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## **CHINA RIVER DIVERSION – OUTLINE (TASK 1)**

Due April 4, 2007

### ***Intro***

*Brief summary of the situation/problem.*

The China River Diversion project, also known as the South-to-North River diversion project, is the largest hydraulics project in human history. The main goal of this mega-project is to simultaneously solve water problems in the northern and southern regions of China. For the South, the problem is over flooding of many of its rivers. As for the North, they have dealt with much drought for many years. To meet the requirements of developments in northwest and north china. the Chinese government plans to divert water from the Chang Jiang River of the South to the plains in the North. Chairman Mao of China first to come up with the plan to help both the North and South back in the 1950's. Then after being studied and discussed by the experts for almost 50 years, the government decided to carry out the project.

*Thorough description of the design/recommendation or project/process studied.*

The reason that this project is so big is because there are three parts to it. The Western Route Project (WRP), Middle Route Project (MRP), and Eastern Route Project (ERP) make up this mega-project. Each project, or phase, is expected to take 15 to 20 years to complete. As it is the largest water diversion project ever, it would be no surprise that it would cost a lot to complete. The entire project is expected to cost somewhere in the tens of billions of dollars. In addition to the large cost, the project will take a long time to complete as well.

*Description of the original design/recommendation or project/process*

The China River Diversion mega-project began in 2002, and completion is expected for 2050. The approximate cost for the entire project is ¥ 500 billion. Two of the three portions (ERP and MRP) are already underway, while the feasibility of the WRP is still under consideration. The project, not only in the size (scope, dimension, scale), but also in difficulty of construction are beyond Three Gorges Dam project in China.

### ***Body (Discussion of Alternatives)***

*Overview of the available alternatives*

Not all technical problems for the WRP have been solved, and it is considered a much more difficult task than the first two portions of the river diversion. Since this portion is

still under review, it would be applicable to consider the completion or cancellation of the WRP as another alternative.

**Alternative 1: Complete only the ERP and MRP**

The ERP includes three stages. Currently, the Chang Jiang River (Yangtze River) is being diverted to Jiangsu and Shandong Province. This portion commenced on December 27, 2002. When completed after about five years of work, 3.9 billion m<sup>3</sup> of water will be diverted to these areas each year.

In the second stage water will be diverted to Hebei province and Tianjing City. Additionally, work will begin to reduce pollution associated with the project, such as that resulting from irrigation problems. This portion of the ERP would take approximately three years to complete.

Stage three is the overall finishing of the ERP, ensuring that the project reaches the goal to divert 14.8 billion m<sup>3</sup> of water per year. Five years have been budgeted to allow for its completion.

The MRP will bring water to Hubei, Henan, and Hebei provinces, Beijing and Tianjing Cities. It involves two stages, the first of which began on December 31, 2003. During this stage, the Dam of Danjiangkou Reservoir is being heightened, and citizens are being relocated as necessary for diversion. This will take about nine year to complete, and will bring 9.5 billion m<sup>3</sup> water pre year at that time. The second part of this route project will be to get the diversion to its goal capacity of 13.0 billion m<sup>3</sup> water pre year.

**Alternative 2: Complete the WRP also**

The purpose of the WRP is to divert water from Chang Jiang River to the Huanghe River in order to supply more water to the northwest of China. Complications arise with the geographic location of the Qinghai-Tibet Plateau which will be more difficult to divert the river through. Thus, whether or not this portion of the project is worth embarking has yet to be determined. Economic analysis can offer one perspective on what can be lost or gained from the WRP.

*Cost of design/recommendation, project/process, or alternatives*

**Eastern Route Project**

Stage 1: ¥ 32 billion

Stage 2: (yet to be determined)

Stage 3: (yet to be determined)

**Middle Route Project**

Stage 1: ¥ 40 billion  
Stage 2: (yet to be determined)

Western Route Project  
¥ 46.893 billion (projected)

*Technical data supporting the design/recommendation, project/process, or alternatives*

The costs of the stages in this project that have yet to begin are difficult to find, and amounts have varied. However, when that information can be located, the worth of the WRP can be compared by the initial cost, annual costs to pump water, and how much water it is expected to divert.

*Non-technical data supporting the design/recommendation, project/process, or alternatives*

Eastern Route Project

This route is diverted from the end of Chang Jiang River, which has plenty of water. Also, the Beijing-Hangzhou Grand Canal and other rivers can be used to channel the water, so the cost is less.

In this section, water will have to be pumped uphill for long distances, which requires large amounts of electricity.

The eastern river seems to be the least efficient due to the numerous pumping stations needed to move the water east. However, as this stage of the route is scheduled to be completed this year, considering removing the portion of the project can be neglected.

Middle Route Project

The quantity of water is good, and water can be diverted to a larger area including five provinces.

The altitude of south is higher than north in this area, so the water can flow from the south to north by gravity, costing less to transfer.

A very long channel must be built to transfer the water, which will require a great deal of construction work.

Due to its length and the number of cities it passes near, many people who live along project's central canal will have to be relocated.

The Danjiangkou Dam along this route will need to be raised to increase its storage capacity.

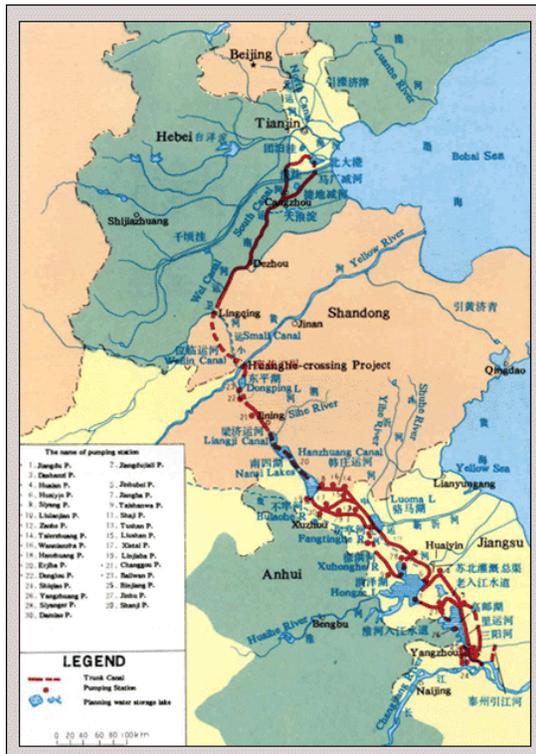
## Western Route Project

Two methods of water diversion in the west were considered: flowing by gravity and pumping. A dam would be needed for both of these, and both were implemented.

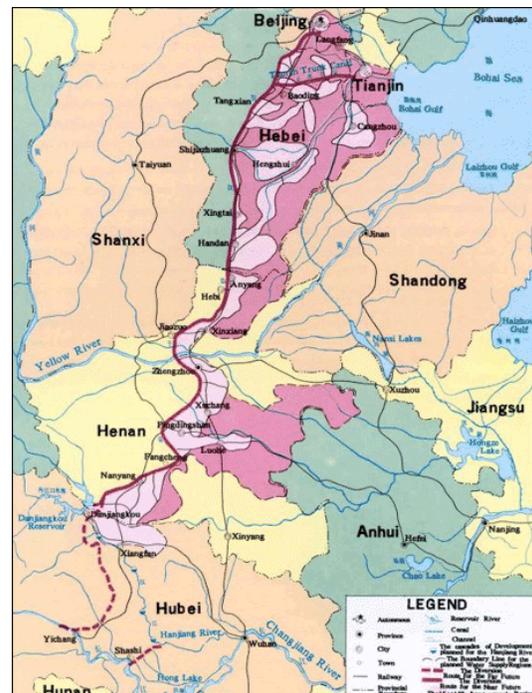
The western portion of the project will have to cut through the high mountains near Tibet.

*Graphics illustrating design/recommendation, project/process, or alternatives*

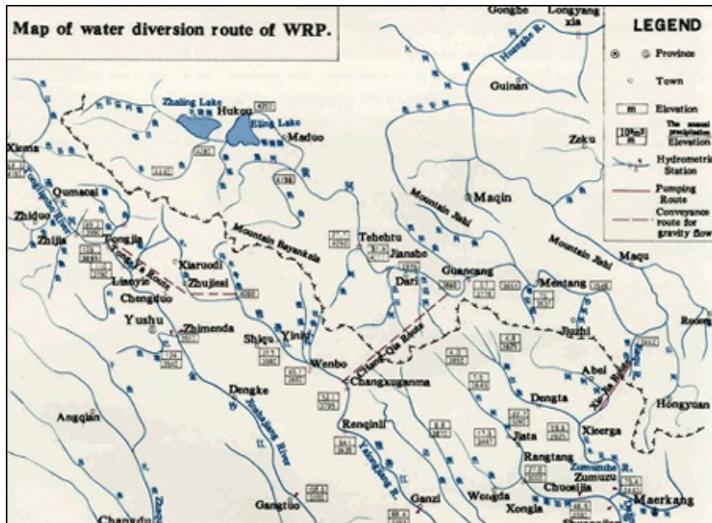
### Eastern Route



### Middle Route



### Western Route



*Problems and costs of implementing*

The following are obstacles prevalent in completing any route of the project:

- Population relocation
- Environmental consequences
- Earthquakes can upset canals and channels driven through mountains
- Remote and geologically complex locations through which the canals run will make construction and repairs difficult

***Summary/Conclusion***

*Explanations of all advantages and disadvantages of the design/recommendation, project/process, or alternatives*

The advantages and disadvantages of each route project were discussed in the technical and non-technical data portions. The following pertain to the project as a whole – those that were the case in completing the ERP and MRP, and will also hold true for undertaking the WRP.

<i>Advantages</i>	<i>Disadvantages</i>
The three routes are completed in stages about five years apart, so once the first river is complete it will be functional before the other two are started.	People currently living along the routes will have to be relocated.
Some of the existing rivers along the way will be used to help divert the water north, reducing the project's time length and cost.	Each route of the river diversion has a high cost. After their completion, there will also be a continuing cost to pump water.

*Estimated net savings*

The river diversion mega-project will not generate a clear net savings. The project aims to solve longtime problems of drought and flooding, and the cost has been deemed necessary. However, there should be some economic benefit based on reduction of damaged land, and potential increase of production. If projections can be found to determine the worth of these aftereffects, they will be included in the economic analysis for this report.

#### *Other items of interest*

There are several components to the China River Diversion. As addressed previously, the project has environmental and social impacts. While the droughts in the north and floods in the south may be alleviated to an extent, some people must also be relocated from areas the rivers will be channeled through. It is difficult to quantify these consequences, but they are important to discuss none-the-less. The project is beneficial for the sustainable development of China. China has the largest population in the world, but has little farm land. The lack of water has to this point influenced the agriculture and industry in northern China.

#### *Summary/Conclusion*

Although the third part of this mega-project, the WRP, is expected to be the largest and most difficult, it may also bring the most aid in years to come. After completing this report, a recommendation based on the predicted costs can give an economic perspective on whether the WRP is worth the endeavor.

#### *Sources*

<<http://www.nsb.gov.cn>>

<[http://www.icivilengineer.com/Big\\_Project\\_Watch/China\\_River\\_Diversion/](http://www.icivilengineer.com/Big_Project_Watch/China_River_Diversion/)>