
付録1
補足調査

第1章 補足調査

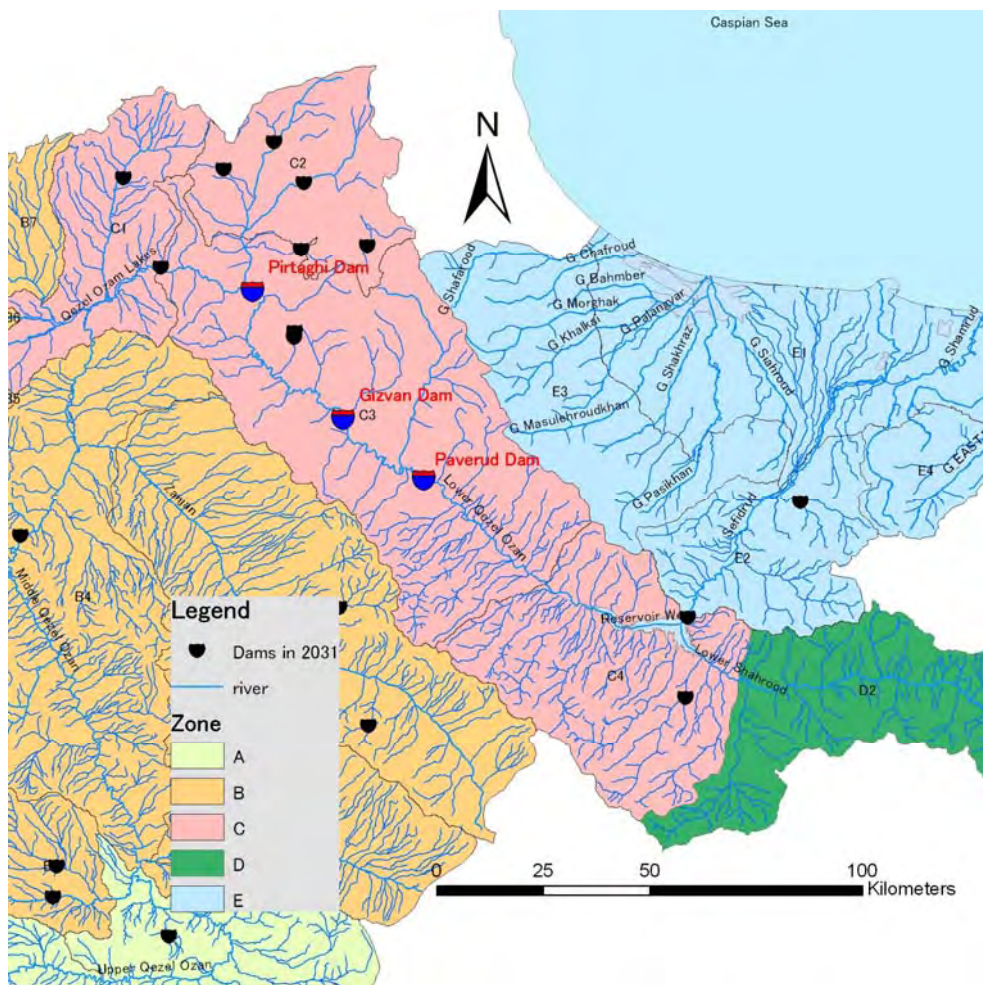
現在、水力発電会社が起案している発電3ダムの建設事業（Manjil ダムと Ostor ダムの間の Qezel Ozan 川本皮）と、アルデビル RWC が計画しているアルデビル導水事業（Ostor ダムから流域外へ導水する）がセフィードルード川流域へ与える影響が、ステークホルダー会議において、水資源管理上の課題として懸案事項となっている。これらの事業は、現在コンセプト段階で、完成目標年の設定や詳細な設計が実施されていないために 9 章のマスタープランにはとりこまれていない。しかしながら、これらの事業の規模が大きいことと、ステークホルダーからの強い要請があったため、事業に関する情報は十分とはいえないが、マスタープランで述べられた長期目標年(2031年)の状況において、事業が流域の水管理へどのような影響を与えるか調査する。評価に当たっては、本調査において構築された利水計算モデルに、これらの情報を取り込んで実施した利水算結果に基づき実施する。

1.1 各事業の概要

1.1.1 発電ダム

1) 発電3ダムの位置

水力発電会社によると、Manjil ダムと Ostor ダムの間の Qezel Ozan 本川に、Manjil ダムに近い下流から Paverud ダム、Gizvan ダム、Pirtaghi ダムの3つの発電用ダムの建設を計画している。現時点における建設予定地は付録図 1.1.1 の通りである。



付録図 1.1.1 発電ダム位置図

2) ダム湖の諸元と各種規定水位

発電 3 ダムのダム湖の水位-面積-貯水量の関係は付録表 1.1.1 の通りである。これらのダムのうち Gizvan ダムおよび Paverud ダムの総貯水容量はマンジルダムと同等かそれ以上を有し、Pirtaghi ダムについても Osor に匹敵するほどの総貯水容量を有する。表中のオレンジ色の部分が無効貯水位、緑が常時満水位、青色がサーチャージ水位を示しているが、Gizvan ダム、Paverud ダムについては、常時満水位やサーチャージ水位は明らかになっていない。

付録表 1.1.1 各ダム湖の水位-面積-貯水量関係

Pirtaghi ダム			Gizvan ダム			Paverud ダム		
Level	Area	Volume	Level	Area	Volume	Level	Area	Volume
(MSL)	(ha)	(MCM)	(MSL)	(ha)	(MCM)	(MSL)	(ha)	(MCM)
856	0.0	0.0	615	0.0	0.0	468	0.0	0.0
860	8.6	0.1	620	16.5	0.3	480	150.0	6.0
880	76.3	7.5	660	369.5	63.2	500	301.7	50.3
890	121.7	19.4	700	1229.1	363.6	520	727.1	150.1
900	167.1	31.2	740	2076.8	1001.6	540	1017.2	323.7
920	301.4	77.4	780	3440.0	2092.0	560	1346.0	559.3
940	498.4	156.6	820	5449.5	3859.6	580	1696.5	862.8
960	873.0	292.0	840	6136.1	5017.5	600	2166.0	1248.1
966	986.2	357.2	871	7196.9	6806.4	600.4	2175.3	1256.9
970	1055.3	397.0	890	7852.6	7912.3	620	2674.0	1731.3
980	1237.5	502.0						

1.1.2 アルデビル導水

アルデビル導水は、Ostor ダムから灌漑用水、飲料水、工業用水を、年間総計 538MCM の規模で流域外へ送水するプロジェクトである。これは長期目標年(2031年)の状況における Ostor ダムへの平均年流入量の約 3 分の 1 を占め、Ostor ダムの有効貯水量に匹敵する水量である。現在、目標完成年等の詳細は不明確であるが、アルデビル RWC によると流域間導水における導水量の内訳は付録表 1.1.2 のように設定されている。

付録表 1.1.2 アルデビルへの導水量('000m³)

月	工業用水	上水	農業	合計
Oct.	13,080	5,247	20,339	38,667
Nov.	16,795	6,736	26,115	49,647
Dec.	17,338	6,952	26,952	51,238
Jan.	17,602	7,060	27,371	52,034
Feb.	17,602	7,060	27,371	52,034
Mar.	16,795	6,736	26,115	49,647
Apr.	17,763	7,125	27,622	52,511
May	15,557	6,240	24,190	45,987
Jun	14,211	5,700	22,097	42,009
July	13,080	5,246	20,339	38,667
Aug.	11,734	4,707	18,225	34,689
Sep.	10,443	4,189	16,238	30,870
合計	182,000	73,000	283,000	538,000

1.2 シミュレーションの実施

1.2.1 計算条件

1) 基本条件

発電 3 ダムの建設目標年が明確でないため、長期目標年 2031 年における状況の利水計算 (MIKE-BASIN モデルによる) モデルに、3 ダムの条件を入力する。このモデルには 2031 年 が完成目標年であるダムやアラムート導水を含んでいる。

2) 計算年数および自然流量

1985 年から 2005 年の 20 年間 (水文年で数えて) の MIKE SHE によって算出した自然流量を用いて利水計算を実施する。

3) 水需要量および灌漑効率

各 Reach における伝統的灌漑エリアと Manjil ダム下流の灌漑エリアにおける水需要量 (取水量) の設定に必要な灌漑効率については、付録表 1.2.1 に示す現況灌漑効率と WRMC の目標値の中間案を使用する。

付録表 1.2.1 灌漑効率

灌漑効率ケース	Manjil 下流の灌漑エリア			伝統的灌漑エリア		
	現況	中期	長期	現況	中期	長期
現況	0.42	0.42	0.42	0.33	0.33	0.33
中間案	0.42	0.45	<u>0.51</u>	0.33	0.37	<u>0.44</u>
WRMC 案	0.42	0.48	0.55	0.33	0.40	0.50

4) ダムの初期値等

モデル中の全ダムにおけるダムの初期水位は有効貯水容量の 70% の水位とした。また、ダムの水位がサーチャージ水位を超過した場合、余剰水は洪水吐きから、流入=流出の関係で放流される設定とする。

なお、Gizvan および Peverud ダムの常時満水位およびサーチャージ水位については、計画値が無いことから、シミュレーションの便宜上常時満水位に 5m 足した水位をサーチャージ水位として設定し、無効貯水位については、マンジルダムの総貯水量と無効貯水量の比を参考にして設定した。

5) 発電放流量

新規発電ダムの発電放流量については、現時点では明確になっていないため、3 つのダムの上流の Ostor ダムからの発電放流量と同等の量を放流させることとした。なお、発電以外の目的の放流は設定していない。

付録表 1.2.2 発電放流量 (’1000m³)

Month	Discharge	Month	Discharge
Oct.	23,872	Apr.	111,314
Nov.	32,841	May	113,966
Dec.	47,226	Jun	83,191
Jan.	59,512	July	41,354
Feb.	70,036	Aug.	26,945
Mar.	94,261	Sep.	26,945
Total			731,463

6) Ostor ダムからの取水の優先順位

Ostor ダムは、流域内の発電、灌漑、飲料水のための水需要を負担している。ここでは、2031年まで継続的に使用されるであろう水需要に対する取水を優先し、Ostor ダムからアルデビル導水のための取水の優先順位は、それよりも低く設定する。つまり、灌漑用水、飲料水、発電用水への取水を行ってから、残量をアルデビルへ導水するアルゴリズムとした。

1.2.2 計算ケース

計算ケースは付録表 1.2.3 の通りとする。これらの計算結果を比較して、発電ダムおよびアルデビル導水事業について、セフィードロード川流域の水資源利用の観点から影響検討を実施する。

付録表 1.2.3 計算ケース

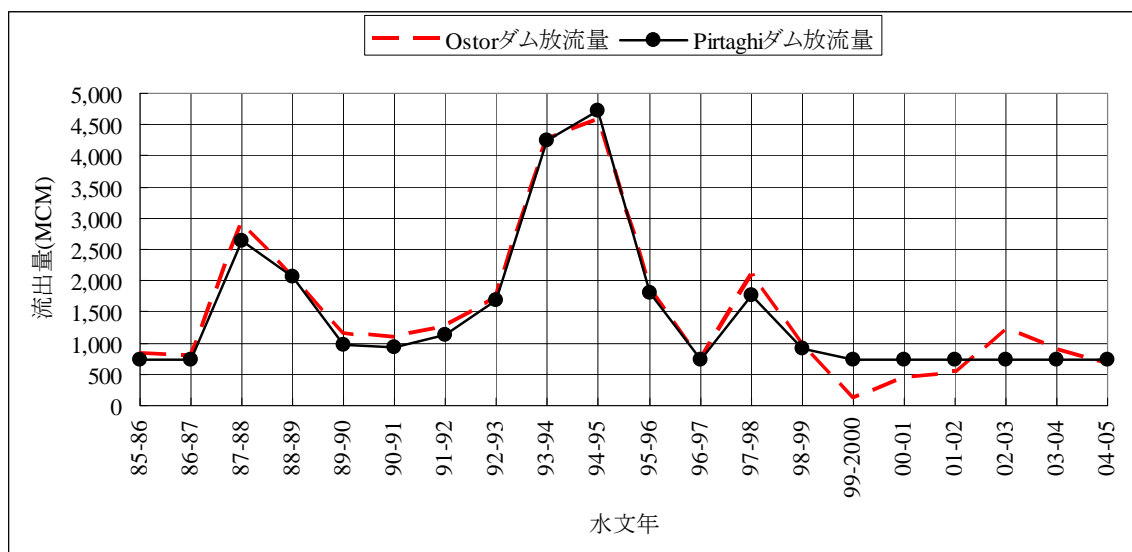
番号	内容
1	発電ダムおよびアルデビル導水を設置しない場合
2	発電3ダムのみ設置
3	発電3ダムとアルデビル導水の両方を設置

1.2.3 影響検討結果

1) 電力ダムによる影響

a) 流況の変化

付録図 1.2.1 は、Ostor ダムからの放流量と発電ダム群より下流の地点における流量（つまり、Pirtaghi ダム放流量）の比較図である。この図を見ると、近年で最も深刻な渇水が発生した2000年から2003年においては、Ostor ダムからの放流量が少ない場合にも、各電力ダムの経年的貯留効果により下流部の流量が回復するというプラスの効果があることも判る。つまり、発電放流量分が河川の流量の維持に寄与しているということである。この結果から、これら大規模なダム湖を有する発電ダム群において下流の水需要を考慮した放流ルールを設定することによって、所定の河川流量を維持できる可能性が十分にあると考えられる。



付録図 1.2.1 Ostor ダムおよび Pirtaghi ダムの放流量の比較

また、付録表 1.2.4 は Ostor から Pirtaghi ダムにかけての、年間の流入量および流出量を整理したものであるが、これらの流出入量の平均値によると Ostor ダムからの流出は、ダム群

の中で最大の貯留量を有する Gizvan ダムにおいても約 1%の低減にとどまっている。加えて、それぞれのダムは発電のための必要流量を毎年放流できていることが判る。

付録表 1.2.4 Ostor・Pirtaghi・Gizvan・Paverud ダムにおける年間流入・流出量

番号	水文年	Ostor		Pirtaghi		Gizvan		Paverud	
		流入	流出	流入	流出	流入	流出	流入	流出
1	85-86	1,024	835	931	905	905	735	740	735
2	86-87	543	787	836	818	818	735	737	735
3	87-88	3,378	2,935	3,027	2,991	2,991	2,630	2,633	2,630
4	88-89	1,907	2,061	2,140	2,119	2,119	2,064	2,066	2,064
5	89-90	1,364	1,149	1,180	1,151	1,152	965	965	965
6	90-91	1,125	1,091	1,123	1,094	1,094	931	931	931
7	91-92	1,396	1,267	1,323	1,296	1,296	1,124	1,125	1,124
8	92-93	1,734	1,734	1,841	1,822	1,822	1,684	1,687	1,684
9	93-94	4,400	4,269	4,484	4,458	4,459	4,238	4,244	4,238
10	94-95	4,625	4,583	4,821	4,800	4,800	4,722	4,729	4,722
11	95-96	1,812	1,895	1,951	1,927	1,927	1,815	1,818	1,815
12	96-97	516	743	767	746	746	737	738	737
13	97-98	2,630	2,110	2,166	2,134	2,134	1,776	1,779	1,776
14	98-99	619	967	1,003	984	984	905	907	905
15	99-2000	131	121	149	610	610	732	732	732
16	00-01	448	435	445	443	443	737	737	737
17	01-02	605	543	571	566	566	735	735	735
18	02-03	1,732	1,229	1,273	772	772	735	736	735
19	03-04	607	886	962	929	930	732	733	732
20	04-05	635	683	739	768	768	737	738	737
Average		1,562	1,516	1,587	1,567	1,567	1,473	1,475	1,473

b) 下流部の水需要への影響

発電ダム群による水需要量の低減は SIDN で約 3%であるが、基本的にこれらのダム自身は水需要を負担していないので、ダム操作ルールの改善によって農作期前か農作期に適切な放流を実施して、Manjil ダムへ貯留させておくことによって十分カバーできる。

2) アルデビル導水による影響検討

電力ダム群を設置した条件においてアルデビル導水事業に関する水需要量を Ostor ダム掛りの取水量として利水モデルに入力し、シミュレーションを実施した結果に基づき、流況の変化、関連ダムの状況、アルデビル導水の充足率、下流の水利用の面からアルデビル導水事業の流域への影響について下記に記述する。

a) 流況の変化

付録表 1.2.5 は Ostor から Pirtaghi ダムにかけての、年間の流入量および流出量を整理したものであるが、アルデビル導水の影響により、Ostor ダム直下流およびダム群下流端（Pirtaghi ダム）においての流出量の平均値は、それぞれ約 22%、約 30%減少することが判る。

付録表 1.2.5 アルデビル導水による流況への影響

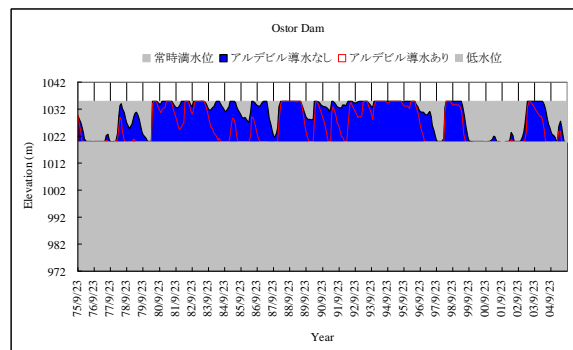
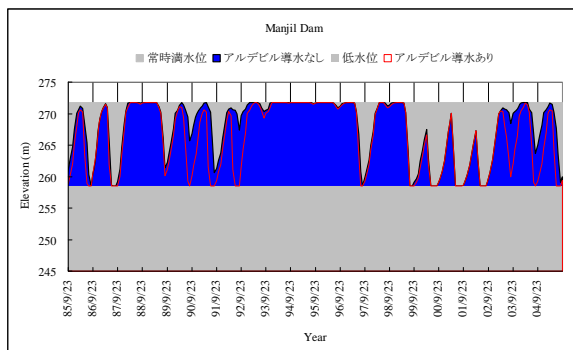
番号	水文年	Ostor		Pirtaghi		Gizvan		Pirtaghi	
		流入	流出	流入	流出	流入	流出	流入	流出
1	85-86	1,024	671	767	735	735	735	740	735
2	86-87	543	449	499	735	735	735	737	735
3	87-88	3,378	2,381	2,474	2,111	2,111	735	737	735
4	88-89	1,907	1,665	1,744	1,722	1,723	735	737	735
5	89-90	1,364	796	828	799	799	735	735	735
6	90-91	1,125	703	735	735	735	735	735	735
7	91-92	1,396	719	775	735	735	735	736	735
8	92-93	1,734	1,167	1,274	1,242	1,242	735	737	735
9	93-94	4,400	3,644	3,859	3,833	3,834	3,406	3,412	2,289
10	94-95	4,625	4,088	4,326	4,305	4,305	4,194	4,201	4,155
11	95-96	1,812	1,437	1,493	1,469	1,470	1,342	1,345	1,295
12	96-97	516	488	512	737	737	737	738	737
13	97-98	2,630	1,840	1,895	1,628	1,628	1,297	1,301	1,191
14	98-99	619	611	647	757	757	735	737	735
15	99-2000	131	100	127	461	461	732	732	732
16	00-01	448	386	396	394	394	737	737	737
17	01-02	605	474	503	498	498	735	735	735
18	02-03	1,732	892	936	732	732	735	736	735
19	03-04	607	568	644	732	732	732	733	732
20	04-05	635	468	524	607	607	737	738	737
平均値 (導水あり)		1,562	1,177	1,248	1,248	1,248	1,100	1,102	1,034
平均値 (導水なし)		1,587	1,516	1,587	1,567	1,567	1,473	1,475	1,473

b) Ostor および Manjil ダムの状況

付録表 1.2.6 に示すように、アルデビル導水実施後にダムの水位が底をつく回数は、20年のシミュレーション期間において、Ostor ダムで15年、Manjil ダムで12年となる。導水実施前よりもそれぞれ、2.5倍、1.7倍程度にまで頻度が増加する。実際のダム運用においては、次年度の流入量の予測が難しいため、ダムの水が底をつくと渇水被害のリスクがかなり高まると考えられるため、このような頻度で底をつくことは望ましくない状況である。

付録表 1.2.6 ダム水位の底つき回数

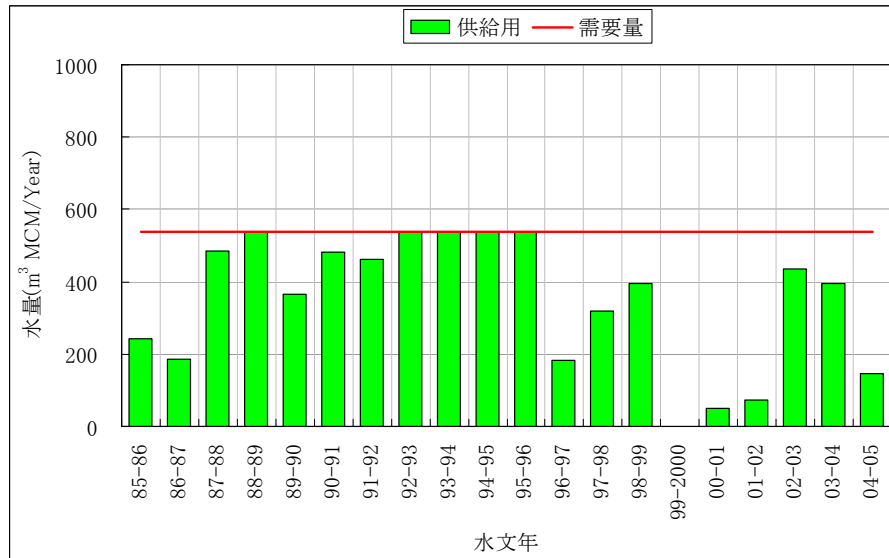
ダム	Ostor ダム	Manjil ダム
導水なし	6年	7年
導水あり	15年	12年



付録図 1.2.2 Manjil ダムおよび Ostor ダムの経年水位の変化

c) アルデビル導水の充足率

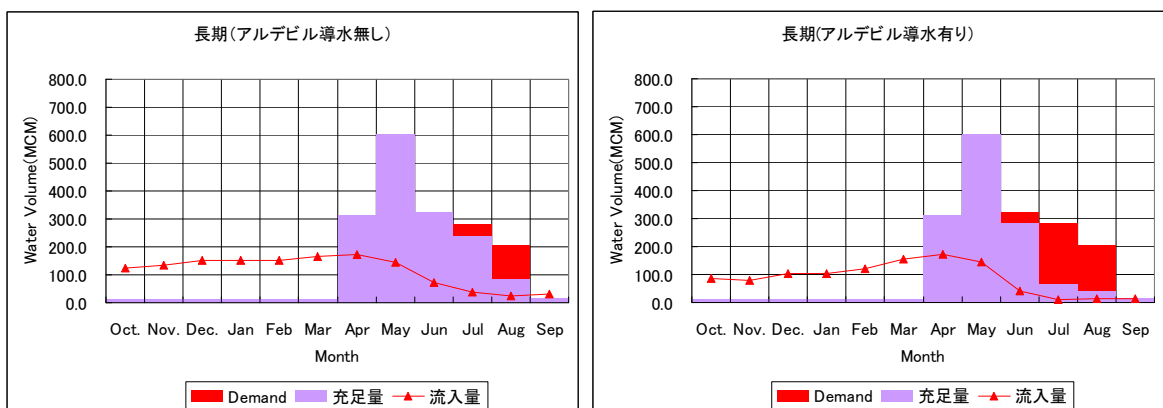
アルデビル導水の充足率は、平均的な充足率は 64.2% であり決して高いとはいえない。20 年間のうち、100% を満たすのはわずか 4 年である。Ostor ダム下流部の水需要への適切な対応をステークホルダー会議を通じて実施しながら、詳細な検討を実施し、適正な量を設定する必要がある。



付録図 1.2.3 アルデビル導水事業における供給量と需要量

d) 下流部の水需要の充足度

Manjil ダム下流部の長期目標年の水需要量（渇水年）に対する充足率は、アルデビル導水事業によって、90.5% から 75.7% まで減少する。現況の灌漑効率のまま長期を迎えた場合でも水需要の 80.3% を満たすことが明らかになっているが（9 章参照）、アルデビル導水事業は、流域内の灌漑効率の向上によって節水された量以上の水量を流域から抽出していることになる。



付録図 1.2.4 Manjil ダム下流部における月別充足率

1.3 まとめ

以上のシミュレーション結果に基づく各事業の評価を付録表 1.3.1 に整理した。基本的に発電ダム事業は、流況調整の機能を持たせることにより下流の水ユーザーに対して正の影響を与えることができる。しかしながら、アルデビル導水事業は流域外に導水することから、既存の水ユーザーへの影響が大きいと見られるため、ステークホルダーと十分に協議・調整して、導水の時期や量について設定していく必要がある。

付録表 1.3.1 各事業の評価

評価項目	発電ダム事業	アルデビル導水事業
流況の変化	全体的に下流への流出量に大きな変化は無く、直列ダム群による貯留効果により、渇水期間の流量を補うことが可能である。	下流部への水量が全体的に約 1/3 減少する。
関連ダムへの影響	Ostor ダムと同等の発電流量を放流する限り、下流ダムへの影響は非常に少ない。	Ostor ダム、Manjil ダムの渇水ポテンシャルを約 2 倍上げる。
プロジェクトの充足度	Ostor ダムと同等の発電流量を放流することは可能である。さらなる放流については下流の水ユーザーの需要と調整しながら設定すべき。	平均的に計画導水量の 64% 程度しか導水できない。
下流水需要への影響	下流ダムとの統合運用によって水需要へ柔軟な対応ができる可能性がある。	下流の水需要の充足度を約 15% 低減させる。長期目標年(2031年)までの灌漑効率の向上による節水分以上の水量を使用する。

1.4 アルデビル導水のための感度分析

アルデビル導水によるセフィードルード川の水利用への影響をさらに調査するために、シミュレーションモデルを使用して、5 ケースの導水量による感度分析を実施した。この感度分析の結果は、将来のアルデビル導水の計画や設計に役立つであろう。

1.4.1 水需要量の設定

利水計算については、オストールダムから流域外へ年間 100、200、300、400、538 百万 m³ の水需要量を目標として送水されるという条件にて実施した。その他の境界条件については、1.2.1 節に示す通りである。

1.4.2 オストールダムとマンジルダムへの影響

表 1.4.1 に示すように、アルデビル導水実施後にダムの水位が底をつく回数は、実施前とくらべて増加することがわかる。実際のダム運用においては、次年度の流入量の予測が難しいため、ダムの水が底をつくと渇水被害のリスクがかなり高まると考えられるため、高い頻度で底をつくことは望ましくない状況である。

付録表 1.4.1 各事業の評価

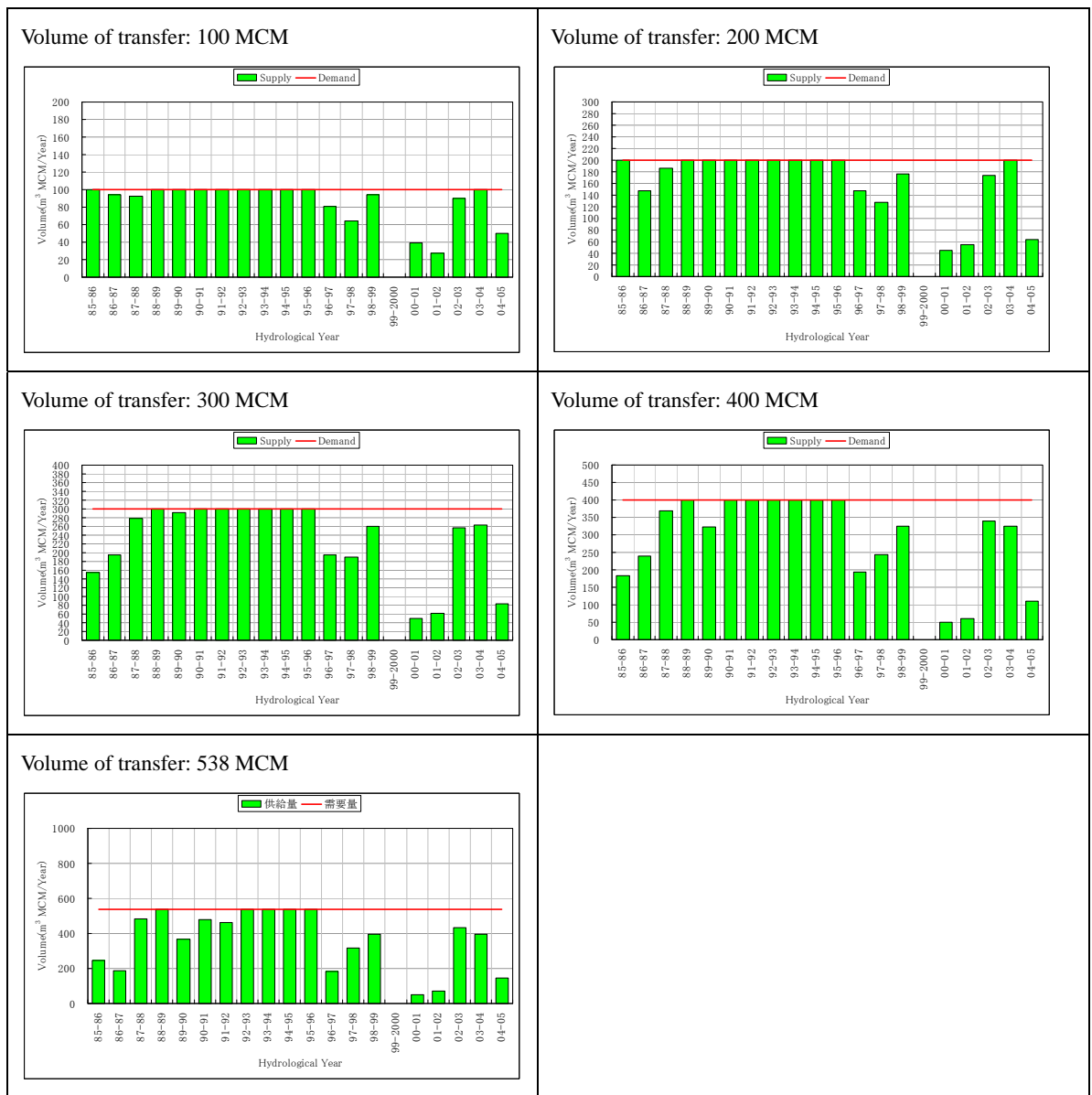
状況	年間導水量 (MCM)	Ostor ダム	Manjil ダム
導水実施前	0	6 年(6 回)	7 年(7 回)
導水後	100	8 年(8 回)	13 年(13 回)
	200	10 years	13 years
	300	13 years	13 years
	400	13 years	15 years
	538	15 years	15 years

1.4.3 アルデビル導水の充足度

導水量毎のアルデビル導水の充足率と、充足率が 100%に達する回数について下表に整理した。Ostor ダム下流部の水需要への適切な対応をステークホルダー会議を通じて実施しながら、詳細な検討を実施し、適正な量を設定する必要がある。

付録表 1.4.2 各事業の評価

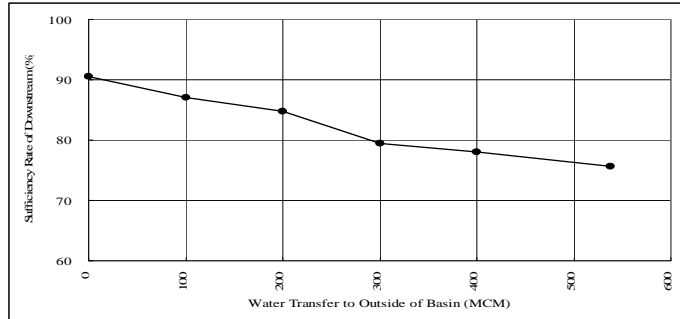
年間導水量 (MCM)	平均充足率	充足率が 100%に達した回数 (20年間)
100	81.7 %	14
200	78.0 %	11
300	73.0 %	9
400	69.4 %	8
538	64.2 %	5



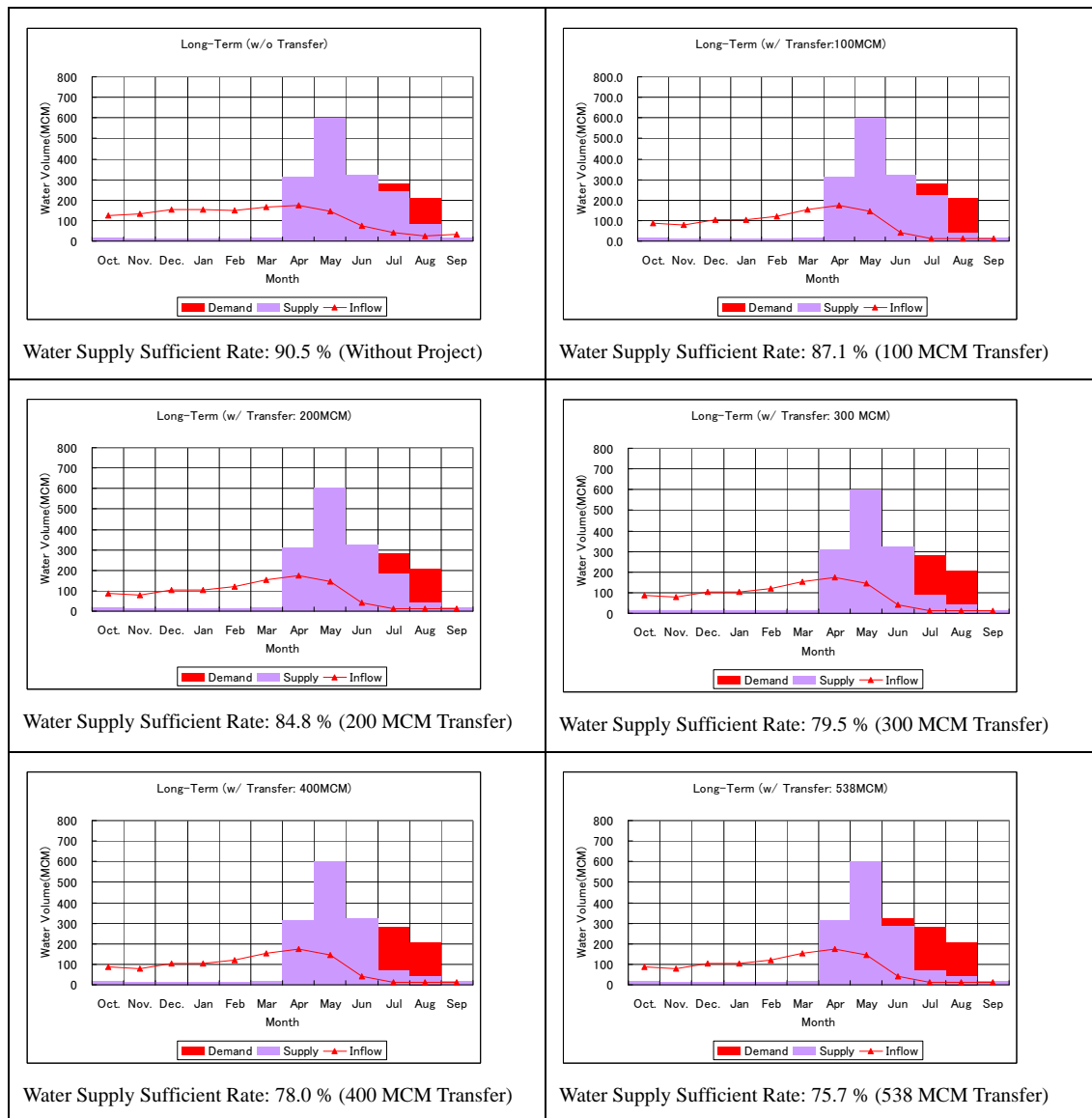
付録図 1.4.1 アルデビル導水事業における供給量と需要量

1.4.4 下流への影響

マンジルダム下流の水需要に対する年間充足率の変化を下図に表す。この図によると、充足率は、導水量が 100MCM 増加する毎に、3%から 5%減ることが判る。図 1.4.3 は 6 ケースの導水量(0, 100, 200, 300, 400, 538 MCM)に対する下流部の月別充足度と不足量を表したものである。



付録図 1.4.2 マンジルダム下流の充足率



付録図 1.4.3 マンジルダム下流の月別充足度と不足量

付録2

初期環境影響評価(IEE)

セフィードルード川流域総合水資源管理調査(M/P)に係る初期環境影響評価(IEE)**1. プロジェクトと関連する報告書の正式名称**

プロジェクト名：セフィードルード川流域総合水資源管理調査

関連する報告書：セフィードルード川流域総合水資源管理調査プログレスレポート 4

2. 調査の分類

マスタープラン

3. 環境カテゴリ及びその理由

カテゴリ B

理由

本件は調査対象流域において社会経済・地形・気象・環境等の調査を実施し、水理・水文解析結果に基づいた総合水資源管理計画（マスタープラン）を策定するものである。これはイラン国において既に計画中であるダム貯水性能やオペレーション方法等について考察し、最適な流域管理方法を提示するものである。

本調査によるマスタープランが実施計画に移された状況において、自然環境・社会環境にどのような影響を与えるか評価した。このマスタープランの実施計画に含まれる想定事業には①灌漑水路改修工事、②取水路建設工事、③ダムの運用管理が挙げられる。主な環境側面には、水利権に関する利害の対立や便益の偏差、河川流況の変化と水生生物への影響、建設工事による汚染等が挙げられる。利害関係の対立・便益の偏差は水資源が不足する当地域では従来からある問題であり、カテゴリ A に相当する規模ではない。また、流況の変化と水生生物への影響は当マスタープランの適正な実施により緩和されうるものである。また、小規模な水路建設工事による汚染も局所的かつ短期的な影響に限定される。したがって、社会環境・自然環境・汚染への影響が大規模ではないものの、多少の影響が予想され、かつ配慮が必要であるため、本調査の環境カテゴリは B とした。

4. 先方実施機関

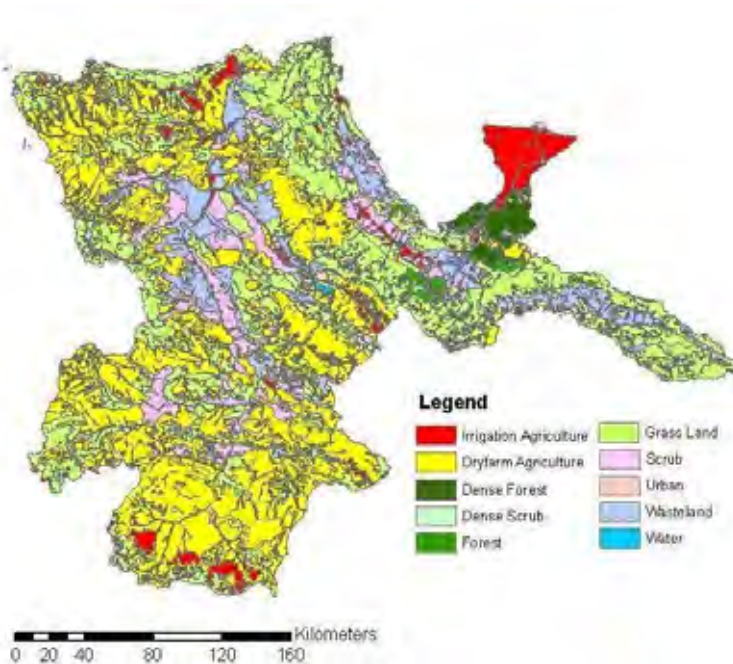
水資源管理公社(Water Resources Management Company: WRMC)

5. 対象地の概要

付録図 1 に示すセフィードルード川はイラン国北西部にあるイラン国最大の大規模河川で、その流域は 8 州にまたがり、流域面積は 5.9 万 km² である。年間降水量が 1000mm を越えるのはカスピ海沿岸にあるアルボルズ山脈以北のわずかな部分のみで、流域の大半を占める南方の地域は年間降雨量が 200～400mm の半乾燥地帯である。付録図 2 に赤色で示すように、セフィードルード川下流域はイラン国随一の稲作地帯を有する地帯でもあり、灌漑用水としての水需要も非常に多い。



付録図 1 調査対象位置



付録図 2 土地利用区分

産業に関して、国内の GDP は年々 25.6% の率で成長してきているが、1997 年価格で見ると年々 4.3 % の率で成長してきているに過ぎない。これは物価の変動がきわめて高かったためで、インフレ率は 1996 年以降 2001 年までは 20 数パーセントであった。GDP の寄与率でみると、「鉱工業」が 2005 年時点の GDP の 21% を占めており、もっとも寄与率が高い。第 2 位、第 3 位は「製造業」と「交通通信・倉庫業」で、それぞれ 15%、12% となっている。「農業」の寄与率は 10% に過ぎないが、農業では特にコメを戦略作物として位置付けている。輸出総額では、原油及び石油製品の輸出額の輸出総額に占める割合は毎年 80% を超えており、原油及び石油製品がイラン国の重要な産業である事を示している。

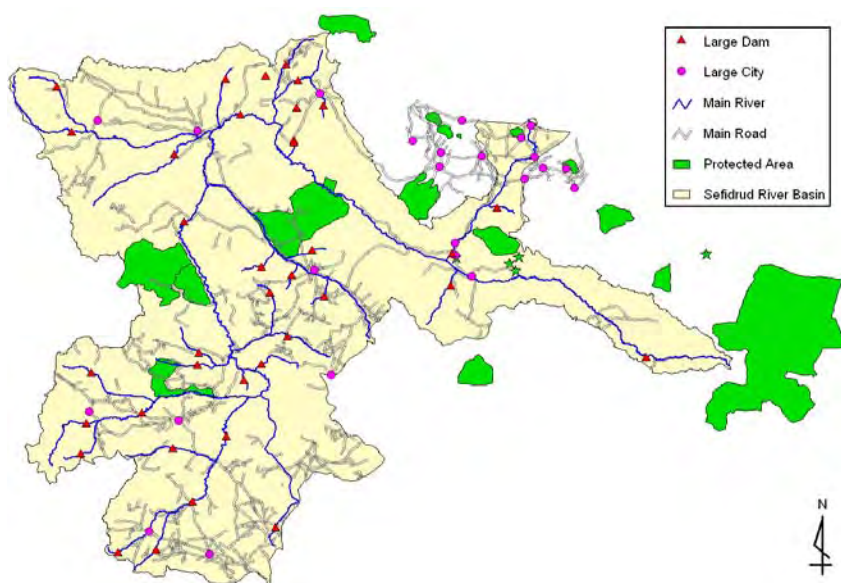
種族は代表的な 11 種族から成り、ペルシャ族(51%)が大半を占める(付録図 3 参照)。他にもアゼリー族、クルド族、アラブ族、ルール族、バルーチ族、カシュガイ族、トルクメン族、ギラキ族、マザンダラニ族、タレシュ族が生活している。調査対象流域内ではペルシャ族、アゼリー族、クルド族、ギラキ族等、多様な民族が生活している。



付録図3 種族と宗教の分布

自然保護区は付録図4に示すように複数存在しており、保護区内ではIUCNのレッドリストでEN(絶滅危惧)、VU(危急)とされている野生動物が生息している(下記)。調査対象である大ダムとの位置関係をみると、自然保護区内に位置する大ダムは無いことが分かる。

- Red-breasted goose (EN)
- Lesser white-fronted goose (VU)
- Lesser kestrel (VU)
- Saker falcon (EN)
- Wild goat (VU)
- Goitered gazelle (VU)
- Meadow viper (EN)
- Houbara bustard (VU)
- Spur-thighed tortoise (VU)



付録図4 自然保護区と大ダムの位置

6. 相手国側の環境社会配慮制度

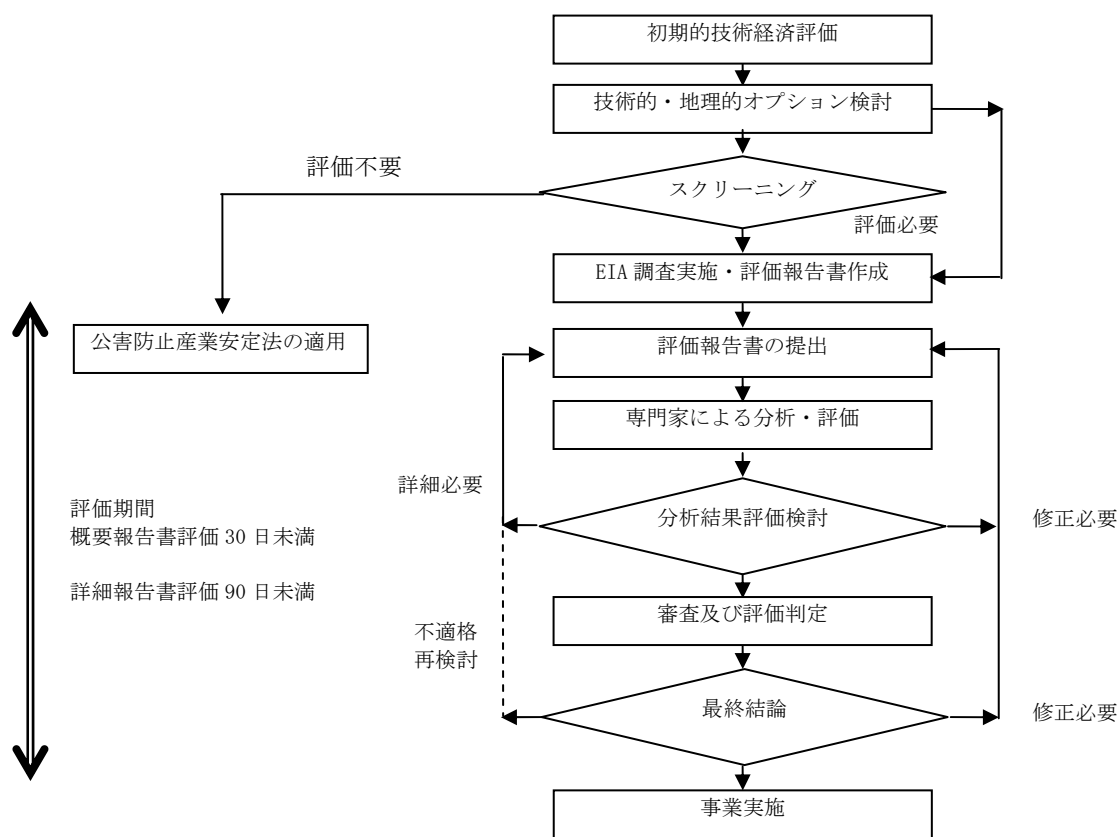
(1) 環境社会配慮に関連する法令や基準、法制度

Decree 138 (12/04/1994)によると環境影響評価(EIA)の直轄機関は環境庁(DOE)であり承認機関は Environmental High Council (EHC)であると規定されている。また、詳細な実施事項が施行規則 (23/12/1997)により規定されている。

このガイドラインに記された EIA が必要な事業を以下に示す。

- ①石油化学工場施設 ②工業団地 ③植林計画 ④高速道路 ⑤鉄道施設
- ⑥火力発電所 ⑦空港施設 ⑧ダム施設 ⑨大規模屠殺施設 ⑩鉄鋼産業施設
- ⑪精製施設 ⑫灌漑排水施設 ⑬農業および産業施設 ⑭都市ごみ処理施設
- ⑮都市ごみ焼却施設

EIA 実施マニュアルによる EIA フローを付録図 5 に示す。



付録図 5 イラン国における EIA フロー

本調査はイラン国において既に計画中であるダムの貯水性能やオペレーション方法等について考察し、最適な流域管理計画を提示するものである。ダムの新規開発を誘発するものではなく、EIA が必要な 15 の項目に該当しないため、イラン国のガイドラインに沿った EIA の実施要領に該当しない。

以上の事により、この IEE 調査は JICA ガイドラインに沿って実施した。

(2) 関係機関の概要

イラン国のガイドラインによると、環境影響評価の承認部はイラン国環境庁人間環境部 EIA 課

となる。国の機関が事業を実施する場合は、EIA 申請を環境庁本庁に提出し、州の場合は州環境局に申請を行う事となる。

7. マスタープランの概要

本調査では開発目標年次を 2016 年の中期目標年と 2031 年の長期目標年に設定し、Phase 1 にて既存資料の調査や現状分析を実施した。Phase 2 では付録図 6 に示すコンポーネントに沿って調査・検討を行い、マスタープランを策定した。

総合水資源管理計画の目指すゴールを以下に示す。

流域水資源の合理的かつ衡平な開発・管理を通して、流域・国家の社会経済の発展、国民の福利厚生を増進に寄与する。

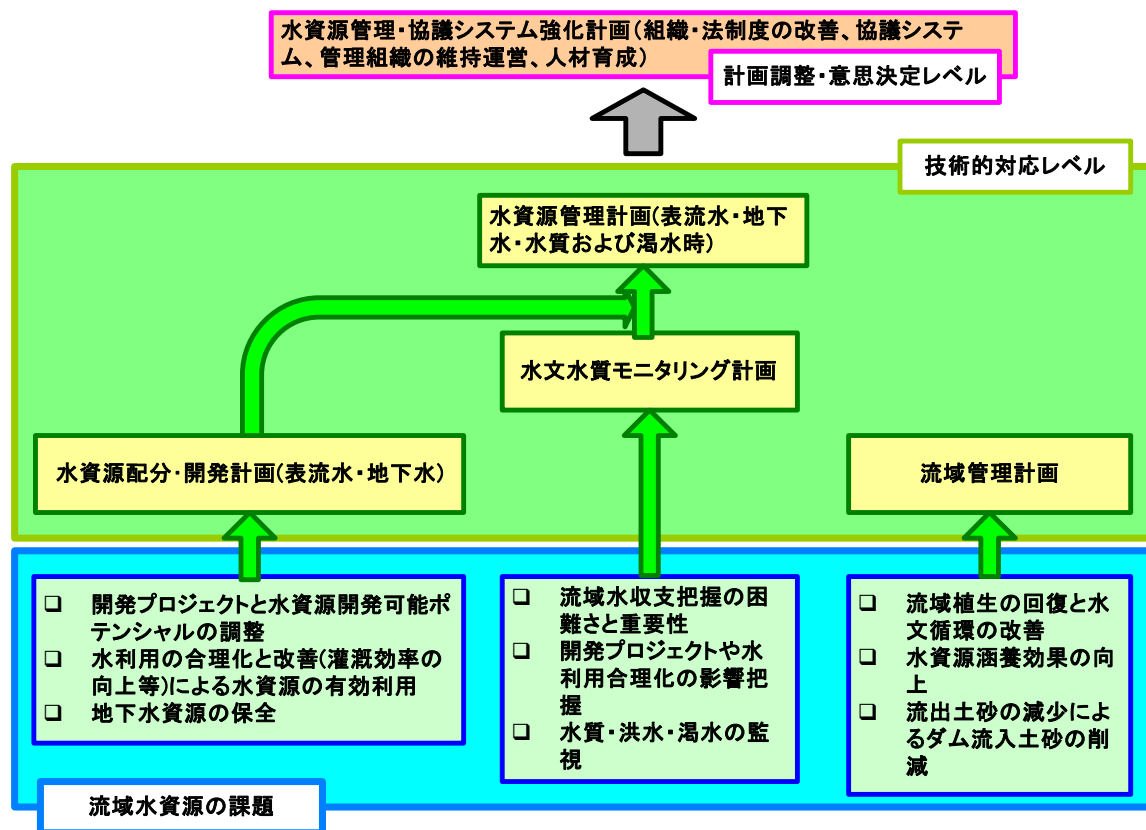
流域総合水資源管理のための主要施策を以下に示す。

流域モデリングを介して水資源の利用可能性、開発プロジェクト相互の水収支的影響、灌漑効率の向上等の改善対策の効果等を定量的に把握し、流域内水資源の持続的開発のための適正な水配分とそれに基づく表流水・地下水の開発計画を策定する。

開発計画に沿った持続的水資源開発の進行に関する監視とその評価・修正等を行う管理計画を策定する。さらに、気象水文モニタリングに基づいて、渇水時のタイムリーな調整を行うような緊急時の計画も併せて立案する。また、水資源涵養の観点から重要である流域管理についても MOJA の流域管理計画に沿った計画を提案する。

流域の十全な総合水資源管理を、水配分や開発プロジェクトおよび渇水時の州間調整を実施し、継続的な監視・評価活動が可能な組織と、そのための人材育成と維持運営に関する計画を提案する。

流域総合水資源管理のためのコンポーネントの相互関係を付録図 6 に示す。水資源配分・開発計画には流域モデリングを実施して水収支を定量的に把握する事、水利用の合理化と最適化が含まれる。また、水文モニタリング計画には定期的なモニタリングによりモデリングを適宜修正し、水資源配分計画を都度修正していくことが含まれる。流域管理計画には水資源涵養効果の向上等が含まれる。



付録図 6 総合水資源管理のコンポーネント相互関係図

8. 現地ステークホルダー協議結果

8.1 コンフリクトアナリシスのワークショップ会合

Phase 1 の調査では各州においてコンフリクトアナリシスのためのワークショップ会合が開催され、活発な意見交換がなされた。各州での参加者の内訳を付録表 1 に示す。

付録表 1 コンフリクトアナリシスのためのワークショップ参加者

	東アゼルバイジャン	アルダビル	コルダスタン	ザンジヤン	ギラン	カズビン	テヘラン
RWC	16	12	20	13	16	13	21
農業省	2	2	5	5		1	1
環境省	3	3	1	1			
天然資源省	1	1			2	1	
農村上下水道	1	4	5	2		2	
鉱工業省	1	1		1			
気象庁				1	1		
州知事公室		1	2		1	3	
大学・研究機関	1	1	1		2	2	1
コンサルタント		2		1	6	2	1
NGO				1	1		
農民代表				1		2	
報道機関						1	
不明			1	1		3	2
合計	25	27	35	27	29	30	36

このワークショップでは総合水資源管理計画に対して「環境や生態系保全への配慮をしつつ効率的かつ公平な水資源の配分を行ってほしい」との意見が全ての州で挙げられた。また、水資源管理に関する問題点は付録表 2 に示すように広範囲に渡り、これらは水不足、水質の悪化、上流と下流の水利権を巡る対立、管理体制の不備、その他社会面の問題に分類される。

多くの州において、飲料水・農業用水の不足、河川や地下水の水質の悪化、地下水の低下、水資源を管理するための組織や規制の不備が挙げられた。上流では特に水量不足が問題であり、下流では上流の下水による水質汚濁および農業・養殖への悪影響が挙げられており、上下流での利害関係の対立が浮き彫りになっている。その他、水不足による農業収益の減少、農業の放棄と都市への流入、一部の地域での人口増加と水不足の深刻化・汚染の深刻化も懸念されている。環境破壊で多く挙げられたのは水質の悪化である。理由には工場排水、生活排水、農業、及び塩分濃度の上昇が挙げられている。

付録表 2 各州の討議内容(抜粋)

出された意見	東	ア	コ	ザ	ギ	カ	テ
水不足							
農業用水が不足している、結果として生産性が低い	○	○		○	○	○	
飲料水が不足している	○	○		○		○	○
工業用水が不足している				○		○	
人口の増加や降雨の減少による渇水の深刻化		○		○	○	○	○
地下水位の低下、地下水の過剰摂取		○	○	○		○	
水質の汚染や環境問題							
地下水水質の汚染、地下水を水源とする飲料水の汚染			○	○	○	○	○
河川水質の悪化、工場排水による汚染	○	○	○	○	○	○	○
河川の塩分濃度が増加している、塩害			○	○	○		
環境影響評価制度が適切に機能していない	○	○	○	○		○	
土壌浸食が激しい・河川やダムでの堆砂が進行している	○	○	○	○			○
水利権に関する対立							
自州の水が他州に(不当に)使われている	○	○		○	○	○	
上流域が、又は下流域が、不当に水を利用している・灌漑効率が悪い(上流の下流に対する不満、及びその逆)	○	○	○	○	○	○	
上流の水質汚染により下流が影響を受けている(排水や汚染された水を灌漑・養殖に用いる等)		○			○		○
管理体制の問題							
縦割り行政による連携不足、州間の連携不足、政治的介入	○	○	○				○
法律や規制の不足、管理体制の不備	○	○	○	○	○	○	○
人材育成の不足、啓発の不足、住民の意識が低い	○			○			
住民の意見が政策に反映されていない	○		○	○	○	○	○
資金不足、投資の不足	○		○	○			○
信頼できる情報の不足	○		○	○	○		
社会的な問題							
多数の農民が耕作を放棄して都市に流入している	○	○	○	○	○	○	
少数民族の文化が守られていない			○				
農家の収入が少ない、貧困化			○	○	○		

上記の「水利権に関する対立」について、意見の対立点を付録表 3 に示す。水資源管理計画により下流の水利権(既得権)が脅かされるため上流の取水計画に不満があり、一方上流では現時点で水不足が深刻であるため下流への不満が募っている事が伺える。

付録表 3 上流域と下流域とで対立している意見の整理

対立点	上流の意見	下流の意見
水利用の権利	水源を所有している者が第一に利用する権利がある。	既に 40 年以上水を使っているため既得権がある。
経済効率	上流は土地の質がいいので開発ポテンシャルがある。下流は効率の悪い水利用をしている。	国家の戦略作物である米を生産しており、ギラン州は最も生産に適した土地である。
公平性・社会正義	所得が国の平均より低いため、農業や工業開発をして所得を増やす事は公平性にかなう。	既に水不足から農家所得が低下しており、これ以上低下すると大きな社会不安をもたらす。
情報・データの信頼性	下流の州が提出する用法・データには信頼性がない。	上流の州が提出する情報・データには信頼性がない。

8.2 IEE の調査報告におけるステークホルダー会議

IEE の調査報告及び意見の収集として、2008 年 7 月 12 日にステークホルダー協議を実施した。召集するステークホルダーは WRMC との協議の上、流域内各州の RWC(地方水公社)とした。

ここで、RWC は WRMC(水資源管理公社)の地方出先機関であり、各州の州都に事務所を置いて、各州の水資源開発(表流水・地下水)、水利施設の維持管理、水配分計画、水利権の認可、井戸掘削の認可、河川整備・維持管理を行う地方機関である。上流と下流の州間に摩擦を生じた場合は各州の利害を調整し、流域全体・国全体の利益を図ることが水資源管理公社の責務となっている。水資源配分計画による直接の利害関係者であり、住民の代表者でもある。参加者を付録表 4 に示す。

付録表 4 ステークホルダー会議参加者

Full Name	Affiliation
Ms. Sadighe Rasouli	Gilan RWC
Ms. Merila Mafakheri	Kordestan RWC
Mr. Ali Heidari	Iran Water Power Company
Mr. Mohammad Taghi Talebpour	Zanjan RWC
Mr. Ali Mozaffarian	Tehran RWC
Mr. Kazem Aziz Moghaddam	Ardebil RWC
Mr. Jafar Fahimi	Zanjan RWC
Mr. Ahmad Rajaei	Ministry of Environment
Mr. Vahid Karami	Mahab Ghodss
Mr. Amirhossein Pakdaman	Mahab Ghodss
Mr. Abdolali Ghobadi	Mahab Ghodss
Mr. Majid Sayyari	WRMC
Mr. Mojtaba Jalilzade	East Azarbaijan RWC
Mr. Yadollah Maleki	Qazvin RWC

ステークホルダー協議は WRMC ビル会議室(テヘラン市)で実施し、本調査(Phase 1)および IEE の調査結果を報告し、今後の調査の進め方について説明した。環境調査に関するコメントでは、自然環境をステークホルダーとして考慮してほしい、水質を河川の本流と支流の両方で検討してほしいとのコメントがあった。またシミュレーションに関して、水収支の解析に下水流出は考慮したのかとの質問があった。以上に加えて、ステークホルダーからの意見は 9 月の中旬にまとめて提出され、環境に関する事項としては塩害に対する調査を求める声が複数上げられた。2009 年 1 月～3 月の調査では塩害の影響も検討項目に加えて、本調査による環境への影響を調査した。

9. プロジェクト実施による環境社会面への影響(スコーピング)

本調査によるマスタープランが実施計画に移された状況において、自然環境・社会環境にどのような影響を与えるか評価した。本マスタープランはイラン国で既に計画済みのダム計画に対して流域モデリングを実施し、解析結果を基に定量的に水資源を管理する仕組みを作るものである。ダム等の新規建設を促すものではない。このマスタープランの実施計画に含まれる想定事業は付録表 5 に示す①灌漑水路改修工事、②取水路建設工事、③ダムの運用管理の 3 つである。

その他の想定事業として運用管理者への能力強化研修も考えられるが、建設工事を伴わないソフト対策であるためスコーピング案には記載していない。また、少雨環境でも育つ換金作物への転換も考えられるが、建設工事を伴わない事業で環境への影響が小さいことからスコーピング案には記載していない。その他水門や堰の建設工事も考えられるが、小規模ダムも含めると既存の事業計画が多数存在するため新規事業計画は妥当性が低く、想定事業からは除外している。

付録表 5 計画に含まれる事業

想定事業	特記事項
①灌漑水路改修工事	素掘り水路のコンクリート水路への転換、点滴灌漑施設の設置等。灌漑効率の改善は当初からイラン国にあった計画である。
②取水路建設工事	灌漑用水を地下水から河川に切り替える目的で建設される、河川水取水路建設工事である。小規模な用水路を想定している。
③ダムの運用管理	ダムオペレーションによる水資源管理の改善である。運用管理の結果として水利用の既得権が侵される地域もあり、利害の対立が予想される。

マスタープランによる影響を評価する上では現在イラン国で計画中のダム・導水計画が全て計画通り施工された状況をベースラインとし、3 つの想定事業計画に対してスコーピングを実施した。スコーピング結果とその根拠を付録表 6 に示す。また、自然環境に与える影響について以下に補足する。

● 本調査による自然保護区・絶滅危惧種への影響

本調査は自然保護区内に大規模工事を誘発するものではないため、自然保護区への影響はない。また、前述した保護動物はカスピ海沿岸の湿地帯に生息する渡り鳥、内陸部の丘陵地に生息する動物であるため、本調査により河川の流況が変化したとしても、その影響は受けにくい。しかし、自然保護区内を流れる河川流量が大きく減少する場合は生態系に影響する可能性があるが、流域モデリングの結果では本川の流量は十分確保されるため、深刻な影響は与えないと思われる。

● 本調査による水生生物への影響

通常、河川管理構造物の建設では遡上阻害が問題となるが、既存するマンジルダムおよび下流の堰により遡上できる範囲は既に限定されている。また、本マスタープランの想定事業①②の建設工事は魚類の遡上を妨げるものではない。本調査による影響としては、流況の変化により魚類の生息およびローカルな移動を妨げることが考えられる。影響を受けうる魚類はマンジルダムより上流に生息するコイ目やナマズ等の魚類である。マンジルダム上流河川に保護動物の生存は確認されていない。マンジルダムより下流およびカスピ海に生息するコイ目やボラ目、サケ目の魚(いずれも保護動物ではない)が受ける影響は軽微であると考えられる。

保護動物であるチョウザメは下流のカスピ海で生息しているが、繁殖時に河川を遡上し産卵する特徴がある。河口部の堰により遡上可能な範囲が限られているため、セフィードルード川河口部ではチョウザメの孵化場を設けて繁殖を保護している。この保護活動は高く評価されているため、イランはカスピ海近郊で唯一管理下での捕獲を許されている国である。

付録表 6 想定事業に於けるスコーピング結果

	①灌漑水路 改修工事	②用水路 建設工事	③ダム の 運用管理	予想される影響の根拠	
● 社会環境					
1	非自発的住民移転	D	C	D	②は小規模建設工事であるため住民移転を要する可能性がある。①は既存施設の改修工事であり、③はソフト対策であるため、いずれも住民移転を必要としない。
2	雇用や生計手段等の 地域経済	C	B	B	②③により利用可能な水資源量が減る地域がある場合、経済的な影響が発生する可能性がある。①は既存施設の改修なので利水量への影響は軽微である。
3	土地利用や地域資源 利用	D	C	D	②の新規建設工事により土地利用に影響する可能性がある。①は既存施設の改修であり、③はソフト対策であるため、土地利用には影響しない。
4	社会関係資本や地域の 意思決定機関等の 社会組織	D	D	C	③ダムの運用管理により既存の社会組織の権限や所掌範囲に影響が出る可能性がある。①②は社会組織に影響しない。
5	既存の社会インフラ や社会サービス	D	D	D	①②は小規模建設工事であり、③は工事を伴わないため、社会インフラや社会サービスへのアクセスを阻害しない。
6	貧困層・先住民・ 少数民族	D	D	D	イラン国には遊牧民が生活しているが、①②は小規模な工事、③はソフト対策であるため、遊牧民の固有な生活習慣を脅かすものではない。
7	被害と便宜の偏在	C	C	B	①②③水資源配分計画により偏差は緩和されるが、上下流でポテンシャルが大きく異なるため多少の偏差は残ると思われる。
8	文化遺産	D	C	D	①②③文化遺産を損なうような大規模開発計画ではないが、②新規建設工事では文化財への影響を避けるよう配慮が必要である。
9	地域内の利害対立	C	C	B	①②③限られた水資源を配分する上で地域内の利害関係が対立する可能性がある。
10	水利用、水利権、入 会権	C	C	B	①②③限られた水資源を配分する上で既存の水利権をめぐって対立する可能性がある。
11	公衆衛生	D	D	D	①②③小規模建設工事なので外部からの人の流入は小数であり、工事労働者の仮住まいも不要であるため、公衆衛生への影響は軽微である。
12	災害、HIV/AIDS 等 感染症	D	D	D	①②③小規模建設工事なので外部からの人の流入は小数であり、感染症の発生につながる可能性は極めて低い。
● 自然環境					
13	地形・地質	D	D	D	①②③地形を改変するような大規模建設工事を伴わない。
14	土壌浸食	D	D	C	③流量調整により河川の流量・流速が急増すると河床の掘削につながる可能性がある。①②により流量・流速が急増する事はないため、河床の掘削にはつながらないと思われる。
15	地下水	D	D	D	①②③地下水を保護する事を目的としているため、地下水位の低下や水質悪化にはつながらない。
16	湖沼・河川状況	C	B	B	①②③流況はより安定すると期待されるが、水資源の再配分により一部の地域で河川流量が減少する可能性はある。
17	海岸・海域	D	D	D	計画の大半は既存のマンジルダムより上流を対象としているため、河口に位置するカスピ海への影響はない。
18	動植物、生物多様性	C	C	C	①②③一部の河川で流量が減少し、水生生物・その他水を必要とする周辺動物に影響する可能性がある。

19	気象	D	D	D	①②③大規模な貯水池を作る工事ではないため、気象への影響は極めて小さい。
20	景観	D	D	D	①②③景観の悪化につながる大規模改修工事は含まない。
21	地球温暖化	D	D	D	①②③建設工事の規模が小さいため、地球温暖化への影響は極めて小さい。
● 汚染					
22	大気汚染	C	C	D	①②建設機械の性能により大気に影響する可能性がある。③は建設工事でないため大気に影響しない。
23	水質汚濁	C	C	D	①②建設工事により発生する濁水に配慮する必要がある。③はダム運用の改善であるため水質を悪化させるものではない。
24	土壌汚染	C	B	C	②灌漑用水を地下水から表流水に転換する事で農地に塩類が蓄積する可能性があるため、配慮が必要である。①③による影響は小さいが、塩害が発生しないよう留意する必要がある。
25	廃棄物	C	C	D	①②建設工事により発生する廃棄物の処理に配慮する必要がある。③に工事は含まれないため、廃棄物は発生しない。
26	騒音・振動	C	C	D	①②建設機械の騒音が周辺住民に影響しないよう配慮する必要がある。③は建設工事でないため騒音は発生しない。
27	地盤沈下	D	D	D	①②③地下水を保護する事業であるため、地盤沈下は発生しない。
28	悪臭	D	D	D	①②③臭気を伴う物質を扱わないので、悪臭は発生しない。
29	沈殿物	D	D	D	①②③へドロ等の沈殿物は発生しない。
30	事故	C	C	D	①②小規模建設工事ではあるが、事故の抑制に配慮する必要がある。
全体評価		B			

Rating;

A: Serious impact is expected, B: Some impact is expected,
C: Extent of impact is unknown, D or blank: No impact is expected. IEE/EIA is not necessary.

10. 環境保全ならびに影響緩和のための対策

以下に想定事業を実施する上での留意点と環境保全ならびに影響緩和のための緩和策を記載する。

①灌漑水路改修工事

既存の素掘り水路をコンクリート水路に改修する建設工事により、社会環境面では水利権に関する利害の対立や便益の偏差、地域経済への影響が発生する可能性がある。自然環境面では影響は小さいながらも、河川の流況、水生生物に影響する可能性がある。汚染の面では建設工事による大気汚染、水質汚濁、廃棄物の発生等が予想される。事業を実施する上ではこれらの影響を事前に予測し、以下に示すような影響を回避または緩和するための方策を実施する必要がある。

1) 社会環境

- ・ 建設工事着手前に地域住民と十分協議し、地域間、上流・下流での不平等感が最小限となるよう努める。
- ・ 利用可能な水資源量が減る地域がある場合、地域住民との対話や補償等により対処する。

2) 自然環境

- ・ 灌漑水路改修により河川水の過剰取水が無いよう、事業計画の時点で河川流量のバランスや上下流の影響を考慮する。
- ・ 河川水量が減少する地域に対して生態系の調査を実施し、重大な影響が出ない事を確認する。重大な影響が懸念される場合は、建設工事の見直しを検討する。

3) 汚染

- ・ 建設機械を選定する上で、大気汚染・騒音による影響が重大とならないよう配慮する。
- ・ 建設工事によって発生する廃棄物、水質汚濁、事故を最小限に止められるよう配慮する。
- ・ 河川水を灌漑用水として利用する上で、塩類の蓄積防止を目的とした維持管理方法を普及・啓発するよう配慮する。

②取水路建設工事

灌漑用水を地下水から表流水に切り替える新規取水路建設工事により、社会面では住民移転、水利権に関する利害の対立や便益の偏差、地域経済への影響、文化遺産への影響が発生する可能性がある。自然環境面では河川の流況、水生生物に影響する可能性がある。汚染の面では建設工事による大気汚染、水質汚濁、廃棄物の発生、河川水の灌漑利用による塩害が予想される。事業を実施する上ではこれらの影響を事前に予測し、以下に示すような影響を回避または緩和するための方策を実施する必要がある。

1) 社会環境

- ・ 取水路建設地点を選定する上で、住民移転が発生しないよう慎重に検討する。
- ・ 建設工事着手前に地域住民と十分協議し、地域間、上流・下流での不平等感が最小限となるよう努める。
- ・ 利用可能な水資源量が減る地域がある場合、地域住民との対話や補償等により対処する。
- ・ 取水路建設地点を選定する上で、重要文化財を損なわないよう慎重に検討する。

2) 自然環境

- ・ 新規用水路により河川水の過剰取水が無いよう、河川流量のバランスや上下流の影響を考慮する必要がある。
- ・ 河川水量が減少する地域に対して生態系の調査を実施し、重大な影響が出ない事を確認する。重大な影響が懸念される場合は、建設工事の見直しを検討する。

3) 汚染

- ・建設機械を選定する上で、大気汚染・騒音による影響が重大としないよう配慮する。
- ・建設工事によって発生する廃棄物、水質汚濁、事故を緩和するよう配慮する。
- ・河川水を灌漑用水として利用する上で、塩類の蓄積防止を目的とした維持管理方法を普及・啓発するよう配慮する。

③ダムの運用管理

ダムの運用管理により流量調節する場合、社会面では水利権に関する利害の対立や便益の偏差、ダム管理機関への影響が予想される。自然環境面では河川流量が増加した区間での土壌浸食、河川流況の変化、水生生物への影響が予想される。汚染の面では河川水の灌漑利用による塩害が予想される。事業を実施する上ではこれらの影響を事前に予測し、以下に示すような影響を回避または緩和するための方策を実施する必要がある。

1) 社会環境

- ・運用計画案を地域住民と十分協議し、地域間、上流・下流での不平等感が最小限となるよう努め、地域の状況を十分配慮した上で運用計画を策定する。
- ・利用可能な水資源量が減る地域がある場合、地域住民との対話や補償等により対処する。
- ・ダム運用管理に係る組織の役割・コミュニケーションを明確にし、組織間の連携が良好に進むよう配慮する。

2) 自然環境

- ・河川水量が減少する地域に対して生態系の調査を実施し、重大な影響が出ない事を確認する。重大な影響が懸念される場合は、ダム運用計画の見直しを検討する。

3) 汚染

- ・河川水を灌漑用水として利用する上で、塩類の蓄積防止を目的とした維持管理方法を普及・啓発するよう配慮する。

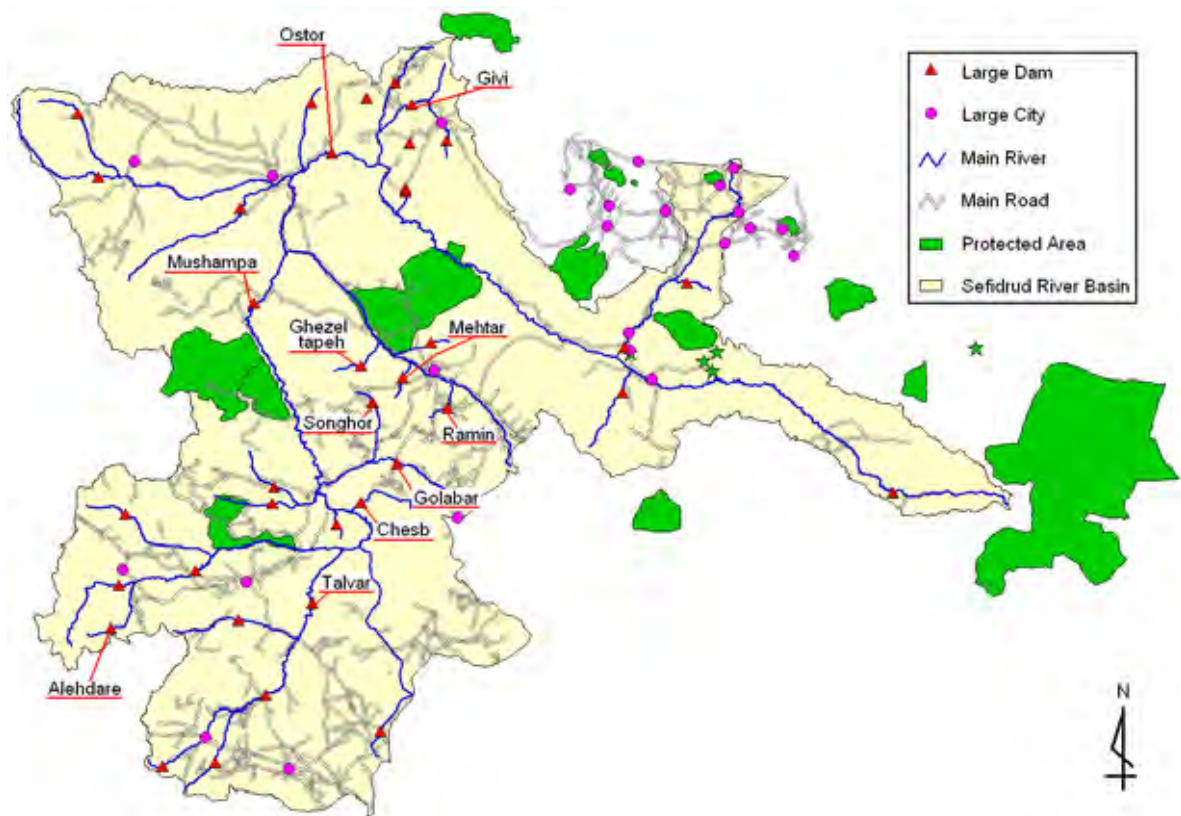
11. 関連資料

本調査はダムの運用による水資源管理の最適化を目的としているため、ダムの流量調整計画の一環として既存の EIA を調査した。この調査はまた、調査対象流域の自然環境・社会環境を把握する目的もあり、想定事業による影響項目(スコーピング)の検討に用いた。以下に現地再委託で実施した既存ダムの EIA レポート集計結果を掲載する。

付録表 7 に調査を実施した 11 のダムの概要を示し、付録図 7 に調査対象ダムの位置を自然保護区と併せて示す。付録表 8 にダム建設工事により発生する社会環境影響を示し、付録表 9 に供用期間中に発生する社会環境影響を示す。影響の程度は数値で示し、正の値が良い影響を、負の値が悪い影響を示している。影響の度合いはダムにより異なるが、影響を生じる理由は概ね同じであったため表の右列に併記している。評価が不十分であると考えられる場合は、コメントを記載している。

付録表 7 調査対象ダムの概略

ダム	州	目的	開発段階	流域面積 (km ²)	ダム高 (m)	総貯水量 (MCM)	住民移転 (人)
Golabar	Zanjan	灌漑	Phase 3	1,131	82.0	116.0	736
Ostor	E.Azarbaijan	多目的	Phase 3	42,600	135.0	700.0	17,000
Talvar	Zanjan	灌漑	Phase 3	6,441	85.0	500.0	578
Givi	Ardebil	灌漑	Phase 3	600	79.0	53.1	50
Mushampa	Zanjan	多目的	Phase 3	24,860	124.0	700.0	不明
Ramin	Zanjan	飲料水	Phase 2	67	63.0	9.8	1,083
Alehdare	Kordestan	灌漑	Phase 1	96	44.5	19.7	不明
Mehtar	Zanjan	灌漑	Phase 1	128	40.0	14.0	350
Songhor	Zanjan	灌漑	Phase 1	102	42.0	10.4	不明
Chesb	Zanjan	灌漑	Phase 1	135	45.5	9.9	不明
Ghezel Tapeh	Zanjan	灌漑	Phase 1	75	57.0	6.0	不明



付録図 7 IEE調査対象ダムの位置

付録表 8 工事期間中に発生する環境社会影響

ダム名	Talvar	Golabar	Ramin	Givi	Ostor	Mushampa	Aleh-dare	Mehtar	Ghezel Tapeh	Songhor & Chesb	主な理由	
社会環境	非自発的住民移転		-3		+3		-2	-2		-	工事中の住民移転、工事労働者の移入 ¹	
	地域経済		+3	+3		+1	+3	+1	+2	+	雇用機会が増え、工事労働収入により貨幣の流通が良くなる	
	貧困層・少数民族					+2			+1	+	就業による収入増	
	利害の対立						-1	-3				
	水利権								-2			
	公衆衛生		0			+2	-1	-1	-2		工事による水質汚濁、収入が増え購買力が上がるため公衆衛生が改善する ²	
	土地利用			-1	-1		-2	-1	+1	-2	ダム建設による土地利用の変化	
	土地の価値							-3	+1	+1	道路等建設による地価の変動	
	社会的合意			-1						+1	補償が受けられるため合意する	
自然環境	動植物、生物多様性				-3	-1	-3	-2	-2	0	重機の移動により丘陵地の生態系が影響を受ける、切土により動植物の生息地が奪われる	
	希少動植物				-1		-1	-3		0	貴重種の生息地が奪われる、貴重種がいないため影響は小さい	
	下流の動植物				-1	-2	0	0	-2	0	工事中に魚類の移動が妨げられる ³	
	水生生物				-1	-2		-3		-2	-	重機の移動により底質が締め固められ底生生物に影響する
	気象		0				0		-1		0	
汚染	水文			-2	-1		-2	-2	-2	-1		河川流量の減少
	水質汚濁		-1	-1	0	-3	-3	-2	-1	-2	+	工事の土砂による水質汚濁、労働者の下水による水質汚濁
	大気汚染		-1	-1		-1	-3	-1	-1	-2	-	重機使用による大気汚染の発生
	騒音		-2	-2		-1	-2	-1	-4	-1	-	重機使用による騒音
	廃棄物	-1				+1	-3	-1		-2		労働者が発生する廃棄物

注：マイナスは負の影響、プラスは正の影響を示し、数値の大きさは程度の大きさを示す、空欄は未検討

¹ 工事労働者の一時的な移入は水没家屋の移転問題とは別であり、移転住民が発生する場合は移入の有無に関わらず負の影響があると評価すべきである。

² 因果関係が間接的であり、効果はあまり期待できない。衛生施設の不足する地域に大勢の人が押し寄せると公衆衛生が悪化する場合があるが、ここでは評価されていない。

³ ダムの工事中はトンネル導水又は半川締め切りにより川を転流するため魚類の遡上は可能である。むしろダムが完成した後には遡上が出来ない又は困難である事を検討するべきである。

付録表 9 供用中に発生する環境社会影響

ダム名	Talvar	Golabar	Ramin	Givi	Ostor	Mushampa	Aleh-dare	Mehtar	Ghezel Tapeh	Songhor & Chesb	主な理由	
社会環境	非自発的住民移転	-5	-3	-3	-5	+3	+3	-1	+3	-	家屋水没による移転住民の発生、労働者の定住・農業の発展による時人口増加 ⁴	
	地域経済	+2		+3	+3	+5	+3	+3	+4	+	労働収入による経済効果 ⁵	
	貧困層・少数民族	+3								+2	雇用機会の増加と労働収入による生活の安定 ⁶	
	利害の対立						+2					
	水利権	+2							-1	+2	税制度の導入による水資源の効率的な管理、河川流量の減少	
	公衆衛生	+2		+2		+3	-1		+2	+1	-	収入が増え購買力が上がるため公衆衛生が改善する ⁷
	土地利用				-1		-2		+2	+2	-	ダム建設による土地利用の変化
	土地の価値			+2			+3	+1	+4	+3	+	ダム建設による地価の向上
社会的合意	+2								+3	-	埋め合わせをするために生活水準は改善する ⁸ 、利用できる灌漑用水が増えるので合意する	
自然環境	動植物、生物多様性	+3			+3	+1	-3	+3	-1	-1	+	ダムにより河川流量が安定し水域の生態系は改善する ⁹ 、貴重種がないため影響は小さい
	希少動植物				-1		-2	+3		0	+	貯水池に渡り鳥が飛来する
	下流の動植物	+3			+1		+2	+4			+	河川流量の安定による良好なハビタットの形成 ¹⁰
	水生生物		+1		+2		-2	+2	-2	+1	+	貯水池・河川流量の安定による良好なハビタットの形成、流量の減少による負の影響
	気象	+1	+2		+2		+3	+2	+1	+3	+	貯水池からの蒸発量が増えるため雨が増える ¹¹
汚染	水文	+3			+1	+4	+3	-1	+1	+3		平時の流量や洪水を管理可能
	水質汚濁	+2		+1		+1	-2	-3	-1	+1	+	貯水池の土砂・汚濁物質補足による水質改善 ¹² 、富栄養化
	大気汚染			0		0	+1	-1	+1	+1	+	植生の増加による空気浄化 ¹³
	騒音			0			-2	-1		-1		装置による騒音
	廃棄物			0		0	-2	-1	+1	-1		廃棄物の発生

注：マイナスは負の影響、プラスは正の影響を示し、数値の大きさは程度の大きさを示す、空欄は未

4 総合的な人口の増減ではなく、非自発的住民移転の発生について検討すべきである。

5 工事期間中に数千人いた工事労働者はオペレーション時には数人から十数人にまで減るため多くは職を失う。経済的に改善するとは言えない。灌漑用水による農業経済の活性化は有りうる。

6 同上。多くは職を失い、以前遊牧民だった者が遊牧生活に戻れない可能性もある。

7 因果関係が間接的で、効果はほとんど期待できない。

8 補償の程度にもよるが、補償の内容については明らかにされていない。

9 環境維持流量を適切に管理できる場合に限り水域の生態系に良い影響を与える。本調査流域のように水が少ない地域では利用可能な水を使いきる可能性があるため、河川流量が減るリスクを検討すべきである。

10 同上。河川維持流量を適切に管理できる場合のみ。

11 巨大な貯水池を持つ場合は気象に影響するが、検討対象ダムは貯水池が小さく気象への影響はほとんど無い。たとえ蒸発量が増えても、流域内で降雨となる可能性は低い。

12 貯水池が計画以上に土砂を捕捉すると貯水容量が減少するため、砂防ダムや植生等で最小限にすべきである。貯水池の建造で問題となる栄養化やプランクトンの増殖、悪臭、冷水現象は検討されていない。

13 植生が増える理由が不明である。土砂流出防止策として意図的に植生する場合は緑が増える。

付録3

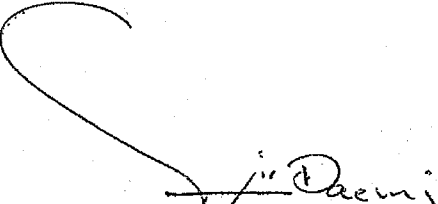
Scope of Work

Minutes of Meetings

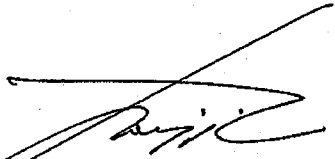
SCOPE OF WORK
FOR
THE STUDY
ON
INTEGRATED WATER RESOURCES MANAGEMENT FOR SEFIDRUD RIVER BASIN
IN THE ISLAMIC REPUBLIC OF IRAN

AGREED UPON BETWEEN
WATER RESOURCES MANAGEMENT COMPANY
THE MINISTRY OF ENERGY
THE ISLAMIC REPUBLIC OF IRAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Tehran, February 10, 2007



Mr. Ali R. Daemi
Deputy of Planning and Economics
Affairs
Water Resources Management Company
Ministry of Energy
(WRMC)



Mr. Kenji Nagata
Leader of the Preparatory Study Team
Japan International Cooperation Agency
(JICA)

I. INTRODUCTION

In response to the official request of development studies from the Government of Islamic Republic of Iran (hereinafter referred to as "the Government of Iran"), the Government of Japan decided to conduct technical cooperation for the Study on Integrated Water Resources Management for Sefidrud River Basin in the Islamic Republic of Iran (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Government of Iran.

The present document sets forth the scope of work with regard to the Study and will be valid after the notification of approval by the JICA headquarters through the JICA Iran office to the Government of Iran.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are:

1. to formulate a master plan for integrated water resources management for Sefidrud River Basin, and;
2. to transfer relevant skills and technologies to personnel concerned with the Study

III. STUDY AREA

The Study will cover the Sefidrud River basin extending to the eight provinces of Tehran, Qazvin, Zanjan, Gilan, Kordestan, Azarbayjan-e Sharghi, Ardabil and Hamedan in Iran. The location of the Study Area is shown in Annex-1.

IV. SCOPE OF THE STUDY

The Study is divided into the following two (2) phases; Phase 1 is for the basic study to understand present and future conditions, and Phase 2 is for formulation of a master plan for integrated water resources management.

The scope of work for the Study shall cover the following items:

Phase 1: Basic Study

1. Collection and review of existing data (incl. site reconnaissance)

Water Resources Management Company (hereinafter referred to as "WRMC") collected the data and information about the items with the mark "*", and will provide those data and information to JICA. Thus, those data and information will be reviewed and additional data collection would be conducted if necessary. The other data and information with no marks will be newly collected in the Study.

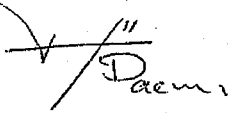
- (1) Socio-economic conditions (administrative division, population, industry, etc.)
- (2) Socio-economic development plans and other development policies/plans
- (3)* Natural conditions (topography, geology, meteorology, hydrology, hydrogeology, environment, etc.)
- (4) Topographical maps, geological maps, land use and vegetation maps, satellite photographs, etc.
- (5)* Meteorological and hydrological data and their monitoring system
- (6)* Water resources potential of surface water and groundwater (quantity and quality)
- (7)* Soil erosion, transportation and deposition
- (8)* Water use conditions and water demand, water rights allocation, facilities and problems/issues
 - ✓ by sector: agriculture (incl. irrigation and fishery), domestic water, industry water, hydropower generation, etc.
 - ✓ by water resources: surface water and groundwater
- (9)* Agriculture: soil reference data, farm product, water users' association, farmer's water use and consciousness on water issue
- (10)* Urban/Rural water services: facilities, water supply amount, organization, operation and maintenance, financial conditions, etc.
- (11)* Existing/on-going/planned projects and studies concerning with water sector
- (12) Existing legal framework for water resources development and management as well as water supply and sanitation
- (13) Existing institutional framework for operation, maintenance and management relevant to water resources
- (14)* Existing database related to water resources management

2. Field survey (if necessary)

- (1) Survey for socio-economic and environmental conditions
- (2) Survey of water facilities such as irrigation works, water supply works, flood protection facilities, groundwater development facilities, etc.

3. Analysis

- (1) Satellite image analysis on land use, surface water, groundwater, etc.
- (2) Rainfall analysis

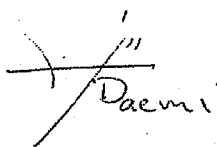
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- (3) Runoff analysis
- (4) Groundwater flow analysis
- (5) Conflict analysis on water resources
4. Water demand projection
 - (1) Socio-economic projection
 - (2) Study for possibility on saving of domestic, agricultural and industrial water
 - (3) Water demand projection for domestic, agricultural and industrial use
5. Water resources potential
 - (1) Available surface water and groundwater (quantity and quality)
 - (2) Hydrological water balance (rainfall, evapotranspiration, surface flow, groundwater flow)
 - (3) Sustainable water resources potential
6. Water balance study between water demand and potential
7. Establishment of GIS data base system for integrated water resources management
8. Evaluation of present laws, institutions and systems for water resources management
9. Stakeholder meetings
 - (1) Problems and issues on water resources management
 - (2) Present water balance and future water resources management policy
 - (3) Causes of conflict on water resources

Phase 2: Formulation of a Master Plan

1. Identification of problems and issues on water resources development and management
 - (1) Surface water development and management
 - (2) Groundwater development and management
 - (3) Operation and maintenance for water facilities
 - (4) Laws, institutions and systems for water resources management
2. Basic policy for water resources development and management
 - (1) Water resources development and management (surface water and groundwater)
 - (2) Water supply and sanitation for urban and rural areas
 - (3) Irrigation water management
 - (4) Water resources conservation
 - (5) Coordination system of water resources development and management
 - (6) Public participation into water resources management


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3. Formulation of the master plan

- (1) Surface water development and management plan
- (2) Groundwater development and management plan
- (3) Monitoring plan for surface water and groundwater
- (4) River basin management plan
- (5) Plan for laws, institutions and systems for water resources management
- (6) Evaluation of priority of the above plans based on the criteria to be proposed
- (7) Operation and maintenance plan
- (8) Water utilization / allocation plan in drought period and usual period
- (9) Initial environmental examination (IEE)
- (10) Design of water facilities
- (11) Implementation plan
- (12) Cost estimate

4. Evaluation of the master plan

- (1) Technical evaluation
- (2) Economic and financial evaluation
- (3) Environmental and social evaluation

5. Stakeholder meetings

- (1) Alternatives of projects to be proposed
- (2) Water resources allocation plan
- (3) Projects of the master plan

V. SCHEDULE OF THE STUDY

The Study will be carried out in accordance with the tentative schedule as attached in Annex-2. The schedule is tentative and subject to be modified when both parties agree upon any necessity that will arise during the course of the Study.

VI. REPORTS

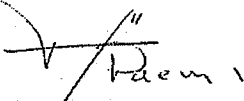
JICA shall prepare and submit following reports in English to the Government of Iran.

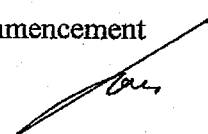
1. Inception Report:

Twenty (20) copies will be submitted at the commencement of the phase 1 work period. This report will contain the schedule and methodology of the Study.

2. Progress Report I:

Twenty (20) copies will be submitted at the time of fourth (4th) month after the commencement





of the phase 1 work period.

3. Interim Report:

Twenty (20) copies will be submitted at the end of the phase 1 work period. This report will summarize the findings of the phase 1 of the Study. The discussion on it will be held at the beginning of the phase 2 work period.

4. Progress Report II:

Twenty (20) copies will be submitted at the time of about fourth (4th) month after the commencement of the phase 2 work period.

5. Draft Final Report:

Twenty (20) copies will be submitted at the end of the phase 2 work period. The Government of Iran shall submit its comments within two (2) month after the receipt of the Draft Final Report.

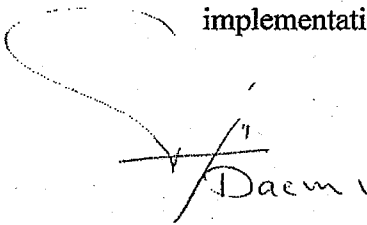
6. Final Report:

Thirty (30) copies will be submitted within one (1) month after the receipt of the comments on the Draft Final Report.

VII. UNDERTAKINGS OF THE GOVERNMENT OF IRAN

1. To facilitate the smooth conduct of the Study; the Government of Iran shall take necessary measures:

- (1) to secure safety of the Japanese study team (hereinafter referred to as "the Team");
- (2) to permit the members of the Team to enter, leave and sojourn in Iran for the duration of their assignments therein, and exempt them from foreign registration requirements and consular fees;
- (3) to exempt the members of the Team from taxes, duties and any other charges on equipment, machinery and other material brought into and out of Iran for the implementation of the Study;
- (4) to exempt the members of the Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Team for their services in connection with the implementation of the Study;
- (5) to provide necessary facilities to the Team for the remittance as well as utilization of the funds introduced into Iran from Japan in connection with the implementation of the Study;
- (6) to secure permission for the Team to enter into private properties or restricted areas for the implementation of the Study;

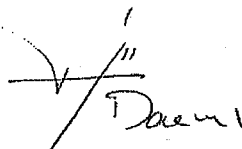

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- (7) to secure permission for the Team to take all data and documents including photographs and maps related to the Study out of Iran to Japan;
 - (8) to provide medical services as needed. Its expenses will be charged on the members of the Team.
2. The Government of Iran shall bear claims, if any arises, against the members of the Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the Team.
 3. On the parts of the Government of Iran, the Ministry of Energy shall act as the counterpart agency to the Team for the Study and also as the coordinating body in relation to other governmental and non-governmental organizations concerned for the smooth implementation of the Study.
 4. Ministry of Energy of Iran shall, at its own expense, provide the Team with the following, in cooperation with other organizations concerned:
 - (1) Security-related information on as well as measures to ensure the safety of the Team;
 - (2) Information on as well as support in obtaining medical service;
 - (3) Available data (including maps and photographs) and information related to the Study;
 - (4) Counterpart personnel;
 - (5) Suitable office space with necessary equipment; and
 - (6) Credentials or identification cards.

VIII. CONSULTATION

JICA and the Ministry of Energy shall consult with each other in respect of any matter that may arise from or in connection with the Study.



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Annex 1: Study Area



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Annex-2: Tentative Schedule of the Study

Tentative Schedule of the Study

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Phase	Phase 1						Phase 2													
Work in Iran						■	■													
Work in Japan																				■
Report Presentation	▲			▲				▲			▲						▲			▲
	IC/R			PG/R1				IT/R			PG/R2						DF/R			F/R

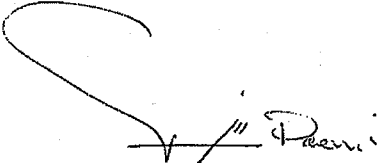
- IC/R: Inception Report
- PG/R1: Progress Report I
- IT/R: Interim Report
- PG/R2: Progress Report II
- DF/R: Draft Final Report
- F/R: Final Report

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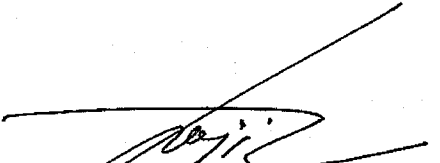
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MINUTES OF MEETINGS
ON
SCOPE OF WORK
FOR
THE STUDY
ON
INTEGRATED WATER RESOURCES MANAGEMENT FOR SEFIDRUD RIVER BASIN
IN THE ISLAMIC REPUBLIC OF IRAN
AGREED UPON BETWEEN
WATER RESOURCES MANAGEMENT COMPANY
THE MINISTRY OF ENERGY
THE ISLAMIC REPUBLIC OF IRAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Tehran, February 10, 2007



Mr. Ali R. Daemi
Deputy of Planning and Economies
Affairs
Water Resources Management Company
Ministry of Energy
(WRMC)



Mr. Kenji Nagata
Leader of the Preparatory Study Team
Japan International Cooperation Agency
(JICA)

I. INTRODUCTION

In response to the official request of development studies from the Government of Islamic Republic of Iran (hereinafter referred to as "the Government of Iran"), the Government of Japan decided to conduct technical cooperation for the Study on Integrated Water Resources Management for Sefidrud River Basin in the Islamic Republic of Iran (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, dispatched a preparatory study team headed by Mr. Kenji NAGATA (hereinafter referred to as "the Team"), from 2nd February to 1st March 2007 to Iran for discussions on the contents of the Study.

During the stay of the Team in Iran, the Team made a field reconnaissance to the study area, and held a series of meetings with Water Resources Management Company (hereinafter referred to as "WRMC"). The list of participants of the meetings is attached in the Appendix-1.

The Minutes of Meetings have been prepared for the better understanding of the Scope of Work agreed upon between WRMC and the Team (hereinafter referred to as "both sides"). The main items that were discussed and agreed upon between both sides are summarized as follows:

1 Demarcation of the Study

WRMC has been conducting the study for water resources management in Sefidrud River (hereinafter referred to as "the WRMC Study") through subcontracting it to Mahab Ghodss Consulting Engineering Co. (hereinafter referred to as "the Subcontractor"). Both sides agreed the demarcation of the Study as follows:

(1) Collecting data and information in Phase-1

WRMC will provide the JICA Study Team with all the data and information collected through the WRMC Study with no compensation. The JICA Study Team will review those data and information and would conduct additional collection of data and information according to need.

(2) Formulating a master plan in Phase-2

The master plan will be formulated mainly by the JICA Study Team in cooperation with WRMC and the Subcontractor.

(3) Mutual sharing of data and information

WRMC, the JICA Study Team and the Subcontractor will share all the data and information as well as the study/planning process and results concerning with the Study and the WRMC

Study, and will cooperate with each other and make their efforts to formulate the best master plan for Sefidrud River Basin.

The Team requested that the interim report of the WRMC Study be given to the Team before 21st February 2007 to prepare the TOR for the Study immediately, and explained that the preparation of the TOR might be delayed if the submission of the interim report to the Team would be postponed because both sides understood that the interim report was the starting point of the Study. WRMC agreed with it and promised to give the interim report to the Team.

2 Master plan

Both sides confirmed that the master plan included structural and non-structural measures on a master plan level, and would not include detailed plans and designs for particular projects such as rehabilitation of Gilan irrigation facilities and countermeasures for sediment in Manjil Dam Reservoir.

3 GIS database

In response to the WRMC's request, the Team agreed to complete the GIS database that WRMC and the Subcontractor has been preparing, compiling the data and information which would be collected and analyzed in the Study.

4 Simulation models for surface water and groundwater

WRMC strongly requested that simulation models should be developed in the Study for surface water and groundwater analysis in terms of quantity and quality. The Team explained that the first priority should be put on immediate formulation of the master plan, and the simulation models might be developed according to need to formulate the master plan. And the Team explained that the level of the simulation models to be applied in the Study depends on data availability and resources (time and budget), and would be decided based on the survey results by the Team. The Team agreed to convey the request to JICA Headquarters. It is emphasized by WRMC that a type and level of simulation model should be clarified in the inception report.

5 Flood and sediment control measures

WRMC requested that recommendation on flood and sediment control measures be included in the Study. The Team answered that the recommendation on those measures would be made in the Study based on existing data and information as well as previous study reports on flood and sediment.

6 Stakeholder meetings

Both sides confirmed that the master plan should be formulated with consensus building through

stakeholder meetings. The Team suggested that stakeholder meetings would be very important to formulate the master plan, and WRMC agreed to hold frequent stakeholder meetings under their responsibility. The Team promised to assist WRMC in holding those stakeholder meetings.

7 Time schedule of the Study

WRMC requested to shorten the time schedule of the Study to complete the master plan immediately. The Team understood the urgency of the formulation of the master plan, and promised to complete the study as soon as possible. The Team added, however, that immediate completion of the Study depended much on data availability and a halfway job would not be conducted to shorten the time schedule. The Team promised to make efforts to start the Study before September 2007.

8 Technology transfer and capacity building

WRMC requested that counterpart personnel should take advantage of training in Japan related to the Study to promote effective technology transfer. The Team agreed to convey the request to JICA Headquarters.

9 Counterpart team

WRMC agreed to assign a counterpart team, and promised to deliver the tentative list of the counterpart team to the Team by 20th February 2007.

10 Steering committee

WRMC will set up a steering committee under the chairmanship of WRMC for the smooth implementation of the Study. Both sides confirmed that the steering committee would consist of responsible persons in WRMC and relevant regional water authorities. Coordination with relevant organizations will be conducted by WRMC. WRMC promised to submit a tentative list of the steering committee to the Team by 20th February 2007.

11 Environmental and social considerations

The Team explained the JICA's environmental and social consideration guidelines. And WRMC understood the policy of the JICA's guidelines. The Study will follow both the laws / regulations of Iran and the JICA's guidelines.

12 Reports

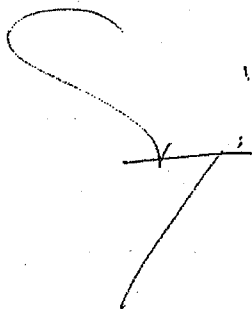
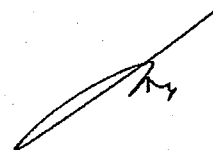
Both sides agreed that the study reports would be open to the public, in principle, in order to achieve maximum use of the Study results.

13 Inception Report

The methodology and policy of the draft inception report will be discussed and finalized by the JICA Study Team and WRMC at the beginning of the Study. Based on the discussion the final inception report will be prepared.

14 Office space

WRMC agreed to provide office space with office furniture, air-conditioning, telephone lines and electricity inside of WRMC in Tehran.

A handwritten signature in black ink, consisting of a large, sweeping 'S' shape followed by a horizontal line and a diagonal stroke.A handwritten signature in black ink, consisting of a long, sweeping horizontal line with a small mark at the end.

Appendix-1 List of Participants

Iranian Side

Water Resources Management Company, Ministry of Energy

Mr. Ali R. Daemi, Deputy of Planning and Economics Affairs

Mr. Majid Sayyari, Director General of Budget and Planning

Ms. Bahareh Hafez, Expert, Water Planning and Allocation Department

Mahab Ghodss Consulting Engineering Co.

Mr. Pakdaman Amir Hassan, Head of Water Resources Section

Mr. Bahman Khayyam, Senior Water Resources Specialist

Mr. M. A. Taban, Head of Integrated Water Resources Department

Mr. A. Ghobadi, Senior Expert, Water Resources Department

Japanese Side

The Preparatory Study Team, JICA

Mr. Kenji NAGATA, Leader

Ms. Hiromi SAWADA, Cooperation planning

Mr. Seiichi YAMAKAWA, Water Resources Development and Management (surface water/
groundwater)

Mr. Takayoshi ITOIGAWA, Water Resources Management Policy and System / environmental
and social consideration

JICA Iran Office

Mr. Hiroshi KURAKATA, Resident Representative

Mr. Yoshinori NAKAYAMA, Project Formulation Advisor

Mr. Babak SAMIEI, Program Officer

MINUTES OF MEETINGS

of

The Scoping of Initial Environmental Examination

for

*The Study on Integrated Water Resources Management for Sefidrud River
Basin in the Islamic Republic of Iran*

AGREED UPON

BETWEEN

Water Resources Management Company

Ministry of Energy

The Islamic Republic of Iran

and

The Study Team of Japan International Cooperation Agency

Tehran,

September 25, 2007

Mr. Majid Sayyari
Director General
Office of Project and Planning
Water Resources Management Company

Mr. Tahara Teruo
Leader of the Study Team
Japan International Cooperation Agency

M. Sayyari

Rajeev

I. Introduction

The Government of Japan, in response to the official request of the Government of Islamic Republic of Iran (hereinafter referred to as "the Government of Iran"), decided to conduct the Study on Integrated Water Resources Management for Sefidrud River Basin in the Islamic Republic of Iran (hereinafter referred to as "the Study") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Study Team to Iran from February 2 to March 1, 2007.

Water Resources Management Company of the Ministry of Energy (hereinafter referred to as "WRMC") and the Preparatory Study Team signed on and exchanged the agreement on the Scope of Work (hereinafter referred to as "S/W") and Minutes of Meetings (hereinafter referred to as "M/M") for the Study.

JICA has prepared the Study according to the S/W and M/M, and dispatched the JICA Study Team, headed by Mr. Tahara Teruo of CTI Engineering International Co., Ltd., to Iran from August 9, 2007.

The Study Team explained the overall activities described in the Inception Report and the Scoping of Initial Environmental Examination (hereinafter referred to as "IEE") to Iranian stakeholder, steering committee, and Environment and Water Resources Quality Office in WRMC (hereinafter referred to as "Iranian Side") in the meeting that were held on 20th of August and 12th of September 2007. Iranian side and the JICA Study Team (hereinafter referred to as "Both Sides") had finally agreed on the scoping of IEE. List of participants are shown in ATTACHMENT 1 and ATTACHMENT 2.

II. Discussions

1. Definition

Both side agreed on that stake holder should be composed of Studies and Evaluation Bureau of WRMC in Ministry of Energy and the representative of Regional Water Company (hereinafter referred to as "RWC") of seven provinces of Zanjan, Kordestan, East Azarbayegan, Gilan, Qazvin, Ardebil, and Tehran.

2. Scoping of IEE

The both sides confirmed that "Environmental Primary Estimate" is required in Iranian regulation. It is synonymous with "IEE" of JICA regulation, so IEE will be conducted in the Study.

IEE would be conducted for getting the environmental condition in the Sefidrud River Basin. Terms of Reference (TOR) of IEE including Scoping are shown in ATTACHMENT 3.

Items of reserved area and dangerous plants will be added in "Natural Environment" in TOR 2.2.2 Scoping.

Positive impacts will be also investigated in TOR 2.2.2 Scoping.

It shall be added "objectives", "schedule", and "environmental standards" of Iran in Inception Report in TOR 2.4 Reporting.

3. Report submission

The Final Report of IEE shall be submitted to "Environment and Water Resources Quality Office in WRMC.

ATTACHMENT 1

List of participants in the Meeting on August 20, 2007 at the meeting room of WRMC.

[Iranian Side]

Mr. Majid Sayyari	Director General	Office of Project and Planning, WRMC
Mr. Davoud Khatib	Expert	Office of Project and Planning, WRMC
Mr. Ahmad Rajaei	Expert	Office of Project and Planning, WRMC
Mr. Yamashita Yoshihiro	JICA Expert	WRMC

List of participants of stakeholder in Stakeholders' meeting on 20th of August

	Full Name	Affiliation	Position	Contact
1	Mr. Mohammad-Ghasem Safice	Qazvin RWC	Deputy of water resource planning	081-2223-7219
2	Mr. Mohammad-Ali Banisefid	Qazvin RWC	Planning & development	0912-181-7151
3	Mr. Kazem Aziz Moghaddam	Ardebil RWC	Engineering 7 technical office	0914-1529-414
4	Mr. Kourosh Kolahchi	Tehran RWC	Manager / planning office	021-8896-8014
5	Mr. Ali Mozafarian	Tehran RWC	Planning expert	021-8896-8014
6	Mr. Mojtaba Jalilzad	East Azerbaijan RWC	Manager / water resource planning office	041-1338-2410
7	Ms. Soheila mafakheri	Kordestan RWC	Expert / water resources planning	087-1662-2950
8	Mr. Jafar Fahimi	Zanjan RWC	Director general	034-1424-1041
9	Mr. Mohammad-Taghi Talebpoor	Zanjan RWC	Exploitation manager	034-1424-1041
10	Mr. Ali Karimi	Zanjan RWC	Technical consultant	034-1424-1041
11	Mr. Ali Abbasi	Zanjan RWC	Manager / water resources preservation office	034-1424-1041
12	Mr. Majid Akbari	R&D	WRMC	021-8890-1081
13	Mr. Fazl-Ali Jafarian	R&D	WRMC	021-8890-9137
14	Ms. Sanaz Dashti	Mahab Ghodss	Expert of water resources	021-2396-5229
15	Mr. Amir Hassan Pakdaman	Mahab Ghodss	Manager / water resources & demands	021-2396-1221
16	Mr. Abdolali Ghobadi	Mahab Ghodss	Water resources & demands	021-2396-1221
17	Mr. Bahman Khayyam	Mahab Ghodss	Water resources & demands	021-2396-1228
18	Mr. Vahid karami	Mahab Ghodss	Irrigation & drainage	021-2396-1351

[Japanese Side]

Mr. Tahara Teruo	Team Leader	JICA Study Team
Mr. Matsumoto Shinichiro	Deputy Team Leader	JICA Study Team
Mr. Morishita Kanehiro	IWRM Planning Specialist	JICA Study Team
Mr. Yajima Makoto	Conflict Management Specialist	JICA Study Team
Mr. Daisaku Kiyota	Environmental Specialist	JICA Study Team
Mr. Onuma Takashi	Administrative Coordinator	JICA Study Team
Mr. Wakui Junji	Assistant Resident Representative	JICA Iran Office

ATTACHMENT 2

List of participants in the Meeting on 12th of September, 2007 at the meeting room of WRMC.

[Iranian Side]

Mr. Majid Sayyari	Director General	Office of Project and Planning, WRMC
Mr. Davoud Khatib	Expert	Office of Project and Planning, WRMC
Mr. Ahmad Rajaei	Expert	Office of Project and Planning, WRMC
Mr. Yamashita Yoshihiro	JICA Expert	WRMC

List of participants of stakeholder in Stakeholders' meeting on 12th of September

No.	Full Name	Affiliation	Position	Contact
1	Ms. Soheila Mafakhary	Kordestan RWC	Expert, Water Resources Planning,	087-1662-2949
2	Mr. Iraj Hamidzadeh	East Azarbayejan RWC	Manager, Water Resources Planning Office	0914-1165-975
3	Mr. Kazem Azizmoghaddam	Ardebil RWC	Manager, Water Resources Planning & Development Office	0914-2529-414
4	Mr. Mohammad Ali Banisefid	Qazvin RWC	Deputy, Development & Planning	0912-181-7151
5	Mr. Amir Kakahaji	Qazvin RWC	Engineering Office	028-1223-9662
6	Mr. Mohammad Ghasem Safiee	Qazvin RWC	Manager, Basic Water Resources Studies Office	028-1223-7219
7	Mr. Mohammad Talebpour	Zanjan RWC	Deputy, Exploitation & Subscribers Affairs	0912-2429-608
8	Mr. Ali Abbasi	Zanjan RWC	Manager, Water Resources Protection Office	0912-3425-272
9	Ms. Mandana Abedini	Zanjan RWC	Manager, Coordination	0912-5422-866
10	Ms. Sedigheh Rasouli	Gilan RWC	Manager, Water Resources Planning Office	013-1666-7257
11	Mr. Mojtaba Jalilzadeh	East Azarbayejan RWC	Manager, Water Resources Planning Office	041-1338-2410
12	Mr. Majid Akbary	WRMC	Expert, Water resources Basic Studies Office	021-8890-1819
13	Mr. Fazl --Ali Jafarian	WRMC	Expert, Water resources Basic Studies Office	021-8890-9137
14	Mr. Amir Hassan Pakdaman	Mahab Ghodss	Manager, Water Resources & Demands	021-2396-1221
15	Mr. Abdolali Ghobadi	Mahab Ghodss	Senior Expert	021-2396-1221
16	Ms. Sanaz Dashti	Mahab Ghodss	Groundwater Senior Expert	021-2396-5229
17	Mr. Vahid Karami	Mahab Ghodss	Manager, Irrigation & Drainage	021-2396-1351

[Japanese Side]

Mr. Tahara Teruo	Team Leader	JICA Study Team
Mr. Matsumoto Shinichiro	Deputy Team Leader	JICA Study Team
Mr. Yajima Makoto	Conflict Management Specialist	JICA Study Team
Mr. Takafumi Szuki	Agriculture/Irrigation Specialist	JICA Study Team
Mr. Yasushi Osato	Organization/ Institution Specialist	JICA Study Team
Mr. Daisaku Kiyota	Environmental Specialist	JICA Study Team
Mr. Onuma Takashi	Administrative Coordinator	JICA Study Team

ATTACHMENT 3: Scoping of IEE

**TERMS OF REFERENCE (TOR)
FOR
INITIAL ENVIRONMENTAL EXAMINATION (IEE)**

1. Implementation Policy of IEE

1.1 General

The objective of the **INITIAL ENVIRONMENTAL EXAMINATION** (hereinafter referred to as **IEE**) is anticipating examining the consequences of Master Plan prior to the project stage and will be applied to the project of "INTEGRATED WATER RESOURCES MANAGEMENT FOR SEFIEDRUD RIVER BASIN IN THE ISLAMIC REPUBLIC OF IRAN (hereinafter referred to as **The Study**)"

IEE will be conducted for the generic master plan study proposed by JICA Study Team with the guidelines of Islamic Republic of Iran and/or JICA guidelines.

1.2 Entrusting of IEE

The JICA Study Team will entrust part of **IEE** studies to a local consultant (hereinafter referred to as **Contractor**) on contract basis as described in the "2. Scope of Work for IEE)".

1.3 Study Process of IEE

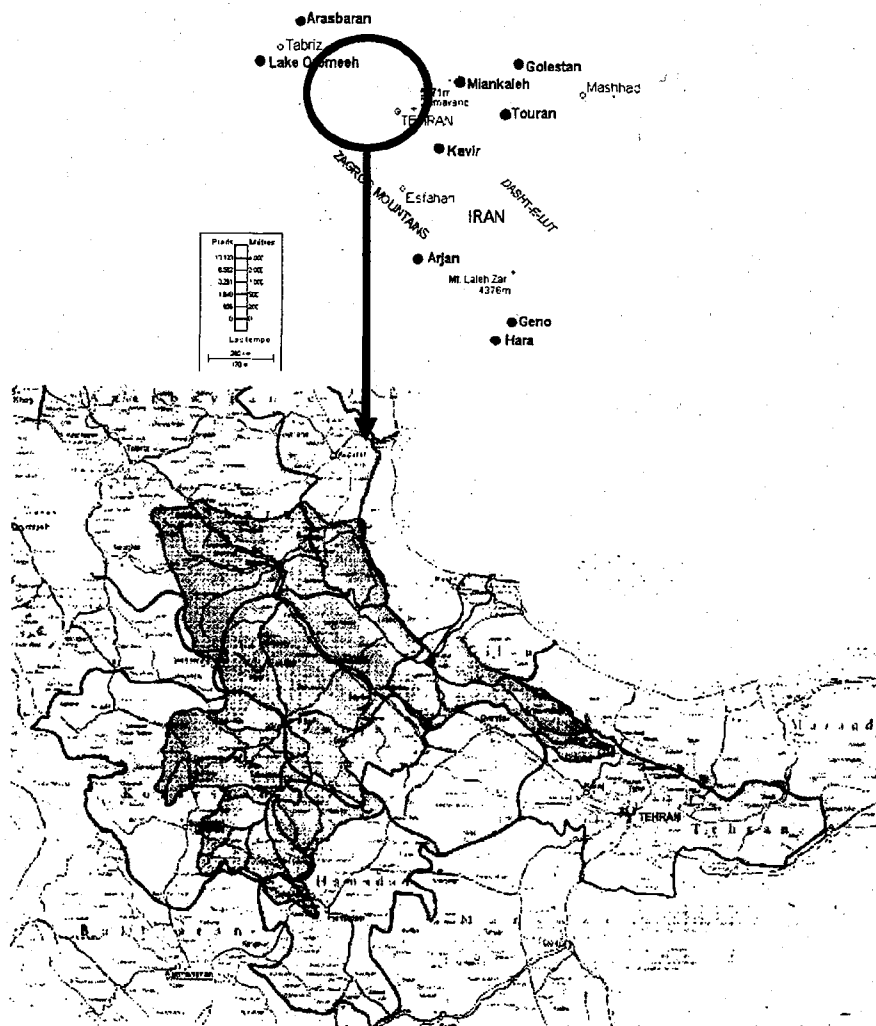
The **IEE** will be conducted for generic master plan. The study process is shown below.

- **Scoping:** JICA study team will prepare a scoping report in consultation with the project proponent. The scoping report was discussed with stakeholders in the stakeholder meeting held on 20th of August and 12th of September 2007.
- **Implementation of IEE:** the contractor and the JICA Study Team will conduct the **IEE**, taking into consideration the opinions/recommendations addressed in the first and second stakeholder meeting. In the course of the study, interim results will be discussed with stakeholders in the third stakeholder meeting that will be held in the beginning of December 2007.
- **Preparation of IEE Report:** the contractor and the JICA Study Team will prepare a draft final report, taking into consideration the opinions/recommendations addressed in the above stakeholder meeting. The draft final report will be discussed with stakeholders in the fourth stakeholder meeting that will be held in the beginning of February 2008. The final report will be prepared, taking into consideration the opinions/recommendations addressed in the above fourth meeting.

2. Scope of Work for IEE

2.1 Target Area

The IEE shall be conducted for the river basins of SEFIDRUD, and related 8 provinces of East Azerbaijan, Gilan, Hamadan, Kordestan, Qazvin, Tehran, Zanjan, and Ardebil in the Islamic Republic of Iran.



2.2 Study Works

2.2.1 Collection of Relevant Documents and Data

The Contractor shall collect existing baseline data/information related to natural and social environments, environmental regulations/guidelines, and water quality standards. The Contractor shall summarize the documents and regulations for review by the JICA Study Team.

2.2.2 Scoping

Scoping is to identify the extent of possible significant impacts caused by the Study and to establish prediction/evaluation methods of the impacts. In more detail, Scoping shall include the following works:

- (i) to identify impact sources of the project activities,
- (ii) to identify environmental items which may be subject to significant negative impacts and,
- (iii) to establish prediction/evaluation method of the impacts.

JICA Study Team established the scoping in the consultation of stakeholder meeting. The Contractor shall conduct the above scoping works based on scoping of JICA Study Team and shall investigate the following items with the analyses of the collected data/information and field reconnaissance.

(1) Identification of Negative Impact Sources

Negative impacts will be generated by the necessary project activities to implement the generic master plan. The impact sources of each component will be identified for pre-construction stages. The contractor shall identify impact sources to be analyzed.

(2) Item to be investigated

The contractor shall identify environmental items which may be affected by significant negative impacts from among the following ones, but not limited to them.

- Social Environment: (i) resettlement, (ii) economic activities, (iii) land use, (iv) separation of community, (v) transportation and living facilities and services, (vi) poverty and minority, (vii) regional imbalance of project benefits, (viii) historical and cultural assets, (ix) regional conflicts, (x) water right and common right, (xi) public hygiene, (xii) disaster and epidemic.
- Natural Environment: (i) topography and geology, (ii) groundwater, (iii) soil erosion, (iv) hydrological regime, (v) coastal and ocean environment, (vi) fauna/flora and biological diversity, (vii) climate, (viii) landscape, (ix) global warming, (x) preserved area, (xi) dangerous plants
- Public Nuisance: (i) air pollution, (ii) water pollution, (iii) soil pollution, (iv) solid waste, (v) noise and vibration, (vi) land subsidence, (vii) odor, (viii) pollution of riverbed materials, (ix) traffic accident.

The degree/extent of negative impacts shall be shown as much clearly as possible, for example, by matrix system with score, so that really important environmental items can be selected.

(3) Identification of Positive Impacts

Positive impacts will be also investigated by this Master Plan, especially in the social environment.

2.2.3 Implementation of IEE

The Contractor shall prepare IEE for the generic master plan, based on the existing data, field reconnaissance, field observation on natural environment (as required), results of social environmental survey for resettlement and engineering studies, and other information.

The IEE study shall include the following works:

- (i) to predict and evaluate negative impacts caused by master plan,
- (ii) to propose mitigation measures of the negative impacts and
- (iii) to propose monitoring plan of the negative impacts.
- (iv) to investigate positive impacts

2.3 Attendance in Stakeholder Meeting

The Contractor shall attend the stakeholder meetings which will be held in the course of the master plan study, and provide the JICA Study Team and project proponent with necessary technical support in the meeting.

2.4 Reporting

The Contractor shall submit the following reports in English to the JICA Study Team at the designated time. The JICA Study Team will examine them for approval to the next step, after consultation with the project proponent.

(1) Inception Report (3 copies)

The Contractor shall prepare five (5) copies of Inception Report and submit them to the JICA Study Team within 2 weeks after signing of the contract. The Inception Report shall contain the following descriptions.

- (a) Objectives
- (b) Schedule
- (c) Environmental standards in Iran
- (d) Environmental Impact Statement System (EIS) and laws/ regulations/ policies related to resettlement of Iran
- (e) Scoping
- (f) Others, if any

(2) Interim Report (3 copies)

The Contractor shall prepare the Interim Report and submit it to the JICA Study Team by the end of November 2007. The Interim Report shall contain the interim results of the IEE.

(3) Draft Final Report (3 copies)

The Contractor shall prepare the Draft Final Report and submit it to the JICA Study Team by the end of January 2008. The Draft Final Report shall contain all the results of IEE study. The JICA Study Team will review the report and make comments.

(4) **Final Report (10 copies and CD)**

The Contractor shall finalize the Draft Final Report based on the comments by the JICA Study Team and submit it to the JICA Study Team by end of February 2008.

4. Equipment, Materials and Labor

All equipment, transportation vehicles, materials and labor required for all the above-mentioned works shall be provided by the Contractor, as defined in the contract. Those costs shall be included in the cost estimate. The contract is based on Lump sum basis.

5. Any Other Issues

Any other issues related to the conduct of the IEE not mentioned above shall be settled with mutual agreement between the JICA Study Team and the Contractor.

MINUTES OF MEETINGS

on

The Inception Report

of

THE STUDY

on

***Integrated Water Resources Management for Sefidrud River Basin
in the Islamic Republic of Iran***

AGREED UPON BETWEEN

Water Resources Management Company

Ministry of Energy

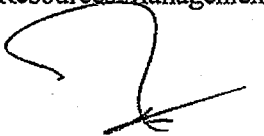
The Islamic Republic of Iran

and

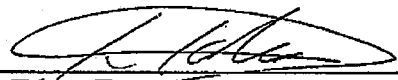
Japan International Cooperation Agency

Tehran, October 2, 2007

Mr. Majid Sayyari
Director General
Office of Project and Planning
Water Resources Management Company

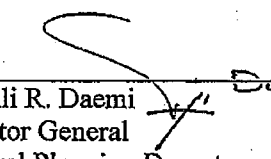


M. Sayyari

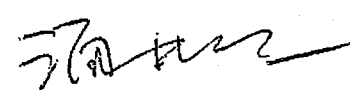


Mr. Tahara Teruo
Leader of the Study Team
Japan International Cooperation Agency

Witness



Mr. Ali R. Daemi
Director General
General Planning Department
Ministry of Energy



Mr. Wakui Junji
Assistant Resident Representative
Iran Office
Japan International Cooperation Agency



I. Introduction

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Water Resources Management Company of the Ministry of Energy (hereinafter referred to as "WRMC") and the Preparatory Study Team signed on and exchanged agreement on the Scope of Work (hereinafter referred to as "S/W") and Minutes of Meetings (hereinafter referred to as "M/M") for the Study.

JICA has prepared the Study according to the S/W and M/M, and dispatched the JICA Study Team, headed by Mr. TAHARA Teruo of CTI Engineering International Co., Ltd., to Iran from August 9, 2007.

At the commencement of the Study, the Study Team explained the overall activities described in the Inception Report to Iranian stakeholders (composed of the representative of seven provinces of Zanjan, Kordestan, East Azerbaijan, Gilan, Qazvin, Ardebil, and Tehran), steering committee (hereinafter referred to as "Iranian Side") in the meeting that were held on 20th of August and 12th of September 2007. List of participants of the stakeholder meeting are shown in ATTACHMENT 1 and ATTACHMENT 2.

After the stakeholder meetings, Iranian side and the JICA Study Team (hereinafter referred to as "Both Sides") had also a series of discussions on the comments from stakeholders. Both Sides finally agreed upon the study components and study plan contained in the Inception Report. List of participants are shown in ATTACHMENT 3.

II. Discussions

1. The target of accuracy of satellite images will be 1/25,000 scale, if such data available.
2. Table 3.12 will be adjusted in accordance with the number of project in the Mahb Ghodss final report.

ATTACHMENT 1

List of participants in the Meeting on August 20, 2007 at the meeting room of WRMC.

[Iranian Side]

Mr. Majid Sayyari	Director General	Office of Project and Planning, WRMC
Mr. Davoud Khatib	Expert	Office of Project and Planning, WRMC
Mr. Yamashita Yoshihiro	JICA Expert	WRMC

List of participants of in Steering Committee and Stakeholders' meeting on 20th of August

	Full Name	Affiliation	Position	Contact
1	Mr. Mohammad-Ghasem Safiee	Qazvin RWC	Deputy of water resource planning	081-2223-7219
2	Mr. Mohammad-Ali Banisefid	Qazvin RWC	Planning & development	0912-181-7151
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6	Mr. Mojtaba Jalilzad	East Azerbaijan RWC	Manager / water resource planning office	041-1338-2410
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8	Mr. Jafar Fahimi	Zanjan RWC	Director general	034-1424-1041
9	Mr. Mohammad-Taghi Talebpoor	Zanjan RWC	Exploitation manager	034-1424-1041
10	Mr. Ali Karimi	Zanjan RWC	Technical consultant	034-1424-1041
11	Mr. Ali Abbasi	Zanjan RWC	Manager / water resources preservation office	034-1424-1041
12	Mr. Majid Akbari	R&D	WRMC	021-8890-1081
13	Mr. Fazl-Ali Jafarian	R&D	WRMC	021-8890-9137
14	Ms. Sanaz Dashti	Mahab Ghodss	Expert of water resources	021-2396-5229
15	Mr. Amir Hassan Pakdaman	Mahab Ghodss	Manager / water resources & demands	021-2396-1221
16	Mr. Abdolali Ghobadi	Mahab Ghodss	Water resources & demands	021-2396-1221
17	Mr. Bahman Khayyam	Mahab Ghodss	Water resources & demands	021-2396-1228
18	Mr. Vahid karami	Ghodss	Irrigation & drainage	021-2396-1351

[Japanese Side]

Mr. Tahara Teruo	Team Leader	JICA Study Team
Mr. Matsumoto Shinichiro	Deputy Team Leader	JICA Study Team
Mr. Morishita Kanehiro	IWRM Planning Specialist	JICA Study Team
Mr. Yajima Makoto	Conflict Management Specialist	JICA Study Team
Mr. Daisaku Kiyota	Environmental Specialist	JICA Study Team
Mr. Onuma Takashi	Administrative Coordinator	JICA Study Team

Mr. Wakui Junji	Assistant Resident Representative	JICA Iran Office
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ATTACHMENT 2

List of participants in the Meeting on 12th of September, 2007 at the meeting room of WRMC.

[Iranian Side]

Mr. Majid Sayyari	Director General	Office of Project and Planning, WRMC
Mr. Davoud Khatib	Expert	Office of Project and Planning, WRMC
Mr. Yamashita Yoshihiro	JICA Expert	WRMC

List of participants of in Steering Committee and Stakeholders' meeting on 12th of September

No.	Full Name	Affiliation	Position	Contact
1	Ms. Soheila Mafakhary	Kordestan RWC	Expert, Water Resources Planning,	087-1662-2949
2	Mr. Iraj Hamidzadeh	East Azarbayejan RWC	Manager, Water Resources Planning Office	0914-1165-975
3	Mr. Kazem Azizmoghaddam	Ardebil RWC	Manager, Water Resources Planning & Development Office	0914-2529-414
4	Mr. Mohammad Ali Banisefid	Qazvin RWC	Deputy, Development & Planning	0912-181-7151
5	Mr. Amir Kakahaji	Qazvin RWC	Engineering Office	028-1223-9662
6	Mr. Mohammad Ghasem Safiee	Qazvin RWC	Manager, Basic Water Resources Studies Office	028-1223-7219
7	Mr. Mohammad Talebpour	Zanjan RWC	Deputy, Exploitation & Subscribers Affairs	0912-2429-608
8	Mr. Ali Abbasi	Zanjan RWC	Manager, Water Resources Protection Office	0912-3425-272
9	Ms. Mandana Abedini	Zanjan RWC	Manager, Coordination	0912-5422-866
10	Ms. Sedigheh Rasouli	Gilan RWC	Manager, Water Resources Planning Office	013-1666-7257
11	Mr. Mojtaba Jalilzadeh	East Azarbayejan RWC	Manager, Water Resources Planning Office	041-1338-2410
12	Mr. Majid Akbary	WRMC	Expert, Water resources Basic Studies Office	021-8890-1819
13	Mr. Fazl -Ali Jafarian	WRMC	Expert, Water resources Basic Studies Office	021-8890-9137
14	Mr. Amir Hassan Pakdaman	Mahab Ghodss	Manager, Water Resources & Demands	021-2396-1221
15	Mr. Abdolali Ghobadi	Mahab Ghodss	Senior Expert	021-2396-1221
16	Ms. Sanaz Dashti	Mahab Ghodss	Groundwater Senior Expert	021-2396-5229
17	Mr. Vahid Karami	Mahab Ghodss	Manager, Irrigation & Drainage	021-2396-1351

[Japanese Side]

Mr. Tahara Teruo	Team Leader	JICA Study Team
Mr. Matsumoto Shinichiro	Deputy Team Leader	JICA Study Team
Mr. Yajima Makoto	Conflict Management Specialist	JICA Study Team
Mr. Takafumi Szuki	Agriculture/Irrigation Specialist	JICA Study Team
Mr. Yasushi Osato	Organization/ Institution Specialist	JICA Study Team
Mr. Daisaku Kiyota	Environmental Specialist	JICA Study Team
Mr. Onuma Takashi	Administrative Coordinator	JICA Study Team

ATTACHMENT 3

1. List of participants in the Meeting on 23rd of September, 2007 at the Director's office of WRMC.

[Iranian Side]

Mr. Majid Sayyari	Director General	Office of Project and Planning, WRMC
Mr. Ahmed Rajaei	Expert	Office of Project and Planning, WRMC

[Japanese Side]

Mr. Tahara Teruo	Team Leader	JICA Study Team
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2. List of participants in the Meeting on 24th of September, 2007 at the Deputy's office of WRMC.

[Iranian Side]

Mr. Ali R. Daemi	Deputy	Planning and Economics Affairs, Studies and Evaluation Bureau of WRMC
Mr. Majid Sayyari	Director General	Office of Project and Planning, WRMC
Mr. Ahmed Rajaei	Expert	Office of Project and Planning, WRMC

[Japanese Side]

Mr. Tahara Teruo	Team Leader	JICA Study Team
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3. List of participants in the Meeting on 25th of September, 2007 at the Director's office of WRMC.

[Iranian Side]

Mr. Majid Sayyari	Director General	Office of Project and Planning, WRMC
Mr. Ahmed Rajaei	Expert	Office of Project and Planning, WRMC

[Japanese Side]

Mr. Tahara Teruo	Team Leader	JICA Study Team
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MINUTES OF MEETING

on

The Interim Report

of

THE STUDY

on

***Integrated Water Resources Management for Sefidrud River Basin
in the Islamic Republic of Iran***

AGREED UPON BETWEEN

Water Resources Management Company

Ministry of Energy

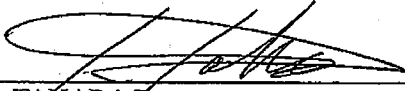
The Islamic Republic of Iran

and

Japan International Cooperation Agency

Tehran, July 13, 2008

Mr. Majid Sayyari
Director General
Office of Project and Planning
Water Resources Management Company



Mr. TAHARA Teruo
Leader of the Study Team
Japan International Cooperation Agency



Mr. Sayyari

Witness

Mr. Alireza Almasvandi
Deputy
Research and Technical Affairs
Water Resources Management Company



Mr. NAGATA Kenji
Leader of Monitoring Team
Japan International Cooperation Agency

I. Introduction

The Government of Japan, in response to the official request of the Government of Islamic Republic of Iran (hereinafter referred to as "the Government of Iran"), decided to conduct the Study on Integrated Water Resources Management for Sefidrud River Basin in the Islamic Republic of Iran (hereinafter referred to as "the Study") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Study Team to Iran from February 2 to March 1, 2007.

Water Resources Management Company of the Ministry of Energy (hereinafter referred to as "WRMC") and the Preparatory Study Team signed on and exchanged agreement on the Scope of Work (hereinafter referred to as "S/W") and Minutes of Meetings (hereinafter referred to as "M/M") for the Study. JICA has prepared the Study according to the S/W and M/M, and dispatched the JICA Study Team, headed by Mr. TAHARA Teruo of CTI Engineering International Co., Ltd., to Iran from August 9, 2007.

A meeting on the Interim Report (hereinafter referred to as "the Report") for the Study was held at the WRMC's Office on July 8, 2008. The Report was explained by the Study Team and discussions were made between the Study Team and WRMC. After the meeting, WRMC received the Interim Report from JICA Study Team and will provide the comments to the Study Team by the middle of September. List of Participants is attached herewith.

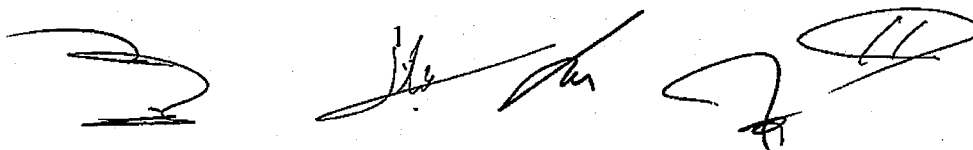
II. Discussions

General

Prior to the discussion, President requested that the Study Team should pay attention to the fair water allocation, improvement of irrigation efficiency and effective utilization of groundwater as well as surface water.

Socio-economic Consideration

1. WRMC expressed that socio-economic analysis was important for the sustainable development, and that fair economic development should be considered as well as fair water allocation. The Study Team replied that socio-economic expert had already conducted such analysis and would consider the fair economic development through fair water allocation in the phase II stage.
2. WRMC requested that a socio-economic model should be linked to the simulation model that the Study Team had been constructing. The Study Team answered that the water balance between water potential and demand by each Province would be studied through the present simulation model and that the socio-economic effects to the Provinces would be evaluated through the simulation results and the results of socio-economic analysis. Both sides agreed with this matter.



Simulation Modeling

1. WRMC requested that land use change, in particular vegetation cover should be considered for the run-off model construction. The Study Team answered that the effects of land use changes so far were already studied, and found that the effects could be negligibly small.
2. WRMC requested that the accuracy of MIKE-SHE and -BASIN should be examined by comparing with the other simulation software. The Study Team answered that even construction of MIKE-SHE and -BASIN was tough work due to constraint of useful data/information, and thus dual ways of simulation and its comparison were too hard. Both sides agreed with this matter.

Environmental Needs

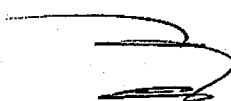
1. There are draft guidelines on an environmental flow in Iran. Presently, preliminary set up of an environmental flow was applied in the water balance simulation. Both guidelines of Iran and Japan should be examined considering the characteristics of rivers in Iran, and the considered environmental flow should be revised through the discussion of Both Sides in the phase II stage.

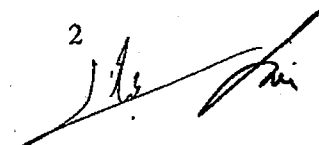
Request of Additional Study


1. WRMC requested that the following Study items be implemented in order to encourage all the stakeholders to be able to reach a close consensus on a water resources management in the Sefidrud River Basin:
 - 1) To include the related area to Sefidrud irrigation network in the Gilan Province in the water balance simulation,
 - 2) To implement a training on the operation of the simulation model using manuals to be specially edited for Sefidrud River Basin, and
 - 3) To hold additional stakeholder meetings on alternative plans of the water resources management in order to build the consensus among the stakeholders.

Satellite Imagery Analysis (Pending Issue)

1. Regarding to the scale of land use map, there are different interpretations. WRMC makes more importance on the scale of 1/25,000 with necessary accuracy, whereas the Study Team believes that 1/250,000 would be accurate enough. WRMC believes that this accuracy may affect greatly on cropping pattern, consequently, on water demand. This item is needed to be more discussed between the Study Team and WRMC.



2




List of Participants

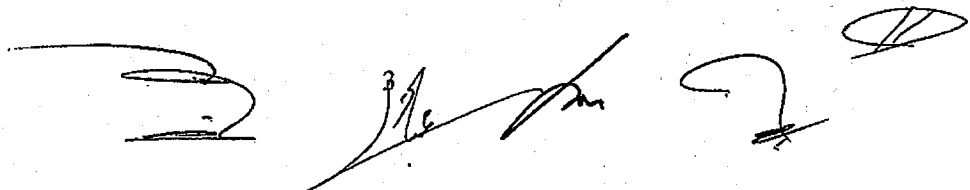
List of participants in the Meeting on July 8, 2008 at the meeting room of WRMC.

[Iranian Side]

Mr. Sattar Mahmudi	WRMC	President
Mr. Alireza Almasvandi	WRMC	Deputy of Research and Technical Affairs
Mr. Majid Sayyari	WRMC	Director General of Office of Project & Planning
Mr. Taghi Ebadi	WRMC	Office of Project & Planning
Mr. YAMASHITA Yoshihiro	WRMC	JICA Expert
Mr. Ali R Daemi	MOE	Director General of Macro Planning of Water & Wastewater

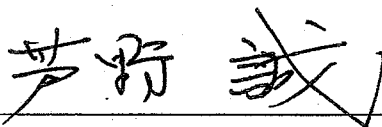
[Japanese Side]

Mr. NAGATA Kenji	JICA Headquarters	Leader of Monitoring Team
Ms. YOSHIDA Sanae	JICA Headquarters	Cooperation Planning, Monitoring Team
Mr. HIRANO Takahiro	JICA Iran Office	Project Formulation Advisor
Mr. TAHARA Teruo	JICA Study Team	Team Leader
Mr. MATSUMOTO Shinichiro	JICA Study Team	Deputy Team Leader
Mr. MORISHITA Kanehiro	JICA Study Team	IWRM Planning Specialist
Mr. GOTO Toshihiro	JICA Study Team	Water Balance Modeling Specialist
Mr. YAJIMA Makoto	JICA Study Team	Conflict Management Specialist
Ms. INOUE Tomomi	JICA Study Team	Environmental Specialist
Mr. TAKATA Satoshi	JICA Study Team	Design/Cost Estimation Specialist
Mr. OSATO Yasushi	JICA Study Team	Organization/ Institution Specialist

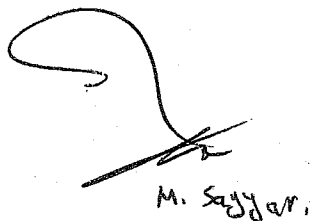


MINUTES OF DISCUSSIONS
ON
THE STUDY
ON
INTEGRATED WATER RESOURCES MANAGEMENT FOR SEFIDRUD
RIVER BASIN
IN THE ISLAMIC REPUBLIC OF IRAN
AGREED UPON BETWEEN
WATER RESOURCE MANAGEMENT COMPANY
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

Tehran, April 15, 2009



Makoto ASHINO
Resident Representative
JICA Iran Office



M. Sayyari

Majid SAYYARI
Director General
Planning and Project Office

1. Background

Scope of Work for “the Study on Integrated Water Resources Management for Sefidrud River Basin in the Islamic Republic of Iran” (hereinafter referred to as the S/W) was agreed upon between Water Resources Management Company (hereinafter referred to as WRMC) and Japan International Cooperation Agency (hereinafter referred to as JICA) on February 10, 2007. During the discussion on the S/W, the original study period of 19 months was designed, as illustrated in the following figure.

Tentative Schedule of the Study

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Phase	Phase 1							Phase 2											
Work in Iran	■							■											
Work in Japan	□																		
Report Presentation	▲																		
	IC/R		PG/R1			IT/R		PG/R2					DF/R		F/R				

IC/R: Inception Report
 PG/R1: Progress Report I
 IT/R: Interim Report
 PG/R2: Progress Report II
 DF/R: Draft Final Report
 F/R: Final Report

In July 2007, the study team was dispatched to Iran and discussed on the study schedule with the WRMC. The study team proposed the study schedule for the period of July 2007 to December 2008.

2. Pending Issues

In the course of the study, the WRMC raised the following issues.

- (1) The dominant water use in the Sefidrud River basin is for agricultural purpose.
- (2) The parameters to estimate water demands for irrigation, such as agricultural land use, cropping patterns and irrigation water requirements by crops, have little persuasiveness and objectivity.
- (3) In order to increase of transparency on estimation process of irrigation demand and to foster the mutual trust among the related provinces, the WRMC strongly proposed the additional works on agricultural land use survey using satellite imagery with high resolution and water requirement survey by crops.

These matters were agreed as pending issues in the meeting on the Interim Report in July 2008.

3. Discussion Results

After rising the above- mentioned issues, the WRMC and the study team continuously discussed in order to find a suitable solution for them. In March 2009, both parties of the WRMC and the study team finally reached to the agreement on the solution of the pending issues. The agreement is composed of cooperative works by the WRMC including Mahab Ghods consulting company and the JICA study team, and the work schedule agreed is summarized below.

No	Work Items	Time Frame	Responsible Parties
1	Clarification of the area covered by satellite imagery and Spot imagery shooting plan will be made, and the imagery shooting should be ordered for two times.	April and July 2009	Mahab Ghods and JICA
2	After receiving the imagery, pre-analysis activities, topologic and radiometric corrections and maps with a 1:25,000 scale shall be made.	Beginning of May 2009	Mahab Ghods and JICA
3	Field trip, sampling with GPS ($\pm 3m$) and spectral study for each crop at least 30 points with even distribution in each frame.	Beginning of May 2009	Mahab Ghods
4	Through data analysis, providing classification algorithm and other necessary activities for the spectral analysis, the initial version of maps shall be prepared.	June 2009	Mahab Ghods
5	After calculation of error coefficient, final version of land use maps divided by crops for two seasons of Summer and Autumn shall be submitted.	July 2009 and October to December 2009	Mahab Ghods
6	Water requirements by crops shall be studied, and ETC and ETO shall be estimated by comparing them with national document	July 2009	Mahab Ghods
7	Agricultural field trips shall be made and questionnaires shall be distributed simultaneously.	May and September 2009	Mahab Ghods
8	Accuracy of all information for estimation of water requirements shall be checked and confirmed.	May and September 2009	Mahab Ghods
9	Water requirements estimated shall be submitted.	July and October 2009	Mahab Ghods

4. Rescheduling

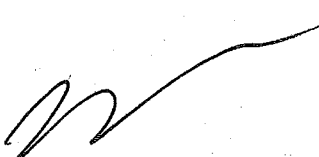
Following the agreed works for more precise estimation of irrigation water requirements, the study period shall be rescheduled as follows:

- (1) Formulation of master plan: April to June 2009
- (2) Submission of satellite imagery and discussion of progress on the imagery analysis: May and August 2009
- (3) Discussion of progress on the imagery analysis and further necessary study: November to December 2009
- (4) Restudy on the proposed master plan based on the results of the imagery analysis: January to March 2010
- (5) Submission of draft final report: July 2010
- (6) Submission of final report: September to October 2010

The original schedule and updated schedules are attached next page.

5. Effectiveness of S/W

The both sides confirmed that the matters discussed and agreed in S/W dated 10th February 2007 will remain effective unless otherwise agreed herein.



Original Tentative Schedule of the Study signed on February 10, 2007

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19																							
Phase	Phase 1										Phase 2																															
Work in Iran	■										■										■																					
Work in Japan	□																																									
Report Presentation	▲		▲		▲		▲		▲		▲		▲		▲		▲		▲																							
	IC/R		PG/R1		IT/R		PG/R2		DF/R		F/R																															

New Tentative Schedule of the Study

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40		
Japanese Fiscal Year	JFY2007										JFY2008										JFY2009										JFY2010											
Gregorian Calendar Year	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10		
Phase I	■										■										■																					
Work in Iran	■										■										■																					
Work in Japan	□																																									
Phase II											■										■										■											
Work in Iran											■										■										■											
Work in Japan																																										
Report Presentation	▲		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲		▲			
	IC/R		PG/R1		IT/R		PG/R2		PG/R3		PG/R4		DF/R		F/R																											

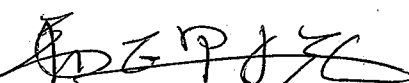


MINUTES OF MEETINGS
on
the Stakeholder Meetings
of
THE STUDY
on
Integrated Water Resources Management for Sefidrud River Basin
in the Islamic Republic of Iran

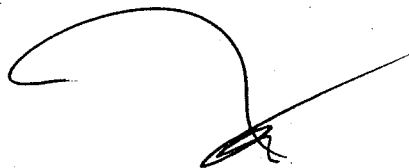
AGREED UPON BETWEEN
Water Resources Management Company
Ministry of Energy
the Islamic Republic of Iran
and
Japan International Cooperation Agency

Tehran, May 31, 2009

Mr. Majid Sayyari
Director General
Office of Project and Planning
Water Resources Management Company



Mr. Kanehiro Morishita
Leader of the Study Team
Japan International Cooperation Agency



Mr. Sayyari:

I. Introduction

The JICA Study Team explained the outline of the draft Maser Plan on Integrated Water Resources Management for Sefidrud River Basin in the Stakeholder Meetings consisting of the representatives of East-Azarbayejan RWC, Ardebil RWC, Kordestan RWC, Zanjan RWC, Gilan RWC, Qazvin RWC, Tehran RWC and WRMC, which were held on 6th and 18th of May 2009 in Tehran. Iranian side and the JICA Study Team had a series of discussions on the Study in such two Stakeholder Meetings.

II. Discussions

Discussions of such two Stakeholder Meetings are described in the following pages.

Minutes of Meeting I

Sefidrud River Basin Stakeholder Meeting, May 6th 2009

Participants: Ardebil RWC, Tehran RWC, Zanjan RWC, WRMC, Mahab Ghods Consultants Co., Kordestan RWC, Guilan RWC, the JICA Study Team

Absence: East-Azerbaijan RWC, Qazvin RWC, Water & Sewage Planning Office

Discussed issues:

First, Mr. Sayyari informed participants that Mahab Ghods Co. has submitted its draft final report before Iranian new year. Also, according to agreement with JICA, satellite imagery shooting has been started in April. Then it was determined that firstly Mahab Ghods and secondly JICA will report the progress of their studies.

Mr. Pakdaman (Mahab Ghods) mentioned that Mahab Ghods report has been sent to the Provinces and asked the Province RWCs to make their comments regarding the report. It was determined that all members of the Stakeholder Meeting make their comments on the report by 20th of May. Then, different scenarios were presented by Mahab Ghods and finally in this section, the Stakeholder Meeting agreed to ask Mahab Ghods to submit the complete information of water resource planning for each reach to all Provinces.

JICA Study Team made its presentation and gave some explanation about the simulation results for both average year and 5-year drought. The JICA Study Team emphasized necessity of improvement of irrigation efficiency from 33% at present condition to 40% and 50% in mid-term and long-term when 36 dams are considered in the simulation model. Possibility of conversion of water source from groundwater to surface water in some areas was also mentioned. More detailed study on a multi-dimensional management is also necessary regarding this issue. Change or improvement of cultivation pattern in some areas should be considered.

The main purpose of Taleghan dam is another issues remarked. The main purpose of this dam is to supply municipal or drinking water to Teheran.

Agreements:

- 1- All members of the Stakeholder Meeting should submit their comments and suggestions regarding Mahab Ghods report by 20th May 2009.
- 2- Mahab Ghods will submit the power point file including result of each scenario which shows irrigation area, water shortage, water demand of new plans, etc. within one week.

- 3- Mahab Ghods report on water resources planning needs to give a clear conclusion. Mahab Ghods should revise the report according to further comments which will be made later by the members of the Stakeholder Meeting and give the conclusion.
- 4- Time-consuming process of IWRM and never-ending need of its updating was emphasized again.
- 5- Revised report of water resources and consumptions (published in Dey 1387), is the base for report on water resources planning, and plans should be considered according to the report of water resources and consumptions.
- 6- Ardebil RWC made their comments on water resources planning report, and submitted them as a document at the end of meeting. This document will be delivered to Mahab Ghods afterward.

Minutes of Meeting II
Sefidrud River Basin Stakeholder Meeting, May 18th 2009

Participants: East-Azerbayejan RWC, Ardebil RWC, Kordistan RWC, Zanzan RWC, Guilan RWC, Qazvin RWC, Tehran RWC, WRMC, MOE, Mahab Ghods Consultants Co., JICA HQ (Tokyo), JICA Iran Office, the JICA Study Team

Agenda:

- 1) Opening by Mr. Majid Sayyari, Director General, Office of Project and Planning, WRMC
- 2) Presentation of Draft M/P and the results of Local Consultation by the JICA Study Team
- 3) Comments by related Provinces and agencies
- 4) Report by MG Consulting Company
- 5) Comments by Mr. Kenji Nagata, Senior Advisor, JICA HQ
- 6) Comments by Mr. Almas Vandi, Deputy, of Bureau of Development Planning, WRMC

Discussions:

[Comments by related Provinces and agencies and Responses by JICA Study Team]

Gilan Province

- Simulations should be conducted based on the data of past 10 years since when the climate has been changed.
 - *The simulations were conducted based on the data of past 30 years with using a hydrological model. No one can say that the same trend of drought would continue further. Another examination will be conducted based on the data of 5-year drought in the recent 10 years.*
- The water quality of the lower reaches has been deteriorated and the EC of the river water shows 3,300. Water quality issues should be considered.
 - *Concerning the water quality, only data analyses were conducted in the Study. As we said in the occasion of the Local Consultation, it is very difficult to solve the salinization problems in this region due to widespread geological origin. However, recommendation will be provided in the report.*
- In Gilan Plain, demands for irrigation water concentrate between April and August, when the flow decreases. Did you consider this effect?
 - *Our model shows the lowest flow between April and August, which causes the same results. Also, the simulation is based on 12 months, thus the low season will be considered.*
- Technical Office of MOE stipulates that only the projects for which the phase 1 study has been completed can be considered. Is JICA Study contrary to this?

- *We included those projects for which F/S had been completed as stipulated by Technical Office in the main scenario. Also other scenario had been simulated in a wide range.*
- Data of drinking water demands presented by Provinces seem overestimated. Did you check them?
 - *Drinking water demands are very small comparing with those for irrigation. Effects of overestimation on drinking water would be negligible.*
- Only water volumes were examined with the model. Did you examine them from the viewpoints of economy and environment?
 - *We estimated changes in flow conditions with a hydrological model. Based on such data, we made additional examinations from the viewpoints of economy and environment.*
- Water potential in a drought year illustrated in the graph seems too big.
 - *Water potential of the lower reaches of Manjil Dam is the difference of natural flow and water consumed in the upper reaches.*
- The yearly capacity of Manjil Dam is 1,085 MCM. Dam capacities should be examined on monthly or daily basis.
 - *We used the same figure and examined them on monthly basis.*

Tehran Province

- The study conducted by Sanyu consulting company proposed an alternative dam to Manjil Dam because it has a sedimentation problem.
 - *This study is for a master plan. The studies in a small scale such as a sedimentation study shall be done in different projects.*
- Taleghan, Karaj and Lar dams were originally constructed to supply both drinking and irrigation water but presently drinking water supply to Tehran is prioritized. Therefore, integrated operation between Manjil and Taleghan dams is difficult.
 - *Integrated operation between Manjil and Taleghan dams were presented just as an example to show possibility.*
- To set a check point at Manjil Dam is suitable at present. In mid-term and long-term examinations, it should be moved or increased because new dams will be constructed then.
 - *It is important to clarify what should be checked when you consider the check point. We will check flow conditions longitudinally along the river, not at just one point (Manjil Dam).*
- Sensitive analysis is necessary in preparation for the case that the improvement of irrigation efficiency would not be attained.
 - *As the improvement of irrigation efficiency is significant, we will examine some other cases as development scenarios.*

East-Azarbajejan Province

- We would like to know water resources potential, specifications of projects, design volumes and so on, on the basis of Province
 - *Such data will be organized on the basis of Province.*
- The graph in the presentation seems that the demands of the lower reaches area are satisfied by almost 100%, which is deemed unfair.
 - *According to a master plan, we are going to distribute water shortage equally to the whole basin. However, it is impossible to achieve the complete distribution of the shortage of water in each region due to their geographical and hydrological conditions.*

Ardebil Province

- Did you examine criteria for deciding water allocation among related Provinces?
 - *It should be decided by the Provinces what criteria should be applied. JICA Study Team provides a tool for consultation / agreement on the water allocation among the Provinces.*
- We would like to ask you to examine and make comments about water resources facilities whose volume is less than 5 MCM because their number is large.
 - *Comments will be made about those less than 5MCM in the reports.*

Kordestan Province

- According to our examination, the traditional irrigation area whose water sufficiency is less than 50% is much larger than that you presented.
 - *Our study is conducted from a macro viewpoint and we do not have such local information. As it is very useful, we would like to ask you to provide us with more detailed information.*
- We would like to ask you to propose detailed ways for improving irrigation efficiency.
 - *As the scale of a master plan, the target should be defined and the concrete ways for improving irrigation efficiency should be studied in a separate project. However, recommendation will be provided in the report.*

Qazvin Province

- Did you include Burmanak Dam of Shahrud river?
- Did you include Alamut Transfer?
 - *Both of them are included in the model.*
- Did you include water supply of 25 MCM for the slope area in Qazvin Province?
 - *Yes, we considered it in D-1 and D-2.*
- Macro approach which targets the whole river basin provides such results that are not necessarily accurate from a local viewpoint.

- *Accuracy is acceptable by WRMC as a master plan level and all the information is in the report. If there is any inaccuracy in the report, please let us know.*

Water and Sewage Planning Office, WRMC

- I would like to know the details about Master Plan of IWRM. What model is used for the simulation?
 - *The detail information is presented in the report.*

Zanjan Province

- JICA Study Team has produced good results. We are expecting that MG consulting company will also produce good results with being influenced by JICA Study Team.
- Is it recommended to change to water saving crops from water consuming ones in the study?
 - *Since this is a study for a master plan, detail studies should be done in different projects. However, recommendation will be provided.*
- We think that the target of irrigation efficiency should be achieved by making efforts though some Provinces are claiming that the target is too high.
- Water resources should be used firstly to fulfill the demands within its basin. Then, they should be transferred to outside of the basin if they have remaining potential.
 - *It's not the matter to be decided by JICA Study Team. It should be decided by the consultation among Provinces or within the basin.*
- The checkpoint should be placed at the river mouth of the Caspian Sea.
 - *Our checkpoints are distributed from the most upstream location to the most downstream location. The lowest downstream checkpoint is located at Astaneh, which is close to the river mouth at Caspian Sea.*

Iran Water & Power Development Co., MOE

- We did not receive the report of JICA Study.
- If the submission of the final results is delayed, additional projects will be proposed. We would like to ask you to submit as soon as possible.
 - *Though we would like to submit the final results as soon as possible, they will be submitted in August next year as it takes a long time to analyze the satellite imagery.*
- Concerning the environmental flow, is it really effective with applying a hydrological method?
 - *We considered some methods recommended by the Ministry of Energy and also we have made the environmental review in the report.*
- Does the hydropower dam between Ostor and Manjil dams affect it?
 - *It is difficult to grasp the situation as we do not have the data on hydropower dams. If it is a small-sized run-off dam, it does not affect. We will visit to your office to collect the*

information later on.

WRMC

- If the dam at the upper reaches is a large-sized one, it affects as its annual evapotranspiration is large.
 - *Evapotranspiration factor was considered in the model.*

[Comments by Mr. Kenji Nagata, Senior Advisor, JICA HQ]

The Master Plan of Sefidrud IWRM has the following issues:

1) Improvement of Irrigation Efficiency

The result is that all the proposed projects could be accepted if the irrigation efficiency was improved to the target level. Efforts and investment are required to achieve the target level. In addition, it is required to examine what would be if the irrigation efficiency remained at the same level in order to propose a realistic master plan. Improvement of the irrigation efficiency should be considered as one of the projects for demand control.

2) Environmental Flow

Though it is a worldwide trend to setup an environmental flow, it should be considered whether it is really necessary at the cost of other demands in the dry areas like Sefidrud river basin. Its objective or what will be conserved should be clarified.

3) RBO

Establishment of an RBO is not enough. It should also be clarified what is necessary to actually functionalize the RBO.

4) IWRM

It requires various data and information. It is important that every Province provides data and information and discusses and confirms them together.

[Comments by Mr. Almas Vandi, Deputy, Bureau of Development Planning, WRMC]

- Since the model used in the Study is a mathematical one, consistent inputs are required to get consistent outputs. Every Province should provide accurate data.
- We would like to ask you to examine the outcomes of the model further from the socio-economic viewpoints.
- It was decided that the satellite imagery be used to improve the accuracy of land use data. It is being shot now.
- Improvement of irrigation efficiency should be achieved. As more than 50% of efficiency was achieved in Latin America, where the water is scarce like Iran, water shortage can not be

attributed to the failure of the achievement.

- Water quality is an important issue. We would like to ask the JICA Study Team to examine it fully.

End

MINUTES OF MEETINGS
ON THE PROGRESS REPORT 4
FOR THE STUDY
ON INTEGRATED WATER RESOURCES MANAGEMENT FOR SEFIDRUD RIVER BASIN
IN THE ISLAMIC REPUBLIC OF IRAN
AGREED UPON BETWEEN
WATER RESOURCES MANAGEMENT COMPANY
MINISTRY OF ENERGY
THE ISLAMIC REPUBLIC OF IRAN
AND
JICA STUDY TEAM

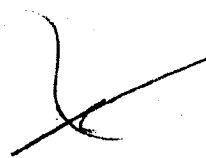
Based on (i) the Scope of Work for the Study on Integrated Water Resources Management for Sefidrud River Basin in the Islamic Republic of Iran (hereinafter referred to as "the Study") and the Minutes of Meeting agreed on 10 February 2007 between the Water Resources Management Company of the Ministry of Energy (hereinafter referred to as "WRMC") and Japan International Cooperation Agency (hereinafter referred to as "JICA"), (ii) the Minutes of Meeting on the Interim Report between the WRMC and JICA concluded on 13 July 2008, and (iii) the Record of Discussion on Work Progress between the WRMC and JICA Study Team (hereinafter referred to as "the Team") on 14 February 2009, the Team has been conducting the Study.

After the close investigation over the study area, the collecting information, the analysis of various matters related to water resources, the Team submitted the Progress Report 4 (hereinafter referred to as "P4/R") describing the activities and the study result in 20 (twenty) copies in English version and presented the summary of P4/R to WRMC. Both sides of WRMC and the Team have discussed and concluded on the contents of P4/R and the Iranian side received P4/R. The result of the discussion was recorded in writing as this Minutes of Meeting and both sides agreed on the attached matters.

TEHRAN, 15 March 2010

Mr. Majid Sayyari
Deputy
Research and Technical Affairs
Water Resources Management Company
Islamic Republic of Iran

Toshihiro Goto
for Mr. MORISHITA Kanehiro
Leader, The Study Team
Japan International Cooperation Agency
JAPAN


M. Sayyari

ATTACHMENT

1. Progress Report 4

- (1) The Team explained the study result in the third field survey, namely, the result of water allocation simulation by using the water demand based on the result of satellite image analysis.
- (2) The Team submitted P4/R in twenty (20) copies in English version.
- (3) WRMC has expressed that the contents shall be amended or added considering the results of the stakeholder meeting on 9 March 2010: namely, (i) the case of 0.39 irrigation efficiency of traditional agricultural area in Gilan province and (ii) the addition of evaluation for improvement projects concerning the water allocation system such as dams, interbasin transfer and irrigation efficiency.
- (4) The Iranian side will provide all of the comments to the Team on the contents of P4/R, if any, by the beginning of May 2007.
- (5) Participants of Stakeholder Meetings are listed in Annex-1.

2. Draft Final Report

Both sides confirmed that the Team would submit the Draft Final Report (hereinafter referred as to "DF/R") to WRMC at the middle of July 2010. In addition, the Stakeholder Meeting and the Seminar on DF/R would be held at the same time. In addition, the Team will refer to the comment on P3/R and P4/R: especially, the delivered comments late for P3/R; namely, that from Ardebil, Kordestern and Zanjan provinces.

3. Office Space

Both sides confirmed that the Team continues to use the office space provided by WRMC. The Team appreciates to use the office space until the third week of July 2010.

Participants Of Meeting

No.	Full Name	Affiliation	Position	Contact
1	Mr.A.Ghobadi	Mahab Ghodss	Expert	021-2396-5615
2	Mr.A.Dehmohseni	Mahab Ghodss	GIS Expert	0912-157-9703
3	Mr.Amin Hoseini	Mahab Ghodss	GIS Expert	0912-2689-3287
4	Mr.Zahra Gorjian	Mahab Ghodss	IT Expert	0912-207-9738
5	Mr.Alireza Sanjabi	Mahab Ghodss	Agricultural Expert	0912-304-6785
6	Mr.M.T. Akrami	Zanjan RWC	Expert	0912-390-3917
7	Mr.Shahrokh Amiraslani	Zanjan RWC	Expert	0912-341-2412
8	Mr.Jafar Fahimi	Zanjan RWC	M.D	0912-150-4775
9	Mr.Kazem Azizmoghadam	Ardabil RWC	Expert	0914-152-9414
10	Mr.Ebrahim Mokalaf	Ardabil RWC	Expert	0912- 419-6200
11	Mr.Yadollah Maleki	Qazvin RWC	Expert	0912-282-2623
12	Mr.Ali Ashraf Moradi	Qazvin RWC	Expert	8891-6596
13	Ms.Sedigheh Rasoli	Gilan RWC	Expert	0131-666-7257
14	Mr.Eghbal Shanazari	Kordestan RWC	Head of Project & Development	0871-666-4619
15	Mr.Mojtaba Jalilzadeh	East Azarbayjan	Manager of Planning & Development	0914-116-8592
16	Mr.Abdolreza Fallahrastgar	WRMC	Expert	021-8891-6596
17	Mr.Mojtaba Kord	WRMC	Expert	-
18	Mr.Majid Sayyari	WRMC	Deputy of development & Planning	0912-148-4345
19	Ms.Maryam Movahediniya	WRMC	Expert	021-8893-7223
20	Mr.Taghi Ebadi	WRMC	Expert	021-8889-8698
21	Mr.Fazlali Jafariyan	WRMC	Expert	021-8890-9137
22	Mr.Gholam Reza	IWPCO	Project Manager	021-2782-2132
23	Mr.ENDO Shinichiro	JICA	Expert	021-8893-7310
24	Mr.Amin Karimi	JICA	Translator	021-8893-7310
25	Mr.HIRANO Takahiro	JICA	Project Formulation Advisor	021-8864-8050
26	Mr.GOTO Toshihiro	JICA	JICA Study Team Leader	021-8890-8658
27	Mr. TAKATA Satoshi	JICA	JICA Study Team member	0919-485-3558
28	Mr.Mehran Mahboobi	JICA	Translator	0912-313-5697
29	Ms.Farideh Ghorabi	JICA	Translator	0912-157-5357

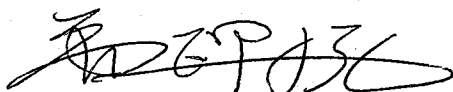


M. Sayyari

Minutes of Meeting
on
Draft Final Report
for
The Study on Integrated Water Resources Management for Sefidrud River Basin
in the Islamic Republic of Iran

Agreed upon between
Water Resource Management Company
Ministry of Energy
and
The Study Team of Japan International Cooperation Agency

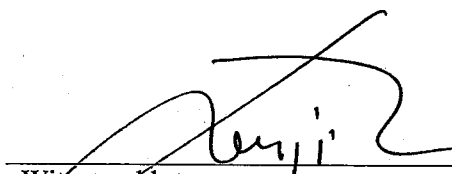
Tehran, 17th July 2010



Kanehiro Morishita
Leader of the Study Team
Japan International Cooperation Agency
Japan



Majid Sayyari
Deputy
Planning and Development
Water Resource Management Company
Islamic Republic of Iran



Witnessed by
Kenji Nagata
Leader of the Monitoring Mission
Japan International Cooperation Agency
Japan

In accordance with the Scope of Work for "The Study on Integrated Water Resources Management for Sefidrud River Basin" (hereinafter referred to as "the Study") agreed upon between Water Resources Management Company (hereinafter referred to as "WRMC"), and Japan International Cooperation Agency (hereinafter referred to as "JICA") on 10 February, 2007, JICA Study Team prepared the Draft Final Report (hereinafter referred to as "DF/R"), and submitted DF/R to WRMC; twenty (20) copies of Main Report and forty (40) copies of Summary.

The Stakeholder Meeting on DF/R chaired by Mr. Majid Sayyari, Deputy, Development and Planning was held on 13th July, 2010 in attendance with the members of the Stakeholder Meeting and participants from WRMC (hereinafter referred to as "the Iranian side"), where the Study Team explained the contents of DF/R. The list of the participants to the Meeting is shown in Appendix 1.

The followings are the main points discussed and/or agreed upon the Stakeholder Meeting, and this Minutes of Meeting was prepared and signed by both sides.

I. Draft Final Report

- (1) The Iranian Side basically received the basic outcomes of the Study mentioned in the DF/R.
- (2) Comments on DF/R will be forwarded from WRMC to JICA Iran Office by the middle of August.
- (3) JICA Study Team has submitted an outline of revision to be made to the DF/R. Revised chapters (mainly chapter 4 and 9) shall be sent to the Iranian side by the end of August 2010.
- (4) Comments on mainly the chapter 4 and 9, if any, will be forwarded from WRMC to JICA Iran Office by the end of September 2010.
- (5) Final Report will be delivered after necessary modification by incorporating the comments from the Iranian side.
- (6) Both sides agreed that the Final Report be open to public.

II. Further Requests made by the Iranian Side

JICA Study Team agreed upon the following requests from the Iranian side;

(1) Donation of equipment and software

The Iranian side requested JICA to donate all equipment and software which JICA Study Team has been using for the Study after JICA Study Team finishes all the necessary works

in Iran. The list of the equipment and software is shown in Appendix 2. The Iranian side is planning to utilize the equipment for future activities and will ensure that the equipment is properly maintained.

(2) Sensitivity Analysis for Ardebil Interbasin Transfer Project

The Iranian side requested JICA Study Team to conduct the sensitivity analysis by using the water allocation simulation model on the long-term condition. JICA Study Team agreed to assist to clarify the water balance variation caused by the above project.

(3) Evaluation of Environmental Flow and Preparation of Schematic Flow Diagram

The Iranian side requested JICA Study Team to evaluate the environmental flow by Montana Method and to figure the study results on the schematic flow diagram.

III. Further Technical Cooperation

The Iranian side requested further technical cooperation on the Integrated Water Resource Management sector, especially policy formulation, coordination and facilitation of the project implementation for WRMC and authorities concerned. JICA Study Team promised to convey this request to JICA Headquarters.

Appendix 1: List of Participants

1. Iranian Side

Mr. Majid Sayyari Deputy Planning and Development, WRMC
Mr. ENDO Shinichiro JICA Expert WRMC

No.	Name	Position	Organization
1	Mr. Ibrahim Mokalef Sarband	Expert of Technical Office	Ardabil RWC
2	Mr. Kazem Azizmoghadam	Manager of Technical Office	Ardabil RWC
3	Mr. Mohamad Reaza Rahimi	Expert	Deputy of Protection
4	Mr. Ghasem Soltanzadeh	Deputy of development & plan	East Azarbayjan
5	Mr. Mojtaba Jalilzadeh	Manager of Planning office	East Azarbayjan
6	Ms. Sedighe Rasoli	Manager of water resources development plans	Gilan RWC
7	Mr. Eghbal Shanazari	Deputy of development & plan	Kordestan RWC
8	Mr. Abdolah Ghobadi	Senior Expert	Mahab Ghods
9	Mr. Abdolrahim Safaritarbar	Water resources Expert	Mahab Ghods
10	Mr. Amir Hossein Pakdaman	Senior Expert	Mahab Ghods
11	Ms. Behiye Jafari	Expert	MOE , Ab Abfa Planning office
12	Mr. Mohamad Ghasem Safieei	Manager of Studies	Qazvin RWC
13	Mr. Yadolah Malaki	Deputy of protection & Operation	Qazvin RWC
14	Mr. Ali Mozafariyan	Expert of Planning	Tehran RWC
15	Mr. A.Fallah Rastgar	Director of Drainage & Irrigation Networks development Office	WRMC
16	Mr. Abdolamir Kakahaji	Khazar basin	WRMC
17	Mr. Fazlali Jafariyan	Head of the group integration	WRMC
18	Mr. Isa Aghajani	Head of the group of planning	WRMC
19	Mr. Mansour Jamshidnezhad	Expert	WRMC
20	Mr. Masoud Najafi	Expert	WRMC
21	Mr. Mohamad Taghi Tavakoli	Director	WRMC
22	Mr. Mosa Aminnezhad	Director	WRMC
23	Mr. Seyyed Ahmad Alavi	Manager of Basin	WRMC
24	Mr. Seyyed Morteza Mousavi	Manager of Casin Area	WRMC
25	Mr. Taghi Ebadi	Manager of Technical Office	WRMC
26	Ms. Ghazal Jafari	Head of the Group	WRMC
27	Mr. Hossein Mehdinezhad	Deputy of planning & Improvement Management	Zanjan RWC
28	Ms. Solmaz Mohamadi	Expert of Water allocation	Zanjan RWC

2. Japanese Side

JICA Monitoring Mission

- | | |
|-----------------|-----------------|
| 1) Kenji Nagata | Team Leader |
| 2) Miki Inaoka | Project Manager |

JICA Iran Office

- | | |
|--------------------|-----------------------------|
| 1) Takahiro Hirano | Project Formulation Advisor |
|--------------------|-----------------------------|

JICA Study Team

- | | |
|-----------------------|--|
| 1) Kanehiro Morishita | Team Leader/IWRM Planning Specialist |
| 2) Toshihiro Goto | Deputy Team Leader/Water Balance Modeling Specialist |
| 3) Makoto Yajima | Conflict Management Specialist |

Appendix 2: List of Equipment and Software

Equipment and Software:

No.	Items	Lot	Description
1	DEM data	-	ASTER DEM in the Study Area
2	Satellite Images	-	ALOS (ERSDAC) 5 images (one season in the Study Area)
3	Facsimile	1	SHARP FO-P610
4	Color Laser Printer (A3)	1	HP Color LaserJet 5550
5	Color Laser Printer (A4)	1	HP Color LaserJet 4005
6	Plotter machine	1	HP Designjet 800 ps
7	Laptop PC	1	Lenovo 0768-4BG (without Microsoft Software*)
8	Multi copy machine	1	HP Laserjet M5025
9	Desktop PC	3	Original (without Microsoft Software*)
10	UPS	3	FARATEL SM1250
11	Mobile GPS	3	Garmin eTrex Legend Cx
12	MIKE BASIN, MIKE SHE and MIKE 11 (2 DVDs, 2 keys)	1 set	- First key is for Mike-Basin Extended licenses, Mike-SHE Enterprise licenses and Mike 11 Enterprise licenses. (Key No. MZ-17615) - Second key is for Mike-Basin Extended licenses and Mike-SHE Enterprise licenses. (Key No. MZ-18318) - Without ESRI software license*

* Unfortunately, these official softwares are not allowed to be granted in Iran.

卷末表

巻末表 3. 7. 1 飲料水の環境基準 (ISIRI)

1. 一般項目 (ISIR)

	Parameter	Maximum Permissible Level	Desirable
1	Turbidity	5NTU (Nephelometric Turbidity Unit)	1=>
2	Color	20 T. C. U (True Color Unit)	1=>
3	Odor	2 at 12 and 3 at 25 degree Celsius	0
4	pH	6.5-9	7-8.5
5	Taste	Acceptable to public, no objection of public	-
6	Oil	Not visible	-

2. 有害金属 (ISIR)

	Parameter	Maximum Permissible mg/l
1	As	0.05
2	Pb	0.05
3	Cr	0.05
4	Se	0.01
5	Cd	0.005
6	Sb	0.005
7	Hg	0.001
8	Mo	0.07
9	CN	0.07
10	V	0.1

3. 有機毒性物質 (ISIR)

	Parameter	Maximum Permissible microgram/l		Parameter	Maximum Permissible microgram/l
1	Aldrin-dialdrin	0.03	20	THM'S: Chloroform	200
2	Chlordane	0.2		THM'S: Bromoform	100
3	2-4 Dichlorophonyoxy acetic acid	30		THM'S: Bromodichloromethane	60
4	DDT (Dichloro Diphenyl Trichloro ethan)	2		THM'S: Dibromochloromethane	100
5	1,2-dichloroethane	30	21	Isoproturon	9
6	1,2-dichloroethene	50	22	2methyl 4 chloro phenoxy Acetic Acid MCPA	2
7	Heptachlor and heptachlor epoxide	0.03	23	Metolachlor	10
8	Hexachloro benzene	1	24	Molinate	6
9	Lindane	2	25	Pendimethalin	20
10	Methoxychlor	20	26	Pentachloro phenol	9
11	P.A.H (Poly Nuclear Aromatic Hydrocarbons)	0.2	27	Permethrin	20
12	Alachlor	20	28	Propanil	20
13	Aldicrab	10	29	Pyrodato	100
14	Atrazine	2	30	Simazine	2
15	Bentazone	30	31	Trifluralin	20
16	Carbfuran	5	32	Dichloroprop	100
17	Chlorotoluron	30	33	Fenoprop	9
18	1,2-dibromo 3-chloropropane	1	34	2-4-5 Trichlorophenoxipropenic Acid	9
19	1,2-dichloropropane	20	35	Surfactant	200
			36	Phenol Index	0.5
			37	Residual pesticides (Used in the region)	WHO standards

4. 無機物質 (ISIR)

	Parameter	Maximum Permissible mg/l
1	(TDS)	1500
2	CaCO3	500
3	Cl	400
4	So4	400
5	H2S	0.05
6	Fe	0.3
7	Mn	0.5
8	Al	0.2
9	Zn	3
10	Cu	1
11	NO3	50
12	NO2	3
13	Ca	250
14	Mg	50
15	NH3	1.5
16	Na	200

巻末表 3. 7. 2 排水基準 (DOE)

	Contaminants	Discharges into surface water (mg/l)	Absorbing Wells (mg/l)	Agriculture and Irrigation use (mg/l)
1	Ag	1	0.1	0.1
2	Al	5	5	5
3	As	0.1	0.1	0.01
4	B	2	1	1
5	Br	5	1	1
6	Be	0.1	1	0.5
7	Ca	75	-	-
8	Cd	0.1	0.1	0.05
9	Cl	1	1	0.2
10	Cl-	600	600	600
11	CH2O	1	1	1
12	C6H5OH	1	Very low	1
13	CN	0.5	0.1	0.1
14	Co	1	1	0.5
15	Cr+6	0.5	1	1
16	Cr+3	2	2	2
17	Cu	1	1	0.2
18	F	2.5	2	2
19	Fe	3	3	3
20	Hg	Very low	Very low	Very low
21	Li	2.5	2.5	2.5
22	Mg	100	100	100
23	Mn	1	1	1
24	Mo	0.01	0.01	0.1
25	Ni	2	2	2
26	NH4	2.5	1	-
27	NO2	10	10	-
28	NO3	50	10	-
29	P-P04	6	6	-
30	Pb	1	1	1
31	Se	1	0.1	0.1
32	SH2	3	3	3
33	SO3	1	1	1
34	SO4	400	400	500
35	V	0	0.1	0.1
36	Zn	2	2	2
37	Oil (liquid)	10	10	10
38	ABS-Detergents	1.5	0.5	0.5
39	BOD	30	30	100
40	COD	60	60	200
41	DO	2	-	2
42	TDS			-
43	TSS	40	-	100
44	SS	0	-	-
45	pH	6.5-8.5	5-9	6-8.5
46	Radioactive substances	0	0	0
47	Turbidity	50	-	50
48	Color	75	75	75
49	Temperature-C			
50	Fecal Coliform (NO/100ml)	400	400	400
51	Total Coloform (NO/100ml:MPN)	1000	1000	1000
52	Nematode egg	-	-	<1 per 1000ml

巻末表 3. 7. 3 産業排水基準 (Ministry of Energy)

	Parameter		Value
1	Temperature	<i>C</i>	43
2	pH		6.5-9
3	Total oil & grease	<i>mg/l</i>	50
4	Sulphates	<i>mg/l-SO⁴</i>	400
5	Suspended solids (SS)	<i>mg/l</i>	350
6	BOD	<i>mg/l-O²</i>	280
7	Phenol and creosol	<i>mg/l</i>	5
8	Copper	<i>mg/l-Cu</i>	1
9	Zinc	<i>mg/l-Zn</i>	1
10	Nickel	<i>mg/l-Ni</i>	2
11	Silver	<i>mg/l-Ag</i>	0.1
12	Mercury	<i>mg/l-Hg</i>	0.1
13	Lead	<i>mg/l-pb</i>	1
14	Cadmium	<i>mg/l-cd</i>	1
15	Cromium	<i>mg/l-cr⁶⁺</i>	2
16	Cromium	<i>mg/l-cr³⁺</i>	6
17	Iron	<i>mg/l-Fe²⁺</i>	10
18	Beryllium	<i>mg/l-Be</i>	1
19	Cyanide	<i>mg/l-CN</i>	0.5
20	Arsenic	<i>mg/l-AS</i>	4
21	Radioactivity	<i>mg/l-cm³</i>	

巻末表 3. 10. 1 各州における主要穀物収量集計表

Crop Year	Province (Crop in detail)	Crop Area (ha)			Production (ton)			Yield (kg/ha)	
		Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed
Paddy									
Gilan									
1383/84	Long grain (sadri)	194,810	0	194,810	743,154	0	743,154	3,815	0
	Long Grain Productio	3,387	0	3,387	16,597	0	16,597	4,900	0
	Middel Quality grain	332	0	332	1,367	0	1,367	4,117	0
	Short Grain	528	0	528	1,796	0	1,796	3,402	0
	Total	199,057	0	199,057	762,914	0	762,914	3,833	0
1382/83	Paddy, Gilan	198,327	0	198,327	721,714	0	721,714	3,639	0
	Average							3,736	0
Wheat									
1382/83	E-Azalbayejan	101,090	351,951	453,041	332,278	408,351	740,629	3,287	1,160
1382/83	Zanjan	22,481	292,327	314,808	78,831	304,491	383,322	3,507	1,042
1382/83	Kordestan	32,607	435,325	467,932	127,744	567,011	694,756	3,918	1,303
1383/84	E-Azalbayejan							3,580	1,111
1383/84	Zanjan							3,580	984
1383/84	Kordestan							4,060	980
	Average							3,655	1,097
Barley									
1382/83	E-Azalbayejan	20,516	56,086	76,602	53,152	53,088	106,240	2,591	947
1382/83	Zanjan	10,676	46,632	57,308	26,651	35,774	62,426	2,496	767
1382/83	Kordestan	4,701	32,364	37,065	14,720	38,772	53,491	3,131	1,198
1383/84	E-Azalbayejan							2,899	933
1383/84	Zanjan							2,775	723
1383/84	Kordestan							3,013	1,019
	Average							2,818	931
Beans									
1382/83	E-Azalbayejan	4,314	0	4,314	5,161	0	5,161	1,196	
1382/83	Zanjan	8,656	0	8,656	16,561	0	16,561	1,913	
1382/83	Kordestan	671	0	671	647	0	647	965	
	E-Azalbayejan	5,378	68,281	73,659	9,482	37,776	47,258	1,763	553
	Zanjan	8977	25,520	34,497	19,535	9,163	28,698	2,176	359
	Kordestan	1,406	85,324	86,730	1,203	30,563	31,766	856	358
	Average							1,478	423
Potato									
1382/83	E-Azalbayejan	10,253	0	10,253	306,857	0	306,857	29,929	0
1382/83	Zanjan	6,895	0	6,895	192,473	0	192,473	27,915	0
1382/83	Kordestan	10,462	0	10,462	282,697	0	282,697	27,021	0
1382/83	E-Azalbayejan	10,003			300,720			30,063	0
1382/83	Zanjan	6,917			152,216			22,006	0
1382/83	Kordestan	10,351			271,947			26,273	0
	Average							27,201	0
Alfalfa									
1382/83	E-Azalbayejan	70,005	19,729	89,734	460,406	39,069	499,475	6,577	1,980
1382/83	Zanjan	38,907	4,402	43,309	171,436	9,669	181,105	4,406	2,197
1382/83	Kordestan	26,480	60	26,540	155,912	96	156,008	5,888	1,600
1383/84	E-Azalbayejan							8,284	2,156
1383/84	Zanjan							4,628	2,062
1383/84	Kordestan							6,967	2,544
	Total/Asverage							6,125	2,090
Apple									
1381/82	E-Azalbayejan	23,054	0	23,054	382,041	0	382,041	16,572	0
	Young tree	3,315	0	3,315		0			
1381/82	Zanjan	3513	0	3,513	56,533	0		16,093	0
	Total/Asverage							16,332	0
Olive									
1381/82	Zanjan	4,650			18,832			4,050	0
	Young tree	3,727							

Olive in the Basin distribute Zanjan (4564ha), Qazvin (6283ha) and Gilan (320ha irrigated) and 642ha rainfed) only.

巻末表 3. 10. 2 小流域別現況・計画灌漑効率

Reach No.	Present Irrigation Area (ha)			Future Irrigation Area (ha)				Efficiency (%)		
	Crop	Orchard	Total	Improve	Develop	Total	Future	Present		Future
								Crop	Orchard	Plan
1	1,232	107	1,339	600	0	600	2964	33	36	65
										57
										57
2	1,197	1,728	2,925	1200	2300	3500	5225	33	36	
3	3,523	600	4,123	0	0	0	4123	33	36	57
4	1,562	962	2,524	0	0	0	2524	33	35	
5	7,249	1,649	8,898	0	0	0	8898	33	35	
6	3,827	1,336	5,163	0	0	0	5163	33	36	
7	120	67	187	150	450	600	637	33	36	57
8	1,581	26	1,607	1090	1500	2590	3007	33	35	
9	2,254	225	2,479	0	0	0	2479	33	35	
10	3,272	754	4,026	600	10300	10900	14326	33	35	
11	5,926	259	6,185	0	6500	6500	12685	33	36	
								33	35	
12	383	141	524	225	675	900	1199	33	36	57
13	272	40	312	0	0	0	312	33	36	
14	81	7	88	0	0	0	88	33	36	
15										57
16	12	5	17	150	600	750	617	33	36	57
17	12,099	740	12,839	0	7000	7000	19839	30	33	
								33	35	
								33	35	
18	3,989	457	4,446	1240	12630	13870	17076	33	36	
19										
20	12,868	3,830	16,698	0	0	0	16698	30	32	
21	2,585	5,115	7,700	192407	0	192407	200106	33	36	
								33	35	
22	2,906	321	3,227	4000	26000	30000	29227	33	35	62
23								33	35	
24	561	211	772	0	0	0	722	33	36	
25	3,890	1,323	5,213	0	0	0	5213	31	34	
26	5,365	1,021	6,386	0	0	0	6386	32	35	
27	15,199	1,890	17,089	0	0	0	17089	30	33	
28	171	77	248	108	450	558	698	30	32	64
29	508	89	597	0	0	0	597	30	33	
30	4,234	880	5,114	0	0	0	5114	30	32	
31	659	170	829	100	900	1000	1729	30	33	64
32	73	3	76	1079	1201	2280	1277	32	35	52
33	365	187	552	0	0	0	552	30	33	
34	733	97	830	1500	0	1500	830	32	35	62
35	551	99	650	0	0	0	650	32	35	
36	821	1,321	2,142	34000	24000	58000	26142	31	34	
37	2,283	314	2,597	0	0	0	2597	37	43	
38	422	84	506	0	1182	1182	1688	31	37	
39	7	2	9	0	9000	9000	9009	31	37	
40	1,368	165	1,533	754	21246	22000	22779	37	43	76
41	2,566	174	2,740	0	0	0	2740	37	43	70
42	1,691	200	1,891	2500	5000	7500	6891	37	43	76
43	372	34	406	0	800	800	1206	37	45	62
44	1,871	365	2,236	0	0	0	2236	37	45	
45	252	37	289	0	0	0	289	37	45	
46	139	10	149	2100	0	2100	149	37	43	
47	16,004	387	16,391	0	0	0	16391	37	45	
48	2,539	571	3,110	0	0	0	3110	37	45	
49	318	55	373	310	90	400	463	37	45	61
50	2,492	60	2,552	0	0	0	2552	37	45	73
51	339	17	356	192	1008	1200	1364	37	45	
52	3,059	213	3,272	0	3400	3400	6672	37	45	
53										
54										
55										
56										
57	3,182	625	3,807	927	6300	7227	10107	32	36	57
										66
60	8,013	1,358	9,371	0	0	0	9371	32	35	
61	10,210	5,500	15,710	0	0	0	15710			65
										57
62										
63	5,833	936	6,769	0	7900	7900	14669	30	33	67
64	691	111	802	50	5950	6000	6752	32	35	62
65	1,142	77	1,219	0	0	0	1219	37	43	
66	7,323	2,038	9,361	362	39412	39774	48773	37	45	62
								32	35	65
								31	37	67
								37	43	71
67	7,060	274	7,334	0	0	0	7334	37	45	
Total	179,244	39,344	218,588	245,644	195,794	441,438	608,263			

Source: Appendix 1 of Vol.5 by WRMC & Mahab Godss