4) Tafila FDS

Table 2-3-2-5 summarizes present state of Tafila FDS.
The following sections describe the general, the state of landfill and the influences on environment

(A) General

Managed by Tafila CSC, Tafila FDS is located about 20 km southeast of Tafila City and at a distance of about 1.5 km from Main Road No.60 (see Fig. 2-3-2-8), in a mildly hilly terrain. There are no houses nor public facilities adjacent to this FDS. The ground is composed of sandy soil-equivalents and limestones partially.
This FDS has an area of 454,815 m^2 for a landfill capacity of 60 years (1990-2049) with facilities such as control office, roads for carrying-in and in-site transport, guard fences and gates, as well as a sedimentation pond used for night-soil treatment. Access roads are not paved.
Wastes received are municipal and medical wastes, the quantity amounting to 170 m^3/day by the 1995 record. But, the quantity obtained by our survey is 52 m^3/day, largely different from the quantity in 1995. By visual observation, wastes are composed of food wastes (approx. 60%), papers (15%), plastics and rubbers (15%), etc. Night-soil collected and transported by private companies, is received by this FDS, and the quantity about 80 m^3/day.

(B) State of landfill

Landfill is done by open dumping method with only the final cover with soil. Without daily cover, the work is hard to be said a sanitary landfill. Efficiency of landfill is estimated to be low.
Wastes carried in is dumped into large trenches excavated irregularly. No leveling and compacting is made. When a trench becomes full, final cover soil is applied, with a random thickness. Soil cut in the site is used for cover.

(C) State of influences environment

This FDS gives no problems on environment in the aspects of traffic, public facilities, pollution of ground-water and air, noise, vibration, offensive

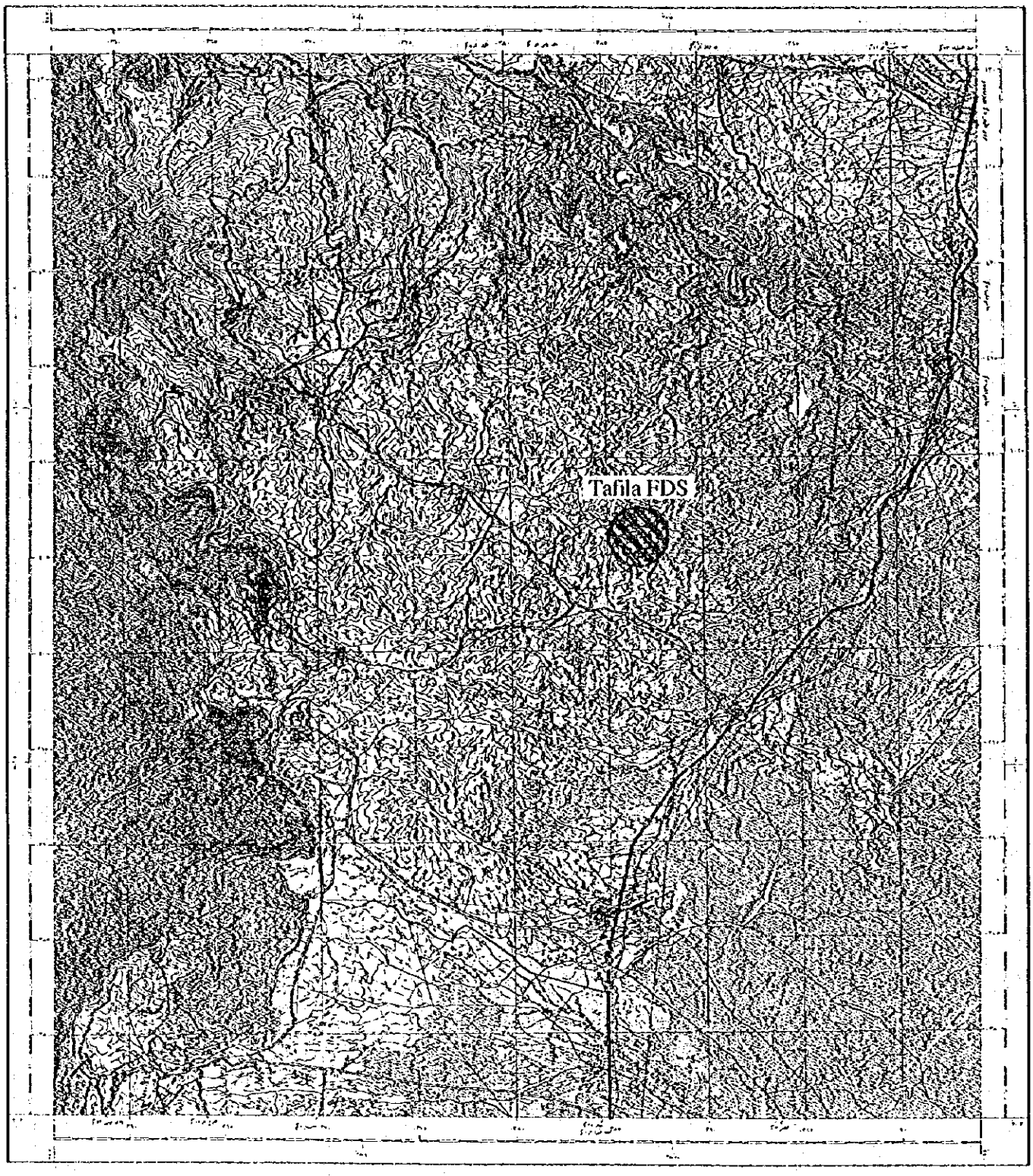


Fig. 2-3-2-8 Location of Tafila FDS

odor, etc. from the facts that ① annual precipitation (258 mm) is small so that evaporation is sufficiently expectable, ② there are no houses nor public facilities around, ③ ground is composed of impermeable layers, and ④ number of hauling trucks is few. The current problem is generation of flies and sanitarily harmful insects.

Table 2-3-2-5 Present State of Tafila FDS (1/3)

Item / Contents
1. Outlines of the final disposal site
(1) Location: About 40 km southeast of Tafilah City; about 2.5 km from Main Road No.60
(2) Geographical configuration: Hilly land without any houses and public facilities nearby
(3) Soil quality: Sandy soil-equivalents with limestones partially
(4) Ground-water: 150-200 m under the surface
(5) Area: 454,815 m^2
(6) Volume capacity: ----
(7) Term of landfill: When to use existing equipment: 1990-2000 (10 years) When to use requested equipment: 1990-2050 (50 years)
(8) Types of received wastes: Municipal solid waste, medical wastes, night-soil
(9) Component of received wastes: 170 m^3/day (1994); 52 m^3/day (by our survey)
(10) Component of wastes(by visual observation): ① papers: 15% ② plastics and rubbers: 15% ③ food wastes: 60% ④ glasses and porcelains: --% ⑤ metals: --% ⑥ fibers: --% ⑦ fibers: --% ⑧ others: 10%

Table 2-3-2-5 Present State of Tafila FDS (2/3)

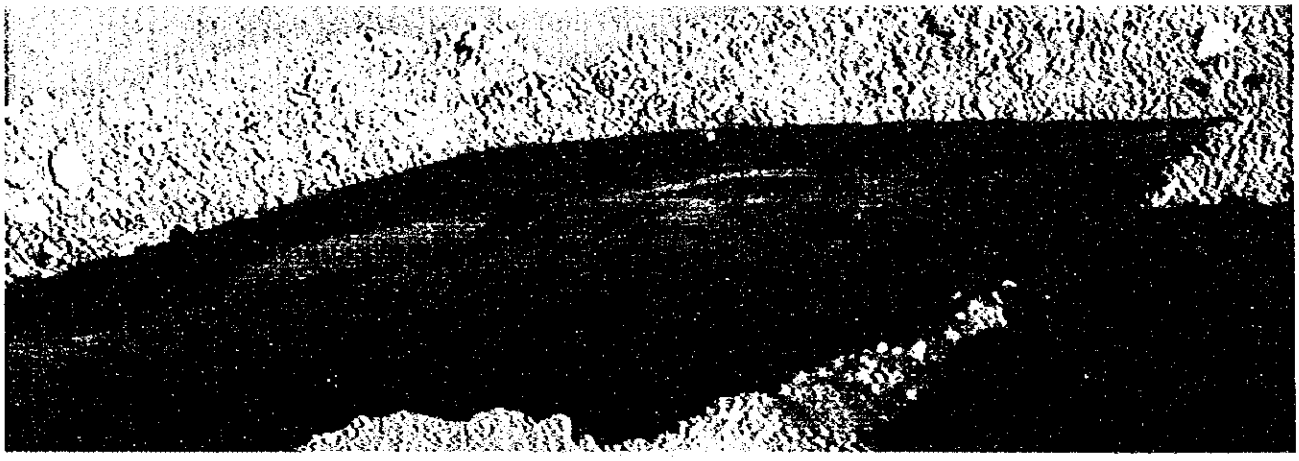
Item	Contents
(11) Equiped facilities: * control office * access roads (unpaved); in-site roads (paved) * guard fences * gates	
2 State of landfill (1) Method of landfill: open dumping method with final soil-cover	
(2) Plan of landfill sequence: from the bottom of FDS to the top	
(3) Method of leveling and compacting: not executed particularly	
(4) Plan and actual state of soil-cover Plan: ① thickness of wastes: 200-400 mm ② thickness of daily cover soil: random ③ thickness of intermediate cover soil: random ④ thickness of final cover soil: random ⑤ procurement of cover soil: soil cut in the site	
Actual state: * Trenches are cut irregularly, into which wastes are dumped open. When a trench has got full, the wastes are finally covered with soil. * Since depth of the trench is irregular, thickness of cover is random relative to thickness of wastes. * No daily cover nor intermediate cover are implemented.	
Item / Judgment / Contents	
3 State of influences on environment. (1) Traffics and life facilities :D * No problem of traffic jams, since dumping trucks are few. * No problem due to traffics, since no houses nor public facilities are near the access roads.	

Table 2-3-2-5 Present State of Tafila FDS (3/3)

Item / Judgment / Contents
(2) State of sanitation and health :B * Flies and harmful insects are generated. * No wastes are scattered.
(3) Ground-water :D * No problem since water level is at 150-200 m under the surface and almost no leachate is generated.
(4) State of lakes and rivers :D * No lakes nor rivers nearby.
(5) Air pollution :D * No smoke pollution, since no open-burn are executed. * No exhaust gas problem, since dumping trucks are few. * No problem of dusts due to waste dumping, since there are no houses nor public facilities.
(6) Water pollution :D * No problem due to leachate since annual precipitation is small (approx. 258 mm) and almost no leachate comes out.
(7) Soil pollution :D * No problem of soil contamination, since most of the received wastes are general wastes.
(8) Noise and vibration :D * No problem of traffic noise, since hauling trucks are few. * No problem from operation of bulldozers or other equipment in the FDS.
(9) Offensive odor :D * Some offensive odor produced by night-soil, but no problem on the site border.
Other remarks * Not so good access because of the unpaved access roads. * No scavengers. * Difficulties in using cut cover soil, since limestones are partially included. * The guard fences made with block fences are complete. * The access roads (L=2.5 km) from the Main Road should be urgently paved. * Difficulties in night-soil treatment. < Judgment classification > A: serious influence presumed B: some influence presumed C: influence unknown D: no influence

View from a control office. Guard fence are set up along landfill site boundary.

Wastes are exposed, because the thick of cover soil is not sufficient.



Sediment control pond for night soil.

Fig. 2-3-2-9 Views of Tafila FDS

5) Ma'an FDS

Table 2-3-2-6 summarizes present state of this FDS.
The following sections describe the general, the state of landfill and the influence on environment

(A) General

Managed by Ma'an CSC, Ma'an FDS is located about 15 km east of Ma'an City and at a distance of about 0.5 km from Main Road No.5, in a flat terrain. (See Fig 2-3-2-10) There are no houses nor public facilities adjacent to this FDS. Ground is composed of sandy soil containing debris in the surface layer (12-15 m) and rocks thereunder.

This FDS has an area of 502,800 m^2 and a landfill capacity of 1,250,000 m^3 for 40-50 year (from 1994). Facilities include control office, access roads, guard fences and gates, as well as four sedimentation ponds for night-soil treatment. Top water of the ponds is planned to be used for vegetable growing in the future, although not used currently.

Wastes received are restricted to municipal solid wastes, and quantity amounts to 100 t/day (winter) and 120-130 t/day (summer) according to 1995 record. But, the quantity would be 34 t/day as a result of this time survey, very different from the quantity in 1995. By visual observation, wastes are composed of food wastes (approx. 60%), papers(15%), plastics and rubbers (15%) and others. Night-soil collected by private companies is received by this FDS, the quantity 150-200 m^3/day.

Another FDS where landfill was completed is located adjacent to this FDS. Remainings of open burn are left on surface of the old FDS.

(B) State of landfill

Landfill adopts the sandwich method using trenches. Landfill technique here is nearly complete, accomplishing the highest level landfill among the FDS's we surveyed this time. Daily cover is executed. Landfill efficiency is good. The wastes carried in by dump trucks are dumped in front of a trench with a bulldozer or a wheel loader and, then, leveled and compacted to a trench with a bulldozer or something to finish a waste layer about 50-70 cm thick. daily cover 30-50 cm thick is applied thereon using trench excavation soil, which is also used for final cover 70-100 cm thick.

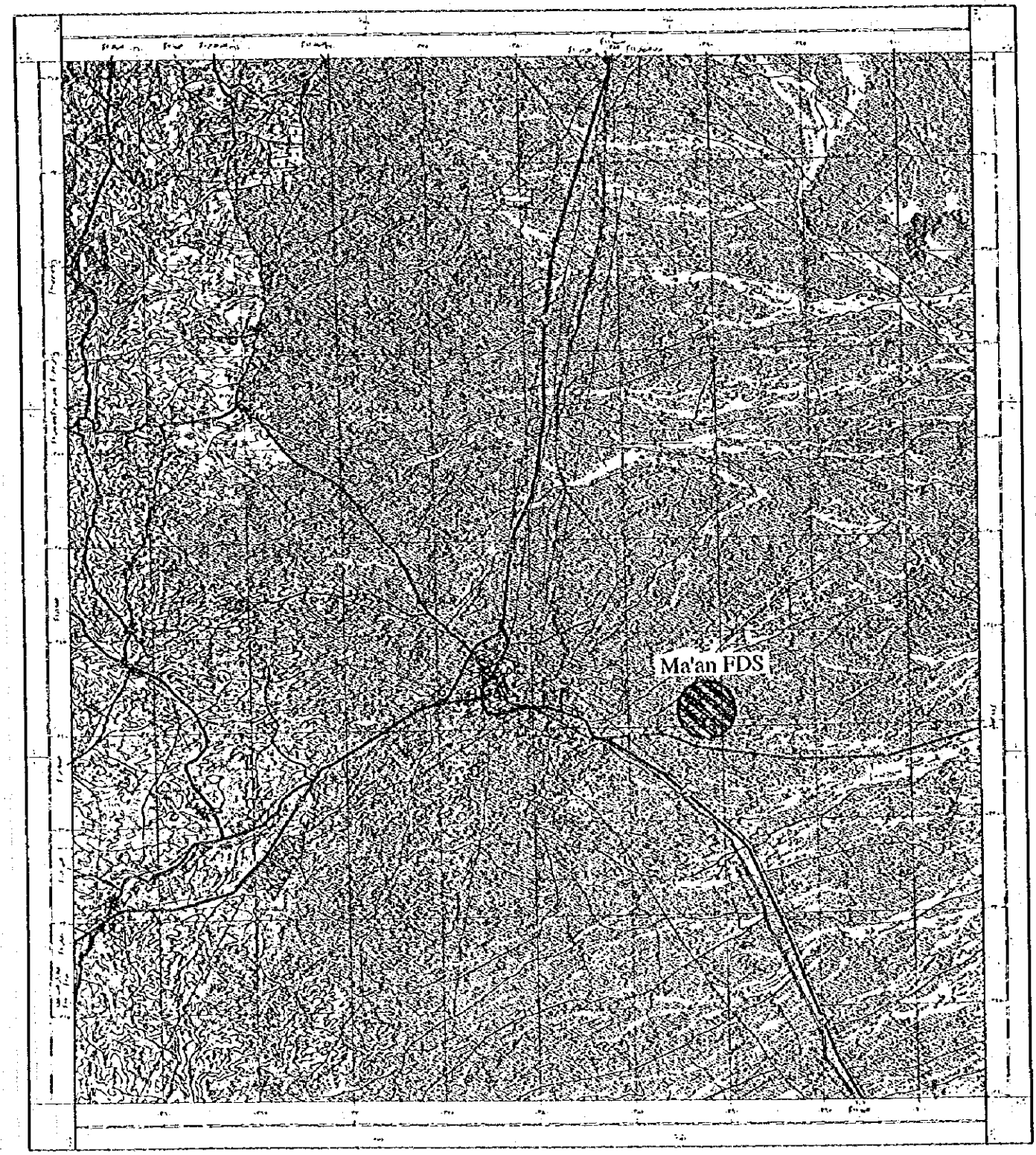


Fig. 2-3-2-10 Location of Ma'an FDS

(C) State of influences on environment

This FDS gives no problems on environment in the aspect of traffic, public facilities, pollution of ground-water and air, noise, vibration, offensive odor, etc. from the fact that ① annual precipitation (42 mm) is small so that evaporation is sufficiently expectable, ② there are no houses nor public facilities around, ③ ground is composed of impermeable layers, and ④ number of hauling trucks is few.

Table 2-3-2-6 Present State of Ma'an FDS (1/4)

Item / Contents
1. Outlines of the final disposal site
(1) Location: approx. 15 km east of Ma'an City; ave. distance from the collection areas: approx. 45 km
(2) Geographical configuration: flat land with no adjacent houses nor public facilities
(3) Soil quality: equivalents to debris-containing sandy soil
(4) Ground-water: 200-300 m under the surface
(5) Area: 502,800 m^2
(6) Volume capacity: 1,250,000 m^3 as the plan and 1,235,000 m^3 still available
(7) Term of landfill: 1994-2033(40-50 years)
(8) Types of received wastes: municipal solid waste and night-soil
(9) Quantity of wastes: 100 t/day in winter and 120-130 t/day in summer; 34 t/day (result of our survey) night-soil: 150-200 m^3/day

Table 2-3-2-6 Present State of Ma'an FDS (2/4)

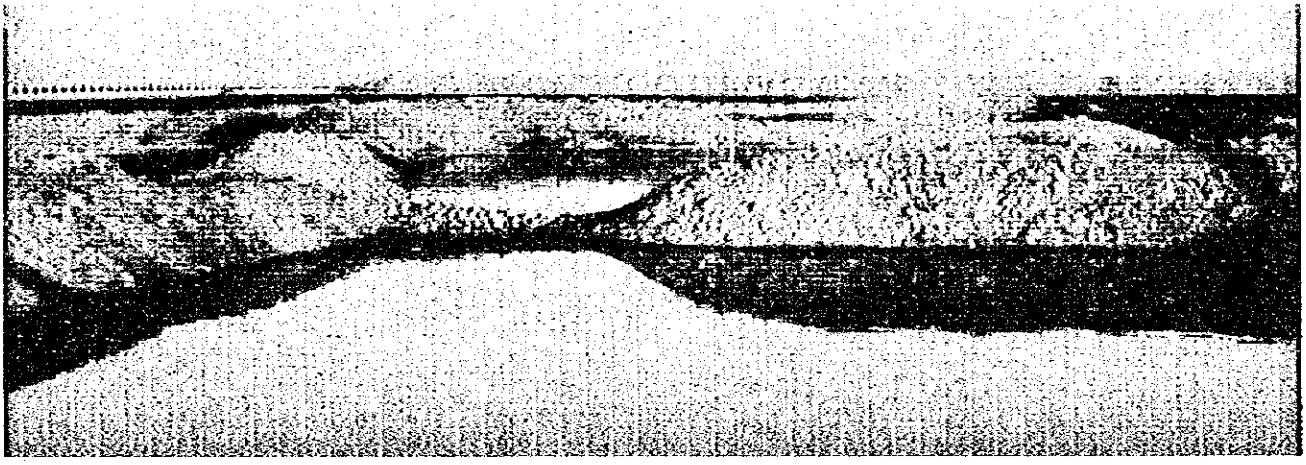
Item / Contents
(10) Component of wastes (by visual observation): ① papers: 15% ② plastics and rubbers: 15% ③ food wastes: 60% ④ glasses and porcelains: --% ⑤ metals: --% ⑥ woods: --% ⑦ fibers: --% ⑧ others: 10%
(11) Equiped facilities * access roads * guard fences * gates * control office
2 State of landfill (1) Method of landfill: sandwiching method, excavating trenches
(2) Sequence of landfill: use north side and east side of the site alternately
(3) Method of leveling and compacting: with bulldozers or other equipment.
(4) Plan and actual state of soil cover Plan: ① thickness of wastes : 50-70 cm ② thickness of daily cover : 30-50 cm ③ thickness of intermediate cover soil : 30-50 cm ④ thickness of final cover soil : 70-100 cm ⑤ procurement of cover soil : soil cut in the site
Actual state: * Wastes are put into a trench, cut regularly, leveled and compacted, and daily cover is applied. * Daily cover is applied systematically and efficiently.

Table 2-3-2-6 Present State of Ma'an FDS (3/4)

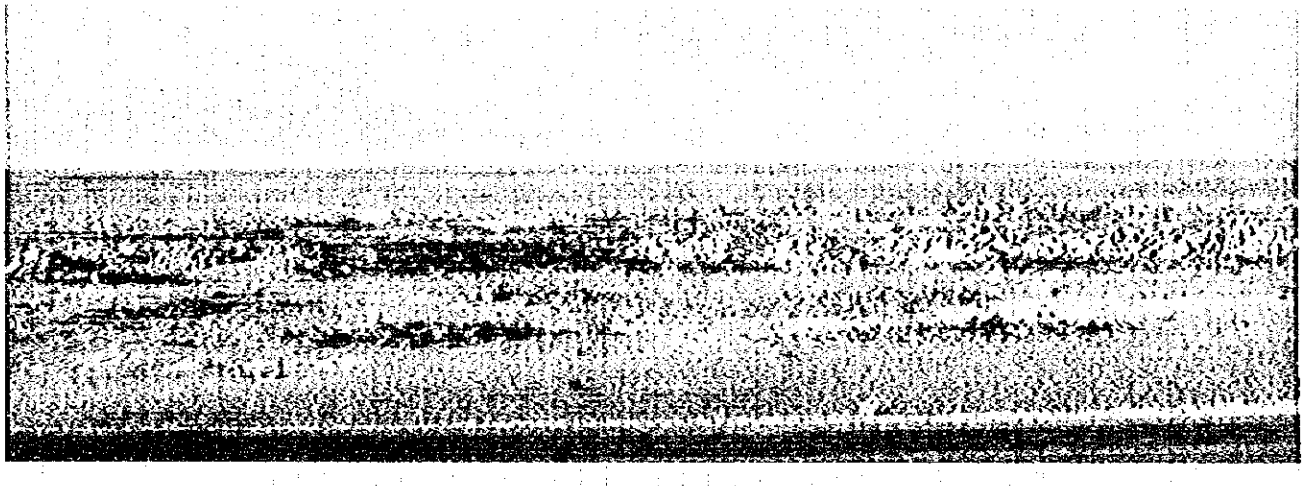
Item / Judgment / Contents
3 State of influences on environment
(1) Traffics and public facilities :D * No traffic jams nor influences on public and other facilities.
(2) State of sanitation and health :D * No problems from generation of flies and harmful insects, since sanitary landfill is systematically executed. * No wastes are scattered.
(3) Ground-water :D * No problem of ground-water contamination, since there is a rock-bed 12-15 m under the surface.
(4) State of lakes and rivers :D * No lakes nor rivers around this FDS.
(5) Air pollution :D * No smoke pollution, since no open burn is executed. * No exhaust gas problem by traffics, since dump trucks are few. * No waste problem, since sanitary landfill is executed.
(6) Water pollution :D * No pollution problem, of ground-water and public water, since annual precipitation is small (approx. 40 mm), leachate water hardly comes out and there is a rock-bed 12-15 m under the surface.
(7) Soil pollution :D * No soil pollution problem, since only general wastes and night-soil are received.
(8) Noise and vibration :D * No noise and vibration problems by traffics and bulldozer operation in the site, since dump trucks are few and there are no houses nor public facilities around this FDS.
(9) Offensive odor :D * Some offensive odor from night-soil, but no problem on the site border.

Table 2-3-2-6 Present State of Ma'an FDS (4/4)

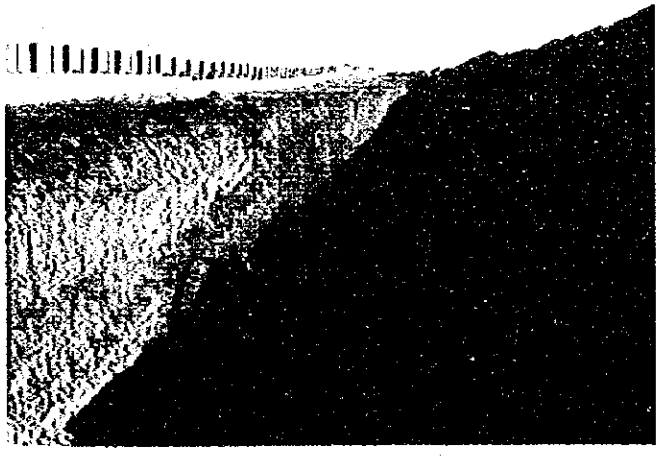
Item/ Judgment / Contents
Other remarks * Access is good with the access roads well arranged from the Main Road. * There are no scavengers. * Sanitary landfill is systematically and efficiently executed, with an almost perfect technical level. * Landfill-completed areas are planned to be used for growing vegetables. Night-soil treated water supplied there. * An encircling road(paved) is planned to be constructed about 5 m inside of the guard fence. * Rainwater draining pipes are installed at an even interval under the guard fence. * There are four sedimentation ponds for night-soil treatment.(1,200 m^3/pond, H=3 m) * There is another existing FDS just outside of the site. Burnt cans and iron scraps remaining there should be carried into this FDS to be disposed. * Collection and transportation of night-soil is mostly undertaken by private companies under contracts, but Ma'an Municipality owns one vacuum tank.
< Judgment classification > A: serious influence presumed B: some influence presumed C: influence unknown D: no influence



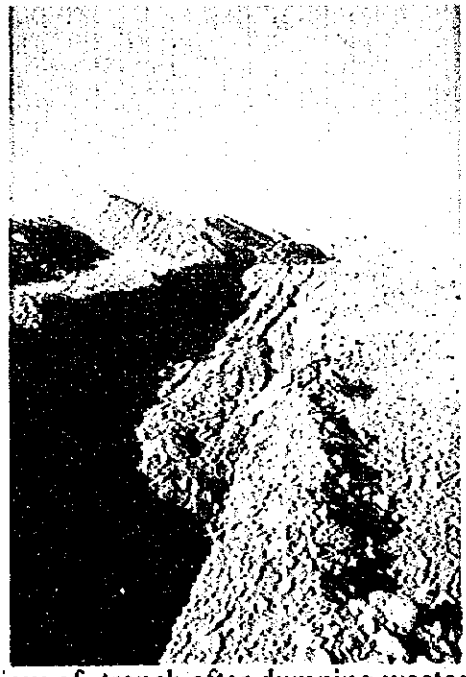
Sediment control pond for night soil.



The residual scattered outside FDS.



View of trench before dumping wastes.



View of trench after dumping wastes.

Fig. 2-3-2-11 Views of Ma'an FDS

6) Lojoon FDS

Table 2-3-2-7 summarizes present state of this FDS.
The following sections describe the general, the state of landfill and the influence on environment.

(A) General

Managed by Karak CSC, Lojoon FDS is located about 27 km east of Karak City and at a distance of about 1.5 km from Main Road No.50 (see Fig. 2-3-2-12), in a mildly hilly terrain. There are no houses nor public facilities adjacent to this FDS. Ground is composed of equivalents to sandy soil containing debris.
This FDS has an area of 500,000-600,000 m^2 and a volume capacity of 883,500 m^3 for a landfill term of 15 years (1996-2010). Landfill here will start in 1996. facilities include control office, access roads, guard fences and gates. The carry-in roads are being paved. According to the manager, this FDS was planned to be the model in the country of Jordan.
Wastes received are restricted to municipal solid wastes, and the quantity of received wastes amounted to 114t/day in 1995. The quantity obtained in this time survey, 96 t/day, agrees fairly well with the result in 1995

(B) State of landfill

Landfill will use the sandwich method with daily, intermediate and final covers. This will realize sanitary landfill of a high level.
Soil cut in the site will be used for cover.

(C) State of influences on environment

It is presumed that there will be no problem in the aspects of traffics, public facilities, ground-water turbidity, water pollution, air pollution, noise, vibration, etc. from the facts that annual precipitation is small (331 mm) making evaporation expectable, there are no houses nor public facilities near this FDS, ground is composed of impermeable layer, and number of hauling trucks is few.
Sanitary landfill will be the essential precondition for prevention of influences on state of sanitation and health including offensive odor.

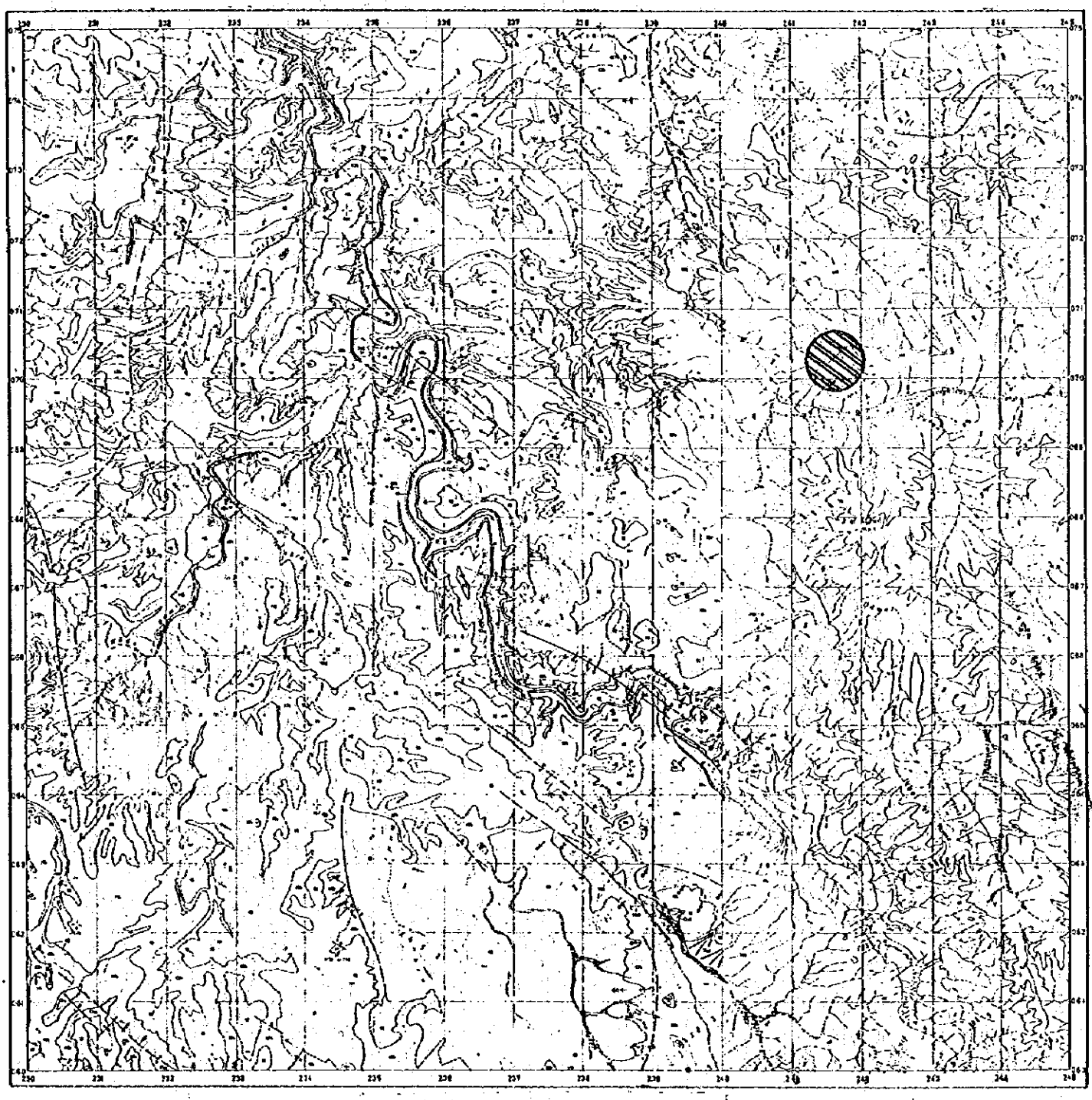


Fig. 2-3-2-12 Location of Lojoon FDS

Table 2-3-2-7 Present State of Lojoon FDS (1/3)

Item / Contents
1. Outlines of the final disposal site
(1) Location: About 27 km east of Karak City; about 1.5 km from Main Road No.50
(2) Geographical configuration: Flat land in a hilly terrain; no houses nor public facilities nearby
(3) Soil quality: Equivalents to sandy soil containing debris
(4) Ground-water: About 250-300 m under the surface
(5) Area: 500,000-600,000 m^2
(6) Volume capacity: Plan: 883,500 m^3
(7) Term of landfill: 1996-2010 (15 years)
(8) Types of accepted wastes: Municipal solid wastes.
(9) Planned quantity of accepted wastes: 114 t/day (as per 1995 record), 96 t/day(by our survey)
(10) Component of wastes: ① papers - %　② plastics and rubbers - % ③ food wastes - %　④ glasses and porcelains - % ⑤ metals - %　⑥ woods - % ⑦ fibers - %　⑧ others - %
(11) Equiped facilities: * control office * access roads * guard fences * gates

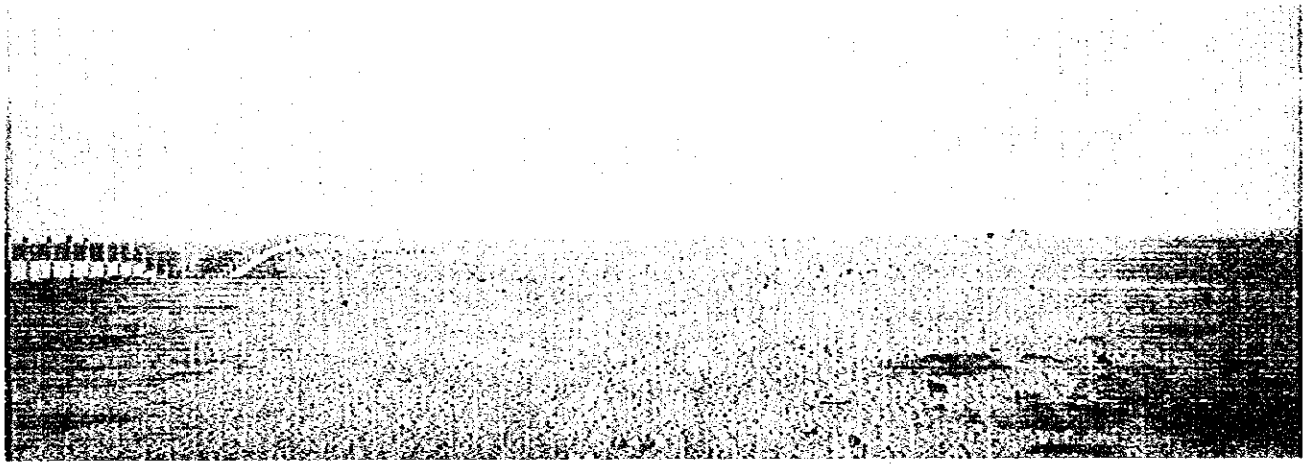
Table 2-3-2-7 Present State of Lojoon FDS (2/3)

Item	Contents
2 Planned landfill	
(1) Method of landfill:	
Sandwich method	
(2) Plan of landfill sequence:	
From remote areas towards the gate	
(3) Method of leveling and compacting:	
With bulldozers or other equipment	
(4) Plan and actual state of landfill	
Plan: ① thickness of waste layer: 50-100 cm	
② thickness of daily cover soil: 25 cm	
③ thickness of intermediate cover soil: 25 cm	
④ thickness of final cover soil: 50 cm	
⑤ procurement of cover soil: soil cut in the site	
Actual state:	
———	

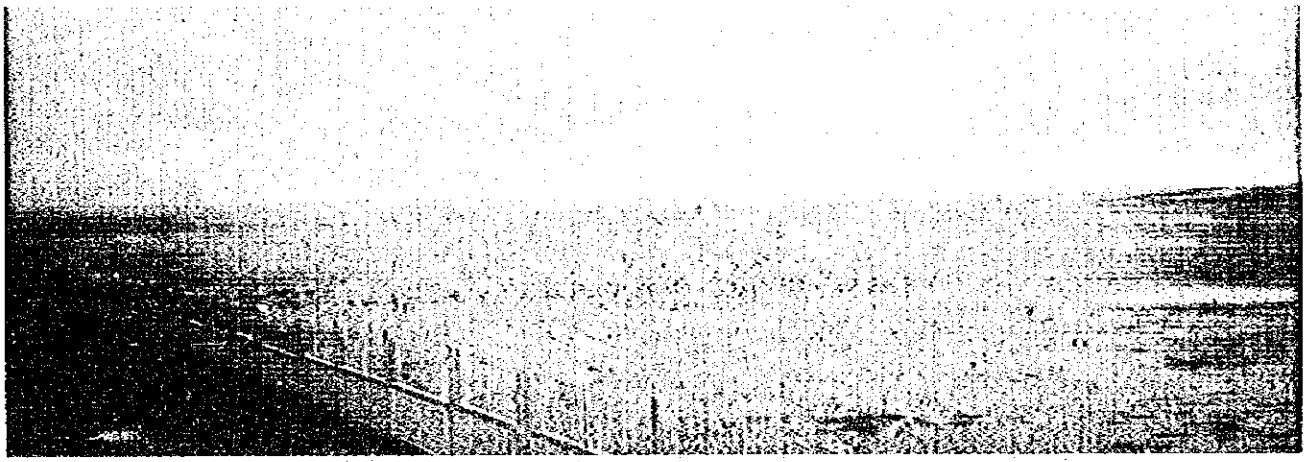
Item	:Judgment	Contents
3 State of influence on environment		
(1) Traffics and public facilities	:D	
* No problem because of few number of hauling trucks and no houses nor public facilities nearby.		
(2) State of sanitation and health	:C	
* Daily cover is an essential precondition, as stated in the plan. No problem by flies and harmful insects has never been reported since there are no houses nor public facilities around, but details are unknown at the present.		
(3) Ground-water	:D	
* No problem since water level is 250-300 m under the surface and leachate hardly comes out.		
(4) State of lakes and rivers	:D	
* No lakes nor rivers nearby.		

Table 2-3-2-7 Present State of Lojoon FDS (3/3)

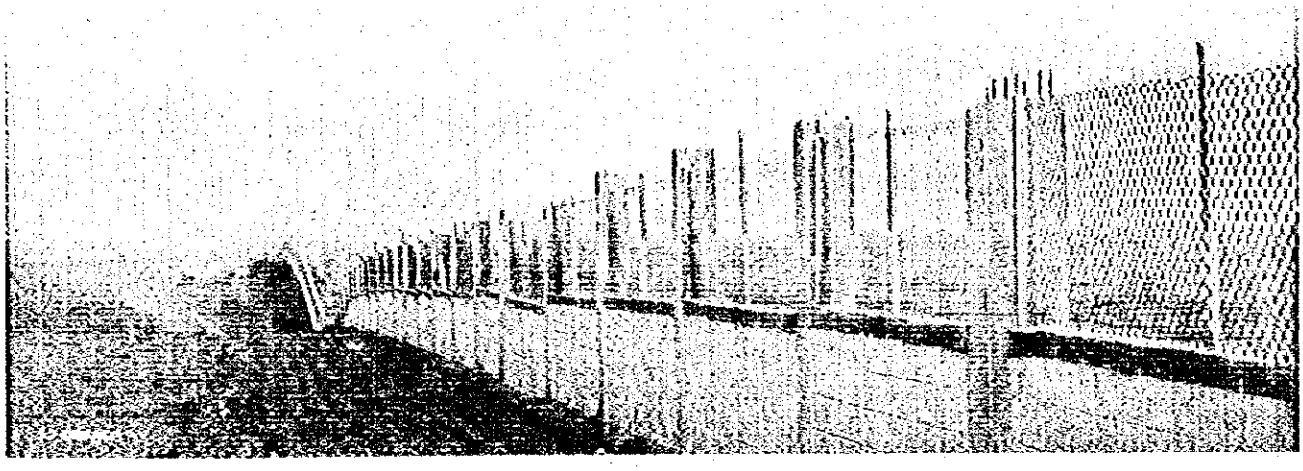
Item	:Judgment	Contents
(5) Air pollution	:D	
* No problem of dusts by waste dumping, smoke pollution and exhaust gas by traffics since there are no houses nor public facilities nearby.		
(6) Water pollution	:D	
* No problem of water turbidity in peripheral water area due to leachate, considering the small annual precipitation of 330 mm and evaporation effect.		
(7) Soil pollution	:D	
* No problem estimated because only municipal solid wastes are received.		
(8) Noise and vibration	:D	
* No problem of noise and vibration caused by operation of construction machines such as bulldozers in the site and traffics since there are no houses nor public facilities nearby.		
(9) offensive odor	:C	
* No problem estimated with sanitary landfill since there are no houses nearby, but details are unknown at the present.		
Other remarks * Access is good with all roads to this FDS paved (the access roads are now being paved). * According to the manager, this FDS was designed planned to be the model in the country of Jordan. * The site border is provided with a block and metal-made guard fence. * Soil on the site is geographically suitable for cover.		
< Judgment classification > A: serious influence presumed B: some influence presumed C: influence unknown D: no influence		



View of FDS.



Same to the above.



Guard fence are set up along landfill site boundary.

Fig. 2-3-2-13 Views of Lojoon FDS

7) Aqaba FDS

Table 2-3-2-8 summarizes present state of this FDS.
The following sections describe the general, the state of landfill and the state of influence on environment.

(A) General

Managed by Aqaba City, this FDS is located 18 km south of Aqaba City and at about 7 km from Aqaba Bay (see Fig. 2-3-2-14), in a mildly hilly terrain. Whereas ground surface is composed of equivalents to sandy soil, bed is supposed rocky as judged from geographical conditions of the peripheral mountain ground.
This FDS has an area of 60,000 m^2 and a landfill capacity of 23 years (1988-2010), and facilities are limited to access and in-site roads. In the future, final disposal sites are planned to be infinitely expanded in the region adjacent to this FDS.
Wastes received are determined to be municipal and the medical wastes, however, illegal dumping of industrial wastes was seen on the occasion of our site visits. Quantity of wastes received by this FDS is 100-120 t/day according to 1995 record, but our survey estimates that this FDS receives wastes of 62t/day. Component of wastes could not be inspected, because all wastes were burnt in the field. A lot of empty cans and iron scraps after burning were seen in this FDS.

(B) State of landfill

Landfill uses the open dumping method together with open burn and final soil-cover. No daily and intermediate covers are executed. Thus, it can hardly be said sanitary, and has no good efficiency.
Dumped wastes are burnt and heaped in the field without being leveled and compacted. Final soil-cover has to be executed by the plan, but we could not judge whether the cover is actually executed or not in our site survey.

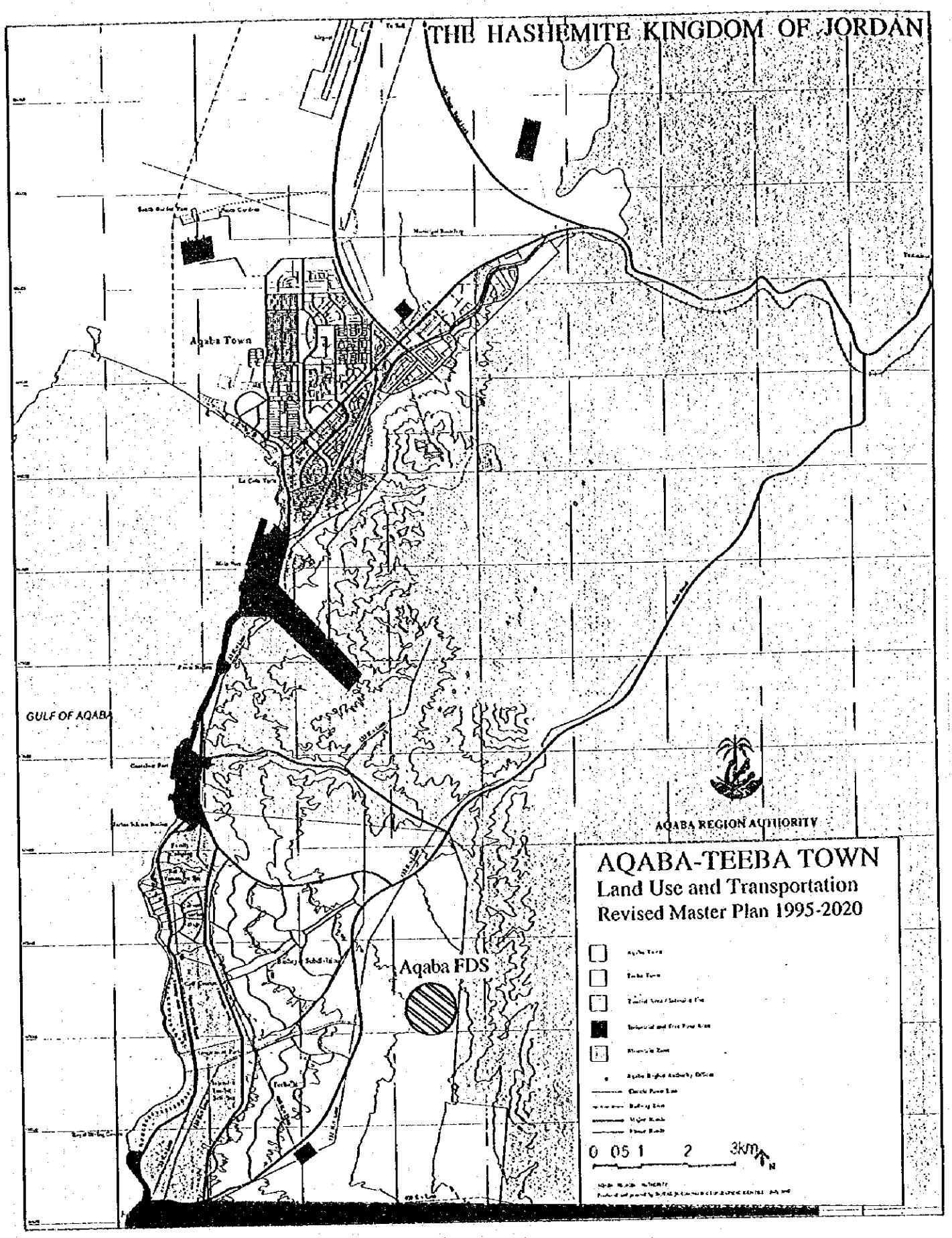


Fig. 2-3-2-14 Location of Aqaba FDS

(C) State of influences on environment

This FDS causes no traffic jams nor environmental problems such as air pollution, noise and vibration, because there is no house and public Facility near by. Also, offensive odor is prevented by open-burn.

Water tribute, is also supposed not to cause any problem, because little leachate is generated under the environment such as small precipitation (34mm/yr) and active evaporation effect. Moreover, impermeable bed rock is lying under this FDS.

With regard to state of sanitation and health, and complaints have never been posed whereas flies and harmful insects are generated, some wastes are scatter.

The urgent problems in this FDS are open burn, scattered wastes and disposal of remain such as empty cans and iron scraps.

Table 2-3-2-8 Present State of Aqaba FDS (1/4)

Item / Contents
1. Outlines of the final disposal site (1) Location: About 18 km south from City; about 7 km from Bay
(2) Geographical configuration: Mild hilly terrain, no houses nearby but a driving license center at about 3 km apart
(3) Soil quality: Sandy soil with a rock-bed (estimated from the mountain ground conditions around)
(4) Ground-water: Details are unknown
(5) Area: 60,000 m^2(but, expandable infinitely)
(6) Volume capacity:
(7) Term of landfill: 1988-2010 (23 years)
(8) Types of received wastes: Municipal, medical and industrial wastes

Table 2-3-2-8 Present State of Aqaba FDS (2/4)

Item / Contents
(9) Component of wastes: 100-120 t/day (1995); 62 t/day (by our survey)
(10) Component of wastes (visual observation impossible because all wastes are burnt) ① papers :- % ② plastics and rubbers :- % ③ food wastes :- % ④ glasses and porcelains :- % ⑤ metals :- % ⑥ woods :- % ⑦ fibers :- % ⑧ others :- %
(11) Equiped facilities: * Access and in-site roads
2 State of landfill (1) Method of landfill: The open dumping method
(2) Plan of landfill sequence: Not systematic
(3) Method of leveling and compacting: Wastes heaped without leveling and compacting
(4) Plan and actual state of cover Plan: ① thickness of waste layer: 100 cm ② thickness of daily cover soil: -- cm ③ thickness of intermediate cover soil: -- cm ④ thickness of final cover soil: 30 cm ⑤ procurement of cover soil: in the site
Actual state: * Whereas final cover was planned after dumping and burning, it is unknown whether actually executed or not. * No daily cover is executed in spite of procurement of suitable soil possible in the site.

Table 2-3-2-8 Present State of Aqaba FDS (3/4)

Item / Judgment / Contents
3 State of influences on the peripheries
(1) Traffics and public facilities :D * No traffic jams because of few number of dump trucks nor complaint on living environment because of no houses or public facilities nearby.
(2) State of sanitation and health :B * Influence to the driving license center supposed due to generation of flies and harmful insects, but no complaints yet. * Wastes are flying.
(3) Ground-water :D * No problem estimated because of rock-bed ground, although water level is unknown.
(4) State of lakes and rivers :D * No problem because almost no leachate comes out, whereas some might discuss influence on Aqaba Bay.
(5) Air pollution :D * No special complaints about smoke pollution despite open-burn executed. * No problem of exhaust gas because of few number of dump trucks. * No problem of dusts generated by dumping because of no houses nor public facilities such as hospitals nearby.
(6) Water pollution :D * No problem because little leachate is generated under the condition of small precipitation (34mm/yr) and active evaporation effect. Moreover, bed rock is lying under this FDS.
(7) Soil pollution :C * Details unknown, but contamination suspected since medical and industrial wastes are disposed besides municipal solid wastes.
(8) Noise and vibration :D * No problem of noise and vibration caused by traffics because of few number of vehicles. * No problem from construction machine operation on the site.
(9) offensive odor :D * No offensive odor of wastes because of open burn.

Table 2-3-2-8 Present State of Aqaba FDS (4/4)

Item / Contents
Other remarks * Good access with the access roads paved from the Main Road. * Scavengers: about 20. * There are some open burn by scavengers. *Some illegal dumping of industrial wastes containing aluminum phosphate. * The land owned by Aqaba Regional Authority. * Disposal needed for remainings of open burn in the periphery such as empty cans and iron scraps. * Installation of fences needed along borderline of the present site to prevent invasion of scavengers and illegal dumping by private companies.
< Judgment classification > A: serious influence presumed B: some influence presumed C: influence unknown D: no influence

View of open burning. Wastes are scattered.

Same to the above.

View of industrial wastes disposed illegally.

Fig. 2-3-2-15 Views of Aqaba FDS

8) Kufrinja FDS, existing

Table 2-3-2-9 summarizes present state of this FDS.
The following sections describe the general, the state of landfill and the influence on environment

(A) General

Managed by Ajloon CSC, the existing Kufrinja FDS is located about 5 km west of Kufrinja City (see Fig. 2-3-2-16), in a flat land surrounded by mountains. There are no houses nor public facilities, but farmlands. Ground is composed of equivalents to sandy soil with limestones partially.
This FDS has an area of 71,000 m^2 for a term of landfill of 15 years (1981-1995), and plans to extend the term by about three years improving current conditions. It is provided only with access and in-site roads as its facilities. Those roads are public.
Wastes received is restricted to municipal solid wastes, quantity as small as 7 t/day by 1995 record. But, the quantity obtained in our this time survey is 38 t/day, very different from the value obtained in 1995. By visual observation, wastes are composed of food wastes of about 60%, papers of 20%, plastics and rubbers of 10%, and others.

(B) State of landfill

Landfill is executed by the open dumping method using open burn together. Without daily and final cover executed, it cannot be said sanitary. Efficiency is low.
Wastes carried in by dump trucks are heaped and burnt, without being leveled and compacted. Remainings after open burn are collected and heaped in a specific section without any soil-cover. But, in our three visits to the site, a considerable portion of wastes was left unburnt in the field.

(C) State of influences on environment

There is no traffic jams caused by dump trucks nor complaints on living environmental, since there are no houses nor public facilities near this FDS. Also, no problems of air pollution, noise and vibration.

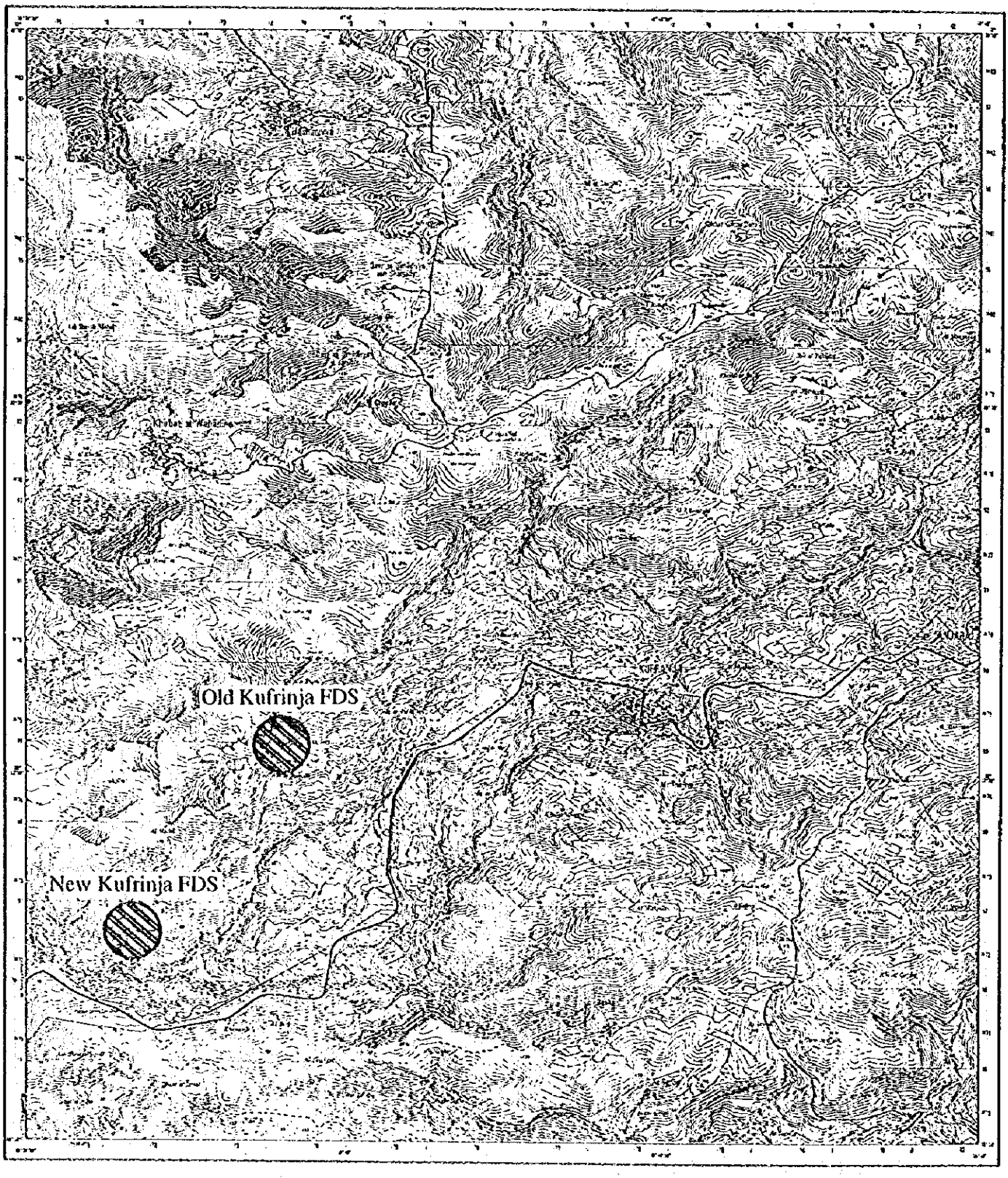


Fig. 2-3-2-16 Location of old Kufrinja FDS

No influence can be considered on water turbidity because evaporation of rainwater is well expectable, leachate hardly comes out and impermeable ground layer goes down to a depth of about 300 m, whereas annual precipitation here is rather large (560 mm) for an area in the country of Jordan.

The current problem is the fact that flies and sanitarily harmful insects give influences to nearby villages. Actions should be taken against the insects, scattered wastes, offensive odor and open burn.

Table 2-3-2-9 Present State of Kufrinja FDS, existing (1/4)

Item	Contents
1. Outlines of the final disposal site	
(1) Location:	
about 5 km west of Kufrinja City	
ave. distance from collection areas: about 27 km	
(2) Geographical configuration:	
a flat land surrounded by mountains including no near houses nor public facilities	
(3) Soil quality:	
sandy soil equivalents with limestones partially	
(4) Ground-water:	
200-300 m under the surface	
(5) Area:	
71,000 m^2	
(6) Volume capacity: ——	
(7) Term of landfill:	
1981-1995 (15 years), but a public extension of about 3 years planned	
(8) Types of received wastes:	
general wastes	
(9) Quantity of wastes:	
7 t/day(1994); 38 t/day(by our survey)	

Table 2-3-2-9 Present State of Kufrinja FDS, existing (2/4)

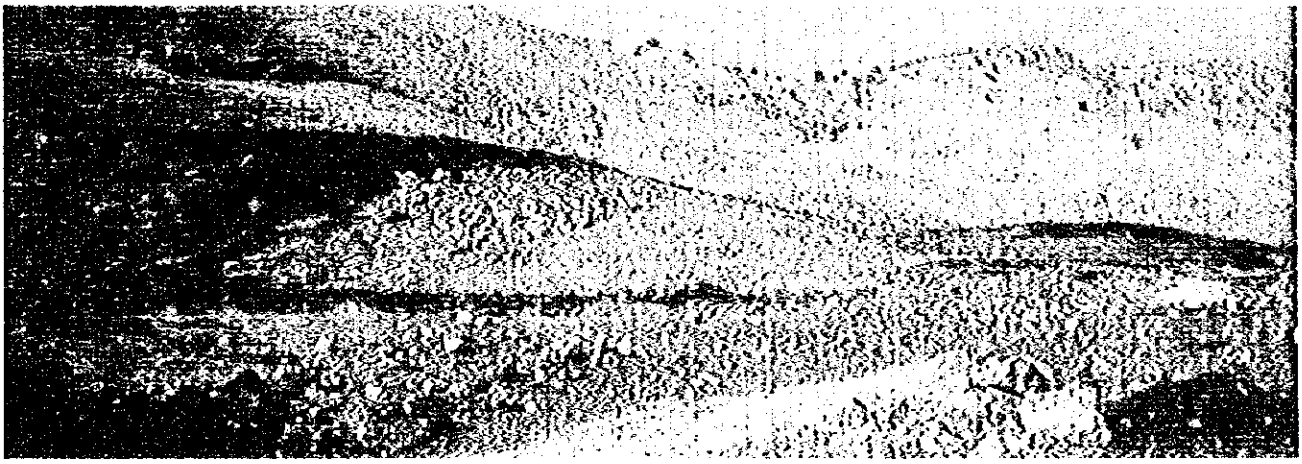
Item / Contents		
(10) Component of wastes	(by visual observation):	
① papers	: 20%	
② plastics and rubbers	: 10%	
③ food wastes	: 60%	
④ glasses and porcelains	: --%	
⑤ metals	: --%	
⑥ woods	: --%	
⑦ fibers	: --%	
⑧ others	: 10%	
(11) Equiped facilities:		
* access and in-site roads		
2 State of landfill		
(1) Method of landfill:		
the open dumping method		
(2) Plan of landfill sequence:		
no determined procedures		
(3) Method of leveling and compacting:		
no works executed		
(4) Plan and actual state of cover		
Plan: ① thickness of waste layer: -- cm		
② thickness of daily cover soil: -- cm		
③ thickness of intermediate cover soil: -- cm		
④ thickness of final cover soil: -- cm		
⑤ procurement of cover soil: --		
Actual state:		
* Received wastes are dumped open and, then, burnt on the field. No cover is applied.		
* No equipment is provided to procure cover soil.		
Item	:Judgment	Contents
3 State of influence on environment		
(1) Traffics and public facilities	:D	
* No traffic jams nor influence on houses because of few number of carry-in vehicles		

Table 2-3-2-9 Present State of Kufrinja FDS, existing (3/4)

Item / Judgment	Contents
(2) State of sanitation and health	:A
* Some complaints come from peripheral inhabitants (farmers) since flies and harmful insects are generated. * Wastes are scattered. * Wastes are left and not treated.	
(3) Ground-water	:D
* No problem from the facts that water level is at 200-300 m under the surface and almost no leachate comes out, considering annual precipitation and evaporation effect.	
(4) State of lakes and rivers	:C
* No influence is considered on the downstream Kufrinja River from the facts that scale of construction is not large and almost no leachate water comes out, but details are unknown.	
(5) Air pollution	:A
* Complaints from farmers since open burn are executed at any time. * No problem of exhaust gas because of few number of hauling trucks. * No problem of dumping dusts because the major waste component is food wastes	
(6) Water pollution	:D
* No problem because evaporation effect can well be expected and almost no leachate comes out whereas annual precipitation here is large (560 mm) for an area in Jordan.	
(7) Soil pollution	:D
* No problem since only municipal solid wastes.	
(8) Noise and vibration	:D
* No problem because of few number of hauling dump trucks. * No problem also from operation of construction machines on the site.	
(9) Offensive odor	:A
* Offensive odor smells since wastes are not covered by soil	

Table 2-3-2-9 Present State of Kufrinja FDS, existing (4/4)

Other remarks * Access includes safety problems, because access roads, unpaved, are provided over the sloped ground configurations. * No scavengers. * Many complaints from farmland owners near the FDS. * About 100 farmers live near the access roads. * There is soil suitable for cover 1-2 m under the surface of mountain ground near the site, whereas the surface is covered with rocks. (from observation of some cuttings) * Roads for carrying in and transport in the site are public. * Some dumped wastes are left unburnd.
< Judgment classification > A: Serious influence presumed B: Some influence presumed C: Influence unknown D: No influence



View of landfill. Cover soil is not implemented, and open dumping is executed.

View of open burning.

Piled residual of open burning.

Side ditch of the farm beside landfill.

Fig. 2-3-2-17 Views of old Kufrinja FDS

9) Kufrinja FDS, new

Table 2-3-2-10 summarizes present state of this FDS.
The following sections describe the general and influences on environment.

(A) General

The newly planned Kufrinja FDS is located at about three kilometers southwest of the existing (see Fig. 2-3-2-18) on a not-so-mild slope surrounded by mountains. No houses nor public facilities are found in the periphery. Geologically, ground is constituted of calcareous clayey soil. This FDS is to have an area of 100,000 m^2 for a landfill capacity of 50 years (1996-2045). Planned facilities include control office, access and in-site roads, guard fences and reservoir banks. In the future, the area will be expanded to 600,000 m^2.

(B) State of influences on environment

Without any houses and public facilities near this FDS, no influences on traffics and public facilities are estimated, and no problems are foreseen also with regard to air pollution, noise and vibration and bad odor.
Ground-water will not be polluted because ground is impermeable.
Kufrinja River which runs just downstream of this new FDS will be influenced by sand and soil when this FDS is constructed. while groundwater is supposed to be polluted by leachate in the consideration of relatively large amount of precipitation (561mm/yr) and the landfill on steep slops, whereas evaporation effect is active.

Table 2-3-2-10 Present State of Kufrinja FDS, new (1/3)

Item / Contents
1. Outlines of the final disposal site
(1) Location:
approx. 3 km southwest of the existing FDS
(2) Geographical configuration:
not-so-mild mountain slope with no houses nor public facilities

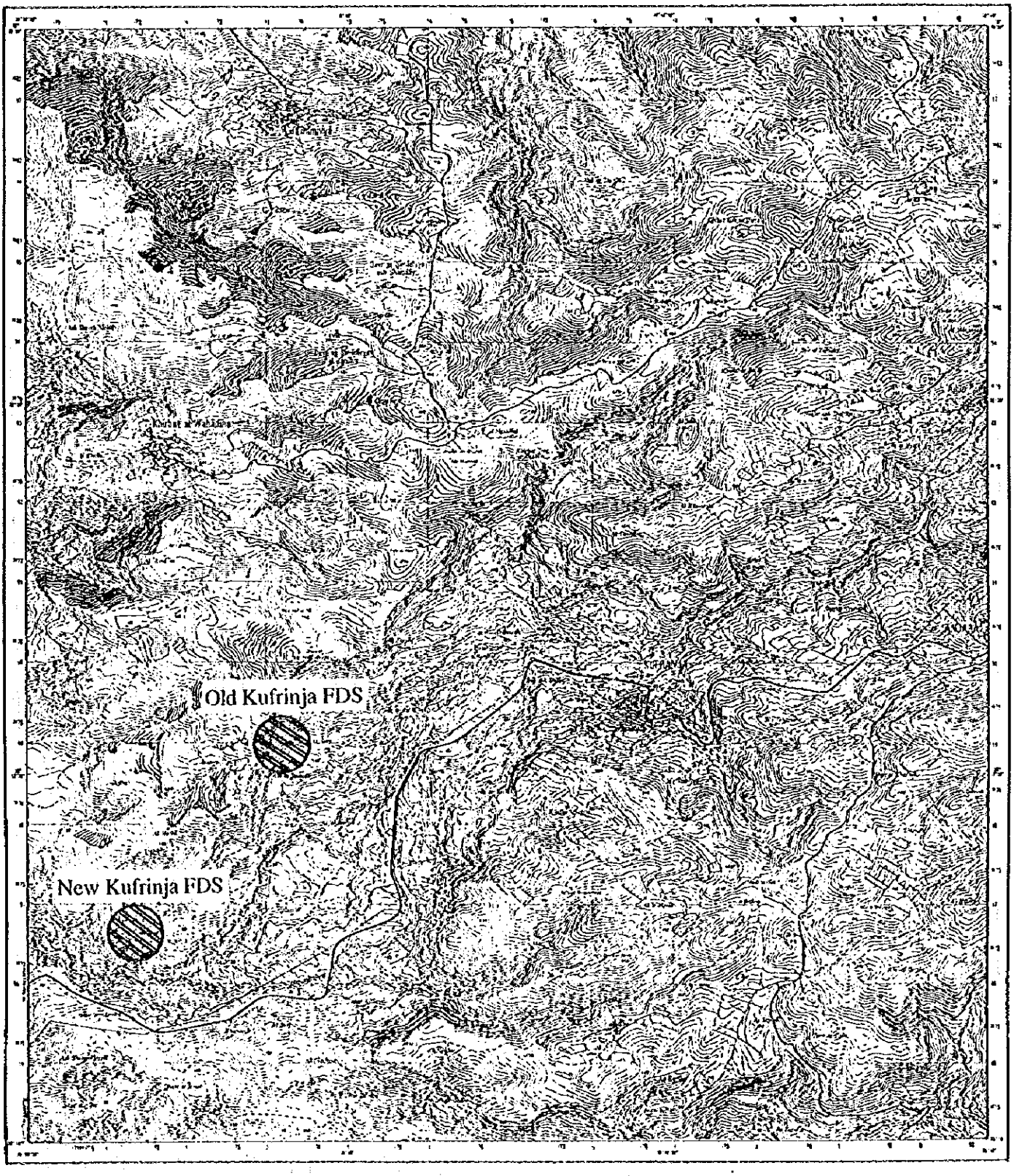


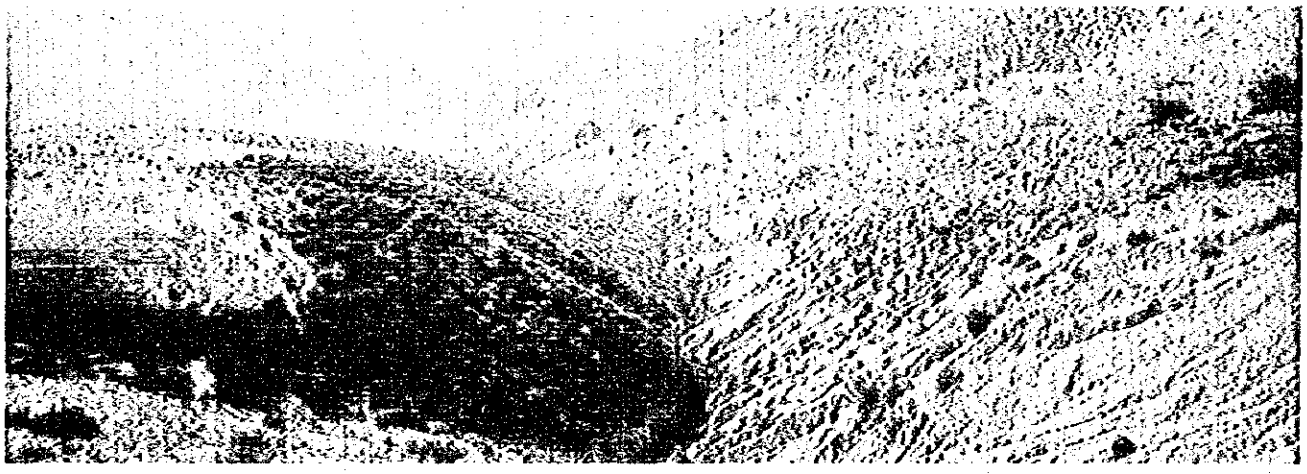
Fig. 2-3-2-18 Location of new Kufrinja FDS

Table 2-3-2-10 Present State of Kufrinja FDS, new (2/3)

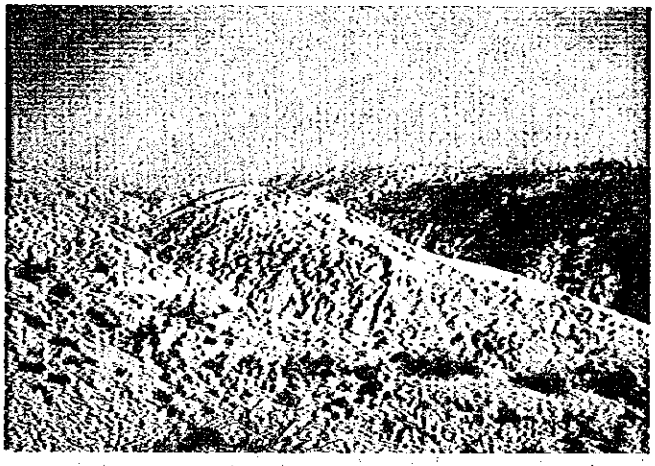
Item / Contents
(3) Soil quality: Calcareous clayey soil equivalents (Maar)
(4) Ground-water: 200-300 m under the surface
(5) Area: 100,000 m² (expanded to 600,000 m² in the future)
(6) Volume capacity: ——
(7) Term of landfill: 1996-2045 (50 years)
(8) Types of received wastes: Municipal solid wastes
(9) Quantity of wastes: ——
(10) Component of wastes: ——
(11) Equiped facilities: * control offices * access and in-site roads * guard fences * reservoir banks
Item / Judgment / Contents
2. State of influences on peripheral environment (1) Traffics and public facilities :D * No influence because of few number of hauling trucks and no houses nor public facilities in the periphery.
(2) State of sanitation and health :C * No special problems are foreseen due to the generation of flies and harmful insects, and scattered wastes if daily cover is executed, but details are unknown at the present.
(3) Ground-water :D * No problem with water level 200-300 m under the surface and impermeable FDS ground.
(4) State of lakes and rivers :B * Soil cut on the construction site will flow into rivers.

Table 2-3-2-10 Present State of Kufrinja FDS, new (3/3)

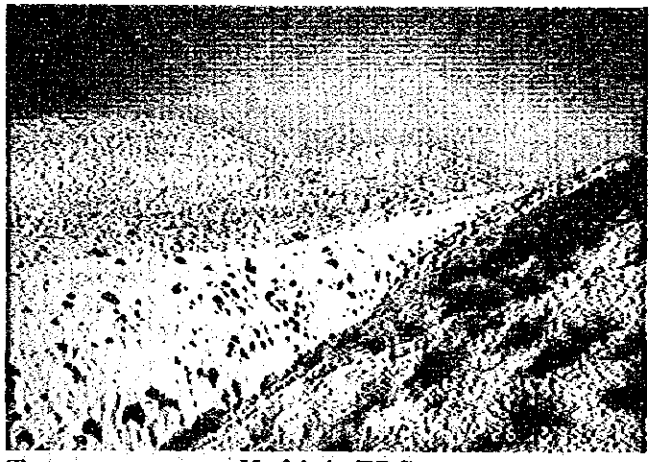
Item / Judgment / Contents
(5) Air pollution :D * No problem because no burning is executed, hauling trucks are few and there are no houses nor public facilities in the vicinity.
(6) Water pollution :B * Some increase in turbidity can occur due to soil cut on the construction site flowing into rivers just downstream. * Rivers just downstream will get more turbid if leachate comes out.
(7) Soil pollution :D * No contamination because only general wastes are received.
(8) Noise and vibration :D * No problems because of few number of hauling trucks and no houses nor public facilities nearby.
(9) offensive odor :C * Daily cover will be the precondition for prevention of offensive odor. Although no problem is foreseen because of no houses nor public facilities nearby, details are unknown at the present.
Other remarks * Hard access is foreseen including some problems in safety because carry-in roads are constructed on slopes of steep mountains. * Sufficient cares are needed for road construction and landfill since this FDS uses a land surrounded by steep mountains. * The roads from the existing FDS have to be expanded in width and paved, which will be worked separately from the FDS construction. * Budget for road construction has already been set by the National Government. * Banks have to be constructed with rock-fill or concrete before starting landfill for prevention of waste flow-out. * Kufrinja river always has water.
< Judgment classification > A: severe influence presumed B: some influence presumed C: influence unknown D: no influence



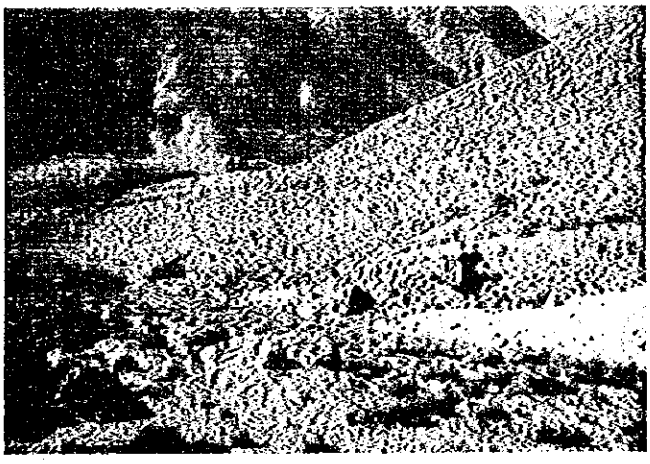
View from the entrance of access road to the bottom of FDS.



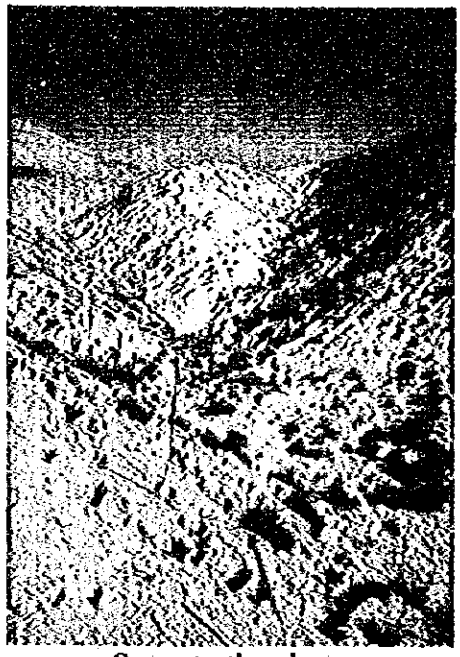
View from the bottom of FDS.



To construct new Kufrinja FDS,
the mound at the center of this photo will be excavated.



View of the flat area at the bottom
where a regulating reservoir will be constructed.



Same to the above.

Fig. 2-3-2-19 Views of new Kufrinja FDS

10) Madaba FDS

Table 2-3-2-11 summarizes present state of this FDS.
The following sections describe the general, the state of landfill and the state of influence on environment

(A) General

Managed by Madaba CSC, this FDS is located 4 km southeast of Madaba City (see Fig. 2-3-2-20) in a flat land including farmlands. There are some houses adjacent to the FDS. Ground is constituted of sandy soil.
This FDS has an area of 50,000 m^2 and a volume capacity of 300,000 m^3 for a landfill term of 23 years (1974-1997). This FDS is already on the landfill 90% of its capacity at the present, and will be expanded in the future. Facilities include control office, access and in-site roads and guard fences (not covering the entire borderline). The main control office, three-storied, has a space for accommodation of landfill equipment.
Although it is cited that received wastes are municipal and medical wastes, the provision of sedimentation ponds for calcium carbonate proves that industrial wastes are also received. Quantity of acceptance is 100 t/day by 1995 record. This time survey, however, led to a result of 63 t/day, considerably different from the 1995 record. Wastes are composed of about 60% of food wastes, 15% of papers, 15% of plastics and rubbers, etc. as judged by visual observation.
At the place where carried-in wastes are dumped, boys living near the site pick up valuables out of the dumped wastes.

(B) State of landfill

Landfill uses the sandwich method without executing daily cover everyday. This can hardly be said a sanitary landfill.
Wastes carried in by dump trucks are dumped on the dumping stage and, then, put into the large hollow, cut beforehand, with a bulldozer or other equipment. And, a cover of a thickness of 20-30 cm is applied not necessarily on the day. For the final cover of a thickness of 70-100 cm, soil cut in the site is used.

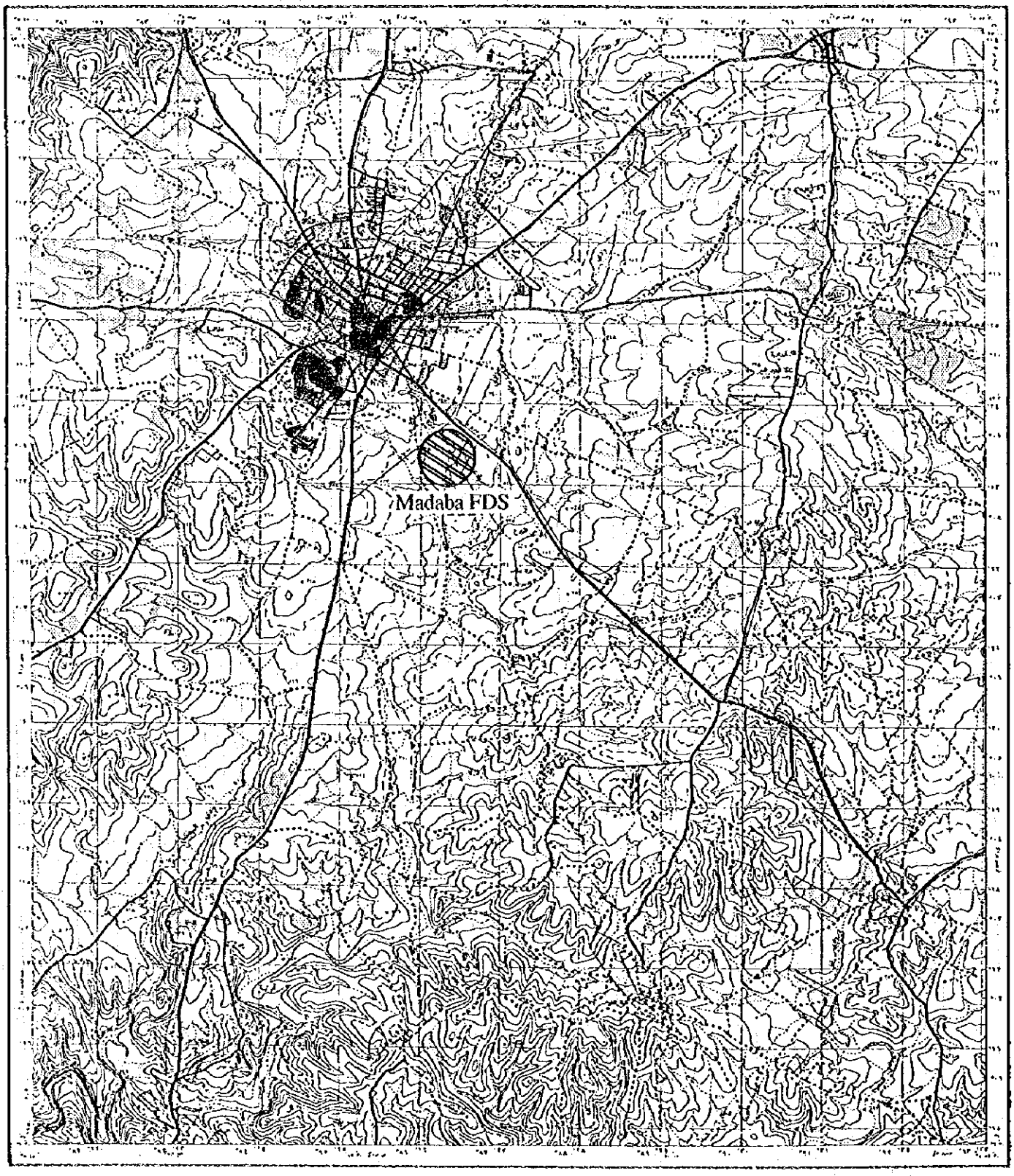


Fig. 2-3-2-20 Location of Madaba FDS

(C) Influence on environment

There are some houses adjacent to this FDS, but route of carrying in is apart from them. Hence, no influence to public facilities is present, as well as no traffic jams. Besides, air pollution, noise and vibration also pose no problems.

Water is estimated not to be polluted, because leachate is hardly generated under the environment where precipitation is small (346mm/yr) and evaporation effect is active.

In the aspect of sanitation and health, flies and harmful insects may be generated, but no complaints have been particularly given by inhabitants. Light wastes are scattered. Some extent of offensive odor is sensed on the site border.

Table 2-3-2-11 Present State of Madaba FDS(1/4)

Item / Contents
1. Outlines of the final disposal site
(1) Location: About 4 km east of Madaba City, about 38 km from the airport, and about 100 m from the adjacent house
(2) Geographical configuration: A flat land with adjacent houses
(3) Soil quality: Sandy soil equivalents
(4) Ground-water: 200-300 m under the surface
(5) Area: 50,000 m^2, with an additional expansion of 50,000 m^2 planned
(6) Volume capacity: 300,000 m^3 as planned, and 30,000 m^3 remaining
(7) Term of landfill: 1974-1997(23 years)
(8) Types of received wastes: Municipal, medical and industrial wastes
(9) Quantity of wastes: 100 t/day (1995); 63 t/day (by our survey)

Table 2-3-2-11 Present State of Madaba FDS(2/4)

Item / Contents
(10) Component of wastes (by visual observation): ① papers : 15% ② plastics and rubbers : 15% ③ food wastes : 60% ④ glasses and porcelains : -- % ⑤ metals : -- % ⑥ woods : -- % ⑦ fibers : -- % ⑧ others : 10 %
(11) Current facilities * control offices * access and in-site roads * guard fences
2 State of landfill (1) Method of landfill: The sandwiching method
(2) Plan of landfill sequence: From the control office side towards the future expansion area
(3) Method of leveling and compacting: Dropping in by bulldozers or other equipment and no leveling nor compacting
(4) Plan and actual state of cover Plan: ① thickness of waste layer : 100 cm ② thickness of daily cover soil : 30 cm ③ thickness of intermediate cover soil : 30 cm ④ thickness of final cover soil : 60-70 cm ⑤ procurement of cover soil : soil cut in the site
Actual state: * Daily cover determined in the plan is not exactly observed. * Thickness of waste layer is considerably thicker than the determined. * Cover is applied only in flat portion of the dumping stage. * Wastes are exposed through cover soil where cover thickness is insufficient.

Table 2-3-2-11 Present State of Madaba FDS (3/4)

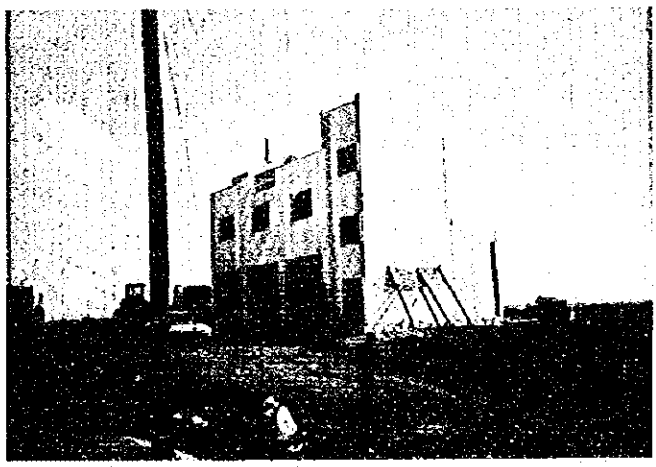
Item / Judgment / Contents
3. State of influence on the peripheries
(1) Traffics and life facilities :D * No traffic jams nor influence on houses because number of trucks are few and access route is apart from houses.
(2) State of sanitation and health :B * Insufficient cover could cause generation of flies and harmful insects. * Wastes are scattered.
(3) Ground-water :D * No problem is estimated from the facts that there are no wells for drinking water and farming, annual precipitation is small (346 mm) and evaporation effect is well expectable, although it is unknown whether ground-water is contaminated or not.
(4) State of lakes and rivers :C * No problem is estimated since almost no leachate comes out in the valley at 500 m apart from the site.
(5) Air pollution :D * No smoke pollution because no burning is executed. * No exhaust gas problem because of few number of dump trucks.
(6) Water pollution :C * No problem since almost no leachate comes out.
(7) Soil pollution :C * Some possibility of contamination with hazardous substances since medical and industrial wastes are received, but details are unknown.
(8) Noise and vibration :D * No problem because of a large distance between the access route and adjacent houses and few number of trucks. * No problem from construction machine operation on the site.
(9) Offensive odor :B * Offensive odor is sensed, because daily cover is not being executed. * No offensive odor from the completed sections since final cover is applied.

Table 2-3-2-11 Present State of Madaba FDS (4/4)

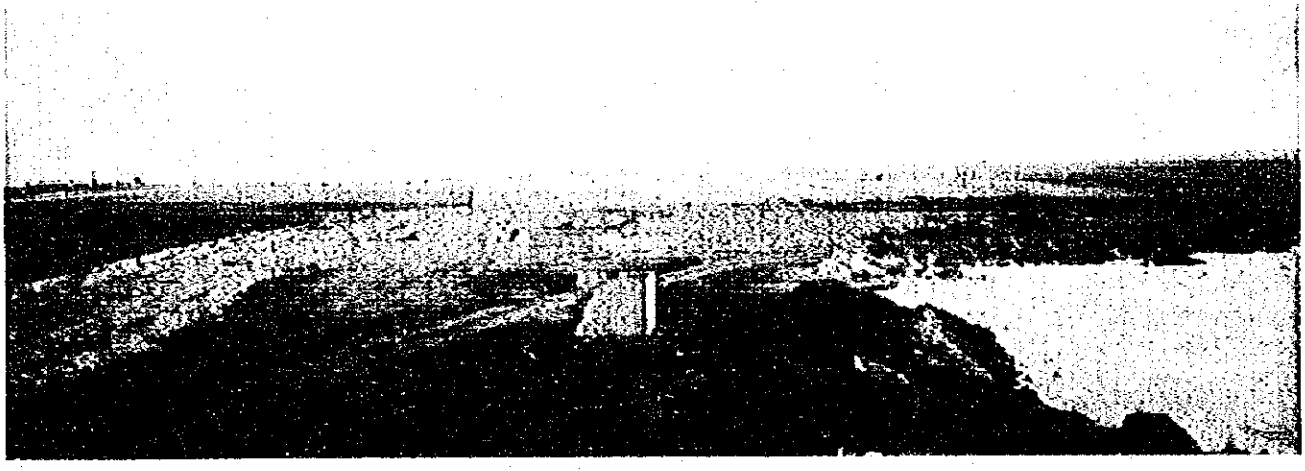
Item / Contents
Other remarks * Not so far from the main road, this FDS has a good access, but the access and in-site roads are not paved. * Whereas no scavengers live in the site, boys living near (about 10 in number) pick up valuables. * Calcium carbonate are carried in and stored in sedimentation ponds. * Soil in this FDS is optimum for cover in quality. * The control office (3-storied) is of high grade. (The ground floor is a garage for heavy machines.) * Guard fences do not cover the entire borderline, rendering people invasion uncontrollable. * Landfill is being executed under a condition that an area of 30,000m², out of the total of 50,000 m², should yet to be purchased. The expansion area of 50,000 m² is not yet purchased.
< Judgment classification > A: serious influence presumed B: some influence presumed C: influence unknown D: no influence

View of landfill. Some children are picking up valuables.

Three storied control office



The space of first floor is kept for parking.



View of landfill. Area on right side is the sediment pond for calcium carbonate.

Fig. 2-3-2-21 Views of Madaba FDS