

Joint Survey Report On The Feasibility
Of The Waterway Improvement Project On the Upper Mekong River
From China-Myanmar Boundary Marker 243 To Ban Houayxai of Laos

1. Introduction

1.1 The Lancang-Mekong River is the sole international river in Asia, which links six countries of the Sub-region. Originating from the Tanggula Mountain in Qinghai Province of China, the River totals 4,880 km in length, with 2,130 km of inland waterway in China, 31 km of China-Myanmar boundary waterway, 234 km of Lao-Myanmar boundary waterway, 976 km of Lao-Thailand boundary waterway, 777 km of inland waterway in Laos, 502 km of inland waterway in Cambodia and 230 km of inland waterway in Vietnam. Total drop of the entire river falls 5,060 meters with average gradient of 1.04%. Its average discharge at the sea entrance reaches 12,000 cubic meters per second and the River basin covers 810,000 square kilometers. Among all developments of the abundant resources in the basin such as waterway transportation, irrigation, hydropower generation, minerals, tourism, forestry and fishery, the waterway transportation development costs the least investment and gains the most prompt benefits to all the riparian countries. Meanwhile it also promotes exploitation and utilization of other resources. Therefore, the Governments of China, Laos, Myanmar and Thailand took the waterway transportation development as an initiating project of resources exploitation in the basin, and organized a joint investigation of waterway transportation on the Upper Mekong River in February 1993 with the following conclusions:

- a) Under the natural conditions, the waterway is navigable for passenger and cargo vessels of 60 Dead Weight Tonnage (herein after referred to as DWT); 重量トン
- b) After a certain regulation, the waterway can be navigable for vessels of 100 - 150 DWT for at least 95% of the time in a year,
- c) After a further regulation, the waterway can be navigable for vessels of 300 DWT for at least 95% of the time in a year,
- d) After the canalization of the waterway, it can be navigable for vessels of 500 x 4 DWT for at least 95% of the time in a year.

1.2 In order to provide a legal guarantee for commercial navigation on the Lancang-Mekong River among China, Laos, Myanmar and Thailand, after having 6 meetings at Working Level in 7 years starting from 1994, the Transportation Ministers of the four countries officially signed Agreement on Commercial Navigation on Lancang-Mekong River. Among the Governments of the People's Republic of China, the Lao People's Democratic Republic, The Union of Myanmar and the Kingdom of Thailand (hereinafter referred to as "the Commercial Navigation Agreement") in Tachileik, Myanmar on 20 April 2000, and proposed that the Official Inauguration Ceremony of the Navigation be held in the middle of June 2001. The

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Commercial Navigation Agreement stipulates that vessels of any Contracting Party are entitled to sail freely in the waterway of 886.1 km between Port of Simao in China and Port of Luangprabang in Laos. Within the waterway of 361 km from China-Myanmar Boundary Marker 243 to Ban Khok Luang of Laos-Thailand boundary, there are more than 100 shoals, rapids and reefs, of which 11 major rapids and 10 scattered reefs seriously threaten the vessels' safe navigation, with more than 10 accidents occurred. They are the hidden dangers to the navigation. In view of the above-mentioned facts, the Second Meeting of the Technical Working Group on the Implementation of the Commercial Navigation Agreement held in Kunming, China on 18-22 September 2000 considered and adopted 6 Draft Documents, including Draft Guidelines on the Maintenance and Improvement of Navigability of the Lancang-Mekong River, and agreed that a Joint Survey Group consisting of waterway, environment protection and boundary experts from the four countries should be established to conduct a joint survey on the feasibility of the waterway improvement project on the above-mentioned section of the River. The Group consists of 9 experts from China, 4 experts each from Laos, Myanmar and Thailand. The list of the experts is attached as Annex 1.

1.3 The main tasks of the Group were:

- a) To make a further joint spot survey and put forward the recommendations on the waterway improvement project from China-Myanmar Boundary Marker 243 to Ban Houayxai of Laos on the basis of the Report on Investigation of Waterway Transportation on the Upper Mekong River among China, Laos, Myanmar and Thailand conducted in February 1993;
- b) To discuss and prepare the recommendations on such issues as the current velocity, flow direction, water level, discharge, river morphology, environment protection and boundary relating to the waterway improvement project;
- c) To put forward the construction plan for the waterway improvement and the recommendations for further improving the waterway conditions;
- d) To prepare a Joint Survey Report on the Feasibility of the Waterway Improvement Project on the Upper Mekong River (hereinafter referred to as "the Joint Survey Report"), which will be firstly submitted to the competent authorities of the four countries for approval and then to the Third Meeting of the Technical Working Group on the Implementation of the Commercial Navigation Agreement and the Senior Officials Meeting to be held concurrently in the middle of December 2000 in Beijing, China for consideration and formal endorsement.

1.4 This Joint Survey was carried out in the following three stages:

- a) On 17 November 2000, the Joint Survey Group was given a brief introduction in Jinghong, China by Chinese side to the Report on Investigation of Waterway Transportation on the Upper Mekong River among China, Laos, Myanmar and Thailand conducted in February 1993 and to the shipping developments over the last 10 years, and investigated the regulated Jinghong

sand bar;

- b) On 18-24 November 2000, the Group surveyed the major rapids, shoals and scattered reefs on the waterways of 331 km between China-Myanmar Boundary Marker 243 and Ban Houayxai of Laos and had discussions on the construction plan of the waterway improvement project on the Chinese Cargo Vessel called Ren Da 7;
- c) On 25-29 November 2000, the Group reviewed the data, prepared and signed the Joint Survey Report.

2. Importance and Imminence of the Waterway Improvement Project

2.1 The volume of the international shipping on the Lancang-Mekong River will increase rapidly thanks to a further recovery of the ASEAN economy, especially the official signing of the Agreement and the implementation of Development Strategy of China Western Areas. It is predicted that the volume of cargoes and the number of passengers to be transported on the River will reach 1.5 million tons and 0.4 millions by 2010 respectively. Whether or not the international shipping on the Lancang-Mekong River can make benefits, become the tie for linking China, Myanmar, Laos and Thailand, and promote a further cooperation in the field of economy, technology and trade and friendly exchanges among the four countries all depends on whether the navigability of the waterway can be improved, the tonnage of vessels increased, safe navigation all the year round ensured and the transportation cost reduced. However, at present the waterway of the 331 km between China-Myanmar Boundary Marker 243 and Ban Houayxai of Laos is the natural waterway with the worst navigability among the waterway of the 886.1 km between Simao of China and Luangprabang of Laos. During the trial navigation periods, such accidents as striking reefs and grounding often happened to the vessels, causing the threatening and losses to crewmembers' lives and properties. Furthermore, the vessels can only navigate with the load reduced for more than half a year during each year, due to the rapids, shoals and reefs hindering navigation.

2.2 According to the provisions of the Commercial Navigation Agreement, the River will be officially opened to navigation among the four countries within one year after its signature. In order to minimize the accidents, prolong navigation duration, the major rapids, shoals and reefs hindering navigation shall be removed and such navigation facilities as winches and marks shall be set up along the waterway of the above-mentioned 331 km as soon as possible so that the River can be navigable for vessels of 100 DWT for at least 95% of the time in a year.

3. Feasibility of the Waterway Improvement Project

3.1 Feasibility

3.1.1 There are abundant vegetations and water along the banks of the Upper Mekong River. The River is supplied by the snow-melted water and underground

water, with average discharge of 1,804 cubic meters per second for many years. The River channel is single and the riverbed is stable with average gradient of 0.427‰ for its all sections. The sections of the river course with 1.5 m in depth account for 99.9% of the whole course in the low water season. Most sections are more than 5 m in depth, with very limited change rate of discharges both in high water and low water seasons. The General Situation of the Upper Mekong River (Nam Ngo River to Ban Khok Luang) is attached as Annex 2. The three key elements of water discharges, gradients and the morphology of river channel are very favorable for developing the international shipping. The River can be navigable for vessels of 300 DWT for at least 95% of the time in a year provided that the rapids, shoals and reefs are removed, dredged and the dikes built for guiding water.

3.1.2 This project is mainly to explode and remove the reefs and the rock plate protrudings, hindering navigation. Construction methodology (see Annex 3) is uncomplicated and the state of art is ripe. Therefore, it is technically feasible. After regulation, the Lancang River waterway of the 262 km with similar conditions in Yunnan Province of China reached China's Class 6 Waterway Standard, thus realizing the navigation for a whole year.

3.2 General Conditions

3.2.1 The Governments of China, Laos, Myanmar and Thailand have been attaching great importance to the international shipping development on the Lancang-Mekong River. China has already regulated the Lancang River waterway of the 262 km from Nandeba downstream in its territory, which is navigable for vessels of 100 DWT. The construction of Port of Simao and Port of Jinghong are completed. Laos has listed Muang Mom Port as the priority construction project, and the four highways stretching to the bank are under construction and rebuilding. Myanmar also has four highways stretching to the bank under construction, and has built ports at Wanpung and along the bank upstream from Nam Loi River Mouth. Thailand has built ports, terminals and bonding warehouses at Chiang Saen and other places. More than 100 vessels from China, Laos, Myanmar and Thailand have been engaged in international shipping on the Lancang-Mekong River since 1993. Some big fleets are under establishment and there exist vessels of 300 DWT sailing on some sections of the Lancang-Mekong River. In addition, the Tenth Meeting of the Tourism Working Group of the Upper Mekong Basin held in Vientiane, Laos in November 1999 listed on its Agenda the tourism development program of the Lancang-Mekong River. Meanwhile the Commercial Navigation Agreement concluded by the Governments of China, Laos, Myanmar and Thailand and the 6 documents including the "Guidelines for Maintenance and Improvement of the Navigability of the Lancang-Mekong River to be reviewed and endorsed at the Third Meeting of the Technical Working Group on the Implementation of the Commercial Navigation Agreement and the Senior Officials Meeting to be held concurrently in Beijing, China in the middle of December 2000 will provide legal guarantee and the implementation methods and standards for developing international shipping among the four countries.

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Because most of rapids and shoals are based on the rock riverbed, the original conditions of the rapids and shoals investigated and surveyed remain unchanged basically. The survey and design of construction plan and the construction can be organized provided that the funds are available. Therefore, the conditions and the time are ripe for the implementation of the waterway improvement project.

3.3 Detailed Survey

3.3.1 It is verified by this Joint Survey that the first hand data on waterway regulation collected by the experts of the four countries during their 83 days joint investigation in 1993 are applicable. However, for an important project like this one, it is very important to have the complete data so as to ensure the effective planning in drawing construction designs and cost estimation. Therefore, prior to the construction planning, a further detailed survey for the construction sites of the proposed rapids, shoals and reefs still needs to be carried out based on the relevant technical specifications of the four countries.

4. Environmental Protection

4.1 The environmental consideration must always be carefully integrated into planning and implementation of major development projects in each basin area to make sure that those projects are environmentally sound. Therefore, data collection, and environmental impact assessment of the waterway development project shall be collectively conducted along the Upper Mekong River by the four countries.

4.2 Environmental impact assessment should include effects of waterway improvement project on ecology, vegetation of forestry, humanities and landscapes, geology and landforms, cultural relics and historic sites, tourism resources, water and air quality, agriculture, fisheries, etc.

4.3 Evaluation Basis

a) The Declaration on the Human Environment adopted at the Human Environment Conference of the United Nations in Stockholm on June 16, 1972, Rio Declaration on Environment and Development adopted at the Environment and Development Conference of the United Nations in Rio De Janeiro in June 1992 and relevant international conventions.

b) The relevant laws, acts and regulations of China, Laos, Myanmar and Thailand.

c) The topography, geology and the formation of the rapids, shoals and reefs of the Upper Mekong River.

d) The regulation practice and experience of sediment shoals of Jinghong and Manting sand bars, and the spot survey and plan of the waterway improvement project

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on the Upper Mekong River.

5. Morphology မြေပုံ

5.1 Whether the reefs exploding and protrudings cutting are carried out for the bedrock rapids, or channel dredging, dike building and pushing water back to channel are carried out for gravel sediment rapids, the regulated channel will be arranged along the main stream (the thalweg). Although the regulated channel of a specific bedrock can not be arranged along the main stream, the exploded and removed volume is very small and the exploded depth is within 3 m below the low water surface, the main stream depth of the bedrock rapids at the low water season is more than 5 m. Therefore, the thalweg of the natural river will remain unchanged.

5.2 The waterway regulation engineering such as reefs exploding and channel dredging is designed in accordance with the principles of " no washing and no sediment of the riverbed " or " balance of washing and sediment ", which will not dam and waste the water, but will generally expand the water passing cross section of the low water season by 1% - 5%. Hydraulics features of natural river course are that the fluid discharge and solid discharge, gradient and water level, cross section of water passing and roughness, water depth and dynamic axis will change unceasingly along the flow course and with the passage of the time. According to the water supply sources of the natural river and the design principles of waterway regulation engineering, the expansion or reduction of the water passing cross section will not change the discharge, namely, not change the fluid discharge and solid discharge of the natural river, but reduce the current velocity at the expanded cross section and increase the current velocity at the reduced cross section. Therefore, the discharge remains unchanged.

5.3 Because the riverbeds in the reefs exploding areas are all rock based, they can stand for torrents of whatever strength and direction, and the bank will not be washed away and collapsed. Therefore, the territories and boundaries along the River will not be affected at all. After the regulation, the shallow shoals formed by the easily washed and changed sand bars and gravels will not affect the territories and boundaries along the River, but will play an important role in protecting the farmlands thereof, thanks to the regulation of the waterway, improvement of flow and reduction of washing-out to the farmlands along the River.

6. Boundary Related Matters

6.1 The Mekong River is an important river from the boundary aspect. The River flows along the boundary lines of China and Myanmar, Myanmar and Laos, and Laos and Thailand.

6.2 The boundaries between China and Myanmar, and Laos and Myanmar have

been fixed once and for all. In other words, the boundaries are fixed boundaries. The boundary treaties between China and Myanmar, and Laos and Myanmar clearly stipulate that the boundary line shall remain unchanged whatever course the River takes.

6.3 However, it is essential to protect the riverbanks from erosion, and to avoid the changing of the River course as far as possible.

6.4 Therefore, the waterway improvement project should take into consideration the protection of riverbanks and the changing of river course.

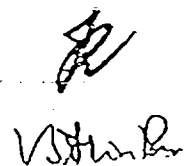
7. Construction Plan of the Waterway Improvement Project and Main Elements of Safe Navigation

7.1 Construction Plan

7.1.1 The Joint Survey Group conducted a further spot investigation and an analysis on the features of the rapids and shoals and the causes of their formation, and worked out the draft regulation plan for the improvement based on the Investigation of Waterway Transportation on the Mekong River of China, Laos, Myanmar and Thailand in 1993.

7.1.2 As for the shoals such as Long Zhom, Nam Loi River Mouth and etc., which are formed of bedrocks, slides, reef islands and cove mouth sediments, and make navigation channel narrower and shallower, such measures as reef exploding and protrudings cutting should be taken so as to make the channel width satisfactory to the safe navigation. As for the rapids and shoals with steep gradient and torrents which are formed of bedrocks, coves and slides, such as Tang Salum, Lower Tang Luang Shoal, and bedrocks protrudings, reefs, sediment cones and slide arising from exploding and removing which cause poor flow and hindrance, such measures should be taken as regulating bank line, widening navigation channel, expanding cross section of water passing, adjusting gradient meanwhile improving flow situation, or changing the "opposite rapids" into "staggered rapids", so as to form the conditions of "overlap jumping" for upstream sailing vessels. As to the sediment shallow shoals such as Mong Pa Liao, Wan Seng, such measures should be taken as building dike to guide flow, blocking tributary to enhance main stream and dredging, so as to push water back to the channel and regulate shoals with water flow.

7.1.3 The waterway improvement project includes the exploding, removing, dike building and dredging for the 11 major rapids, shoals and 10 scattered reefs hindering navigation on the Upper Mekong River from China-Myanmar Boundary Marker 243 to Ban Houayxai of Laos. The methodology of machinery drilling and blasting can be adopted for reefs exploding and the protrudings cutting and the dredging can be done by the exposed blasting and raking. As for the details of rapids, shoals, reefs and the regulation plan, please see Annex 3: Summary of the Waterway Improvement



Project on the Upper Mekong River between China-Myanmar Boundary Marker 243 and Ban Houayxai of Laos: Annex 6: Design Drawings of the Waterway Improvement Project on the Upper Mekong River between China-Myanmar Boundary Marker 243 and Ban Houayxai of Laos and Annex 7: Navigation Channel Map of the Upper Mekong River (Nam Ngo River Mouth to Ban Khok Luang).

7.1.4 According to the design and calculation, even after regulation and improvement, there are still 4 to 6 shoals (Lower Tha Ban Bo, Tang Salum, Lower Tang Luang and Nam Loi River Mouth) which can not be past through by the conventional vessels with their own power. Therefore, it is necessary to set up winching facilities such as rope pile, towing passage and winching vessel.

7.1.5 In order to guarantee the safe navigation, it is necessary to set up 100 navigation marks, 106 markers and 4 winching facilities in the above-mentioned 331 km of waterway. The navigation marks will be set up in compliance with the harmonized standard to be developed by the four countries. The markers should be labeled in English and a national language, please see Annex 4: Navigation Marks to Be Set-up along the Upper Mekong River (Nam Ngo River Mouth to Ban Khok Luang) and Annex 5: Name Marks of the Places to Be Set-up along the Upper Mekong River (Nam Ngo River Mouth to Ban Khok Luang).

7.2 Main Elements of Safe Navigation

7.2.1 The competent authorities of four countries should harmonize the navigation regulations, navigation marks, signals and navigation charts of the Upper Mekong River, and train the national crewmembers.

7.2.2 When passing through the controlled river sections or single navigable channel, the vessel must follow the indications of the navigation marks with a view to avoiding collision. When passing through the river sections with shallow shoals or unknown navigation channel, the vessel shall strictly follow the indications of the navigation marks. When passing through the shallow shoals, the vessel shall take the soundings.

7.2.3 The vessels shall have enough power and be equipped with a winch with sufficient power so as to pass through a shoal by its own winch or by a winching vessel when it cannot pass through the shoal by itself.

8 Scope and Investment of the Waterway Improvement Project

The project includes the removal of 11 major rapids, shoals and 10 scattered reefs with approximate total of 116,300 cubic meters (of which 3,360 cubic meters for above water reef exploding, 42,700 cubic meters for under water reef exploding and 10,000 cubic meters for dike building) and installation and provision of 100


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navigation marks, 106 markers, 1 navigation mark boat and 4 winches (2 vessel winches and 2 bank based winches).

8.2 The total estimated investment is 5.3 million US Dollars. As for the details, please see Annex 3: Summary of the Waterway Improvement Project on the Upper Mekong River between China-Myanmar Boundary Marker 243 and Ban Houayxai of Laos.

8.3 Actual construction work volume must be ascertained for the calculation of investment required and to ensure cost-effectiveness.

9. Benefits of the Waterway Improvement Project

9.1 After the completion of the waterway improvement project on the 331 km waterway of the Upper Mekong River between China-Myanmar Boundary Marker 243 and Ban Houayxai of Laos, the waterway of 1,368 km from Nandaba of Simao, China to Vientiane, Laos can be initially navigable for vessels at least of 100 DWT, with further reaching southward to the important cities such as Thakhek, Savannakhet and Pakse of Laos and Nongkhai, Nakhonphanom and other cities of Thailand. The waterway may also form the network of water and land transportation, with the water transported cargoes to be carried by lorry from Thai ports of Chiang Saen and Chiang Khong to Chiang Mai, and then to be carried by train directly to Malaysia and Singapore. The cargoes may also be transported to Tachileik of Myanmar via Mae Sai of Thailand and then transferred to the eastern Myanmar cities such as Kyaing Tong and Taungyi. With respect to the imported and exported cargoes of the four countries, the transportation through the above-mentioned waterway is more cost-effective than other sea transportation, with the distance shortened, the time saved and the freight reduced. Because there are a lot of colorful ethnic and beautiful sceneries for sightseeing along the River, therefore the waterway provides a convenient and shortcut corridor of transportation and tourism for the markets of China, Laos, Myanmar and Thailand as well as the other countries of ASEAN.

9.2 The construction duration of the project is short. The project, including the pre-stage works, can be completed within 2 low water seasons with the investment of 5.3 million US Dollars. This amount of the funds is not enough for building the 5 km of railways or 30 km of Class 4 highways. The project will not take use of farmland, but increase the cultivated land and protect the townships and villages along the River. It is an initiating project for promoting the development of the other resources of the Sub-region, thus achieving good benefits for China, Laos, Myanmar and Thailand.

9.3 The project will play an important role in developing international shipping on the Lancang-Mekong River and improving the economic development conditions along the River. It will also lay a good foundation to form the effective monitoring networks for the environment of water and ecosystem.

10. Conclusions and Recommendations

10.1 Conclusions

10.1.1 The data obtained from the Quadripartite Joint Investigation in 1993 are applicable. The survey and design results basically satisfy the requirements for the regulation plan, scope and standard. It is verified that most of shoals are on the rock beds and the shoals surveyed basically remain unchanged. Therefore, it is technically feasible.

10.1.2 The project will not change the thalweg and discharge of the River and the boundaries along the River.

10.1.3 China, Laos, Myanmar and Thailand have already built harbors and ports along the investigated sections of the River and have taken an active part in shipping development among the four countries. However, due to a lot of rapids, shoals and reefs hindering navigation in the channels, such accidents as striking a reef and running aground have often happened to vessels, resulting in a threatening to and losses of the lives and properties of crewmembers. Therefore, it is imperative and imminent to carry out the project.

10.2 Recommendations

10.2.1 The project should get started with EIA process followed by the detailed survey prior to the construction. The issue on the coordinator and commencement date of EIA should be discussed and agreed upon by the Senior Officials Meeting to be held in Beijing, China in the middle of December 2000.

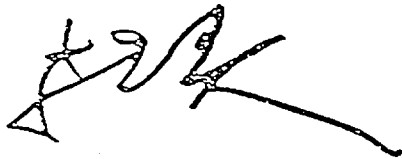
10.2.2 China as a coordinator should organize a detailed survey and design team, which will make the construction survey and design on the removal of the rapids, shoals and reefs after the EIA process.

10.2.3 The construction of the project will be divided into two phases. The first phase is to remove the shoals of Lower Tang Luang, Long Zhom, Tha Ban Bo, Kon Mu Tai, Nam Loi River Mouth, Kon Don Chai and Pa Toei and the scattered reefs. The remaining works of the project will be completed in the second phase.

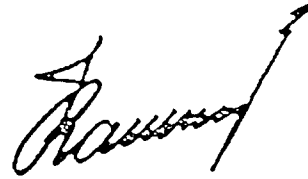
10.2.4 The waterway regulation of the Lancang-Mekong River should be implemented in three phases. In the first phase, after the removal of the 11 major rapids, shoals and 10 scattered reefs and the setting-up of 100 navigation marks, 106 markers and 4 winches, the waterway can be navigable for vessels at least of 100 DWT for at least 95% of the time in the year. In the second phase, after the regulation of 51 rapids and shoals, the waterway can be navigable for vessels at least of 300 DWT for at least 95% of the time in the year. In the third phase, after the canalization of the waterway, it can be navigable for vessels of 500 x 4 DWT for at least 95% of

the time in the year.

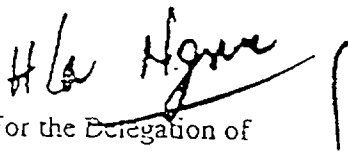
10.2.5 The delegations of the four countries expressed that they would submit the " Joint Survey Report " and its Annexes to their national competent authorities for consideration and approval immediately after they returned back to their countries, and recommended that the " Joint Survey Report " and its Annexes should be submitted to the Third Meeting of the Technical Working Group on the Implementation of the " Commercial Navigation Agreement " and the Senior Officials Meeting to be held concurrently in Beijing, China in the middle of December 2000 for further consideration and formal endorsement, so as to complete the project as soon as possible and ensure the safe navigation among the four countries.



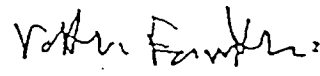
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For the Delegation of
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