China: Jilin-Tumen-Hunchun Railway Project

Environmental Assessment
Executive Summary

March 2011
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1. INTRODUCTION

Background

The proposed Jilin-Tunmen-Hunchun Railway Project is a double-track electrified railway line linking Jilin City and Hunchun City in north-east China. The objective of the proposed railway is to provide additional passenger and freight transport capacity and reduce passenger transport tie in the project corridor.

The Executive Summary summarizes the its key environmental and social issues based on the findings and conclusions of Environmental Impact Assessment, Environmental Management Plan and Resettlement Action Plan.

It is a Category A project due to the significance and scale of potential environmental and social impacts. A full Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) was prepared by China Academy of Railway Sciences (CARS) and China Railway Engineering Consults Group (CRECG)\(^1\) and approved by the Ministry of Environmental Protection (MEP) on November 18, 2010. The EIA and EMP reports cover the area of influence including railway line alignment, tunnels, terminals, and all construction related infrastructure such as access roads, workers’ camps, borrow pits and disposal sites. The EIA report and EMP were submitted to the World Bank for review and they conform fully to Bank policy guidelines regarding environmental and social issues. All above reports have been made available in China on February 11, 2011, and in the Public Information Center (INFOSHOP) of the World Bank on _______. The Chinese EA reports were approved by.

As designed, the project (i) has adopted careful alignment selection and advanced engineering designs(tunnels and bridges comprises 76% of the whole length of the line) to avoid and minimize adverse impacts on sensitive areas including nature reserves, cultural relics sites and water resource protection areas; (ii) will not adversely affect or convert critical, known or proposed natural habitats; (iii) will not adversely affect ethnic minorities but rather provide opportunities for their own development; (iv) will have minimized the need for resettlement and will provide adequate and just compensation and income restoration for affected peoples; and (vi) includes a management plan for addressing environmental and social issues during construction and operation of the project.

Environmental Assessment Process and Legal Framework

A full Environmental Assessment (EA) was carried out following the Chinese environmental assessment laws/regulations as well as the World Bank safeguards policies. Five safeguard policies are triggering: 1) **OP4.01 Environmental Assessment**; 2) **OP4.04 Natural Habitats**; 3) **OP4.11 Physical Cultural Resources**; 4) **OP4.12 Involuntary Resettlement**; and 5) **OP4.10 Indigenous Peoples**. Compliance with these policies, and the World Bank’s disclosure of information policy, is summarized in Table 1. As no pesticide will be used for clearing and maintaining the right of way, therefore, **OP4.09 Pest Management** is not triggered.

The project is also in full compliance with China national laws, regulations, guidelines and standards, as well as sector policies, norms and codes.

\(^1\) CARS is a Class A EA consultant and CRECG is a Class B EA consultant accredited by the Ministry of Environmental Protection (MEP).
<table>
<thead>
<tr>
<th>Safeguard Policies</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Assessment (OP/BP 4.01)</td>
<td>- Category A project. Full EIA and EMP have been prepared.</td>
</tr>
<tr>
<td>Natural Habitats (OP/BP 4.04)</td>
<td>- Alignment alternatives, use of tunnels and viaducts to avoid and minimize impacts on natural habitats</td>
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<td></td>
<td>- Adequate assessment of impacted protected areas and mitigation measures incorporated in EMP</td>
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<tr>
<td>Physical Cultural Resources (OP/BP 4.11)</td>
<td>- Archeological survey conducted along alignment</td>
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<tr>
<td></td>
<td>- Alignment alternatives to avoid cultural relics sites</td>
</tr>
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<td></td>
<td>- Chance procedures developed in EMP</td>
</tr>
<tr>
<td>Involuntary Resettlement (OP/BP 4.12)</td>
<td>- Resettlement Action Plan has been prepared</td>
</tr>
<tr>
<td>Indigenous Peoples (OP/BP 4.10)</td>
<td>- Social Assessment has been conducted</td>
</tr>
<tr>
<td></td>
<td>- Ethnic Minority Indigenous Plan has been developed</td>
</tr>
<tr>
<td>Consultation</td>
<td>- A combination of opinion surveys and public meetings were held during July 2010 – February 2011 in the township government, village committee and affected villagers’ homes during preparation of the EIA and Resettlement Action Plan and Ethnic Minority Plan</td>
</tr>
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</table>

**Project Description**

The project will construct a double-track, electrified, passenger-dedicated high-speed rail line capable of a maximum speed of 250 km/h of about 360 kilometers between the cities of Jilin and Hunchun in Jilin province. This line is an extension of the high speed Intercity Changchun-Jilin Railway currently under construction. Nine new railway stations will be constructed. The project consists of civil works; acquisition and installation of goods, maintenance equipment, and rolling stock; as well as land acquisition and the resettlement of displaced persons. The location, alignment and main technical characteristics of the railway line are presented in Figure 1.

The new line will substantially reduce the travel time between Jilin and cities of Yanji, Tumen and Hunchun. The current travel time between Jilin and Tumen (304km along the new alignment) is around seven hours and will be reduced to about two hours once the proposed Jilin-Tumen-Hunchun railway is under operation. The new line will offer a rapid link between the city of Jilin and Jilin’s far eastern cities of Yanji, Tumen and Hunchun and integrate this city cluster into the main high-speed rail network in China by connecting the railway lines in Changchun.

The existing mixed-use (freight and passenger) single track railway line between Jilin and Tumen (owned by CR) and Tumen and Hunchun (a local railway) follow an old alignment and are working to capacity. These lines are used for the transport of mainly coal, timber, grain, petroleum, cement and chemical fertilizer. About 10 pairs of passenger trains per day are also operated on these lines. As the majority of passenger trains will transfer to the proposed JiTuHun high speed line, the existing lines will be able to offer additional capacity for anticipated growth of freight traffic. Thus the capacity and service standards of both passenger and freight would be enhanced, enabling railways to compete effectively with passenger services offered by highways.
**JiTuHun Location and Alignment (bold-red line):** The Jilin-Tumen-Hunchun railway is located in the province of Jilin, starting from Jilin city and extending eastward through Changyi, Fengman, Longtan, Jiahe; then connecting Yanbian Prefecture’s Dunhua, Antu, Longjing, Yanji, Tumen and ending at Hunchun finally.

**Main Technical Specifications of the JiTuHun Railway**

- Length: 365km
- Maximum speed: 250 kilometer/hour
- Distance in center line of two tracks: 4.6 meter
- Minimum curve radius: 3,000 meter, may be reduced to 2,800m at difficult locations
- Maximum grade: 20 in 1000, generally 12 per 1000
- Effective length of departure track: 650 meter
- Traction: Electric 25 kilovolt, 50 Hertz, AT System
- Train type: Electric Multiple Units, 8 or 16 cars (409 tonnes and 1000 tonnes)
- Train operation control: Automatic (CTC 2)
- Traffic management control: Integrated Centralized Traffic Control
- Minimum headway between trains: Short run: 4 minutes. Long run: 3 minutes
- Track structure: Ballastless

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**Figure -01 JiTuHun Railway Line Location**
2. ENVIRONMENTAL SETTING

A necessary and important element of the EA was the baseline research that describes the physical, ecological, and social characteristics of the project area. The project area is rather complex, particularly from the socio-economic and ecological perspectives. A detailed environmental baseline was needed to highlight locations of highest potential impact. The JiTuHun Railway line will traverse a wide variety of ecosystems and landscapes from the flood plains of major rivers to steep and strikingly beautiful mountains. The line will traverse heavily populated (megacities) areas mainly at both ends of the line, as well as rural areas with dispersed populations and ethnic minority communities. These widespread variations of urban, rural and natural landscapes and social situations will require careful planning and supervision during construction and operation.

**Physical Setting**

**Landforms:** The project area belongs to the medium and low mountains of the Changbaishan Mountain, with valleys and basins distributed in between the mountains. From west to east, the line will traverse Songhua River alluvial plain, Laoyeling medium-low hills, Jiaohe basin, Weihuling medium-low hills, Dunhua basin, Harbalin low hills and Burhatong River valleys, Yanji basin, Burhatong River valley and Tumen River how hills, and Hunchun Basin.
Weather: The project area presents north Asian temperate zone continental monsoon characteristics. The project line passes through a frigid zone with a frozen depth of soil of about 1.7 to 1.9 meter and heavy snow in the winter. Frost prevention and ease of snow removal from the roadbed were therefore important design parameters.

Water Systems: The railway line crosses two major river systems: the Songhua River and Tumen River basins. Major rivers include Songhua River, Jiaohe River, Mudanjiang River, Gaya River, Burhatong River, Mijiang River, and Hunchun River.

Seismic and geology: The terrain is relatively flat and has low seismicity, the seismic peak ground acceleration being 0.05g except a few locations having peak ground acceleration of 0.10g. At such locations suitable precautions shall be taken in the design for safety against earthquake. Unfavorable geological conditions along the railway line are mainly found in the low hills at the edge of basin, including weak rock formations and slope, and weathering slopes. The project has either avoided these areas or designed adequate engineering structures and measures to cross them.

Ecological Environment

Reserves, Forest Parks, Scenic Areas, and Water Sources. Field surveys were conducted along the corridor to identify environmental sensitive areas. Although extensive effort has been made for alternative alignment selection in order to avoid environmental, social and cultural sensitive areas, the proposed final alignment will inevitably pass some reserves and drinking water resource protection area, as well as urban areas.

Rare Plants and Fauna Species of Concern. Plant species in the project alignment are mostly common species of mixed coniferous and broad leave ecosystem. There is no “ancient and old trees” under special protection in China found in the assessment area. Ecological survey shows that in the assessment area there are six types of national class II protected plants, i.e. red pine (*Pinus koraiensis*, 3538 trees), ash tree (*Fraxinus mandshurica*, 74 trees), Amur corktree (*Phellodendron amurense*, 20 trees), *Tilia amurensis* (39 trees), *Glycine soja* (55 trees), *Juglans mandshurica* (67 trees).

Fauna resources were studied through field survey and review of existing data from research institutes, nature reserve management authorities and other relevant local governments, as well as consultation with local villagers, forest guards, animal protection organizations and herb medicine collectors. Special studied have conducted to the Songhua River Sanhu (Three Lakes) Reserve, Qutu Mingyue Matsutake Nature Reserve and Hunchun Mijiang River Salmon Reserve. There are twenty types of national class II protected fauna, including 15 bird species and 5 animals, such as *Anthropoides virgo*, *Grus vipio*, *Cervus elaphus*, *Selenarctos thibetanus*, and *Tetrastes bonasia*, etc.

Socioeconomic Setting

The project will be constructed to link the city of Jilin and Yanbian Korean Autonomous Prefecture. Yanbian borders North Korea and Russia and is considered has a great potential for international trade and collaboration. However, Yanbian is economically underdeveloped with per capita GDP CNY17,357 Yuan in 2008, being only 77% of the national average. Yanbian has the largest Korean minority population in China, which account for 38% of the total in the prefecture. Upon screening and social assessment, two Korean minority villages within Jilin Municipality are considered as indigenous people as per OP4.10.

The project area has rich natural and tourism resources, in particular hydro resources. The Changbaishan Mountain, Songhua Lake, Korean minority culture, and Tumen River are major tourism attractiveness.

The regional traffic services by waterways, highways and airlines are comparatively lagging and constrained by extreme cold weather in the winters. The low level of rail service offered by the existing line in

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2 Ecological survey is conducted for corridor within 300m of both sides of alignment. GIS analysis is conducted for 10km wide corridor.
combination with relatively poor roadway infrastructure has for many years been a constraint to accessibility in the eastern region of Jilin Province. This poor accessibility is thought to contribute to the relatively low GDP per capita in the region of USD $2,641 (2009), which is 30 percent lower than the average for the province as a whole.

Physical Cultural Resources

A cultural relics survey was conducted along the project corridor through field survey, data review and consultation with local cultural relics authorities and the general public. Several sites were identified and taken into account the project alignment selection. As a result, two sites were avoided through alignment shift. However, the line will have to cross the construction control area for another two national level cultural relics, namely Maoershan Cemetery and Longtanshan Town. However, the alignment has avoided the found relics, and chance-find procedures have been developed in EMP. The state-of-the-art engineering design (bridge-tunnel-bridge) has been used to minimize the potential impacts on the sites.

Project Relationship to Potential Tiger Habitats

During EA preparation, specific attention is also paid to the potential habitat of tigers. Based on findings of recent Technical Report on the Identification of Potential Tiger Habitat in the Changbaishan Ecosystem, Northeast China (January 2010), a joint research by WWF, WCS, Northeast Normal University, KORA and the University of Montana, it can be concluded that: (i) the railway alignment is within a well developed transportation corridor with existing railway, expressway and local roads; (ii) the locations of tiger presence found in late 1990s survey are far from the proposed alignment; (iii) three types of modeling simulations in WWF report concluded that the current transport corridor is very unlikely (nearly zero possibility) to become potential tiger habitats given its intensive transport infrastructure, human activity and farmland dominant landscape; (iv) four recommended priority protection areas for potential tiger habitats are all fragmented by existing transportation corridors, within which the proposed railway alignment will not cause any further fragmentation of these potential habitats.

The key findings of WWF report is shown in Figure 3.

3 http://www.wwf.de/downloads/publikationsdatenbank/ddd/33661/
Figure 2 WWF Tiger Report: Existing transport corridor, Tiger presence found, Potential habitats modeling, and Priority protection areas recommendations
3. ASSESSMENT OF IMPACTS AND MITIGATION

As all transportation projects, the JiTuHun will have the potential to cause direct, indirect, or cumulative impacts to the social and natural environments. The JiTuHun is anticipated to enhance the economic mobility and accessibility to labor and freight market in north-east China. However, the proposed project involves large scale of civil works, which may potentially cause significant social and environmental impacts, especially during construction. Mitigation measures have been developed in the EMP and RAP to address these potential impacts, which are primarily related to: (i) crossing sensitive sites such as nature reserves, the vicinity of sites with cultural resources, water resource protection areas.; (ii) community impacts such as land acquisition and resettlement; (iii) noise, dust, soil erosion and social disturbance during construction; (iv) noise, safety and community connectivity during construction and operation. In summary, MOR adopted a three-fold approach to minimize environmental and social impacts:

- **Avoidance.** Alternative analysis has been carefully conducted to avoid the environmental and social sensitive areas to the extent possible, as one of the most important mitigation measures to minimize potential adverse environmental and social impact. The selected alignment led to reduced house and structure demolition, especially in urban areas, and has avoided a number of sensitive sites including nature reserves and cultural heritage sites.

- **Sound Engineering.** The project has been designed with state-of-the art engineering. Bridge-tunnel-bridge schemes are adopted for more than 66% of the whole alignment (about 24% for large and medium bridges and 42% for tunnels) will minimize land acquisition and ecological footprint.

- **Comprehensive Mitigation Plans.** Detailed environmental design plans (green corridors and landscaping), environmental management plans, resettlement action plans have been prepared in order to minimize and/or compensate unavoidable impacts from the project.

**Analysis of Alternatives**

The process of alignment selection has been perhaps the most important means to minimize adverse environmental impacts from this project. The selection of the optimal alignment and location of terminals has taken into account the technical, economic and environmental aspects and concerns that were raised by project stakeholders during consultations. An important restriction for the selection of the alignment has been the need for connecting economic hubs along the railway line. These include Jilin, Changyi, Fengman, Longtan, Jiaohe, Dunhua, Antu, Longjing, Yanji, Tumen and Hunchun. As stations are needed in each economic hub, it was a challenge to reach an optimal compatibility of rout selection and location of stations.

There are a number of environmentally sensitive sites identified in the vicinity of the project corridor during EA preparation, including 9 nature reserves, scenic area and forest parks, 3 cultural relics sites and 5 water resource protection areas. Alternatives have been studied and carefully selected to avoid 10 of these sensitive sites. Table-2 summarizes the information, location with the alignment and the form of impact of these sensitive areas that have been considered during the project EA study.
Table 2– Sensitive Areas along the Project Corridor

<table>
<thead>
<tr>
<th>Name</th>
<th>Protection Objects</th>
<th>Location and Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Songhua River Three-lake Nature Reserve (Provincial Level)</td>
<td>Forest ecology and water resources</td>
<td>40.5 km of the railway line will cross the reserve through subgrade (12.6km), bridges (8.6 km) and tunnels(19.3 km).</td>
</tr>
<tr>
<td>Antu Mingyue Pine-mushroom Protection Area (County level)</td>
<td>Pine-mushroom (matsutake)</td>
<td>41.3 km of the railway line will cross the reserve through subgrade (12.9km), bridges (6.1 km), and tunnels (22.3km)</td>
</tr>
<tr>
<td>Mijiang Salmon Resources Protection Area (national level)</td>
<td>Migrating fish species including salmon etc.</td>
<td>0.77 km of the railway line will cross the Mijiang in the form of a bridge</td>
</tr>
<tr>
<td>Jilin City Songhua River Water Source Class II Protection Zone</td>
<td>Drinking water resources</td>
<td>0.89 km of the railway line will cross the Mijiang in the form of bridge</td>
</tr>
<tr>
<td>Jiaohe City Water Source Protection Area</td>
<td>Drinking water resources</td>
<td>11.7 km of the railway line will cross the para-protection area of the Protection Area through subgrade, bridges, and tunnels.</td>
</tr>
<tr>
<td>Longtanshan Town (national level)</td>
<td>Relics of Han Dynasty and Gaogouli Culture</td>
<td>2.3 km of the railway line will cross the development control area in between the two relics sites, in the form of bridge (0.67km) and tunnel (1.62km).</td>
</tr>
<tr>
<td>Maoershan Cemetery (national level)</td>
<td>Ancient tombs and relics of Han Dynasty</td>
<td>2.25 km of the railway line will cross the park through a tunnel according to the Feasibility Study. After detailed design stage, the alignment has been fine tuned to avoid crossing the park.</td>
</tr>
<tr>
<td>Riguangshan Forest Park (Provincial level)</td>
<td>Forests and landscape resources</td>
<td>20 km of the railway line will cross the south periphery area of the South Zhangguangailing.</td>
</tr>
<tr>
<td>South Zhangguangailing – potential tiger habitat</td>
<td>Ecology</td>
<td>Avoided. 2.1 km away nearest.</td>
</tr>
<tr>
<td>Songhua Lake Scenic Area (National level)</td>
<td>Songhua Lake</td>
<td>Avoided. 0.8 km away nearest.</td>
</tr>
<tr>
<td>Lafashan Forest Park (National Level)</td>
<td>Forest and landscape resources</td>
<td>Avoided. 1.17 km away nearest.</td>
</tr>
<tr>
<td>Huannihe Dalazi Forest Park (Provincial Level)</td>
<td>Drinking water resources</td>
<td>Avoided. 4km away nearest.</td>
</tr>
<tr>
<td>Liudingshan Nature Reserve and Forest Park (County level)</td>
<td>Forests and landscape resources</td>
<td>Avoided. 2.9km away nearest.</td>
</tr>
<tr>
<td>Dunhua Drinking Water Source Area</td>
<td>Drinking water resources</td>
<td>Avoided. 2.9km away from the development control area</td>
</tr>
<tr>
<td>Mopanshan Town</td>
<td>National level cultural relics of the Tang Dynasty</td>
<td>Avoided. 2.9km away from the development control area</td>
</tr>
<tr>
<td>Hunchun Chengdong Water Source Area</td>
<td>Drinking water resources</td>
<td>Avoided. 1.2km away nearest.</td>
</tr>
</tbody>
</table>
Figure 3: JiTu Hun Railway Alignment, Alternative Alignments and Environmental Sensitive Sites
**Crossing Sensitive Areas**

Although, alternatives have been carefully studied and selected to avoid most of these sensitive sites, the final alignment will still go through the following natural reserves and good engineering designs had been adopted:

- One section of the alignment will go through Songhuajiang Three-lake Nature Reserve close to the edge of the reserve but far from the core three lakes area (over 15km). Along this section, there are mainly farmlands and planted and secondary forests, with active human development (existing railway, national road G302 and provincial/county roads). There is no natural habitat for endemic or protected wildlife along the alignment.

- The alignment within Antu Mingyue Pine-mushroom Reserve goes along the Buerhadong river valley, where existing Chang-Tu railway, national road G302, provincial/county roads and Antu county are all within the boundary of the reserve. The alignment area is mainly farmland and residential built-up area, far from the protected red-pine forests (over 5-10km).

- For Mijiang Salmon Resource Protected Area (an important salmon migratory channel), the alignment will cross the river surface via Mijiang Extra-long Bridge, with a particular 48m long-span beam (instead of regular 32m beam) crossing the water surface to avoid the in-water pier during migratory season.

- For Jinlin City Water Source Protection Area, the alignment will cross the Songhuajiang River in the city center (where is classified as Class II protection zone) next to an existing railway bridge, about 2 km from the downstream water-intake.

- For Jiaohe City Water Source Protection Area, the alignment goes through the semi-protected terrestrial area (outside the buffer zone), and 5km away from the water source.

- For Longtianshan relic site and Maorshan Cemetery, the alignment will traverse through the outer buffer-zone (Construction Control Zone) mainly via tunnel and long bridges, far away from the core protected zones. The potential impact is limited, and proper chance-find procedures have been included in the EMP.

Based on comprehensive analysis for these specific sensitive sites, and close consultation with relevant authorities, it is concluded that the railway’s impact on these sensitive sites is not significant, and can be well avoided, minimized and mitigated with proper engineering design and mitigation measures in the environmental management plan.
**Box 1 - Crossing Songhua River Three-lake Provincial Level Nature Reserve**

**Baseline Data.** The Songhua River Three-lake Provincial Level NR includes the Songhua Lake, Hongshi Lake, Baishan Lake and the Songhua River sections linking the three lakes, and adjacent land area. The Three-lake Provincial Level NR covers 1,144,710 ha and encapsulates Songhua Lake Scenic Area and Songhua River Three-lake National Level NR (115,253ha). The proposed railway line, constrained by terrain conditions and the necessity to locate Jiaohe West Station, will have to cross the distant-lake, namely periphery, area of the Provincial Level NR and is 2.5 km away from the Scenic Area and 15 km away from the National Level NR nearest. While the NR serves well the forest ecosystem.

**Impact Analysis.** 40.5 km of the railway line will cross the reserve 3 times, in the form of subgrade (12.6km), bridges (13 bridges totaling 8.6 km) and tunnels (10 tunnels totaling 19.3 km) and 1 railway station (Jiaohe West Station). A dedicated biodiversity impact assessment was conducted, taking into account ecological system, habitats, species, key protection objects, bio-safety and stakeholder considerations. Results show the negative impacts will be small overall. However, construction will cause permanent land occupation, vegetation clearance, disturbance to wildlife, and other typical impacts including wastewater, gas, noise, solid waste etc.

**Mitigation Measures.** Tunnel-Bridge-Tunnel scheme was incorporated into the engineering design as much as possible to minimize land occupation and impacts to habitats connectivity. In total, 69% of the railway section will be tunnels and bridges. Rare plants will be relocated prior to the commencement of construction. Consultation with NR administrative authority was carried out during EA preparation and advices and approvals obtained. Timely reclamation, revegetation and restoration of disturbed sites will be conducted. Other mitigation measures such as fencing, code of contractor conduct, waste control, soil erosion control, dust control, education and awareness raising will be implemented.
**Baseline data** The protection zone covers 6,610ha, aiming to protect mainly migrating salmon fish species, migrating channel, spawning sites and their habitats. Due to terrain constraints, the railway line will have to cross the Mijiang River in the form a bridge. The alignment will cross the river almost perpendicularly. The cross section is about 30 meters in width in dry season, and 100 meters in flooding season. There is no station, borrow pits or disposal sites within the protection zone.

**Impact Analysis.** A dedicated impact assessment was conducted to evaluate the potential impacts of bridge construction and operation on the fish migration and habitats. It is found that the Mijiang River is the only migrating channel for the migrating fish species, the river be has not been damaged, the water quality, velocity, and amount in combination is ideal for the fish spawning. The bridge construction will have the potential to occupy river area, change currents, disturb the river bed, causing waste, noise and vibration, which all may negatively affect the fish migration, movement and spawning.

**Mitigation Measures.** It is proposed that a long arch, instead of building pier(s) in the river, to be used for the bridge design to avoid substantially disturb the river area and current. Construction activities will be restricted outside the water surface to minimize impact on migratory channel. Construction techniques should be carefully selected and operated to avoid or minimize impacts. Waste discharge into the river should be strictly prohibited. Timely site cleanup upon construction completion should be followed. A comprehensive monitoring and control plan has been prepared, including emergency conservation and fish monitoring plans. A compensation plan that will provide budget (CNY 6.2 million) for migrating channel restoration, fish reproduction facilities and operation, long-term monitoring has also been prepared and agreed upon with the protection area authority. Consultation with the Ministry of Agriculture was carried out and approvals obtained in August, 2010.
Box 3 – Crossing Longtanshan and Maoershan Relics

Baseline data. Maoershan Cemetery (15 km², lower light green area) and Longtanshan Town (upper light green area) are located in the east of the 2nd Songhua River that flows through Jilin City. They both present relics of Fuyu and Gaogouli cultures and are national key cultural relics unit. Maoershan Cemetery is the center of a group of relics that present similar culture characteristics.

Impact Analysis. The railway line will cross the development control area (darker green area) in between the two relics’ protection areas in the form of bridges (670m) and a tunnel (1.62km). Relics surveys have been conducted to the areas to be traversed in the past decades. Though there are no above-ground relics found, it is still likely that underground relics exist. Construction will have the potential to impact the underground relics, the integrity of the landscape and cultural values, and future research efforts.

Mitigation Measures. According to People’s Republic of China Cultural Relics Protection Law, construction in the development control area should be approval from relevant authorities. The China National Cultural Relics Administration has approved that the railway line crosses the area in the form of bridge and tunnel. Mitigation measures include: field investigation will be conducted by cultural relics authority prior to construction. Construction activities will be strictly limited within prescribed boundary, no borrow pits or disposal sites or camps are allowed in the area. Low-vibration machinery should be used to the extent possible. Chance-find procedure will apply.
**Box 4 - Crossing Antu Mingyue Pine Mushroom Reserve**

**Baseline Data.** The Mingyue Pine Mushroom Reserve is located in Antu county of Yanbian Prefecture. It covers an area of 120,000 ha, with the main protective objects being pine mushroom. The proposed railway line will have to set Antu station which is an important economic hub. Since the entire Antu core area is encompassed the Reserve. The railway line cannot avoid passing through the Reserve.

**Impact Analysis.** 41.3 km of the railway line will cross the reserve in the form of subgrade(11.4 km), bridges (13 bridges totaling 6.1 km) and tunnels (17.5 tunnels totaling 22.9 km) and 1 railway station (Antu West Station). A dedicated biodiversity impact assessment was conducted, taking into account ecological system, habitats, species, key protection objects, bio-safety and stakeholder considerations. Results show the negative impacts will be small overall. However, construction will cause permanent land occupation, vegetation clearance, disturbance to wildlife, and other typical impacts including wastewater, gas, noise, solid waste etc.

**Mitigation Measures.** Tunnel-Bridge-Tunnel scheme was incorporated into the engineering design as much as possible to minimize land occupation and impacts to habitats connectivity. In total, 68.8% of the railway section will be tunnels and bridges. Consultation with NR administrative authority was carried out during EA preparation and advices and approvals obtained. Timely reclamation, revegetation and restoration of disturbed sites will be conducted. Other mitigation measures such as fencing, code of contractor conduct, waste control, soil erosion control, dust control, education and awareness raising will be implemented.
Box 5 – Crossing Drinking Water Sources Protection Area

Baseline data. The railway line will cross the 2nd Songhua River through a bridge. The river cross-section to be crossed belongs to Class II drinking water source protection area for Jilin City. The bridge site will be 0.17 km away from the nearest upstream water plant intake and 2.03 km away from the nearest downstream intake (red dot).

Impact Analysis. Pier building will disturb the water body and increase turbidity, affecting downstream water intake. Waste generated in the construction field, if discharged into the river, will pollute the water quality.

Mitigation Measures. Consultation with Jilin Municipal Government has been carried out regarding cross the river, and approval obtained accordingly. The following measures should be taken to avoid or minimize contamination to the river quality. Submersible pier foundation building should use steel weir to prevent leakage of wastewater. Construction and domestic wastewater must not be discharged into the river. During bridge building, it is not allowed to pile materials, open borrow pits or disposal sites within the river dikes. Spoils and wastes should be cleaned up timely. Revegetation should be should be implemented timely. Education and awareness raising campaigns should be implemented. Strengthen supervision and management during operation. Prepare emergency response plan for water sources protection.

Community Impacts
Community impacts are mainly related with (i) land acquisition, relocation of houses, and livelihood impacts; (ii) impacts on ethnic minorities; (iii) impacts on community infrastructure; (iv) noise and vibration impacts; and (v) safety and connectivity especially in rural areas; and (iv) nuisances from construction.

**Land Acquisition and Resettlement Impacts.** An estimated 1,138 ha (17,069 mu) of land, including 1,114 ha (16,718 mu) of collective land, are to be permanently acquired and about 808 ha (12,032 mu) are to be temporarily acquired. The project will relocate an estimated 4,221 households with 12,913 people, including 3,192 urban households, 35 enterprises with 1,167 persons, 30 shops and one school. The total affected population is estimated at 19,452 persons. A Resettlement Plan (RP) has been prepared including a Resettlement Plan Framework (RPF) for resettlement related activities which are not clear at preparation stage (such as camp sites and access roads), following the national requirement and OP4.12.

Urban resettlement will be critical for the project. Rail stations close to urban areas will result in extensive resettlement at the following sites: Jilin, Dunhua, Antu, Tumen and Yanji. Urban resettlement should include impact investigation, compensation rate justification, but also proper restoration schemes. Since rural resettlement relies more on social security programs as a important measure in livelihood restoration, the RP should include a chapter to reflect the social security program approach in each county/district.

Land compensation rates will follow the latest regulation of land compensation and are displayed in the RP. Rural house will be compensated according to replacement cost while urban structure will be paid based on professional evaluation in reference with market price. All households will also obtain resettlement allowance and relocation subsidies. Compensation for enterprises and shops will be based on professional evaluation including economic loss due to the relocation. School compensation will base the budget of the new school design. Infrastructure will be paid according to restoration plan conducted by contractors under consultation with the affected villages/communities.

Rural houses will be restored near the original villages with residential land and public facilities provided by villages, and two new resettlement sites will be prepared for 73 relocated households while other households chose scattered relocation. Urban households will purchase their houses with enough compensation or house replacement, and only 639 households chose house replacement.

There is no villages losing more than 20 percent of the total land, so the main restoration measures rely on cash compensation, with other assistant measures like land readjustment within village group, employment training. Enterprises, shops and school can be restored with the replacement cost.

**Indigenous People.** A Social Assessment was prepared by the Central Minority University, and concluded that the two Korean villages in Jiaohe County are located 3.8 km and 4.8 km away from the alignment. In accordance with OP 4.10 an Minority Development Plan was prepared by the Central Minority University.

**Noise and Vibration Impacts.** The construction and operation of the JiTuHun have the potential to increase noise and ground-borne vibration in nearby sensitive land uses. Such increases can cause undesirable effects on people, animals, and structures. The principal source of existing noise in urban areas is vehicular traffic. In most of the corridor, adjacent land uses are exposed to very low to moderate noise levels.

Chinese specified models (TJH 2010 Revision, No. 44 Document) for noise and vibration impact criteria were used to assess impacts at sensitive sites near the proposed alignments. The assessment identified 107 current and 71 short-term noise sensitive points, and 76 current vibration sensitive points. Current noise level monitoring has been conducted for all sensitive sites.

Noise and vibration pollution control measures (noise barriers, encasing bridges, strengthening of glass windows, etc.) have been identified in all critical sensitive points along the line. These measures will be complemented with Right-of-Way zoning restrictions which will be enforced by townships and cities. These measures have been incorporated in project design and budget.
Safety and Community Severance. Urban master plans as well as environmental protection plans for all cities and counties were carefully studied to determine the railway alignment. For major cities such as Jilin and Yanji, alternatives were thoroughly compared in terms of compatibility with existing urban planning. In addition, intensive consultation with local governments was carried out thus the final selection and determination of alignment and station locations are fully compatible with urban planning and supported by local governments.

Safety is a major concern for the operation of high-speed railway line. In this regards, the JiTuHun railway line will be fully fenced to restrict random access of pedestrians, animals, or vehicles to the railway tracks. This will effectively minimize the potential accidents of random railway crossing.

Impacts from a fully-fenced operation of the line -cross traffic and social severance- were fully considered during project design. All local road crossings are designed with interchanges. A total of 29 road viaduct and more than 278 culverts are designed, in close consultation with local communities. With these designs, the impact on local traffic, community severance, and agricultural irrigation systems will be effectively minimized.

Construction Impacts

Construction of the JiTuHun will cause temporary impacts to the surrounding environment. Typical short-term construction impacts could include noise, vibration, air quality, and water quality. If properly planned, construction impacts to neighborhoods, businesses, and the natural environment can be minimized. Several aspects of construction have been received special attention such access roads, disposal of excess material from tunnel construction, and management of camps. A comprehensive Soil Erosion Control Plan, as required by Chinese regulations, has been prepared and will address all erosion, stability and restoration issues associated with earth cuts, disposal sites, embankments and affected areas in general.

Access Roads Access roads will be required to provide access to the construction sites, tunnel entrances and exits, borrow pits, construction camps, waste disposal areas, mix plants, casting yards, etc. Existing rural road networks will be improved, particularly in sensitive areas. As a result, in total 212.1 km rural roads will be rehabilitated or strengthened, and 202.1 km new access roads will be built. Therefore, access roads will require careful design and construction in order to avoid typical impacts of roads such as soil erosion, slope stability problems, pedestrian safety, among many others.

A framework for dealing with new access roads will be part of bidding documents and contracts. The framework includes procedures and decision making criteria regarding new access roads that are identified during construction. Basic elements of the framework include:

- Contractors shall use existing roads as much as possible. Existing roads will be rehabilitated to meet MOR design standards, including erosion control, slope stabilization.
- After construction, all roads will be rehabilitated for community use. No new access roads will be approved in or through protected areas.
- Any new access road proposed by contractors will have to be reviewed and approved by the environmental supervision team of MOR.

Borrow Pits and Disposal Sites The project will generate significant amounts of excess material from tunnel construction even after using portions for construction purposes (embankment, base and sub-base). 78 borrow pits and 109 disposal sites have already identified. All sites were screened for environmental and social issues (not in protected areas, not in scenic areas, not on flood plains, unstable areas) and mitigation measures identified. As a result, 28 borrow pits and 27 disposal sites have been relocated. These criteria will be strictly enforced during construction. All sites will be enclosed with retaining wall, proper drainage and re-vegetated.
**Tunnel Works.** 85 tunnels totaling 155km will be constructed. Construction of tunnels will entail destruction of vegetation due to excavation of tunnel portals, large amounts of spoils, tunnel dewatering, and lowering local groundwater table. The potential impact from each tunnel has been assessed and mitigation and monitoring programs have been designed, including prior forecast, sealing with limited discharge, provision of back-up water sources for relevant communities. Groundwater levels and water supply systems will be closely monitored and budget for remedial actions has been included in project costs.

**Camps Locations and Management** The number and location of camps are not known yet. It will depend on Contractors’ plans to manage their contracts and construction. Criteria for camp location have been identified and will be strictly enforced (scenic areas, sensitive areas, near vulnerable minority groups). Camp specifications include the type of facilities (adequate accommodations, water supply and sanitation, cooking facilities.) and the need for education and sensitivity programs on natural habitats, ethnic minorities and health.

**Induced and Cumulative Impacts**

The railway will provide excellent opportunities for local development such as local business trade, transportation and construction, especially around the terminals. Without planning, these changes could bring about congestion, increased waste and pollution, and threats to cultural resources. Impacts on large urban centers will be less significant since they will easily absorb these changes. Throughout the project feasibility study, MOR has maintained extensive dialogue with local governments who provided official decision and approval of the alignment and terminal locations. Alignment and location of terminals in urban areas meet restrictions and objectives of urban land use, and are consistent with urban master plans. Therefore, the induced development will be fully incorporated into the urban planning and management.

**5. ENVIRONMENTAL MANAGEMENT PLAN**

A detailed Environmental Management Plan (EMP) addressing all issues identified in the EIA (i) organizes all measures to mitigate environmental impacts during the construction and operation; and (ii) establishes an organizational structure, procedures, institutional responsibilities for implementation, and a budget and source of financing for each activity. The EMP also includes environmental monitoring and capacity building programs. Main components of the EMP are:

- **Environmental protection measures in design stage:** mitigation measures have been incorporated in project design: slope stabilization, noise reduction, landscaping, and special design of terminals.
- **Environmental protection measures during construction:** these include: additional surveys (cultural resources), environmental specifications for construction, camp management, restoration of affected areas, access roads and disposal sites
- **Environmental protection measures during operation:** mainly monitoring programs.

In addition to the project-specific mitigation measures included in the EIA and EMP, project design and construction of the GRL are also subject to a wide range of domestic laws, regulation, technical guidelines and codes of practice in China, which by default are legal requirement for project design and construction management. These include (i) Environmental Protection Regulations for Railway; (ii) Environmental Supervision Regulations for Railway, Implementation; (iii) Guidelines for Environmental Protection Plan for Railway.; and (iv) a wide range of standard and codes such as Design Code for Environmental Protection in Railway Projects (TB10501-98), Environment and Hygiene Standards for Construction Site (JGJ146-2004), Management Regulations for Construction Sites, Safety Rules for Construction Projects, Environmental Acceptance Rules for Railway Project Completion Inspection.
Mitigation Measures. A set of comprehensive mitigation measures has been included in the EMP. Most of the construction management measures will be included in the construction contracts. While, a number of measures warrant specific design and budget to ensure effective implementation. These mainly include:

- Ecological conservation: measures to minimize soil erosion in construction sites, borrow/disposal areas, access roads and camps, extensive re-vegetation measures for slope protection, disposal/borrow sites reclamation/restoration and corridor greening, measures for nature reserve impact mitigation, compensation and management enhancement (e.g. Mijiang Salmon Fish Protection Area), etc.
- Noise and vibration control: Noise barriers totaling 33,600m at 56 sensitive sites, and 15 noise-insulation windows at 15 households total 1060m², and resettlement of 710 households prone to noise impact.
- Wastewater treatment: wastewater treatment facilities for all the railway stations and facilities.
- Electromagnetic impact control: Compensation budget reserved for cable TV installation for affected communities.
- Solid waste disposal: solid waste collection and disposal facilities of the railway stations and related facilities.
- Air pollution control: air pollution control facilities for heating system in railway stations and related facilities.

Management Organization and Responsibilities. Environment management responsibilities have been defined. Environmental management during construction involves the Project Office of JiTuHun Railway Corporation, Contractors and Environmental Supervision Engineers (Figure 3). During operation, environmental management responsibilities will rest with JiTuHun Railway Corporation.

Environmental Monitoring. Comprehensive environmental monitoring programs have been designed for both construction and operation phases. Monitoring includes water quality, noise, hydrology, construction dust and noise, as well as soil erosion and vegetation restoration. The Project Office will entrust environmental monitoring stations to carry out these plans. During operation, environmental monitoring will be carried out by provincial and prefecture (municipal) environmental protection bureaus, forestry bureaus,
and water conservancy bureaus, which will be responsible for submitting the annual report on environmental management and for compiling the reports of environmental monitoring.

All personnel of the Project Office Environment Protection Section and construction workers will receive environmental training at least one time before commencement of construction. Key environmental administrative and monitoring personnel will also go through technical training provided by the project.

**Environmental Supervision.** During construction, environmental supervision shall be carried out by qualified supervision unit reporting to the Project Office of the JiTuHun Railway Corporation. Each Supervision Engineer company will be required by contract to assign one Environmental Supervision Engineer. The Environmental Supervision Engineers will:

- Review and assess on behalf of the Project Office whether the construction design meets the requirements of the mitigation and management measures of the EIA and EMP,
- Supervise site environmental management system of contractors including their performance, experience and handling of site environmental issues, and provide corrective instructions;
- Review the EMP implementation by the contractors and subcontractors, verify and confirm environmental supervision procedures, parameters, monitoring locations, equipment and results;
- Report EMP implementation status to Project Office and prepare the environmental supervision statement during the construction period; and
- Approve invoices or payments.

**Independent Environmental Consultant (IEC).** The Project Office of the JiTuHun Railway Corporation will recruit an Independent Environmental Consultant (IEC) to conduct independent supervision on implementation of EMP. The lead IEC shall be a person who can independently and professionally examine records, procedures and processes. He she may require a small team to assist he/she with checking the site (i.e. the IEC team). The IEC shall have extensive knowledge and experience in environmental monitoring and auditing to provide independent, objective and professional advice on the environmental performance of the project (at least 5 years experience is required). The IEC shall familiarize himself with the project works through review of the reports, including the project EMP. In particular, the IEC is expected to perform the following duties:

1. Review and audit in an independent, objective and professional manner in all aspects of the EMP;
2. Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers;
3. Carry out random sample check and audit on monitoring data and sampling procedures, etc;
4. Conduct random site inspection;
5. Audit the EIA recommendations and requirement against the status of implementation of environmental protection measures;
6. Review the effectiveness of environmental mitigation measures and project environmental performance;
7. On a need basis, verify and certify the environmental acceptability of the construction methodology (both temporary and permanent works), relevant design plans and submissions. Where necessary, the IEC shall seek the least impact alternative in consultation with the designer, the Contractor(s), and Project Office;
8. Verify the investigation results of any non-compliance of the environmental performance and the effectiveness of corrective measures; and
9. Feedback audit results to Project Office and ESE team according to EMP procedures of non-compliance in the EMP, and provide Supervision Engineer (SE) suggests on actions of penalty, suspension or other punishment;
③ Provide environmental training to the Contractors, Environmental Supervision Engineers (ESE) and the Project Office staff prior to and during construction;
③ Prepare quarterly report to the Project Office, MOR and the World Bank.
6. PUBLIC CONSULTATION AND DISCLOSURE

During the EA and RAP preparation, public consultations were conducted in accordance with the Bank’s OP4.01 and OP4.12, through a combination of opinion surveys and public meetings in the city, townships and villages. Stakeholders such as local authorities, civil society, and the affected population were consulted through diverse ways of newspaper, meetings, and focus groups on land acquisition matters. Local governments were consulted on the alignment of the railway line and location of stations. Management authorities for affected nature reserves, cultural resources and water source protection areas were consulted for agreement and proper mitigation measures. All the affected villages are informed, investigated and consulted. Public concerns raised during the consultation have been incorporated in project design, the EMP and RAP.

The EMP and RAP have been disclosed in accordance with the Bank’s policy and will be sent to the InfoSHOP prior to project appraisal. Information disclosure of EA preparation has been carried out by posting posters and bulletins in townships and villages, local newspapers (Yanbian Daily, Jiangcheng Daily) and through the internet (www.rails.com.cn). The draft EIA document was disclosed in local environmental protection bureaus, railway administrative offices in October 2010, and a publically accessible internet website (www.cec-cn.com.cn) on February 11, 2011. Information disclosure on project land acquisition and resettlement was distributed in the affected villages and communities during the resettlement impact investigation and planning process.
7. EMP BUDGET

All mitigation measures have been budgeted and fully incorporated in project costs including monitoring and supervision.

The gross investment for environmental protection is RMB 696,668,900 Yuan, accounting for 1.72% of the total project investment. The estimated gross investment of environmental protection of this project is shown in Table 3.

Table 3 - Investment Estimate of Environmental Protection Measures

<table>
<thead>
<tr>
<th>Item</th>
<th>Design</th>
<th>EIA recommended</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological Conservation</td>
<td>428,131,700</td>
<td>+9,611,200</td>
<td>437,742,900</td>
</tr>
<tr>
<td>Noise Control</td>
<td>105,826,500</td>
<td>+148,742,000</td>
<td>254,568,500</td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>3,300,000</td>
<td>0</td>
<td>3,300,000</td>
</tr>
<tr>
<td>Electromagnetic Control</td>
<td>440,000</td>
<td>-15,500</td>
<td>424,500</td>
</tr>
<tr>
<td>Solid Waste Disposal</td>
<td>400,000</td>
<td>0</td>
<td>400,000</td>
</tr>
<tr>
<td>Air Pollution Control</td>
<td>208,000</td>
<td>+25,000</td>
<td>233,000</td>
</tr>
<tr>
<td>Total</td>
<td>538,306,200</td>
<td>158,362,700</td>
<td>696,668,900</td>
</tr>
</tbody>
</table>

Unit: Yuan RMB