

Study on route layout of long-distance water diversion project across river basins based on water ecological protection

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Objectives

The water diversion project in central Yunnan is a strategic basic project for the sustainable development of Yunnan Province. In the 1950s, the idea was put forward. The preliminary work has been studied for nearly 16 years. The water is taken from the Jinsha River, and the total length of the water conveyance trunk is 664 kilometers. It passes through Lijiang, Dali, Chuxiong, Kunming, Yuxi and Honghe six cities, spanning the four major river basins of Jinsha River, Lancang River, Pearl River and Red River, and the design flow of the canal head is 135 m³/s. The project has fundamentally solved the contradiction of water shortage in central Yunnan, repaired and improved the ecology and water environment of lakes and rivers in central Yunnan, and played an important role in promoting the sustainable development of economy and society in Yunnan Province. The Dali II section of the Central Yunnan Water Diversion Project is located in the watershed intersection of the Jinsha River, the Lancang River and the Red River, involving the plateau lake Erhai. The feasibility of using Erhai Lake to transport water, the comparison of the first section of the west line and the east line of the front section of Haidong and the route selection of the sensitive area of environmental influence are studied. Finally, the scheme of not using Erhai Lake and the east line of the front section of Haidong was selected based on the principle of avoiding karst water system and reducing groundwater discharge, and the overall layout scheme of water transfer in Jinsha River Basin was formed.

Methods

Dali II section of the front line layout more influencing factors, using the Erhai lake water are the main factors influencing the line layout, therefore, should be combined with water resources situation, from the environmental sensitive area, water environment, ecological environment, social environment, etc, feasibility analysis and study of Erhai lake water; Considering that the water quality of Erhai Lake is class II and the water quality of Jinsha River, the source of water diversion in central Yunnan, is class III, the feasibility of using Erhai Lake to transport water is poor, and the west route scheme based on the principle of being close to the receiving area and the east route scheme based on the principle of making the route short should be arranged. The western route has environmental sensitive areas near Erhai National Nature Reserve, populated areas and deposit overlying problems. The eastern route has prominent karst water environment problems, so it is necessary to study the route selection of sensitive areas in the middle and back of Haidong tunnel to avoid the prominent karst water environment problems.

Results

The water diversion project in central Yunnan is a huge project, and the preliminary work lasted for 16 years. With the continuous deepening of the survey and design research at each stage, through the study of the use of Erhai Lake, the comparison and selection of the east and west lines, and the in-depth study and optimization of the karst and drying problems of the east line scheme, an economic, reasonable and feasible Dali II section line layout scheme was gradually formed, which took the principles of reducing the cross-basin ecological environment problems, avoiding the economically developed Haidong development zone in Dali city, and avoiding the sensitive area of karst water environmental impact. Finally, it provided a scientific basis for the project decision-making, achieved good survey and design work results, and laid a solid foundation for the sustainable development of social economy in the project area.

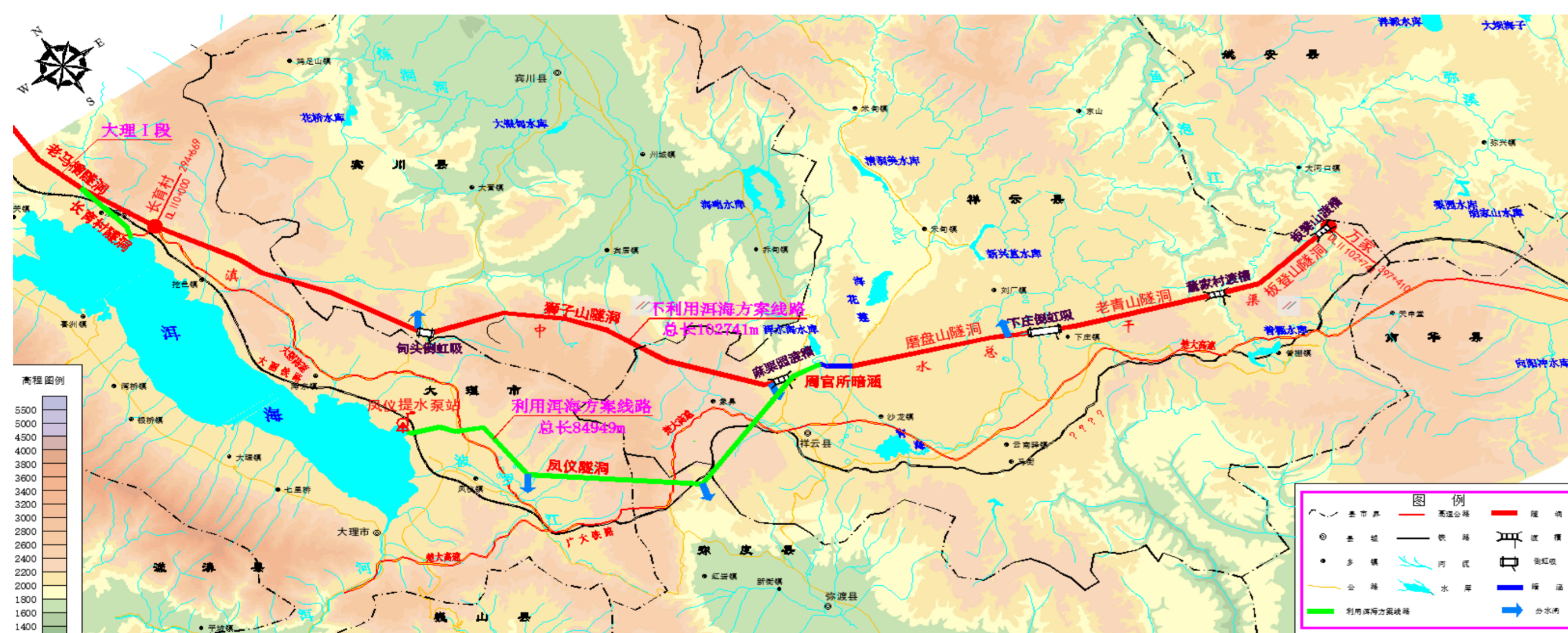


Figure 1 Line layout of water transmission scheme with and without Erhai Lake

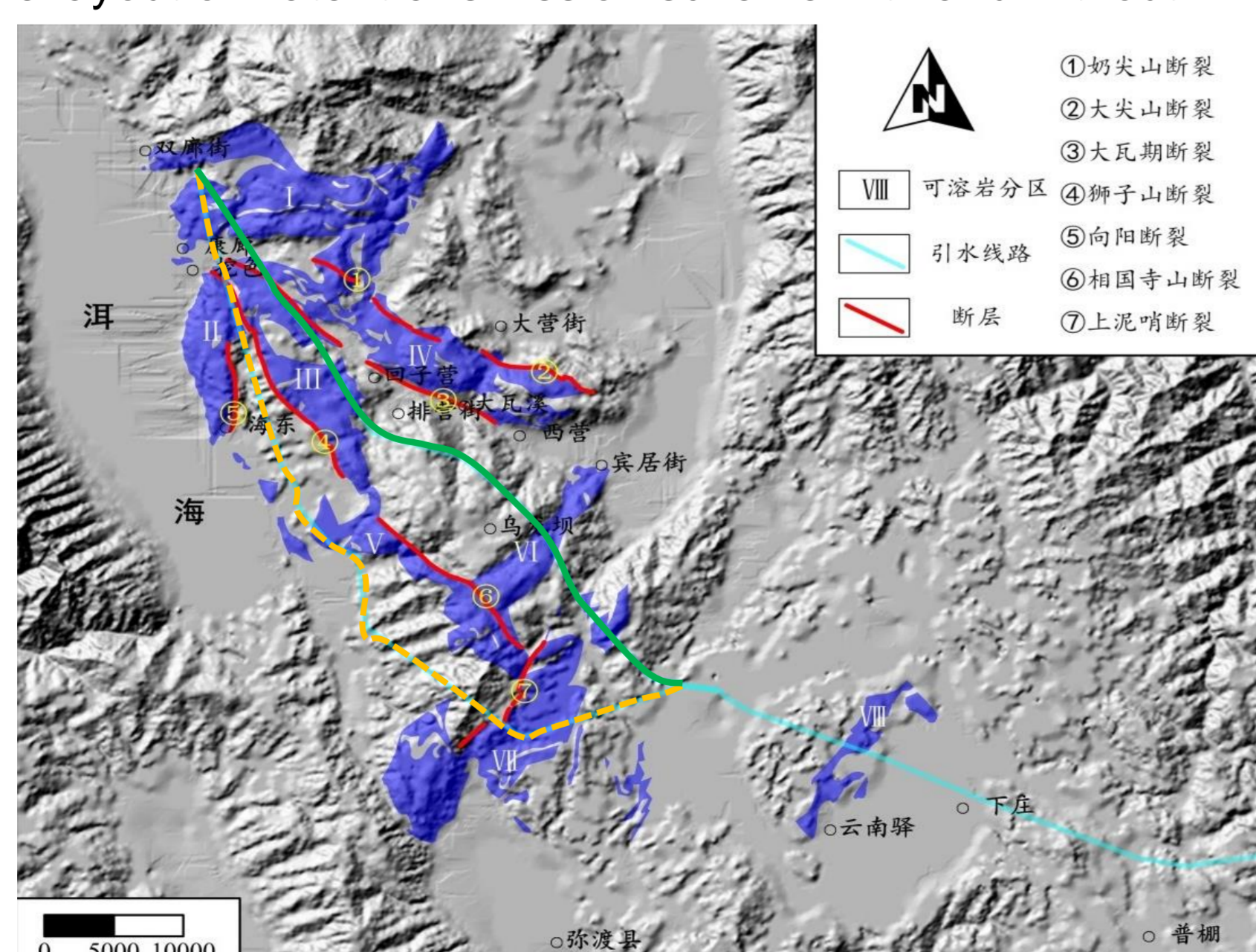


Figure 2 Distribution of rock depth in project area and map of east and west routes

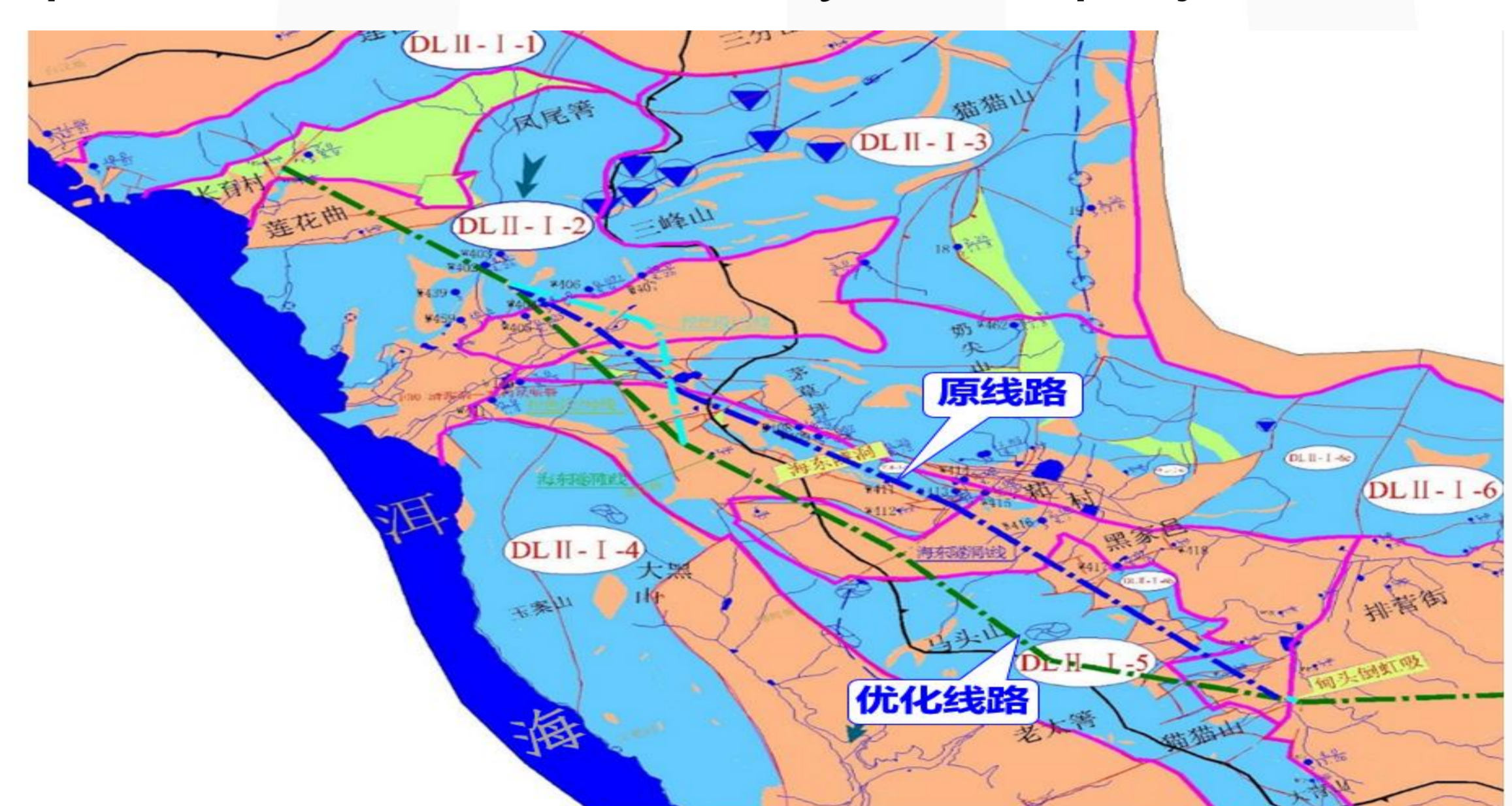


Figure 3 Optimized route layout of the middle and back section of Haidong tunnel based on karst influence

Conclusions

Practice has proved that only by grasping the regional geological control factors and the differences in the distribution of these factors that have a greater impact on major projects, making correct analysis and evaluation of various schemes, considering various schemes and scheme combinations in a wide range and with multiple factors, and fully carrying out the research and comparison of schemes, can major projects be well selected, so as to improve the rigor and scientificity of scheme decision-making.