

## 12) 経済評価

### (1) エンクヒレット川

本事業においては、100年確率洪水を対象とした第二期工事では、現在設備住宅省による工事中のものを含めた全河川区間改修となり施工時期を想定できないため、緊急案件である10年確率洪水を対象とした第一期工事のみの経済評価を行った。また本事業の実施によって発生すると考えられる便益は洪水被害の減少分とする。流域内の氾濫域での各確率洪水による被害額を算定した結果、10年確率洪水に対しては現況の土地利用のもとでは年平均便益はDT1,447,000であり、また予測される将来の土地利用のもとではDT7,721,000と見積られた。経済費用の算定に対しては、移転支出と見做される関税などの税金は財務費用の約10%と考えた。その結果、エンクヒレット川の洪水対策計画に見込まれる経済費用はDT12,475,000となった。

経済評価は以下の仮定に基づき、経済的内部収益率（EIRR）を指標として行った。

- i) プロジェクトライフを50年とした。
- ii) 工事実施計画を詳細に積み上げた結果、施工期間は財源措置、詳細設計、入札等の事前作業を含め1994年から1998年までの5年間とした。
- iv) 本プロジェクトにより発生する経済便益は、土地利用の変化による洪水被害の増大に伴い工事終了後から2020年までは直線的に伸び、その後は一定とした。
- iii) 維持管理費用は直接工事費の2%とした。

以上の仮定に基づいた場合のEIRRは24.6%となった（表-13参照）。また以下に感度分析の結果を示す。

ケース1	20%のコスト増	EIRR = 21.4%
ケース2	20%のコスト減	EIRR = 29.1%
ケース3	20%の便益増	EIRR = 28.4%
ケース4	20%の便益減	EIRR = 20.6%
ケース5	ケース1とケース4の組み合わせ	EIRR = 18.0%

これらの結果よりエンクヒレット川の洪水対策工事の実施は、経済的に妥当であると判断された。マスタープラン時と比べ経済的内部収益率が高くなったがその理由としては、（1）フィージビリティ調査では流域外への転流案を採用することによって事業費が軽減できたこと、（2）エンクヒレット川からの洪水がエ

ンクヒレット川流域のみならず隣の流域まで影響している事が新たに判明し、事業を実施することによりこの便益も取り込むことができたことがあげられる。

## (2) ハンマム川

ハンマム川においてもエンクヒレット川と同様の条件の基で経済評価を実施した。その結果、第一期工事の経済費用は DT8,368,000、年平均被害軽減額は現況の土地利用で DT1,015,000、将来の土地利用では DT2,328,000、EIRRは17.4%となった(表-14 参照)。また以下に感度分析の結果を示す。

ケース 1	20% のコスト増	EIRR = 14.8%
ケース 2	20% のコスト減	EIRR = 21.4%
ケース 3	20% の便益増	EIRR = 20.9%
ケース 4	20% の便益減	EIRR = 14.0%
ケース 5	ケース 1 とケース 4 の組み合わせ	EIRR = 11.9%

これらの結果よりハンマム川の洪水対策工事の実施は、経済的に妥当であると判断された。



## 6. 結論と提言

エンクヒレット川およびハンマム川について、技術的、経済的な面から種々の検討を加えた結果、次の洪水対策案が最も有望であるとの結論に達した。

### (1) エンクヒレット川

転流路 No.3 と No.4、それに遊水池 A、G、I、J1 の四つを組み合わせた洪水対策案で、これには一部を除き河川改修も含まれている。工事は第一期と第二期に分けて考えた。必要な事業費は財務費用で計算すると、第一期が、DT15,094,000 で、第二期は DT8,960,000 の合計 DT24,054,000 が見込まれる。経済的内部収益率は 24.6% となった。

### (2) ハンマム川

部分的な河川改修のみ（橋梁の新設工事を含む）で、その区間は観光道路から GP-1 のバイパス道路にかけて、それにケビル川の下流域および上流域で中間部は一部除く。エンクヒレット川のケースと同様に、工事は第一期と第二期に分けて考えた。必要な事業費は、第一期が DT10,413,000 で、第二期は DT787,000 の合計 DT11,200,000 が見込まれる（財務費用ベース）。経済的内部収益率は 17.4% となった。

上記のごとく両案とも技術的にも経済的にも事業化することは問題ないと判断された。近年のこれらの流域内での都市化、それに伴う洪水被害の増加を考えれば、チュニジア政府による早急な対応が望まれる所である。今回、推奨される洪水対策計画に欠かすことの出来ない遊水池の用地の確保は急務であると考えられるので、都市化による宅地開発に遅れをとらない為にも早い時期に何らかの手段を講ずることが必要であろう。



# 付 表



表一I エンクヒレット川の遊水池の比較検討

Number of Retarding Basin	Type	Catchment Area (km <sup>2</sup> )	Construction Cost of Retarding Basin (DT 1,000) (A)	Decreased River Improvement Cost by Retarding Basin (DT 1,000) (B)	Retarding Basin Cost less Decreased River Impro. Cost (DT 1,000) (C)=(A)-(B)	Costs Ratio (D)=(A)/(B)	Selected Retarding Basin	Remarks
Ain Snoussi	Dam	1.09	58.0	174.1	-116.1	0.33	Existing	Existing retarding basin constructed by the Ministry of Agriculture.
A	Dam	0.92	42.9	118.1	-75.2	0.36	○	It shows a high economic advantage.
B	Dam	1.11	741.8	82.6	659.2	8.98		It shows a low economic advantage.
C	Dam	0.21	123.2	8.7	114.5	14.16		It shows a low economic advantage.
D	Dam	1.02	251.5	33.3	218.2	7.55		It shows a low economic advantage.
E	Dam	0.2	114.0	18.0	96.0	6.33		It shows a low economic advantage.
F	Dam	0.25	84.2	22.3	61.9	3.78		It shows a low economic advantage.
G	Pond	1.62	467.9	1,486.9	-1,019.0	0.31	○	It shows a high economic advantage. Further study in combination with Retarding Basin I is required.
H	Pond	0.36	1,119.6	152.2	967.4	7.36		It shows a low economic advantage.
I	Pond	2.46	1,752.0	1,476.4	275.6	1.19	○	It shows a relatively high economic advantage. Further study in combination with Retarding Basins G, J1 and diversion plan is required.
J1	Pond	1.05	580.3	930.5	-350.2	0.62	○	It shows a high economic advantage. Further study in combination with Retarding Basin I and diversion plan is required.
J2	Pond	0.34	-	-	-	-		It is a prospective retarding basin site, however this site is discarded for alternative study because housing development at the site was commenced during the Study.
K	Pond	0.71	2,014.5	632.3	1,382.2	3.19		It shows a low economic advantage.
L	Pond	3.09	1,053.8	533.6	520.2	1.97	○	It shows a relatively high economic advantage. Further study in combination with Retarding Basin M, Ain Snoussi Dam and diversion plan is required.
M	Pond	1.93	460.4	197.4	263.0	2.33	○	It shows a relatively high economic advantage. Further study in combination with Retarding Basins A, L and diversion plan is required.
N1	Pond	1.92	1,170.8	119.4	1,051.4	9.81		It shows a low economic advantage.
N2	Pond	0.57	712.3	48.2	664.1	14.78		It shows a low economic advantage.



表-2 エンクヒレット川の各種治水計画案の比較検討

Alternative Plan	Direct Construction Cost + Land Acquisition Cost (1,000 DT)				Remarks	Ranking	
	River Improvement	Diversion	Retarding Basin	Total		Group	Total
<b>River Improvement Plan</b>							
1. Alt. Div. 0	9,659	0	0	9,659	Only River Impr.	(1)	9
<b>Diversion + River Improvement Plan</b>							
2. Alt. Div. 3	7,615	671	0	8,286	Div.3 + River Impr.	(4)	5
3. Alt. Div. 4	8,356	586	0	8,942	Div. 4 + River Impr.	(6)	7
4. Alt. Div. 5	8,450	597	0	9,047	Div. 5 + River Impr.	(7)	8
5. Alt. Div. 2 & 3	7,486	885	0	8,371	Div. 2 & 3 + River Impr.	(5)	6
6. Alt. Div. 3 & 4	6,689	1,168	0	7,857	Div. 3 & 4 + River Impr.	(2)	3
7. Alt. Div. 3 & 5	6,663	1,210	0	7,873	Div. 3 & 5 + River Impr.	(3)	4
8. Alt. Div. 3, 4 & 5	6,203	1,558	0	7,761	Div. 3, 4 & 5 + River Impr.	(1)	2
<b>Retarding Basin + Diversion + River Improvement Plan</b>							
9. <u>Alt. U-1 + D-5</u>	<u>4,216</u>	<u>515</u>	<u>1,914</u>	<u>6,644</u>	<u>R.B-A,G,I&amp;J1 + Div.3&amp;4 + River Impr.</u>		<u>1</u>
<b>- Upstream Basin</b>							
9.1 Alt. U-1	403	44	1,848	2,294	R.B-G,I&J1 + Div.3 + River Impr.	(1)	
9.2 Alt. U-2	403	509	1,421	2,333	R.B-G,I&J1 + Div.2&3 + River Impr.	(2)	
9.3 Alt. U-3	1,581	446	355	2,382	R.B-G + Div.3 + River Impr.	(3)	
<b>- Downstream Basin</b>							
9.4 Alt. D-1	3,451	0	1,169	4,621	R.B-A,L&M + River Impr.	(2)	
9.5 Alt. D-2	4,108	0	917	5,025	R.B-A&L + River Impr.	(6)	
9.6 Alt. D-3	3,552	421	917	4,890	R.B-A&L + Div.5 + River Impr.	(5)	
9.7 Alt. D-4	3,655	471	503	4,629	R.B-A&M + Div.4 + River Impr.	(3)	
9.8 Alt. D-5	3,813	471	66	4,350	R.B-A + Div.4 + River Impr.	(1)	
9.9 Alt. D-6	3,814	851	66	4,730	R.B-A + Div.4&5 + River Impr.	(4)	

Note: "River Impr." = River Improvement, "Div." = Diversion, "R.B" = Retarding Basin

表-3 エンクヒレット川治水計画の諸元 (1/13)

Oued Enkhilet Main

Stretch E-1 ( from Sebkhet Ariana to junction with Canal C1)

First Stage

- |     |                         |  |
|-----|-------------------------|--|
| (1) | River improvement       | Design discharge : 40 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 21 m<br>Length : 1,115 m<br>Excavation : 25,700 m <sup>3</sup><br>Embankment : 22,200 m <sup>3</sup><br>Bank protection : 60 m on both bank |
| (2) | Bridge for RVE-543 Road | Width : 12 m<br>Length : 50 m  |
| (3) | Drainage Sluiceway      | 1 no   |

Second Stage

- |     |                   |   |
|-----|-------------------|---|
| (1) | River improvement | Design discharge : 75 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 40 m<br>Length : 1,115 m<br>Excavation : 21,200 m <sup>3</sup> |
|-----|-------------------|---|

Stretch E-2 ( from junction with Canal C1 to junction with Canal R2)

First Stage

- |     |                         |   |
|-----|-------------------------|---|
| (1) | River improvement       | Design discharge : 24 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 9 m<br>Length : 1,095 m<br>Excavation : 14,200 m <sup>3</sup><br>Embankment : 12,500 m <sup>3</sup><br>Bank protection : 70 m on both bank |
| (2) | Bridge for RVE-533 Road | Width : 12 m<br>Length : 30 m   |
| (3) | Drainage Sluiceway      | 4 nos   |

Second Stage

- |     |                   |   |
|-----|-------------------|---|
| (1) | River improvement | Design discharge : 50 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 20 m<br>Length : 1,095 m<br>Excavation : 18,100 m <sup>3</sup> |
|-----|-------------------|---|

表-3 エンクヒレット川治水計画の諸元 (2/13)

Stretch E-3 ( from junction with Canal R2 to junction with Canal N1)

<u>First Stage</u>	No river improvement
<u>Second Stage</u> (1) River improvement	Design discharge : 28 m <sup>3</sup> /s Length : 70 m Twin type of concrete box culvert width : 3.9 m & height : 2.7 m Excavation : 2,200 m <sup>3</sup> Concrete : 570 m <sup>3</sup>

Stretch E-4 and E-5 ( from junction with Canal N1 to junction with Canal G2)

<u>First Stage</u>	No river improvement
<u>Second Stage</u> (1) River improvement	Design discharge : 16 m <sup>3</sup> /s Length : 561 m Single type of concrete box culvert Width : 4.3 m & height : 2.7 m Excavation : 9,600 m <sup>3</sup> Concrete: 2,700 m <sup>3</sup>

Stretch E-6 ( from junction with Canal G2 to Diversion No.4)

<u>First Stage</u>	No river improvement
<u>Second Stage</u>	No river improvement

Stretch E-7 ( from Diversion No.4 to Jct. with Canal G1)

<u>First Stage</u>	Included in Diversion No.4
<u>Second Stage</u>	Included in Diversion No.4

Stretch E-8 ( from junction with Canal G1 to Diversion No.3)

<u>First Stage</u>	No river improvement
<u>Second Stage</u> (1) River improvement (To construct additional concrete box culvert)	Design discharge : 7 m <sup>3</sup> /s Existing culvert : 3.5 m <sup>3</sup> /s Additional culvert : 3.5 m <sup>3</sup> /s Length : 984 m Single type of concrete box culvert Width : 2.3 m & height : 1.6 m Excavation : 12,800 m <sup>3</sup> Concrete : 2,800 m <sup>3</sup>

表-3 エンクヒレット川治水計画の諸元 (3/13)

Stretch E-9 ( from Diversion No.3 to junction with Canal C3)

<u>First Stage</u>	No river improvement
<u>Second Stage</u>	
Downstream half	
(1) River improvement	Design discharge : 12 m <sup>3</sup> /s Length : 366 m Single type of concrete box culvert Width : 4.3 m & height : 2.2 m Excavation : 8,500 m <sup>3</sup> Concrete : 1,650 m <sup>3</sup>
Upstream half	
(1) River improvement	Design discharge : 12 m <sup>3</sup> /s Length : 626 m Single type of concrete box culvert Width : 2.9 m & height : 2.2 m Excavation : 11,600 m <sup>3</sup> Concrete : 2,250 m <sup>3</sup>

Stretch E-10 ( from junction with Canal C3 to Retarding basin I under GP-8 Road)

<u>First Stage</u>	No river improvement
<u>Second Stage</u>	
(1) River improvement	Design discharge : 7 m <sup>3</sup> /s Length : 32 m Single type of concrete box culvert Width : 2.0 m & height : 2.2 m Excavation : 600 m <sup>3</sup> Concrete : 125 m <sup>3</sup>

Stretch E-11 ( from Retarding basin I to Jct. with Canal C5)

<u>First Stage</u>	
(1) River improvement	Design discharge : 7 m <sup>3</sup> /s Length : 485 m Single type of concrete box culvert Width : 2.2 m & height : 2.0 m Excavation : 7,300 m <sup>3</sup> Concrete : 1,470 m <sup>3</sup>
<u>Second Stage</u>	
(1) River improvement (To construct additional concrete box culvert)	Design discharge : 14 m <sup>3</sup> /s First stage : 7 m <sup>3</sup> /s Additional culvert : 7 m <sup>3</sup> /s Length : 485 m Single type of concrete box culvert Width : 2.2 m & height : 2.0 m Excavation : 5,800 m <sup>3</sup> Concrete : 1,470 m <sup>3</sup>

表-3 エンクヒレット川治水計画の諸元 (4/13)

Canal C1

Stretch C1-1 ( from junction with Oued Ennkhilet to junction with Canal C2)

First Stage

(1) River improvement      Design discharge : 22 m<sup>3</sup>/s  
 Type : trapezoidal earth-lining  
 Bottom width : 11 m  
 Length : 535 m  
 Excavation : 8,600 m<sup>3</sup>  
 Embankment : 8,700 m<sup>3</sup>  
 Bank protection : 30 m on both bank

(2) Drainage Sluiceway      2 nos

Second Stage

(1) River improvement      Design discharge : 35 m<sup>3</sup>/s  
 Type : trapezoidal earth-lining  
 Bottom width : 18 m  
 Length : 535 m  
 Excavation : 4,500 m<sup>3</sup>

Stretch C1-2 ( from junction with Canal C2 to Diversion Route No.5)

First Stage

(1) River improvement      Design discharge : 20 m<sup>3</sup>/s  
 Type : trapezoidal earth-lining  
 Bottom width : 10 m  
 Length : 469 m  
 Excavation : 6,300 m<sup>3</sup>  
 Embankment : 8,500 m<sup>3</sup>

(2) Drainage Sluiceway      2 nos

Second Stage

(1) River improvement      Design discharge : 35 m<sup>3</sup>/s  
 Type : trapezoidal earth-lining  
 Bottom width : 18 m  
 Length : 469 m  
 Excavation : 4,100 m<sup>3</sup>

Stretch C1-3 ( from Diversion Route No.5 to junction with Diversion No.4)

First Stage

(1) River improvement      Design discharge : 16 m<sup>3</sup>/s  
 Type : trapezoidal earth-lining  
 Bottom width : 4 m  
 Length : 573 m  
 Excavation : 6,600 m<sup>3</sup>  
 Embankment : 5,700 m<sup>3</sup>  
 Bank protection : 30 m on both bank

表-3 エンクヒレット川治水計画の諸元 (5/13)

(2) Drainage Sluiceway 1 no

Second Stage

(1) River improvement  
 Design discharge : 35 m<sup>3</sup>/s  
 Type : trapezoidal earth-lining  
 Bottom width : 11 m  
 Length : 573 m  
 Excavation : 6,400 m<sup>3</sup>

Stretch C1-4 ( from junction with Diversion No.4 to Upstream)

First Stage No river improvement

Second Stage No river improvement

Canal R2

Stretch R2-1 ( from junction with Oued Ennkhilet to junction with Canal N2)

First Stage

(1) River improvement  
 Design discharge : 12 m<sup>3</sup>/s  
 Type : trapezoidal earth-lining  
 Bottom width : 2 m  
 Length : 220 m  
 Excavation : 600 m<sup>3</sup>  
 Bank protection : 30 m on both bank

Second Stage

(1) River improvement  
 Design discharge : 24 m<sup>3</sup>/s  
 Type : rectangular concrete wall  
 Bottom width : 6 m & height : 2.0 m  
 Length : 220 m  
 Excavation : 2,500 m<sup>3</sup>  
 Concrete : 660 m<sup>3</sup>

Stretch R2-2 Downstream (Downstream half between Jct. with Canal N2 and U/S end)

First Stage

(1) River improvement  
 Design discharge : 8 m<sup>3</sup>/s  
 Type : trapezoidal earth-lining  
 Bottom width : 2 m  
 Length : 370 m  
 Excavation : 1,000 m<sup>3</sup>  
 Bank protection : 80 m on both bank

(2) Small bridge  
 Type : Concrete box culvert  
 Width : 4.3 m & height : 2.3 m  
 Length : 8 m  
 4 sites

表-3 エンクヒレット川治水計画の諸元 (6/13)

Second Stage

- |                       |  |
|-----------------------|--|
| (1) River improvement | Design discharge : 16 m <sup>3</sup> /s<br>Type : rectangular concrete wall<br>Bottom width : 4.3 m & height : 2.0 m<br>Length : 338 m<br>Excavation : 3,200 m <sup>3</sup><br>Concrete : 870 m <sup>3</sup> |
|-----------------------|--|

Stretch R2-2 Upstream (Upstream half between junction. with Canal N2 and U/S end)

First Stage

- |                       |   |
|-----------------------|---|
| (1) River improvement | Design discharge : 8 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 2 m<br>Length : 328 m<br>Excavation : 1,000 m <sup>3</sup><br>Bank protection : 10 m on both bank |
|-----------------------|---|

- |                            |  |
|----------------------------|--|
| (2) Small bridge to quarry | Type : Concrete box culvert<br>Width : 3.2 m & height : 1.8 m<br>Length : 12 m<br>1 site |
|----------------------------|--|

Second Stage

- |                       |  |
|-----------------------|--|
| (1) River improvement | Design discharge : 16 m <sup>3</sup> /s<br>Type : rectangular concrete wall<br>Bottom width : 3.2 m & height : 1.5 m<br>Length : 316 m<br>Excavation : 2,100 m <sup>3</sup><br>Concrete : 600 m <sup>3</sup> |
|-----------------------|--|

Canal G2

Stretch G2-1 Downstream (D/S between junction with Ennkhilet and junction with tributary)

First Stage

- |                       |  |
|-----------------------|--|
| (1) River improvement | Design discharge : 7 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 2 m & depth : 1.0m<br>Length : 559 m<br>Excavation : 1,600 m <sup>3</sup><br>Bank protection : 20 m on both bank |
|-----------------------|--|

- |                  |   |
|------------------|---|
| (2) Small bridge | Twin type of Concrete box culvert<br>Width : 2.4 m & height : 1.7 m<br>Length : 8 m<br>1 site |
|------------------|---|

表-3 エンクヒレット川治水計画の諸元 (7/13)

<u>Second Stage</u>	
(1) River improvement	Design discharge : 14 m <sup>3</sup> /s Type : trapezoidal earth-lining Bottom width : 2 m & depth : 1.4 m Length : 559 m Excavation : 850 m <sup>3</sup>
Stretch G2-1 Midstream (M/S between junction with Ennkhilet and junction with tributary)	
<u>First Stage</u>	
(1) River improvement	Design discharge : 7 m <sup>3</sup> /s Type : trapezoidal earth-lining Bottom width : 2 m & depth : 0.9m Length : 499 m Excavation : 1,100 m <sup>3</sup> Bank protection : 40 m on both bank
(2) Small bridge	Twin type of concrete box culvert Width : 2.2 m & height : 1.5 m Length : 8 m 2 sites
<u>Second Stage</u>	
(1) River improvement	Design discharge : 14 m <sup>3</sup> /s Type : trapezoidal earth-lining Bottom width : 2 m & depth : 1.2 m Length : 499 m Excavation : 400 m <sup>3</sup>
Stretch G2-1 Upstream (U/S between junction with Ennkhilet and junction with tributary)	
<u>First Stage</u>	
(1) River improvement	Design discharge : 7 m <sup>3</sup> /s Type : trapezoidal earth-lining Bottom width : 2 m & depth : 0.8m Length : 197 m Excavation : 330 m <sup>3</sup>
<u>Second Stage</u>	
(1) River improvement	Design discharge : 14 m <sup>3</sup> /s Type : trapezoidal earth-lining Bottom width : 2 m & depth : 1.1 m Length : 197 m Excavation : 350 m <sup>3</sup>
Stretch G2-2 (from junction with tributary to upstream)	
<u>First Stage</u>	
No river improvement	
<u>Second Stage</u>	
(1) Small bridge	Twin type of Concrete box culvert Width : 1.8 m & height : 1.3 m Length : 8 m



表-3 エンクヒレット川治水計画の諸元 (8/13)

Canal G1

Stretch G1-1 Downstream (D/S half between junction Ennkhilet and junction with Canal G1')

First Stage

- |     |                   |  |
|-----|-------------------|--|
| (1) | River improvement | Design discharge : 12 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 2 m<br>Length : 890 m<br>Excavation : 1,800 m <sup>3</sup><br>Bank protection : 30 m on both bank |
| (2) | Bridge            | Type : Concrete box culvert<br>Width : 4.0 m & height : 2.1 m<br>Length : 17 m<br>1 site   |

Second Stage

- |     |                   |  |
|-----|-------------------|--|
| (1) | River improvement | Design discharge : 24 m <sup>3</sup> /s<br>Type : rectangular concrete wall<br>Bottom width : 4.0 m & height : 1.8 m<br>Length : 873 m<br>Excavation : 7,300 m <sup>3</sup><br>Concrete : 2,000 m <sup>3</sup> |
|-----|-------------------|--|

Stretch G1-1 Upstream (U/S half between junction Ennkhilet and junction with Canal G1')

First Stage

- |     |                   |  |
|-----|-------------------|--|
| (1) | River improvement | Design discharge : 12 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 2 m<br>Length : 223 m<br>Excavation : 340 m <sup>3</sup><br>Bank protection : 20 m on both bank |
| (2) | Bridge            | Type : Concrete box culvert<br>Width : 3.6 m & height : 2.1 m<br>Length : 8 m<br>1 site  |

Second Stage

- |     |                   |  |
|-----|-------------------|--|
| (1) | River improvement | Design discharge : 24 m <sup>3</sup> /s<br>Type : rectangular concrete wall<br>Bottom width : 3.6 m & height : 1.8 m<br>Length : 215 m<br>Excavation : 1,800 m <sup>3</sup><br>Concrete : 470 m <sup>3</sup> |
|-----|-------------------|--|

表-3 エンクヒレット川治水計画の諸元 (9/13)

Stretch G1-2 (from junction with Canal G1' to GP-8)

<u>First Stage</u>	No river improvement
<u>Second Stage</u>	
(1) River improvement	Design discharge : 12 m <sup>3</sup> /s Type : rectangular concrete wall Bottom width : 2.2 m & height : 1.8 m Length : 480 m Excavation : 4,900 m <sup>3</sup> Concrete : 840 m <sup>3</sup>
(2) Bridge	Type : Concrete box culvert Width : 2.2 m & height : 2.1 m Length : 8 m 2 site

Canal G1' (from junction with Canal G1 to GP-8)

<u>First Stage</u>	
(1) River improvement	Design discharge : 10 m <sup>3</sup> /s Type : trapezoidal earth-lining Bottom width : 2 m Length : 299 m Excavation : 1,400 m <sup>3</sup> Bank protection : 20 m on both bank
(2) Bridge	Type : Concrete box culvert Width : 3.2 m & height : 2.1 m Length : 8 m 1 site
<u>Second Stage</u>	
(1) River improvement	Design discharge : 20 m <sup>3</sup> /s Type : rectangular concrete wall Bottom width : 3.2 m & height : 1.8 m Length : 299 m Excavation : 2,400 m <sup>3</sup> Concrete : 610 m <sup>3</sup>

Canal C4 ( from Retarding Basin I to Retarding Basin G)

<u>First Stage</u>	No river improvement
<u>Second Stage</u>	
(1) River improvement (To construct additional concrete box culvert)	Design discharge : 5 m <sup>3</sup> /s Existing culvert : 2.6 m <sup>3</sup> /s Additional culvert : 2.4 m <sup>3</sup> /s Length : 555 m Single type of concrete box culvert Width : 1.2 m & height : 1.2 m Excavation : 4,600 m <sup>3</sup> Concrete : 1,050 m <sup>3</sup>

表-3 エンクヒレット川治水計画の諸元 (10/13)

Flood Diversion No.3

Stretch Div.3 D/S ( from Sebkheth Ariana to junction with tributary)

First Stage

- |     |                                     |   |
|-----|-------------------------------------|---|
| (1) | River improvement                   | Design discharge : 22 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 14 m<br>Length : 1,861 m<br>Excavation : 43,000 m <sup>3</sup><br>Embankment : 15,500 m <sup>3</sup><br>Bank protection : 100 m on both bank |
| (2) | Bridge for RVE-543 Road             | Width : 12 m<br>Length : 43 m   |
| (3) | Rehabilitation of ONAS Sewage Canal | Length : 50 m   |
| (4) | Rehabilitation of ONAS Sewage Pipe  | Length : 50 m   |
| (5) | Drainage Sluiceway                  | 4 nos   |

Second Stage

- |     |                   |   |
|-----|-------------------|---|
| (1) | River improvement | Design discharge : 50 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 34 m<br>Length : 1,861 m<br>Excavation : 53,000 m <sup>3</sup> |
|-----|-------------------|---|

Stretch Div.3 U/S ( from junction with tributary to junction with Oued Enkhilet)

First Stage

- |     |                         |   |
|-----|-------------------------|---|
| (1) | River improvement       | Design discharge : 5 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 2 m & depth : 1.3 m<br>Length : 1,939 m<br>Excavation : 8,600 m <sup>3</sup><br>Embankment : 10,200 m <sup>3</sup><br>Bank protection : 70 m on both bank |
| (2) | Small bridge            | Twin type of concrete box culvert<br>Width : 3.0 m & height : 2.2 m<br>Length : 8 m<br>3 sites  |
| (3) | Bridge for RVE-533 Road | Type : Concrete box culvert<br>Width : 2.5 m & height : 2.2 m<br>Length : 25 m  |
| (4) | Drainage Sluiceway      | 2 nos   |

to be continued

表-3 エンクヒレット川治水計画の諸元 (11/13)

Second Stage

- |   |   |
|---|---|
| (1) River improvement                               | Design discharge : 12 m <sup>3</sup> /s<br>Type : trapezoidal earth-lining<br>Bottom width : 2 m & depth : 1.9 m<br>Length : 1,939 m<br>Excavation : 8,400 m <sup>3</sup> |
| (2) Bridge for RVE-533 Road<br>(Additional culvert) | Type : Concrete box culvert<br>Width : 3.5 m & height : 2.2 m<br>Length : 25 m  |

Flood Diversion No.4 (from junction with Canal C1 to junction with Oued Enkhilet)

First Stage

- |                       |   |
|-----------------------|---|
| (1) River improvement | Design discharge : 16 m <sup>3</sup> /s<br>Length : 288 m (incl. under RVE-533)<br>Single type of concrete box culvert<br>width : 3.4 m & height : 2.2m<br>Excavation : 5,800 m <sup>3</sup><br>Concrete : 1,130 m <sup>3</sup> |
|-----------------------|---|

Second Stage

- |  |  |
|--|--|
| (1) River improvement<br>(To construct additional<br>concrete box culvert) | Design discharge : 35 m <sup>3</sup> /s<br>First stage : 16 m <sup>3</sup> /s<br>Additional culvert : 19 m <sup>3</sup> /s<br>Length : 288 m (incl. under RVE-533)<br>Single type of concrete box culvert<br>width : 3.8 m & height : 2.2m<br>Excavation : 4,900 m <sup>3</sup><br>Concrete : 1,200 m <sup>3</sup> |
|--|--|

Retarding Basin - A

First Stage

- |                      |   |
|----------------------|---|
| (1) Type             | Concrete wall dam   |
| (2) Dimension        | Dam crest elevation : EL.43.0 m<br>Maximum storage volume : 7,800 m <sup>3</sup><br>Dam height : 4.5 m<br>Dam crest length : 40 m<br>Orifice size : 0.2 m x 0.2 m |
| (3) Work Volume      | Excavation volume : 1,100 m <sup>3</sup><br>Concrete volume : 260 m <sup>3</sup><br>Screen weight : 1.2 ton   |
| (4) Hydraulic Design | Peak discharge of inflow (10-yr) : 5.4 m <sup>3</sup> /s<br>Peak discharge of outflow (10-yr) : 0.2 m <sup>3</sup> /s<br>Maximum water level : EL.41.5 m          |

Second Stage

- |                      |   |
|----------------------|---|
| (1) Extension Work   | Extension of Orifice  |
| (2) Dimension        | Orifice size : 0.6 m x 0.6 m  |
| (3) Hydraulic Design | Peak discharge of inflow (100-yr) : 10.9 m <sup>3</sup> /s<br>Peak discharge of outflow (100-yr) : 1.9 m <sup>3</sup> /s<br>Maximum water level : EL.42.6 m |

表-3 エンクヒレット川治水計画の諸元 (12/13)

Retarding Basin - G

First Stage

- |                      |  |
|----------------------|--|
| (1) Type             | Pond type  |
| (2) Dimension        | Pond area : 0.66 ha<br>Maximum storage volume : 17,400 m <sup>3</sup><br>Pond bed elevation : EL.16.7 m<br>Average pond height : 5.3 m<br>Orifice size : 0.55 m x 0.55 m |
| (3) Work Volume      | Excavation volume : 25,600 m <sup>3</sup><br>Concrete volume : 40 m <sup>3</sup><br>Screen weight : 1.4 ton  |
| (4) Hydraulic Design | Peak discharge of inflow (10-yr) : 9.3 m <sup>3</sup> /s<br>Peak discharge of outflow (10-yr) : 1.5 m <sup>3</sup> /s<br>Maximum water level : EL.20.7 m                 |

Second Stage

- |                      |  |
|----------------------|--|
| (1) Extension Work   | Extension of pond and construction of new outlet structure with same dimension as in the first stage   |
| (2) Dimension        | Pond area : 1.26 ha<br>Maximum storage volume : 37,500 m <sup>3</sup><br>Pond bed elevation : EL.16.7 m<br>Average pond height : 5.2 m<br>Orifice size : 0.55 m x 0.55 m |
| (3) Work Volume      | Excavation volume : 27,600 m <sup>3</sup><br>Concrete volume : 40 m <sup>3</sup><br>Screen weight : 1.4 ton  |
| (4) Hydraulic Design | Peak discharge of inflow (100-yr) : 18.9 m <sup>3</sup> /s<br>Peak discharge of outflow (100-yr) : 2.8 m <sup>3</sup> /s<br>Maximum water level : EL.20.7 m              |

Retarding Basin - I

First Stage

- |                      |   |
|----------------------|---|
| (1) Type             | Pond type   |
| (2) Dimension        | Pond area : 1.45 ha<br>Maximum storage volume : 22,500 m <sup>3</sup><br>Pond bed elevation : EL.7.1 m<br>Average pond height : 3.3 m<br>Orifice size : 0.6 m x 0.6 m |
| (3) Work Volume      | Excavation volume : 42,700 m <sup>3</sup><br>Concrete volume : 30 m <sup>3</sup><br>Screen weight : 0.8 ton   |
| (4) Hydraulic Design | Peak discharge of inflow (10-yr) : 5.8 m <sup>3</sup> /s<br>Peak discharge of outflow (10-yr) : 1.2 m <sup>3</sup> /s<br>Maximum water level : EL.9.0 m               |

Second Stage

- |                      |  |
|----------------------|--|
| (1) Extension Work   | Extension of orifice   |
| (2) Dimension        | Orifice size : 1.7 m x 1.7 m   |
| (3) Hydraulic Design | Peak discharge of inflow (100-yr) : 11.6 m <sup>3</sup> /s<br>Peak discharge of outflow (100-yr) : 6.6 m <sup>3</sup> /s<br>Maximum water level : EL.9.0 m |

表-3 エンクヒレット川治水計画の諸元 (13/13)

Retarding Basin - J1

First Stage

(1) Type	Pond type
(2) Dimension	Pond area : 1.47 ha Maximum storage volume : 19,600 m <sup>3</sup> Pond bed elevation : EL.7.2 m Average pond height : 2.8 m Orifice size : 0.4 m x 0.4 m
(3) Work Volume	Excavation volume : 24,100 m <sup>3</sup> Concrete volume : 80 m <sup>3</sup> Screen weight : 0.7 ton
(4) Hydraulic Design	Peak discharge of inflow (10-yr) : 7.6 m <sup>3</sup> /s Peak discharge of outflow (10-yr) : 0.5 m <sup>3</sup> /s Maximum water level : EL.8.7 m

Second Stage

(1) Extension Work	Extension of Pond & orifice
(2) Dimension	Pond area : 2.35 ha Maximum storage volume : 32,100 m <sup>3</sup> Pond bed elevation : EL.7.2 m Average pond height : 2.8 m Orifice size : 1.4 m x 1.4 m
(3) Work Volume	Excavation volume : 15,200 m <sup>3</sup>
(4) Hydraulic Design	Peak discharge of inflow (100-yr) : 15.5 m <sup>3</sup> /s Peak discharge of outflow (100-yr) : 3.9 m <sup>3</sup> /s Maximum water level : EL.8.7 m

表-4 ハンマム川治水計画の諸元 (1/3)

Stretch H-1 (Oued Hammam from river mouth to GP-1 Road)

First Stage

- |     |                           |   |
|-----|---------------------------|---|
| (1) | River improvement         | Design discharge : 200 m <sup>3</sup> /s<br>Bottom width : 36 m<br>Length : 572 m<br>Excavation : 15,100 m <sup>3</sup><br>Bank protection : 300 m on both bank |
| (2) | Bridge for Touristic Road | Width : 26 m<br>Length : 84 m   |

Stretch H-2 (Oued Hammam from GP-1 Road to Bypass Road of GP-1 Road)

First Stage

- |     |                      |  |
|-----|----------------------|--|
| (1) | River improvement    | Design discharge : 90 m <sup>3</sup> /s<br>Bottom width : 33 m<br>Length : 560 m<br>Excavation : 37,800 m <sup>3</sup><br>Embankment of dike : 2,500 m <sup>3</sup><br>Bank protection : 60 m on both bank |
| (2) | Bridge for GP-1 Road | Width : 12 m<br>Length : 48 m  |
| (3) | Drainage Sluiceway   | 2 nos  |

Second Stage

- |     |                   |   |
|-----|-------------------|---|
| (1) | River improvement | Design discharge : 200 m <sup>3</sup> /s<br>Length : 560 m<br>Embankment of dike : 4,600 m <sup>3</sup> |
|-----|-------------------|---|

Stretch H-3 (Oued Hammam from Bypass Road of GP-1 to Junction with Oued Kebir)

First Stage

- |     |                    |  |
|-----|--------------------|--|
| (1) | River improvement  | Design discharge : 90 m <sup>3</sup> /s<br>Bottom width : 33 m<br>Length : 565 m<br>Excavation : 18,700 m <sup>3</sup><br>Embankment of dike : 2,600 m <sup>3</sup><br>Bank protection : 50 m on both bank |
| (2) | Drainage Sluiceway | 2 nos  |

Second Stage

- |     |                   |   |
|-----|-------------------|---|
| (1) | River improvement | Design discharge : 200 m <sup>3</sup> /s<br>Length : 565 m<br>Embankment of dike : 3,800 m <sup>3</sup> |
|-----|-------------------|---|

to be continued

表-4 ハンマム川治水計画の諸元 (2/3)

Stretch H-4 (Oued Laia from Junction with Oued Kebir to Upstream)

First Stage

- |     |                    |  |
|-----|--------------------|--|
| (1) | River improvement  | Design discharge : 65 m <sup>3</sup> /s<br>Bottom width : 8 m<br>Length : 250 m<br>Excavation : 1,900 m <sup>3</sup><br>Embankment of dike : 2,600 m <sup>3</sup><br>Bank protection : 30 m on both bank |
| (2) | Drainage Sluiceway | 2 nos  |

Second Stage

- |     |                   |  |
|-----|-------------------|--|
| (1) | River improvement | Design discharge : 140 m <sup>3</sup> /s<br>Bottom width : 20 m<br>Length : 250 m<br>Excavation : 2,700 m <sup>3</sup> |
|-----|-------------------|--|

Stretch K-1 (Oued Kebir from Junction with Oued Hammam to MC-48 Road)

First Stage

- |     |                       |   |
|-----|-----------------------|---|
| (1) | River improvement     | Design discharge : 60 m <sup>3</sup> /s<br>Bottom width : 7 m<br>Length : 884 m<br>Excavation : 23,300 m <sup>3</sup><br>Embankment of dike : 8,100 m <sup>3</sup><br>Bank protection : 60 m on both bank |
| (2) | Bridge for MC-48 Road | Width : 15 m<br>Length : 30 m   |
| (3) | Drainage Sluiceway    | 2 nos   |

Second Stage

- |     |                   |   |
|-----|-------------------|---|
| (1) | River improvement | Design discharge : 130 m <sup>3</sup> /s<br>Bottom width : 18 m<br>Length : 884 m<br>Excavation : 22,300 m <sup>3</sup> |
|-----|-------------------|---|

Stretch K-4 (Oued Kebir from Railway to Junction with Oued Seghir)

First Stage

- |     |                       |   |
|-----|-----------------------|---|
| (1) | River improvement     | Design discharge : 45 m <sup>3</sup> /s<br>Bottom width : 6.5 m<br>Length : 84 m<br>Excavation : 1,600 m <sup>3</sup><br>Embankment of dike : 700 m <sup>3</sup><br>Bank protection : 60 m on both bank |
| (2) | Bridge for MC-48 Road | Width : 12 m<br>Length : 27 m   |

to be continued



表-4 ハンマム川治水計画の諸元 (3/3)

Second Stage

- |                       |   |
|-----------------------|---|
| (1) River improvement | Design discharge : 100 m <sup>3</sup> /s<br>Bottom width : 17 m<br>Length : 84 m<br>Excavation : 600 m <sup>3</sup> |
|-----------------------|---|

Stretch K-5 (Oued Kebir from Junction with Oued Seghir to Upstream)

First Stage

- |                            |   |
|----------------------------|---|
| (1) River improvement      | Design discharge : 35 m <sup>3</sup> /s<br>Bottom width : 4.5 m<br>Length : 1,532 m<br>Excavation : 14,900 m <sup>3</sup><br>Embankment of dike : 10,300 m <sup>3</sup><br>Bank protection : 130 m on both bank |
| (2) Culvert for Small Road | Twin type, width : 4 m & height : 2.6 m<br>Length : 8 m<br>2 site   |
| (3) Drainage Sluiceway     | 2 nos   |

Second Stage

- |  |  |
|--|--|
| (1) River improvement                                  | Design discharge : 75 m <sup>3</sup> /s<br>Bottom width : 12 m<br>Length : 1,532 m<br>Excavation : 21,300 m <sup>3</sup><br>Bank protection : 100 m on both bank |
| (2) Culvert for Small Road<br>to add existing culverts | Single type, width : 4 m & height : 2.6 m<br>Length : 8 m<br>Number : 10 nos (5 site on both banks)  |

表-5 洪水被害算定における単価 (エンクヒレット川)

Category	Coefficient	
	Present (1993)	Future (2020)
1. Residential Areas		
(i) Damage to Buildings		
*Popular/Spontaneous Housing	15/m <sup>2</sup>	15/m <sup>2</sup>
*Medium Standard	25/m <sup>2</sup>	25/m <sup>2</sup>
*High Standard	35/m <sup>2</sup>	35/m <sup>2</sup>
(ii) Damage to Household Articles (per household)	350	350
(iii) Loss of Income to Households (DT per day)		
*Skilled	16	67
*Unskilled	5	22
2. Industrial Sector		
(i) Damage to Buildings	15/m <sup>2</sup>	15/m <sup>2</sup>
(ii) Loss of Income to Workers		(as per households)
3. Agricultural Sector (per hectare)		
(i) Value of Olive Crops	1,600	1,600
(ii) Value of Vegetable Crops	1,800	1,800
(ii) Average loss per ha	1,750	1,750
4. Transport		
(i) Rehabilitation of Roads (per km)		
*Primary	120,000	120,000
*Secondary	80,000	80,000
*Agricultural Roads	25,000	25,000
(ii) Traffic Delays/Value of Time (DT per hour)		
*Skilled Labour	0.5	2.1
* Unskilled Labour	0.16	0.7
*Tourists	1.0	4.0
(iii) Additional Vehicle Operating Costs (DT per 1,000 km)		
*Private Cars/taxis	28.79	28.79
*Buses	51.60	51.60
*Light/Medium trucks	86.11	86.11
*Heavy trucks	236.73	236.73

表-6 エンクヒレット川、現況土地利用下における洪水氾濫域内の土地利用

	<u>Zones</u>					
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
Residential	44.0	41.0	32.0	46.0	25.0	0.0
Agricultural	65.0	66.0	0.0	16.0	75.0	32.0
Commercial	2.0	0.0	0.0	0.0	0.0	0.0
Recreational	0.0	0.0	0.0	0.0	0.0	0.0
Wetlands	0.0	7.0	0.0	15.0	0.0	42.0
Open Space	6.0	124.0	32.0	51.0	0.0	18.0
Infrastructure(schools)	0.0	4.0	4.0	0.0	0.0	0.0
<u>Total:</u>	<u>117.0</u>	<u>242.0</u>	<u>68.0</u>	<u>128.0</u>	<u>100.0</u>	<u>92.0</u>

表-7 エンクヒレット川、将来土地利用下における洪水氾濫域内の土地利用

	<u>Zones</u>					
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
Residential	112.0	127.0	64.0	57.0	53.0	0.0
Agricultural	0.0	32.0	0.0	0.0	0.0	14.0
Commercial	3.0	0.0	0.0	0.0	0.0	0.0
Recreational	0.5	1.2	0.0	0.0	7.0	0.0
Wetlands	0.0	40.0	0.0	38.0	40.0	28.0
Open Space	1.0	40.0	0.0	24.0	0.0	50.0
Infrastructure(schools)	0.5	1.8	4.0	9.0	0.0	0.0
<u>Total:</u>	<u>117.0</u>	<u>242.0</u>	<u>68.0</u>	<u>128.0</u>	<u>100.0</u>	<u>92.0</u>

表一 8 洪水被害算定における単価 (ハンナム川)

Category	Coefficient	
	Present (1993)	Future (2020)
1. Residential Areas		
(i) Damage to Buildings		
*Popular/Spontaneous Housing	15/m <sup>2</sup>	15/m <sup>2</sup>
*Medium Standard	25/m <sup>2</sup>	25/m <sup>2</sup>
(ii) Damage to Household Articles (per household)	350	350
(iii) Loss of Income to Households (TD per day)		
*Skilled	16	67
*Unskilled	5	22
2. Industrial Sector		
(i) Damage to Buildings	15/m <sup>2</sup>	15/m <sup>2</sup>
(ii) Loss of Income to workers		( as per households)
3. Agricultural Sector (per hectare)		
(i) Value of Olive Crops	1,600	1,600
(ii) Value of vegetable crops	1,200	1,200
4. Transport		
(i) Rehabilitation of Roads (per km)		
*Primary	120,000	120,000
*Secondary	80,000	80,000
*Agricultural Roads	25,000	25,000
(ii) Traffic Delays/Value of Time (DT per hour)		
*Skilled Labour	0.5	2.1
* Unskilled Labour	0.16	0.7
*Tourists	1.0	4.0
(iii) Additional Vehicle Operating Costs (DT per 1,000km)		
*Private Cars/taxis	28.79	28.79
*Buses	51.60	51.60
*Light/Medium trucks	86.11	86.11
*Heavy trucks	236.73	236.73

表-9 ハンママ川、現況土地利用下における洪水氾濫域内の土地利用

	<u>Zones (ha)</u>						
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
Agricultural	107	23	25	13	5	12	5
Urban	30	10	3	0	1	1	1
Open	16	6	10	6	5	3	6
<u>TOTAL:</u>	<u>153</u>	<u>39</u>	<u>38</u>	<u>19</u>	<u>11</u>	<u>16</u>	<u>12</u>

表-10 ハンママ川、将来土地利用下における洪水氾濫域内の土地利用

	<u>Zones (ha)</u>						
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
Agriculture	74	20	25	15	7	13	5
Urban	70	16	6	0	3	1	2
Open	16	6	10	6	5	3	6
<u>TOTAL:</u>	<u>160</u>	<u>42</u>	<u>41</u>	<u>21</u>	<u>15</u>	<u>17</u>	<u>13</u>

表-11 ハンママ川、100年洪水における洪水被害額

<u>Zone</u>	<u>Present Land Use Conditions</u>	<u>Future Land Use Conditions</u>
	(DT1,000)	
A	5,405.0	12,530.0
B	845.7	1,296.4
C	264.6	745.5
D	30.0	34.5
E	111.0	409.0
F	69.5	73.0
G	79.0	218.0
<u>TOTAL:</u>	<u>6,804.8</u>	<u>15,306.4</u>

表-12 ハンママ川、1年および10年洪水における洪水被害額

<u>Area</u>	<u>Present Land Use Condition</u>		<u>Future Land Use Condition</u>	
	<u>1-yr</u>	<u>10-yr</u>	<u>1-yr</u>	<u>10-yr</u>
A	261	2,030	498	4,993
B	75	459	84	771
C	57	66	250	261
D	0	5	0	7
E	10	20	40	72
F	5	10	5	13
G	23	46	75	127
<u>Total:</u>	<u>431</u>	<u>2,636</u>	<u>952</u>	<u>6,244</u>

表-13 エンクヒレット川治水計画の経済費用と便益収支表

EIRR = 24.6%		(Unit : 1,000 DT)				
No.	Year	Cost			Benefit	Net Benefit
		Construction	O&M	Total		
1	1994	19	0	19	0	-19
2	1995	4,666	0	4,666	0	-4,666
3	1996	1,673	23	1,696	663	-1,033
4	1997	3,732	82	3,814	1,327	-2,487
5	1998	2,385	117	2,502	1,990	-512
6	1999		117	117	2,653	2,536
7	2000		117	117	2,894	2,777
8	2001		117	117	3,136	3,019
9	2002		117	117	3,377	3,260
10	2003		117	117	3,618	3,501
11	2004		117	117	3,860	3,743
12	2005		117	117	4,101	3,984
13	2006		117	117	4,342	4,225
14	2007		117	117	4,584	4,467
15	2008		117	117	4,825	4,708
16	2009		117	117	5,066	4,949
17	2010		117	117	5,307	5,190
18	2011		117	117	5,549	5,432
19	2012		117	117	5,790	5,673
20	2013		117	117	6,031	5,914
21	2014		117	117	6,273	6,156
22	2015		117	117	6,514	6,397
23	2016		117	117	6,755	6,638
24	2017		117	117	6,997	6,880
25	2018		117	117	7,238	7,121
26	2019		117	117	7,479	7,362
27	2020		117	117	7,720	7,603
28	2021		117	117	7,720	7,603
29	2022		117	117	7,720	7,603
30	2023		117	117	7,720	7,603
31	2024		117	117	7,720	7,603
32	2025		117	117	7,720	7,603
33	2026		117	117	7,720	7,603
34	2027		117	117	7,720	7,603
35	2028		117	117	7,720	7,603
.	.		.	.	.	.
.	.		.	.	.	.
.	.		.	.	.	.
50	2043		117	117	7,720	7,603

表-14 ハンナム川治水計画の経済費用と便益収支表

EIRR = 17.4%		(Unit : 1,000 DT)				
No.	Year	Cost			Benefit	Net Benefit
		Construction	O&M	Total		
1	1994	18	0	18	0	-18
2	1995	774	0	774	0	-774
3	1996	1,627	23	1,650	317	-1,333
4	1997	3,629	80	3,709	634	-3,075
5	1998	2,320	114	2,434	951	-1,483
6	1999		114	114	1,268	1,154
7	2000		114	114	1,318	1,204
8	2001		114	114	1,369	1,255
9	2002		114	114	1,419	1,305
10	2003		114	114	1,470	1,356
11	2004		114	114	1,520	1,406
12	2005		114	114	1,571	1,457
13	2006		114	114	1,621	1,507
14	2007		114	114	1,672	1,558
15	2008		114	114	1,722	1,608
16	2009		114	114	1,773	1,659
17	2010		114	114	1,823	1,709
18	2011		114	114	1,874	1,760
19	2012		114	114	1,924	1,810
20	2013		114	114	1,975	1,861
21	2014		114	114	2,025	1,911
22	2015		114	114	2,076	1,962
23	2016		114	114	2,126	2,012
24	2017		114	114	2,177	2,063
25	2018		114	114	2,227	2,113
26	2019		114	114	2,278	2,164
27	2020		114	114	2,328	2,214
28	2021		114	114	2,328	2,214
29	2022		114	114	2,328	2,214
30	2023		114	114	2,328	2,214
31	2024		114	114	2,328	2,214
32	2025		114	114	2,328	2,214
33	2026		114	114	2,328	2,214
34	2027		114	114	2,328	2,214
35	2028		114	114	2,328	2,214
.	.		.	.	.	.
.	.		.	.	.	.
.	.		.	.	.	.
50	2043		114	114	2,328	2,214

# 付 図





Phase 1: Basic Investigation

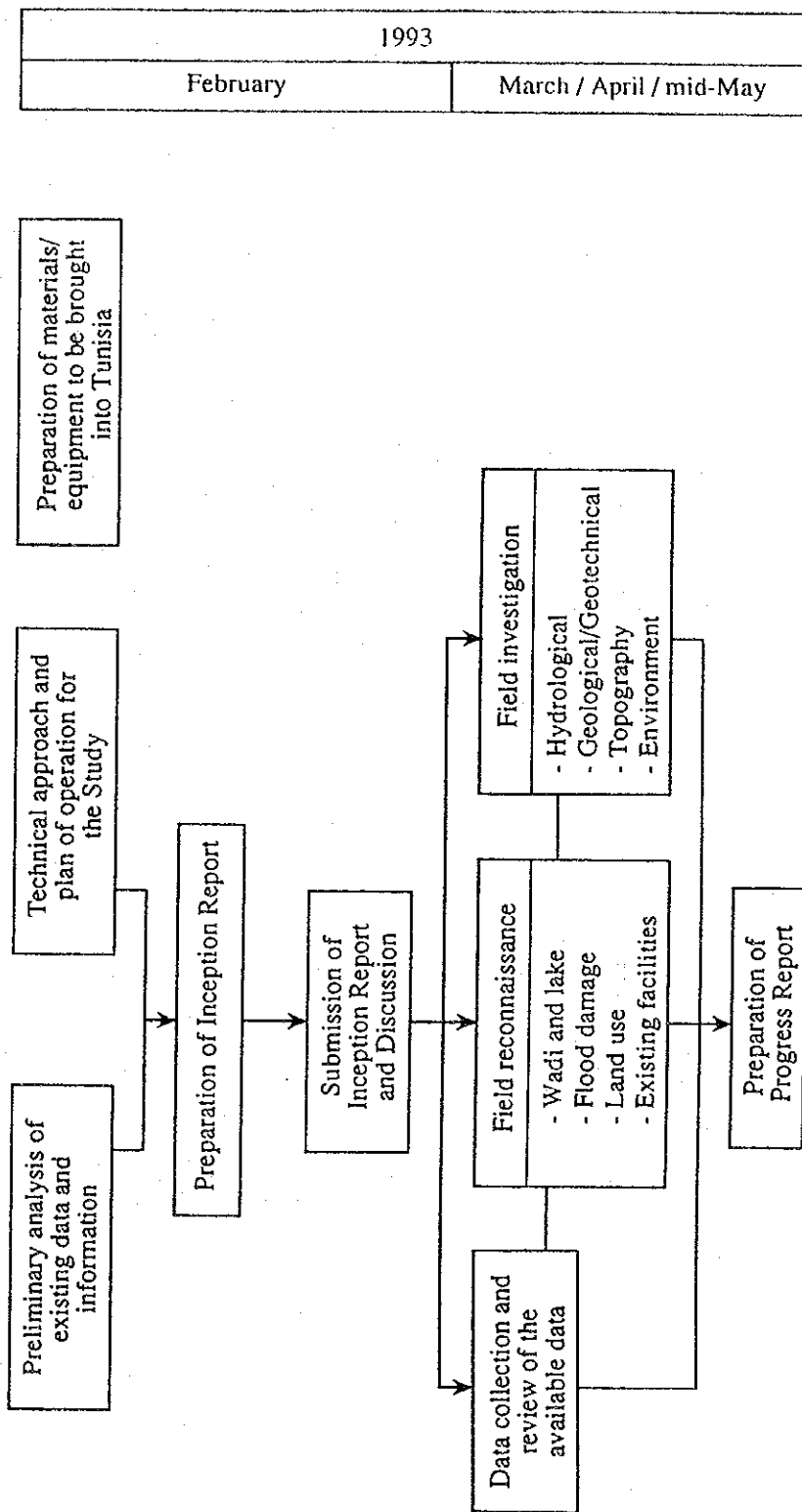


図-1 作業の流れ図 (1/3)

Phase 2: Formulation of Master Plan for Flood Protection

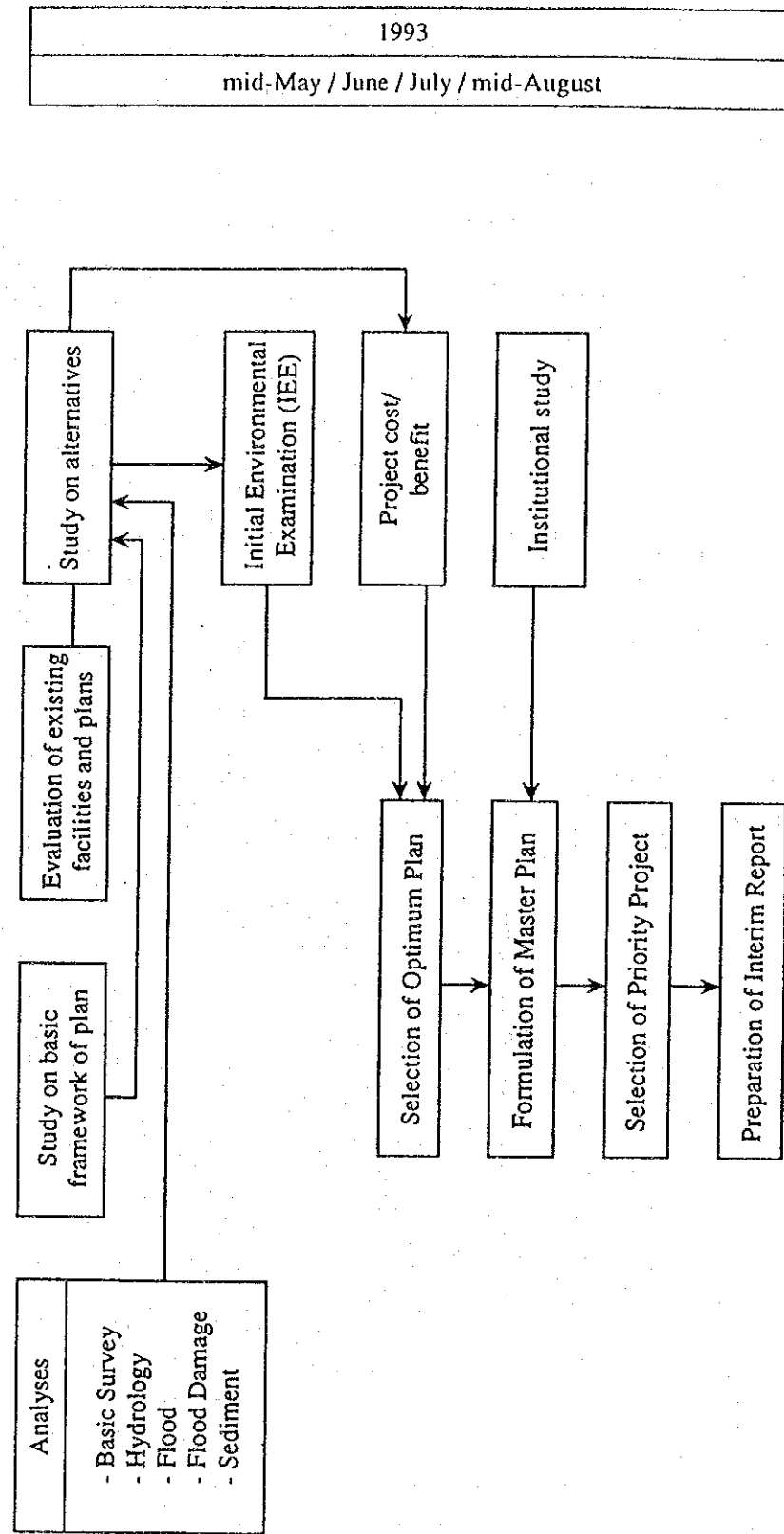


図-1 作業の流れ図 (2/3)

Phase 3: Feasibility Study on Priority Projects

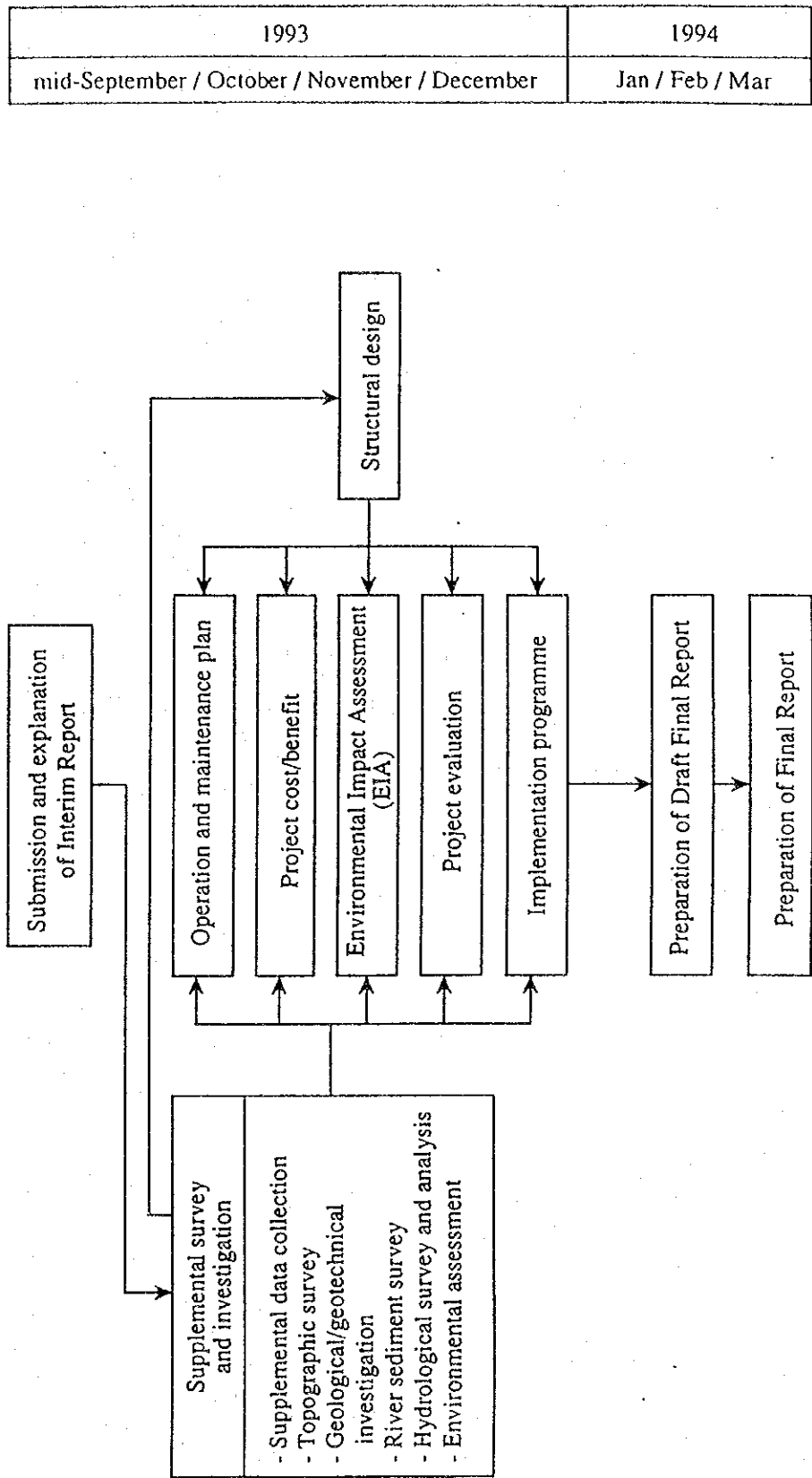


図 - 1 作業の流れ図 (3/3)

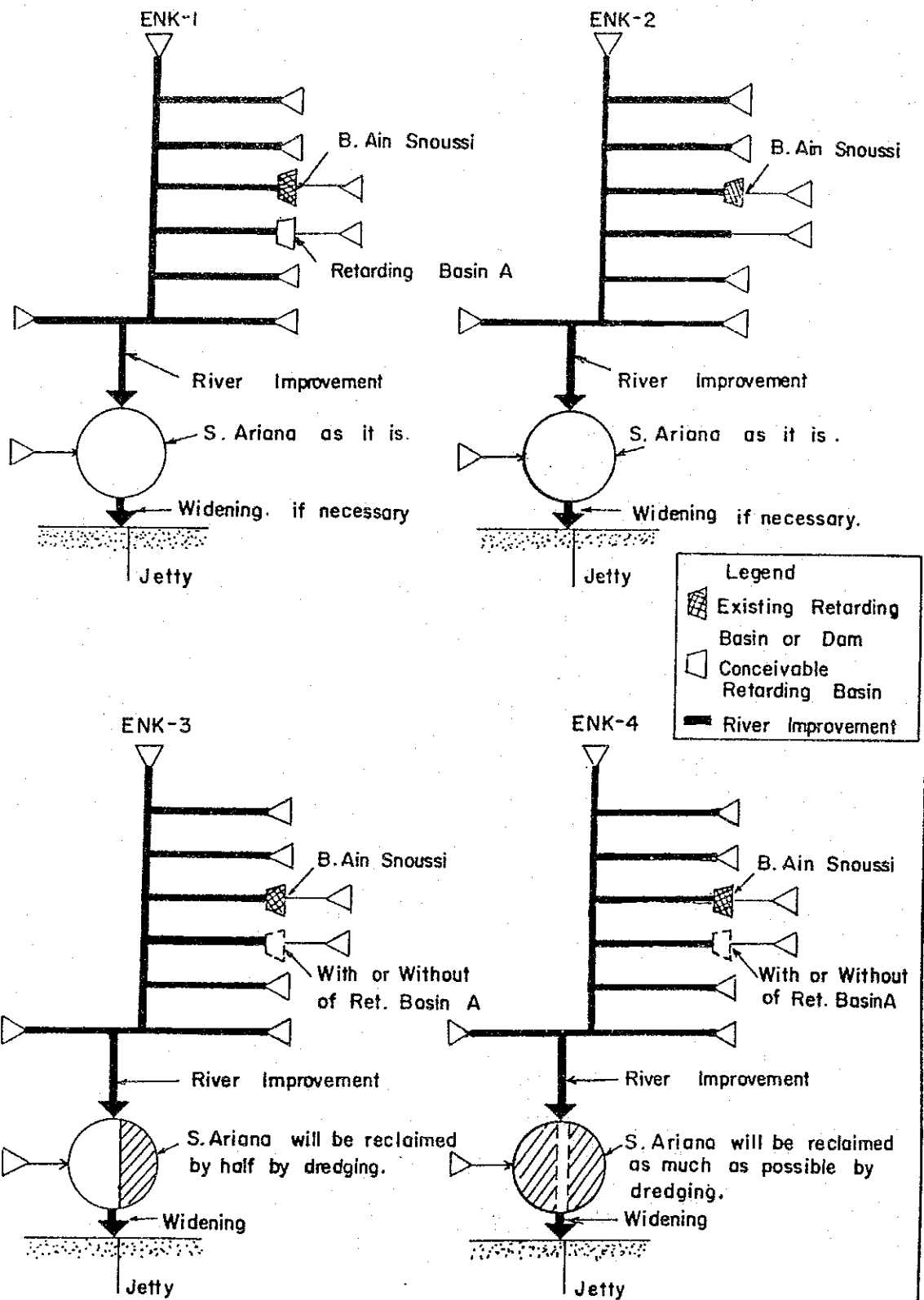


図-2 エンクレット川及びアリアナ湖改修計画代替案

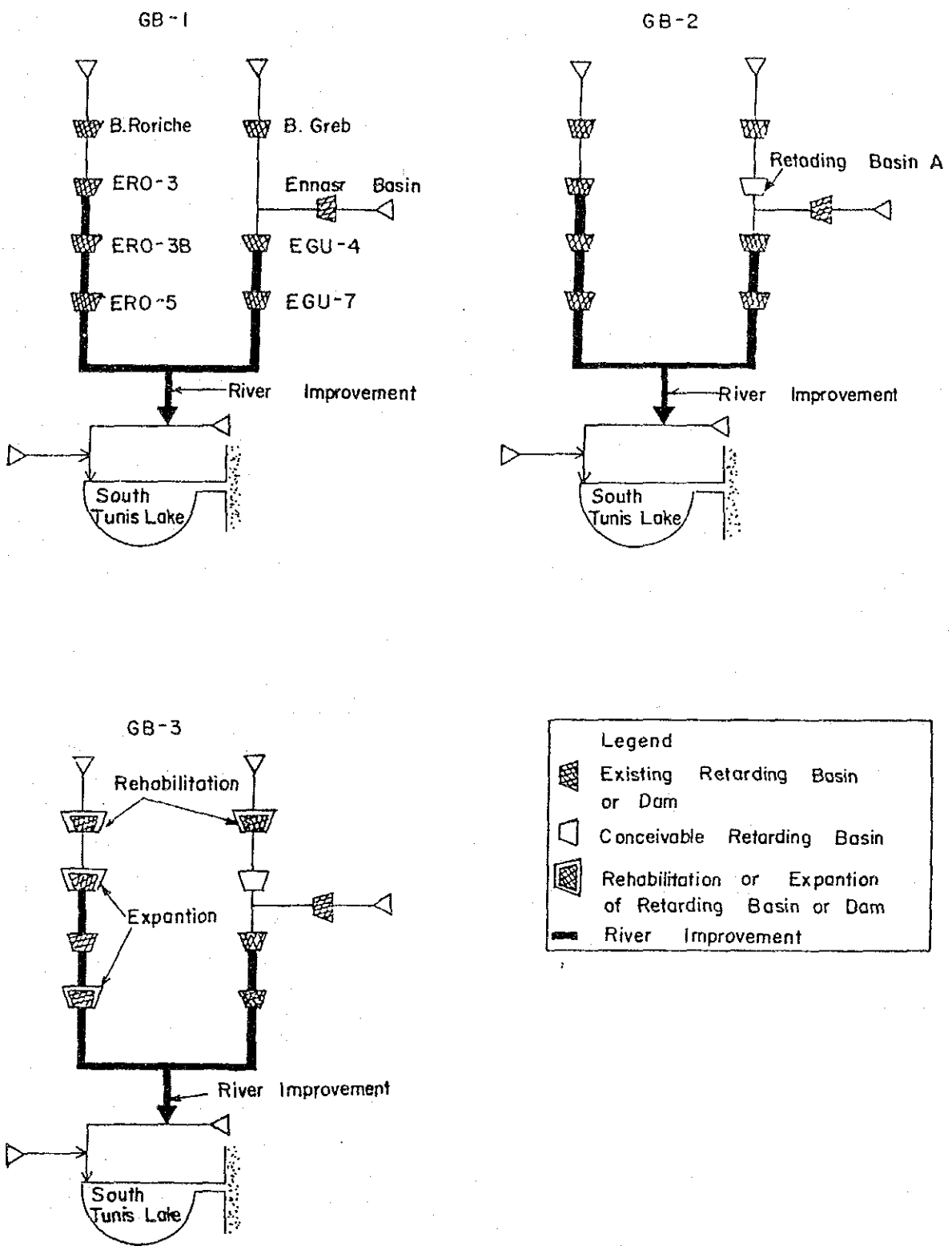
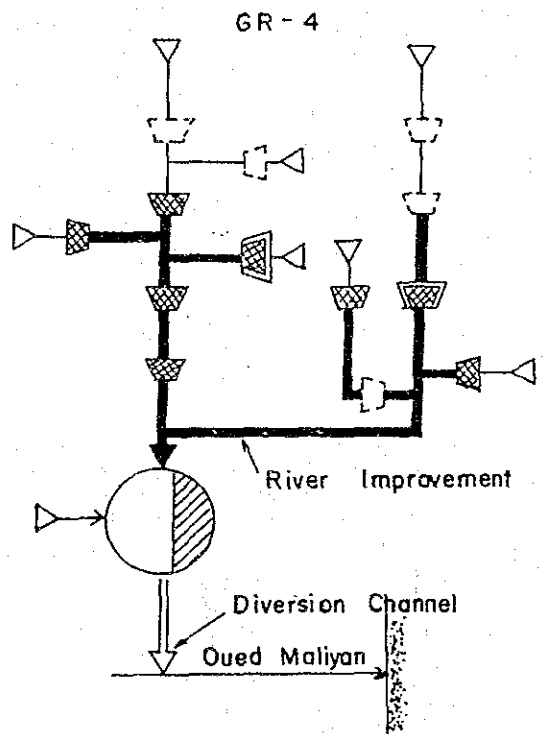
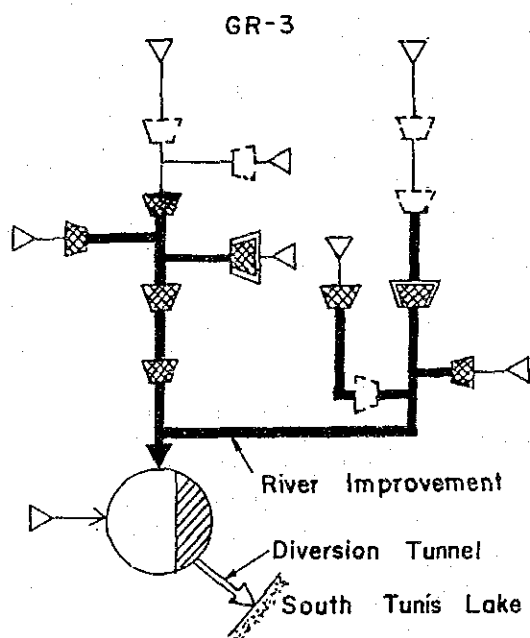
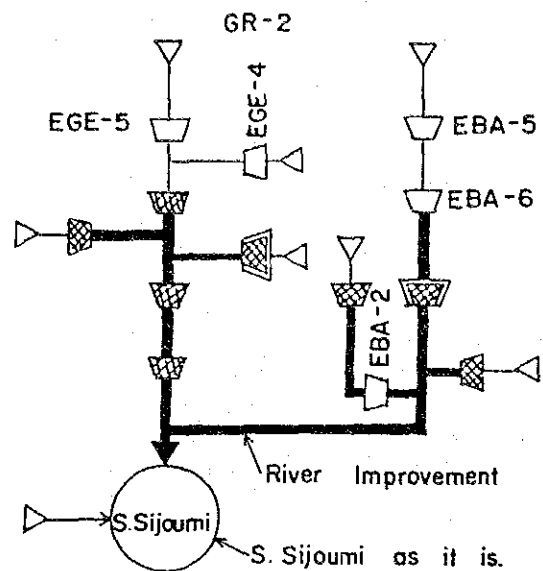
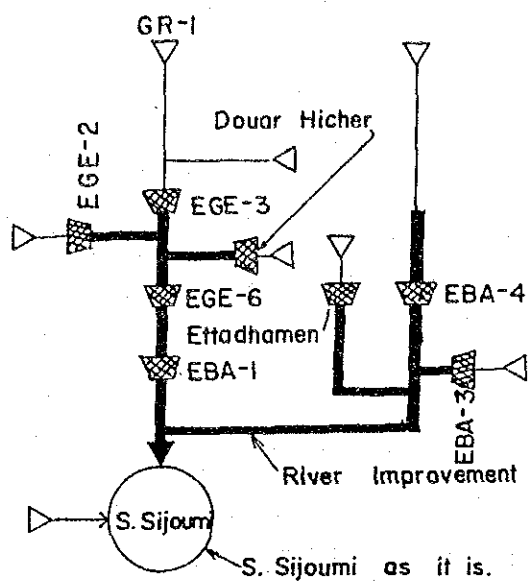


図-3 グレブ川改修計画代替案



GR-3-1 S. Sijoumi reduced 15%  
with GR-1 or GR-2

GR-3-2 S. Sijoumi reduced 30%  
with GR-1 or GR-2

GR-4-1 S. Sijoumi reduced 15%  
with GR-1 or GR-2

GR-4-2 S. Sijoumi reduced 30%  
with GR-1 or GR-2

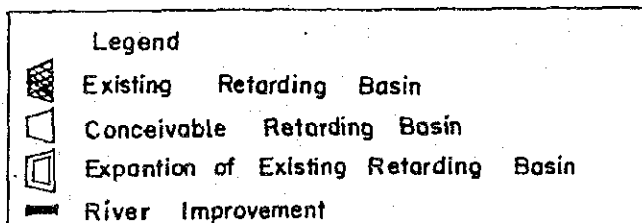


図-4 ガリアナ川及びシジュミ湖改修計画代替案

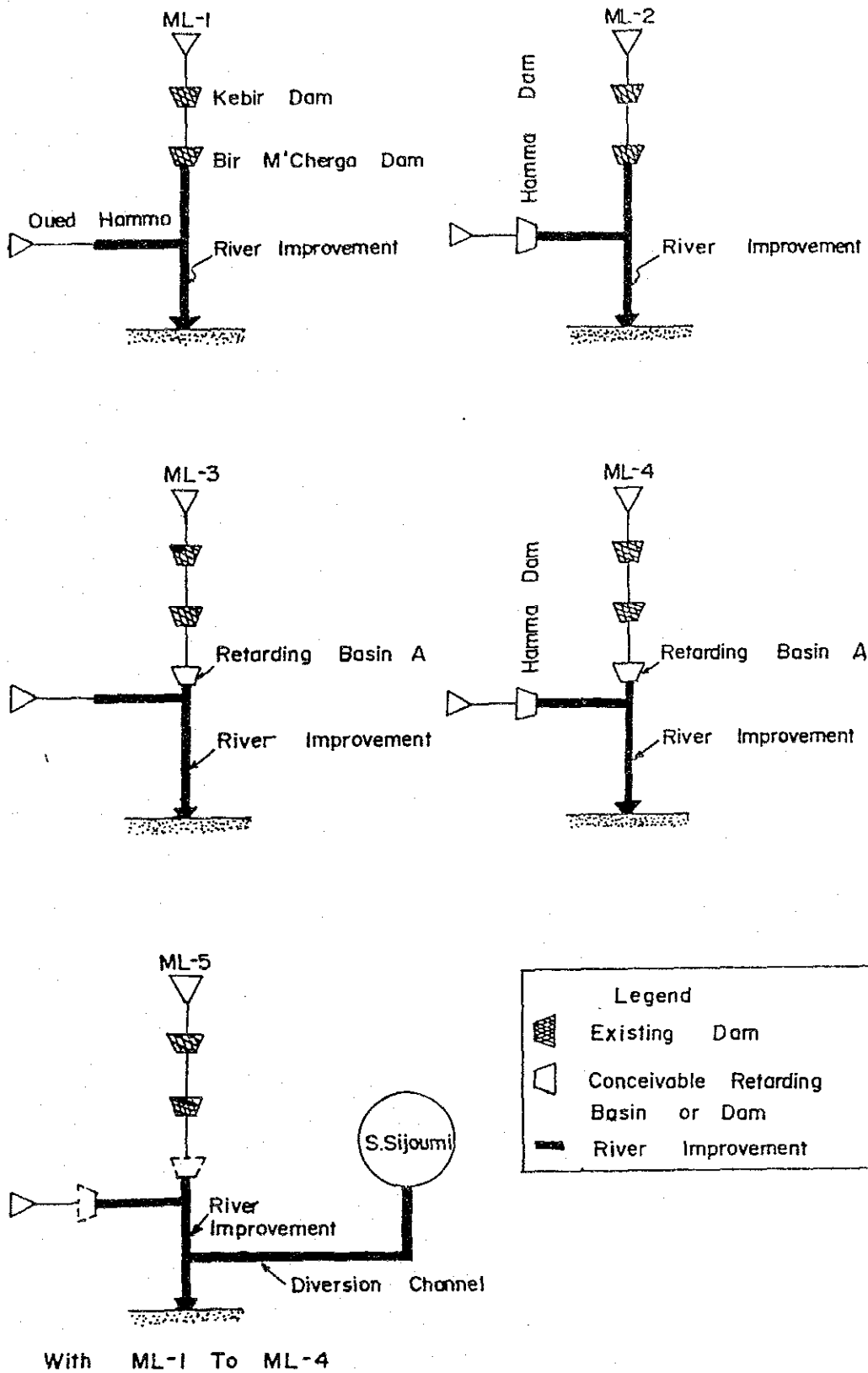


図-5 マリヤン川改修計画代替案



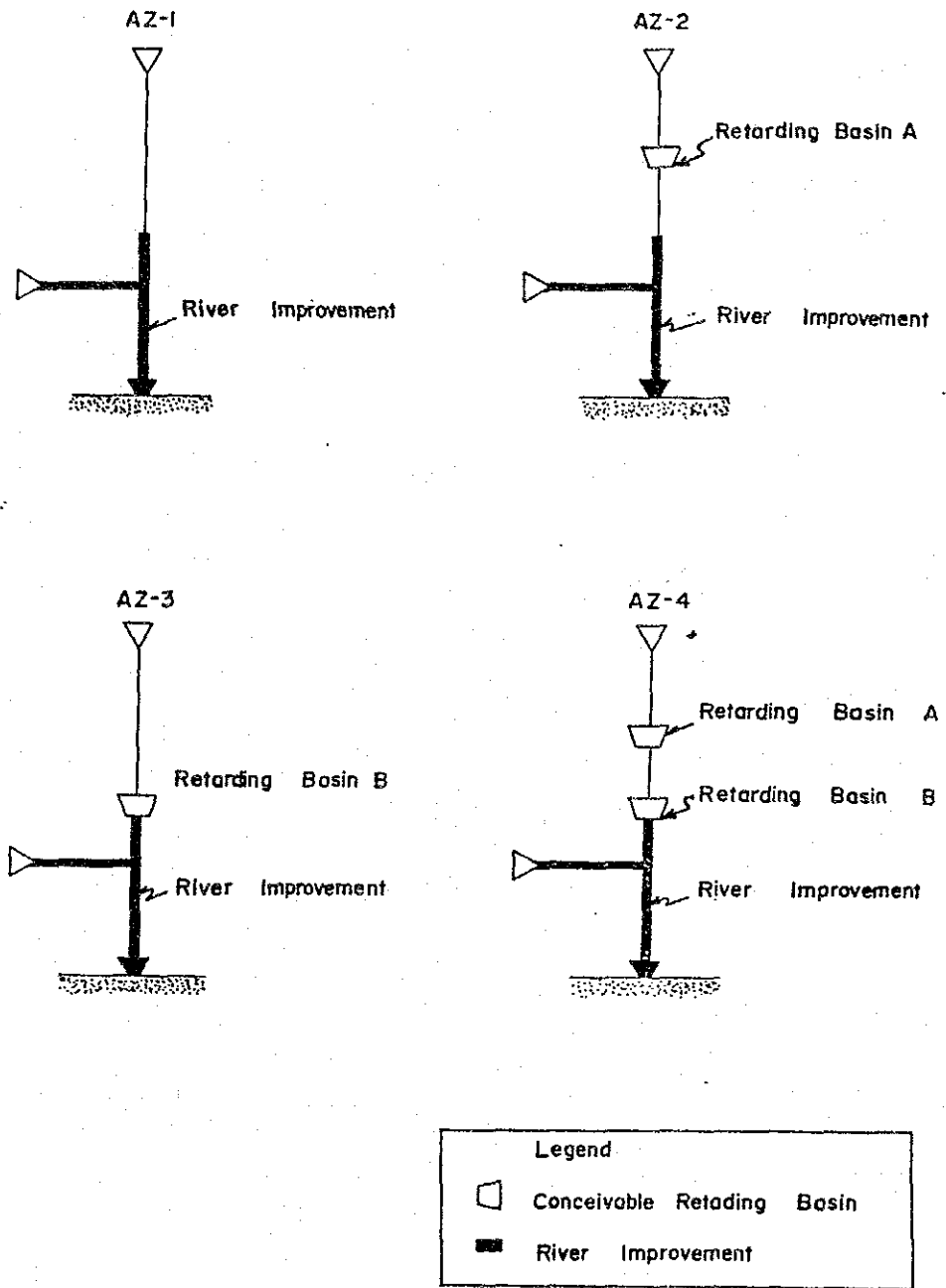


図-6 アインゼルガ川改修計画代替案

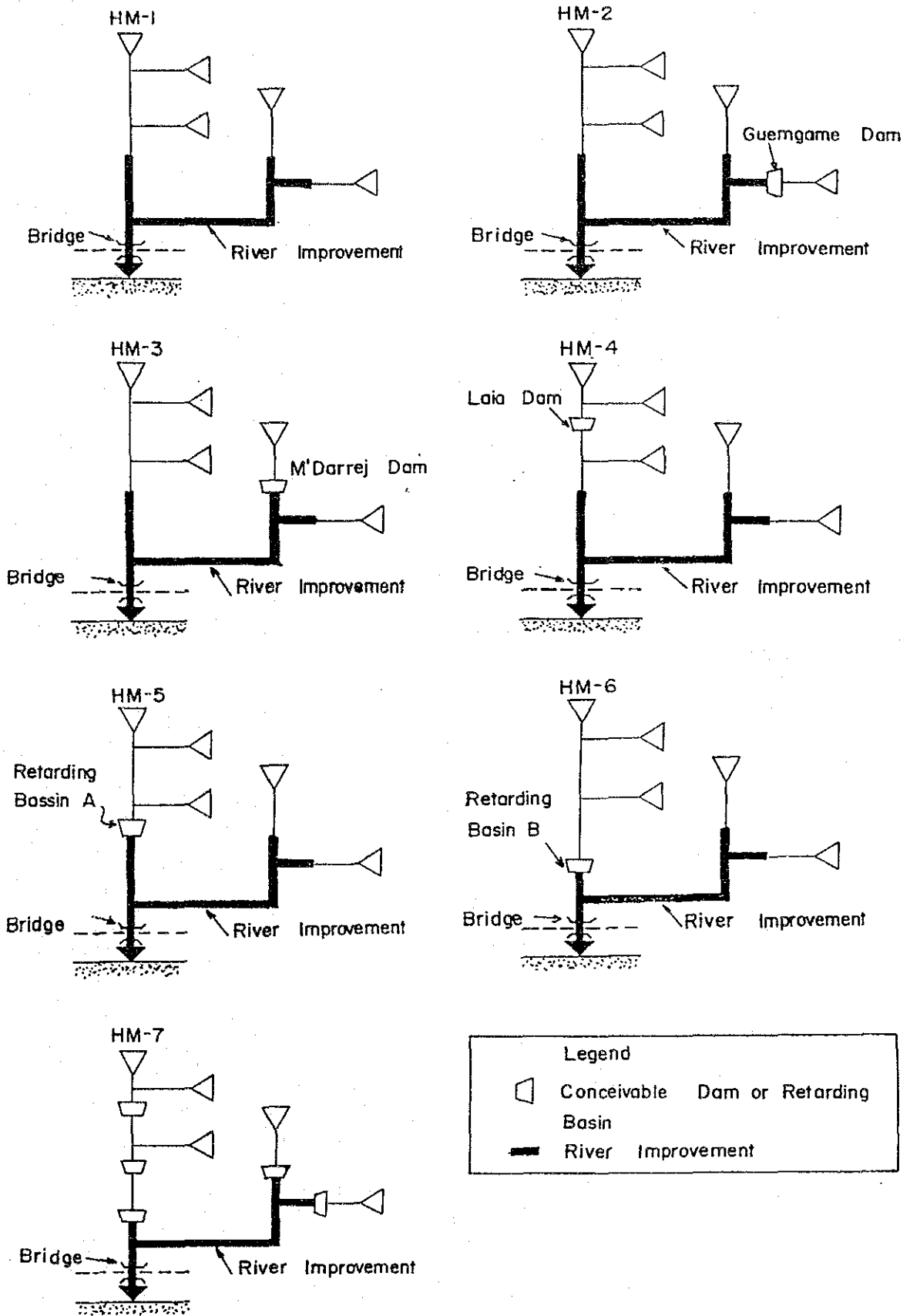
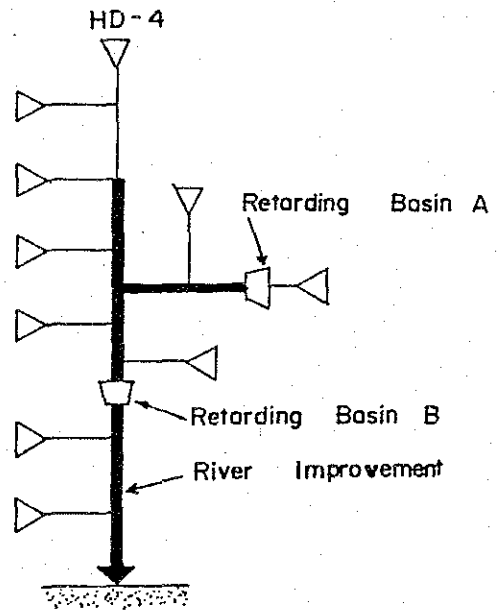
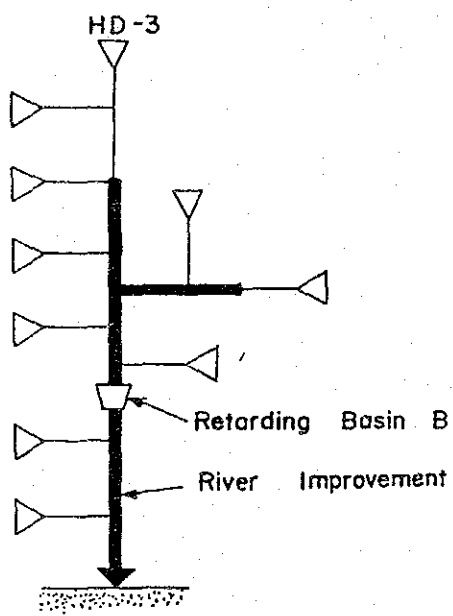
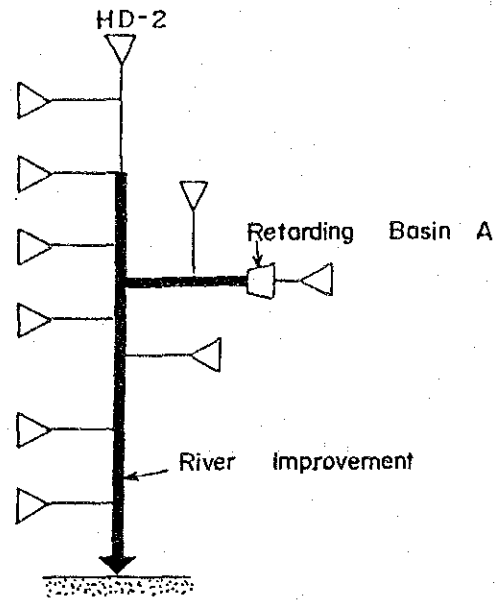
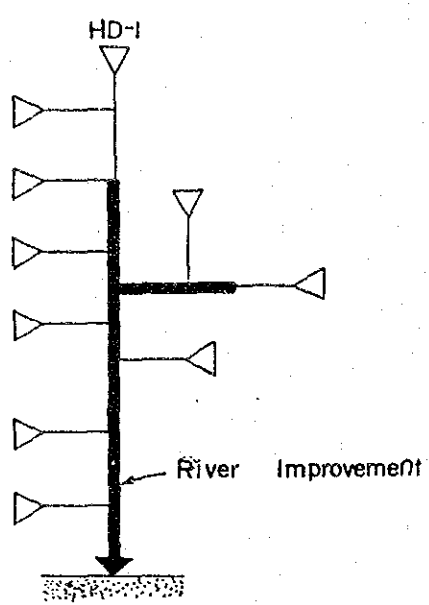


図-7 ハンمام川改修計画代替案



Legend



-  Conceivable Retarding Basin
-  River Improvement

図-8 ハムドゥーン川改修計画代替案



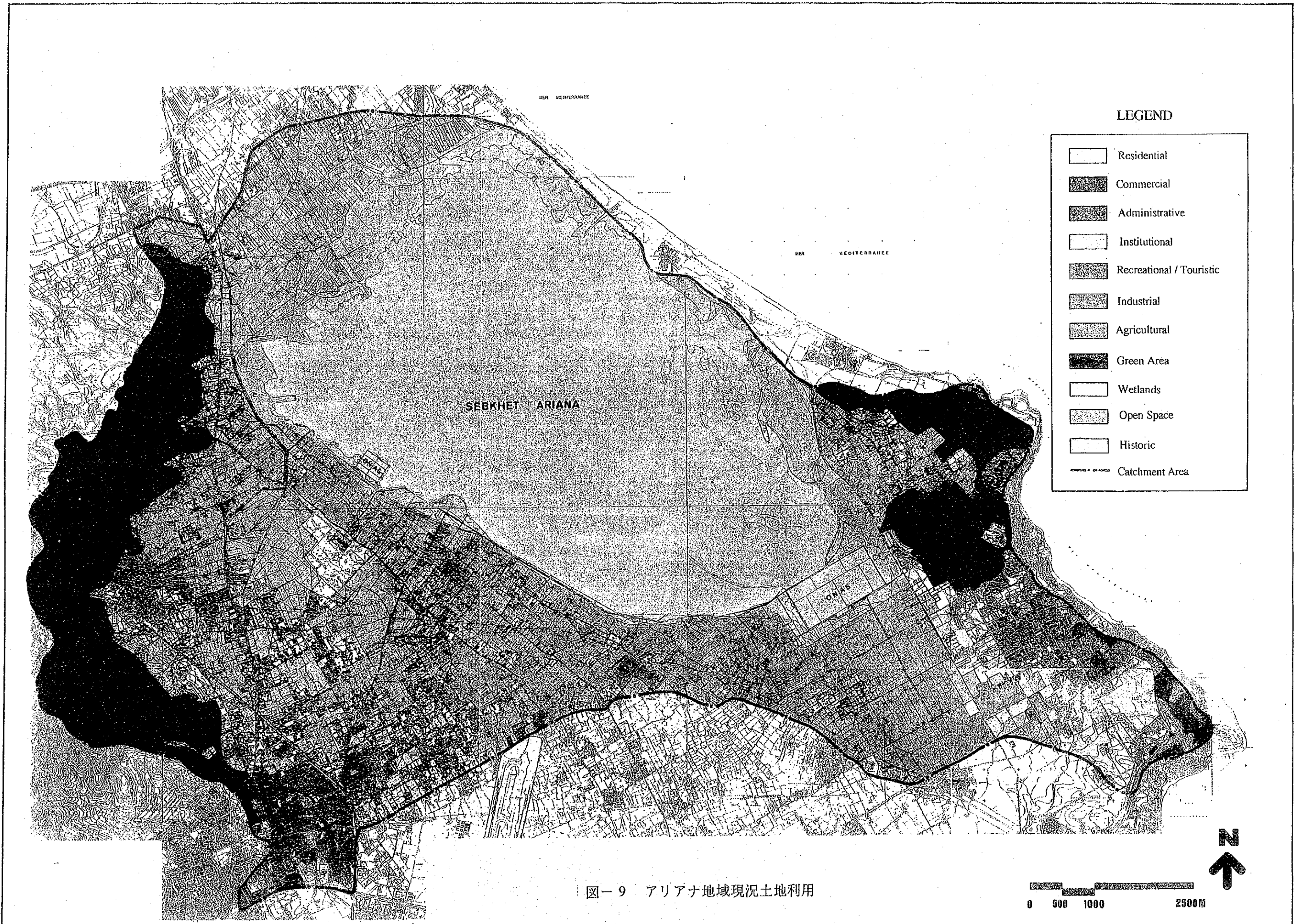
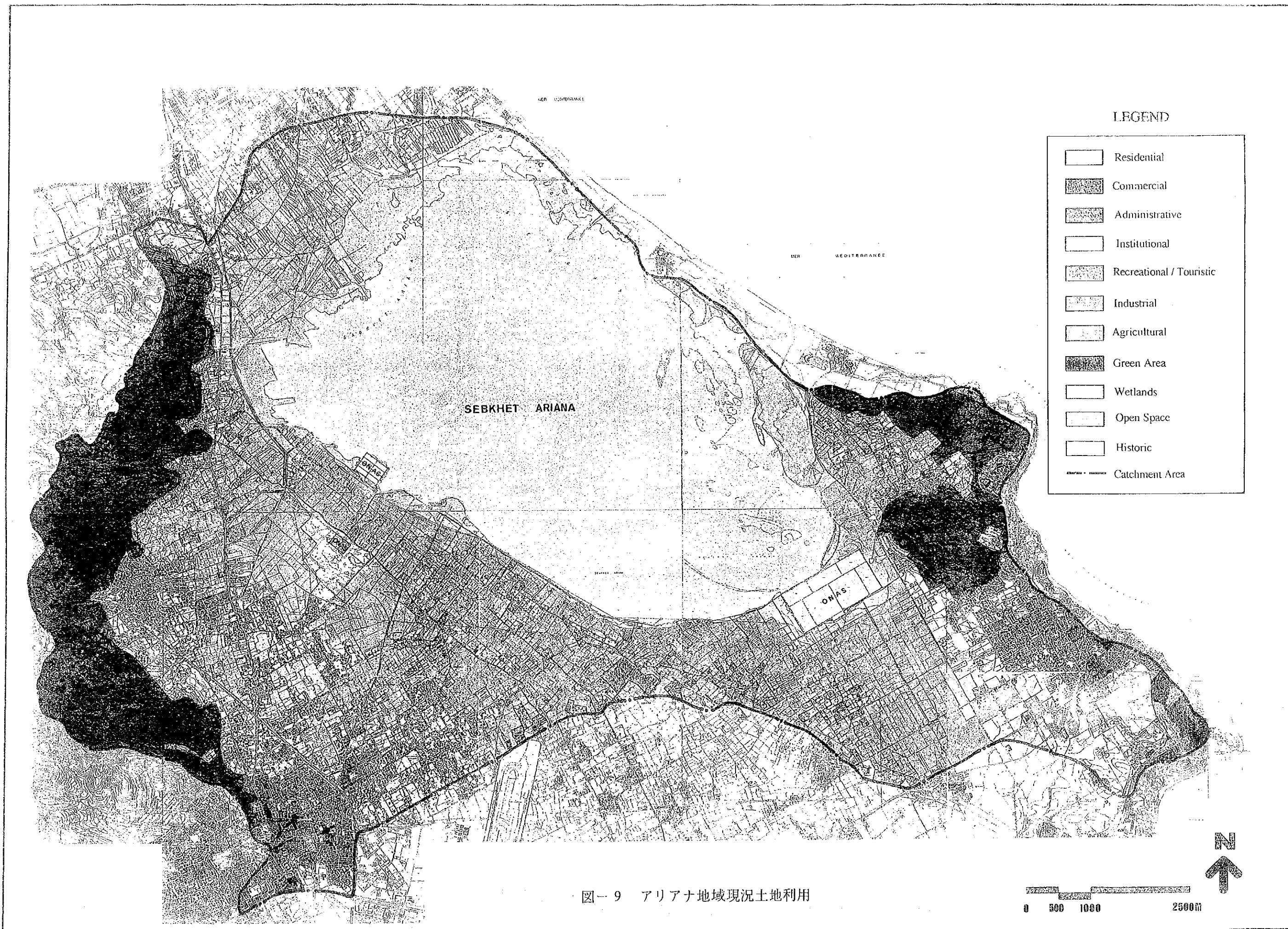


図-9 アリアナ地域現況土地利用



LEGEND













-  Residential
-  Commercial
-  Administrative
-  Institutional
-  Recreational / Touristic
-  Industrial
-  Agricultural
-  Green Area
-  Wetlands
-  Open Space
-  Historic
-  Catchment Area

図-9 アリアナ地域現況土地利用













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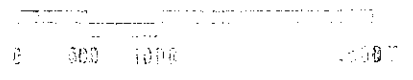




SEBKHET ARIANA

-  Residential
-  Commercial
-  Administrative
-  Institutional
-  Recreational
-  Industrial
-  Agricultural
-  Green Area
-  Wetlands
-  Open Space
-  Historic
-  Category Area

図一 9 アリアナ地域現況土地利用



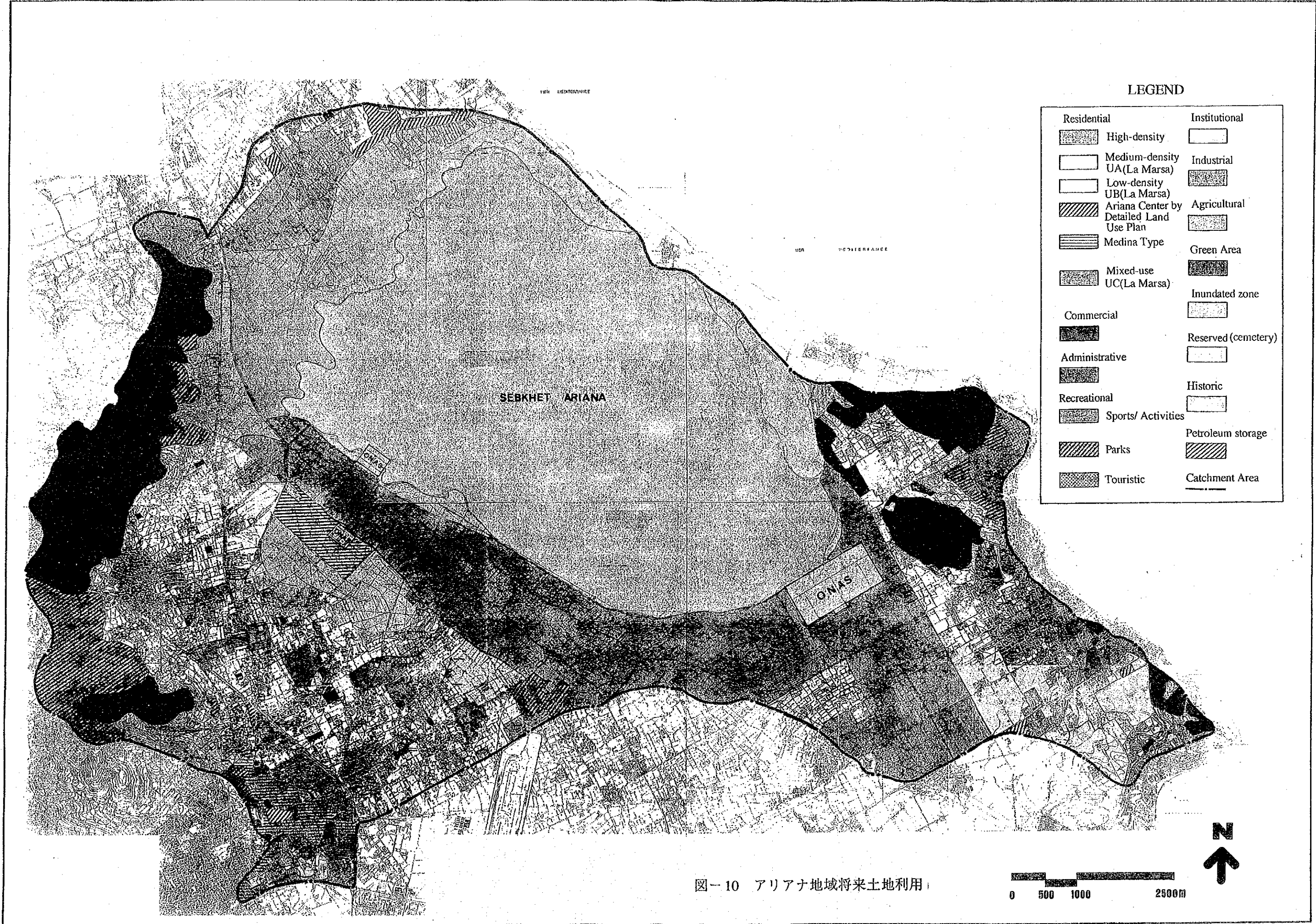
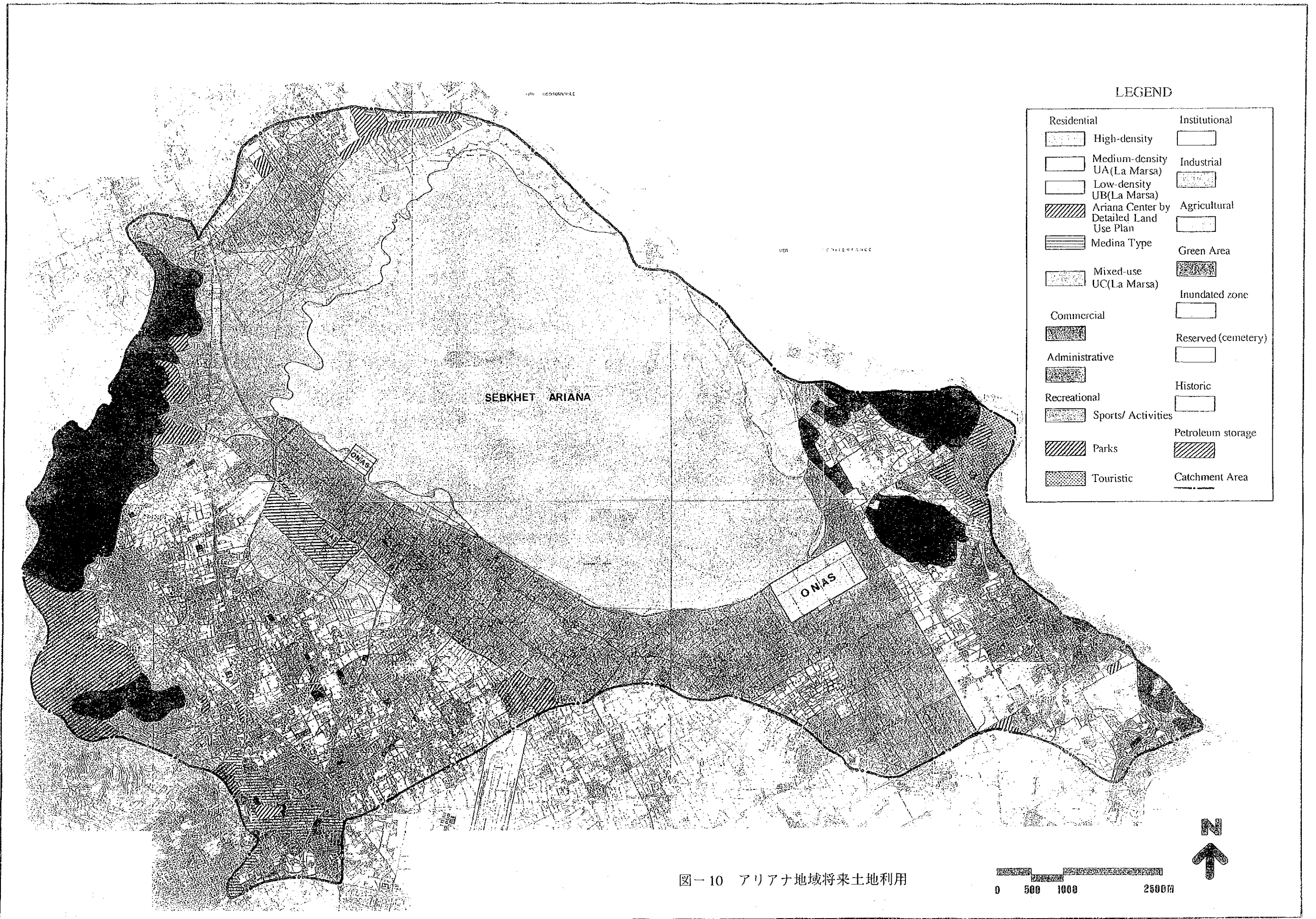


図-10 アリアナ地域将来土地利用

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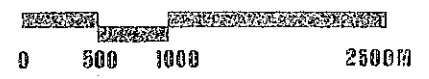




LEGEND

Residential	Institutional
High-density	
Medium-density UA(La Marsa)	Industrial
Low-density UB(La Marsa)	
Ariana Center by Detailed Land Use Plan	Agricultural
Medina Type	
Mixed-use UC(La Marsa)	Green Area
Commercial	Inundated zone
	Reserved (cemetery)
Administrative	
	Historic
Recreational	
Sports/ Activities	Petroleum storage
Parks	
Touristic	Catchment Area

図-10 アリアナ地域将来土地利用





図一〇 アリアナ地域将来土地利用

