Sichuan Urban Environment Project (SUEP)

ENVIRONMENTAL ASSESSMENT
Volume 1 Executive Summary

December 1998

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<table>
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<th>Definition</th>
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<tr>
<td>AIC</td>
<td>Average Incremental Cost</td>
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<tr>
<td>BOD</td>
<td>Biochemical Oxygen Demand</td>
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<tr>
<td>BMP</td>
<td>Best Management Practice</td>
</tr>
<tr>
<td>COD</td>
<td>Chemical Oxygen Demand</td>
</tr>
<tr>
<td>dBA</td>
<td>Decibels (noise level)</td>
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<tr>
<td>DFID</td>
<td>Department for International Development</td>
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<tr>
<td>EA</td>
<td>Environmental Assessment</td>
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<tr>
<td>EIRR</td>
<td>Economic Internal Rate of Return</td>
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<td>EPB</td>
<td>Environment Protection Bureau</td>
</tr>
<tr>
<td>EPO</td>
<td>Environment Protection Officers</td>
</tr>
<tr>
<td>ERI</td>
<td>Environmental Research Institute</td>
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<tr>
<td>FIRR</td>
<td>Financial Internal Rate of Return</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GVIO</td>
<td>Gross Value of Industrial Output</td>
</tr>
<tr>
<td>Ha</td>
<td>Hectare</td>
</tr>
<tr>
<td>hh</td>
<td>Household</td>
</tr>
<tr>
<td>IMR</td>
<td>Infant Mortality Rate</td>
</tr>
<tr>
<td>m³/s</td>
<td>cubic metres per second</td>
</tr>
<tr>
<td>m³/d</td>
<td>cubic metres per day</td>
</tr>
<tr>
<td>m³/h</td>
<td>cubic metre per hour</td>
</tr>
<tr>
<td>M&amp;E</td>
<td>mechanical and electrical</td>
</tr>
<tr>
<td>ML/d</td>
<td>mega litres per day</td>
</tr>
<tr>
<td>MM</td>
<td>Mott MacDonald</td>
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<tr>
<td>MSW</td>
<td>municipal solid waste</td>
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<tr>
<td>OVI</td>
<td>Objectively Verifiable Indicators</td>
</tr>
<tr>
<td>PAC</td>
<td>Poly-aluminium Chloride</td>
</tr>
<tr>
<td>PAM</td>
<td>Poly-acrylamide</td>
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<tr>
<td>PC</td>
<td>Project Component</td>
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<td>RAP</td>
<td>Resettlement Action Plan</td>
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<td>SPG</td>
<td>Sichuan Provinicial Government</td>
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<td>Sichuan Urban Environment Project Office</td>
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<td>SWMEDRIC</td>
<td>South West Municipal Engineering Design and Research Institute of China</td>
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<tr>
<td>ToR</td>
<td>Terms of Reference</td>
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<tr>
<td>t/a</td>
<td>tonnes per annum</td>
</tr>
<tr>
<td>t/d</td>
<td>tonnes per day</td>
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<tr>
<td>TVE</td>
<td>Township and Village Enterprises</td>
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<tr>
<td>WB</td>
<td>World Bank</td>
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<tr>
<td>WTP</td>
<td>Willingness to Pay</td>
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<td>WTW</td>
<td>Water Treatment Works</td>
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<td>WwTW</td>
<td>Wastewater Treatment Works</td>
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<td>WYR</td>
<td>Western Yangtze Region</td>
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Appendix B. Approaches to Water and Wastewater Treatment
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   B-2. Wastewater Treatment


Appendix D. Relevant National and Provincial Regulations and Standards
EXECUTIVE SUMMARY

The Environmental Assessment of the Sichuan Urban Environment Project
This report provides a summary of the Environmental Assessment Report – Main Report and Appendices. This latter report covers the assessment of the environment impacts of the project components to be developed under the Sichuan Urban Environment Project. It has been prepared by the Sichuan Research and Monitoring Institute of Environment Protection with the assistance of Mott MacDonald, consulting engineers.

Sichuan Province Overview
Sichuan Province, located in the south-west of China, is the third most populous province with over 82 million people over an area of about 385,000 km². The province had been the most populated province until the spring of 1997 when Chongqing and the surrounding area were given provincial status. Sichuan Province is land-locked, approximately 1500 km from the sea and shares its borders with 8 provinces - Qinghai, Gansu and Shaanxi to the north, Hubei and Hunan to the east, Guizhou and Yunnan to the south and Xizang (Tibet) to the west.

The topography of Sichuan Province consists mainly of mountains and plateaux and can be geographically divided into the eastern basin area, the western plateau and the mountain area. About 95% of the population lives in the basin area. The capital of Sichuan Province is Chengdu, located in the portion of the basin area known as the Chengdu plain, often referred to as "the land of plenty". Chengdu plain's level terrain, fertile land, plentiful rainfall and temperate climate combined with established irrigation systems such as the Dujiangyan Irrigation Scheme all contribute to the area's agricultural abundance. The western half of the province is dominated by the Himalayan Mountains, with an average altitude of 3,000 m, which peaks at 7,500 m at the Gongshan Shan massif located in the southwestern area of the province.

Although the Sichuan Province is surrounded by various mountain systems, the project cities tend to be located along waterways in rolling terrain. The Chengdu plain watercourses are fed by the Dujiangyan diversion works on the Min River at about elevation 700m. The main agricultural areas in the upper plain are from 400 to 600m elevation. All project cities are located in the semi-tropical monsoon climate zone, and its climate is mild and wet. There is only a minor variation in climate from the southern city of Luzhou to the northern cities of Chengdu and Deyang.

SUEP Project and Components

In order to fully solve the pollution problems in Sichuan province major works will need to be developed for most of the cities in the province. It is not possible to finance all necessary works in one step. It is therefore foreseen that the SUEP will continue over many years with several phases. The present project is seen therefore to be Phase 1 of this longer-term programme.

In accordance with the national World Bank (WB) policies and priorities, the Sichuan Provincial Government (SPG) has requested WB and bi-lateral donor support for the Sichuan Urban Environment Project (SUEP). The UK Government agreed to provide a grant, administered by the Department for International Development (DFID), to cover the costs of consultancy services, equipment and training required to assist the SPG in the preparation of the SUEP Phase 1 to meet WB requirements. Support for improving environmental management is one of the main objectives of the
World Bank's and DFID's Country Assistance Strategy (CAS) for China. Managing the impact on China's urban environment of rapid urbanisation and economic growth is a focus of the CAS. SUEP is also a key element of China's Agenda 21 programme.

The SUEP objectives are to enable municipalities to recover from past environmental degradation of water and land resources and to put in place policies, practices and institutions to facilitate and sustain the cost of effective provision of essential services. The location of the Sichuan Province and SUEP cities in upstream areas tributary to the Three Gorges Scheme (TGS) on the Yangtze River was also a key determinant of project priority. The overall objective of the SUEP is therefore:

- To allow environmentally sustainable growth in Sichuan Province.

Description of the Phase 1 Study Area

The “study area” considered for the Phase I projects and Environmental Assessment (EA) is the Min and Tuo river basins, including the city of Luzhou located at the junction of the Tuo and the Yangtze rivers, and the small portion of the Yangtze river upstream and downstream of Luzhou. The study area does not include other tributary river basins in Sichuan Province, the Chongqing provincial city, or areas further downstream on the Yangtze including the Three Gorges Dam site.

Regional Water Resources

The eastern half of the Sichuan Province has four major rivers, the Tuo, Min, Jialing and Wu, which all flow into the Yangtze at the southern part of the province. Together with the Jinsha and rivers in the mountainous western part of the province, they endow the province with rich water resources. Sichuan Province lies to the northwest of the Yangtze and 98% of the province's surface run-off drains to the Yangtze. The Project Cities lie on the Tuo and the Min Rivers, which drain to the Yangtze.

It is necessary to have an understanding of the regional water resource management in the Sichuan Province in order to better appreciate the water quality issues of the study area. The agricultural potential of the Chengdu Plain has been greatly enhanced by the Dujiangyang Irrigation Scheme located northwest of Chengdu on the Minjiang (the Min River). This Scheme consists of major headworks in the Min River and a complex network of natural and artificial channels across the Chengdu plain. The site has documented irrigation systems from over 2000 years ago and the original headworks was built in the year 700. It is reportedly the oldest functioning irrigation scheme in the world and it uses the natural river configuration to minimise sedimentation in the irrigation systems. The plain drops from about 730 m at Dujiangyang to about 500 m at Chengdu.

The significant urbanisation and industrialisation is putting extreme pressure on the surface waters in the five Phase I SUEP cities. In Chapter 2 of the Main Report the details of the major surface waters in each city are shown. It is also very important to realise that there are many small drainage channels and tributaries in these urban areas that consist mainly of domestic and industrial wastewater discharges, hence the environmental needs extend well beyond the larger, classified surface waters.

The Phase I SUEP projects have concentrated on urban water resources and water quality issues. The COWI/DHI water resources modelling and strategies contain significant information on the overall water resource conditions and wastewater loadings from other pollutant sources in the study area. Important environmental aspects in the long term plans for the province should cover aspects such as
industrial wastewater, agricultural water usage and water quality impacts, non-point pollution control and related issues. These issues have not been fully addressed in the Phase I of SUEP. These issues will be re-visited in later phases of SUEP, but the proposed interventions of Phase I are necessary regardless of the ongoing efforts to develop an integrated system for water resources and water quality decision-making in the Province. The Industrial Pollution Control Action Plan, which is under preparation, will provide a reasoned development plan to deal with the serious industrial discharges in the area and will form a basis for the introduction of more effective industrial pollution control.

Agriculture is by far the most water-consuming sector in the province. From the present average consumption of 37 million m$^3$/day, it is expected (despite a decrease in agricultural land) that irrigated agriculture will increase to create a water demand of 40-45 million m$^3$/day in 2010. The general agricultural practices, with widespread terracing capturing the natural runoff, favours high water losses by evapotranspiration, thereby limiting the water available for the major cities. Since water use for irrigation mostly coincides with dry weather conditions it is a significant factor affecting water resource availability during periods of low river flow, and hence, is often the key factor determining water resource conditions for urban areas.

The pollution level in Jinsha-Yangtze and Jialing rivers is generally low, as shown in Appendix A to the Main Report, but the entire Tuo river and parts of the Min river are polluted by wastewater. Small rivers like the Fu in Chengdu and the Fuxi in Zigong are heavily polluted. According to the COWI/DHI studies, the main pollutants are mostly confined to the following:

- micro-organisms including bacteria from households and animal husbandry
- degradable organic matter from households and industry
- ammonium/ammonia from households and industry
- the nutrients, phosphorus and nitrogen, which contribute to eutrophication problems.

Need for the Project
The Sichuan provincial government has undertaken overall planning of the exploitation and utilisation of water, the collection treatment and discharge of wastewater and the collection and disposal of solid waste in a number of the cities in the Yangtze River catchment area as a part of the longer term objectives of SUEP. This planning covers the cities of Chengdu, Deyang, Zigong, Neijiang, Luzhou, Leshan, Yibin, Mianyang, Guangyuan, Panzhihua and Nanchong. The objectives of this planning are to:

- Comprehensively control water body pollution of the main channel of the Yangtze River and its four tributaries in Sichuan Province;

- Meet the increasing water demand of large and medium sized cities in the province and to improve the urban environmental quality of cities along the rivers;

The complete implementation of the above mentioned components or sub-projects will ultimately resolve the problems related to water supply, wastewater treatment and solid waste or refuse treatment/disposal for 75% of urban residents in the province. The implementation of those sub-projects will have practical and far-reaching significance for creating a good ecological environment.
improving people's living standard and achieving the strategic target of sustainable development in Sichuan.

**EA Preparation Requirements**

The Environmental Assessment (EA) for this project was based on the following directives and guidance documents:

- World Bank Operational Directive 4.01, October 1991 (Class A Project);
- World Bank Environmental Assessment Updates 1-21, through December 1997.
- Class A project determination

**Project Preparation**

The SUEP I has been undergoing preparatory work for several years under a variety of funding sources, in addition to the DFID project preparation work of Mott MacDonald. Some of the most relevant work on the project covered in this EA is listed below:

- Water Sector Fact Finding Study carried out by Ausino (Australian funding);
- Development Trends and Infrastructure Study undertaken by Chreod (Canadian funding);
- Urban Water & Wastewater Resources Strategy including water quantity and quality modelling carried out by COWI/DHI (Danish funding);
- GIS Implementation study carried out by several Canadian firms in joint venture as the Canadian Sichuan Information Management Consortium.

**The Prioritisation of Schemes**

Although a large number of proposals were submitted to SUEP Management Office (SUEPO) from the project cities, SUEPO has proposed that the projects within the Tuo River Basin, Chengdu and Leshan for priority implementation during the Phase I of SUEP. The provincial SUEPO provided the following background information relative to this prioritisation:

- The Tuo River Basin has the highest preference because it contains over 22 million population, or about 20% of the provincial total, even though it only contains 5% of the provincial land area. Water shortages are severe in the basin and at the same time pollution loads are serious, negatively affecting the ability to abstract more water.
- Chengdu City, the capital of Sichuan, is the centre of Southwestern China in terms of economy, trade and culture. The environmental infrastructure is far short of what is necessary to serve the city causing extreme water quality degradation in the urban area.
- Leshan is one of the most popular tourist cities in China and the location of the Grand Buddha cultural and historic site. Water supplies are outdated and insufficient and there is no adequate wastewater collection or treatment system. Solid waste management is also inadequate.
The relative merits of alternative water pollution control schemes for both the Tuo and Min river basins were evaluated by Mott MacDonald, on the basis of data provided by COWI/DHI. The report of this work is presented in full in Appendix A. The methods used in the conduct of this work are summarised further below. The project components selected for the SUEP Phase I and summarised below, all ranked highly in terms of benefit/cost and are clearly justifiable in these terms.

Overview of SUEP Phase I Project Components

The objectives of Phase I of the SUEP have been delineated in detail by SUEPO and DFID and can be summarised as follows:

- To develop environmentally, socially and economically effective schemes to improve water supply, water pollution control and solid waste services for six cities in Sichuan.

The following list shows the projects that are now included in the first phase of the SUEP. Six cities were originally to be included in the Phase I of SUEP but Neijiang WwTW scheme was dropped due to funding limitations and project readiness. Five cities are now covered by the SUEP Phase I.

**Water Supply**

1. Leshan Water Supply Pipeline and Treatment Works Nr. 4 100,000 m$^3$/d
2. Zigong Water Supply Pipeline and Treatment Works 200,000 m$^3$/d
3. Luzhou Beijiao Water Supply Works Expansion and pipelines 50,000 m$^3$/d
4. Luzhou Daxikou Water Supply Pipeline and Treatment Plant 50,000 m$^3$/d

The two water supply schemes listed above for Luzhou have now been combined as a single project component but have been considered independently.

**Municipal Waste Water**

5. Chengdu Long Quan Treatment Works and interceptor sewer 300,000 m$^3$/d
6. Leshan Wastewater Collection and Preliminary Treatment 254,000 m$^3$/d
7. Deyang Treatment Works and interceptor sewer 100,000 m$^3$/d
8. Zigong Treatment works, pumping stations and interceptor sewer 80,000 m$^3$/d

**Municipal Solid Waste**

9. Leshan Improved Collection Equipment and Landfill 400 T/d

**Urban Management Information Systems (UMIS)**

The Urban Management Information Systems (UMIS) component is being prepared for the Phase I of SUEP under support of the Canadian government. It will support the improvement of urban management practices in five project cities through the upgrading of computerised information systems and extension and updating of urban mapping information.

**Cultural Heritage**

The Sichuan Province Cultural Heritage Strategic Master Plan (SPCHSMP) is under preparation with funding support from the Italian government.
Technical Assistance
The WB considers it critical that institutions responsible for implementing and managing SUEP sub-
projects are equipped with the management and technical knowledge, skills and equipment necessary
to carry out their mandates. A technical assistance (TA) needs assessment has been undertaken and
this has formed the basis for an institutional programme which will provide training and equipment to
the provincial and city PMOs, Provincial and City EPBs, and the water, wastewater and solid waste
operating companies or departments.

Of particular relevance to the EA, the WB has insisted on an overall environmental strengthening
component in the area of environmental monitoring. This strengthening is aimed at improving the
city and provincial ability to monitor and report on environmental conditions under stress, as well as
providing the means to better assess the environmental performance of the Phase I investment
package.

Total Project Cost
The Phase I SUEP programme is working under an overall budget of approximately $300M USD,
with about half supplied by a World Bank Loan and half from the province and cities.

Water and Environmental Objectives
The Constitution of the People's Republic of China (1982) provides the framework for environmental
protection law in China. Article 26 of the Constitution stipulates that "the State protects and
improves the living environment and the ecological environment, prevents and remedies pollution and
other public hazards." National legislation is comprehensive and appears to cover most areas of
environmental concern. However, the level of enforcement in Sichuan (as in the rest of China) is
clearly often less than satisfactory. The Chinese economy continues to grow rapidly and there is often
a trade-off between the strict enforcement of environmental legislation and promoting economic
growth and employment.

All surface waters in China have been classified according to ambient stream standards. The
following is a general translation of the surface water classes:

Description of Surface Water Classifications:

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>The headworks of rivers and national protected areas:</td>
</tr>
<tr>
<td>II</td>
<td>Areas where water for drinking use is abstracted, where endangered fish</td>
</tr>
<tr>
<td></td>
<td>exist, where animal habitats are of importance, and where national/provincial</td>
</tr>
<tr>
<td></td>
<td>tourism is a designated use:</td>
</tr>
<tr>
<td>III</td>
<td>Areas where water is abstracted for drinking use, where common fish exist,</td>
</tr>
<tr>
<td></td>
<td>and where city visiting is important:</td>
</tr>
<tr>
<td>IV</td>
<td>Areas where water is used by industrial and for recreation:</td>
</tr>
<tr>
<td>V</td>
<td>Agriculture areas (separate standards also apply to agricultural irrigation</td>
</tr>
<tr>
<td></td>
<td>water but rarely enforced).</td>
</tr>
</tbody>
</table>

The Sichuan Province, in line with the national policies, has set the following year 2000 targets:

1. the domestic unit water supplies should increase from 160 l/cd to 210 l/cd by 2000;
2. centralised systems for treatment of domestic wastewater shall be constructed in all
   large and middle size cities;
3. with regard to industrial wastewater, the national target rate of treated wastewater shall be 60% compared to 48% at present:
4. the total amount of heavy metals in industrial wastewater shall not exceed, and should preferably be less than, 1995 levels:
5. the seriously increasing pollution situation in the Tuo River and the Min River shall be alleviated significantly:
6. the quality of surface water in all major cities shall be improved and shall meet relevant national standards.

The Urban Pollution Impacts Assessment (UPIA) is fully presented as Appendix A of this EA. The UPIA considered impacts on Sichuan's rivers from discharges of municipal wastewater which is of domestic and industrial origin. The objective underlying this water quality modelling work was to identify, from a selection of possible wastewater treatment and collection schemes, those bringing the greatest benefit to the environment and to the people of Sichuan for the least expenditure of limited funds. Normally in a benefit cost analysis a monetary value is calculated to quantify the benefits and this may be compared directly with the construction and operating costs of the project. For an environmental improvement project such as SUEP it is not practical or realistic to attempt to calculate a monetary value for the benefits. For this reason, an alternative using the River Basin Pollution Index (RBPI) was developed, which provides a sound, objective and consistent quantitative measure of benefit. The prediction of the UPIA is that unless major steps are taken to reduce and treat discharges the quality of the water in the rivers Min and Tuo is going to seriously deteriorate from its already poor condition. The implementation of the component works, selected from the UPIA prioritisation, will do much to improve river water quality but even on completion of these works it will not be possible to meet river water quality objectives, in all seasons, for much of the length of the rivers in the Min and Tuo Basins. It has been shown that the low flows in a number of river reaches would need to be augmented in the dry season for objectives to be attained. Clearly this is a matter which should be addressed in later Phases of the SUEP.

Project Benefits
Project benefits have been identified for the nine component projects in the following general areas:

- Water Treatment Works – 4 Projects
  - Water Supply Quality and Availability
  - Sanitation and Public Health
  - Economic Development

- Wastewater Treatment Works – 4 Projects
  - Water Quality Improvements
  - Sanitation and Public Health
  - Downstream Water Use
  - Aesthetics and Water Amenity

- Leshan Municipal Solid Waste Project – 1 Project
  - Solid Waste Collection and Treatment
  - Sanitation and Public Health
  - Economic Development
  - Aesthetic and Enjoyment
Social Impacts

Resettlement and compensation plans have been prepared and are covered in a separate “Resettlement Action Plan” (RAP). The final RAP has been submitted to the World Bank in December 1998.

The main findings of the RAP are summarised as follows:

<table>
<thead>
<tr>
<th></th>
<th>Chengdu</th>
<th>Deyang</th>
<th>Leshan</th>
<th>Luzhou</th>
<th>Zigong</th>
<th>Project Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nr. of households to be resettled</td>
<td>340</td>
<td>24</td>
<td>1</td>
<td>53</td>
<td>37</td>
<td>11</td>
</tr>
<tr>
<td>Land Area to be used (mu)</td>
<td>478</td>
<td>159</td>
<td>94</td>
<td>16</td>
<td>284</td>
<td>41</td>
</tr>
<tr>
<td>Total Cost (MW)</td>
<td>131</td>
<td>20.8</td>
<td>9.4</td>
<td>7.7</td>
<td>25.9</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Environmental Impacts

Potential construction phase impacts are relatively minor and easily mitigated. These construction impacts have been sorted according to their geographic location within the overall project scheme. Details of mitigation measures, the monitoring required to ensure that mitigation measures are effectively implemented, and responsibilities are provided in detailed charts. SUEP PMOs will have an ongoing responsibility to track and report the monitoring work of all the identified agencies, in addition to their own direct monitoring activities.

The potential operational phase impacts are relatively minor and easily mitigated. Many of the concerns have been addressed in the course of the design of the water treatment and wastewater treatment facilities. Details of mitigation measures, a programme for monitoring mitigation measures and responsibilities are provided in detailed charts.

The economic analysis for cities with both single and multiple SUEP Phase I component projects indicates that they are needed and affordable for the population of the cities. This project is meeting a “backlog” need for environmental infrastructure (including water supplies, wastewater collection and treatment, and solid waste management) and should not induce adverse extensive growth or secondary impacts. The present environmental problems are serious and the provision of this environmental infrastructure is necessary for current needs and to mitigate current problems. Future problems without the project would become even more critical.

Mitigation and Monitoring Budget

The capital budgets prepared for all SUEP component projects include allowances for necessary laboratory construction and equipment. Using this equipment to perform the necessary and required testing by the utility is also included in the operations budget for the project. Environmental strengthening is considered a critical component of the Phase I SUEP project and a detailed Technical Assistance (TA) programme has been developed to address the needs. This includes training in management and operations for the PMOs and the utility companies, in a wide variety of disciplines. There is a significant environmental monitoring component in the TA program to provide both equipment and training for city EPBs and the provincial EPBs.
These facilities and the training planned will greatly facilitate the monitoring of the environmental impact mitigation measures proposed. Furthermore, accomplishing the specified monitoring and reporting outlined in this mitigation plan will be greatly enhanced by the TA program. This TA program will also allow for improved overall performance assessment of the SUEP Phase I programme relative to meeting the project objectives. Future Phases of the SUEP will benefit from such assessments.

Despite the above facilities and training the conduct of the mitigation monitoring programme will require additional funding. Cost estimates to cover both the short-term and long-term environmental monitoring have been estimated. In this context “Short-term” has been defined as the 5-year construction phase plus 2-year initial startup and environmental performance verification. “Long-term” is defined as annual monitoring required to verify the environmental performance and other operational mitigation measures previously outlined. These mitigation monitoring costs are being added into the utility operational cost estimates for final appraisal documents. Costs for mitigation measures that relate to the management of construction will be included in the tender documents and responsibility passed on to the construction contractors. The following table summarises the monitoring cost estimates:

<table>
<thead>
<tr>
<th>SUEP Phase I Component Project</th>
<th>SRIEP Environmental Monitoring Cost Estimates (Yuan/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short Term (5 years)</td>
</tr>
<tr>
<td>Leshan Number 4 WTW</td>
<td>90,000 - 110,000</td>
</tr>
<tr>
<td>Zigong Min River Diversion and WTW</td>
<td>110,000 - 120,000</td>
</tr>
<tr>
<td>Luzhou Beijiao WTW</td>
<td>100,000 - 120,000</td>
</tr>
<tr>
<td>Luzhou Daxikou WTW</td>
<td>90,000 - 110,000</td>
</tr>
<tr>
<td>Chengdu Long Quan WwTW</td>
<td>140,000 - 160,000</td>
</tr>
<tr>
<td>Leshan Wastewater Collection and Preliminary Treatment System</td>
<td>120,000 - 150,000</td>
</tr>
<tr>
<td>Deyang WwTW</td>
<td>120,000 - 140,000</td>
</tr>
<tr>
<td>Zigong WwTW</td>
<td>120,000 - 140,000</td>
</tr>
<tr>
<td>Leshan Municipal Solid Waste Project</td>
<td>110,000 - 140,000</td>
</tr>
<tr>
<td>Phase I Total Annual Cost, SRIEP</td>
<td>1,100,000 - 1,300,000</td>
</tr>
</tbody>
</table>

Options Reviewed in Project Development
The evaluation of options for individual project components covered issues such as:

**Water Treatment Works**
- Alternative water sources
- Design and technology selection
- Construction techniques and materials

**Wastewater Treatment Works**
- Sewer interceptors (routes, sizing, materials)
- Wastewater treatment works (sizing, technology, processes)
- Sludge processing and disposal system
Leshan MSW Project
- Solid waste management schemes (collection and disposal)
- Landfill locations
- Leachate treatment methods
- Gas collection

Public Participation in the EIA
During the 20-month project development time leading up to the finalisation of this EA, there have been many meetings with the city PMOs, utility companies, city EPBs and other affected city departments to discuss the proposed projects and environmental assessments. These meetings have occurred monthly at a minimum and been conducted with the full collaboration with local officials and have resulted in full support of the project and EA process. A survey form was used to gauge the public perception of the positive and negative impacts of each of the proposed projects in the five Phase I cities. An attempt was made to keep the survey random and representative in order to obtain an unbiased response from the community.

The many meetings with public officials in the city, coupled with the surveys of public support, have shown that these projects are considered extremely positively and are well received by the public. The Willingness to Pay surveys also showed a reasonable level of support. It is not possible in China to hold full public meetings on the projects, as is the standard practice in western countries. However, there is no indication that there is anyone that is not in support of these projects or would try to stop their completion.

Conclusions and Recommendations

1. The present environmental conditions in the project area are serious and the environmental infrastructure needs are high and expanding rapidly.

2. The project components selected for inclusion in Phase I SUEP have emerged from a rigorous prioritisation process, and are well formulated, and are supported by detailed and complete preliminary designs and cost estimates.

3. There is public support for the projects, indicated by the results of WTP and public opinion surveys.

4. The proposed projects meet financial and economic tests of sustainability and are affordable to the local citizens.

5. Social impacts centre mainly around land acquisition and resettlement and these impacts are not significant and will be managed in line with a detailed RAP.

6. The potential environmental benefits of the Phase I SUEP projects are large as is demonstrated in the previous sections.

7. Potential construction and operational phase impacts of the proposed Phase I projects have been adequately assessed and no major issues have been identified. Detailed mitigation and monitoring procedures have been prepared and these should adequately
lesser the overall effect of these potential impacts. Monitoring costs have been included for this work and assignments detailed.

8. The overall conclusion is that the potential positive impacts are large, the potential negative construction and operation impacts can be successfully mitigated, and the projects contain no serious problems or "fatal flaws" in their formulation. The project components are essentially environmentally positive and should be approved.

Ongoing Activities
COWI/DHI recently prepared an Urban Water and Wastewater Resources Strategy (March 1998) that outlines and reviews many of the water resources and water quality problems and potential remedial strategies. This integrated planning work was carried out simultaneously with the project preparation work for the Phase I SUEP components. There is no significant conflict between the two separate evaluations.

Future Phases of SUEP
Phase I of the SUEP is intended to be only the beginning of a long-term investment program in environmental infrastructure in the Province. Future phases of the SUEP will benefit from the strategy and modelling work performed by COWI, the project preparation work and river pollution index work prepared by Mott MacDonald, and the variety of other action plans and studies just discussed. In addition, the technical assistance program for Phase I of SUEP will prepare a cadre of management and technical leaders for this ongoing work. Some of the initial priorities that should be considered are those projects that were initially selected but then dropped as well as other high scoring projects in the COWI/DHI screening exercise. New projects are likely to emerge from the integrated water resources and water quality work as well as the Industrial Pollution Control Action Plan work.