

第6章 本格調査の実施方針

6-1 調査の基本方針

6-1-1 現状認識

(1) 対象地域の水需要

農業立国を自認するタイ国は、従来より灌漑を中心とする農業基盤整備事業に積極的な投資を行っており、1990年時点における農業用水における水需要量はタイ国全土の水需要量約330億 m^3 の約90%に相当する300億 m^3 となっている。調査対象区域内のチャオプラヤ川流域はナン川、ヨム川、ピン川、ワン川、サカエ・クラン川、パ・サック川、チャオプラヤ・デルタの5流域から構成されている。国の中央部に位置するチャオプラヤ・デルタは、流域の最下流にバンコク首都圏を有する流域面積2万 km^2 、農地面積1.6万 km^2 、流域内人口約2,000万人（全国人口4,700万人の40%）のタイ国における最も重要な政治・経済の中心地域となっている。近年、タイ国の急激な経済成長に伴い農業分野以外でも急激な水需要が予測され、特に、バンコク首都圏を有するチャオプラヤ・デルタの水需要は現在の125億 m^3 から2006年には187億 m^3 に増大すると予測されている。

(2) 対象地域の水資源

対象地域は、国際河川メコン川の支流であるコク川、イン川の2流域とナン川、チャオプラヤ・デルタから構成されている。チャオプラヤ川流域全体の水資源は約255億 m^3 で現在の水需要215億 m^3 に対し40億 m^3 の余裕があると考えられるが、下流域のチャオプラヤ・デルタへの責任放流が上流のナン川、ピン川にそれぞれ50億 m^3 、53億 m^3 が課せられており両河川流域の開発は抑制され、実際には現在のチャオプラヤ流域の水バランスは逼迫した状況下にある。したがって、将来の水需要329億 m^3 に対し新しい水資源開発が必要となり、1980年代より本格的に多くの水資源開発計画が立案されたが、水資源に余裕のあるコク川、イン川の流域変更によるKok-Ing-Nan導水計画案が最も実現性の高いものとして今回の調査となった。

(3) リシキットダム

チャオプラヤ流域の上流部にはシリキットダム（ナン川）とプミボン・ダム（ピン川）の2大ダムのほか、多数の小規模ダムが建設されている。今回、コク川、イン川から導水が検討されているシリキットダム（満水位貯水量95億 m^3 ）は灌漑およびその他の水利用、水力発電を目的として、1971年に完成したダムであるが、1975年に満水位に達したものの、そ

の後1994年まで満水位に達していない。特に、1986年～1993年の7年間は連続渇水年で、ナン川からの貯水池流入量は30億 m^3 から40億 m^3 と著しく少なく、この渇水年期間のダム放流量は25億 m^3 ～35億 m^3 と、計画放流量の約50%に制限されたためチャオブラヤ・デルタにおいて著しい水不足が生じ、発生電力量も計画発電量の40～50%に過ぎなかった。渇水年が継続したため、豊水年であった1994年においても、ダム貯水位の回復を図るため、放水量を制限し、約1995年も引き続き放流制限を行ったため、9月～10月にかけて洪水が貯留されず、ほとんど洪水吐から越流したため、ダム管理運用ルールの確立が望まれることとなった。

(4) 対象地域の農業

- ① Kok-Ing-Non流域の農業の状況は、基本的には稲作が中心である。乾期には涵養水が不足していることから単作となっている。灌漑用水が十分供給されれば乾期の農業が飛躍的に伸びる潜在力を有している。
- ②本計画の灌漑用水の供給目的の第1は、シリキットダム下流における農業開発地域への灌漑用水の供給である。特に、ウタニディット地区およびピサノロック左岸地区の農業開発は灌漑用水を確保することが最大の課題となっている。第2はチャオブラヤ・デルタ地域における都市用水、塩水遡上防止、灌漑用水の供給が挙げられる。この水は、直接導水量に計上されているもののほか、反復利用されるものもある。第3にコク川、イン川、ナン川上流の各流域について農業開発計画を策定するとともに、本計画に合わせて灌漑計画を策定することが望まれている。
- ③水利用計画については、乾期の計画が課題である。乾期の水利用計画は基本的には前年の雨期に関係機関と協議のうえ策定される。一方、需要量の把握は各地方においてRIDの地方事務所が中心となり、地方関係機関、農業者代表等が協議して次期水需要見通しを策定し、これをRID本部がとりまとめ全国の水需要見通しを策定するシステムとなっている。

(5) 対象地域の自然環境

現地調査の結果、コク川、イン川、ナン川の山岳地域は熱帯雨林を予測していたが、盗伐および焼き畑農業等により、ほとんどの地域において禿山状態が観測された。1995年の洪水において保水・涵養能力を失った山岳地域からの降雨の短時間流出による鉄砲水が下流地域に押し寄せ多大の被害をもたらした。

本調査団がナン流域の中心都市であるナン市を訪れた際、市の中心部において浸水深1.5m以上を確認した。したがって、山岳地域において今なお行われている焼き畑農業から灌

澗用水を活用した農業に転換を図るとともに、合わせて植林計画を策定することにより、森林の再生にも寄与できるものと考えられる。

近年、水資源の確保を目的としたダム建設プロジェクトが数多く計画されたが、住民の移転を伴う環境問題のため大部分のプロジェクトが中断された状態となっている。本調査においては、調査の初期段階からの住民参加による環境影響調査が最も重要な課題の1項目と考えられる。

6-1-2 本格調査の考え方

(1) 一般概要

本事業は規模が大きいことから、各方面からの関心が高く、いろいろな批判が予想される。従来、この種のプロジェクトについては「効果、妥当性」、「情報公開、住民参加」、「貧困問題への配慮」等の観点のものが多い。批判には謙虚に耳を傾けつつ、それらに十分耐えうるよう、調査成果はもちろん、調査の進め方においても質の高い調査を目指す必要がある。

- 1) 大規模事業というだけで反対意見が出されるのが最近の傾向である。当プロジェクトの場合、特に、経済効果およびいくつかの代替案との比較により導水路案の「必然性、妥当性」を示す客観的な説得力のある資料を作る必要がある。
- 2) 【情報公開、住民参加】は、決して容易なことではないが、その労を怠ったため、後日、調査や事業の実施に大きな支障をきたす例が多い。RIDとしても情報公開、住民参加の重要性を十分認識しているが、この分野はRIDにとって経験の乏しい分野なので、JICAに助言を求めている。JICAとしては、タイ側コンサルタントが作成する「情報公開・住民参加アクションプラン」をなるべく早く入手し、調査の初期の段階から計画的かつ適切に実施されるよう必要な助言を行うものとする。
- 3) 「貧困」がグローバルな課題である。このため、援助プロジェクトの良否の判断には、国家的な経済効果だけでなく、この課題にどう配慮しているかも問われる。少数であれ、社会的弱者に対する配慮を欠いた計画は良い計画とは見なされない。事業により直接影響を受ける人々の生活保証はもちろん、直接、間接に多少とも影響を受けるコク、イン両河川下流部および導水路周辺地域の開発にも極力寄与するよう計画する。
- 4) 既にRIDはローカルコンサルタントに委託して調査を開始しており、JICA調査は、タイ側調査を補完・補強する形で実施される。このような調査形態はいろいろな困難を伴い、かえって面倒であるが、中進国とりわけタイ国のように近い将来自立を目指す国においては、むしろ望ましい形態であるといえよう。その意味で本調査は中進国の調査のモデルとしての意義がある。タイ側コンサルタントとJICA調査団の共同作業がスムー

ズに進行するためには、調査内容について双方の責任の範囲を明確にする必要がある。S/W協議の段階には、タイ側コンサルタントのI/Cレポートが未完成で業務内容の詳細が明確でなかったため、JICAのI/C説明の際、再度協議し確認するものとする。

- 5) RIDは、1998年2月までに調査を完了する計画であり、JICA調査もこの計画に沿って実施してほしいとの希望が強い。厳に拙速を慎むべきであるが、極力、調査期間を短縮するため、JICA内での手続きを迅速に行うとともに、調査団への投入技術者の増員等を検討する。
- 6) JICA調査のフェーズ1はRID調査のフェーズ1の結果をレビューし、導水路案の「必要性、妥当性」を確認しフェーズ2に移行するかどうかを判断する重要な調査である。JICAフェーズ1調査を効率的に実施するため、導水路案の必要性、妥当性を確認するためにどの程度の作業がRIDフェーズ1調査でカバーされているべきかについて、あらかじめRIDに指示する必要がある。
- 7) 本件プロジェクトに対しOECFが関心を有している。OECFが実施を検討する際、再調査をする等の手戻りがないよう、調査の内容およびレベル等についてOECFの意見を聴しつつ調査を実施する。
- 8) RIDは、本件調査に先立ちメコン委員会関係に必要な手続きは全て完了しているため問題はない。問題が生じてもRID/タイ政府の責任において措置するとしている。しかし、メコン委員会関係の動きには、なお流動的などころがあり、適宜、報告を入手し動向を把握しておく必要がある。

(2) 導水計画の検討について

- 1) 導水計画の検討に当たっては、ナン川中下流域およびチャオプラヤ川流域の水不足に対応するため、いかに効率よく水を貯水できるかという観点から、シリキットダムをはじめとする諸施設の運用計画を検討する必要がある。
- 2) シリキットダムの運用に当たっては、チャオプラヤ・テタル地域の水利用が最優先されることから、当地域の将来における水需要についても十分把握しておく必要がある。シリキットダムの運用計画は、プミポン・ダム、チャイナット・ダム等との連帯を十分検討する必要がある。
- 3) ナン川流域においては、現在も数多くのダム計画があるが、それらの施設規模、操作方法によっては、シリキットダムをはじめとする現在の諸施設の運用計画を再度検討する必要がある（検討の前提条件を明確にしておく必要がある）。
- 4) 上流域の洪水対策について
コク川、イン川からの導水量については、ナン川流域での需要量を念頭に置きつつコク

川、イン川の水文特性、利用可能量（コク、イン流域での必要量、環境に与える影響等から決定される）、経済性等から決定されるが、導水は雨期の降雨から行われることから、導水されるヨム川、ナン川では従来の自己流量に加えて導水量分だけ水位が上昇することとなるので、過去の洪水の被害状況と導水の影響分を踏まえ洪水対策が必要となってくる場合が考えられる。しかし、上流域の河川については、現況の河川の流下能力をはじめ、洪水時の浸水状況等の諸データが十分整理されておらず、まず、これらの状況を十分把握する必要がある。

(3) 水需要量について

- 1) 本導水計画に基づき、策定されるウタナデイト地域、ピサノロック地域等の農業開発計画については、タイ側が実施することとなっていることから、日本側としては灌漑計画の必要性、妥当性、導水計画との整合性等を確認する必要がある。
- 2) コク川、イン川およびナン川上流部については、本導水計画の影響を受ける地域であることから、この影響を確認することが必要である。そのうえで水資源の有効活用を図るため新たに当該地域の農業開発計画を策定し、地域振興を図ることが重要である。

6-2 調査対象地域および範囲

(1) 調査対象地域

コク川、イン川およびナン川の3流域（29,000km²）およびシリキットダムから下流の本調査によって利益を受けるチャオプラヤ・デルタを含んだ流域（43,000km²）の合計面積72,000km²とする。

(2) 調査範囲

- 1) Kok - Ing - Nan 導水計画の実施確認調査
- 2) 同計画のフィージビリティ調査

6-3 調査項目および内容

本格調査は、RIDの委託先ローカルコンサルタントへの技術移転を目的とした共同作業による、Kok - Ing - Nan 導水計画実施確認調査（Phase1）とフィージビリティ調査（Phase2）からなる。各フェーズの調査項目および内容は以下のとおりである。

6-3-1 実施確認調査（Phase1）

(1) 本計画の必要性、妥当性の確認

- ①ナン川下流域およびチャオプラヤ・デルタの水不足、将来の水需要の増大に対し各種水

資源開発計画が立案されたなかで、本計画案（Kok - Ing - Nan）の妥当性と過去の計画調査を検証し確認する。

②国家経済社会開発計画における対象地域の位置づけについて確認する。

(2) 目標年の設定

タイ国の過去の水資源開発計画における水需要予測は2006年に設定されており、本調査において計画を立案する際、重要な基準となる。したがって、RIDとの協議のうえ目標年を設定する。

(3) 計画降雨

タイ国の過去の農業関連開発計画における計画降雨は、渇水年5年確率で計画されていると想定される。本調査の目的は、コク川、イン川、ナン川の洪水対策と対象地域の水資源開発の両面を有している。したがって、両者の対象降雨は異なり、計画降雨によって施設規模および事業費等が左右されるため計画降雨決定に際し、十分な検討が必要となる。

(4) 農業開発計画

目標年における対象地域の総水需要の予測を目的として、直接受益地域である下記流域の農業開発計画を、計画の必要性、妥当性を確認のうえ策定する。なお、本地域の他の水需要（都市用水、工業用水等）予測は、既存の関連調査計画に基づくものとする。農業開発計画の策定に当たっては、地域の自然・社会環境等の特殊性を十分考慮するものとする。

①コク川流域

②イン川流域

③ナン川のシエイキット・ダム上流域

(5) 対象地域の水需要

設定された目標年における灌漑用水、都市用水、工業用水、塩水遡上防止等の水需要量の予測を行う。

(6) コク川、イン川、ナン川上流域の洪水処理計画

洪水処理計画の目的は雨期の導水によって影響を受けるヨム川、ナン川に河道対策と洪水処理計画を本導水計画に取り込んで総合的に行うことの有効性である。本来なら、洪水対策だけで1調査を形成できるが、本計画レベルは次回調査の基礎となるレベルにとどめる。調査計画の項目は以下の内容とする。

- ①河川現況調査（縦横断、流下能力の把握）
- ②浸水状況、土地利用状況（現在、将来）
- ③導水による影響の把握
- ④洪水処理計画

(7) 導水計画

導水計画は下記事項に基づいて計画導水量を決定するとともに、導水ルート、施設規模（貯水池、開水路、トンネル、河川改修等）について検討する。

- ①計画降雨
- ②目標年における水需要量
- ③洪水処理計画
- ④現況河川の流下能力
- ⑤コク川、イン川、ナン川の農業開発計画
- ⑥地形、地質
- ⑦シリキット・ダムの貯水能力
- ⑧利用可能量の把握

(8) 導水路計画（トンネル、開水路、貯水ダム等）

RIDが実施する測量資料に基づいて、自然流下によるルートの検討を行う。検討に際し重要なことは、①上下流の高低差に余裕がない、②ルートの地質が北の標高の高い山岳は石灰岩、南の割合の低い丘陵は砂岩を主体としている。

したがって、ルートの選定によって運転水位による貯留ダムの規模の変動が大きくなり環境問題、事業費に響くこととなる。また、50kmに及ぶトンネル区間、難度の高い地質、大断面が予想され、立抗位置、工法、ルートの選定に経験と高度な技術力が要求される。

(9) 運転管理手法

本計画の直接受益であるKok - Ing - Nan流域にかかるシリキット・ダムおよび関連取水施設の操作管理のほか、プミボン・ダム、チャイナット・ダムの操作管理も含めた水利用計画を策定し、特に、1995年の大規模な洪水被害を教訓に、災害を防止するとともに、資源の有効活用を目的とし、施設の適正かつ合理的な運転管理手法を策定する。

(10) 事業費、維持管理費

事業費、維持管理費の算出に際し、建設資材、建設機械、労務単位、タイ国の積算構成

等の資料収集を行う。事業に大きな影響を及ぼすトンネル工事費の算定において、経験者を配置する。

(11) 経済分析

マスタープランにおける経済分析と同時に、近隣社会経済に及ぼす効果についても考察するものとする。

(12) 環境影響評価

本事前調査のスクリーニングをレビューし、マスタープランで策定される代替案について初期環境評価（IEE）を実施する。

6-3-2 フィージビリティ調査（Phase 2）

Phase 1の目的は、本導水計画の「必要性、妥当性」を確認してPhase 2へ移行するかどうかを判断する調査である。主に貯水ダム、開水路、トンネル等から構成される導水計画は、施設、ルートに対する数案の代替案は策定されるが、従来F/Sとは異なり、本計画においては施設等に対する優先プロジェクトの選定を行うものではない。但し、①コク川、イン川、ナン川流域の農業開発計画、②水バランス解析、③運転管理手法等については、F/Sレベルの検討を加えるものとする。

(1) 地質・土質調査

M/Pの段階でタイ側コンサルタントによって一部実施されているが、下記仕様の調査を行う。但し、下記仕様は策定時に見直し、JICA担当者の承認を得て実施するものとする。

(2) 施設計画

タイ国の実状に適合する計画条件に基づき、各施設の設計を行う。

(3) 施工計画

タイ国の事業計画に基づいて、施設を施工するために必要な資機材計画、工程計画を設定する。

(4) 事業費の算定

事業実施に要する費用を、内貨、外貨に分けて算定する。

(5) 経済分析

費用、便益に関わる経済効果について分析する。

(6) 実施設計の仕様書作成

フィージビリティ調査の完了時に、次に行われる実施設計の仕様書を作成する。

(7) 環境評価

事業実施により、社会・自然環境に及ぼす影響について環境評価を行う。

6-4 要員計画および調査工程（案）

(1) 本調査には概ね以下の専門分野による要員構成が必要と考えられる。

- ①総括／運用管理計画
- ②環境影響（総括／社会調査）
- ③河川計画
- ④水理・水文
- ⑤灌漑計画
- ⑥栽培計画
- ⑦トンネル計画
- ⑧地質・土質
- ⑨施設計画（ダム）
- ⑩施設計画（開水路）
- ⑪積算／施工計画
- ⑫経済評価
- ⑬環境影響（村落開発）
- ⑭環境影響（動物）
- ⑮環境影響（植物）
- ⑯環境影響（水圏生態）

(2) 調査工程（案）

調査工程は、タイ国内での現地調査と日本国内で行われる解析作業とで構成される。現地作業は約12.5カ月、国内作業は約7カ月を予定し、ファイナルレポートの提出まで合計24カ月を予定している。調査工程（案）を以下に示す。

(3) 報告書

下記報告書を作成し、タイ国側に提出のうえ、説明、協議等を行う。

- 1) イセプション・レポートⅠ：IC/R
英文20部、現地調査開始後2週間以内に提出
- 2) インテリム・レポートⅠ：IT/R
英文20部、現地作業終了時に提出
- 3) ドラフト・ファイナルレポートⅠ：DF/R
英文40部、国内作業完了時に提出（タイ側は15日以内にコメントする）
- 4) ファイナルレポートⅠ：F/R
メインレポート英文80部、サマリーレポート英文80部、サマリーレポートタイ語80部を、タイ側コメントを受領後30日以内に提出
- 5) イセプション・レポートⅡ：IC/R
英文20部、現地調査開始時に提出
- 6) インテリム・レポートⅡ：IT/R
英文20部、第2次の現地調査終了時に提出
- 7) ドラフト・ファイナルレポートⅡ：DF/R
メインレポート英文40部は第3次の現地調査開始時に、EIA・レポート英文40部は第2次現地調査終了時に、それぞれ提出
- 8) ファイナルレポートⅡ：F/R
メインレポート英文80部、サマリーレポート英文80部、サマリーレポートタイ語80部をタイ側のコメントを受領後60日以内に提出

6-5 調査用資機材（案）

- ①調査用資機材としては土質調査室内試験器材、②測量調査器材のついてタイ国より要請が出された。これらはいずれも、使用するとしてもフェーズ2において使用するものであり、また、土質調査、測量調査とも、タイ国内で、業務再委託の可能なローカルコンサルタントが存在することから、日本側で購送する必要性は低いと考えられる。

6-6 相手国の便宜供与

便宜供与の内容については、S/WおよびM/Mに記載のとおりである。オフィスについてはRID内と、現地の2カ所に設けられる予定であるが、車両についてはタイ側からは便宜供与が期待できないと考えられる。

6-7 調査実施上の留意点

(1) コク川分水堰

分水堰の建設に当たっては分水計画水位、分水量を十分加味する必要がある。

(2) コク川～イン川間導水路

コク側流域内の開水路構造上に大規模なスワンプが存在する。したがって、このスワンプに雨期流量を揚水・貯留し、乾期用水として利用できるかの可能性や、イン川流域内においては開水路ルート上で流域内農地に乾期用水を供給する施設の建設の可能性、また、イン川流域では導水路によってイン川のいくつかの支流が分断されるため、これらの排水に対しての検討が必要である。

(3) イン川～ヨット川間導水路

地質が良好であれば工期短縮のためTBM（トンネルボーリングマシン）による施工の可能性についても検討、さらに、長大トンネル施工のための工事用道路、橋梁、送電線、土捨場、排水施設等、工事に必要な各施設の計画の検討が必要である。

(4) ヤオ川河川改修

河川改修には、河川断面の拡幅、河床の補強や護岸、堰やドロップによる水勢の軽減、河川横断橋の改修・架け替え、河川沿い集落の給水施設の改修等が含まれている。

(5) コク川およびイン川流域灌漑事業計画

これらの既存・新規計画の事業についてインベントリー調査を行い、事業計画の立案・見直し・実施を推進する必要がある。特に本事業と関連する灌漑事業が多数あると思われることから、それら事業計画の策定を行う必要がある。これら事業計画の立案はタイ国ローカルコンサルタントが実施することとなっている。

(6) ナン川流域灌漑事業計画

本計画においても、これら事業のインベントリー調査を実施し、事業計画の立案を行う必要があり、これらについてもタイ国ローカルコンサルタントが実施することとなっている。

(7) コク・イン・ナン導水事業総合水管理

以下の項目についての事業計画を策定する。

・コク川の流量観測、分水堰からのコク・イン・ナン導水事業への分水量、下流放流量のモ

ニタリングおよび取水、洪水吐ゲートの管理

- ・コク川～イン川間導水路における調整ゲートのコントロールおよび流量変化のモニタリング
- ・イン川の流量観測、イン川調整池の水位、貯水量管理、イン川～ヨット川間導水トンネルへの分水量、下流放流量のモニタリング
- ・イン川～ヨット川間導水トンネル出口における水位、流量のモニタリング
- ・ヤオ川洪水調整ダムの洪水調整管理、流入量および放流量のモニタリング
- ・ヨット川の水位、流量のモニタリング
- ・シリキットダムおよびバンコク RID 本部の水管理センターとのコミュニケーション

(8) ナン川総合水管理

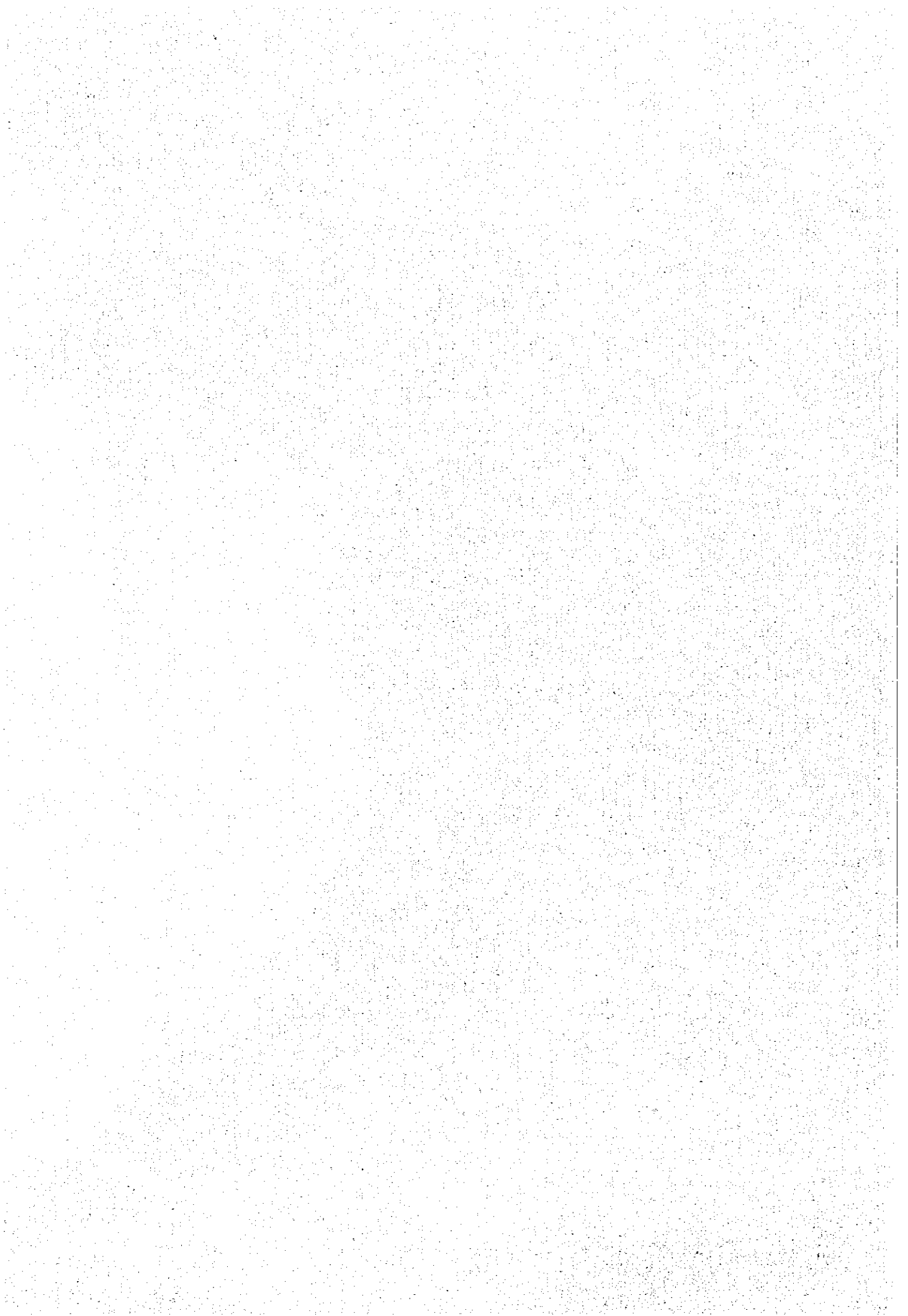
以下の項目についての事業計画を策定する。

- ・ナン川の大・中・小規模ダム群の貯水池運用ルールを水利および洪水調整の観点から策定する
- ・小流域およびナン川下流域の水収支と洪水コントロール効果の予測検討

但し、上記2点については、フィージビリティ調査において、これらの指針を施策するにとどめるものとする。

付 属 資 料

1. Terms of Reference
2. Scope of Work
3. Minutes of Meetings
4. 主要面会者リスト
5. 主要収集資料リスト
6. ローカルコンサルタント一覧
7. 環境配慮・環境アセスメントのためのガイドライン



付属資料1. Terms of Reference

REQUEST FOR TECHNICAL ASSISTANCE

Project Title : Feasibility Study on the Proposed Kok-Ing-Nan Water Diversion Project for Irrigation in the Chao Phraya River Basin

Requesting Agency : Royal Irrigation Department (RID)
Ministry of Agriculture and Cooperatives (MOAC)

Proposed Source of Assistance : The Government of Japan

Type of Assistance : Development Survey

1. Background

The Chao Phraya river basin is the most essential agricultural production area in Thailand. With supply of irrigation water from the Bhumibol dam, Sirikit dam and other storage reservoirs built at the upper reach of the basin, about 2.0 M.ha. farm lands are supposed to be irrigated during the wet season and about half of the area will be irrigated during the dry season. However, due to shortage of water in the catchment areas, the stored water in the reservoirs is decreasing year by year resulting in serious water shortage occurred in the lower Chao Phraya river basin.

Water demand in the Chao Phraya river basin has been increasing in recent years and reached about 30,000 MCM per year at present with the details as follows.

- Irrigation requirement for wet season paddy	12,000 MCM.
- Irrigation requirement for dry season paddy and other crops.	8,000 MCM.
- Domestic water demand of the rural area	1,200 MCM.
- Water demand for Metropolitan and urban areas	1,200 MCM.
- Water demand for desalinization of lower basin area	2,400 MCM.
- River maintaining water	5,200 MCM.
<u>Total</u>	<u>30,000 MCM.</u>

On the contrary, the annual outflow of the Bhumibol and Sirikit reservoirs which are the main and largest storage reservoirs in the Chao Phraya river basin is only about 6,000 to 7,000 MCM and decreased considerably due to less inflow from the upstream catchment areas.

Sirikit dam is located at the Nan river, - one of the major tributaries of the Chao Phraya river. It was completed in 1974 with multi-purpose function of irrigation and power generation, etc. according to the original plan. Outline of the reservoir elements and benefit figures proposed in the original plan can be shown as follows.

(1) Reservoir elements

Average annual run-off	about 6,000 MCM.
Total reservoir capacity at FWL 162 m (MSL)	9,500 MCM.
Low water capacity at LWL 128 m. (MSL)	2,850 MCM.
Active water capacity FWL-LWL: 34 m.	6,650 MCM.
Maximum discharge capacity of outlet	400 CM/Sec.
Head for power generation 162 m - 77 m	85 m.

* Source : EGAT Hydro-electric Projects - Basic Data 1982.

(2) Benefit

Available water for irrigation and power	about 6,000 MCM.
Irrigation area (wet 100%, dry 50%)	300,000-400,000 ha.
Power installation capacity	370 MW.
Annual power generation (peak)	1,200 GWH.

With the above proposed reservoir storage function, the Sirikit dam, however has never reached the full scale operation during the past 18 years after completion, and shortage of water becomes even more critical after 1987 as can be observed from the following records.

- Annual inflow to the reservoir	4,000-5,000 MCM.
- Water level in the reservoir	Maximum 150 m (12m below FWL) Minimum 129 m
- Annual outflow	3,000-4,500 MCM.
- Annual power generation	400-700 GWH.

* See Table - 2 for details

Should the critical water shortage be continued, the irrigation area downstream of the dam will be seriously affected and the dry season cropping shall be entirely suspended. Accordingly the water shortage problem in the Chao Phraya river basin becomes not only a threat to the regional socio-economic growth but also a great impediment to the national economic development.

The Government of Thailand is therefore, eagerly looking for an effective solution of the problem in order to place the national economic development on more sustainable basis.

For securing new water resources for the Chao Phraya river basin, EGAT ever proposed the Ing-Yom-Nan and the Kok-Ing-Yom-Nan transbasin diversion plans in early 1980's, but both plans require construction of the Kaeng Sua Ten reservoir at Yom river as premise to relay the diverted water to the Sirikit reservoir, and construction of the Kaeng Sua Ten reservoir seems to take some more years due to environmental problems.

In view of such a situation, RID has examined an alternative conceptional plan to divert the Kok and Ing river water through construction of a diversion tunnel to cross the northern mountainous area for supply to the Sirikit reservoir for use in the Chao Phraya river basin. After careful preliminary studies and reconnaissance survey, the plan was found to be highly feasible in both technical and economic aspects. To conduct feasibility study for further confirmation of technical soundness, economical viability and financial feasibility is therefore urgently required.

Aside from the above mentioned, the proposed plan has the following specific characteristics to be emphasized in particular.

- (1) The plan intends to divert excess water during wet season for storage in the reservoir, hence, it will not affect water use in the lower Mae Khong river basin.
- (2) The reservoir with substantial storage capacity is existing and available which can store the whole amount of diverted flow for use of dry season irrigation as well as for power generation without any additional cost for storage and distribution of water.

- (3) Most of the diversion channel running across the mountainous area is tunnel section so that the project can avoid environmental destruction problem.

Since the project involves a lengthy tunnel with a large diameter, and Japan has developed the most advanced technology in tunnel engineering, to apply for conducting feasibility study for the captioned project through technical cooperation program with Japan is therefore proposed.

2. Objective of Study

The objective of study is to conduct necessary survey and studies on the feasibility level over the proposed project which is aimed to divert the excess water in the Kok and Ing rivers to the Nan river for recovery of water storage in the Sirikit reservoir for use of irrigation in the Chao Phraya river basin.

3. Proposed Kok-Ing-Nan Water Diversion Project

3.1 Diversion Plan of the Kok and Ing River Water

The Kok and Ing rivers are located at the northern part of Thailand in the province of Chiang Rai. With the catchment area of about 5,800 sq.km and 5,700 sq.km. respectively at the dam sites, the rivers could provide a rich run-off of about 3,500 MCM and 2,200 MCM per annum respectively which are emptying into the Mae Khong river without effective utilization at present, particularly during the wet season. The concept of the proposed project is to divert such an excess amount of water to recover the Sirikit reservoir storage for use of irrigation in the Chao Phraya river basin.

(1) Possible Diversion Water

In case the diversion dam is constructed at each of the rivers and a diversion tunnel together with the canal to link the diversion dams and the Nan river are provided, about 2,700 MCM per annum of excess water in the rivers can be conveyed to the Sirikit reservoir as shown in the attached Table - 1.

(2) Kok Diversion Dam

As one of the alternatives, the proposed Kok diversion dam is located at about 10 km. downstream of Amphoe Muang, Chiang Rai where the intake water level is set at about 385 m (MSL). This site has no influence of backwater from the Mae Khong river.

(3) Diversion Waterway from Kok to Ing Rivers

A diversion waterway with approximately 45 km. in length which is consisting of an open canal of 40 km. and culvert and tunnel of about 5 km. will be constructed to connect the Kok diversion dam and the Ing river.

(4) Ing Diversion Dam

As one of the alternatives, the proposed Ing diversion dam in the Ing river is located in Amphoe Thoeng at the site nearby the existing Thoeng gaging station in order to receive the diverted water from the Kok river, to take the water in the Ing river and to divert water from both rivers to the Nan river. The intake water level at the diversion dam is set at about 365 m. (MSL) which has also no backwater influence from the Mae Khong river.

(5) Diversion Tunnel from Ing Diversion Dam to Nan River

A diversion tunnel to convey the Kok and Ing river water to the Nan river is proposed to run across the northern mountainous area. The proposed diversion tunnel will have a total length of about 62 km. consisting of 50 km. tunnel and 12 km. culvert.

(6) Outlet of Diversion Tunnel

The outlet of the diversion tunnel is located in the Huai Yot at the site with elevation of about 330 m (MSL). Huai Yot is a tributary of the Nan river.

(7) Tunnel Outlet to Sirikit Dam

The water released from the tunnel outlet will pass through the river course of the Huai Yot and the Nan river to the Sirikit Reservoir. A river training work of about 50 km in length will be required in order to convey the diverted water to the reservoir.

3.2 Outline of the Water Diversion Project

Based on the above planning and layout, the outline of the water diversion project can be summarized and shown in the following table.

<u>Items</u>	<u>Kok to Ing</u>	<u>Ing to Nan</u>	<u>Total</u>
Discharge Capacity (m ³ /sec)	120	175	-
Discharge Velocity (m./sec)	2.0	2.7	-
Slope	1/3,000	1/2,500	-
Tunnel Diameter (m)	8.5	10.0	
Length			
Tunnel (km)	0.5	50.0	50.5
Culvert (km)	4.5	12.0	16.5
Open Canal (km)	40.0	-	40.0
Total (Length) (km)	45.0	62.0	107.0

3.3 Construction Method of Tunnel

Since the tunnel between Ing and Nan is rather long and the cross-section is large, tunnel excavation will be carried out by using tunnel boring machine. The length of tunnel reach to be excavated by tunnel boring machine is planned to be about 10 to 12 km. with two to three adits and number of shaft provided, the construction period of tunnel can be estimated as follows.

- Temporary works	6 months
- Tunnel excavation 12,000 m./400 m. per month =	30 months
- Concrete lining in parallel with tunnel excavation	10 months
<u>Total</u>	<u>46 months</u>

Accordingly, the entire water diversion project could be accomplished within about 4-year period.

3.4 Expected Project Benefit

(1) Increased Amount of Water

After completion of this project, the diverted water amounting to 2,700 MCM. could be available for use every year in case the tunnel is designed to have 175 m³/sec. discharge capacity. All

of 2,700 MCM., water will be diverted during the wet season from June to December during which water in the Mae Khong river used to be ample.

(2) Increased Irrigable Area

Since the Sirikit reservoir has enough capacity to store the diverted water, all 2,700 MCM. increased amount of water could be used for dry season irrigation or partially for wet season supplemental irrigation. With average irrigation water requirement of 10,000 cu.m./ha., 2,700 MCM. increased amount of water could irrigate about 270,000 ha. for one additional crop of paddy rice. Irrigation net benefit is therefore estimated at about 1,620 million Baht per year. (6,000 Baht/ha. x 270,000 ha.)

(3) Increased Power Generation for Peak Hours

- Total outflow : 7,000 MCM. including 2,700 MCM. diverted water
- Annual power operation hour : 4,900 hrs. per annum
7,000 MCM./((400 cu.m./sec. x 3,600 sec./hr.)
- Annual power production : 1,500 GWH.
370 MW (plant capacity) x 4,900 hrs. x 85%
- Present power production : 500 to 700 GWH.
- Increased power production : 800 to 1,000 GWH.
- Estimated benefit : 1,350 million Baht
1.5 Baht/kwh x 900 x 10⁶ kwh.

(4) Total benefit

1,620 M.Baht + 1,350 M.Baht: 2,970 million Baht

3.5 Construction Cost of the Project

Construction cost of the project is approximately estimated as follows.

- Tunnel	400,000 Baht/m. x 50,500 m	= 20,200 M.Baht
- Culvert	100,000 Baht/m. x 16,500 m	= 1,650 M.Baht
- Open Canal	50,000 Baht/m. x 40,000 m	= 2,000 M.Baht
- River Training	40,000 Baht/m. x 50,000 m	= 2,000 M.Baht
	<u>Total</u>	= <u>25,850 M.Baht</u>

3.6 Economic Justification

With the estimated cost and benefit as shown above, B/C ratio of the project can be roughly calculated at about 1.15 as shown below.

- Annual investment cost : 2,585 M.Baht
25.850 M.Baht x 10%
- Estimated annual benefit : 2,970 M.Baht
- B/C ratio : 1.15
2,970 M.Baht/2,585 M.Baht

4. Proposed Scope of Works

4.1 Scope of Works for the Study

In order to achieve the objective of the study, the following surveys and studies shall be carried out during the feasibility study period.

- (1) Hydrological Study consisting of
 - (a) Run-off analysis of the Kok river
 - (b) Run-off analysis of the Ing river
 - (c) Run-off analysis of the Nan river
- (2) Agriculture and Irrigation Study, consisting of
 - (a) Agricultural and irrigation study for the Kok river basin
 - (b) Agricultural and irrigation study for the Ing river basin
 - (c) Agricultural and irrigation study for the Chao Phraya river basin
- (3) Optimum Intake Capacity Study for Diversion Tunnel, including
 - (a) Study on optimum intake capacity at the Kok river diversion work.
 - (b) Study on optimum intake capacity at the Ing river diversion work.
- (4) Reservoir Operation Study for the Sirikit Dam, including
 - (a) Irrigation water demand study
 - (b) Domestic and other water demands study

- (c) Power generation requirements
 - (d) Water supply study from the Nan river basin
 - (e) Water supply study from the Kok-Ing diversion
 - (d) Reservoir operation study
- (5) Study on the Diversion Dams, including
- (a) Study on the Kok river diversion works
 - (b) Study on the Ing river diversion works
- (6) Tunnel and Canal Study, including
- (a) Alignment study
 - (b) Hydraulic analysis
 - (c) Facilities plan
- (7) River Training Study for the Upper Nan River Course, including
- (a) Hydraulic analysis
 - (b) Erosion and sedimentation study
 - (c) River training plan
- (8) Analyses of Engineering Geology, including
- (a) Geological analyses for the Kok diversion dam site
 - (b) Geological analyses for the Ing diversion dam site
 - (c) Geological analyses for canal alignment
 - (d) Geological analyses for tunnel alignment
- (9) Control System and Tele-communication Plan, consisting of
- (a) Control system plan
 - (b) Tele-communication plan
- (10) Construction Plan, including
- (a) Construction plan for the Kok diversion dam
 - (b) Construction plan for the Ing diversion dam
 - (c) Construction plan for the diversion canal works
 - (d) Construction plan for the tunnel works
 - (e) Construction plan for the river trainings works

- (11) Project Cost Estimate
- (12) Study on the Operation and Maintenance Plan of the Project Facilities
- (13) Study on the Project Implementation Plan
- (14) Economic Evaluation and Project Justification
- (15) Environmental Assessment

4.2 Survey and Investigations Required for the Study

(1) Topographic Survey

(a) Aero-photo Survey and Mapping

- Canal and tunnel alignment
100 km(L) x 10 km(W) Scale: 1/10,000 Contour Interval: 2.5 m.
- Nan river training site
50 km(L) x 2 km(W) Scale: 1/10,000 Contour Interval: 2.5 m.

(b) Plan Survey

- Kok diversion dam site
2 km x 2 km Scale: 1/2,000 Contour Interval: 1.0 m.
- Ing diversion dam site
2 km x 2 km Scale: 1/2,000 Contour Interval: 1.0 m.
- Tunnel inlets outlets and access
1 km x 1 km x 6 places Scale: 1/2,000 Contour Interval: 1.0 m.

(c) Profile and Cross-sectional Survey of Nan River Training Site

- Profile of river bed
L = 50 km Scale: 1/10,000
- Cross-section of the river
500 m. interval Scale: 1/1,000

(2) Geological Investigation

- (a) Seismic Prospecting Survey 60 km.
- (b) Core Drilling
 - Diversion dam sites 4 x 2 places x 30 m. (D)
 - Tunnel inlets and outlets 6 places x 50 m. (D)
 - Tunnel alignment 4 places x 200 m. (D)
 - Canal alignment 4 places x 20 m. (D)
- (c) In-situ Borehole Tests
 - Velocity logging of 10 boreholes
 - Water pressure test of 10 boreholes
- (d) Drilled Core Rock Tests 10 borehole cores

5. Study Period

The study period covers about eighteen (18) months which is divided largely into three (3) phases namely; conceptual planning covering 6 months, survey and investigation covering 9 months and feasibility study covering 9 months. There are 3 months overlapping period between conceptual planning and survey and investigation and between survey and investigation and feasibility study. Detailed study schedule is shown in the attached Fig.-1 for reference.

6. Assistance Requested

6.1 Required Expertises and Man-months

During the study period, the following expertises are required to carry out various surveys and studies. Details of manning schedule are shown in the attached Fig. - 2.

	<u>In Field</u>	<u>At Home Office</u>	<u>Total</u>
1. Team Leader	6 months	9 months	15 months
2. Hydrologist (A)	4	6	10
3. Hydrologist (B)	2	4	6
4. Hydraulic Engineer	5	5	10
5. Diversion Dam Engineer (A)	4	5	9
6. Diversion Dam Engineer (B)	3	3	6
7. Irrigation Engineer	5	5	10
8. Agronomist	4	4	8
9. Water Works Engineer	2	2	4
10. Hydro-power Engineer	2	2	4
11. Tunnel Engineer (A)	6	7	13
12. Tunnel Engineer (B)	4	4	8
13. Canal Engineer (A)	5	6	11
14. Canal Engineer (B)	4	4	8
15. Structure Engineer (A)	5	5	10
16. Structure Engineer (B)	2	2	4
17. River Training Engineer (A)	6	6	12
18. River Training Engineer (B)	2	5	7
19. Construction Planner (Tunnel)	3	5	8
20. Construction Planner (Facilities)	3	3	6
21. Cost Estimator	2	3	5
22. Telemetering Expert	1	2	3
23. O/M Expert	2	2	4

	<u>In Field</u>	<u>At Home Office</u>	<u>Total</u>
24. Economist	2 months	4 months	6 months
25. Environment Expert	2	3	5
26. Geologist (A)	3	2	5
27. Geologist (B)	7	0	7
28. Geologist (C)	6	0	6
29. Surveyor (A)	1	0	1
30. Surveyor (B)	5	0	5
<u>Total</u>	<u>108</u>	<u>108</u>	<u>216</u>

6.2 Fellowship

It is proposed that number of RID personnel concerned with the study will be dispatched to Japan for technical training and study tour in accordance with the procedure of the Colombo Plan Technical Cooperation Program.

6.3 Counterparts Contribution

A number of technical staff should be assigned as the counterpart staff during the execution of the project.

6.4 Office Equipments

- Split type air conditioner 35,000 Btu 1 set
- Split type air conditioner 18,000 Btu 1 set
- Desktop Facsimile 1 set
- AT. compatible notebook and desktop computer each 1 set
- Typewriter, English 1 set
- Typewriter, Thai 1 set

LAYOUT PLAN OF KOK - ING - NAN WATER DIVERSION PROJECT
FOR IRRIGATION IN THE CHAOPHRAYA RIVER BASIN

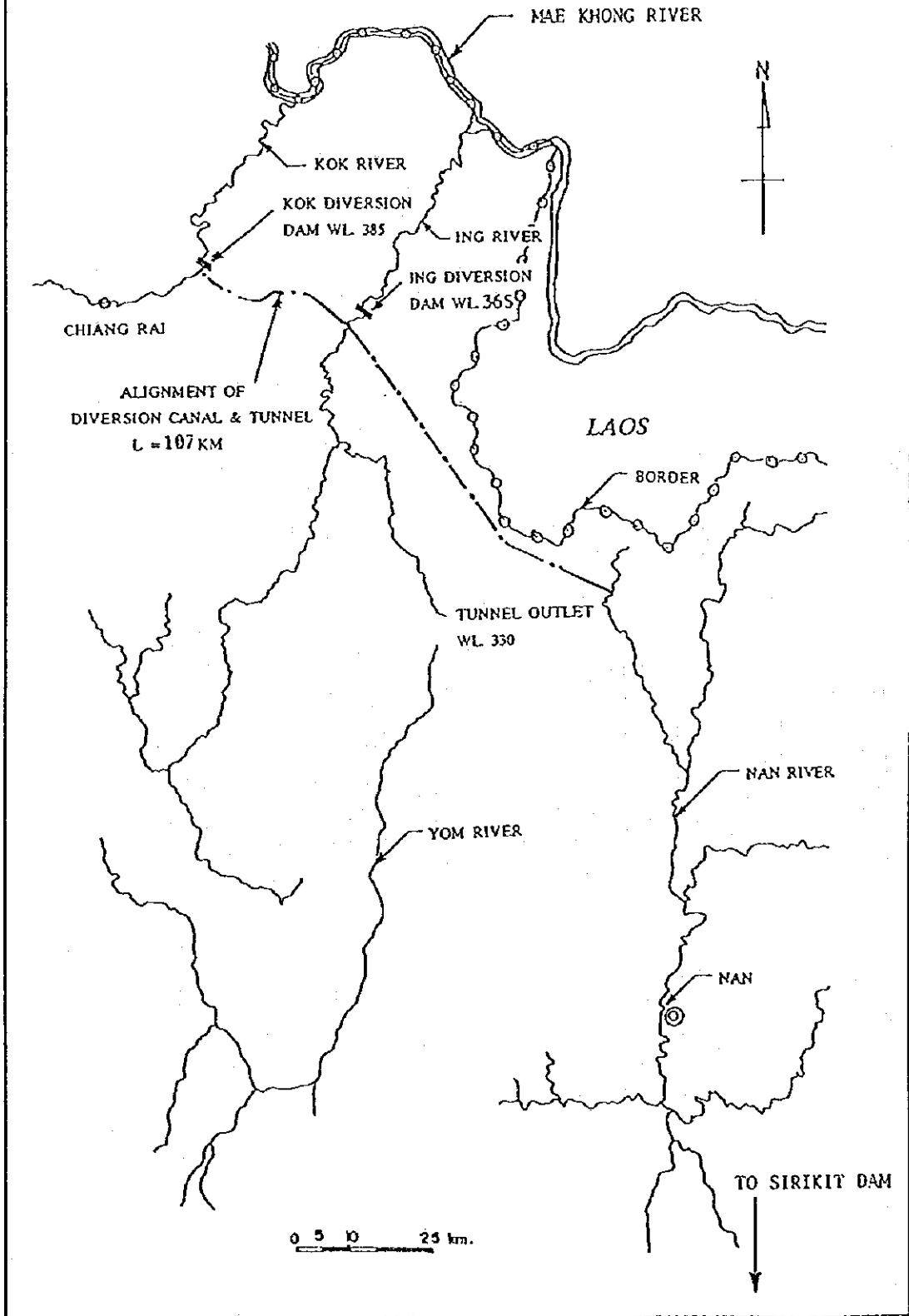


Table ~ 1 Possible Diversion Water Amount in Terms of Various Diversion Discharge
Unit : MCM

Diversion Discharge in CMS	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Whole Year
	MCM/Year	MCM	MCM	MCM	MCM	MCM	MCM	MCM	MCM	MCM	MCM	MCM	MCM
125	-	-	221	309	335	324	335	271	270	-	-	-	2,065
150	-	-	229	348	402	389	402	365	280	-	-	-	2,415
175	-	-	231	375	468	454	468	414	283	-	-	-	2,693
200	-	-	231	402	527	518	528	464	287	-	-	-	2,957

* ... Mean monthly diversion water in MCM between 1972 - 1980.

Table ~ 2 Sirikit Reservoir Operation Record After Completion

Water Year	Rea.In-flow MCM/Year	Res.Out-flow MCM/Year	Storage at Maximum		Power Yield GWH/Year	Water Year	Rea.In-flow MCM/Year	Res.Out-flow MCM/Year	Storage at Maximum		Power Yield GWH/Year
			MCM	Month					MCM	Month	
1972	4601 ¹	3577 ¹	3933 ²	Oct.	-	1982	5235 ¹	5532 ¹	7596 ²	Oct.	- ²
1973	6183	1754	8122	Oct.	-	1983	5440	4507	7562	Nov.	-
1974	4277	5051	8065	Sept.	-	1984	6446	6169	8577	Oct.	995
1975	8498	7418	9680	Sept.	-	1985	5420	4446	8291	Dec.	937
1976	6111	7374	8203	Oct.	-	1986	4583	6336	7037	Oct.	878
1977	4280	5885	5444	Oct.	-	1987	3052	3800	4776	Nov.	359
1978	6264	4542	7843	Oct.	-	1988	4589	2186	6676	Oct.	517
1979	3682	5597	5172	Sept.	-	1989	4030	4407	6639	Oct.	981
1980	6071	3640	7593	Oct.	-	1990	4068	4949	5549	Oct.	592
1981	7689	7216	8454	Oct.	-	1991	3492	3385	4858	Oct.	399

¹ Annual in-flow and out-flow are the sums from April to March

² Annual power production is the sum from October to September

³ Storage at Maximum is the storage at the maximum month in the year

FIGURE - 1 : SCHEDULE OF THE STUDY

DESCRIPTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Conceptional Plan	[Solid bar]																	
2. Survey & Investigation	[Solid bar]																	
3. Feasibility Study	[Solid bar]																	
a) Hydrological Studies	[Dotted bar]																	
b) Agriculture & Irrigation Studies	[Dotted bar]																	
c) Water Diversion Analysis	[Dotted bar]																	
d) Reservoir Operation Studies	[Dotted bar]																	
e) Diversion Dams Studies	[Dotted bar]																	
f) Tunnels & Canals Studies	[Dotted bar]																	
g) River Training Studies	[Dotted bar]																	
h) Geological Analysis	[Dotted bar]																	
i) Control System & Telecommunication Plan	[Dotted bar]																	
j) Construction Plan	[Dotted bar]																	
k) Cost Estimation	[Dotted bar]																	
l) Operation & Maintenance Plan	[Dotted bar]																	
m) Implementation Plan	[Dotted bar]																	
n) Project Evaluation	[Dotted bar]																	
o) Environmental Assessment	[Dotted bar]																	

FIGURE - 2 : MANNING SCHEDULE


Expert	Month																		Site Work	N/N Home Office Work
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
1. Team Leader																			6	9
2. Hydrologist (A)																				6
3. Hydrologist (B)																				4
4. Hydraulic Engineer																				4
5. Diversion Dam Engineer (A)																				5
6. Diversion Dam Engineer (B)																				5
7. Irrigation Engineer																				3
8. Agronomist																				5
9. Water Works Engineer																				4
10. Hydro-power Engineer																				4
11. Tunnel Engineer (A)																				2
12. Tunnel Engineer (B)																				2
13. Canal Engineer (A)																				2
14. Canal Engineer (B)																				2
15. Structure Engineer (A)																				7
16. Structure Engineer (B)																				4
17. River Training Engineer (A)																				4
18. River Training Engineer (B)																				6
19. Construction Planner (Tunnel)																				1
20. Construction Planner (Facilities)																				5
21. Cost Estimator																				2
22. Telemetering Expert																				6
23. O/M Expert																				3
24. Economist																				3
25. Environment Expert																				2
26. Geologist (A)																				3
27. Geologist (B)																				2
28. Geologist (C)																				0
29. Surveyor (A)																				0
30. Surveyor (B)																				0
																			100	100

付属資料2. Scope of Work

THE SCOPE OF WORK
FOR
THE STUDY
ON
THE KOK-ING-NAN WATER DIVERSION PROJECT
IN
THE KINGDOM OF THAILAND

AGREED UPON BETWEEN
THE ROYAL IRRIGATION DEPARTMENT
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

BANGKOK
MARCH 20, 1996



MR. ROONGRUENG CHULAJATA
DIRECTOR GENERAL,
ROYAL IRRIGATION DEPARTMENT
MINISTRY OF AGRICULTURE
AND COOPERATIVES



MR. HIDETOMI OI
LEADER,
PREPARATORY STUDY TEAM,
JAPAN INTERNATIONAL
COOPERATION AGENCY

I. INTRODUCTION

In response to the request of the Government of the Kingdom of Thailand (hereinafter referred to as "the Government of Thailand"), the Government of Japan has decided to conduct the Study on the Kok-Ing-Nan Water Diversion Project in the Kingdom of Thailand (hereinafter referred to as "the Study"), within the general framework of technical cooperation between Japan and Thailand, which is set forth in the Agreement on Technical Cooperation between the Government of Japan and the Government of Thailand signed on November 5, 1981.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for 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 Thailand.

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are:

1. to investigate the necessity and viability of the Kok-Ing-Nan Water Diversion Project (hereinafter referred to as "the Project"), which aims to contribute to agricultural and other development in Kok, Ing and Chao Phraya river basins, through their water demand projection and the comparison with alternative plans for water resources development,
2. to conduct a feasibility study for the Project in order to make the Project plan sound technically, economically, socially and environmentally,
3. to conduct a study on the environmental impact of the implementation of the Project, and
4. to carry out technology transfer to the Thai counterpart personnel in the course of the Study.

III. STUDY AREA

The Study shall cover (1) Kok, Ing and Nan (upstream of Sirikit dam) river basins for physical planning and environmental assessment of the Project, approximately 29,000km² and (2) beneficial areas down stream from Sirikit dam to Chao Phraya Delta for study on potential benefit of the Project, approximately 43,000km², in total approximately 72,000km².

IV. SCOPE OF THE STUDY

The Royal Irrigation Department, the Ministry of Agriculture and Cooperatives (herein after referred to as "the RID") has already initiated "Feasibility and Environmental Impact Study on Kok-Ing-Nan Development Project" for the period of twenty four months from March 1996. Accordingly, the Study will be conducted to supplement and strengthen the RID study, covering the scope as follows:

The Study will be divided into two phases.

1. Phase 1: Conceptual Planning and Initial Environmental Examination (IEE)

The Phase 1 of the Study will be implemented in order to investigate the necessity and the viability of the Project through the water demand projection, the comparison with alternative water resources development plans and IEE.

A. Conceptual Planning

Results of Conceptual Planning Study made by the RID will be reviewed and summarized in a report, focusing on :

1) Projection of water demand for agricultural, and other purposes (hydro-power generation, domestic, industrial, salinity control etc.) in the beneficial areas.

- a) present condition of water use
- b) existing projects and plans for irrigation and other purposes
- c) water demand projection in future

2) Water resources available at present

- a) inflow and outflow at Sirikit Dam (annual data since its construction in 1972)
- b) discharge of tributaries at the confluence with Nan / Chao Phraya River (annual data since 1972)
- c) Water balance from studies of a) and b) mentioned above

3) Comparison of alternative water resources development plans

- a) identification of other water resources development plans
- b) comparison and analysis of the alternative plans with the Project

4) Conceptual planning of the Project

- a) water balance study for the Kok, Ing, and Nan Rivers
- b) potential water diversion from the Kok and Ing Rivers
- c) identification and comparison of alternative alignment of water diversion
- d) conceptual plan for the water diversion and its facilities

5) Recommendation

- a) works to be conducted by the RID during the Phase 2 of the Study
- b) works to be conducted by the JICA Study Team during the Phase 2 of the Study

B. Initial Environmental Examination (IEE)

1) Review of the environmental examination conducted by the Thai side

2) Initial Environmental Examination (IEE)

- a) social environment
- b) natural environment
- c) pollution

2. Phase 2: Feasibility Study and Environmental Impact Assessment (EIA)

The Phase 2 of the Study will be conducted on condition that the necessity and viability of the Project are confirmed through the Phase 1 of the Study.

The draft of the scope of the Phase 2 of the Study is set tentatively as Appendix 2, although the details of the Phase 2 of the Study including the study schedule will be discussed and decided when the Phase 2 of the Study is confirmed to be conducted.

V. STUDY SCHEDULE

The Phase 1 of the Study will be carried out in accordance with the tentative schedule attached in the Appendix 1.

The Phase 2 of the Study will be carried out, in case that it is conducted, in accordance with the tentative schedule attached in the Appendix 3.

VI. REPORTS

1. Reports of the Phase 1 of the Study and IEE

JICA will prepare and submit the following reports in English to the Government of Thailand. In addition, JICA will also prepare and submit the executive summary for the Final Report in Thai in order to achieve better understanding of the Study by Thai people.

1) Inception Report:

Twenty (20) copies. Inception Reports will be submitted at the beginning of the work in Thailand.

2) Interim Report


Twenty (20) copies. Interim Report will be submitted at the end of the first work in Thailand.

3) Draft Final Report

Forty (40) copies. The Draft Final Report of the Phase 1 of the Study and the Draft Final Report of IEE will be submitted simultaneously at the beginning of the second work in Thailand. The Government of Thailand will submit its comments to JICA within fifteen (15) days after receipt of the Draft Final Report.

4) Final Report

Eighty (80) copies of Final Report together with eighty (80) copies of the executive


R. P. P. P. P.

summary within thirty (30) days, after JICA's receipt of comments on the Draft Final Report.

2. Reports of the Phase 2 of the Study and EIA

JICA will prepare and submit the following reports in English to the Government of Thailand. In addition, JICA will also prepare and submit the executive summary for the Final Report in Thai in order to achieve better understanding of the Study by Thai people.

1) Inception Report:

Twenty (20) copies. Inception Reports will be submitted at the beginning of the work of the Phase 2 of the Study in Thailand.

2) Interim Report

Twenty (20) copies. Interim Report of the Phase 2 of the Study and Interim Report of EIA will be submitted simultaneously at the end of the first work of the Phase 2 of the Study in Thailand.

3) Draft Final Report

Forty (40) copies. The Draft Final report of EIA will be submitted at the end of the second work of the Phase 2 of the Study in Thailand. The Draft Final Report of the Phase 2 of the Study will be submitted at the beginning of the third work of the Phase 2 of the Study in Thailand. The Government of Thailand will submit its comments to JICA within thirty (30) days after receipt of the Draft Final Report.

4) Final Report

Eighty (80) copies of Final Report together with eighty (80) copies of the executive summary within sixty (60) days, after JICA's receipt of comments on the Draft Final Report.

VII. UNDERTAKINGS OF THE GOVERNMENT OF THAILAND


1. To facilitate the smooth conduct of the Study, the Government of Thailand shall take necessary measures;

(1) to secure the safety of the Study Team in Thailand,

(2) to permit the members of the Study Team to enter, leave and sojourn in Thailand for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,

(3) to exempt the members of the Study Team from taxes, duties, fees and any charges on equipment, machinery and other materials brought into Thailand for the conduct of the Study,

(4) to exempt the members of the Study 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 Japanese Study Team for their services in connection with the implementation of


R. Chantach

the Study,

(5) to provide necessary facilities to the Study Team for remittances as well as utilization of the funds introduced into Thailand from Japan in connection with the implementation of the Study,

(6) to secure permission for entry into private properties or restricted areas for the implementation of the Study,

(7) to secure permission for the Study Team to take all data and documents (including photographs and maps) related to the Study out of Thailand to Japan, and

(8) to provide medical services as needed. Its expenses will be chargeable on members of the Study Team.

2. The Government of Thailand shall bear claims, if any arises, against the members of the Study 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 members of the Study Team.

3. The RID shall act as the counterpart agency to the Study Team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. The RID shall, at its own expense, provide the Study Team with the following, in cooperation with other organizations concerned:

(1) available data and information related to the Study,

(2) necessary number of counterpart personnel,

(3) suitable office space with necessary equipment in Bangkok and project sites,

(4) credentials or identification cards, and


(5) necessary number of vehicles with drivers for field survey.

VIII. UNDERTAKINGS OF JICA

For the implementation of Study, JICA shall take the following measures;


1. to dispatch, at its own expense, the Study Team to Thailand, and

2. to pursue technology transfer to the Thai counterpart personnel in the course of the Study.


R. Chulwite

IX. CONSULTATION

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

R. Philip 

TENTATIVE SCHEDULE OF THE PHASE 1 OF THE STUDY

MONTH	1	2	3	4	5	6	7	8	9
WORK IN THAILAND									
WORK IN JAPAN									
REPORT SUBMISSION									

Timeline diagram showing milestones:

- ICR (Initial Country Report) at Month 1
- ITR (Interim Technical Report) at Month 5
- DFR E/R (Draft Final Report) at Months 7 and 8
- IEE (Interim Evaluation) from Month 5 to Month 8

(Handwritten signature)
 Chai Sook

Draft Scope of the Phase 2 of the Study

A. Feasibility Study

JICA Study Team will be responsible for conducting the following study components, which are considered to be difficult for the RID to conduct, in collaboration with the RID in the Phase 2 of the Study while the RID will be responsible for conducting other components.

- 1) engineering works for water diversion (tunnels, canals, dams and culverts) and river training
- 2) water management
 - review / revise / update of irrigation development plan
 - method of overall water management for irrigation water use, flood control etc. and rational water allocation among various uses
 - system of integrated water management including institutional arrangement, monitoring system, operation system of Sirikit Dam and other proposed dams
- 3) geological survey such as time domain electro-magnetic prospecting survey and deep boring

B. Environmental Impact Assessment (EIA)

C. Preparation of a comprehensive report

A comprehensive report will include :

- 1) summary of the Phase 1 of the Study
- 2) water utilization/ management plan for irrigation and other water demands
- 3) results of hydro-meteorological, topographical and geological studies
- 4) comparison of alternative alignments of water diversion
- 5) layout and preliminary design of facilities for the Project
- 6) construction plan
- 7) cost estimation of the Project
- 8) financial and economic analysis
- 9) operation and management plan of Sirikit Dam and other related facilities
- 10) monitoring system of water diversion
- 11) result of EIA and impact mitigation measures
- 12) procedures for public information and participation
- 13) recommendation



R. Chantana

DRAFT SCHEDULE OF THE PHASE 2 OF THE STUDY

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1997											98					
4/20										12		2	3	4	5	6
WORK IN THAILAND																
WORK IN JAPAN																
REPORT SUBMISSION																

ICR → ITR → DFR → EIR

← ICR ← ITR ← DFR ← EIR

E I A

[Signature]
P. Chulchai

MINUTES OF MEETINGS
ON
THE SCOPE OF WORK
FOR
THE STUDY
ON
THE KOK-ING-NAN WATER DIVERSION PROJECT
IN
THE KINGDOM OF THAILAND

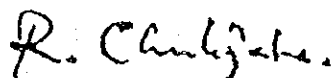
AGREED UPON BETWEEN

THE ROYAL IRRIGATION DEPARTMENT

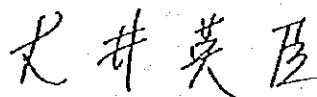
AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

BANGKOK
MARCH 20, 1996



MR. ROONGRUENG CHULAJATA
DIRECTOR GENERAL,
ROYAL IRRIGATION DEPARTMENT,
MINISTRY OF AGRICULTURE
AND COOPERATIVES



MR. HIDETOMI OI
LEADER,
PREPARATORY STUDY TEAM,
JAPAN INTERNATIONAL
COOPERATION AGENCY

I. INTRODUCTION

In response to the request of the Government of the Kingdom of Thailand (hereinafter referred to as "the Government of Thailand"), the Preparatory Study Team (hereinafter referred to as "the Team") of the Japan International Cooperation Agency (hereinafter referred to as "JICA") visited Thailand from March 6 to April 4, 1996 to discuss the Scope of Work (hereinafter referred to as "S/W") for the Study on the Kok-Ing-Nan Water Diversion Project in the Kingdom of Thailand (hereinafter referred to as "the Study").

The Team carried out field surveys of the study area and held a series of discussions with the authorities concerned of the Royal Irrigation Department, the Ministry of Agriculture and Cooperatives (hereinafter referred to as "the RID"), and other organizations.

The list of attendants is shown in Appendix.

The Minutes of Meetings has been prepared for the better understanding of the Scope of Work agreed upon between the RID and the Team on 20th March, 1996, summarizing main points of the discussions made in the course of the preparation of the Scope of Work.

II. STUDY TITLE

Both sides agreed to use the title "the Study on the Kok-Ing-Nan Water Diversion Project in the Kingdom of Thailand" for the Study.

III. OBJECTIVES OF THE STUDY

With regard to the "II. OBJECTIVES OF THE STUDY 1.", both sides confirmed that the main beneficiary area of the project is Kok, Ing, and Nan River Basins (upper basin of Nakon Sawan) where the existing development plans have been prevented from implementing due to the shortage of water, and the diverted water shall also be provided to the Chao Phraya Delta which is located downstream of the Nan River Basin.


IV. COMPONENTS OF THE STUDY

1. The Phase 1 of the Study

Both sides confirmed that it is necessary to justify the proposed water diversion project through the comparison with other water resources development alternatives. JICA will be in a position to conduct the works necessary for the comparison in collaboration with the RID.

2. The Phase 2 of the Study

(1) The Draft Scope of the Phase 2 of the Study is shown in the appendix 2 of the S/W. This is tentative and to be finalized after the Phase 1 of the Study. In this connection, basic information on the contents of the Phase 2 of the Study was provided by the RID.


R. Chulabide

- (2) Sirikit Dam should be operated, not independently, but in combination with other dams and weirs for the best benefit of the downstream areas concerned. Accordingly, the operation rule of Sirikit Dam should be prepared as a part of an integrated operation of such water regulating facilities for various purposes including irrigation, power generation, etc.
- (3) The RID requested that EIA of JICA Study should meet the standard of the international level. The Team agreed that the JICA Study should, in principle, follow the JICA's guideline referring to the international guidelines.

V. STUDY AREA

The Study shall cover the Kok, Ing, and Nan River Basins (upper basin of Nakon Sawan) and other areas where the water is provided from Nan River. The Chao Phraya Delta which is located downstream of the Nan River Basin and other related area will be included in the study on water demand projection, benefit estimation etc, if necessary.

VI. STUDY SCHEDULE

The RID requested that the Phase 1 of the Study should be started as soon as possible preferably not later than in August, 1996 for the period of four months according to the schedule of the RID. Throughout the intensive discussions, both sides agreed that the Study schedule shall be fixed by JICA paying due consideration to the request from the RID for the earlier completion of the Study.

VII. TARGET YEAR FOR THE STUDY

Both sides agreed that the target year for the Phase 2 of the Study shall be discussed and decided in the course of the Phase 1 of the Study.

VIII. COORDINATION WITH OTHER MINISTRIES AND ORGANIZATIONS

The Team requested the RID to coordinate with other ministries and organizations concerned whenever necessity arises, and the RID agreed to this request.

IX. RELATIONSHIP WITH THE MEKONG COMMITTEE MEMBER COUNTRIES

The RID explained that the Government of Thailand had already taken all necessary steps in accordance with the Agreement made among the Mekong Committee member countries in April 1995, and the RID assured the Team that the responsibility to settle any problem in conflict, if any arises, with the Agreement shall be borne by the RID and the Government of Thailand.

X. PUBLIC RELATIONS

The necessity of the Public Information and the People's Participation is well recognized by Thai side as well as JICA. Both sides agreed that the RID will prepare an action program at an early stage of the Study and promote it accordingly. JICA will provide the advisory support to this work.

XI. REPORTS

As for the Final Report, the RID agreed to make it open to the public in order to achieve maximum use of the results of the Study.

XII. POSITION OF FLOOD OF 1995

Sirikit Dam was overflowed through the spillway in September 1995 for the first time since the commencement of the operation in 1974. The information on rainfall in the catchment, inflow / outflow of the reservoir, flood situation in the downstream areas, etc. will be collected and reviewed in the Phase 1 of the Study for consideration in the Study on operation rule of the dam planned in the Phase 2 of the Study.

XIII. UNDERTAKING OF JICA


(1) The RID requested that JICA hold a seminar as a part of the technology transfer in the course of the Study. The RID also requested that JICA provide seminar materials in Thai for better understanding of the seminar. The Team recognized this necessity and promised to convey this request to JICA H.Q. for positive consideration.

(2) The RID requested that JICA conduct counterpart training in Japan for the purpose of the smooth transfer of technology during the Study taking into account the scale of the Project. The Team agreed to convey this request to JICA H.Q. for consideration within the framework of the Training Program of JICA. The training period, training field and selection of personnel shall be mutually discussed after the plenary study starts.

(3) The RID strongly requested that JICA provides necessary equipment for executing geological investigation and field survey, due to the lack of existing equipment and financial difficulties. The Team promised to convey the request to JICA H.Q. for consideration.

XIV. UNDERTAKING OF THE GOVERNMENT OF THAILAND

(1) The Team requested the RID to assign the necessary counterpart personnel as well as support staff for the smooth implementation of the Study and the RID agreed in principle to assign the counterpart personnel. The RID, however, expressed concern that, due to budgetary constraints, support staff would be hard to assign.


R. Chulabha

(2)The Team requested that the RID provide sufficient numbers of vehicles with drivers, fuel, and cover the maintenance, and the RID agreed in principle to this request. The RID, however, expressed concern that, due to budgetary constraints, such a request would be hard to accept to the full extent.

(3)The Team confirmed that the RID will provide suitable offices, each in Bangkok (within the RID) and project sites, equipped with electricity, water supply, telephones, desks, chairs.

XV. OTHERS

(1)The Team explained JICA's Development Study Program and the RID fully understood the Program.

(2)The Team strongly requested the RID to keep command over a group of consulting firms throughout the Study period in order to ensure that their works may be accomplished without delay according to the schedule and to the level originally planned , in close cooperation with JICA Study Team.

(3)The RID informed the Team that the Project Management Unit (PMU) will be set up to coordinate and supervise the Study. It was agreed upon that the leader of the Study Team will be a member of PMU.

(4)It may happen that some study components (Environmental Impact Assessment , Geological survey etc.) take longer than the period originally expected, as the study progresses. The Team requested both the RID and JICA to take proper measures ,as far as possible, in case that such a case occurs in the course of the Study .

(5)The RID requested that JICA would prepare the terms of reference of the Detailed Design in the Phase 2 of the Study. JICA promised to record this request for consideration.

R. Chulachit

LIST OF ATTENDANTS

Thai Side

Mr. Roongrueng Chulajata	Director General	RID
Mr. Charoon Kamolratana	Deputy Director General	RID
Mr. Vudhichai Chullakesa	Senior Expert for Water Resources Planning & Development Division	RID
Mr. Naarong Sopak	Director, Topographical Survey Division	RID
Mr. Dhanapong Sridhavat	Director, Geotechnical Division	RID
Mr. Somtop Kaewyen	Director, Regional Irrigation Office 2	RID
Mr. Suporn Rakchareon	Director, Regional Irrigation Office 3	RID
Mr. Sunthorn Rungrongthanin	Director, Regional Irrigation Office 7	RID
Mr. Tribhand Mekjaroon	Chief, Environmental Study Branch	RID
Mr. Thanu Hampattanapanich	Chief, Engineering Geology Branch Geotechnical Division	RID
Mr. Suwit Thanopanuwat	Chief, Project Planning Branch PPD	RID
Mr. Kosit Losirirat	Hydrologist 7, Hydrology Division	RID
Mr. Thanar Suwattana	Civil Engineer 7, PPD	RID
Mr. Chatchai Boonlue	Engineer 6, PPD	RID
Miss Uba Sirikaew	Geologist, Geotechnical Division	RID
Mr. Koichi Yamazaki	JICA Expert	RID
Mr. Jitsuya Nagata	JICA Expert	RID


Japanese Side

Embassy of Japan	
Mr. Hiroshi Watanabe	First Secretary
The Overseas Economic Cooperation Fund of Japan Bangkok Office	
Mr. Junichi Abe	Chief Representative
Japan International Cooperation Agency Thailand Office	
Mr. Naoto Hattori	Assistant Resident Representative
Study Team	
Mr. Hidetomi Oi	Team Leader
Mr. Atsushi Iwasaki	Member
Mr. Hideo Tamura	Member
Mr. Atsushi Kobayashi	Member



R. Campbell

Mr. Masato Togawa	Member
Mr. Kazuhiro Tambara	Member
Mr. Sigehiko Honna	Member
Mr. Hitosi Okita	Member
Mr. Tsuyosi Sasaka	Member


R. Chulrich

付属資料4. 主要面会者リスト

Royal Irrigation Dep., Min. of Agriculture and Cooperatives(RID)

Mr. Roongrueng Chulajata	Director General
Mr. Charoon Kamolratana	Deputy Director General
Mr. Vudhichai Chullakesa	Senior Expert for Water Resources Planning & Development Division
Mr. Naarong Sopak	Director, Typographical Survey Division
Mr. Dhanapong Sridhavat	Director, Geotechnical Division
Mr. Tribhand Mikjaroon	Chief, Environmental Study Branch
Mr. Thanu Hampattanapanich	Chief, Engineering Geology Branch Geotechnical Division
Mr. Suwit Thanopanuwat	Chief, Project Planning Branch PPD
Mr. Kosit Losinrat	Hydrologist 7, Hydrology Division
Mr. Thanar Suwattana	Civil Engineer 7, PPD
Mr. Chatchai Boonlue	Engineer 6, PPD
Mis. Uba Sirikaew	Geologist, Geotechnical Division
Mr. Koichi Yamazaki	JICA Expert
Mr. Jitsuya Nagata	JICA Expert

RID Nan Office

Mr. Kriangkrai Mahawongsanant

RID Chiang Rai Office

Mr. Tanakorn

Dep. of Technical and Economic Cooperation (DTEC)

Mr. Nipon Sirivat	Chief, Japan Sub.-Div.
Mr. Kanakwan Pringruks	Programme Officer
Mr. Michimasa Numata	JICA Expert

Office of Environmental Policy and Planning (OEPP)

Mr. Saksit Tridech Deputy Secretary General

Embassy of Japan

Mr. Hiroshi Watanabe	First Secretary
Mr. Ryoji Shimojo	First Secretary

The Overseas Economic Cooperation Fund of Japan Bangkok Office

Mr. Junichi Abe Chief Representative

Japan International Cooperation Agency Thailand Office

Mr. Eiryō Sumida	Resident Representative
Mr. Yūsi Saito	Deputy Resident Representative
Mr. Naoto Hattori	Assistant Resident Representative
Mr. Takashi Kawaguchi	Assistant Resident Representative

付属資料5. 主要収集資料リスト

様式第1号

資料リスト (収集資料)

地域	東南アジア	調査団員又は 専門家氏名	タイ王国コク・イン・ナン 渾水計画調査	調査の種類又は 指導科目	事前調査S/W協議	作成部課	社会開発2課
国名	タイ	配属機関名		現地調査期間 又は派遣期間	平成8年3月6日～平成8年4月4日	担当者氏名	
番号	資料の名称	版型	ページ数	オリジナル コピーの別	部数	収集先名称又は 発行機関	取扱い区分 利用表示
1	Unit Cost Duplicate from Kok - Ing - Nan Contract	A 4	1	コピー	1	RID (王室灌漑局)	寄贈・購入 (価格)の別
2	Consultancy	A 4	15	コピー	1	RID (王室灌漑局)	寄贈
3	1990 POPULATION AND HOUSING CENSUS (CHANGWAT PHAYAO)	A 4	290	オリジナル	1	NSO (首相府統計局)	購入
4	1990 POPULATION AND HOUSING CENSUS (CHANGWAT NAN)	A 4	290	オリジナル	1	NSO (首相府統計局)	購入
5	1990 POPULATION AND HOUSING CENSUS (CHANGWAT CHIABG RAD)	A 4	290	オリジナル	1	NSO (首相府統計局)	購入
6	Thailand Firures 1995	A 6	10	オリジナル	1	NSO (首相府統計局)	寄贈
7	STATISTICAL BOOKLET ON THAI WOMEN AND MEN	B 6	80	オリジナル	1	NSO (首相府統計局)	寄贈

番号	資料の名称	版型	ページ数	オリジナル コピーの別	部数	収集先名称又は 発行機関	寄贈・購入 (価格)の別	取扱区分	利用表示
8	タイ国経済状況 (1994/95年版)	B 5	470	オリジナル	1	日本人商工会議所	購入		
9	タイ王国経済概況 (経済統計を中心に) 1995年版	B 5	30	オリジナル	1	日本人商工会議所	購入		
10	第7次経済社会開発フレームワーク (概要) 1992-96	B 5	40	オリジナル	1	日本人商工会議所	購入		
11	タイ政治ガイドブック	B 5	290	オリジナル	1	日本人商工会議所	購入		
12	GEOLOGY OF NORTHERN THAILAND	A 4	37	コピー	1	DMR (鉱工業省)	寄贈		
13	GEOTECTONICS AND GEOLOGIC EVOLUTION OF THAILAND	A 4	20	コピー	1	RID (王室権視局)	寄贈		
14	REGIONAL STRATIGRAPHIC CORRELATION IN THAILAND	A 4	21	コピー	1	RID (王室権視局)	寄贈		
15	GOEOLOGICAL INVESTIGATION PLAN	A 1	1	コピー	1	RID (王室権視局)	寄贈		
16	Geological map of Project Area	A 1	1	コピー	1	RID (王室権視局)	寄贈		
17	TUNNEL ALIGNMENT PROFILE KOK-ING TUNNEL	A 2	1	コピー	1	RID (王室権視局)	寄贈		
18	TUNNEL ALIGNMENT PROFILE ING-YOT TUNNEL SOUTH-ROUTE	A 2	1	コピー	1	RID (王室権視局)	寄贈		
19	TUNNEL ALIGNMENT PROFILE ING-YOT TUNNEL NORTH-ROUTE	A 2	1	コピー	1	RID (王室権視局)	寄贈		
20	Geological Map of Northern Thailand 1 : 250000 (Changwat Lampang)	B 1	1	コピー	1	DMR (鉱工業省)	購入		
21	Geological Map of Northern Thailand 1 : 250000 (Changwat Loei)	B 1	1	コピー	1	DMR (鉱工業省)	購入		

番号	資料の名称	版型	ページ数	オリジナル コピーの別	部数	収集先名称又は 発行機関	寄贈・購入 (価格)の別	取扱区分 利用表示
22	Geological Map of Northern Thailand 1:250000 (Changwat Chiang Dao)	B 1	1	コピー	1	DMR (鉱工業省)	購入	
23	Geological Map of Northern Thailand 1:250000 (Changwat Phayao)	B 1	1	コピー	1	DMR (鉱工業省)	購入	
24	Geological Map of Northern Thailand 1:250000 (Changwat Nan)	B 1	1	コピー	1	DMR (鉱工業省)	購入	
25	1/50000 地形図	A 1	10枚	コピー	1	Royal Thai Survey Department	寄贈	
26	チェンライ県RID水資源関連施設マップ (S=1/250000)	A 1	1	コピー	1	RID チェンライ事務所	寄贈	
27	Map of Land Use Chiang Rai (S=1/100000)	A 1	16	オリジナル	1	จังหวัด Land Use Office	寄贈	
28	Ministerial Regulation regarding Project Typa	A 4	31	コピー	1	RID, 環境 C/P	寄贈	注 意
29	List of Consulting Firms	A 4	8	コピー	1	OEPP, MoSTE	寄贈	
30	Enhancement and Conservation of National Environmental Quality Act	A 4	32	オリジナル	1	OEPP, MoSTE	寄贈	
31	NGO Environmental	A 4	180	オリジナル	1	DEQP (発行) MoSTE	寄贈	
32	Table of contents of Environmental Ecological Investigation Impact Study of Kok-Ing-Non Project	A 4	30	コピー	1	TEAM Consulting Engineers Co., Ltd.	寄贈	
33	科学技術環境省 (MoTES) 組織図	A 4	1	コピー	1	MoSTE (科学技術環境省)	寄贈	
34	王立森林局 (RFD) 組織図	A 4	1	コピー	1	RFD (王室森林局)	寄贈	
35	チェンライ社会概況パンフレット	A 4	6	オリジナル	1	チェンライ県庁	寄贈	
36	Investment Project for Chaing Rai	B 5	169	オリジナル	1	チェンライ県庁	寄贈	
37	Northern Top of Thailand the Way to Economy of Golden Triangle, Chang Rai (Summary Version) 1995	A 4	23	オリジナル	1	チェンライ県庁	寄贈	

番号	資料の名称	版 型	ページ数	オリジナル コピーの別	部 数	収蔵先名称又は 発 行 機 関	寄贈・購入 (価格)の別	取扱区分	利用表示
38	An Investment Plan for Chaing Rai Province Thailand	A 4	47	オリジナル	1	チェンライ県庁	寄 贈		
39	Community Forestry in Thailand : A Case Study from the North	A 4	29	コピー	1	チュラロンコン大学	寄 贈		
40	The Promise of Social Forestry : Avolution and Sustainability	A 4	5	コピー	1	チュラロンコン大学	寄 贈		
41	Forestry Statistics of Thailand	B 5	130	オリジナル	1	RFD (王室森林局)	寄 贈		
42	Conclusive Report, Natural Disaster bay Flood, Chaing Rai	A 4	14	オリジナル	1	チェンライ県庁	寄 贈		
43	Natural Disaster by Flood, Chaing Rai	A 4	80	オリジナル	1	チェンライ県庁	寄 贈		
44	List of Station Gaging Station in Thailand	B 5	75	オリジナル	1	RID	寄 贈		
45	Ing-Yon-Nan Diversion Project Mae Kok Extension	A 4	147	コピー	1	EGAT	寄 贈		
46	コク川、イン川、ナン川の代表的観測所水文データ	A 4	25	コピー	1	RID	寄 贈		
47	Ground Water Development in Thailand	A 4	15	コピー	1	MMD	寄 贈		

付属資料6. ローカルコンサルタント一覧

タイローカルコンサルタント一覧

会社名	項目	創立年	資本金 (1,000Baht)	売上高 1990年 (1,000Baht)	職員数 (人)	地質/土質			水理/水文			備考		
						ボーリング	室内試験	透水性試験	深圧ボーリング	電磁探査	岩石		湧水	水質
1. A & R Consultants Co., Ltd.														
2. Aggie Consult Co., Ltd.														
3. Asdecon Co., Ltd.														
4. Asia Consultants Co., Ltd.														
5. Asian Engineering Consultants Co., Ltd.		1980	3,000	132,700	340	○	○	○	○	○	○	○	○	○
6. AIT Consultants Co., Ltd.														
7. Chula Unisearch, Chulalongkorn University														
8. Consultants of Technology Co., Ltd.		1983	4,400	60,000	200	○	○	○	○	○	○	○	○	○
9. Creative Technology Ltd.														
10. Dhara Consultants Co., Ltd.														
11. Index International Group Co., Ltd.														
12. K. Engineering Consultants Co., Ltd.		1965		35,400	210	○	○	○	○	○	○	○	○	○
13. Midas Agronomics Co., Ltd.														
14. National Engineering Consultants Co., Ltd.		1978	1,000	22,200	110	○	○	○	○	○	○	○	○	○
15. Pal Consultants Co., Ltd.														RID委託分受注
16. Panya Consultants Co., Ltd.		1980	5,000	25,000	60	○	○	○	○	○	○	○	○	RID委託分受注
17. Pre-Development Consultant Co., Ltd.														
18. Quality Team Consultants Co., Ltd.														
19. Rege and Associates Co., Ltd.														
20. Siam Tone Co., Ltd.														日系企業
21. Sindhupakirvong Consultants		1966	10,000	117,000	170	○	○	○	○	○	○	○	○	
22. Soil testing siam Co., Ltd.														
23. STS Engineering Consultants Co., Ltd.														
24. TEAM Consulting Engineers Co., Ltd.		1978	12,000	157,600	300	○	○	○	○	○	○	○	○	RID委託分受注
25. Technological Consultants Co., Ltd.														
26. Thai Consultant Engineering Co., Ltd.														
27. Thai DCI Co., Ltd.		1974	1,000	72,000	120	○	○	○	○	○	○	○	○	○
28. Thai Engineering Consultant Co., Ltd.		1961	4,000	87,800	240	○	○	○	○	○	○	○	○	○
29. Tippo Consultants Co., Ltd.														
30. Visuddhi Consultants Co., Ltd.														
31. What Co., Ltd.														
32. Yontikit Engineering Development Ltd., Part														

注：無記入分は不明

タイローカルコンサルタント住所録

会社名	住所	TEL	FAX
1. A & R Consultants Co., Ltd.	71/5 Sersri 2 Road, Samsen-Nai, Phya-Thai, Bangkok 10400 Thailand	279-7576	271-3967
2. Aegle Consult Co., Ltd.	2102/20-23 Ramkambang Road, Hua Mark, Bangkok 10240 Thailand	374-0074	374-7018
3. Asdecon Co., Ltd.	2688-92 Soi 130 Ladprao Road, Bang Kapi, Bangkok 10240 Thailand	259-4573	253-4283
4. Asia Consultants Co., Ltd.	420 Soi Ladprao 63, Ladprao Road, Bangkapi, Bangkok 10310 Thailand	539-7894	530-3140
5. Asian Engineering Consultants Co., Ltd.	9/F Sathorn Thani Bldg., 90 North Sathorn Road, Bangruk, Bangkok 10500 Thailand	236-6090	236-6086
6. ATT Consultants Co., Ltd.	230 Land and Tower Building 9/L Rachadapisek Road, Maanykwang, Bangkok 10310 Thailand	274-0704	274-0734
7. Chula Unisearch, Chulalongkorn University	344 Soi Chulalongkorn 22, Benchat Thong Road, Phatumwan, Bangkok 10300 Thailand	215-2660	215-7435
8. Consultants of Technology Co., Ltd.	39 Soi Ladprao 124 Ladprao Road, Wongtonglang, Bangkok 10310 Thailand	924-3233	934-3248
9. Creative Technology Ltd.	25/23-24 Soi Chinalkhet, Niamwongwan Road, Don Muang, Bangkok, Bangkok 10210 Thailand	580-6844	589-0686
10. Dhara Consultants Co., Ltd.	300/32 Soi Ladprao 35/1, Ladprao Road, Ladprao, Chatuchak, Bangkok 10900 Thailand	511-3978	938-3159
11. Indekt International Group Co., Ltd.	454, 4-5th/F Thavorn Bldg., Suthisarn Road, Din Deang, Huay Kiewang, Bangkok 10400 Thailand	277-4121	277-7953
12. K. Engineering Consultants Co., Ltd.	136 Intanara 18, Vibhadi Road, Bangkok 10400 Thailand	691-9322	275-7030
13. Midas Agronomics Co., Ltd.	P.O.Box 2-245, Bangkok 10200 Thailand	246-1714	246-5785
14. National Engineering Consultants Co., Ltd.	55/160-161 Suthisan Road, Huaychwang, Bangkok 10320 Thailand	275-1795	276-2654
15. Pal Consultants Co., Ltd.	202/12 Soi Pravit, Prachachuen Road, Lad Yao Chatuchak, Bangkok 10900 Thailand	580-0433	580-5449
16. Panya Consultants Co., Ltd.	22 Ladprao 35, Ladsao, Jarujak, Bangkok 10900 Thailand	938-2480	938-2499
17. Pre-Development Consultant Co., Ltd.	50/584 Soi Boonsongpitt, Sukhaphan 1 Road, Klongkhum Bangkok, Bangkok 10240 Thailand	374-4111	374-4111
18. Quality Team Consultants Co., Ltd.	2910, 2912, 2914, 2916 Drive-In Center, Ladprao Road Soi 130, Bangkok, Bangkok 10240 Thailand	375-7367	377-3480
19. Roge and Associates Co., Ltd.	259/243-4 Soi Pibulwes, Sukhumvit 71 Road, Klong Toey, Bangkok 10110 Thailand	391-3838	391-6911
20. Siam Tone Co., Ltd.	5/15 Moon 6 (Am15) Bangna-Trad Road, Bangchalong Bangplee-Samutprakarn 10540 Thailand	312-6281	312-5804
21. Sindhul Pulirivong Consultants	1 SPC Building, Soi Jantun Sukhumvit 55, Klongkay, Bangkok 10110 Thailand	332-8717	381-0857
22. Soil testing siam Co., Ltd.	196/8-9 Soi Kingchinda, Pradipat Road, Bangkok 10400 Thailand	278-0332	-
23. STS Engineering Consultants Co., Ltd.	196/10-12 Soi Pradipat 14, Pradipat Road, Bangkok 10400 Thailand	279-1375	271-0020
24. TEAM Consulting Engineers Co., Ltd.	2782-2790 Drive-In Center Ladprao Road, Bangkok, Bangkok 10240 Thailand	377-3490	375-1070
25. Technological Consultants Co., Ltd.	89/297 Tesabarn Songkron Road, Ladsao, Chatuchak, Bangkok 10900 Thailand	580-0408	580-0412
26. Thao Consultant Engineering Co., Ltd.	75/1-2 Annuay-Songkram Road, Bang-Kra-Bue, Tha-non Nakornchaisri, Dusit, Bangkok 10300 Thailand	243-0761	243-1248
27. Thai DCI Co., Ltd.	198/5 Rama VI Road, Samsan-nai, Pyayvathai, Bangkok 10400 Thailand	271-3461	271-3483
28. Thai Engineering Consultant Co., Ltd.	37/1 Petchburi 15 Road, Bangkok 10400 Thailand	253-4573	253-4283
29. Tpoos Consultants Co., Ltd.	556 Pracharat II Road, Bangsue, Dusit, Bangkok 10800 Thailand	585-1552	585-1552
30. Visuddhi Consultants Co., Ltd.	24 Soi Ladprao 126/1 Rachprao Road, Bangkok, Bangkok 10240 Thailand	731-0162	731-1868
31. What Co., Ltd.	75/53 Soi Boon-Plam, Niamwongwan Road, Bangkok, Bangkok 10210 Thailand	589-0789	589-0789
32. Yonidit Engineering Development Ltd., Part	492 Suthisarn Road Din-daeng, Hua Kiewang, Bangkok 10400 Thailand	277-2743	541-1087

タイ側調査TOR (チュラロンコン大学理工学部による)

① 表4-1

Table 4-1 Environmental Parameter Assessment List

1. Physical Environment

- 1.1 Meteorological/Climatic condition
- 1.2 Surface water hydrology
- 1.3 Surface water quality
- 1.4 Groundwater
- 1.5 Soils condition
- 1.6 Erosion/Sedimentation
- 1.7 Geology/Seismology

2. Ecological Environmental

- 2.1 Aquatic ecology
- 2.2 Fisheries/Aquatic weed
- 2.3 Forest ecology
- 2.4 Wildlife/Ecology/Habitat/Endemic and Endangered species
- 2.5 Watershed management

3. Human Use Values

- 3.1 Land use and development
- 3.2 Agriculture/Animal husbandry/Aquaculture
- 3.3 Irrigation
- 3.4 Water supply
- 3.5 Minerals/Salt/Heavy metals
- 3.6 Navigation/Transportation
- 3.7 Flood control

4. Quality of Life Values

- 4.1 Socio-economics
- 4.2 Compensation
- 4.3 Resettlement
- 4.4 Public health/Sanitation/Nutrition
- 4.5 Pollution control/Mitigation
- 4.6 Recreation and aesthetics
- 4.7 Archaeological and historical resources

② 表4-2

Table 4-2 Main Environmental Concerns which need Detailed Investigation

1. Important areas to concentrate the study on the impact of the Project

- 1.1 Towards the lower portions of Kok and Ing rivers.
- 1.2 The upper portion of Nan river to Sirikit Dam.

2. Location of Diversion Points

- 2.1 The location shall be selected in such a way to mitigate the impact to Mae Kok and Mae Ing as much as possible.
- 2.2 Invent structures, i.e. strain, dike, obstruction of various types, etc, to be fixed at the diversion points as well as any tunnel openings to prevent as much as possible for any animals to pass through.
- 2.3 Field survey of settlement affected and their attitudes toward the project.
- 2.4 The attitude of upstream and downstream settlements to the Project.
- 2.5 The impact of diversion to the adjacent area.

3. Canals and Tunnels Routes

- 3.1 Impact of canals on existing environment.
- 3.2 Risk in contamination of heavy metals or salt.
- 3.3 Geological condition, especially faults.
- 3.4 Attitude of settlement both along the canals and over the tunnels.

4. Specific Physical Environment

- 4.1 Careful analysis on geological condition. Faults shall be clearly identified.
- 4.2 Quality of water shall be carefully checked to indicate the contaminants, particularly heavy metals, salt, etc.

Table 4-2 Main Environmental Concerns which need Detailed Investigations
(Continued)

- 4.3 Characteristic of water passing from one river to another shall be checked; physio-chemical properties, especially after passing through each tunnel.
- 4.4 Impact on flooded river banks.
- 4.5 Study the existing local natural disasters, such as, flooded after heavy rain, forest fire, drought, etc., which could have some impact on the project.
- 4.6 Study the mitigation measures for natural disasters after the project is completed.

5. Construction Period

- 5.1 Impact from construction activities, roads, transportation, noise, dust, etc. along the routes connected to the project and at project sites.
- 5.2 Contamination of surface water.
- 5.3 Disposal of drilling materials and the impact on disposal sites.
- 5.4 Deterioration to natural forest and wildlife caused by the project and construction activities.

6. Bio-diversity and Biological Aspects

- 6.1 Bio-diversity should in fact cover 3 specific types; genetic diversity, species diversity and ecological diversity. For this task, genetic diversity might not be possible to include due to time constraint and it could be explained somewhat by other factors. This task anyway should have the data on species and ecological or habitat diversity for project evaluation.

Bio-diversity of Kok, Ing and Nan, different watersheds, shall be compared by various tools:

Useful indices of species

Table 4-2 Main Environmental Concerns which need Detailed Investigations
(Continued)

Structures in communities

- Dominance index
- Similarity index
- Species diversity index
 - Species richness
 - Evenness index
 - Shannon index of general diversity
 - Importance value

6.2 Predicting contamination of living species both plants and animals among watersheds and the impacts on existing condition.

6.3 Species diversity must be studied in all 3 rivers. Data of flora and fauna both on the list of species and their abundance within each locality should be analyzed to indicate various species indices as mentioned earlier. Comparison should be made to show their similarities or differences. If there are significant differences, this project has to formulate effective measures to avoid contamination of living organisms.

6.4 Study the macro-ecotype and micro-ecotype along the whole project route and related areas. To study ecological or habitat diversity of these 3 watersheds, various techniques could be employed, i.e. aerial photographs analysis, etc. In order to classify and analyze all types of habitats existed in all 3 areas, including the amount covered by each habitat, particularly, in the affected areas of the project. Prediction should be made on which existing habitats would be affected by the project. How strong the impact would be on such habitat. The study should also be able to identify whether there would be

Table 4-2 Main Environmental Concerns which need Detailed Investigations
(Continued)

any new types of habitat created from the impact of the project and how drastic that phenomena would affected the existing ecosystems.

6.5. Study on bio-diversity in Kok-Ing-Nan watersheds should be conducted or obtaining data which would cover the two seasons, dry and flooded times of the year. This is important since migration in and out of Mekong river exist in all tributaries of Mekong River, particularly during flooded time when migration from Mekong is known to come into all connected rivers.

6.6 Bacterial, fungi or algae growth within or at opening of tunnels should be studied and predicted.

6.7 Study the existing and predict the future conditions of the distribution and expansion of aquatic weeds.

7. Settlement

7.1 Compensation of affected families and complementary reinforcement to those not directly affected but in the vicinity of the Project, i.e. around the diversion areas, should be studied and recommended.

7.2 Benefits to local people should be pointed out.

7.3 Introducing of new settlements should be performed to the locals affected by the Project.

7.4 Change in profession and socio-cultural of the local people should carefully be studied and recommended.

7.5 Population growth in the vicinity should be predicted and study the impact.

7.6 Impacts on existing agriculture by the Project.

7.7 From geological study of salt or heavy metals which might accumulate in the pathway of the Project, prediction

Table 4-2 Main Environmental Concerns which need Detailed Investigations
(Continued)

should be made about possible contamination. Particularly, in case of any accidental phenomena which cause damage to tunnel lining, how can contamination prevention be made should be suggested.

8. Quality of Life

- 8.1 Vector-borne diseases must be studied and prediction shall be made for future expansion.
- 8.2 Deterioration in aesthetic values should be studied and recommend mitigation measures.
- 8.3 Archaeological and historical resources for salvaging should be pointed out.
- 8.4 Tourism attraction possibility should be pointed out.
- 8.5 Changing in local way of life should be identified.
- 8.6 Changing in local economy should be studied and advise to the locals should be stated.

イン-ヨム-ナン導水計画ファイナル・レポート

① 目次詳細

FINAL REPORT OF SUBPROJECT 1

FINAL REPORT OF SUBPROJECT 2

FINAL REPORT OF SUBPROJECT 3

ENVIRONMENTAL AND ECOLOGICAL INVESTIGATION OF

ING-YOM-NAN DIVERSION PROJECT

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- (1) "Tender Documents of Selected Environmental and Ecological Investigation of Kok-Ing-Yom-Nan Diversion Project" prepared by EGAT, December 1983.
- (2) "Comprehensive Desk study on the Ing-Yom Diversion Project" prepared by EGAT, 1980.
- (3) "Preliminary Environmental and Ecological Investigation of the Ing-Yom Diversion Project" prepared by EGAT, 1980.
- (4) "Pre-feasibility Study of the Ing-Yom-Nan Diversion Project" prepared by Howard Humphreys & Partners and Acres International, 1981.
- (5) "Pre-feasibility Study of Ing-Yom-Nan Diversion Project" prepared by Howard Humphreys & Partners, 1982.
- (6) "Environmental and Ecological Investigation of Ing-Yom-Nan Diversion Project" prepared by TEAM Consulting Engineers Co. Ltd., 1982.
- (7) "Kaeng Sua Ten Dam Feasibility Study" prepared by Howard Humphreys & Partners and Acres International, 1983.
- (8) "Feasibility on Ing-Yom Diversion Project" prepared by Snowy Mountains Engineering Corporation.
- (9) "Summary Report of Feasibility Study of Kok-Ing-Yom-Nan Diversion Project" Thai Version Report, prepared by Electricity Generating Authority of Thailand, February, 1984.
- (10) "Environmental and Ecological of Kok Project" prepared by Technology Ace Co., Ltd., 1985.
- (11) "Annual Expenditure for Kok-Ing-Yom-Nan Diversion Project", prepared by EGAT, Project Feasibility Division, Planning Department.
- (12) "Input-Output Table of Thailand for Analytical Uses, 1975" prepared by National Economic and Social Development Board and National Statistical Office of Thailand and Institute of Developing Economics of Japan, 1976.
- (13) "Nae Kok Project Feasibility Report", prepared for National Energy Administration/Royal Irrigation Department by Salzgitter Consult GmbH, June, 1975.
- (14) "Lower Mun-Chi Basin Study", prepared for Mekong Secretariat by Netherlands Engineering Consultants, 1981.

付属資料7. 環境配慮・環境アセスメントのためのガイドライン

① タイ国ガイドライン

a. 対象事業

環境影響評価対象事業の内、コク・イン・ナン導水事業計画（以下、KIN 導水計画）に関わると考えられる事業は表-1の通りである。

表-1 タイ国環境影響評価対象事業（KIN 導水計画関連）

事業内容	事業規模
ダムまたは貯水池	貯水量1億m ³ または貯水面積15km ² 以上
灌漑	灌漑面積12,800ha以上
大量輸送システムおよび高速道路	全て
以下の地域を通る、幹線道路法で規定された幹線道路および一般道路 ・分水嶺 ・国立公園 ・野生生物の保護区域	幹線道路・拡張道路は全て

* 〈1992年の国家環境保全法改正に伴う科学技術環境省（以下、MoSTE）の告示：添付資料参照〉

全ての環境影響評価報告書に対して、作成のための「一般ガイドライン」がMoSTEから出されているが、更に17の特定内容のプロジェクトのための「補足ガイドライン」がある。〈添付資料参照〉

その中でKIN 導水計画に関係する可能性がある特定プロジェクトは、「農工業」、「ダムと貯水池」、「浚渫と埋立」、「一般道路」、「定住」、「急速な計画の移り変わり」に関するものである。

b. 調査項目

プロジェクトの種類別、調査地域別にみた調査項目一覧（KIN 導水計画関連）を、それぞれ表-2、表-3に示す。環境影響評価対象事業の指定が、1992年の国家環境保全法改正に伴うのに対して、調査項目についてのプロジェクトタイプ別ガイドラインは、現在も1979年にNEBが出したマニュアルに基づくために、若干の不整合がみられる。〈添付資料参照〉

表-2 プロジェクト別調査項目一覧 (KIN 導水計画関連)

プロジェクト タイプ	ダム及び 貯水池	配水 システム	幹線道路
調査項目			
景観	●	●	●
農業	●		●
大気質	●		●
水生生物	●		
考古学	●		●
文化	●		●
漁業	●		●
洪水調整/排水	●		●
森林/分水嶺	●	●	●
地質学/地震学	●	●	●
陸水	●	●	●
産業の発達	●		●
土地利用	●		●
鉱物資源			
航海法	●		
公衆衛生	●	●	
安全一般	●		●
レクリエーション他	●	●	●
居住計画	●		●
流出土砂/浸食	●		●
社会経済	●	●	●
土壌	●		●
表面水	●	●	●
陸上輸送	●		●
水質	●	●	
配水	●	●	
陸生生物	●		●

●は必要調査項目

出典：JICA資料、国別環境情報整備調査 (1979MoSTE)

表-3 調査地域別調査項目一覧 (KIN 導水計画関連)

プロジェクト タイプ	都市地域	農村地域	川の流域	森林と 丘陵地域
調査項目				
景観	●			
農業		●	●	●
大気質	●			
水生生物			●	●
考古学			●	
文化	●		●	
漁業		●	●	●
洪水調整/排水	●		●	●
森林/分水嶺		●	●	●
地質学/地震学				
陸水	●	●	●	●
産業の発達	●		●	
土地利用	●			
鉱物資源				●
航海法			●	
公衆衛生	●	●	●	
安全一般	●			
レクリエーション他	●			●
居住計画	●		●	
流出土砂/浸食			●	●
社会経済	●	●	●	●
土壌		●	●	●
表面水	●	●	●	●
陸上輸送	●	●	●	
水質	●		●	
配水		●		●
陸生生物		●		●

●は必要調査項目

出典：JICA資料、国別環境情報整備調査 (1979MoSTE)

② JICA ガイドライン

JICA ガイドラインには「相手国の意向に基づき、住民の生活の向上のための持続的な開発の推進と、適切な環境との調和に役立てることを基本的方針とする」ことが環境配慮の位置づけとして述べられている。その背景となる考え方は、環境配慮とは「開発プロジェクトにより著しい環境インパクトが生じるか否かを調査し、その結果を評価し、必要に応じ、環境インパクトを回避または軽減するような対策を講じることである」という定義と開発途上国側の政策・実施体制等の実状に柔軟に対応する必要があるという認識である。

このような基本認識に立って、プロジェクト実施の各段階で表-4 のような環境配慮が行われる。

表-4 プロジェクトと環境配慮の各段階の対応

プロジェクト実施の各段階			環境配慮実施の各段階	
JICAによる実施	事前調査 Preparatory Study		環境予備調査 Preliminary Environmental Survey	
	本格調査	全体計画調査 Master Plan Study	実施可能性調査 Feasibility Study	初期環境調査(評価) Initial Environmental Examination (IEE)
		実施可能性調査 Feasibility Study		環境影響評価 Environmental Impact Assessment (EIA)
事業実施機関による実施	実施計画作成 (詳細設計を含む)		環境保全対策のチェック	
	施 工		環境保全対策の実施	
	運 営		環境モニタリング	

- (注) 1. 各段階の対応は厳密なものではない。
 2. IEEあるいはEIAはプロジェクトによって必要でない場合もある。
 3. 実施計画作成には環境保全対策のために施設及び工事の詳細設計を含む。
 4. □は本ガイドラインの主たる適用範囲を示す。

環境予備調査ではスクリーニング及びスコーピングが行われ、本格調査初期にスコーピングを補完しながら環境影響評価(EIA)の環境調査対象重要項目を明確にする。スクリーニングにおいて環境影響調査の実施が必要な開発プロジェクトか否かが判断され、スコーピングにおいて環境

影響のうち、重要項目が見い出され、EIAの重要項目が明確にされる。

スクリーニングとスコーピングはプロジェクト概要及び立地環境の把握から出発するが、次のような地域が特に環境配慮上注意されるべき地域とされている。

- ・ 土壌保全の必要な地域（土壌浸食、塩害等の起こりやすい地域）
- ・ 乾燥地域、半乾燥地域の砂漠化にさらされている地域
- ・ 熱帯林
- ・ 水源
- ・ 野生生物資源の保護・保全にとって、あるいはその持続的利用にとって貴重な地域（湿地帯、マングローブ生息地、珊瑚礁等）
- ・ 歴史的、考古学的、景観的、科学的に特有な価値を有する地域
- ・ 人口または産業が集中しており、それ以上の産業開発あるいは都市拡大が重大な環境問題を引き起こしそうな地域
- ・ 特定の脆弱な人口集団にとって特別な社会的価値のある地域
（例えば、伝統的な生活様式を持つ遊牧民・先住民等の人々の居住地あるいは利用地域）

a. 調査項目

スコーピングにおいて「開発プロジェクトの考えうる環境インパクトのうち、重要と思われるものを見い出す」ためには、事業の実施に伴い発生することが予測される全ての環境項目を網羅する必要がある。環境予備調査ガイドラインに示される河川・砂防計画の事前調査におけるスコーピング対象環境項目を表-5に示す。

表-5 スコーピング・チェック項目一覧「河川・砂防計画」

社会環境	自然環境	公害
1. 住民移動	10. 地形・地質	18. 大気汚染
2. 経済活動	11. 土壌浸食	19. 水質汚染
3. 交通・生活施設	12. 地下水	20. 土壌汚染
4. 地域分断	13. 湖沼・河川流域	21. 騒音・振動
5. 遺跡・文化財	14. 海岸・海域	22. 地盤沈下
6. 水利権・入会権	15. 動植物	23. 悪臭
7. 保健衛生	16. 気象	
8. 廃棄物	17. 景観	
9. 災害（リスク）		

b. 検討条件

検討の対象時期となるのは計画実施における供用開始前及び供用開始後であり、検討対象とする空間的範囲は河川・砂防事業を行う区域のみに限らず、流況及び流送土砂の変化が及

ぶ範囲までも対象とする。また、環境インパクトの対象は基本的に現況の環境に与えるマイナスの影響とする。

c. 重点項目、分野の判断方法

上記23の環境項目に対して「発生の要因」、「起こりうる環境影響」、「評定に役立つ要素」、「対策等」、「関連する調査」に関する記載を参照しながら下記の4段階に評定を行う。

- A：重大なインパクトが見込まれる。
- B：多少のインパクトが見込まれる。
- C：不明（ただし検討の要あり、調査の進展の中で明らかになるものを含む）
- D：ほとんどインパクトが見込まれないためIEEあるいはEIAの対象としない。

また、現実の生起している環境問題についても重要分野の判断に役立つ。

項目別の評定結果A～Cに対し今後の調査方針を概略で記述する。特に、適切な対策を講じることによって環境インパクトが軽減あるいは回避できるものについては、その内容を記載する。

上記のような基準で行われたスコーピングに基づき、IEE及びEIAにおいて焦点を合わせた環境影響調査が行われ、対策が立てられる。

③ OECF ガイドライン

OECFの審査の指針と借入国がプロジェクトの計画準備段階において配慮・準備すべき環境面の諸事項を下記に示す。

a. プロジェクトの分類

プロジェクトのOECFの審査に際して、各プロジェクトは以下の3種に分類される。

	環境アセスメント報告書*1の提出*2)	OECF 環境ガイドラインに基づいた審査
A種	必要あり	あり
B種	必要なし	あり
C種	必要なし	省略

* 1) 英文もしくは和文の要旨が添付されているもの。

* 2) 借入国内での所要手続きを終了した報告書（借入国内で公開されたものが望ましい）を借入国からOECFへ提出する。

各分類の内容でKIN 導水計画に関わる可能性があるものは以下の通りである。

〈A種〉

- ①大規模な新規及び改修等のプロジェクト：道路・鉄道、灌漑、廃棄物処理、広範囲の地域の水没を伴う開発、河川の集水域の開発

②以下の地域で実施される、もしくは以下の地域に影響を及ぼすおそれのあるもの：半乾燥地帯、水源、魚及び野生生物資源の保護・保全もしくは持続的利用にとって貴重な生息地

③以下の性格を有するもの

- ・ 広範囲、多様かつ不可逆的な環境影響を生じるもの
- ・ 多くの住民に影響が及ぶもの（住民移転の影響を除く）
- ・ 再生不可能な自然資源を大量に消費するもの
- ・ 土地利用あるいは社会的、物理的、生態的環境の著しい変化が発生する原因となるもの

〈B種〉

①A種に属さず、かつ右記のセクターに属するプロジェクト：道路・鉄道、放水路、灌漑

b. 環境配慮に関する基本的事項

プロジェクトの計画準備段階において配慮すべき環境面の基本的な事項を下記に示す。

(1) 借入国の環境保全にかかる法律や加入している国際条約等に定められた規定を遵守する。

(2) 公害

①借入国の排出基準等の規制基準を遵守する。借入国は、実施地域に適用される環境保全のための行政目標値の達成に努める。

②借入国に排出基準が設定されていない際、必要に応じてOECFは当該プロジェクトにかかる暫定排出目標値を設定することを促す。

(3) 自然環境

①プロジェクトは、原則として借入国の国内法等に基づき指定された自然保護地区の外で実施させる。また、同地区への重大な影響があってはならない。

②プロジェクト実施に際して、稀少な野生生物の生息及び生物の多様性の保全に著しい影響を及ぼさないよう必要な措置をとる。

(4) 住民移転

①プロジェクトの計画と実施に当たり、非自発的な立ち退きと再定住が求められる住民及び主たる収入源を喪失する住民（以下「移転住民」という）への配慮を行う。

②計画策定段階における移転住民数を必要最小限とするように代替案の慎重な検討を行う。

③住民移転が発生するプロジェクトにおける影響を軽減するための計画を策定する。計画にかかる移転住民の意向を十分聴取する。

④移転住民の移転後の生活、所得の回復を目的とした住民移転に伴う影響の低減計画する。

(5) 環境保全対策

①プロジェクトコストに環境保全対策（住民移転他社会環境を含む）に必要な費用を含める。公害防止機器等による環境保全対策及びモニタリングが必要なプロジェクトにおけ

- る適切な運転及び維持管理コストの手当を行う。
- ②プロジェクトの環境対策を客観的に評価し監視することのできる第三者機関を活用する。

C. チェック項目と解説

OECFの主要融資対象17セクター（詳細省略）について「チェック項目と解説」が作成されている。ここでは参考としてセクター16、灌漑について示す。

(1) 公害

- ①農薬散布等による大気汚染
- ②施設の設置に起因する水系変化による水生生物、漁業、その他の水利用等への影響（現況の水系が変わることによる利水等への影響、浸食等の増加による災害の発生等）
- ③灌漑排水による水質汚濁（灌漑排水による人の健康及び生活環境に対する影響）

(2) 自然環境問題

- ①施設の設置及び利用による生態系への影響（主要な及び貴重な魚類、動物、植物等への影響）
- ②景観への影響（特殊な景観及び主要の眺望点からの眺望に与える影響）

(3) 社会環境問題

- ①施設の設置による歴史的・文化的遺産への影響（重要な歴史的・文化的遺産に損傷を与えるような場合を事業予定地としないよう配慮）
- ②既設インフラストラクチャーへの影響
- ③住民移転、土地利用への影響等（移転住民への十分な配慮、住民により利用されている森林、沼地の保全、既存の土地利用と新たな土地利用計画の調和）
- ④他の水利用への影響（適切な水源管理、水配分、施設の配置、機能及び管理）

(4) その他

- ①建設工事時の環境影響（地域への悪影響を軽減させるような機械配置、工事方法、工期）
- ②環境モニタリング（上記の各チェック項目について、a) 影響は少ないと考えられるがモニタリングする必要があると判断される場合、b) 対策が講じられるが、その対策が有効に働いているかどうかをモニタリングする必要がある場合）

④ 世界銀行ガイドライン

世界銀行で出された「環境アセスメントソースブックⅠ、Ⅱ、Ⅲ（1991年）」によると、世界銀行は以下のような項目に対して環境配慮のためのガイドラインを持っている。このソースブックのVolume Iでは、プロジェクトを推進してゆく中で環境に配慮してゆくにはどうあるべきかの原則、方針、方法、制度の面を説明している。更に、地球レベルやセクター間、社会的文化的

な面を考察し、経済的な評価のあり方も論じ、住民参加やNGO活動にも言及している。Volume IIでは、農業、インフラ、都市開発や人口、健康に関連したプロジェクトでの環境アセスメントのあり方を説明している。Volume IIIでは、エネルギー及び工業セクターのプロジェクトの環境アセスメントに関するガイドラインを示している。

開発プロジェクトを環境面から配慮するために環境アセスメントを行う際、個々のプロジェクトの計画準備段階において配慮すべき項目としては、一般には大気汚染、水質汚濁や土壌汚染といった都市域における環境項目と地形・地質、植物・動物、史跡・文化財、景観といった自然環境項目がある。更に、途上国の場合はこれらの項目に、野生生物、生物学的多様性／種の絶滅などが加わる。また、世界銀行としては更に次の点に留意している。

- ・現地住民
- ・強制的移住
- ・文化遺産
- ・プロジェクト誘発要因

環境アセスメント（EA）の一般的な手順として、先ず環境アセスメントの定義を行い初期環境評価（IEE）によりスクリーニングを行う。その後問題点の抽出を行うスコーピングを経て、EAを行う。プロジェクト実施段階では、環境面からのモニタリングが必要である。そして、プロジェクトが完了し、実運転が行われるようになると、EAの評価が行われる。

環境アセスメントについては、これまで2度にわたって業務指示書（Operational Directive = OD）に方針が示されている。

OD4.00、AnnexA 環境アセスメント（1989年10月31日）

OD4.01、環境アセスメント（1991年10月3日）

現在は、後者のODのEAが使われており、このODによって世界銀行の全てのプロジェクトは、次の3つのカテゴリーに分けられている。

- カテゴリーA：全面的な環境アセスメントが必要
- カテゴリーB：部分的な環境アセスメントが必要
- カテゴリーC：環境アセスメントが不要

これらのカテゴリー分けは、一般にはプロジェクト種別によって分けられており、KIN導水計画に関わる可能性があるものは以下の通りである。

カテゴリーA	カテゴリーB
ダム・貯水池プロジェクト 灌漑、排水プロジェクト 移住プロジェクト 河川、土地開発プロジェクト	灌漑、排水プロジェクト（小規模） 水系（管理と改修）プロジェクト

JICA