department's total expenditure as illustrated in the table below, on page 561.

Sources of revenue derive from the implementation of a number of Municipal Ordinances covering, for example, payment of the value of damage resulting from traffic accidents, damage resulting from companies working in cultivated areas, revenue from sale of seedlings, revenue from sale of Rodus fodder and other revenues collected from companies violating Municipal Ordinances.

Total revenues are low in comparison to expenditure, but this is compensated for by the benefits to the community of the landscaping work carried out in the city and in public parks, the cultivation of roadsides and central reservations, the cultivation of forests and nature reserves. Some of the Horticulture Section's revenue from sale of seedlings and fodder from the Rodus farm was transferred to the Horticulture Services Section after this was established in 1997.

Number	Name of Park	Year of Inauguration	Year of Re-development	Total Area (in sq.m.)
1	Mushrif	1974	1989	1,250,000
2	Al-Safa	1975	1992	640,000
3	Jumeirah Beach	1989	-	131,370
4	Al-Mamzar	1994	-	990,000
5	Al-Khor	1994	-	960,000

### Main Residential Parks and Squares in residential areas of Dubai, 1982 – 2002, showing year completed

No.	Name of Park	Year	No.	Name of Park	Year	No.	Name of Park	Year
1	Irtihad	1982	8	Hamriyyah	1988	15	Al-Tawar	1997
2	Sheraton	1983	9	Al-Rashidiya	1988	16	Oud Meitha	1998
3	Burger King	1983	10	The Memorial	1988	17	Hor Al-Anz	1998
4	Nayif	1985	11	Khazan	1989	18	Karamah	1999
5	Al-Jamal	1986	12	Burj Nahar	1993	19	Shu'la	2000
6	Al-Wasl	1987	13	Open Beach	1994	20	Nad Shema	2001
7	Airport	1987	14	Umm Suqeim	1996			

21 public squares were developed during 1987 and 2002, as illustrated in the following table:

No.	Name of Square	No.	Name of Square	No.	Name of Square
1	Khawaneej	8	Hamriyyah (1)	15	Al-Quoz (1)
2	Mehaisina	9	Hamriyyah (2)	16	Al-Quoz (2)
3	Rashidiya (1)	10	Umm Suqeim (1)	17	Jumeirah (1)
4	Rashidiya (2)	11	Umm Suqeim (2)	18	Jumeirah (2)
5	Rashidiya (3)	12	Bed'a	19	Jumeirah (3)
6	Al-Tawar	13	Jafiah	20	Hadhbiyah
7	Muraggabat	14	Al-Mankhool	21	Al-Safa

### Development of Public Parks in Dubai

Over the past twenty years, there has been a lot of progress made in terms of public parks in Dubai. Prior to 1980, there were only two parks, Mushrif and Al-Safa, opened in 1974 and 1975 respectively. Since 1982, however, there has been considerable effort expended on identifying suitable locations for new parks, and then on establishing them, including some in the city centre, and squares.

Between 1982 and 2002, twenty new parks have been established as well as 21 new squares. Other work included a complete re-design of Al-Safa Park, with the construction of a hill and

new lakes.

The following table summarises details of the most important and largest public parks in the Emirate of Dubai.

There are still areas on the structural plan for the Emirate of Dubai that are allocated for parks and landscaping. By 2005 the number of parks is expected to increase from 21 to 29, with a further 21 squares. These have all contributed to the earning of a new title for Dubai of City of Parks, to add to those which it has already earned, such as Pearl the Gulf, Most Beautiful Arab City and City of Investment and Tourism.

The parks have a wide variety of attractions for the public. Excellently-located, some adjoining the Arabian Gulf or the Creek, they each have different designs, derived from their architectural, landscaping or natural features.

The plants are kept well-maintained, through a programme designed so that it is carried out when the parks are not open to the public, while the parks themselves and their facilities are regularly cleaned.

Another attraction is the wide diversity of planting, including trees, ornamental trees, fruit trees, shrubs, ground cover plants, ornamental bulbs, succulents, thorny plants, perennial and annual flowers. Good use has been made of the 900 local plant species found within the Municipality Nurseries.

The Khor Dubai Park (Creek Park) has a particularly innovative planting programme, with a total of 238 individual species, some of which have been introduced to the Arabian Gulf for the first time, like Royal Palm, African Oil Palm, Pento Palm and Sykes' Palm, in addition to many decorative trees such as *Spathodea*, *Araucaria*, *Adansonia*, *Chorisia* and many other plants. Particularly notable are the succulents and spine-bearing plants found in the rock garden.

Watering is done through automated systems, which also distribute fertilisers, a feature unique to Dubai.

The facilities available for visitors are also very varied, including children's play areas, lakes, beaches, swimming pools, barbeque areas, sports training areas (Al-Safa Park), sports fields (football, volleyball, basketball, tennis, 18-hole golf), electronic games halls, theatres, train tours within the parks, bikes for touring the parks, directional signs, internal radio broadcasts, toilets

Some of the permanent attractions in the various parks are detailed in this table.

Item	Name of Park	Permanent Activities
1	Al-Mushrif	Swimming pools (one for men, another for women and children), Global Village, recreational games, riding horses and camels, circular train, barbeque areas, date-palm plantation, flower garden, mosque, park nursery, lavatories for men and women, drinking water coolers, restaurants, cafeterias and canteens, seating areas, night-time lighting, facilities for the disabled, car parks inside and outside the park, direction signs and tennis court.

2	Al-Mamzar	Five beaches for swimming and walking, equipped with five lifeguard towers, changing rooms, umbrellas, swimming pools, including one large pool and three smaller pools, 15 chalets (10 large and 5 small), Park Tower, play area, cafeteria, canteens, traditional cafe', barbeque areas, circular train, lavatories for men and women, skating area, drinking water coolers, night-time lighting, directional signs, seating areas, facilities for the disabled, car parks inside and outside the park and bicycles.
3	Khor Dubai Park (Creek Park)	Theatre, cable cars, park train, bicycles, barbeque areas, lavatories for men and women, drinking water coolers, boats for sailing in Dubai Creek, hot air balloon, restaurants and canteens, Al-Aflaj Heritage Village, golf course and clubhouse, beach theatre, facilities for the disabled, night-time lighting, seating areas, car parks inside and outside the park, directional signs, Snow World and Children's City.
4	Al-Safa	A Sports Playground which includes a football pitch, volleyball, basketball, tennis courts, an area for track and field events, a waterfall and lakes area, fixed play equipment area, electronic games area, Traffic Village, circular train, iron train, bicycles for hire, restaurants and canteens, lavatories for men and women, facilities for the disabled, Park Nursery, seating areas, night-time lighting, car parks outside the park, directional signs, jogging & walking track outside the park fence, seating outside the park fence and a special ladies park.a
5	Jumeirah Beach	A swimming beach equipped with safety features and lifeguard towers, changing rooms, a theatre, fixed play equipment area, volleyball courts, restaurants and canteens, lavatories for men and women, drinking water coolers, facilities for the disabled, night-time lighting, seating areas, car parks inside and outside the park and directional signs.

and chalets that can be rented for use during daylight hours.

The needs of the disabled are also catered for, with special car-parks, access ramps, lavatories and recreational facilities.

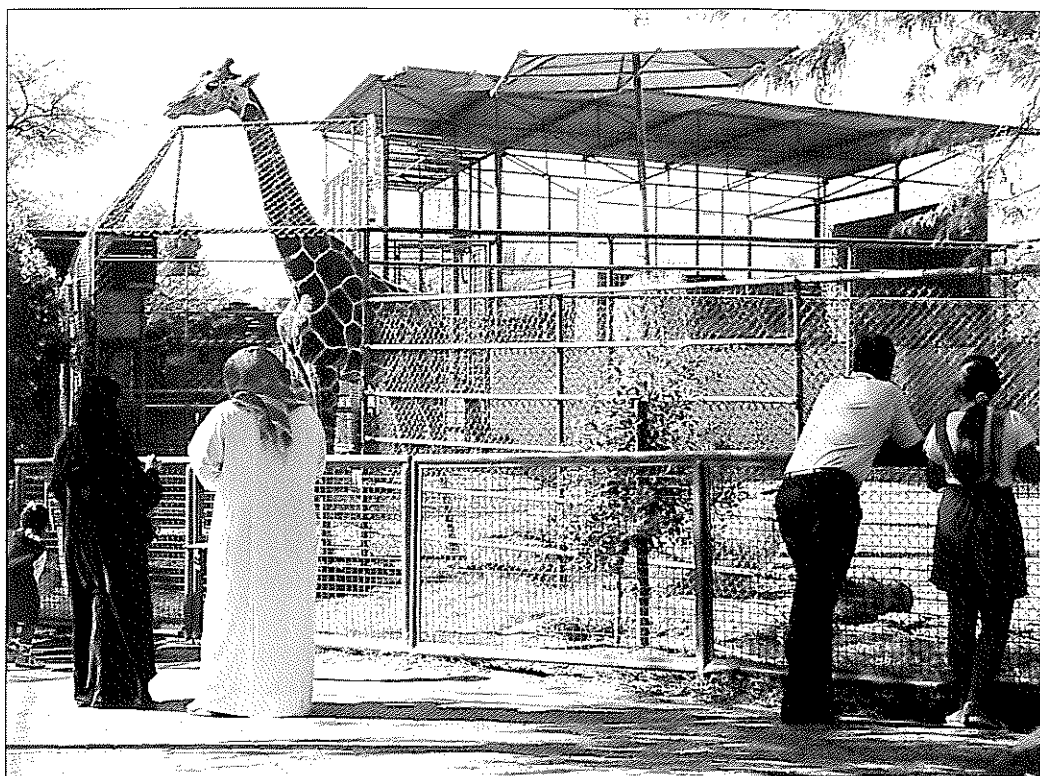
The parks have been designed in such a way that not only can they be updated but also they have special areas that can be used for events staged as part of the Dubai Shopping Festival, like Snow City and the Spaceship. Such events are planned by a special office that has been given the responsibility for devising and organising them.

Events held in the parks during the 2000 and 2001 Shopping Festivals contributed in an important way to the success of the festivals while the Department was recognised for its achievements by winning the Excellence Award for three consecutive years between 2000 and 2002.

All of the parks have restaurants and cafeterias with mosques and praying areas in most, especially the public parks.

### Recreational equipment available in the parks

One of the most important aspects when play equipment is chosen for the parks is that related to the health and safety of visitors, especially children. The equipment is also selected so as to provide a range of options for all age groups and family members.



Inside the Zoo



A Socotra Cormorant in the Zoo

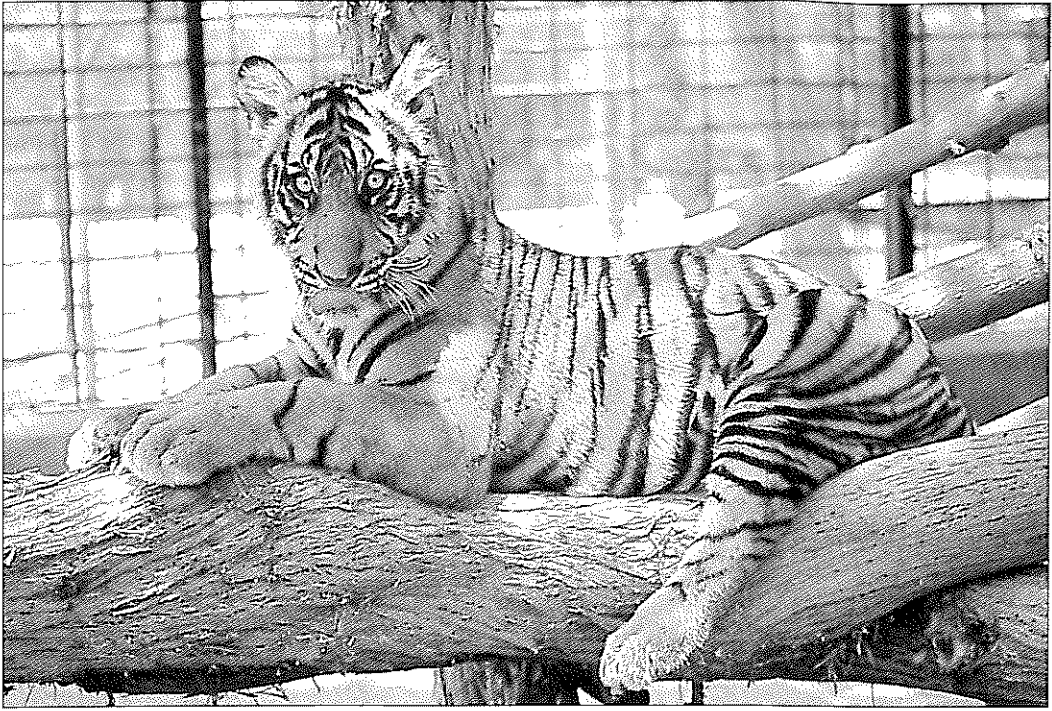
## The Zoo Section

Dubai Zoo has two units, the Animal Care Unit and the Administrative Services Unit. It is responsible for looking after the animals and for operating zoo facilities.

The origins of Dubai Zoo date back to 1967, when an Austrian expatriate, Otto J. Bulart, obtained permission from the late Ruler of Dubai, HH Sheikh Rashid bin Saeed Al Maktoum, to construct a special enclosure for the keeping of wild animals on a 2-hectare plot in Jumeirah. At the time, the area was still largely desert, with a few date palms and naturally-occurring trees, and only a few European expatriates then lived in the vicinity.

The first animals in the Zoo included some big cats and monkeys as well as a few ungulates (animals with hooves) and a small aquarium. Bulart and his son, along with a few friends, allowed visitors to come and see the collection, and continued to run the fledgling Zoo until 1971, when it was taken over by the Municipality.

Although the district of Jumeirah began to develop, the Municipality was able to enlarge and to re-design the Zoo between 1984 and 1989. From that time until 2002, although some further work was carried out, it was limited in scope because of plans for a new Zoo to be built in the Al Mushrif area. It is due to be built during the 2006-2010 Municipality Five Year Plan.



Siberian Leopard

The Zoo is one of the oldest in the whole of the Arabian Peninsula and was the first in the Arab world to successfully breed chimpanzees and Arabian wildcats. It is also among the few zoos in the world to have bred in captivity Socotra Cormorants, a near-endemic for the Emirates, the Yellow-legged Gull, the Great Black-headed Gull and the African Spoonbill.

The Zoo is now a Section within the Public Parks and Horticulture Department and is run by a specialist team headed by a leading zoologist, who has been able to establish a very diverse collection, despite the limitations imposed by the Zoo's size.

Covering an area of 1.76 hectares, the Zoo in 2001 had a collection of 157 species, with a total of 1001 animals, including 228 mammals, 415 birds, 338 reptiles and 20 aquatic species. At present the zoo houses 141 species of vertebrates that included 48 species of mammals with 163 specimens, 65 species of birds with 416 specimens and 28 species of reptiles with 192 specimens.

The Zoo has an important collection of species from the Arabian region, including Arabian Gazelle, Sand Cat, Arabian Wildcat, Arabian and Rueppell's Fox, Arabian Wolf, Striped Hyaena, Greater and Lesser Flamingo, Black-headed, Sooty and Yellow-legged Gulls, Tawny and Bonelli's Eagles, Sand Boa, Hissing Sand Snake, Saw-scaled and Sand Vipers, Desert Monitor and Oscillated Skink.

Other animals, from other parts of the world, include Bengal Tiger, Siberian Tiger, Somali Leopard, Eastern Lowland Gorilla, Chimpanzee, Rhesus, Bonnet, Green and Dent's

Monkeys, Reticulated Giraffe, Indian and Reticulated Pythons, Australian Carpet Python, Ball Python, Common Iguana, African Spur-thighed, Greek, Leopard and Indian Star Tortoises and American Red-eared Terrapin.

In 1997, a special gorilla house, appropriately air-conditioned, was built to resemble their natural habitat, with tree trunks, branches and hanging ropes. A grassed enclosure was added in 2001, when air-conditioned units for housing snakes were also built.

The Zoo has its own small lecture theatre, capable of seating 50 people, and a small library, where lectures are given to visiting students and other visitors.

The Zoo has been able to develop close co-operation with a number of other Zoos, with whom it has exchanged animals, including those in Al Ain, Riyadh, Kuwait, Qatar, Damascus, Mashad in Iran, Dhaka Zoo in Bangladesh, Colombo Zoo in Sri Lanka and others in Singapore, Stuttgart in Germany and Amsterdam in Holland and has won recognition as an important centre of scientific research.

In 1993, it became the first Zoo in the Middle East to be a member of the World Association of Zoos and Aquariums, WAZA.

It also acts as a refuge and shelter for animals confiscated from people violating laws and local ordinances or which are confiscated when passing through the UAE in transit. These latter are kept at the zoo until the status is resolved.

The Zoo also frequently receives animals formerly kept as household pets when their owners are no longer able or willing to take care of them.



**Legal Affairs  
Department**

Laws and the legal system are among the most important tools in organising societies and in helping them to achieve comprehensive and sustainable development. They also help to make it possible to translate policies, plans and programmes into action.

The origins of the Legal Affairs Department of Dubai Municipality date back to 10th January 1982, when a legal consultant was appointed with the task of drafting the Municipal Ordinances and Administrative Directives issued by the Municipality in addition to providing legal opinions and advice, as illustrated in Chart No. 1.

### Chart No. 1

Director - General



Legal Consultant

With the increase in the Municipality's work arising out of the growth of Dubai, it became necessary to establish a formal legal unit. On 24th November 1988, therefore, Administrative Directive No. 288/1988 established the Legal Affairs Office, which was directly linked to the office of the Director General, as shown in Chart No. 2.

### Chart No. 2

Director - General

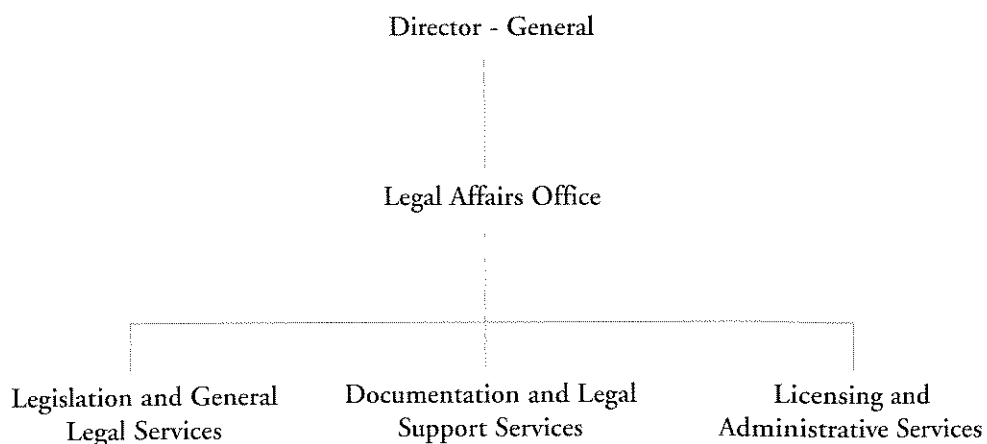


Legal Affairs Office

On 25th May 1991, Administrative Directive No. 146/1991 laid down the organisation chart for the Legal Affairs Office, bringing all legal work and duties of a similar kind under a single technical and administrative structure and providing a basis for the provision of comprehensive legal services for the Municipality, as shown in Chart No. 3.

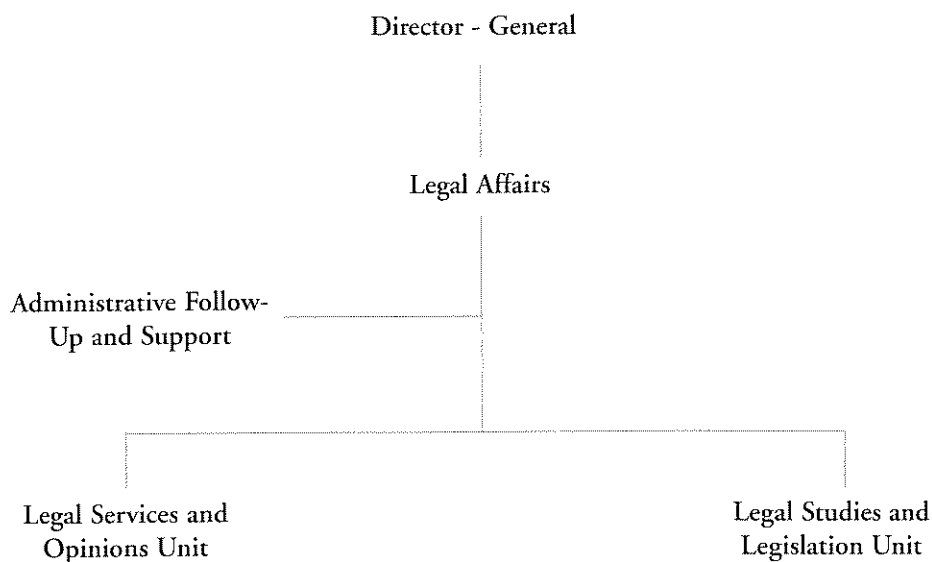
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### Chart No. 3



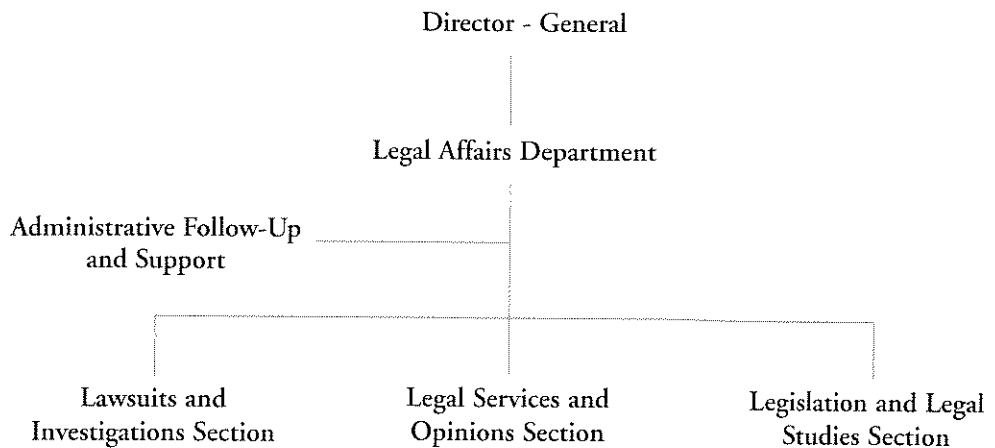
On 22nd July 1997, the units in the Legal Affairs Office were merged in accordance with the terms of Administrative Directive No. 1000/1997, which established a new organisation chart and laid down the duties of the office, as shown in Chart No. 4.

### Chart No. 4



Further expansion of the role of legal affairs within the Municipality followed, requiring the addition of more staff. On 5th November 1998, Administrative Directive No. 309/1998 raised the Office to the level of a Department, this being followed on 18th April 2000 by Administrative Directive No. 94/2000 which approved a new organisation chart and specified the duties of the new Department, as shown in Chart No. 5.

**Chart No. 5**



The main duties and responsibilities of the Legal Affairs Department and of its sections are as follows:

- 1- To provide consultation and legal services in an effective manner to all organisational units of the Municipality.
- 2- To suggest and implement the Municipality's policies, rules and directives relating to legislative, legal and judicial matters or other subjects relating to the Municipality.
- 3- To propose the annual budget, plans and work programmes for Legal Affairs and to implement them once they have been approved.
- 4- To study projects pertaining to laws, orders, directives and other legislation relating to the Municipality's fields of expertise such as technical, administrative and organisational and other fields, in accordance with existing laws and other local and federal legislation.
- 5- To suggest, prepare, draft and review projects pertaining to laws and Municipal Ordinances,

- 
- by-laws, new organisational and administrative directives designed to regulate various aspects of work within the Municipality in addition to developing and updating existing legislation.
- 6- To carry out specialised legal studies and research according to the needs of the Municipality, in response to instructions issued.
  - 7- To receive enquiries and requests from organisational units of the Municipality on issues and problems they face with regard to their normal duties, as well as handling enquiries received from other offices, establishments and government organisations and to prepare the appropriate responses on legal aspects.
  - 8- To receive complaints submitted by employees with respect to decisions made by discipline committees within the Municipality and to offer legal opinions of them, and to study complaints from employees and from clients of the Municipality and to offer a legal opinion on cases referred to the Department by the Director General or by another organisational unit, so that action may be taken, or in order to offer legal opinions.
  - 9- To carry out investigations relating to staff discipline in the event of any violation of Municipality internal rules and regulations.
  - 10- To carry out an administrative investigation of any incident relating to matters submitted to the Legal Affairs Department.
  - 11- To assume responsibility for dealing with all legal cases in which the Municipality is either plaintiff or defendant, or those against any of its employees for actions which take place while they are carrying out their duties. This also includes studying the cases, preparation of reports and briefs in this respect as well as preparing the declarations and briefs which clarify the Municipality's opinion and position, as well as representing the Municipality before the judicial authorities and affiliated parties in all legal actions for or against the Municipality and carrying out all procedures and necessary legal steps to safeguard the rights and interests of the Municipality and its employees.
  - 12- To prepare, draft and revise all contracts and agreements entered into by the Municipality with other parties, excluding standard contracts relating to Municipality projects, requirements and procurements.
  - 13- To undertake the legal translation of legislation and rules issued by the Municipality, as well as legal correspondence which requires translation into other languages, in accordance with the relevant directives.
  - 14- To supply other organisational units with federal and local legislation relating to their work, in coordination with the Administrative Affairs Department, and to post the Municipality's legislation on the internet through the Municipality's website as well as updating this information periodically, in coordination with the Information Technology Department.

- 15- To co-ordinate with legal units in other UAE government offices, organisations and establishments on all legal issues and matters relating to the Municipality's duties and responsibilities.
- 16- To take part in the work of committees, meetings and seminars, both at home and overseas, in accordance with instructions issued by the Director General.
- 17- To propose suitable training courses for employees in the Legal Affairs Department in subjects related to their duties.
- 18- To calculate the annual cost of the Legal Affairs Department according to the Municipality's rules, in coordination with the organisational unit in the Municipality responsible for cost calculations.
- 19- To implement approved performance indicators to measure the Legal Affairs Department's performance and to carry out an annual review of these indicators in coordination with the relevant specialised unit in the Municipality.
- 20- To prepare periodical reports on the work carried out by the Legal Affairs Department, these to identify achievements and problems as well as to suggest ways of improving performance, these reports to be submitted to the Director General according to Municipality rules.
- 21- To perform any other related duties.

### **Legislation and Legal Studies Section**

The specific tasks of this Section include those of studying and preparing projects pertaining to laws, municipal ordinances, by-laws, administrative regulations and directives and other legislation or rules designed to organise all administrative and technical aspects of work in the Municipality.

It also carries out specialised legal studies and research related to the Municipality's activities and identifies any inadequacies or conflicts in legislation implemented by the Municipality.

### **Legal Services and Opinion Section**

This Section provides consultancy advice and legal opinions on subjects referred to the Director General and to organisational units of the Municipality or to other Government offices and public bodies on matters related to the Municipality and its work.

It also receives written complaints from employees in respect of decisions issued by Municipality disciplinary committees and provides legal opinions on them, and also provides legal opinions or takes action on complaints from employees and Municipality customers.

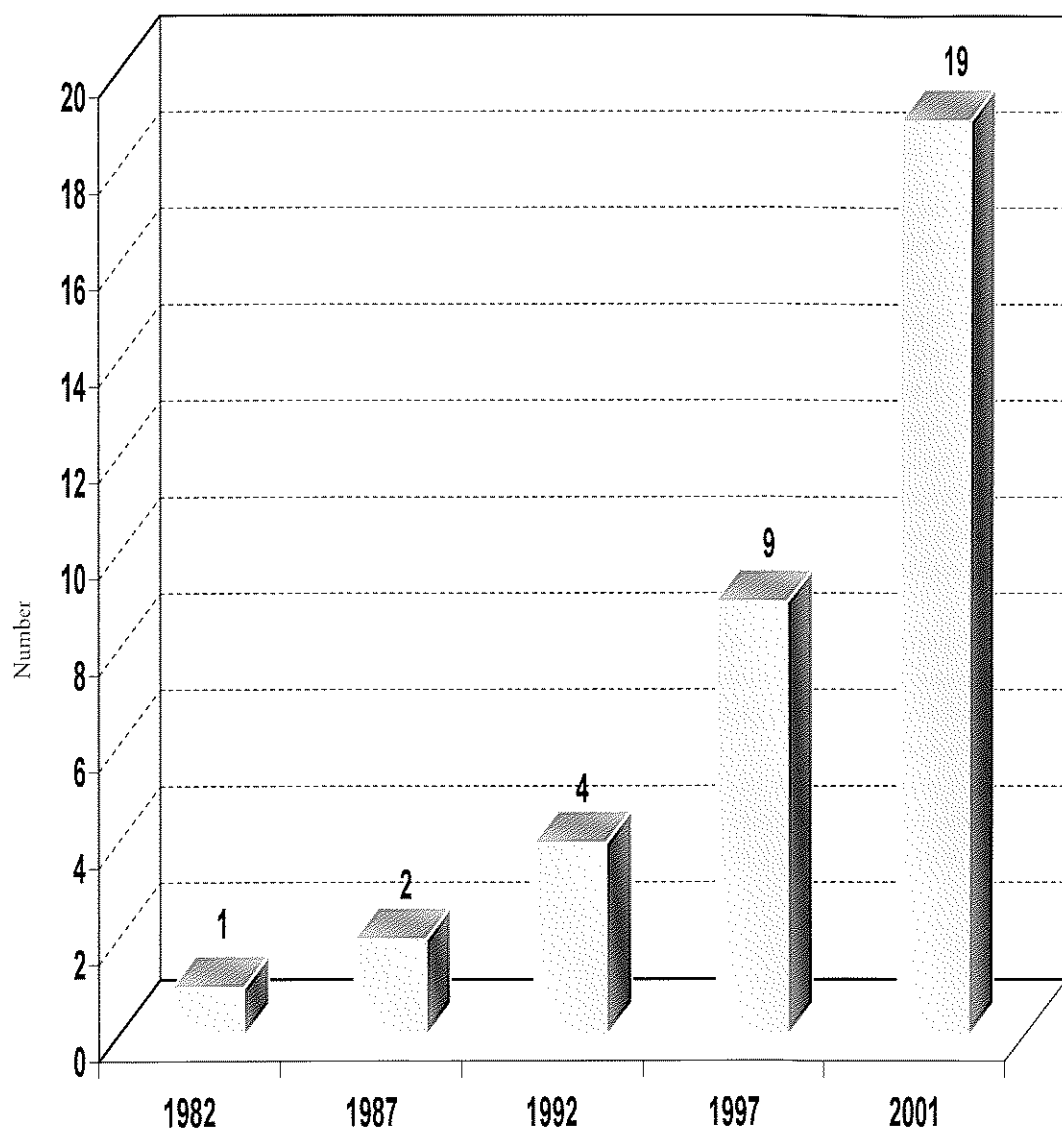
### **Lawsuits and Investigations Section**

This Section represents the Municipality in the judicial system in all cases in which the Municipality is either plaintiff or defendant, attending court sessions and taking all necessary

procedures to safeguard the rights and interests of the Municipality and its employees. It also follows up on the implementation of judgements and directives issued in favour of the Municipality. It is, further, responsible for initiating and carrying out all internal investigations related to violation of rules and regulations by Municipality employees.

The growth in the complexity of the Department's organisation chart has been paralleled by an increase in its staff, in order to meet the growing demand for its services. By 2001, the Department had 27 employees, of whom 19 were specialist legal personnel.

Number of legal staff in the Department, 1982 – 2001



## Achievements

Like many other organisational units in the Municipality, the Legal Affairs Department has achieved a considerable amount since it was established, and it has made a real contribution to the improvement of the Municipality's performance.

- Its formulation and drafting of laws, municipal ordinances, directives and by-laws, in particular those relating to external and internal customer services, has been of a standard in keeping with the development achieved by Dubai and the rest of the UAE in all fields.

**By the end of 2000, the following work had been completed.**

Type of Legislation	Municipal Ordinances	Administrative Directives
Number	140	2,097

Among the achievements of the Department has been the preparing and drafting of legislation to administer, organise and safeguard the utilities and public services run by the Municipality. This legislation has dealt with topics such as the classification and rationing of land use, regulation of construction activities, the protection of the infrastructure and of agricultural land, maintaining cleanliness of public areas, drainage networks, roads, bridges and underpasses, general public health issues, the monitoring of foodstuffs and fertilisers and the setting up of specialist census centres.

Other topics dealt with have included the organisation and maintenance of public transport, the classification of economic activities, licencing of professionals, craftsmen and specialised activities such as engineering consultancy and construction, hotel work, licencing and monitoring of co-operatives and cultural and charitable organisations and the organisation of the public markets.

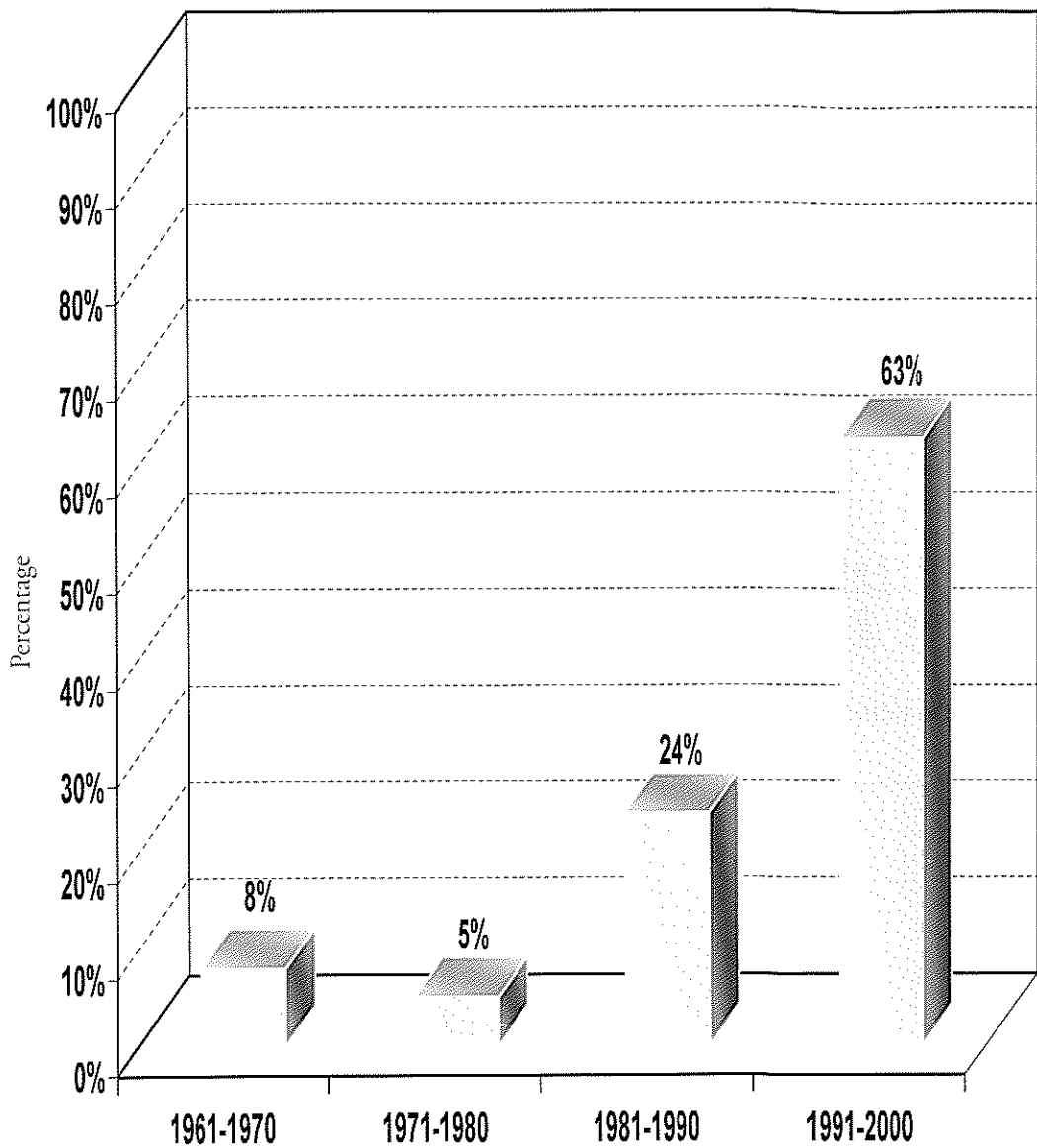
The Department has also made suggestions for the amendment of various other legislation and proposed the establishment of the Legal Committee of the Secretariat-General of the UAE Municipalities, which now plays an important role in unifying legislation throughout the country's Municipalities.

Another part of its work has been the provision of advice to external private legal offices.

The following table gives the number of agreements, contracts, legal opinions and complaints handled between 1995 and 2001.

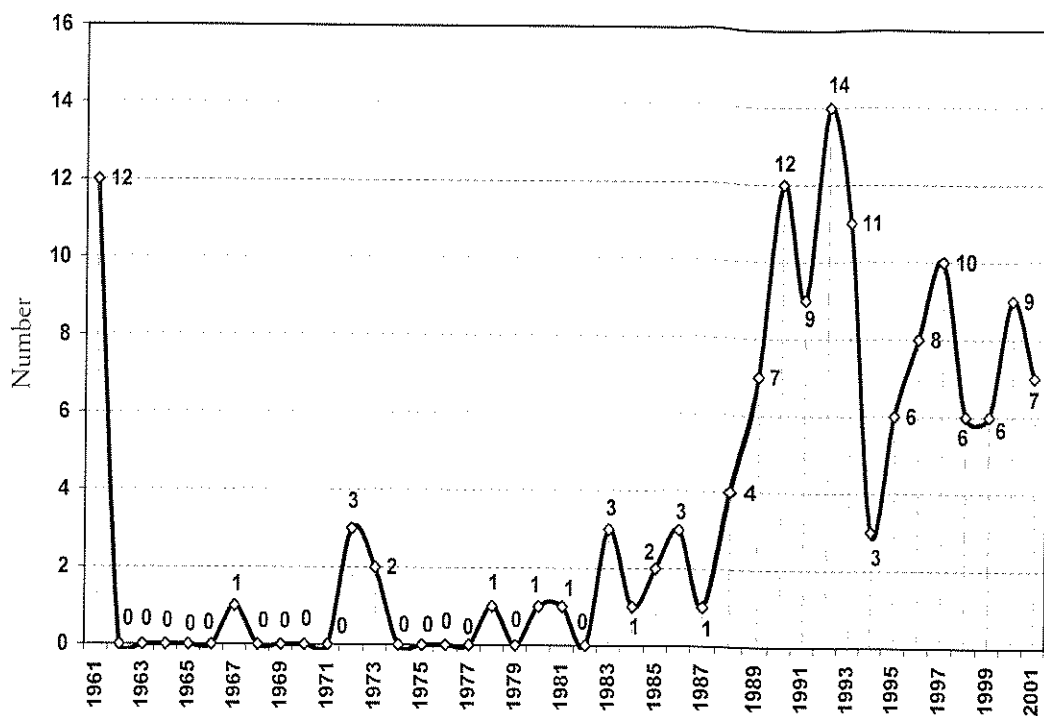


## Municipal Ordinances, 1961 – 2000

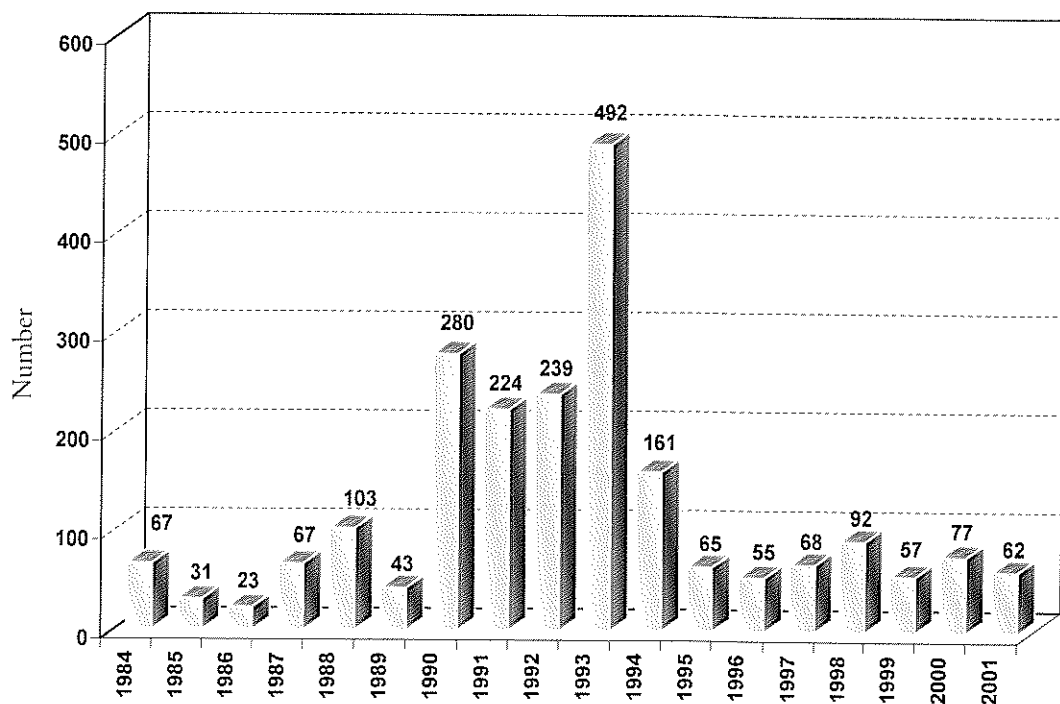


Subject	1995	1995	1997	1998	1999	2000	2001	Total
Agreements and Contracts	5	1	4	2	4	4	3	23
Legal Opinions	9	9	26	13	27	48	30	162
Complaints	1	-	2	5	5	4	2	19

Comparison between the number of Municipal Ordinances according to year, 1961 – 2001

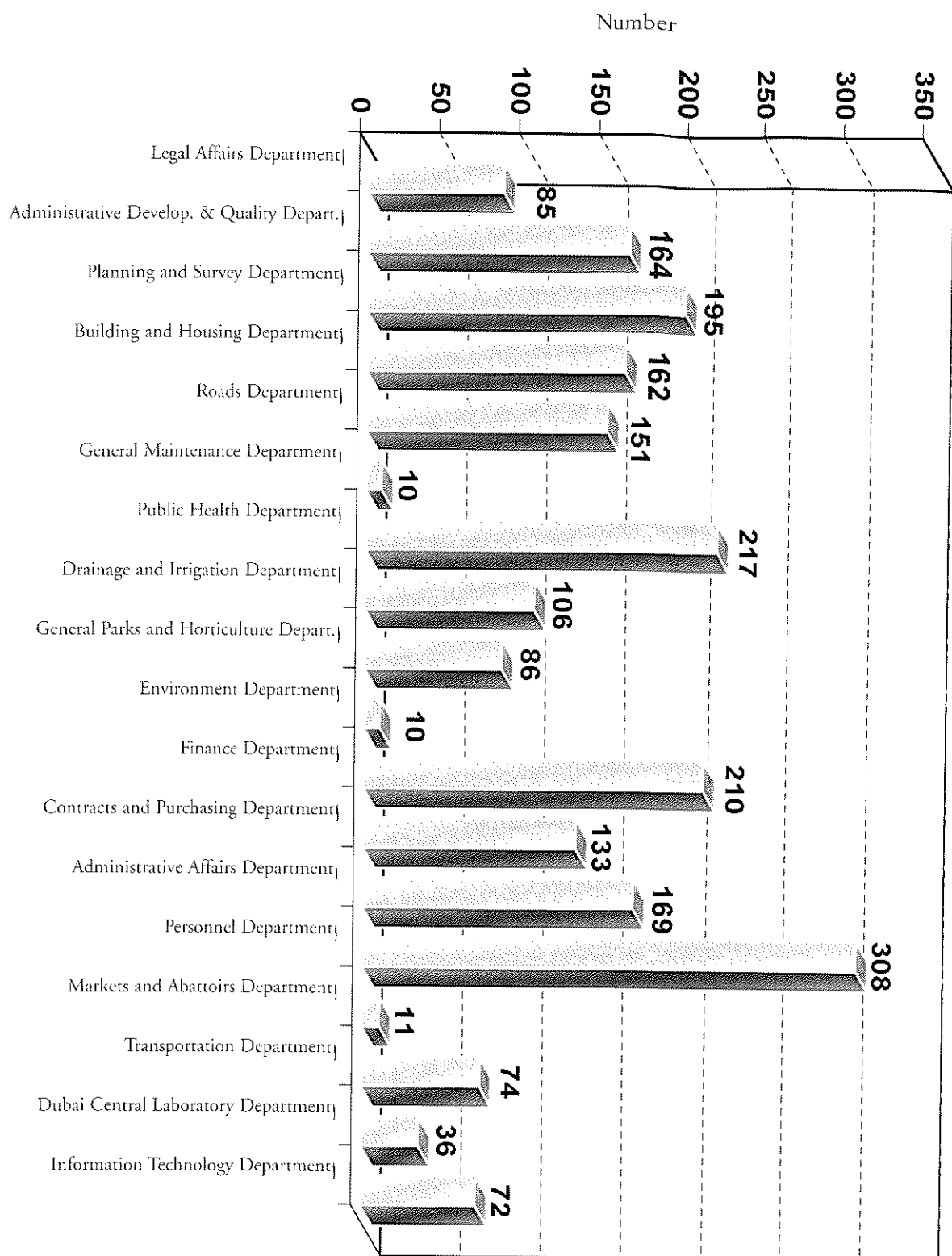


Comparison between the numbers of Administrative Directives according to year, 1984 – 2001



Comparison between the number of Municipal Ordinances according to Municipality Departments, 1961 – 2001





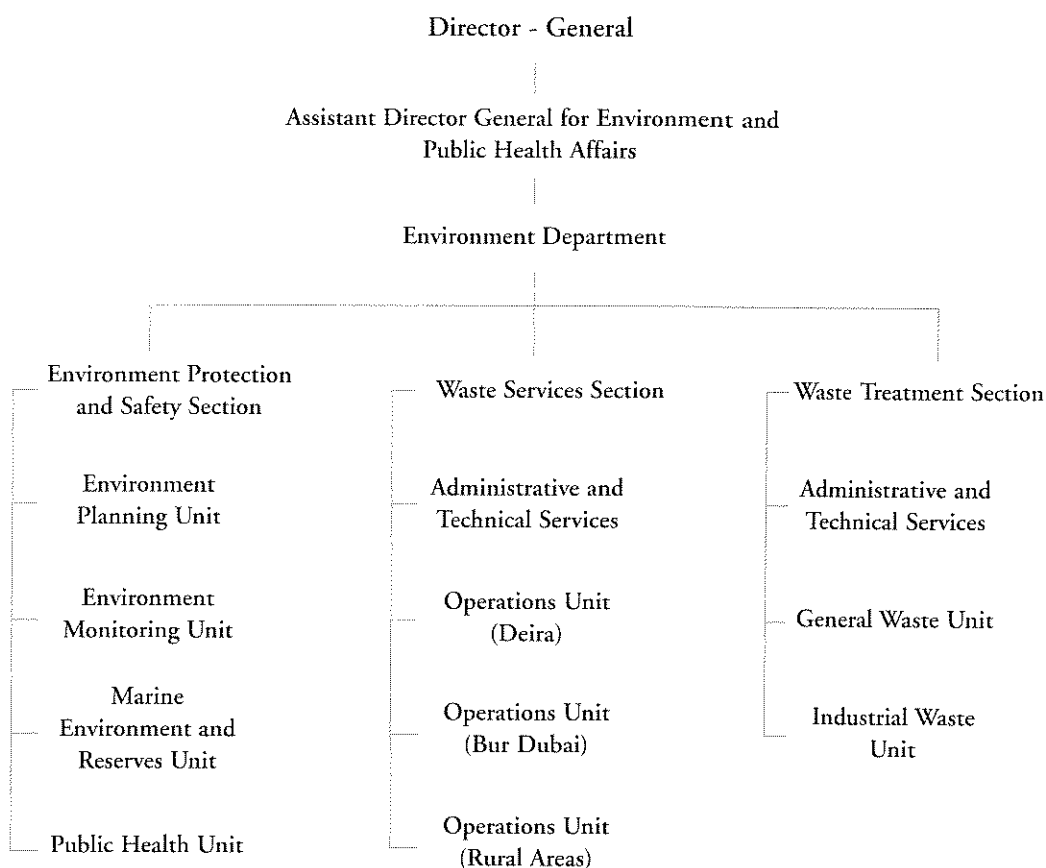
**Historical  
Development of  
the Environment  
Department**

The United Arab Emirates has paid special attention to the protection of its environment through the creation of a number of bodies, at both a federal and a local level. Among these are several units of the Dubai Municipality.

The Municipality has sought to develop programmes to monitor the state of the environment on a regular basis and to establish and implement by-laws and other regulations to limit any adverse impact on the environment of Dubai. Its objective is to identify ways in which, in contrast, environmental protection can be enhanced.

The Municipality's Environment Department was formally established in 1998, with the removal of the Environment Protection and Safety Section and the Waste Services Section from the Public Health Department. This step was undertaken so as to have a dedicated department dealing with environmental issues that could not only improve the services offered to the public but could also seek to bring about a change in existing practices where these had an adverse impact on the environment. The Department was also given the tasks of increasing public awareness and of being responsible for pollution control. The organisation chart for the Department, shown in Chart No. 1, was laid down in Administrative Directive No. 66 for 1999.

Chart No. 1. Organisation Chart of the Environment Department in 1999



To undertake its tasks of environmental protection, preventing pollution and ensuring sustainable exploitation of natural resources, the main Environment Centre, in Bani Yas Street, has a total of 22 branch offices throughout the Emirate. There are also five sites for back-filling with waste and a central compound for the treatment of all hazardous waste arising from industrial activities as well as of medical waste. The Department has a fleet of around 300 vehicles, primarily used for cleaning services and for the removal and transportation of waste.

One important component of the environment protection programme of the Municipality is, of course, those members of its workforce whose tasks involve the maintaining of general cleanliness. This workforce was initially part of the Waste Services Section, part of the Public Health Department, as was the Environment Protection and Safety Section until the Environment Department was established in 1998. The following table gives details of the development of the workforce involved in environmental duties over the course of the last three decades.

### Environment-related workforce, 1970 – 2002

Year	1970*	1980*	1990*	1999	2000	2001	2002
Total employees (excluding manual labour)	40	317	724	516	558	542	598
Emiratis	6	10	42	39	56	67	58
Percentage of Emiratis	15%	3.2%	5.8%	7.6%	10.3%	12.4%	9.7%
Number of Labourers	38**	961	1,971	2,048	2,178	2,108	2,178
Total personnel	78***	1,278	2,695	2,564	2,736	2,650	2,776

#### Note:

- \* The figures for the period 1970 – 1990 relate to employees in the Public Health and Environment Sections of the Health Department, prior to the establishment of the Environment Department in 1998
- \*\* There are no Emiratis in this group
- \*\*\* Total number of personnel in the Department = Total number of employees + number of manual labourers

## The Main Duties and Responsibilities of the Environment Department and its subsidiary Sections are as follows:

- To ensure the highest standards of cleanliness in public areas of the Emirate through the carrying out of effective programmes to transport, remove and dispose of various types of waste.
- To monitor and protect the various elements of the environment in the Emirate of Dubai (water, air and soil) against pollution.
- To administer effectively general waste, hazardous waste and waste treatment facilities.
- To ensure that existing and new factories adhere to the appropriate environmental, health and safety requirements.
- To work for a reduction in the amount of general waste and industrial waste being generated.
- To protect the marine environment, wildlife and nature reserves.
- To carry out the appropriate studies and research on various environmental topics.
- To educate the public and industrialists on environmental issues and on ways of protecting the environment against the dangers of pollution.
- To carry out public safety programmes for all sectors, to follow up on the implementation of safety programmes in buildings and public establishments and to implement the appropriate health and safety procedures in industrial plants.
- To maintain a continuous review of environment monitoring and observation policies and procedures.

### 1. Environment Protection and Safety Section

The Environment Protection and Safety Section is responsible for the monitoring and observation of environmental pollution levels throughout the Emirate of Dubai, including pollution in water, air and soil, and for measuring factors which have an adverse impact on the human environment, such as noise and hazardous waste, as well as for health and safety. The section also carries out inspection and monitoring programmes in industrial areas to control gas emissions and waste resulting from industrial activities. It also monitors the handling and transport of hazardous waste and medical waste and oversees the procedures for its safe disposal, these being designed to limit the negative impact of such waste on the environment.

The Section is also responsible for monitoring the marine environment and all wildlife, with a view to protecting them from pollution and to guarding against the possibility of species of fauna and flora becoming extinct or endangered in the Emirate.

### 2. Waste Services Section

The Waste Services Section is one of the oldest parts of the Municipality, dating back to its



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foundation in the 1950s. It plays a vital role in ensuring that the city of Dubai, in particular, and the rest of the Emirate, is kept clean.

It is responsible for all activities related to the administration of waste, including the collection of domestic waste, the cleaning of cleaning roads, streets, and public squares within the city and the cleaning of areas in the Emirate used by tourists. It also undertakes the cleaning of public lavatories, provides services to drain septic tanks for buildings in areas which do not have public drainage facilities and deals with the flow and collection of rainwater and unblocking of manholes.

### 3. Waste Treatment Section

This section was established at the time that the Environment Department itself was created, in 1998. Prior to that, the disposal and treatment of waste was the responsibility of the Waste Services Section.

The Section was set up to handle the disposal of all types of waste, including general, medical, industrial and hazardous waste. Special units were created to handle and to dispose safely of medical and hazardous waste, in accordance with approved international standards, while general waste was tackled through the introduction of programmes designed to reduce the amount produced and to implement re-cycling, where appropriate.

### Development of Legislation and Environmental Regulations

The success of any environment department depends on the existence of the appropriate legislation and environmental regulations relating to the administration and protection of all components of the environment, such as air, water and soil, the handling of general and hazardous waste, and protection of the working environment, so as to protect natural resources and human health and to ensure sustainable development. In order to achieve this, the Municipality has introduced legislation and environment regulations, laying down rules and procedures to protect the environment and specifying of enforcement and the legal procedures and penalties for violations.

These include:

#### ■ Environment Protection Policy

A document outlining the “Environment Department Policy Pertaining to Waste, Environment and Sustained Development” was prepared, based upon the principles and concepts relating to sustainable development and the work programmes which emerged as a result of the World Summit held in Rio de Janeiro, Brazil, in 1992, called to discuss and to prepare to face the challenges of the 21st century (these being known, collectively, as Agenda 21). The policies laid down in the document are used as planning instruments with the aim of achieving the specified objectives of the Environment and Public Health Departments.

## ■ General Cleaning Regulations

Municipal Ordinance No. 28 of 1985 deals with issues related to cleaning of public areas in the Emirate of Dubai, laying down the regulations and procedures to curb incorrect practices relating to cleaning and for the administration of waste and public health. A number of senior employees and those concerned with environmental issues in Dubai were granted the status of judicial officers in order to contribute to the implementation of this Municipal Ordinance and to safeguard Dubai's environment.

## ■ Environment Protection Regulations

Municipal Ordinance No. 61 of 1991 lays down environment protection and safety regulations for the Emirate of Dubai. Its 91 articles, divided into eight chapters, deal primarily with the protection of natural resources such as water, air and soil, and with the preservation of quality for all environmental sectors.

It also spells out the conditions and regulations required for industrial licences, for the sound administration of waste and for the conservation of the natural environment and wildlife in the Emirate.

## ■ Medical Waste Administration Regulations

Municipal Ordinance No. 115 of 1997 laid down rules for the administration and handling of medical waste in Dubai, from the moment of production until its final disposal at the special treatment plant, one of the Environment Department's facilities.

## Development of Environmental Services

### 1. Treatment of Solid Waste

The processes for the treatment of solid waste in Dubai have developed along with other aspects of the Emirate's rapid development. Initially, during the 1960s, special areas were allocated for disposal of solid waste and methods for improving disposal techniques were introduced.

This was followed in the 1970s by the introduction of refuse trucks with the facility to compress the waste, while during the 1980s, the focus was on upgrading the methods used for storage of waste, such as the introduction of galvanised containers to replace the steel drums previously been in use. By this time, the amount of waste being produced had risen by more than five times compared to the 1960s. Road sweeping and sand removal were also introduced.

In the 1980s, more than 12,000 containers a day of waste were being removed, transported to disposal sites and emptied, along with over a million tons a year of general waste, while around 4.4 million tons of general, industrial and construction waste were being treated. Over 17,000 kilometres of paved roads and streets in the Emirate were also being

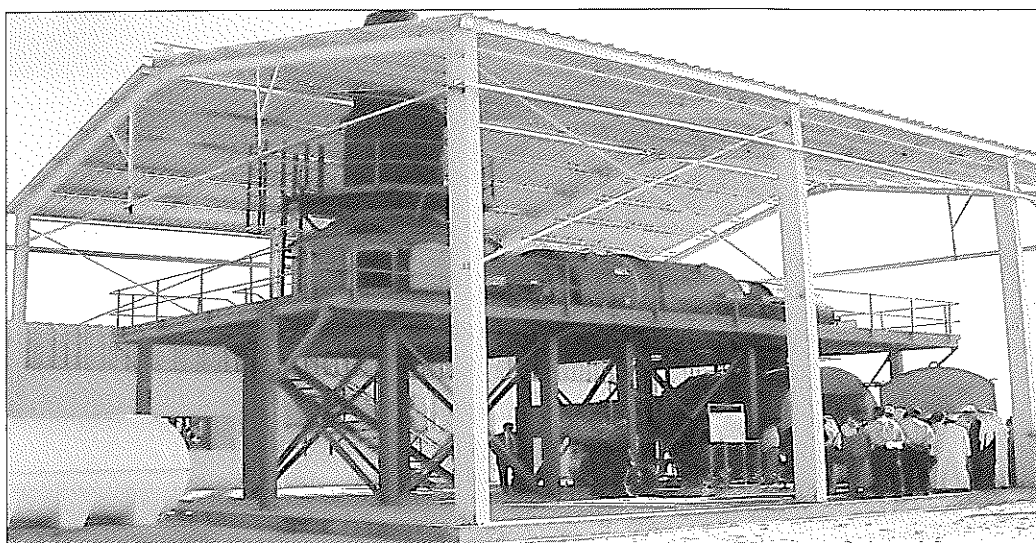
cleaned on a regular basis.

During the 1990s, new concepts of waste treatment were introduced, in line with the principles of a sustainable development programme. The Target 555 Programmes were implemented while recycling was adopted as an important way of dealing with waste, since statistical data suggested that there was likely to be a continued expansion in the amount of domestic solid waste being produced. Between 1987 and 2002, the amount of waste being produced rose from 270,000 tons to over 1.32 million tons per years.

This growth of activities required an internal re-organisation, so as to ensure that the efficiency and quality of the services being provided to the public were maintained. The re-organisation also involved a re-structuring of the allocation of supervisory staff, to introduce a system based upon geographical areas, such as Bur Dubai, Deira and the out-lying areas. The use of vehicles and other machines was also revised to enhance productivity, taking into account factors such as the hours of work, the distances being covered and the amount of waste collected, to provide a basic gauge of performance and efficiency.

New services were introduced for the public, such as the free distribution of plastic sacks for refuse, these being handed out through the branch offices of the Municipality. Around one million sacks are distributed every month, with the objectives being both to help to ensure the safe disposal of waste and to increase awareness among the public of their responsibilities. It also helps to protect the machinery and containers used for refuse collection.

The specifications for all machinery and methods of storage were updated to further develop the service, in accordance with developments elsewhere, while the fleet of vehicles was upgraded. New machinery was introduced, including side-loading refuse trucks, which require less labour to operate, mechanical road sweepers and machines to improve procedures for the disposal of trees that have been removed, in line with the international developments in this field.



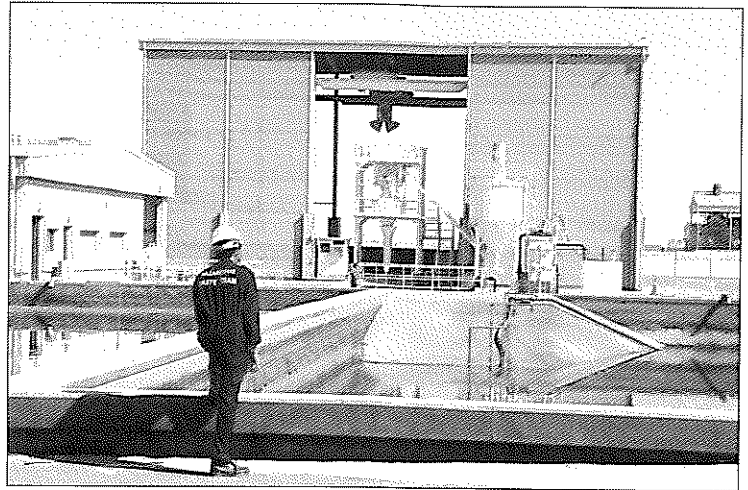
The Medical Waste Treatment Facility

New methods of storage were also introduced, such as plastic containers, while other waste disposal methods were designed in-house for use at public festivals and other events. New machinery for cleaning the ground, including the beaches, was also brought into use, to improve the services provided in areas of industrial activity or being used by tourists.

## 2. Treatment of hazardous and medical waste

The industrial development of Dubai has led to a rapid increase in the amount of hazardous waste being produced, particularly since 1994. The amount of such waste produced on an annual basis, including oil-based waste and other waste that is difficult to handle, increased from 9,740 tons in 1994 to 23,300 tons in 1995 and then to 34,800 tons in 1996. This increase necessitated planning to safeguard against the dangers of pollution or the destruction of natural resources in the Emirate, all part of the Municipality's efforts through the Environment Department to identify solutions that will permit Government to fulfil its commitments to its population and environment through a balanced approach which takes into account the development of Dubai.

It was, therefore, determined that an industrial waste treatment plant, in line with those in the industrialised nations, should be set up for the collection and treatment of such waste. The Hazardous Waste Treatment Complex was established in Jebel Ali, with facilities for the treatment of hazardous waste, for treatment of medical waste and for its incineration.



The Hazardous Waste Treatment Facility

### ■ Hazardous Waste Treatment Facility

Prior to the opening of the Hazardous Waste Treatment Facility, in February 1999, such waste had been buried without treatment. The facility was officially inaugurated on 6th February 2000, on the occasion of the third UAE National Environment Day, and is designed to handle projected hazardous waste production up until the year 2015.

At present, the plant is the only one of its kind in the whole of the United Arab Emirates and represents a major achievement by the Municipality in the sphere of the protection of the environment.

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In 1999, the facility treated 19,000 tons of waste, 26,000 tons in 2000, around 123,557 tons in 2001 and 117,216 tons in 2002, excluding medical waste or other waste that is difficult to process.

### ■ Medical Waste Treatment Facility

During the first half of the 1990s, the Municipality carried out studies to identify the amount of medical waste being produced by both government and private sector facilities and it became apparent that there was a need for the introduction of special treatment facilities.

The Medical Waste Treatment Facility began operating on a temporary basis in 1997, to meet urgent demand, with the capacity of handling four tons a day this being designed to meet anticipated need for a five year period.

An Operations Manual for Administration of Medical Waste from Hospitals, Clinics and Medical Care Establishments in the Emirate of Dubai was issued and a comprehensive system for monitoring and administering medical waste was introduced. Immediate results included the reduction of the amount of medical waste by eighty per cent, through a simple process of treatment that rendered it harmless and similar in properties to ordinary waste.

### ■ Hazardous Waste Incinerator

In 2000, the Environment Department began work on its hazardous waste incinerator, designed to be an integral part of the Hazardous Waste Treatment Facility and also to serve the needs of the Medical Waste Treatment Facility.

The incinerator, inaugurated in February 2001 on the occasion of the fourth UAE National Environment Day, was designed in accordance with the latest European specifications, with the capacity to treat medical waste at a rate of 500 kilograms per hour and to burn any solvents stored at the facility as well as oil waste from the unit used to extract oil from water. It also uses the resulting heat to boil and evaporate treated liquid waste.

## 3. Air Quality Administration

In order to safeguard the environment and the quality of air within the Emirate of Dubai, the Air Quality Administration has focused on two main programmes.

### ■ Observing and Monitoring Air Quality

Monitoring of air quality in Dubai began in 1987, and was initially limited to the gathering of data and taking readings for a limited number of pollutants.

In 1993, a network was established to monitor air quality by measuring the presence of widely-known air pollutants. The air quality monitoring equipment was linked to an electronic network and computer which analyses data around the clock to obtain detailed and

accurate information about air quality and its compatibility with the objectives in place. These stations are in five strategic locations throughout the Emirate, with control and communications being handled by the main station, located in the offices of the Environment Protection and Safety Section. This includes a central receiving station for the collection, analysis and storage of information, so that it can be used in decision-making.

The monitoring of air quality is undertaken to obtain information about the pollution indicators and to compare them against natural standards, so that the necessary measures can be taken, while a database of information is maintained that can be of assistance of research into land use and transport planning in urban areas. The information is also of assistance in developing and evaluating strategic plans and in the preparation of procedures for the future measuring of air quality.

### ■ Direct monitoring of gas emissions

Implementation of this system in large industrial establishments and at power plants began in 1995. It entails the measuring of air pollutants from furnaces and kilns in factories, chimneys, power stations and the like. Specialist, licenced, laboratories in Dubai carry out the tests required, in order to ensure that those responsible for emissions stay within the relevant international rules and standards.

Companies and factories which do not have the resources to instal the system will be required to put in place special control equipment to monitor their emissions.

The following elements are monitored and studied.

- Measurements of the polluting elements released into the atmosphere as a result of industrial activities.
- The conditions and methods used to control polluting emissions into the air from fixed sources, in accordance with best international practices.
- Implementation of procedures to monitor polluting emissions from chimneys and drainage points and to specify the approved methods of incineration.
- Studying of the effects on the environment of new industrial activities and the issuing of licences that stipulate the need for monitoring and the control of gas emissions.

## 4. Industrial Monitoring

The Department inspects factories in order to organise and monitor the handling of waste and industrial emissions, implements health and safety procedures to protect workers and monitors hazardous materials, methods of storage and methods for using and controlling hazardous materials as well as monitoring the disposal of these materials, in accordance with Municipal Ordinance No 61 of 1991 and supplementary orders and directives.

An inspection programme covers factories, workshops, laundries, chemical stores and other sites, these being mainly located in the Al-Quoz, Ramool, Al-Aweer, Qusais and Jebel Ali areas, although some are also present in other parts of the Emirate.

Following inspection, detailed reports are prepared. If any shortfall in procedures or vio-

lation of regulations is identified, a written notification is sent to the establishment concerned, giving them a reasonable period of time during which they must comply with environment protection and safety requirements. Fines are imposed if the violations continue.

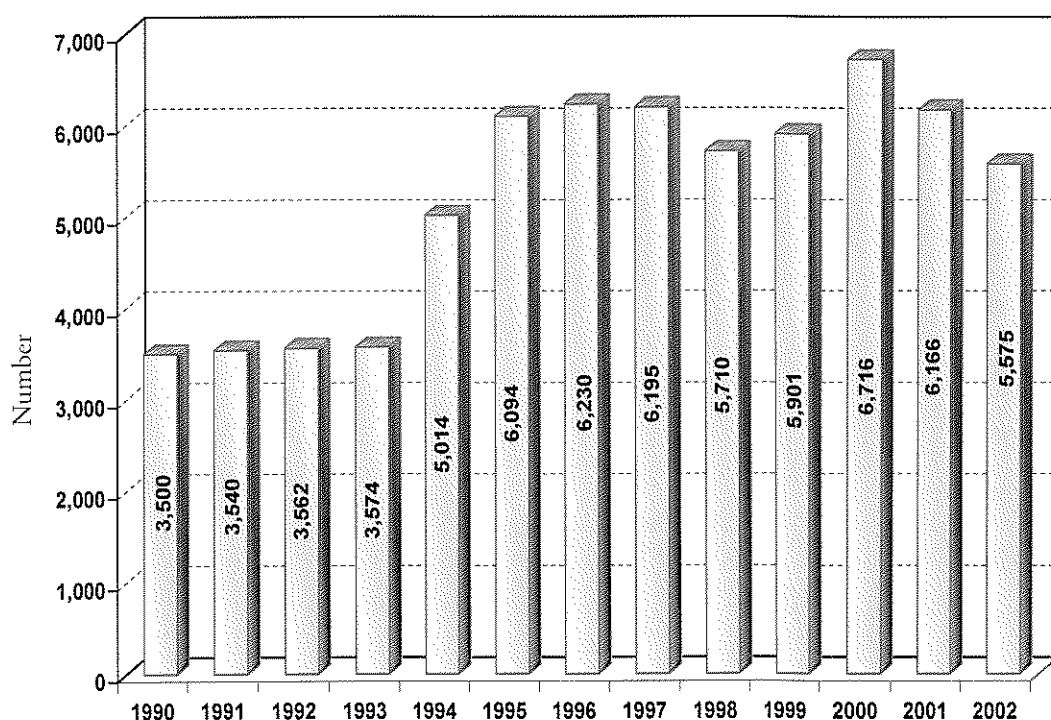
This inspection of industrial establishments has increased since the establishment of the Municipality's Environment Protection and Safety Section, with annual inspections rising from 3,500 in 1990 to 5,575 in 2002, as shown in the following table.

In 1990, the sum of 50,000 UAE dirhams was levied in fines, this rising to 768,600 dirhams in 2001. Fees received for the environmental assessment of new establishments were 125,795 dirhams in 2001, making total revenue for the Section for the year of 894,395 dirhams.

**Inspections carried out of Industrial Establishments, 1990 – 2002**

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number of Inspections	3,500	3,540	3,562	3,574	5,014	6,094	6,230	6,195	5,710	5,901	6,716	6,166	5,575

**Inspections carried out of industrial establishments in Dubai, 1990 – 2002**



## 5. Public Safety

The Environment Department performs regular inspections and implements the necessary rules and procedures to protect the public. This includes the implementation of the swimming pool regulations laid down in Municipal Ordinance No. 61 of 1991, which provides for the inspection of plans and engineering drawings to ensure pools are in accordance with safety and environmental requirements, before they are built.

In 2001, plans were approved for the construction of 308 swimming pools, with fees for reviewing and approving the plans amounting to 341,600 dirhams, compared to fees of 234,800 dirhams for approving plans for 232 pools in 2000.

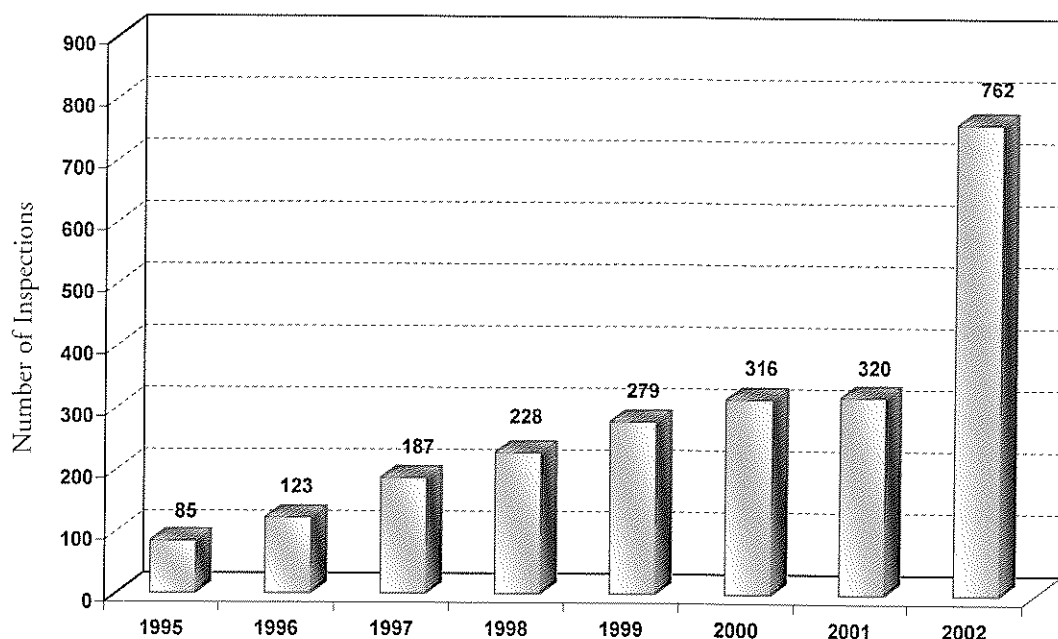
Regular and unscheduled inspections are also carried out of public and semi-public swimming pools to test water quality and to ensure that it meets the specified requirements. In 1995, there were 85 inspections, this number rising to 762 in 2002.

Regular inspections are also carried out on importers of toys, to ensure that unsuitable

Swimming pool inspections, 1995 – 2002

Year	1995	1996	1997	1998	1999	2000	2001	2002
Number of Inspections	85	123	187	228	279	316	320	762

Swimming pool inspections, 1995 – 2002





products are not brought into the country, as well as of markets and toy shops. Importers are also briefed on the of Municipal Ordinance No. 61 of 1991 regarding the safety of children's toys.

The Department also ensures that its Safety Manual for construction sites is being implemented, through the carrying out of regular inspections. Notifications of violations are issued to contractors who are responsible for the health and safety of labourers on construction sites where such violations are noted, while the Dubai Police report any dangerous accidents on sites, so that safety procedures can be investigated. The Department also follows up on the implementation of the Safety Manual within the Municipality's Departments.

It also implements a health programme, carrying out tests on employees of industrial firms in the Municipality's Public Health Clinic.

As part of the Municipality's commitment to protect wildlife and the environment, and in accordance with the decree issued on 28th May 1989 by the late H.H. Sheikh Maktoum bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, prohibiting the sale or purchase of elephant ivory and rhinoceros horn, the Municipality has confiscated around 12.13 tons of these products, paying a total of 7,600,066 dirhams in compensation to owners.

Confiscated products are then destroyed, one such incident taking place on 22nd January 1992, and being witnessed by the Regional Representative of the United Nations and by the Consul-Generals of the United States and Britain.

The UAE is the first Arab country to have destroyed confiscated ivory in this way, in accordance with international regulations, in particular the Convention on International Trade in Endangered Species of Flora and Fauna, CITES, to which the UAE is a signatory.



Destroying confiscated ivory

## 6. Monitoring the Marine Environment

The economic importance of Dubai is based on its geographical location on the southern shores of the Arabian Gulf and, in particular, the presence of Dubai Creek (Khor Dubai), as well as of other, recently-created, ports and coastal facilities.

The Creek is not only an attractive location, but is also an important centre for tourism, thanks to its biologically-diverse environment and the fact that it has an important nature reserve, at Ra's al-Khor, at the inner end.

The Dubai Municipality began in 1985 to devote attention to the protection of the



Ship Monitoring

marine environment of the Creek, carrying out research, undertaking clean-up campaigns and ship monitoring programmes and monitoring of sea water and soil quality, as well as launching a public education programme. Other marine and coastal areas are also cleaned.

### ■ Marine Environment Cleaning Operations

Methodical cleaning of Dubai Creek began in 1985. The programme also involves regular cleaning of Al-Hamriyyah Port, Khor Al-Mamzar and Dubai's beaches.

Special vessels are used to collect refuse, with two daily shifts, in the mornings and afternoons. During 2000, as an example, 319 tons of floating refuse were collected from the areas of the Creek used by shipping and from Al-Hamriyyah.

### ■ Monitoring Ships and Coastal Activities

As part of efforts to protect the marine environment in Dubai and to ensure that cleaning operations were in line with the conservation efforts, the Municipality purchased two speedboats in 1990 and instituted daily patrols to monitor activity in the Creek. These cover the whole of the Creek, including the Al-Jadaf shipyard and the nature reserve at Ra's al-Khor, as well as the public beaches, and also extend to Al-Hamriyyah port.

In 2000, the patrols issued 291 notices of violations of regulations to ships and small boats, with total fines imposed amounting to 285,100 dirhams. In 2001, there were 400 violation notices issued, with fines of 415,800 dirhams, and in 2002, 294 violation notices were issued, with fines of 280,490 dirhams.

## ■ Monitoring sea water quality

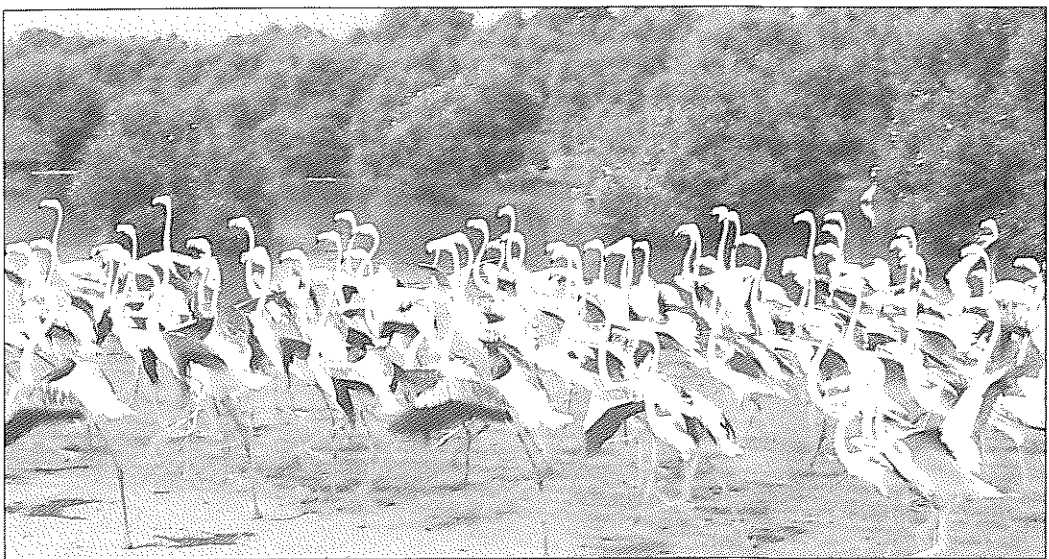
The programme for monitoring the quality of sea water began in 1990. This involves monitoring the presence of physio-chemical and chemical indicators and concentrations of nutrients, hydrocarbons and heavy metals as well as the biological properties of the water and marine sediments. The work is undertaken by a network of 30 monitoring stations in the Creek, at Al-Hamriyyah Port, Al Manzar Creek, Port Rashid, Jebel Ali and in other coastal areas.

## 7. Nature Reserves

On 1st March 1998, Municipal Ordinance No. 2 for 1998 was issued, declaring the Ra's al-Khor area and an area south of Jebel Ali to be nature reserves. The Ordinance also included maps of the areas concerned.

In the same year, the Municipality carried out a study of all nature reserves and protected areas throughout the Emirate of Dubai, including those of Ra's al-Khor and Jebel Ali and also others at Nad al-Sheba, Khawaneej, Mushrif Park and Hatta. This study examined their bio-diversity and other environmental aspects as well as the pressures to which they were exposed. It also identified further areas worthy of protection and laid down detailed administrative plans for the Ra's al-Khor and Jebel Ali reserves.

The Municipality also erected noticeboards around the Jebel Ali reserve and carried out a programme to remove and confiscate fishing nets and traps placed in this reserve, following the placing of warning notices in the newspapers. Warnings were also widely issued, including to hotels, against the carrying out of any activities in the reserves which might cause damage to them or to the wildlife present, while liaison was maintained with the Dubai Police and the Coast Guard Administration with regards to the carrying out of regular patrolling.



The nature reserve at Ra's al-Khor

Where illegal activities are detected in the Jebel Ali reserve, such as the leaving of ashes or charcoal from barbeques, or the bringing of domestic pets or other livestock on to the reserve, or the driving of vehicles close to the high tide mark, causing damage, the appropriate penalties are imposed.

Activities in the Creek which may have an adverse impact on the Ra's al-Khor reserve are also closely monitored.

## 8. Environmental Education

The Department's education programmes are an important part of the methods used to achieve its objective of protecting Dubai's environment and wildlife. These are undertaken in association with other Municipality units, such as the Environment and Health Education Office and the Public Relations Section, and also with non-governmental organisations such as the Emirates Environment Group, Emirates Marine Environment Group, Diving Society and Friends of the Earth. The activities include the following:

- The regular issuing of press releases with information about programmes, activities and data or which outline new rules and regulations on protection of the environment and the safety of the public.
- The issue of widely-distributed Information Bulletins on environment protection in Dubai, and of technical guidelines, in both Arabic and English, on procedures and controls relating to the environment and safety, these latter being distributed to factories.
- The organisation of training and field trips for students in universities, schools and the Higher Colleges of Technology.
- The holding of lectures on various aspects of the environment as part of regular school programmes and the arranging of field trips for students, to environmental monitoring centres, for example, to show them the work involved.
- Active participation in national and international environment celebrations such as the National Environment Day, Municipalities Week, Earth Day, International Environment Day and Clean Up the World Day

## Technical Guidelines

By the end of 2002, the Environment Department had prepared and issued a total of 69 booklets on technical guidelines and five booklets on implementation references (Table No. 1), to explain the details of the Environment Protection Regulations. These guidelines included the required procedures and requirements relating to environmental issues and various safety issues. This has helped to strengthen co-operation with the industrial sector on environmental protection issues, thereby contributing to the achievement of the overall goal of sustainable development.

Table No. 1. Technical Guidelines relating to Environmental Protection and Safety

No.	Name of Technical Guidelines	First Issued	Last Amendment
1	Application for permit to dispose of waste into drains, on land or into the marine environment	1993	April 1997
2	Guidelines on waste analysis test reports	1993	-
3	Preparation of safety procedures audit reports	1993	-
4	Guidelines on environmental impact reports for new industrial establishments	1993	Nov. 1998
5	Preparations for and response to oil spills	1993	-
6	Industrial compressed gas cylinders	1993	-
7	Heat exhaustion in the work place	1993	-
8	Entry into prohibited areas	1993	-
9	Safety of electrical works	1993	-
10	Protection of dangerous equipment	1993	-
11	Approval of swimming pool plans	1993	-
12	Requirements for liquid waste segregation equipment	1993	-
13	Disposal of liquid industrial waste	1993	Oct. 1997
14	Personal Protection Equipment – Protection of the head	1993	-
15	Personal Protection Equipment – Protection of the eyes and face	1993	-
16	Personal Protection Equipment – Protecting the ears and hearing	1993	-
17	Personal Protection Equipment – Protective Clothing	1993	-
18	Personal Protection Equipment – Protection of hands	1993	-
19	Personal Protection Equipment – Protection of feet	1993	-
20	Personal Protection Equipment – Protection from falls/ safety ropes	1993	-
21	Personal Protection Equipment – Protection of the respiration system	1993	Nov. 2000
22	Safe use of industrial biological solvents	1994	-
23	Procedures to test distribution filters/penetration of hazardous waste	1994	-
24	Taking samples of hazardous waste	1994	-
25	First Aid Requirements	1994	-
26	Applications for approval to dispose of hazardous waste	1994	April 2000
27	Annual permits to dispose of hazardous waste	1994	Oct. 1997
28	Reduction of industrial waste to the lowest level possible	1994	Oct. 2000
29	Requirements for the disposal of waste gases, vapours and dust into the atmosphere	1994	-
30	Spray Paint Booths	1994	-
31	Safety in car repair and service shops	1994	-
32	Estelline Generators	1994	-
33	Disposing of expired drugs and pharmaceutical compounds	1994	-
34	Requirements for use of exhaust oils in boilers and furnaces in Dubai	1994	-

Table No. 1.

35	Guidelines for the analysis of waste and the preparation of the related reports.	1994	-
36	Guidelines concerning the disposal of waste from service stations	1994	-
37	Transport of non-hazardous liquid waste by tanker	1994	April 1999
38	Health and safety in kitchens and food preparation areas	1994	-
39	Design of septic tanks/drainage holes	1994	-
40	Test and issue of certificates for boilers and pressure containers	1994	-
41	Test and issue of certificates for lifting apparatus such as hoists and lifts	1994	-
42	Requirements for cement mixing factories.	1994	-
43	Placing of warning signs on vehicles transporting hazardous materials	1994	Nov. 1998
44	Requirements relating to the reduction of noise arising from building and demolition work.	1994	-
45	Requirements on the control of noise levels from entertainment equipment	1994	-
46	Approval for the disposal of hazardous merchandise	1994	June 2001
47	Guidelines for the disposal of containers containing used chemicals	1994	-
48	Safety in dealing with asbestos	1994	-
49	Policy of exemption for hazardous waste	1994	-
50	Requirements for transporting hazardous waste	1994	Jan. 2000
51	Collection and storage of oils carried by water.	1995	-
52	Activities relating to treatment of metal surfaces	1995	-
53	Procedures to evaluate effects on the environment	1995	-
54	Removal of pollution from the soil	1995	-
55	Replacement of CFCs with other compounds for cleaning work and the removal of grease	1995	-
56	Preparation of the Environment Department's Regulations – Implementation of ISO 14001 in Dubai	1995	March 1998
57	Barriers for storage tanks and transport facilities	1995	-
58	Policy on the control of emissions into the atmosphere	1995	Sep. 2001
59	Administration of medical waste produced by clinics and laboratories	1995	May 1997
60	Accreditation of environmental audit companies	1996	March 1998
61	Development of procedures for dealing with accidents involving hazardous merchandise	1997	-
62	Re-use of sludge and liquid waste for agricultural and irrigation purposes	1998	-
63	Environmental guidelines for tourist tours in the Emirate of Dubai.	1998	-
64	Health, safety and environmental requirements in laundries	1998	-
65	Liquefied gas oil cylinders	1998	-
66	Protection from UV rays	August 2000	Not Translated
67	Safety requirements for children's toys	Jan. 2001	-
68	Control of waste resulting from industries producing brick, tiles and marble.	June 2001	Not Translated
69	Special requirements for companies collecting and transporting used oils.	Draft only	Not Translated

**Information  
Technology  
Department**

The use of modern technology is one of the key factors in ensuring that any office works efficiently and with a high rate of productivity. This role in the Municipality is handled by the Information Technology Department, which is responsible for planning for computer capability, the development of computerised information systems and of new programmes, the training of employees and the processing of data. This has not only enhanced efficiency and productivity, but has also permitted the introduction of a number of new services.

The Information Technology Department was formally created under the terms of Administrative Directive No. 100 of 1998. The history of the use of computer technology in the Municipality, however, goes much further back.

On 24th February 1985, Administrative Order No. 146 gave instructions for a study to be undertaken of the use of computers throughout the Municipality. A special team of four people was provided by the United Nations Development Programme with the task of setting up an Information Technology Centre. They were assisted by two UAE nationals, who were also given training so that they could eventually take over management of this function. Between then and 1990, a number of major achievements were made, including the preparation of the main needs and criteria for the system and the obtaining of quotations from selected companies.

In 1986, the servers, personal computers and printers arrived, this being immediately followed by the development of the system. A plan was drawn up to handle the building of a database, systems support and development of the systems and network over a five year period, ending in 1990.

This complex task involved developing the main systems, those for Commercial Licences, Finance, Purchasing, Personnel, Stores and Buildings, using the COBOL computer language. The PLEXUS optical archive programme was purchased for use in the Personnel, Buildings, Planning and Survey Departments, to help them increase their efficiency and productivity while, at the same time, reducing the amount of time required to transfer papers and documents between them, as required.

This expansion of work was reflected, of course, in the expansion of the manpower dealing with information technology, as shown in Table No. 1.

The process of network development involved the establishment of a number of key features and the training of operators throughout the Municipality.

A central computer room was established, meeting all relevant international specifications on health and safety, while external locations, such as the Health Section, the old Municipality and the Rashidiya Stores were connected to the main server.

Table No. 1. Manpower, 1985 – 1990

Year	1985	1985	1986	1988	1989	1990
Number of Emiratis	2	2	5	6	8	11
Number of Expatriates	-	-	1	4	7	10

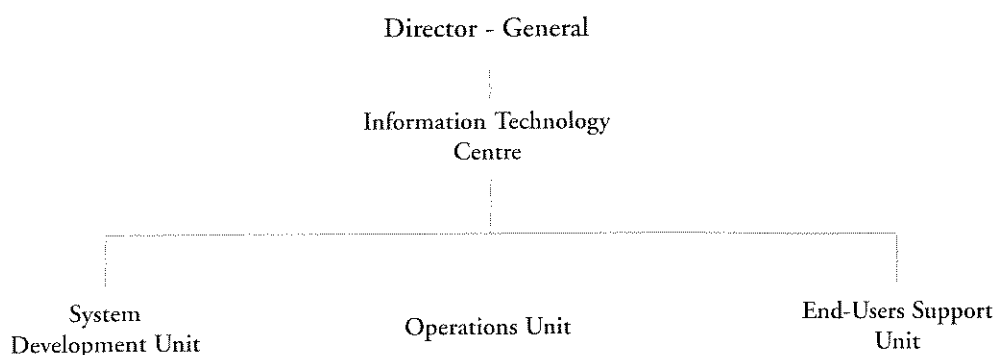


An internal network was also developed, linking computer terminals to the Customer Services Centre at a speed of 96 kb per second, this being initially confined to the Commercial Licences Department, as it then was, Finance, Food Control and Personnel. The use of personal computers for secretarial use within the various Departments and Sections was also introduced.

As a result of this initial work, the use of modern Information Technology was successfully introduced in most of the Municipality's organisational units while the key main systems were established. A proper programme of training and support was also instituted.

In 1990, Administrative Order No. 244 for that year formally established the Information Technology Centre, which was directly affiliated to the office of the Director General. The Order also laid down the Centre's organisation chart, as shown in Chart No. 1.

**Chart No. 1. Organisation Chart in 1990**



Over the course of the next five years, up until 1995, the Centre's three Units became increasingly busy in the introduction of new systems throughout the Municipality. Its workforce increased from 21 employees in 1990 to 44 employees in 1995, as shown in Table No. 2.

**Table number 2. Workforce of the Department, 1991 – 1995**

Year	1991	1992	1993	1994	1995
Number of Emiratis	13	16	20	22	23
Number of Expatriates	16	19	22	22	21

During this period, some of the existing systems were upgraded, in accordance with the requirements of the Department and the introduction of new programming languages. This work was carried out by personnel from a specialist IT company, DataMission, who also undertook some other functions.

Systems development was also carried out internally on a number of systems, including those for Purchasing, Stores, Personnel, Commercial Licences, Treasury, Violations and Industrial Land. These were upgraded, using COBOL language on an IMAGE database.

In 1991, English language systems, using an ORACLE database, were developed for units like Food Control, Abattoirs, Pest Control, Industrial Land, the Medical Clinic and the Environment Protection Laboratory.

The programme of upgrading the systems included the introduction of faster computers and introduction of new operating systems such as the UNIX and ORACLE databases. The installation of the latest technology also permitted the internal network to be upgraded to a speed of 5 – 10 MB per second, while the number of servers was increased to 15, three of which were HP models.

These servers included dedicated units for the Optical Archiving System, the Abattoir System, the Health Clinic and the Environment Protection Systems.

Another innovation was the installation of optical fibre cables between the floors of the main Municipality building, while modems on lines rented from Etisalat permitted an expansion of the links to external locations such as the Garage and Al Awir station and all of the Municipality Stores. Work on independently-designed internal networks began in a number of the external

Table No. 3. Equipment in use, 1993 – 1995

Year	1993	1994	1995
Number of Computers	162	200	250
Number of Printers	80	132	140
Number of Scanners	10	8	5

Table No. 4. Employees trained, 1993 – 1995

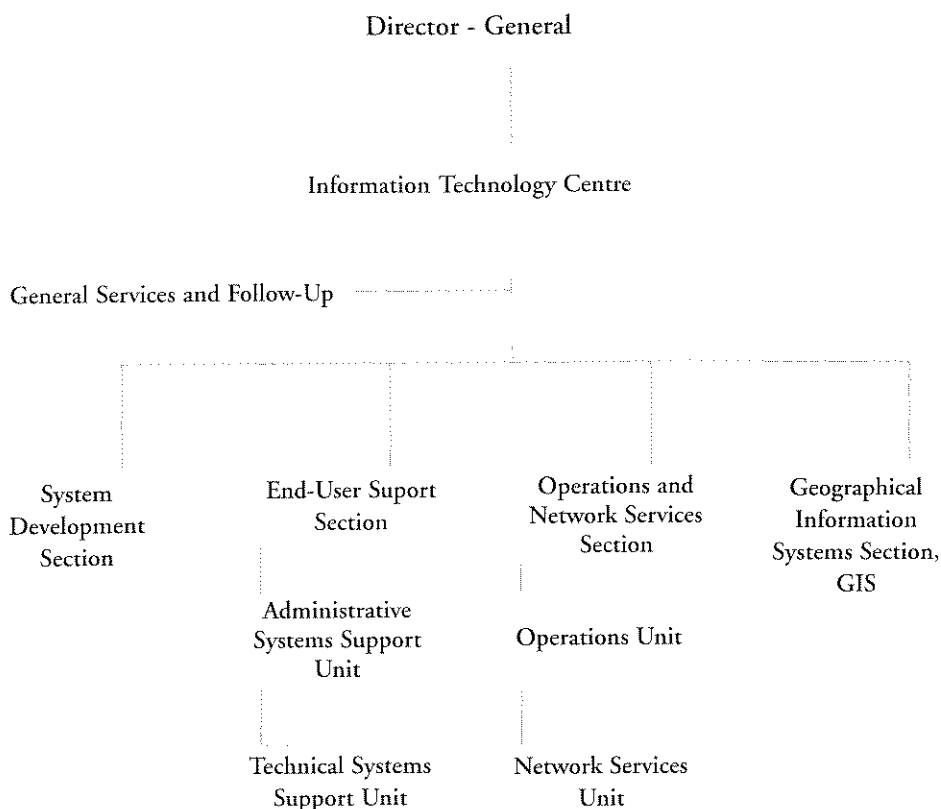
Year	1993	1994	1995
Number of Trainees	91	93	210

locations, including the Garage, while the network as a whole was expanded to link other locations outside the Municipality, such as the ports and airport, and links were established, through a dial-up system, to rural locations.

Internally, the speed and efficiency of the system was enhanced through the replacement of the old terminals with high speed personal computers, along with printers and the appropriate office programmes, with training being provided for all users. This had a rapid and beneficial effect upon efficiency, speed and accuracy, resulting in the provision of better services to consumers and an increase in the amount of work being achieved.

The increasing amount of work being undertaken by the Centre, as well as the expansion of its manpower, meant that there was a need to plan for a revision of its organisation chart and the internal distribution of responsibilities. Following a study carried out in association with the Administrative Development Department, Administrative Directive No. 598/1995 introduced the new structure, which established new working groups to simplify work procedures, to increase productivity and to improve the service provided to end-users, as shown in Chart No. 2.

**Chart No. 2. Organisation Chart for the Information Technology Centre in 1995**



During 1995, a number of new steps forward were made Among these were:

- The introduction of e-mail in several departments, following a test of the system in the Information Technology Department in 1994.
- The introduction of Client/Server information technology.
- The introduction of the NT Windows system.
- The installation of INTEL servers.
- The Microsoft SQL database.

A new network with a speed of BS166 was also installed.

In 1998, Administrative Directive No. 100 introduced a further revision of the organisational structure, as shown in Chart No. 3.

Chart No. 3. Organisation Chart for the Information Technology Department in 1998

