



# Aqualyng Holding AS

## Cangzhou SWRO Desalination Plant

### Environmental and Social Impact Assessment

July 2013



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## Appendices

Appendix A Social Impact Study

Appendix B Environmental Management Plan

# Acronyms

Aqualyng	Aqualyng Holding AS
ADB	Asian Development Bank
BEWG	Beijing Enterprises Water Group Limited
BNAIZ	Bohai New Area Industrial Zone
BEPB	Boha New Area Environment Protection Bureau of Cangzhou
CCSG	Changlu Cangzhou Salt Group Co Ltd
CSR	Corporate Social Responsibility
CNHRM	China North Human Resource Market
DAF	Dissolved Air Floatation
EMP	Environmental Management Plan
EPC	Engineering Procurement Construction
ESIA	Environmental and Social Impact Assessment
EMS	Environmental management systems
EIA	Environmental Impact Assessment
EHSMP	Environmental, Health and Safety Management Plan
FYP	Five-Year-Plan
FRIT	Fisheries Research Institution of Tianjin
FSR	Feasibility Study Report
GHG	Greenhouse Gases
HPG	Hebei Provincial Government
IFC	International Finance Corporation
HWTT	Hangzhou Development Center of Water Treatment Technology Company Ltd
HPEPSRI	Hebei Provincial Environmental Protection Research Institute
HRSSB	Human Resources and Social Security Bureau of Cangzhou
HR	Human Resource
HRB	Human Resource Bureau
NDRC	National Development and Reform Commission
OHS	Occupational Health and Safety
PS	Performance Standards
PPE	Personal Protection Equipment
PDRC	Hebei Provincial Development and Reform Commission
RO	Reverse Osmosis
SS	Suspended Substances
SWRO	Seawater Reverse Osmosis
TDS	Total Dissolved Solids
UF	Ultrafiltration
WWTP	Wastewater Treatment Plant

# Executive Summary

Aqualyng Holding AS (Aqualyng) propose to develop a 50,000 m<sup>3</sup>/d reverse osmosis desalination facility within the Bohai New Area Industrial Zone (BNAIZ) in the south eastern coastal region of Hebei Province, PRC. The Project supports the government development strategy to promote local industries within the industrial zone.

The Project has the potential to provide environmental and social benefits, including (i) improved resilience to climate change through the provision of a reliable industrial water resource independent of climate variability, and (ii) employment opportunities for local community, including employment of approximately 200 people during the construction phase and 40 people during operations.

The Project has the potential to result in some negative environmental and social impacts. Key potential negative impacts commonly associated with desalination have been mitigated in the design phase, including (i) mitigation of potential impact of brine to Bohai Bay by incorporating direct recycling of all brine under an agreement with a local evaporative salt production company, and (ii) reduction potential impact associated with high energy requirement through the use of energy recovery technology within the process design, resulting in greenhouse gas equivalent CO<sup>2</sup> emissions of less than 100,000 per year.

To mitigate potential environmental impacts associated with the construction and operational phase, an Environmental Management Plan (EMP, Appendix B) has been prepared. The EMP addresses the potential impacts of the Project including management of potential emissions including dust, noise, wastewater, solid waste and hazardous waste. The EMP also addresses the potential social, health and safety impacts associated with the Project.

With respect to IFC Performance Standards 1, 2 and 3, the following conclusions are drawn:

## **PS1: Social and Environmental Assessment and Management System**

Aqualyng's environmental management team has overall responsibility for ensuring consistency and compliance with local regulatory requirements. Potential impacts of the Project have been identified during the planning stage through the local EIA process and this ESIA. Based on these assessments specific environmental management plans have been developed outlining mitigation measures consistent with local regulatory requirements.

Aqualyng will adopt IFC's environmental and social Performance Standards as part of the applicable legal and other requirements in its management system. The management system will be extended to incorporate community engagement, including clear procedure on disclosure and consultation with potentially affected communities.

## **PS2: Labor and Working Conditions**

Aqualyng currently employs approximately eight people directly for its Project development operations in China, and approximately 45 people in its operational desalination facility in Caofeidian. The proposed project will employ approximately 200 people at peak activity during the construction phase and in the order of 40 people during the operational phase. Aqualyng has a Human Resources policy that complies with local regulatory requirements, and is applied consistently to all direct employees. The policy is consistent with PS2, including non-discrimination, freedom of association, and protection of the workforce. As required by law, the policy is included in employment contracts, and addresses working conditions, terms of employment, and wages and benefits. This information is provided in the form of an employee handbook at the time of induction.

Occupational health and safety at Aqualyng will be managed by its Administration and Human Resources department. There is a plan for accident prevention and worker safety consistent with local regulatory requirements. All employees in the company will undergo a training program as part of their induction, and ongoing training as required regarding worker health and safety relevant to their job activity. The Project will be audited yearly by the Bohai New Area Environment Protection Bureau (EPB) of Cangzhou and other agencies to monitor compliance with labour regulations. Aqualyng's operational Caofeidian desalination facility has been in compliance with regulatory requirements and has recorded no significant lost time incidents or fatalities in its operational history.

### **PS3: Pollution Prevention and Abatement**

Pollution prevention and abatement has been incorporated into the Project design and EMP as outlined above. The Project will promote international good practice in energy efficiency, waste recycling and waste management; focusing on minimisation, reuse, and recycling, including minimisation of waste generation. Wastewater which can not be directly recycled to the Changlu Cangzhou Salt Group Co Ltd (CCGC) salt production facility have been minimised by improved process design, with all remaining wastewater directed to an established wastewater treatment plant within the BNAIZ.

Overall, the ESIA has identified that adverse environmental impacts of the Project will be minimal and adequate mitigation measures will be implemented. Adverse environmental impacts associated with the Project will be prevented, eliminated, or minimized to an acceptable level if the EMP is effectively implemented, particularly through the mechanism for the continuous refinement and effective implementation of the environmental mitigation measures.

# 1. Introduction

Aqualyng Holding AS (Aqualyng) are proposing to develop a 50,000 m<sup>3</sup>/d reverse osmosis desalination facility within the Bohai New Area Industrial Zone (BNAIZ) in the south eastern coastal region of Hebei Province, Peoples Republic of China (PRC) (hereby referred to as 'the Project'). The Project supports the PRC Government development strategy to develop local industries within the industrial zone.

The Project received preliminary development approval from the Hebei Provincial Development and Reform Commission (PDRC) in 2012, as documented in the Administrative Committee of Cangzhou Bohai Development Zone Framework Agreement, dated January 2012. A Project Feasibility Study was prepared by the Hangzhou Development Center of Water Treatment Technology Company Ltd (HWTT, 2013) and submitted to the PDRC for final development approval in June 2013.

A local Environmental Impact Assessment (EIA) report was prepared for the Project by the Hebei Provincial Environmental Protection Scientific Research Institute (HPEPSRI, 2013) in accordance with the relevant PRC EIA Law and supporting regulations and guidelines. The EIA report will be submitted to the Bohai New Area Environment Protection Bureau of Cangzhou (EPB) for environmental approval in July 2013.

This Environmental and Social Impact Assessment (ESIA) has been conducted in parallel to the development of the local EIA and Feasibility Study. It provides a summary of the findings of the local EIA, along with additional assessment and studies to meet international good practice<sup>1</sup> for environmental and social sustainability with regard to the Project design, construction and operation. This ESIA is consistent with the Project Feasibility Study report (HWTT, 2013) and local EIA report (HPEPSRI, 2013), providing supplementary information in key areas of stakeholder engagement, information disclosure, grievance redress mechanisms, and impacts of associated facilities.

## 1.1 Aqualyng in China

Aqualyng is an international water company, founded in 1998, that designs, builds, finances, owns and operates seawater reverse osmosis desalination facilities. Aqualyng owns proprietary energy recovery technologies and equipment which reduces the overall energy requirements of the desalination process, providing improved energy efficiencies. With over 15 years' experience in the desalination industry, Aqualyng has installed seawater reverse osmosis plants in eight countries including most recently PRC, all equipped with its proprietary energy recovery device, which ensures low life-cycle cost in the industry.

Aqualyng has a focus on the PRC market and was recently awarded a build-own-operate-transfer contract for a 50,000 m<sup>3</sup>/day reverse osmosis seawater desalination plant in Caofeidian Industrial Zone, one of China's 13 pilot Eco-Cities in Tangshan City, Hebei Province. The Caofeidian desalination facility was successfully commissioned in 2012. The design and operational requirements of the Caofeidian desalination facility is similar to that being proposed for the Project, with the exception of an additional RO Pass; as such the Caofeidian desalination facility has been used as an example in the ESIA of potential environmental and social impacts and benefits associated with the facility and operational management.

Approved on 26 July 2012 (IFC Project Number 31717) and in accordance with IFC due diligence requirements, a Category B environmental assessment was completed for the Caofeidian desalination facility in line with IFC performance standards on social and

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<sup>1</sup> This report has been prepared in line with the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (January, 2012), as adopted by the Equator Principles



environmental sustainability. A summary of the environmental and social review is documented on the IFC website<sup>2</sup> and outlines that the project will create a limited number of specific environmental and social impacts that can be minimized, avoided or mitigated by adhering to recognized performance standards, guidelines, or design criteria. The project has a very limited footprint, and is collocated with other industries in an exclusive industrial zone located on a purpose built manmade island. Local environmental approvals were obtained in accordance with PRC EIA Law and the approvals of a local EIA Report.

The Caofeidian desalination facility was one of the first commercial operational seawater reverse osmosis large-scale plants in PRC, supplying water to domestic and industrial customers within the industrial zone.

Aqualyng has formed a joint venture with Beijing Enterprises Water Group Limited (BEWG), one of the recognised top tier water companies in China, in order to exclusively work on Chinese desalination Projects. Aqualyng will also form a separate joint venture for its technology/equipment manufacturing, with a leading desalination contractor in China. This partnership will serve to commercialize and market the Company's energy recovery device for seawater SWRO and other technologies.

## 1.2 Reverse Osmosis

The Project will use seawater reverse osmosis (RO) to remove salts and contaminants from intake seawater. The RO processes is proven technology which uses a semi-permeable membrane that permits only water, and not dissolved ions (such as sodium and chloride), to pass through its pores. Raw water is subject to a high pressure that forces pure water through the membrane, leaving contaminants behind in a brine solution. RO can effectively remove nearly all inorganic contaminants from water. It removes more than 70% of arsenic (III), arsenic (IV), barium, cadmium, chromium (III), chromium (VI), fluoride, lead, mercury, nitrite, selenium (IV), selenium (VI), and silver, and appropriately operated units can attain up to 96% removal rates (IFC, 2007). RO can also effectively remove radium, natural organic substances, pesticides, and microbiological contaminants. RO is particularly effective when used in series; water passing through multiple units can achieve near zero effluent contaminant concentrations. Aqualyng propose to use a two pass process, which is designed to remove 99.7% of salts and other contaminants.

RO systems are relatively insensitive to flow and Total Dissolved Solids (TDS) concentration, and are therefore suitable for small systems with a high degree of seasonal fluctuation in water demand. Operational simplicity and automation allow for less operator attention and make RO suitable for small system applications. However, RO tends to have high capital and operating costs, and a high level of pretreatment is required in some cases to prevent fouling. The pretreatment proposed as part of Aqualyng's Project includes dissolved air floatation and ultrafiltration as described in Section 2.1.

The product water recovery relative to input water flow is 15% to 50% for most seawater desalination plants. Aqualyng's design for this Project will result in approximately 37% recovery.

The brine and other liquid wastes from the desalination plant may contain all or some of the following constituents: high salt concentrations, chemicals used during defouling of plant equipment and pretreatment, and toxic metals (which may be present if the discharge water was in contact with metallic materials used in construction of the plant facilities). The constituents of the brine and other liquid waste associated with the Project are detailed in Section 2.

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<http://ifcext.ifc.org/ifcext/spiwebsite1.nsf/78e3b305216fcd8a85257a8b0075079d/2c937ecb0af517be852579a3006f759c?opendocument>

Aqualyng propose to directly re-use discharge brine as a resource, which will be supplied to an established salt production operation. There will be zero brine discharge to Bohai Bay. Liquid waste associated with flushing and cleaning will be discharged to local sewer.

Desalination plants also produce a small amount of solid waste (including spent pretreatment filters and solid particles that are filtered out in the pretreatment process). Under the proposed Project, these wastes will be managed in accordance with local solid waste to landfill regulations and guidelines.

### 1.3 Regulatory Context

The Project is subject to several levels of regulatory requirements, guidelines and internal corporate policy, which require potential environmental and social impacts to be assessed, mitigated where possible and management plans developed, implemented and monitored. In addition, Aqualyng have voluntarily adopted the IFC Performance Standards on Social and Environmental Sustainability as a Project bench mark, to demonstrate international good practice.

Different regulations and guidelines require varying levels of assessment detail, different levels of emissions limits and different levels of tolerance for potential impact. The following regulatory and guiding standards are considered to comprise the key local regulatory and bench mark requirements for the Project with respect to environmental and social performance. The subsequent section expands on these key regulations and guidelines.

**Table 1 Key legislation and guidelines**

Key Legislation and Guidelines	Comment
National and local laws and regulations	Chinese law requires an EIA for the planned Project. The Environment Impact Assessment Law of the People’s Republic of China (2003) is the primary EIA legislation, triggering requirement for environmental assessment for any construction project with the potential to result in significant environmental impacts. The EIA Law 2003 draws on relevant national emissions standards for air, water and soil pollution along with relevant standards for land, forest and waste management and energy conservation legislation.
IFC PS	<p>The IFC Performance Standards (PS) on Social and Environmental Sustainability (2012) includes eight PS. The most relevant to the Project are include:</p> <ul style="list-style-type: none"> <li>▶ PS1 Assessment and Management of Social and Environmental Risk and Impacts,</li> <li>▶ PS2 Labour and Working Conditions; and</li> <li>▶ PS3 Resource Efficiency and Pollution Prevention.</li> </ul> <p>All eight performance standards have been considered as part of the ESIA assessment.</p>
IFC EHS Guidelines (IFC, 2007)	<p>EHS Guideline on Air Emissions and Ambient Air Quality</p> <p>EHS Guideline on Energy Conservation</p> <p>EHS Guideline on Wastewater and Ambient Water Quality</p> <p>EHS Guideline on Water Conservation</p>

	<p>EHS Guideline on Hazardous Materials Management</p> <p>EHS Guideline on Waste Management</p> <p>EHS Guideline on Noise</p> <p>EHS Guideline on Contaminated Land</p>
Aqualyng EMS and CSR Commitments	<p>Aqualyng has a well-developed set of sustainability and social responsibilities and principles, summarised in an Aqualyng Code of Conduct, which apply to all Projects and employees globally. These have been developed in a bid to promote consistently sustainable and ethical business operations. These policies include environmental management systems (EMS), corporate social responsibility (CSR) commitments and Project specific principles; and provide a valuable guide and bench mark for the potential impacts associated with this Project.</p>

### 1.3.1 National and Local Laws and Regulations

China legislative requirements with regard to environmental approvals and operational compliance are covered by an extensive framework of laws, regulations, standards and specifications. Requirements with regard to social impact assessment are less developed, especially when compared to international standards. The following provides a list of the key laws applicable to environmental impact assessment. Further listing of applicable regulations, guidelines and specifications is provided in the local EIA report (HPEPSRI, 2013).

- ▶ Environment Protection Law of the People's Republic of China, 1998
- ▶ Environment Impact Assessment Law of the People's Republic of China, 2003
- ▶ Land Administration Law of the People's Republic of China, 1998
- ▶ Law of the People's Republic of China on Water and Soil Conservation, 1991
- ▶ Law of the People's Republic of China on the Prevention and Control of Water Pollution 1996
- ▶ Air Pollution Prevention Law of the People's Republic of China, 2000
- ▶ Law of the People's Republic of China on Prevention of Environmental Pollution Caused by Solid Waste, 1996
- ▶ Law of the People's Republic of China on Prevention of Environment Noise Pollution, 1998
- ▶ Law of the People's Republic of China on Evaluation of Environmental Effects, 2003
- ▶ Law of the People's Republic of China on Promotion of Cleaner Production, 2002
- ▶ Energy Conservation Law of the People's Republic of China, 2007
- ▶ Ambient Air Quality Standard (GB3095-2012)
- ▶ Marine Water Quality Standard (GB3097-1997)
- ▶ Marine Sediment Quality (GB18668-2002)
- ▶ Marine Biological Quality (GB 18421-2001)
- ▶ Environmental Quality Standards for Noise (GB3096-2008)
- ▶ Integrated Wastewater Discharge Standard (GB8978—1996)
- ▶ Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008)
- ▶ Emission Standard of Environment Noise for Boundary of Construction Site (GB12523-2011)

- ▶ Standard for Pollution on the Storage and Disposal Site for General Industrial Solid Wastes (GB18599-2001)
- ▶ Standard for Pollution Control on Hazardous Waste Storage (GB18597-2001)

With regard to the requirement for an environmental impact assessment, Article 16 of the Environmental Impact Assessment Law of the People's Republic of China (2003) stipulates that an EIA is required for any capital construction Project producing significant environmental impacts. The Management Guideline on EIA Categories of Construction Projects (2008) classifies Projects into one of the following three categories: (i) Category A: Projects with significant adverse environmental impact; (ii) Category B: Projects with adverse environmental impacts which are of lesser degree and/or significance than those of Category A; and (iii) Category C: Projects unlikely to have adverse environmental impact.

The Project was classified as Category B by the BEPB and requires a Tabular EIA report. The draft Tabular EIA report (the 'local EIA report') was prepared by HPEPSRI and will be subsequently submitted for approval in July 2013. The local EIA indicated that the Project design complied with the following relevant local standards: Integrated Wastewater Discharge Standard (GB8978 – 1996); Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008); Emission Standard of Environment Noise for Boundary of Construction Site (GB12523-2011); Standard for Pollution on the Storage and Disposal Site for General Industrial Solid Wastes (GB18599-2001); and Standard for Pollution Control on Hazardous Waste Storage (GB18597-2001).

In addition to seeking BEPB approval, the Hebei Water Resources Bureau and the Hebei Land Resources Administration have been consulted. At the time of writing, final approval for the Project from the Hebei PDRC was pending.

### 1.3.2 IFC Performance Standards

The IFC Performance Standards (2012) include eight performance standards covering aspects of sustainable development, which have been used as a guide for this review and assessment.

In line with IFC's Procedure for Environmental and Social Review of Projects, the Project is classified as a Category B Project because it will create a limited number of specific environmental and social impacts that can be minimized, avoided or mitigated by adhering to recognized performance standards, guidelines, or design criteria. The Project has a limited footprint, and is collocated with other industries in an exclusive industrial zone located on a purpose built land area. The proposed Project is subject to strict environmental oversight by local regulatory agencies.

IFC's environmental and social due diligence indicates that the investment may have impacts which should be managed in a manner consistent with the following Performance Standards:

- ▶ **PS1: Social and Environmental Assessment and Management System.**  
Performance Standard 1 establishes the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of Projects; (ii) effective community engagement through disclosure of Project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of environmental and social performance throughout the life of the Project. The objectives of PS1 include:
  - Identify and evaluate environmental and social risks and impacts of the Project.
  - Adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment.

- Promote improved environmental and social performance of clients through the effective use of management systems.
- Ensure that grievances from affected communities and external communications from other stakeholders are responded to and managed appropriately.
- Promote and provide means for adequate engagement with affected communities throughout the Project cycle on issues that could potentially affect them, and to ensure that relevant environmental and social information is disclosed and disseminated.

The Project has the potential to result in impacts to the local environment and impact on local communities; as such, assessment and management of these risks has been considered as part of the planning process. The assessment has included the local EIA and this ESIA which includes supplementary social surveys, information disclosure, and development of a clear environmental and social management plan. The findings and recommendations of the EIA and this ESIA have influenced the design of the Project. In addition, the Project seeks to comply with all local Laws, regulations and guidelines and is in the process of attaining required government approvals.

- ▶ **PS2: Labor and Working Conditions.** Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. For any business, the workforce is a valuable asset, and a sound worker-management relationship is a key ingredient in the sustainability of a company. Failure to establish and foster a sound worker-management relationship can undermine worker commitment and retention, and can jeopardize a Project. Conversely, through a constructive worker-management relationship, and by treating the workers fairly and providing them with safe and healthy working conditions, clients may create tangible benefits, such as enhancement of the efficiency and productivity of their operations. The objectives of PS2 include:
  - Promote the fair treatment, non-discrimination, and equal opportunity of workers.
  - Establish, maintain, and improve the worker-management relationship.
  - Promote compliance with national employment and labour laws.
  - Protect workers; including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.
  - Promote safe and healthy working conditions, and the health of workers.
  - Avoid the use of forced labour.

Aqualyng currently employs about 8 people directly for its project developments operations in PRC as part of its joint venture with BEWG. For the Project, approximately 200 people will be indirectly contracted during construction, and about 20 people will be directly contracted during normal operation. PS2 has been used to evaluate equal opportunity for workers, sound worker-management relationships and promote safe and healthy working conditions, as part of the Project.

- ▶ **PS3: Pollution Prevention and Abatement.** Performance Standard 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. There is

also a growing global consensus that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. This Performance Standard outlines a Project-level approach to resource efficiency, and pollution prevention and control in line with internationally disseminated technologies and practices. In addition, this Performance Standard promotes the ability of private sector companies to adopt such technologies and practices as far as their use is feasible in the context of a Project that relies on commercially available skills and resources.

The Project will result in the generation of waste streams including liquid wastes, solid wastes and the indirect association with greenhouse gas emissions from use of power generated from non-renewable sources. During the construction phase of the Project dust may be generated, there will also be the potential for increased sediment runoff to the marine environment. Pollution prevention and abatement measures have been considered for each of these emission and waste streams as part of the ESIA.

- ▶ **PS4: Community Health Safety and Security.** The proposed Project is Aqualyng's second operation in PRC and will be located in an exclusive industrial zone. As such, community safety and security is not applicable as a benchmark as part of this ESIA.
- ▶ **PS5: Land Acquisition and Involuntary Resettlement.** Performance Standard 5 is not considered applicable as a benchmark as part of this ESIA, as the Project is located on reclaimed land in an established industrial zone and will not require any resettlement. There is no history of any public dispute or legal challenges to their establishment.
- ▶ **PS6: Biodiversity Conservation and Sustainable Natural Resource Management.** The Project is considered to have limited potential to impact biodiversity or natural resources within the area, as the area is dominated by reclaimed land in an operational port, with limited remaining biodiversity conservation value. The seawater intake (an associated facility) is proposed within the shipping port bays, and the Project will result in no discharge of brine to the receiving environment (Bohai Bay). As such, Performance Standard 6 is not considered applicable as a benchmark as part of this ESIA.
- ▶ **PS7: Indigenous People.** No Indigenous people are known to have been affected by either Project. As such, Performance Standard 7 is not considered applicable as a benchmark as part of this ESIA.
- ▶ **PS8: Cultural Heritage.** The Project is not located in areas of known historical or cultural significance. As such, Performance Standard 8 is not considered applicable as a benchmark as part of this ESIA.

### 1.3.3 IFC EHS Guidelines

The IFC publishes a set of EHS Guidelines, which provide relevant industry specific reference documents outlining examples of good international industry practice and performance levels; these levels are considered to be reasonably achievable in new facilities through the implementation of existing technologies or management strategies. These guidelines identify potential environmental, occupational health and safety and community health and safety impacts, and have been used as a guide for this ESIA.

Along with the IFC guidelines, the Asian Development Bank (ADB) Environmental Assessment Guidelines have provided a useful reference for evaluation of environment and social impacts and benefits as part of this ESIA.

### 1.3.4 Aqualyng Policy

Aqualyng has an established set of sustainable and socially responsible policies and principles, summarised in a Code of Conduct that applies to all Projects and employees globally, to ensure consistently sustainable and ethical business operations. Aqualyng strives to implement internationally recognised management systems and seeks to meet the following in its operations: (i) ISO 14001 Environmental Management; (ii) OHSAS 18001 Occupational Health and Safety; and (iii) ISO 9001 Quality Management.

Some of the key aspects of Aqualyng policies relevant to the proposed Project include the following:

- ▶ A commitment to managing and developing its business in a sustainable manner, balancing its economic, environmental and social responsibilities to maintain a sustainable business and create benefits for stakeholders.
- ▶ An ambition to continually improve sustainability performance, including transparent communication and engagement with stakeholders in active and constructive dialogue.
- ▶ A policy to operate according to Aqualyng values, policies and principles everywhere around the globe, respecting different cultures, customs and values of the societies where Aqualyng operates. Aqualyng policy is that Projects and operations must comply with and, when necessary, go beyond the requirements of national legislation and regulations.
- ▶ Aqualyng addresses sustainability throughout its value chain, and expects its suppliers and partners to comply with Aqualyng policies and principles related to sustainability.
- ▶ To minimise impact on the environment, Aqualyng considers a life cycle approach and uses applicable control technologies. Aqualyng must use raw materials, energy and other resources efficiently. Aqualyng seeks to use products produced from renewable raw materials that are recyclable and safe to use.
- ▶ Aqualyng must adhere to ethical business practices in all their activities. The policies honour and support globally accepted human and labour rights and seek to create a healthy and safe workplace for all of their employees.

Aqualyng has expressed its commitment to meeting and, when relevant and necessary, exceeding the requirements of Chinese national and local laws, regulations and standards with regards to environmental protection and monitoring. Specific to this Project, Aqualyng has established a variety of sustainability initiatives that follow the company's philosophies and standards, including: (i) training in Environmental Management Systems (EMS), Code of Conduct and Corporate Social Responsibility (CSR) for all staff from the start of the Project; (ii) ensure that a reliable, transparent ESIA has been developed and is in place; (iii) all necessary environmental permits have been obtained; (iv) social and environmental sustainability requirements implemented in the supply chain; (v) systems in place to secure that contractors/suppliers are following human and labour rights; and (vi) Environmental and Social Impact Monitoring Plan established.

## 1.4 Report Purpose, Objectives and Limitations

The aim of this ESIA is to assess the potential environmental and social impact associated with the proposed Project in accordance with relevant international good practice:

The report also seeks to address specific gaps in previous studies with supporting complementary studies. The overarching objectives of the analysis are summarized as follows.

- ▶ Create an independent ESIA report for the proposed Project.

- ▶ Engage different stakeholders in the environment and social assessment process.
- ▶ Conduct complementary studies to address gaps in previous environmental and social impact assessments.

This ESIA is not intended to be a comprehensive or extensive assessment of all potential environmental and social impacts associated with the Project; rather it focuses on the key potential environmental and social impacts and provides guidance for monitoring, management and mitigation of those impacts.

The Project is limited to desalination process infrastructure and associated building structures only, and does not include the seawater intake or pipe infrastructure outside the Project site boundary (defined in Section 2.3). These associated facilities will be developed by the BNAIZ in parallel to the development of the Project.

The ESIA has a specific focus on the scope of Aqualyng's investment Project and does not extend to a detailed assessment of Associated Facilities, including the seawater intake site which will be developed by the BNAIZ administration as part of the port development. The ESIA does however provide a qualitative discussion of the potential environmental risks connected with these associated facilities.

The impact assessment does not extend to cover potential cumulative environmental and social impacts associated with the BNAIZ, including related infrastructure, sediment dredging or the new port development.

As a foreign company operating in China, Aqualyng has restrictions as to the mapping and spatial data it can access and reproduce. This report therefore does not include detailed mapping of the BNAIZ.

## 1.5 Report Structure

This report is structured as follows:

- ▶ Section 1: Introduction – outlines a brief introduction to Aqualyng, a summary of the objectives and limitations of this report, and a summary of the regulatory and legal context.
- ▶ Section 2: Project Description – describes the Project, including location, process, lists hazardous materials to be used, and outlines the designed discharge parameters.
- ▶ Section 3: Social and Environmental Setting – outlines a summary of the social, economic and environmental characteristics of the Project area, including socio-economic data, existing land use, ambient water and air quality baseline data.
- ▶ Section 4: Social and Environmental Impacts – provides an assessment of the potential key social and environment impacts associated with the Project.
- ▶ Section 5: Information Disclosure, Consultation and Participation – includes details of public consultation conducted.
- ▶ Section 6: Environmental Management Plan – outlines management strategies to help ensure a socially and environmentally responsible project development.
- ▶ Section 7: Summary and Conclusions.



## 2. Project Description

The Project includes a RO desalination facility designed to produce 50,000 m<sup>3</sup>/d of high quality water which will be used for industrial processes within the BNAIZ. The general features of the Project are summarised in Table 2.

Table 2 General Features of the Project

Project Aspect	Description
Total Proposed Investment	350 Million RMB total Project cost to commission phase
Water production	The facility will produce 50,000 m <sup>3</sup> /d, with the option to expand an additional 50,000 m <sup>3</sup> /d. The potential expansion is not covered as part of this ESIA.
Project commencement date	The 50,000 m <sup>3</sup> /day Plant shall be constructed in two phases. The first phase ("Phase A") is to fast track construction to allow 18,000 m <sup>3</sup> /day to be commissioned by September 2014. The second part ("Phase B"), which is the remaining 32,000 m <sup>3</sup> /day (Nominal) of production capacity, is to commence at the same time as Phase A, and the Substantial Completion of the full 50,000 m <sup>3</sup> /day is to be 12 months later (September 2015).
Start of desalinated water production	First water production by September 2014 for Phase A, and September 2015 for Phase B.
Project Site	The Project will cover a site area of approximately 45,000 m <sup>2</sup> , including approximately 1,000 of landscaped green areas. The Site is located at 38°19'19.44"N and 117°48'41.34"E.
Building foot print	In the order of 13,221 m <sup>2</sup> including main plant building, office building and auxiliary facilities
Seawater intake	The seawater intake will be developed by the Hebei Provincial Government and will draw water from the industrial port at a rate of 137,540 m <sup>3</sup> /d. As the intake is not part of the Project, it is considered in this ESIA as an associated facility.
Discharge	50,000 m <sup>3</sup> /d product water  In the order of 19,640 m <sup>3</sup> /d discharged directly from the floatation process, untrafiltration process and system cleaning wash to Cangzhou industrial waste water treatment plant.  In the order of 67,900 m <sup>3</sup> /d brine concentrate piped to existing salt works for evaporative salt recovery.
Desalination process	Pre-treatment coagulation, dissolved air floatation (DAF), ultrafiltration (UF), two pass reverse osmosis (RO)
Power demand	66 GWh/yr provided by the State Grid network. Aquayng's proprietary energy recovery technology included.
Construction workforce	In the order of 200 contractors at peak activity

Operational workforce	40 Staff
Resettlement	None

The following section provides a summary description of the Project, including details of the desalination process, the technology applied, seawater intake and power requirements, discharges and emissions, and a description of associated facilities.

### 2.1.1 Alignment with PRC National Plan and Strategy

In 2006, the National Development and Reform Commission (NDRC) compiled the Beijing – Tianjin – Hebei Regional Planning Report – Planning on Energy Resources. In order to accelerate the economic development of cities in the Beijing – Tianjin – Hebei region the NDRC has strategically analysed the constraint factors. This analysis included local coal source depletion, lack of water resources and scarce land resources. Aqualyng’s high technology RO energy efficient desalination plant addresses one of the constraint factors. According to the Industrial Restructuring Directory (Revision 2011), the Project falls into the category of projects for encouragement, due to its nature of environmental protection, energy conservation and comprehensive utilisation, and conforms with national industrial policies.

Since 2011, development of the Bohai Bay coastal area including Cangzhou and the Project area has become a national priority. Known as the Bohai Economic Rim, it provides a third economic centre on the east coast of PRC along with the Yangtze River Triangle and Pearl River Economic Zone.

The Hebei Provincial Government (HPG) lists the BNAIZ as one of the Provinces three priority economic development areas in the Hebei 12<sup>th</sup> Five-Year-Plan (FYP), along with Caofeidian and Beidaihe. The Hebei 12<sup>th</sup> Five-Year-Plan proposes to develop the BNAIZ into a modern coastal urban and industrial hub, with a focus on logistics, petrochemical processing, steel processing, manufacturing and power generation. The HPG will develop supporting infrastructure industrial development including roads, water supply, power supply, power transition, education and information services.

The Hebei 12<sup>th</sup> FYP promotes sustainable use of water including the use of seawater for industrial processes where suitable, such as encouraging the use of seawater for industrial cooling water and desulfurization. The Hebei 12<sup>th</sup> FYP encourages the utilisation of seawater desalination technologies to meet industrial and urban water demands, including both RO and thermal desalination technologies. The FYP links the proposed development of desalination projects with the expansion of industrial salt production industry within the BNAIZ, supporting a circular economic model of direct re-use of waste streams. Aqualyng’s proposed Project is directly aligned with the Hebei 12<sup>th</sup> FYP development objectives.

## 2.2 Project Location

The Project is located within Cangzhou Municipality in the south eastern coastal region of Hebei Province, PRC (Figure 1), approximately 250 km south east of Beijing.

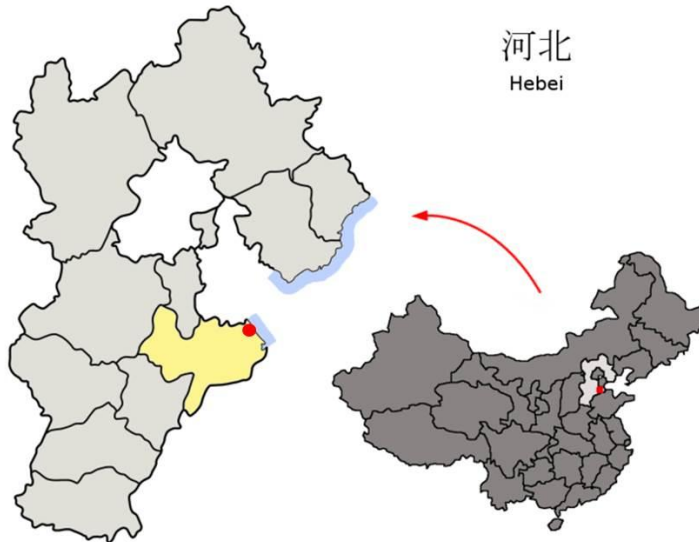


Figure 1 Project Location within Cangzhou Municipality (highlighted), within Hebei Province, PRC

The Project site covers a total area of approximately 45,000 m<sup>2</sup> (here in ‘the Site’) in the eastern part of the BNAIZ (38°19’19.44”N and 117°48’41.34”E), about 3.0 km northwest of the office building of Huanghua Port, 4.3km southeast of Fengjiabao Village, 1km and 2km north of Shuohuang railway and the Port city area. The project geographic coordinate is approximately east longitude: 117048’41”; North Latitude: 38019’19’. Refer to Site Locality Plan Figure 2 and Figure 3. The site is located on reclaimed land. The site is in a clear level state and is accessible by road.

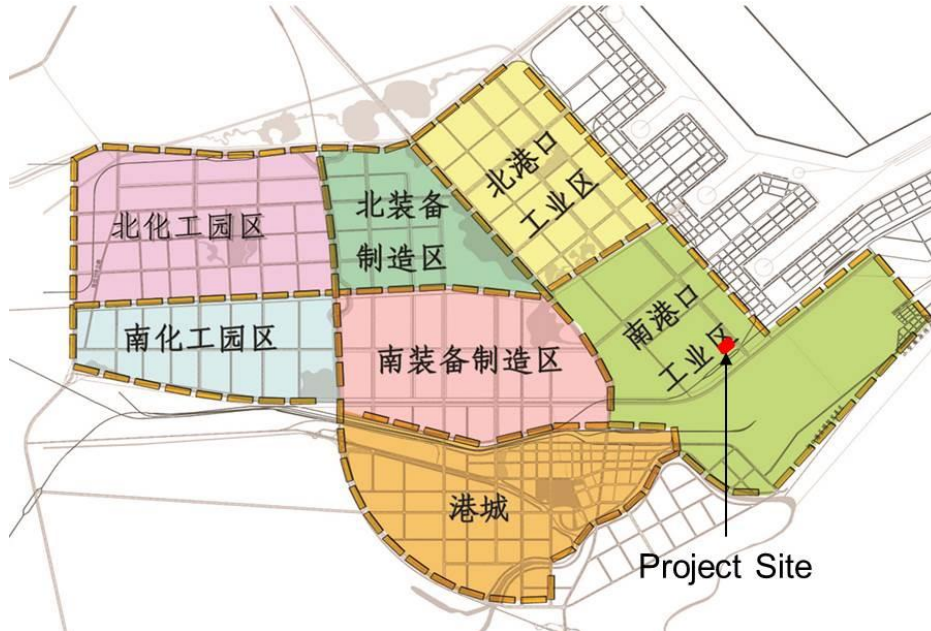


Figure 2 Approximate Project Site boundary (‘the Site’) located within the BNAIZ



Figure3: Site area on reclaimed greenfield land (photo taken April, 2013)

### 2.3 Project Building Structures

The Project is a greenfield development and will largely involve above ground structures. The seawater intake is an Associated Facility which will be developed by the HPG. The plant will connect to government owned pipe utilities at the Site boundary (Battery Limit), including pipe utilities for seawater intake, product water delivery, brine discharge to salt works, wastewater, town drinking water (for office administration building), storm water, and steam for heating. Additional above ground connection at the Project Site boundary include power supply.

Above ground buildings are detailed in Table 3 with a total foot print of 3,454 m<sup>2</sup>. The remaining area of the Site will be partially asphalted for vehicle access and parking and partially landscaped with plants species common to the region. The site will be secured with a 2 m high fence and a manned access gate. All buildings will be centrally heated during the winter months, with heating supplied by the BNAIZ Heating Supply Company, a subsidiary of Cangzhou Heating Power Group.

Table 3 Project above-ground structures

Description	Building foot print (m2)	Primary construction materials
Main plant building, including all processing infrastructure, the main workshop, control room, chemical dosing room, pump room and general store room.	12,000	Steel frame, corrugated iron, concrete, brick
Administration building	324	Brick, concrete
Utilities workshop	400	Brick, concrete
Auxiliary clarification workshop	234	Brick, concrete
Seeled area (exterior to buildings), including vehicle access and parking	234	Asphalt
Landscaped area (improved site amenity)	1,000	Plant species common to the region
Perimeter fencing	-	Concrete and steel

Figure 4 Proposed Site Layout

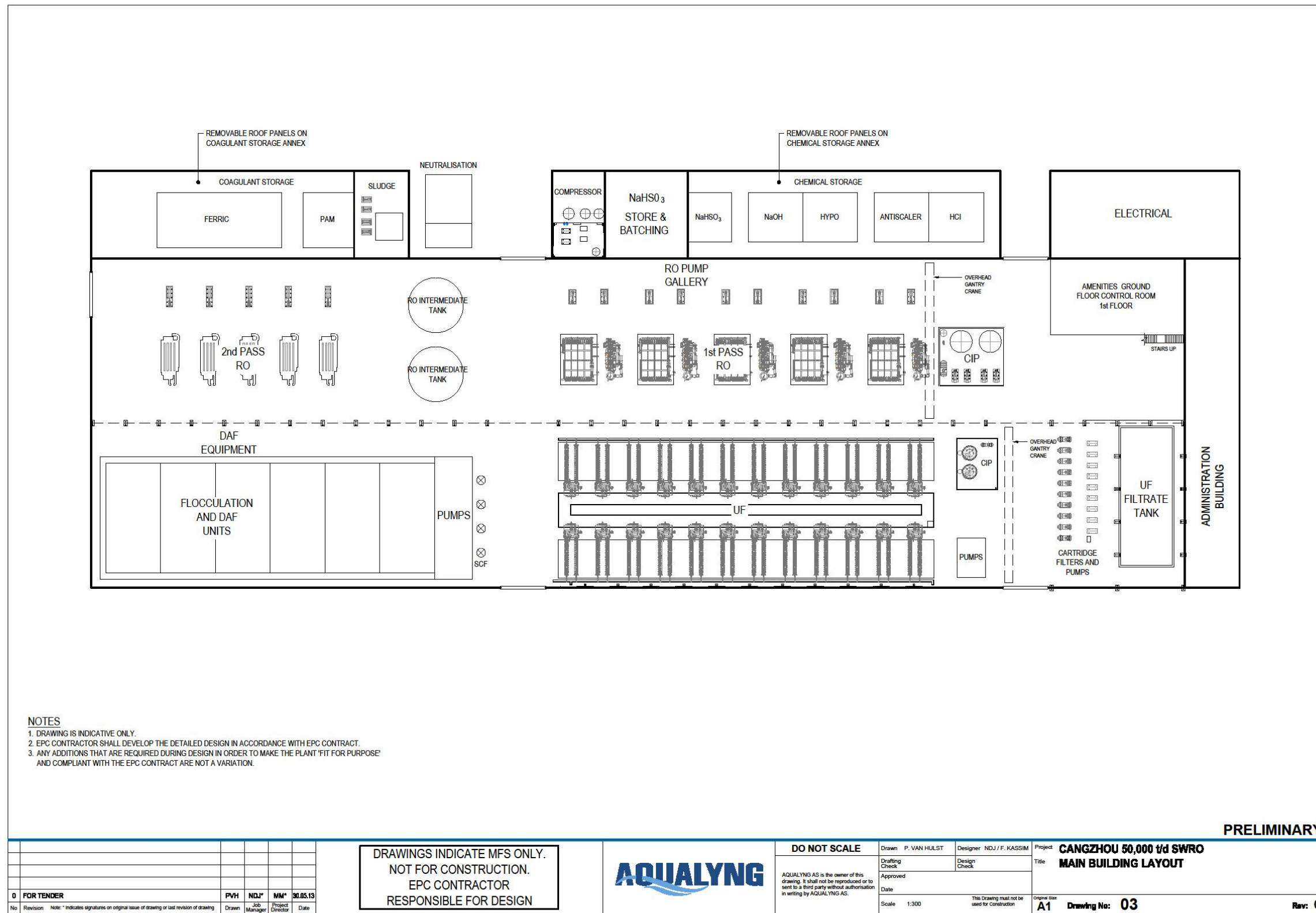




Figure 5 Example of Project Site layout, photo of Caofiedian desalination facility building structures with a similar layout to the proposed Project

## 2.1 Desalination Process

The proposed RO plant will use seawater from Bohai Bay as the raw water source. The treatment process will include pre-treatment involving Dissolved Air Flotation (DAF), followed by a membrane based ultrafiltration (UF) system. Following the pre-treatment step, the feed water will be collected in a filtrate tank, from which it will be pumped through cartridge filters and to a set of parallel RO lines.

### 2.1.1 Pre-treatment

Primary pretreatment will remove suspended matter, colloid, particle, bacteria and alga. The first step involves addition of sodium hypochlorite to seawater to kill the bacteria and alga. Following sterilization, DAF will be used to remove suspended solids. The DAF system uses injected air bubbles combined with PAC (flocculant) and PAM (coagulant aid) removed suspended solids from the seawater. The suspended solids, flocculant and coagulant are collected from the DAF process and discharged as a liquid to off-site wastewater treatment.

To further reduce turbidity and improve water quality prior to RO, influent water will be passed through a UF system. UF is the membrane separation technology that involves differential pressure as impetus. UF requires backwashing and a chemical wash as part of regular maintenance, as described below:

- ▶ **Ultrafiltration backwashing (chemical enhanced backwashing):** Solid particles deposited on membrane are removed by periodical backwashing. Particles absorbed onto membrane that cannot be removed by backwashing are removed by chemical enhanced backwashing. In chemical enhanced backwashing, particles are removed with addition of chemical cleaners including NaClO, HCl, NaOH by means of soaking and rinsing. Backwashing and chemical enhanced backwashing is designed to effectively maintain the water quality from UF and prolong service life of the UF membrane.
- ▶ **Ultrafiltration chemical wash:** After longer-term service of UF, the surface of the UF membrane can become blocked so that differential pressure between UF inlet and outlet rises and water output lowers. To maintain long-term stable running of UF, a

chemical washing system will be established and specific cleaning fluid will be used to remove pollutants on and recover performance of ultrafiltration membrane.

- ▶ **Residual chlorine removal:** To remove residual chlorine from the pretreatment process, stopping chlorine from entering the RO process which would result in damage, NaHSO<sub>3</sub> is added at the conclusion of the pretreatment.
- ▶ **Scale inhibitor dosing:** Scale inhibitor is introduced prior to the RO process.

### 2.1.2 Reverse Osmosis

The proposed RO system consists of cartridge filters, high-pressure pumps, RO membranes and energy recovery devices.

Water will be pumped through the cartridge filters to the RO system. Part of the RO feed water will be pumped to the high pressure pumps, while the remaining part shall be pumped to the energy recovery system, for pressure exchange. From the high pressure pumps and energy recovery system, the feed flow will be mixed before entering the RO system. Each RO line will have its own dedicated energy recovery system. The RO is expected to be a two pass system to provide the high quality permeate required under the contract.

Concentrate from the RO membranes will be directed to the energy recovery device for pressure exchange with part of the incoming feed water. RO concentrate will be discharged to a brine disposal point just outside the site boundary after the energy recovery step, following which the brine will be piped to the salt production facility.

The RO system will require periodic cleaning (which could be in the order of every 6 to 12 months). Cleaning agents will be prepared with RO effluent (freshwater). By function, the cleaners are divided into 0.2% HCl (for removing scale of CaCO<sub>3</sub> and inorganic colloid) and 0.1% NaOH (for removing scales of BaSO<sub>4</sub>, CaSO<sub>4</sub> and SrSO<sub>4</sub> and organic colloid). After cleaning, effluent (freshwater) from RO is used to wash out residual cleaner.

The process is designed to produce water quality in accordance with key parameters: pH 6.5~8.5, Turbidity ≤0.1 NTU, TDS ≤1000 mg/l, Fe ≤0.3 mg/l, Sulphate (SO<sub>4</sub>) ≤250 mg/l, and Chloride ≤250 mg/l.

## 2.2 Intake and discharge volumes

The process will draw in the order of 137,540 m<sup>3</sup>/d of seawater and result in the discharge of the following volumes of product water, brine and wastewater (Table 4).

**Table 4 Intake and discharge volumes**

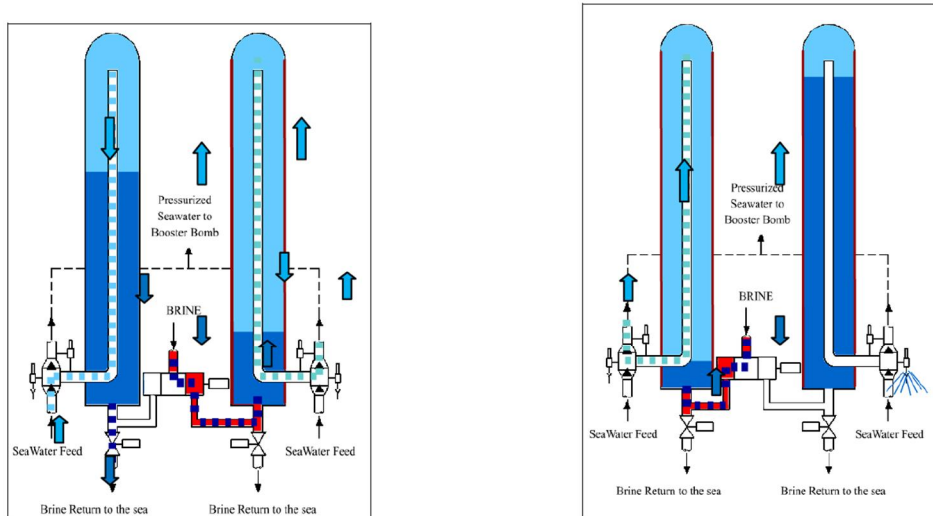
Parameter	Volume (m <sup>3</sup> /d)	% Balance	Discharged to
Seawater Intake	137,540	100%	-
DAF, UF process and system cleaning wash	19,640	14%	Wastewater treatment facility
Brine	67,900	49%	Direct re-use at salt works
Product water	50,000	37%	Industrial uses

### 2.3 Energy Recovery

The RO process will include Aqualyng's energy recovery system, and/or equivalent Energy Recovery Device, a work exchanger that fits into the classification of Isobaric Energy Recovery Devices, more specifically in the 'piston-type' work exchangers, known as the Recuperator. Use of the Recuperator is expected to provide up to 98.5% energy recovery from the RO process to be directly reused in the system. The total energy requirements of the Project, including the

energy recovery technology, will be in the order of 66GWh/yr supplied by the State Grid (as discussed further in Section 4.2.1)

A schematic drawing of the Recuperator sequences is shown in Figure 6 and further details of the energy recovery process provided below.



**Figure 1a**  
**Vessel #1 is filled with pretreated feed water.**  
**Well water in vessel #2 is displaced and pressurized by brine.**

**Figure 1b**  
**Pretreated feed water in Vessel #1 is pressurized and displaced by brine.**  
**Vessel #2 is just ended the cycle and decompresses before discharging the brine.**

**Figure 6 Schematic diagram of Aqualyng's energy recovery device**

The system uses the saline-reject (brine) from the membranes to pressurize pre-treated seawater in a sequential process regulated by the brine flow from the RO membranes. The device consists of vertically standing pairs of duplex stainless steel chambers that work alternatively in a compression-transfer and decompression-discharge sequence.

Pre-treated seawater will come from a pressurized feeding tank at a constant flow and pressure into the system. One of the chambers will be under high-pressure by the brine and displacing seawater into the RO system, while the other will be filling up with low-pressure pre-treated seawater from the top and discharging the brine (that has exchanged its energy to pre-treated seawater in the previous cycle) at the bottom. The pressurized seawater goes into the membrane train via a booster pump. This pump compensates the head losses across the membrane elements and the piping system, which are normally around 1.5 – 2.5 bar. The whole sequence is accomplished by the operation of a set of several piston duplex stainless steel valves, some of them actuated by differential pressure and others by a hydraulic system, and automatically controlled by a PLC platform. This valve configuration assures a continuous flow of high pressure seawater into the membranes.

Aqualyng's Recuperator allows the pressurized brine to 'recycle' back to the membranes through the booster pump – only that the brine is replaced with pre-treated seawater at an identical flow.

## 2.4 Chemicals Use and Storage

Chemicals required for the desalination process will be stored on site in three areas: (i) coagulant area for storage of liquid bulk ferric and PAM, (ii) dry chemical store are including sodium metabisulphite, and (iii) other liquid chemical storage area for NaOH, HCl, anti-scalant, NaOCl, sodium metabisulphite solution. All chemicals will be stored in segregated separate



bunds in accordance with PRC regulations. Reactive chemicals will not be located adjacent to each other. Bund walls shall not exceed 1 m and will be located to provide a 2 to 1 angle from top of the wall to top of the storage. The bund volumes have been designed to be greater than 11% volume of the largest tank, after excluding the volume occupied by the tanks. The bunds will be of suitable structural material for leak containment, with coatings where necessary to meet asset life. Stairs will be provided in order to access each bund (stairs materials shall be corrosion resistant) and access platforms will be provided to reach the top of each tank. Chemicals will be stored in temperature controlled, ventilated and lockable storage rooms.

Chemicals will be delivered by licenced chemical transport companies and unloaded on site within an unloading bay with containment bunding suitable to capture any spills. Safety equipment for safe unloading will include tank sight level gauges, safety showers/eyewash stations, personal protective clothing and signage.

The total quantities of chemicals to be stored on Site as summarised in Table 5.

**Table 5 Chemical Storage volumes**

Chemical	Storage Volume	Storage tank sizes
PAM	24 m <sup>3</sup>	(2 No. x 12 m <sup>3</sup> )
Ferric chloride	24 m <sup>3</sup>	(2 No. x 12 m <sup>3</sup> )
NaOH (Summer)	30 m <sup>3</sup>	(2 No. x 15 m <sup>3</sup> ) (3m dia x 5m)
Sodium Metabisulphite*	10 t	say 15 m <sup>2</sup> store
Antiscalant*	5.4	(2 x 2.7 m <sup>3</sup> )
NaOCl **	9.6	(2 x 4.8 m <sup>3</sup> )
HCl**	(10.6	(2 x 5.3 m <sup>3</sup> )

The consumption of raw materials and auxiliary materials are listed in Table 6.

**Table 6 Consumption of raw materials and auxiliary materials**

Chemicals	Active composition	Method of package or storage	Concentration (%)	Annual consumption (t)
Antiscalant	Antiscalant	Liquid, in barrel	100	24
Flocculant	Ferric chloride	Solid, in bag	100	24
Disinfectant	NaClO	Liquid, in barrel	13	363
Reducing agent	Sodium bisulphate	Solid, in bag	100	86
Post treatment chemicals	CaCO <sub>3</sub>	Solid, in bag	100	190
pH adjustment	Sulphuric acid	Liquid, in barrel	98	447
Cleaning reagent	Muriatic acid	Liquid, in barrel	35	34
Cleaning reagent	Sodium hydroxide	Solid, in bag	50	14

## 2.5 Pollution Emission

Pollution emissions from the operational desalination process will include: (i) noise, (ii) wastewater, and (iii) solid wastes. No air pollution emissions will be produced by the desalination process, however indirect greenhouse gas emissions will result from the facilities power consumption of 66 GWh/yr.

**Noise.** Running noise of the Project will primarily be produced by equipment and pumps in pretreatment system and RO system. The major noise sources are ultrafiltration feed pump,

seawater RO high-pressure pump, pressure lift pump and freshwater RO high-pressure pump. Based on specifications for these equipment, noise produced is expected to be within the range of 65dB(A) and 85dB(A), which is within the requirements for Class III noise standards, as detailed in the Environmental Quality Standards for Noise (GB3096-2008) applicable to the Project Site.

**Wastewater.** Wastewater will be produced from several processes, including: (i) water from floatation in pretreatment section, (ii) wastewater from UF backwashing, (iii) wastewater from chemical enhanced wash and cleaning, (iv) concentrated brine from seawater RO, (v) water from cleaning in freshwater RO, (vi) wastewater from periodical cleaning of RO device, and (vii) staff's domestic sewage.

**Solid wastes.** Solid wastes will be produced from the following sources: (i) waste membrane element from UF and RO process, (ii) waste chemical packaging, (iii) staff's domestic garbage.

**Table 7 Production and expected emission of primary pollutants**

	Emission source	Primary pollutant of potential concern	Expected Concentration	Discharge (m3/a)	
<b>Air</b>	--	--	--	--	
<b>Water</b>	Floatation	Suspended Solids	150mg/L	287	
	Ultrafiltration backwashing	Salt		4.29 million	
	Chemical enhanced wash and cleaning	pH	5~11	0.2772 million	
	Seawater RO	Brine (Salt)		22.407 million	
	Membrane cleaning	pH	5~11	495	
	Domestic sewage		COD	450mg/L	0.19t/a
			NH <sub>3</sub> -N	30mg/L	0.02t/a
		SS	250mg/L	0.04t/a	
<b>Solid waste</b>	Ultrafiltration and RO section	Waste membrane element		10 t/a 2 t/a	
	Chemical	Package			
	Staff's living	Domestic garbage		9.9t/a	
<b>Noise</b>	After completion of the Project, main noise sources consist of RO high-pressure pump, energy recovery device and fan. Noise produced in equipment running falls between 65dB and 85 dB.				

## 3. Environmental and Social Setting

The following section presents a summary of the economic, social, physical and environmental setting of the Project area. Focus is given to the potentially sensitive ecosystems and community benefits and concerns regarding the Project. Some baseline data is presented from surveys undertaken as part of this assessment along with past studies.

### 3.1 Economic Development

Hebei has remained a largely underdeveloped Province, with limited economic, social, technological, or political linkages with Beijing and Tianjin, despite proximity to these major cities (ADB, 2012). Hebei suffers from undeveloped urban-rural linkages, underinvestment in infrastructure, weak urban management, and significant deterioration of the natural environment, including the depletion of water resources. The Asian Development Bank has noted a key challenge associated with economic development in Hebei is to improve infrastructure service delivery, safeguard the environment, and improve local employment to achieve sustainable development.

To promote economic development, the Hebei Provincial Government has outlined priority Projects, 12th Oceanic Economic Development Five-year Plan of Hebei Province, including the BNAIZ. Since approval in 2007, the BNAIZ has become central to the economic development plan for the region, with expectation of substantial employment opportunities for local and migrant workers.

The BNAIZ is a strategic Provincial and State-Level supported economic development zone, which includes three board areas: (i) Huanghua Port zone, already the second-largest coal export port in PRC, (ii) Zhongjie industrial and chemical industries park, and (iii) the Nandagang industrial park. With a proposed total area of 2,375 km<sup>2</sup>, accessing a coastline of 130 km, and a forecast workforce of over 546,000, the NBAIZ plays a important role regional economic development of Hebei Province, the Bohai Economic Circle and Beijing-Tianjin Economic Circle.

The BNAIZ received development and environmental approval from the NRC and MEP in 2007, with an investment commitment of over RMB 180 Billion to expand and develop new industrial and port infrastructure. In addition to industrial infrastructure, the BNAIZ will include development of education facilities including the Beijing University of Chinese Medicine, the Dongfang College, Zhongjie Technical School, and the Affiliated School of Beijing Normal University. Community infrastructure will include Hebei Publishing & Media Cultural Creative Center, China's Communist Youth League Young Pioneers Red Scarf Cultural Experience Park, an Expo Amusement Park, and over 15 km<sup>2</sup> of community parks and landscaped areas.

Access to fresh water had been identified as a limiting factor in industry development within the BNAIZ. Existing reservoirs providing water for municipal and industrial purposes are not sufficient to facilitate development of the industrial zone. The Project will support development of industries requiring high quality water within the BNAIZ.

The BNAIZ development plan promotes sustainable use of water, including utilization of seawater for industrial cooling and desulfurization. In addition, the development plan promotes the application of energy efficient desalination and supports the direct reuse of the brine desalination by-product in the local salt production industry. One example of this, already in operation, is the Guohua Cangdian Desalination Facility (applying a thermal desalination technology) from which the brine waste stream is directed to the Changlu Cangzhou Salt Group

Co Ltd (CCSG) for evaporative salt production. The CCSG reported an increase in salt production of approximately 150,000 ton/yr as a result of the agreement to accept brine from the Guohua Cangdian Desalination Facility.

Aqualyng's Project will demonstrate similar sustainable practice, with a framework agreement signed between Aqualyng, the Administrative Committee of Cangzhou Bohai Development Zone and CCSG in 2012. The brine from the proposed Aqualyng plant will be accepted by CCSG.

### 3.2 Social Setting

Hebei Province is home to over 72 Million people (HPG, 2012), of which, approximately 7 Million reside in Cangzhou Municipality. The population within Cangzhou includes 96.5% Han Chinese, with the Hui nationality (Muslim) being the largest of the minority groups. The population is divided roughly evenly between rural (54%) and urban (46%) settings, and the male (51%) population is slightly higher than that of the female (49%). Approximately 68% of people have been educated to a Secondary School level and above, with only 4.25% illiteracy rate. The detailed demographic profile is displayed below in Table 8.

**Table 8 Demographic Profile of the Hubei Province 2011**

Indicators		Number (10 <sup>4</sup> )
Total Population of Year-end (10000 persons)		7240.51
Population by Residence	Urban Population	3301.673
	Rural Population	3938.837
Population by Sex	Male Population	3742.62
	Female Population	3479.89
Birth Rate(‰)		13.02
Death Rate(‰)		6.52
Natural Growth Rate(‰)		6.5
Density of Population(‰)		386
Household (10000 units)		2171.4
Population by Age Group (%)		
0-14		17.82
15-64		73.51
65 and over		8.67
Population by Education Attainments (%)		
Illiterate		4.25
Primary School		26.84
Junior Secondary Schools		49.15
Senior Secondary Schools		14.44
College and Higher Level		5.33

Hebei 2012 Yearbook

According to the Hebei 2012 Yearbook, among the surveyed households, the rural household size is 3.66, larger than that of the urban. Their incomes accounts for 66% of their urban counterparts, which shows incomes gaps between rural and urban areas. About half of their incomes were expended for the basic living substances, such as food, clothing and housing. This has shown that the economic development was not well advanced. The demographic profile of urban and rural households is displayed in Table 9 below.

**Table 9 Demographic Profile of Urban and Rural Households**

Indicators	Urban	Rural
------------	-------	-------

Average Household Size	2.84	3.66
Average Number of Employed Persons per household	1.39	2.72
Per Capita Annual Incomes (Yuan)	19,591.91	10,046.91
Per Capita Annual Living Expenditures (Yuan)	11609.29	4711.16

Hebei 2012 Yearbook

### 3.2.1 Labour Force

According to the 2012 Hebei Yearbook, the percentage of employees working in the primary, secondary and tertiary sectors were almost same, 36%, 33% and 30% respectively in 2011 while nearly 50%, 27% and 23% of people worked in these three sectors ten years ago. This shows a drop of employees in the primary sector. Large numbers of workers have moved on from farming work and into secondary sectors such as manufacturing, construction, wholesales and the retail trades.

The average monthly salary in the secondary industry is approximately RMB 2,000 Yuan, this being lower than the average of the province as a whole, which is RMB 3,000 Yuan. Farmers and fishermen are on the lower end of the scale, earning RMB 1,350 Yuan monthly. This salary discrepancy may be the primary reason for the large migration from the more rural areas into the urban areas.

### 3.2.2 Project Area Labour Conditions

The recent survey by Human Resources and the Social Security Bureau of Cangzhou (HRSSB, 2012) revealed that the overall employment demands are robust and labour shortage are common, especially for technical labourers and senior technicians. The overall education levels of the surveyed area are low.

The survey indicated that approximately 85% of the surveyed prefer to work close to their hometown, and only 15% choose to work in big cities, like Beijing and Tianjian. Preferred jobs were listed as manufacturing, building, wholesale and retail, information services and hotel and catering. The expected salary level was RMB 2,000~3,000 per month. The minimum wage in 2011 in Cangzhou city was RMB 860 per month. Over 90% of the surveyed would like to sign formal employment contracts with employers and have social/welfare benefits.

### 3.2.3 Resettlement

The Project Site is undeveloped vacant land. No resettlement will be required as part of the Project development. The closest village is the Yugou Village, approximately 3.5 km west of the Project area, with a population of about 1,000.

## 3.3 Physical Setting

### 3.3.1 Land uses

At the time of this ESIA, the BNAIZ was under construction. The new port area within Huanghua Port had been developed, along with a substantial area of reclaimed land. Roads and power distribution infrastructure had been development, and several industrial facilities and community infrastructure was in construction.

There were no current land uses at the Project Site, which was observed to be un-vegetated, un-developed reclaimed land during a site inspection in April 2013 (as shown in Photo plate 1). The surrounding land uses included road and power transmission infrastructure, along with the

port infrastructure development approximately 3 km to the east. Within the BNAIZ there were several operational industrial facilities.



Photo plate 1: Project Site undeveloped reclaimed land (April 2013)

### 3.3.2 Landforms, geology, groundwater

The BNAIZ is located within a low flat coastal plain, dominated by silt rich sedimentary deposits with a gradual gradient towards the west. The coastal plain is subject to tidal inundation. The landform is highly modified by man-made bunds, segregating much of the land form into isolated tidal ponds some of which are used for fishing, others used as evaporative salt production.

The Project Site is located within an area of recently reclaimed coastal plain (reclaimed within the past 3 years). Prior to reclamation the land area was underdeveloped coastal plain, as shown in Figure 7.



Figure 7 Approximate location of Project Site (red square) and surrounding area prior to land reclamation associated with the BNAIZ (circa 2010). Dotted red line indicates approximate initial area of land reclamation for the industrial zone.

At the time of this assessment, the Site existed at approximately 3 m above sea level, reclaimed with marine sediments, dominated by silt and clay. The Geological Survey Report for Reconstruction at Huanghua Port (2012) outlines the geotechnical properties of the subsurface with respect to building requirements.

The BNAIZ is located with the North China Seismic Belt, within which earthquakes of greater than 6 have not been recorded (China Earthquake Catalogue, Compilation of Historical Earthquakes in China and East China Earthquake Catalogue).

Groundwater was not investigated as part of this assessment, however groundwater is likely to exist at shallow depths (<3 below ground surface) at the Project Site relative to the sites low elevation above sea level. The surface aquifer groundwater is likely to be highly saline with limited beneficial use.

### 3.3.3 Climate

The Project Site is located within a subhumid continental monsoon climate, with strong maritime influences due to its proximity to the Bohai Bay. Based on information obtained from the Huanghua City weather station, the mean monthly temperature ranges from 27 °C in July to 2.75°C in February. The annual mean sunshine duration is 27:55 hrs. The annual rainfall is 727 mm, which is greatly exceeded by annual evaporation of around 2,000 mm.

The annual mean wind speed for Cangzhou is 2.9 m/s, peaking in April (monthly mean of 3.76 m/s) and dropping to its lowest in December (monthly mean of 2.38 m/s). The prevailing wind direction is SW (occurring 11% of the time) as shown in the Figure 8 below.

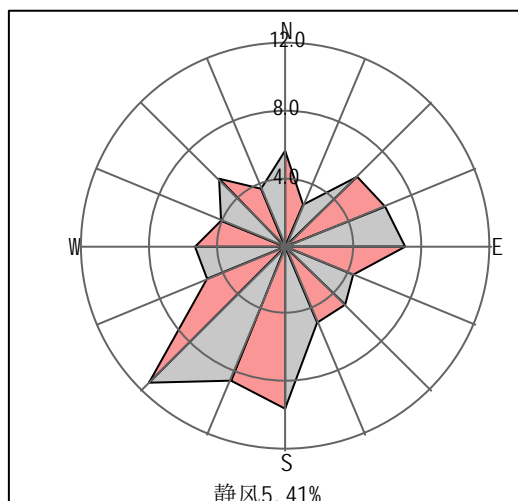


Figure 8 Wind rose of winter wind direction over past 20 years

Huanghua Port remains an ice-free harbor during the winter months. Sea ice outside the harbor basin occurs at the beginning of December, peaking by the end of December, and is generally melted by the end of February. The maximum thickness of drift ice is approximately 0.2 m.

### 3.3.4 Surface Water

Surface water is a scarce resource within Hebei. Hebei's average water resource per capita is 306 m<sup>3</sup>, which is significantly lower than the national average of 2,195 m<sup>3</sup>.

In the last 30 years, rapid socio-economic development has increased the water demand rate to 2.5 billion m<sup>3</sup> each year. This has resulted in an excessive exploitation of groundwater, with 50 billion m<sup>3</sup> used in the Hebei Province. The Hebei Provincial Government notes that exploitation of groundwater storages have been exhausted, and installation of additional groundwater extraction wells is no longer permitted.

There are no freshwater surface water bodies within a 3 km radius of the Project Site.

Freshwater for potable and industrial purposes is supplied to area from the Yangcheng Reservoir, Nandagang Reservoir, and the Guanyangchang Reservoir.

## 3.4 Biodiversity and Sensitive Ecosystems

The Project is located in a previously established industrial area and therefore biodiversity levels in the immediate area surrounding the site are not high.

There are no conservation areas or known sensitive ecosystems within the BNAIZ. The closest nature reserve to the Site is located approximately 60 km to the east, the Nandagang Wetland Nature Reserve. This nature reserve is approximately 13,380 ha and was established as a Provincial-level nature reserve in 1995. The reserve includes salt marshes, fishponds, salt pans and freshwater reservoirs, and a major vegetation type of salt-marsh. The reserve is a major staging area for migratory shorebirds, with over 20,000 waterbirds passing through during the migration season (Bird Life International, 2009). The Project is not expected to have any negative impact on the Nandagang Wetland Nature Reserve.

There are no marine reserves or sensitive areas within the BNAIZ port area.

### 3.4.1 Marine Biodiversity

No detailed marine biodiversity studies for the BNAIZ have been made available for this ESIA. A study for a similar area within the Bohai Bay (Caofeidian) undertaken by the Fisheries Research Institution of Tianjin (FRIT, 2007) provides some limited information on marine



biodiversity within near-shore tidal zones such as the BNAIZ that demonstrates the level of biodiversity that may occur in the area.

Mollusks and other shellfish are common within the tidal mud flats around Caofeidian, including *Potamocorbula amurensis* Larvae, *Macra quadrangularis*, Japanese *Macrophthalmus pacicus*, *Moerella jodoensis* and *Umbonium thomasi*. FRIT, 2007 identified 49 different mollusk and shellfish species near Caofeidian. Similar species diversity may be expected within the BNAIZ.

Based on the highly modified nature of the BNAIZ it is likely that marine biodiversity is limited. Further marine biodiversity studies are outside the scope of this ESIA.

### 3.5 Environmental Quality Baseline Data

Environmental monitoring was conducted for ambient air, noise, marine water quality, and marine sediment quality for an adjacent site in January 2013 by the Hebei Aquatic Environmental Science Laboratory. The monitoring sites used by the Hebei Aquatic Environmental Science Laboratory were located within 3 km of the Project Site and can be considered representative of ambient conditions in the area. The following provides a summary of the results.

#### 3.5.1 Ambient Air Quality

Maximum hourly concentration and maximum daily average concentration of SO<sub>2</sub> was recorded at 0.239 mg/m<sup>3</sup> and 0.102 mg/m<sup>3</sup> respectively. The maximum daily average concentration of PM<sub>10</sub> was 0.122mg/m<sup>3</sup>. The maximum daily average concentration of TSP was 0.252mg/m<sup>3</sup>. The maximum hourly concentration and maximum daily average concentration of NO<sub>x</sub> was 0.140mg/m<sup>3</sup> and 0.072 mg/m<sup>3</sup> respectively.

All of the results are within the Class II standard in GB3095-2012 Ambient Air Quality Standard.

#### 3.5.2 Ambient Noise

The acoustic environment functional area of the Project is classified as a Category III Area, and the main source of noise pollution is traffic noise. The maximum daytime noise levels and the maximum night time noise levels of the regional acoustic environment are 49.0dB(A) and 46.3dB(A) respectively, with both meeting the Class 3 standard for the GB3096-2008 Environmental Quality Standard for Noise.

#### 3.5.3 Marine Water Quality

Environmental quality monitoring undertaken by the Cangzhou Municipal Marine Environment Monitoring Station from 25 May to 6 June 2011 within the BNAIZ (HEPD, 2011). Monitoring results were compared to the water quality criteria for Class III waters, with concentrations of the following parameters recorded: pH, dissolved oxygen, chemical oxygen demand, arsenic, copper and cadmium. However, inorganic nitrogen, hydrocarbons, mercury, lead and zinc concentrations all exceeded the criteria.

Inorganic nitrogen commonly exceeds the water quality criteria within the Bohai Bay area; this may be the result of agricultural runoff and urban sewerage discharge into the area. Average inorganic nitrogen ranges from 0.320 mg/L to 0.334 mg/L.

Hydrocarbons are generally a result of urban runoff, oil spills and industrial wastewater discharge, and commonly exceed the Class III waste quality standards within Bohai Bay. In recent years, with the rapid economic development of construction areas, the construction of ocean and coastal projects, and frequent shipping activities, petroleum hydrocarbons are being introduced at a higher rate into the environment. Because petroleum hydrocarbons are diffused

and transported quickly in the seawater, petroleum hydrocarbons in neighbouring sea areas may also impact upon the monitoring area.

Ambient mercury concentrations within seawater around the BNAIZ range from 0.123 µg/L to 0.0633 µg/L between seasons, falling between Class II and Class III water quality standards.

Lead and Zinc concentrations within Bohai Bay range from Class II water quality standard to poorer than Class I seawater quality standard.

#### 3.5.4 Marine Sediment Quality

The organic carbon, sulfide, oil, mercury, arsenic, copper, lead, zinc and cadmium in the sediments of the investigated sea area meet relevant requirements in GB18668-2002 Marine Sediment Quality, in both the neap season and the spring tide period.

## 4. Potential Environmental and Social Impacts

The potential environmental and social impacts and benefits of the proposed activities have been assessed in line with IFC guidelines, including assessment of the possible benefits and impacts with regard to: (i) biodiversity conservation and sustainable natural resource management; (ii) pollution prevention and abatement; (iii) social and socio-economic impacts; and (iv) health and safety.

### 4.1 Incremental Environmental and Social Benefits

#### 4.1.1 Increased availability of freshwater and improved Climate Change Resilience

The Project will increase the availability of freshwater for industrial purposes, with the production of 50,000 m<sup>3</sup>/d of desalinated water meeting industrial intake water quality standards. With no major surface water bodies in the area and limited rainfall, freshwater resources are under pressure from increasing development. In addition, the potential of future climate variability may result in further challenges in managing the already scarce freshwater resources within the region. The Hebei Provincial Government has noted availability of freshwater as one of the potential limiting factors of development within the BNAIZ<sup>3</sup>. In response, the government has proposed to improve the water resource availability in the 12th Five-Year Plan; including measures to strengthen water resource management, posing stringent controls on groundwater exploitation and finding alternative sources of water, specifically noting seawater desalination.

This Project provides a reliable source of fresh water independent of the potential future impacts of climate change, increasing the resilience to climate variability of the BNAIZ into the future.

#### 4.1.2 Increased employment and skills exchange

Employment opportunities will exist for both skilled and unskilled personal. With labourers required during both the construction and operational phases of the desalination process. Local labourers will be utilised over outside workers; this will aim to ensure that there is not an influx of workers into the area, and that local residents are provided with benefits as a result of the Project.

According to the estimated person-day requirements for the Project, approximately 200 labour positions will be created during construction and approximately 40 permanent positions will be created during operation. The operational positions will be technical roles, and will be supported by technical training and skills exchange programs, based on Aqualyngs international operational expertise.

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<sup>3</sup> According to “the Specific Plan of New Bohai Area for Infrastructure”, the total water demand will be 1.5 million m<sup>3</sup>/d by 2020. However, the current water supply from two water supply plants, Juyuan and Shenhua is approximately 20,000 m<sup>3</sup>/d, which could meet domestic water use of the current population (approximately 40,000 persons) and water demands of partial small and medium-sized businesses.

## 4.2 Potential Adverse Impacts and Mitigation Measures Associated with Project Design

### 4.2.1 Energy use and indirect GHG emissions

Seawater desalination is often more energy intensive than other water supply options; particularly if the current water supply comes from local elevated catchments, which operate by gravity. Increased energy use has implications for issues such as climate change, and also local infrastructure limitations if power is limited.

Aqualyngs has included energy efficiency design technology in their process design, providing up to 98.5% of the waste energy to be reused in the RO process (as described in Section 2.3).

Principal energy usage as part of the Project will include electricity procured from the grid (estimated to be about 66GWh per year). Net green house gas (GHG) emissions attributable to the annual consumption of electricity for the Project are estimated to be about 53,870 metric tons of carbon dioxide equivalents per year. Although GHG emissions from the Project will not exceed 100,000<sup>4</sup> tons of carbon dioxide equivalents per year, Aqualyng will explore opportunities for energy efficiency in its operations to reduce operational cost and their carbon footprint. Consistent with IFC PS3 requirements on GHG emissions, Aqualyng will also monitor and quantify GHG emissions, as well as those avoided, in accordance with internationally recognized methodologies. Should the level of GHG's exceed 100,000 tons of carbon dioxide equivalents per year, Aqualyng will evaluate technically and financially feasible and cost-effective options to reduce or offset Project-related GHG emissions during the design and operation of the Project.

### 4.2.2 Mitigation of potential brine toxicity impacts to marine environment

The Project will result in 67,900 m<sup>3</sup>/d of brine with salinity concentrations in the order of twice the concentration of that in seawater. At this level the salinity concentrations can have negative impacts on marine organisms if discharged directly to the marine environment. To mitigate this potential impact the Project design incorporates an agreement with the CCSG salt works for evaporative salt production. All brine will be directly recycled by CCSG under a contractual agreement. Desalination brine has excellent properties for salt production (fewer impurities); as such, Aqualyng has developed a potential strong new line of business for new desalination plants, with the dual-purpose of producing water and generating brine for salt production, and has had agreements reached with CCSG.

### 4.2.3 Associated facilities – Seawater Intake

The Project has the potential to impact upon marine ecology, as marine biota may become entrapped in the intake structure of the plant. This may include the entrapment of organisms at the intake opening, and/or smaller organisms being drawn into the plant. The location of the intake infrastructure and the intake velocity can mitigate this impact.

The construction of the intake structure may also impact upon marine ecology by disturbing the seabed and consequently resulting in the re-suspension of nutrients, sediments and pollutants into the water column. The intake structure may also act as an artificial reef for organisms, or affect water exchange or sediment transport.

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<sup>4</sup> IFC policy only require projects with “significant emissions” to quantify GHGs. “Significant emissions” refer to projects that emit at least “100,000 tons CO2 equivalent per year for the aggregate emissions of direct sources and indirect sources associated with purchased electricity for own consumption.”

### 4.3 Potential Adverse Impact and Mitigation Measures during Construction Phase

Potential adverse impacts of the Project construction phase include: (i) increased siltation of marine water bodies due to runoff from excavation, (ii) impacts on air quality from dust and emissions from vehicles, (iii) noise impacts from excavation machinery and transport, and (iv) waste impacts from construction camp, general waste and construction solid waste. Construction-phase impacts are likely to be localised and will occur over a relatively short period of time.

#### 4.3.1 Siltation, soil erosion and mitigation measures

Excavation for construction of building foundations and installation of pipes will cause disturbance of sediment/soil at the Site, and may result in short-term increases in concentrations of suspended substances (SS) in adjacent marine water bodies, especially during rainfall events. To mitigate this potential impact, the contractor will be required to have sound environmental management programs; including a sediment control plan which outlines sediment control measures, such as sediment nets and booms, covering and bunding around stockpiles, and use of water diversion trenches as appropriate. Water quality in the adjacent marine water bodies will be monitored during construction for suspended solids to confirm the result of the impact assessment and effectiveness of mitigation measures adopted. Mitigation measures in the EMP include:

- (i) Implement erosion protection measures including silt barriers;
- (ii) Stabilize excavation slopes, embankments, and other erosion-prone working areas during excavation works;
- (iii) Stabilize all earthwork areas within 30 days after earthworks have ceased;
- (iv) Divert drainage around excavation areas during channel/lake earthworks;
- (v) Undertake excavation in sections, to minimize the area of active excavation at any time;
- (vi) Provide temporary detention ponds or containment to control silt runoff;
- (vii) Construct intercepting ditches/drains to prevent runoff entering the construction sites, and divert runoff from sites to existing drainage;
- (viii) Limit construction and material handling during periods of rains and high winds;
- (ix) Properly vegetate disturbed surfaces at construction completion; and
- (x) If evidence of sediment runoff entering the marine environment is recorded, construction works will be halted and corrective action (improved siltation protection measures) will be implemented.

#### 4.3.2 Potential for contamination of soil, groundwater and marine waters

Potential soil, groundwater and marine water impacts associated with the release of construction related pollution to the environment will be managed and mitigated as follows:

- (i) Develop contingency plans for control of oil and other dangerous substances (Spill Management Plan);
- (ii) Equip all areas where construction equipment is being washed with water collection basins and sediment traps;
- (iii) Do not undertake any fuel storage, refuelling or vehicle maintenance on site;

- (iv) Place storage facilities for hazardous materials within secured areas on impermeable surfaces, and provide bunds and clean up installations;
- (v) Follow proper protocol for hazardous materials transport and handling as detailed in JT 3145-88 (Transportation, Loading and Unloading of Dangerous or Harmful Goods);
- (vi) Install eco-toilets and septic treatment and disposal systems at the construction camp along with proper maintenance protocols;
- (vii) Water quality parameters (for pollutants including SS, TP, TN, oil, and grease) in the drainage channels will be monitored during construction in accordance with the EMP monitoring program to assess effectiveness of adopted mitigation measures; and
- (vii) Implement awareness building and training program for construction workers.

#### 4.3.3 Noise nuisance and mitigation measures

During construction, noise will primarily be produced from construction machinery, such as excavators, scrapers, tractors, dump trucks, cars, washing and piling of construction material. The noise of construction machinery is generally between 80 ~ 110 dB, while the vehicle noise intensity is generally 90 dB. As the construction area is not adjacent to any villages, noise is not expected to have adverse effects on residents. However, appropriate controls should be implemented according to the Standard of Measurement Method for Noise from Construction Site (GB12523-90). In the Project area, the noise will be controlled according to the Standard of Environmental Noise of Urban Areas (GB3096-93).

Noise mitigation measures that may be employed include: (i) noise source control; select the low-noise technology and equipment; equipment (components) with large vibration should be equipped with vibration dampers; (ii) strengthen equipment repair and maintenance, so that construction machinery is maintained in good working condition; and (iii) make reasonable arrangements for construction time. When vehicles pass noise sensitive areas, speed should be controlled to no more than 35km/h and use of a whistle/horn prohibited.

#### 4.3.4 Dust generation and mitigation measures

Potential sources of dust during construction activities include: (i) dust generated from earth excavation, loading, hauling, and unloading; (ii) dust generated by the movement of vehicles and heavy machinery on unpaved access and haul roads; and (iii) dust from aggregate preparation, concrete-mixing, and haulage activities. To limit dust generation during construction, water trucks will be used to wet the construction roads, according to a daily schedule and taking into consideration weather conditions. When construction takes place during dry and windy days, water will be sprayed on earth piles and exposed surfaces to suppress dust. Dust suppression equipment will be installed for any concrete-batching.

#### 4.3.5 Pollution Prevention and Abatement

##### ***Wastewater from construction camp***

Pollution relating to wastewater discharge from the construction camp will be managed by use of portable sanitary systems. The wastewater will be collected, transported off site and disposed of to the domestic sewerage system.

##### ***General waste from construction***

The Project will promote best practice waste management, focusing on minimisation, reuse, and recycling, including minimisation of solid waste generation through appropriate materials procurement and use of multi-compartment collection bins to promote recycling of construction materials.

### ***Greenhouse gas emissions***

Potential sources of greenhouse gas emissions from Project works include machinery and vehicle exhaust. Proper maintenance of vehicles and diesel equipment, and avoidance of unnecessary running of vehicle and equipment engines will reduce emissions. No vehicle that emits black smoke will be allowed to operate on-site. According to past similar construction works, greenhouse gas emissions from vehicles and machinery are likely to be low.

#### 4.3.6 Construction Contractor Health and Safety

##### ***Increased risk of disease***

During construction, with the accumulation of a large Project workforce (up to approximately 200 workers), there may be increasing incidence of communicable and vector-borne diseases, which poses potential health threat to Project personnel and residents of local communities. Migrant workers may bring their families or members of their families to the placement of employment. The negative impacts could include children exposed to dangerous or hazardous conditions, poor living conditions and lack of access to services such as healthcare and education. To mitigate against this potential impact, suitable construction camp accommodation will be provided as part of the construction contract for migrant works. The accommodation will include adequate sanitation facilities and access to freshwater.

Improving health awareness and education campaign through trainings; distributing control of transmittable diseases (HIV/STD) posters and pamphlets at construction sites; encouraging condom use; providing on-site or community health care facilities; promoting collaboration with local authorities to enhance access of construction workers families to public health and sanitary services.

Providing workers with clean, dry dormitories to prevent any vector-borne diseases; adopting use of repellents, clothing, netting and other barriers to prevent insect bites; collaborating with local authorities to promote education, prevention and available treatment.

##### ***Child labour***

Chinese Labour Law defines labour forces less than 16 years old as child labour. A strict employee identification and age confirmation process will be implemented as part of both the construction and operational phase contracts. Aqualyng, and/or its respective Owner's Engineers, will undertake random checks to monitor compliance with this policy.

As it is illegal to employ labourers under the age of 16, Aqualyng should set a minimum work age for the proposed Project construction and review and retain copies of verifiable documentation concerning the age and employment profile of all personnel working at the construction site.

##### ***Contractor health and safety during construction activities***

Construction activities have potential to result in minor and serious health impacts on construction workers. Appropriate mitigation measures have been included in the EMP. All construction works will be undertaken in compliance with National codes, standards and regulations for labour safety and health.

Prior to commence of construction, Aqualyng should train its site staffs and contractors about the OHS policy, plan and procedures. Contractors should provide more specific training to their staffs, including basic hazard awareness, site-specific hazards during the constructions, safe work practices and emergency procedures etc. The respective mitigation measures for protecting injuries are:

- Protection from over-exertion: Training workers in lifting and material handling techniques; planning the site wisely to minimize the need for manual transfer of heavy loads; applying tools and machinery to reduce force requirements and holding times;
- Protection from slips and falls: Slips and falls at the same elevation are usually due to poor housekeeping. Good housekeeping should be maintained, including designating special area for storage of construction material and tools; collecting and removing trashes and other debris at regular intervals; providing slip-resistant footwear.
- Protection of falls and slips at heights: Training workers to use temporary fall prevention devices, such as barriers; use of personal protection equipment and training workers on rescue procedures.
- Protection from being struck by falling objects: Wearing appropriate PPE is essential including safety glasses with side shields, face shields, and hard hats etc.
- Safety in machine and equipment operation: Only certified and trained personnel are permitted to operate machinery and equipment at the construction site. This machinery should be checked and inspected daily before use, and maintained at a regular basis to ensure safe operational conditions. Any defective or broken parts should be removed and replaced as soon as discovered.
- Protection from dust and noise: Based on empirical calculation, the noise level with the distance of 200m will be below 60 dB, which will not have impact on the nearby industries. Machine operator must wear appropriate PPE to combat dust and noise impacts.
- Excavation protection: Any excavated trenches deeper than 1.2 m should be protected with sloping, shoring and shielding. Fencing and barricades should be installed and marked with bright colors. Inspections should be conducted by a competent person prior to the start of work.
- Protection of chemical substances: Safety training should be provided to workers on the correct transfer and handling of chemical substances. Emergency response facilities will be provided at the site, and training will occur on the chemical container deployment. Suitable PPE will be provided including eye, face, head, hand, body, foot and respiratory protections.

### ***Workers contract of engagement***

Aqualyng will select EPC contractors by a pre-qualified tender, to be involved in the SWRO Plant construction. Aqualyng has less control and influence on the workers engaged by contractors, compared to their own staff, but are obliged to ensure contractors follow relevant IFC, national and local labour laws and regulations.

Aqualyng should have a HR policy in place, which is in full compliance with IFC and national and local laws and regulations to manage these contracted workers. Aqualyng should incorporate assessing the capacity of potential contractors in HR management as a key indicator of its selection criteria when engaging them and include these in the contract specifications. Practically the measures for managing and monitoring the performances of contractors are:

- Assess/audit the employment relationship between contractor and workers, and ensure that all contractors comply with legal requirements covering but not limited to minimum wage, hours of work, overtime payments, health and safety conditions, health insurance and pension schedules, and other legally mandated employment terms.
- Making unannounced visits and visual inspections at the construction site.



- Monitoring the compliance of the construction contractors as specified in the tender document.
- Providing training for the construction contractors to explain labour and working conditions for the Project.
- Providing OHS training to all contractors in Aqualyng OHS policy, plan, procedures, practice and reporting to ensure health and safety of all workers.

A grievance mechanism has been established as part of this ESIA, allowing for the workers of the contractors to directly bring complaints to Aqualyng, which then bring to the attention of contractor for resolution.

#### 4.4 Potential Adverse Impact and Mitigation Measures during Operational Phase

##### 4.4.1 Energy Usage

Energy-saving technology included in the reverse osmosis desalination engineering design is an important part of reducing energy consumption. The Project uses the world's most advanced energy recovery technology and inverter technology, and a low operating pressure and high seawater reverse osmosis membrane element complex (large flux, low operating pressure). This greatly reduces the energy consumption of the seawater reverse osmosis desalination systems.

##### 4.4.2 Chemical Spillages

Chemicals used at the plant if not properly handled or stored could have a detrimental effect on human health as well as the surrounding environment. Chemicals which will be stored on site include polyacrylamide, ferric, sodium metabisulphite, sodium hydroxide, hydrogen chloride, anti-scalant, and sodium hypochlorite (as defined in Section 2.4).

All chemical delivery, storage and handling shall meet all Chinese regulations, with the following measures taken to ensure this:

- Two tanks in bunded area for each chemical. The total volume for two tanks together is the maximum of either 14 days or 1.5 times delivery tanker size;
- The liquid chemical delivery system shall include a tanker unloading bay, duty/standby unloading transfer pumps, monorail for transfer pump maintenance, and safety equipment at the unloading station;
- The liquid chemical storage area shall include chemicals segregated into separated appropriate bunded tanks, bund volumes greater than 11% of the volume of the largest tank, access platforms to reach the top of tanks and stairs to access each bunded area.
- The chemical building shall be heated (to prevent freezing of chemicals), be ventilated, have easy safe access, be secure and have provisions to allow future tanks to be removed and replaced;
- Dry chemical storage shall have equipment to transfer pallets from the trucks into the storage area, batching tanks including mixer, dust extraction equipment and duty and standby pumps for transfer of mixed chemicals to the bulk storage tank; and

The chemical pipework shall have valves for isolation at each end and to allow pumps to be removed for maintenance, be sleeved for safe transfer and leak containment, insulated and heat traced to prevent freezing.

#### 4.4.3 Wastewater discharge

Wastewater discharge from the Project will total 19,640 m<sup>3</sup>/d from the DAF, UF process and system cleaning, and other minor sources. The wastewater will be discharged to the government owned wastewater treatment plant within the BNAIZ for treatment. The wastewater quality will be monitored to ensure it is within the acceptance criteria for the wastewater treatment plant.

#### 4.4.4 Solid and Hazardous Wastes

Approximately 55 kg of general solid waste, including packaging, plastics, and general rubbish will be generated on Site per day. General waste will be managed in an efficient manner, with all wastes collected by a licence waste management contractor and transported to suitably licenced landfill. The used membranes and chemicals packaging will be considered as hazardous waste and will be collected and disposed of by a BEPB licensed hazardous waste contractor. It is estimated that approximately 12 t of hazardous waste will be produced per year.

#### 4.4.5 Noise and Vibration

During construction noise may be generated by vehicles on site, tunnelling, drilling, rock removal, dredging, tunnelling and pile driving. During Project operation, noise sources mainly include various equipment and pumps of the RO system and pretreatment system, including RO high-pressure pump, energy recovery unit and blower fan. Noise generated by equipment operation will vary between 65-85db.

The following measures have been taken to reduce noises in the proposed Project:

- Adoption of low-noise equipment and shields;
- Laying of sound-insulation materials for adjacent walls; and
- Mount of shock absorption base and installation of the equipment within the workshop

The equipment will not impact on the sound environment of the plant after distance attenuation.

#### 4.4.6 Drainage and Erosion

There is the potential for erosion of soils to occur as a result of the creation of hardstand areas for the Project. Soil erosion is possible leading from the plant into the sea along gullies. A general change in the nature of the site may lead to drainage and erosion issues at the site and surrounding. Runoff from the plant may also be susceptible to pollution.

Landscaping of the area surrounding the plant will occur after construction, in order to ensure loose soil is not eroded and drained into the sea. Steep slopes will be avoided throughout the Project, runoffs will be managed and drains and pipes may be installed to dispose of storm water on site.

#### 4.4.7 Air Quality

During the construction phase of the Project air quality may be effected by dust particles which may be present above ambient levels. The changes in air quality may be a direct result of site preparation activities including vehicle movement on site, as well as any excavation activities. There are no changes to air quality likely to occur during the operational phase of the Project.

#### 4.4.8 Employment Contracts

The human resource management policies and procedures will be developed on the basis of national and local relevant employment and labour laws and regulations, IFC policies and guidelines and good practices from the operational Caofeidian SWRO Plant. A set of human

resource management policies and procedures have been developed to manage workers in compliance with national and local labour laws, including:

- **Recruitment:** Prepare clear job description and skill requirements, and then advertise the information in the local human resource internet. The positions will be open to any qualified persons without discrimination on gender, race or physical disability.
- **Onboarding:** The new staff will be provided with a staff manual to explain work conditions, terms of employment including wages and benefits, wage deductions, hours of works, overtime, leave for illness, vacation, maternity and holiday, and code of conducts. An employment contract will be signed between Aqualyng and the employee, which includes employment duration, wages and benefits, hours of work, overtime, rest days, breaks, grievance procedures, termination procedures and occupational health and safety.
- **Training:** The new staff will be trained to understand technical process, operational procedures and occupational health and safety measures. On the job training will be conducted from time to time to continuously improve their technical qualification.
- **Terms of Employment:** The average salary level will be approximately RMB 2500~3000 per month, which slightly higher than that offered by similar companies. The social security payments to be provided will include pension, medical care, unemployment, injuries and maternity and public housing fund.
- **Grievance Mechanism.** Any grievances will be dealt with according to the relevant national and local laws and regulations. Any grievances/disputes will be consulted and negotiated internally first in accordance with grievance redress mechanism established in the EMP. If issues can not be resolved, the disputes will be lodged to the local labour dispute arbitration committee to settle.

#### 4.4.9 Occupational Health and Safety

Aqualyng has committed to achieve high standards of environmental quality and product safety, and providing a safe and health workplace for its employees, contractors and communities. Aqualyng's policy is to perform work in the safest manner possible.

The Health and Safety Plan for the operational SWRO Plant in Caofeidian will be adapted for the Project. The plan will clearly defines Aqualyngs commitment, policy, health and safety structure and responsibility, filing system, identify a list of hazardous activities on the construction sites and chemical hazards, detail required personal protection equipment (PPE), procedures of accident reporting, investigation, analysis and correction actions, and outline suitable training for emergency preparedness.

The findings from a review of the Health and Safety plan for the operational SWRO plant in Caofeidian as presented in Appendix A, includes:

- **The general facility design and operation:** buildings structurally safe, floor even and non-skid, workplace and exit adequate for safe execution of all activities, fire precautions, natural lighting plus artificial illumination, portable drinking water, clean eating area, clean toilets and washing areas, showering facilities in case of skin contamination or exposure to poisonous substances and suitable work environment temperate.
- **Occupational health and safety (OHS) training:** all new employees were provided OHS orientation training to ensure they are familiar with the basic site rules of work, safe work practice, personal protection and emergency responses.
- **Area signage and labelling of equipment:** Hazardous chemical areas were marked appropriately and located separately; all vessels containing hazardous chemicals were

labelled appropriately; piping systems containing hazardous substances were labelled with the direction of flow.

- **Noise:** The noise level was lower than 85dB(A) according to the record during the plant operation. Hearing protection was adopted for any period of noise exposure in excess of 85dB(A).
- **Chemical hazards:** All new employees were trained in basic hazard awareness, site-specific hazards, safe work practices and emergency procedures. Chemical lists were placed on the bulletin board to remind all of the operators. Emergency showering and eye wash facilities were located conveniently within the facility, in case of skin contact or exposure to chemicals.
- **Personal Protection Equipment (PPE).** PPE was the last resort beyond the other facility controls and safety systems. Employees were issued with PPE including eye and face protection, head protection, hearing protection, foot protection, hand protection and body/leg protection.

#### 4.5 Cumulative Impacts

Existing and future activities within the BNAIZ have the potential to contribute to cumulative environmental and social impacts. Aqualyng will not have any direct control over these external activities by others; however Aqualyng may be able to:

- Modify plant activities to help reduce cumulative impacts;
- Work with other parties in reducing overall impacts via a coordinated monitoring system, integrating all present industries; and
- Participate in the coordination mitigation programs.

A complete cumulative impact assessment was not within the scope of this study. Specific information about other industries in the BNAIZ, operating or planned, has not been possible to obtain and key reports on strategic environmental assessment for the BNAIZ were not accessible in the public domain.

# 5. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

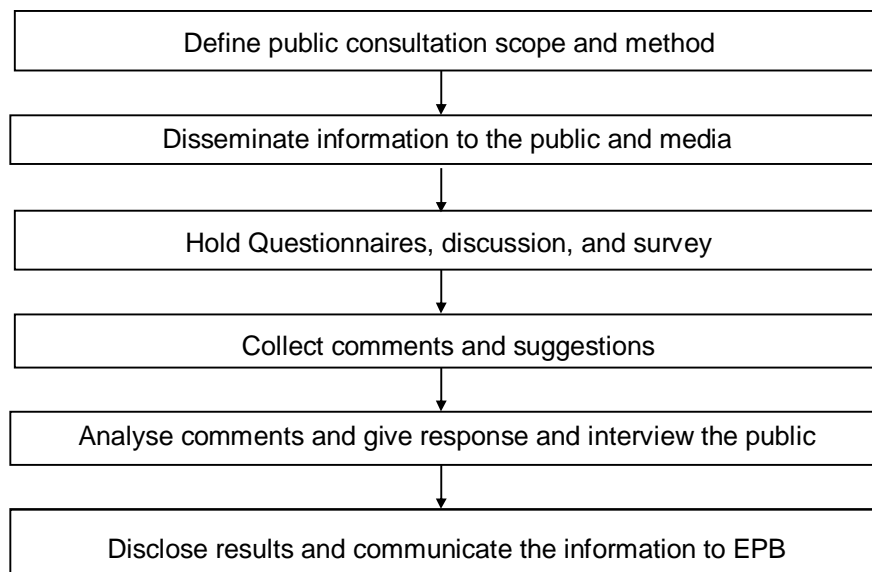
## 5.1 Legislative Framework for Public Consultation

The IFC identifies that public participation and consultation in the evaluation of Project design, planning and implementation is an important part of environmental impact assessment. It can directly reflect the public's perceptions on environmental quality in the Project's area of influence. Relevant national provisions in the Environmental Protection Law and Regulations on the Administration of Construction Projects' Environmental Protection (Order of the State Council, No. 253) of the PRC require that an "Environmental Impact Report formulated by construction unit shall be in accordance with relevant laws to solicit the opinions of units concerned and inhabitants of Project construction site". IFCs' environmental guidelines also have detailed and strict requirements on public participation and consultation. The public consultation processes for this Project follows both the PRC requirements, and the IFCs SPS. An integral part of the ESIA procedure is two rounds of public consultation, involving information dissemination, or questionnaire exercise and analysis and incorporation of comments.

## 5.2 Public Consultation Activities

The following figure (Figure 9) presents the public consultation process for the proposed Project.

Figure 9 Public Consultation Process Conducted



## 5.3 Public Consultation

During the Project feasibility assessment, two rounds of public consultation were undertaken, the first by the ESIA consultants in April and May 2013.

During the planning stages of the Project, the ESIA randomly distributed questionnaires among the residents and the public within the area of influence.

The ESIA teams carried out the stakeholder consultations in the Project district in April 2013. The ESIA team ensured that people from areas where potential impacts might occur were consulted, as well as the appropriate representatives of age, gender, poverty, and ethnic

categories. The objectives of the consultations were to gather information on public concerns about the Project before finalizing the ESIA. Concise Project descriptions about the components were discussed with the public before or at the time of the consultation. The stakeholder consultations and disclosure exercises comprised:

- Dissemination of Project information to local residents,
- Public consultation meetings with people directly affected by the proposed Project; and
- Distribution of public consultation questionnaires.

The affected people from the Project were mainly interested in employment opportunities, and did not express any specific concerns regarding the Project. Some concerns were expressed regarding the cumulative impact of the industrial development as a whole, including impact to local fishing livelihoods.

The consultations revealed that 85% of the consulted public are supportive of the Project, with the rest being unsure. The expected benefits include promotion employment opportunities and better prospect for socioeconomic development.

The anticipated negative impacts include possible noise pollution, solid waste, and land use change. The consulted public made several suggestions for mitigating the potential adverse environmental and social impacts: (i) construction activities close to residential areas should stop between 10:00 pm and 7:00 am; (ii) heavy construction equipment located in close proximity residential areas should be fitted with noise suppression apparatus; (iii) dust-generating construction vehicles should be covered and dusty construction areas sprayed with water. Most of these suggestions have been incorporated in this ESIA report and associated EMP. Those concerns that are beyond the scope of this ESIA have been conveyed to relevant authorities.

A local-language copy of the EIA will be posted on the Aqualyngs web site (<http://www.aqualyng.com/>). An announcement informing the public of its availability for review and comment will also be placed in a local newspaper.

#### 5.4 Grievance Redress Mechanism

In order to settle unforeseen issues effectively, an effective and transparent channel for lodging complaints and grievances has been established. The grievance redress mechanism is detailed in the EMP (Appendix B).

## 6. ENVIRONMENTAL MANAGEMENT PLAN

The objective of the EMP (Appendix B) is to prescribe Project-specific mitigation and monitoring measures. It is based on the findings of this ESIA. The EMP is intended to be reviewed and updated at the end of the detailed design of the Project.

### 6.1 Mitigation Measures

The EMP contains measures to mitigate the potential environmental impacts. The responsibilities for implementing and supervising these measures are assigned to different parties (Appendix B).

### 6.2 Inspection, Monitoring, and Reporting

Aqualyng will undertake regular inspections during the construction process, to review the implementation of the construction phased requirements of the EMP. Monitoring of ambient environmental quality including air, noise and surface water runoff will be undertaken by the construction contractor on a quarterly basis during construction. The construction contractor will report the results of the quarterly monitoring along with any non-conformances, spills, public comments or complaints to Aqualyng and BEPB on a monthly basis in a brief monitoring report.

During operation, Aqualyng will undertake regular monitoring and inspections in accordance with EMP and develop an annual summary report, detailing monitoring results, any non-conformances and corrective actions taken. The report will be submitted to BEPB annually.

### 6.3 Mechanism for Feedback and Adjustment

The EMP and grievance redress mechanism will be refined during the detailed design phase of the Project when more design details become available. The updated documents will be approved by the HPG.

Once the Project has started, Aqualyng will assess whether further mitigation measures are required or if improvement is required to strengthen the EMP. If monitoring and inspections reveal deviation from the EMP or changes in Project activities, which may cause new adverse impacts to the environment or local communities, the Aqualyng will consult with the HPG immediately and undertake additional environmental assessment and, if necessary, further public consultation.

## 7. Summary and Conclusions

Aqualyng Holding AS (Aqualyng) propose to develop a 50,000 m<sup>3</sup>/d reverse osmosis desalination facility within the BNAIZ in the south eastern coastal region of Hebei Province, PRC. The Project supports the government development strategy to develop local industries within the industrial zone.

The Project has the potential to provide environmental and social benefits including: (i) improved resilience to climate change through the provision of a reliable industrial water resource, independent of climate variability, and (ii) employment opportunities for local community, including employment of approximately 200 during the construction phase and 40 during operations.

The Project has the potential to result in some negative environmental and social impacts. Key potential negative impacts commonly associated with desalination have been mitigated in the design phase, including: (i) mitigation of potential impact of brine to Bohai Bay by incorporating direct recycling of all brine under an agreement with a local evaporative salt production company, and (ii) reduction in energy requirements through the use of energy recovery technology within the process design, resulting in greenhouse gas equivalent CO<sub>2</sub> emissions of less than 100,000 per year.

To mitigate potential environmental impacts associated with the construction and operational phase, an Environmental Management Plan (EMP, Appendix B) has been prepared. The plan addresses the potential impacts of the Project, including management of potential emissions including dust, noise, wastewater, solid waste and hazardous waste. The EMP also addresses the potential social, health and safety impacts associated with the Project.

With respect to IFC Performance Standards 1, 2 and 3, the following conclusions are drawn:

### **PS1: Social and Environmental Assessment and Management System**

Aqualyng's environmental management team, as well as its EPC Contractor, has overall responsibility for ensuring consistency and compliance with local regulatory requirements. Potential impacts of the Project have been identified during the planning stage through a local EIA process and this ESIA. Based on these assessments, specific environmental management plans have been developed, outlining mitigation measures consistent with local regulatory requirements.

Aqualyng will adopt IFC's environmental and social Performance Standards as part of the applicable legal and other requirements in its management system. The management system will be extended to incorporate community engagement, including clear procedure on disclosure and consultation with potentially affected communities.

### **PS2: Labor and Working Conditions**

Aqualyng currently employs about 8 people directly for its Project developments operations in China, and approximately 45 people in its operational desalination facility in Caofeidian. The proposed project will employ approximately 200 people during the construction phase and 40 people during the operational phase. Aqualyng has a Human Resources policy that complies with local regulatory requirements, and is applied consistently to all direct employees. The policy is consistent with PS2, including non-discrimination, freedom of association, and protection of the workforce. As required by law, the policy is included in employment contracts, and addresses working conditions, terms of employment, and wages and benefits. This information is provided in the form of an employee handbook at the time of induction.



Occupational health and safety of employees at Aqualyng will be managed by its Administration and Human Resources department. There is a plan for accident prevention and worker safety consistent with local regulatory requirements. All employees in the company will undergo a training program as part of their induction and ongoing training as required regarding worker health and safety relevant to their job activity. The Project will be audited yearly by the CEPB, and other agencies, to monitor compliance with labour regulations. Aqualyng operational Caofeidian desalination facility is in compliance with regulatory requirements, and has recorded no significant lost time incidents or fatalities in its operational history.

### **PS3: Pollution Prevention and Abatement**

Pollution prevention and abatement has been incorporated into the Project design and EMP, as outlined above. The Project will promote international good practice in energy efficiency, waste recycling and waste management, focusing on minimisation, reuse, and recycling, including minimisation of waste generation. Wastewater which can not be directly recycled to the CCGC salt production facility has been minimised by improved process design, with all remaining wastewater directed to an established wastewater treatment plant within the BNAIZ.

Overall, the ESIA has identified that adverse environmental impacts of the Project will be minimal and adequate mitigation measures will be implemented. Adverse environmental impacts associated with the Project will be prevented, eliminated, or minimized to an acceptable level if the EMP is effectively implemented, particularly through the mechanism for the continuous refinement and effective implementation of the environmental mitigation measures.

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# Appendices

This document is in draft form. The contents, including any opinions, conclusions or recommendations contained in, or which may be implied from, this draft document must not be relied upon. GHD reserves the right, at any time, without notice, to modify or retract any part or all of the draft document. To the maximum extent permitted by law, GHD disclaims any responsibility or liability arising from or in connection with this draft document.

# Appendix A Social Impact Study

## 1. Socio-economic Background of Hebei Province

### 1.1 Economic Development and Demographic Profiles

Hebei Province embraces the capital city of Beijing, with the total area of 0.19 million square kilometres. Its capital city, Shijiazhuang is about 283km to the south of Beijing, to the west of Tianjin and close to Bohai Sea, to the northwest and the north of Shandong and Henan Province and to the east of Shanxi Province. The province administers 11 municipalities including Shijiazhuang, Qinhuangdao, Baoding and Cangzhou, where the proposed project is located.

In 2012, the GDP in Hebei province was RMB 2657.5 billion Yuan, increased 9.6% than that of last year including RMB 318.67 billion Yuan from the primary sector, RMB 1400.1 billion Yuan from the secondary sector and RMB 938.73 billion Yuan from the tertiary sector respectively. Among three sectors, the secondary sector, including mining, manufacturing and construction etc has the most contribution to GDP growth, followed the tertiary and primary industry.

By the end of 2011, the total permanent residents were 72.405 million of which 54% and 46% were rural and urban respectively. The Male to female ratio is 51% to 49%. The natural population growth rate in 2011 was 6.5‰. About 68% people were educated at the junior secondary school and above while 26% of them only had the diplomas of the primary school and 4% of them were illiterate. The detail demographic profile was shown below:

Indicators		Number ( 10 <sup>4</sup> )
Total Population of Year-end (10000 persons)		7240.51
Population by Residence	Urban Population	3301.673
	Rural Population	3938.837
Population by Sex	Male Population	3742.62
	Female Population	3479.89
Birth Rate(‰)		13.02
Death Rate(‰)		6.52
Natural Growth Rate(‰)		6.5
Density of Population(‰)		386
Household(10000 units)		2171.4
Population by Age Group(%)		
0-14		17.82
15-64		73.51
65 and over		8.67
Population by Education Attainments (%)		
Illiterate		4.25
Primary School		26.84
Junior Secondary Schools		49.15
Senior Secondary Schools		14.44
College and Higher Level		5.33

Source: Hebei 2012 Yearbook

According to the Hebei 2012 Yearbook, among the surveyed households, the rural household size is 3.66, larger than that of the urban. Their incomes accounts for 66% of their urban counterparts, which shows incomes gaps between rural and urban areas. About half of their incomes were expended for the basic living substances, such as food, clothing and housing. This has shown that the economic development was not well advanced.

In 2012, the urban average disposable income per capita was RMB 20,543 Yuan while the rural was RMB 8,081 Yuan, almost 3 times lower than their urban counterparts.

The Household Status of Hebei Province

	Urban	Rural
Average Household Size	2.84	3.66
Average Number of Employed Persons per household	1.39	2.72
Per Capita Annual Incomes( Yuan)	19,591.91	10,046.91
Per Capita Annual Living Expenditures(Yuan)	11609.29	4711.16

Source: 2012 Hebei Yearbook

According to the 2012 Hebei Yearbook, the percentage of employees working in the primary, secondary and tertiary sectors were almost same, 36.33%, 33.31% and 30.36% respectively in 2011 while nearly 50%, 27% and 23% of people worked in these three sectors ten years ago. There are dramatic drop of labour forces in the primary sector. Large numbers of them have left their farming and worked in sectors of manufacturing, construction, traffic, transportation, wholesales and retail trades, hotel and catering services etc. their average monthly salary level in these sectors was about RMB 2,000 Yuan, which was lower than RMB 3,000 Yuan, the average level of the whole province. Farmers and fishermen earned even less, with the average level of about RMB 1,350 Yuan. That's why so many people moved into the cities as migrant workers.

## 1.2 Natural Resources and Energy

Hebei is one of the most scarce water provinces in China. The mean total water resources is 20.469 billion m<sup>3</sup>, only accounting for 0.72% of the total volume in China. The average water resource per capita was 306.69 m<sup>3</sup>, compared with the national average level of 2195 m<sup>3</sup>. But its three coastal cities, Qinhuangdao, Tangsha and Cangzhou, are rich in marine organisms, crude salt, oil and tourism. The major industries developed here include aquatic products, transportation, shipping, salt chemical industry, oil and tourism.

Hebei Province is one of the major energy suppliers in China and has the developed energy industries. Its oil and gas resources are mainly located along the Bohai coastline and the total proven reserves of oil was 2.7 billion tons and 180 billion m<sup>3</sup> of gas.

The geotherm resources are mainly at the central south part. The total proven reserves was equivalent to 41.891 billion ton of coal and the exploitable yield was the amount to 9.383 billion ton of coal.

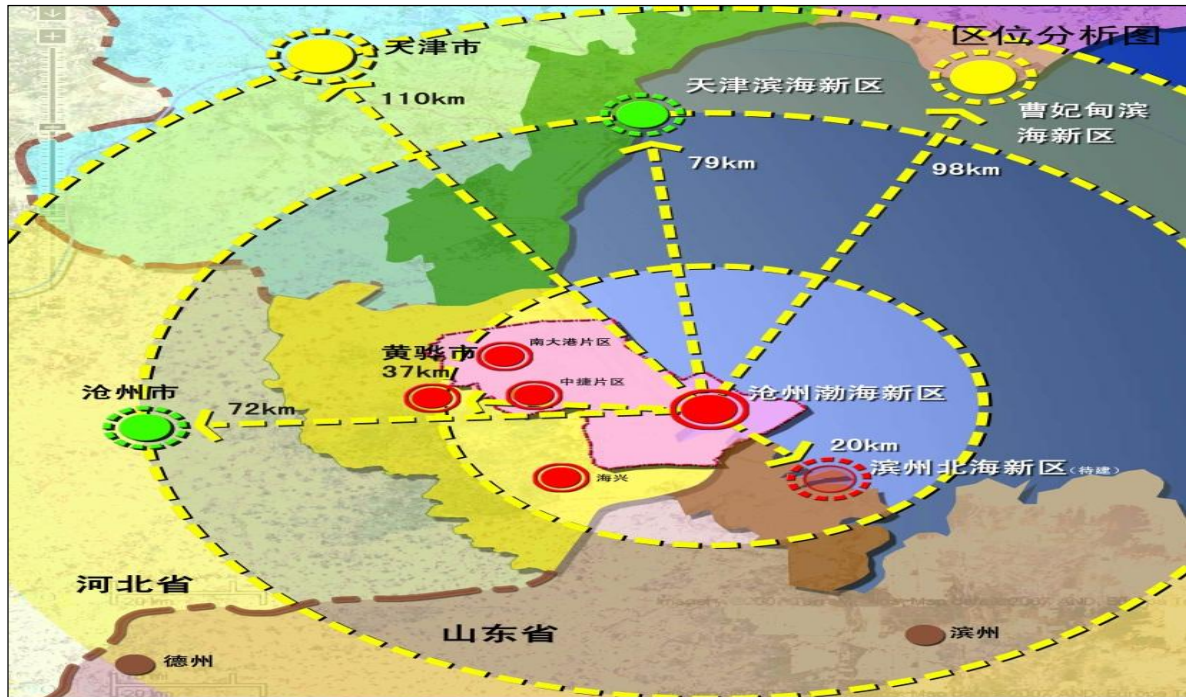
The total reserves of wind power were 74 million KW and the exploitation amount was 2 million KW in the coastline. The first wind power demonstration site in China was established in Bashang of Chengde City, near Inner Mongolia.

The annual solar radiation was 4981~5966MJ/m<sup>2</sup>. The annual sunshine duration was the most in Zhangjiakou, Chengde and east of Cangzhou, about 2,800~3,000 hour.

## 2. Socio-economic Background of Project Area

### 2.1 Economic Development and Demographic Profiles

The project site is located within the New Bohai Area, which is a subordinate administrative region of Cangzhou City, established in July 2007 as a result of the rapid development of Huanghua Port. The New Bohai Area lies to the west of Bohai Sea, to the south of Beijing and Tianjin and on the opposite side of Shandong Peninsula. It's about 47 kilometres away from the downtown of Cangzhou City and 85 kilometre distance to New Binhai Area of Tianjin, which is one of national key development areas after Shenzhen and Pudong in Shanghai. The map is shown below.



In 2012, the GDP was RMB 47 billion Yuan with the growth rate of 12.1%, accounting for 16.7% of the GDP in Cangzhou City. The pillar industries include petrochemical, metallurgy equipment, hi-technologies and logistics. The fiscal incomes were RMB 8.8 billion Yuan, accounting for 23.3% of the total of Cangzhou City. The Area includes “one city and three zones”: Huanghua City, Zhongjie Industrial Zone, Nandagang Industrial Zone and Lingang Economic Development Zone, where the project site is located. The total area is about 2400 square kilometre with the population of 0.6 million, accounting for 8% of the total (7.19 million) in Cangzhou City.

The demographic profile of the project area is shown as below:

Indicators		Number ( 10 <sup>4</sup> )
Total Population of Year-end (10000 persons)		713.4062
Population by Residence	Urban Population	121.7070
	Rural Population	591.6992
Population by Sex	Male Population	364.7202
	Female Population	348.6860
Birth Rate(‰)		13.95
Death Rate(‰)		6.47
Natural Growth Rate(‰)		7.48
Density of Population(‰)		386
Household ( 10 <sup>4</sup> )		205.6649
The Average Size of Household		3.46
Population by Age Group(%)		
0-14		17.92

15-59	68.88
60 and over	13.20

Source: Hebei 2010 Census and Hebei 2012 Yearbook

## 2.2 Overall Labour Conditions in the Project Area

According to the Hebei 2010 Census, there were about 7.13 million populations, about 69% of which were labour forces by the end of 2010 in Cangzhou City. 2%, 38% and 60% of them worked in the primary, secondary and tertiary sectors respectively. Among them, 18% worked for private businesses and as self-employed. The average annual salary was RMB 36,201 Yuan (RMB 3016.75 Yuan/month), almost same with the provincial average but about 13% lower than that in the coastal cities of Tanshan and Qinghuangdao.

The recent survey by Human Resources and Social Security Bureau of Cangzhou in 2012 revealed that the overall employment demands were robust but labour shortage was common, especially for technical labours and senior technicians; the overall education levels of the surveyed were low, which have made difficult for them to find high-paid jobs and have to work as physical labourers; the migrant workers have become the major sources of labour besides graduates from various universities, college and vocational schools. The survey also showed that about 85% of the surveyed prefer to work close to their hometown and only 15% choose to work in big cities, like Beijing and Tianjian. The preferred job ranking was manufacturing, building, wholesale and retail, information services and hotel& catering. The expected salary level was RMB2,000~3,000 Yuan per month. The mini wage level in 2011 in Cangzhou city was RMB 860 Yuan per month. Over 90% of the surveyed would like to sign the formal employment contracts with employers and have social/welfare benefits.

## 3. Identification of Positive Social Impacts of the Proposed Project

### 3.1 Alignment with National Plan and Strategy

Since 2011, the coastal area development including Cangzhou, where the proposed project is located, has become the national priority. It has been part of the capital economic circle in parallel to Yangtze River Triangle and Pearl River Triangle, which have been the economic driving forces of China. The provincial government has listed New Bohai Area (hereafter the Area) as their key tasks. The Area is one of three core regions in the province to drive the economic development besides Caofeidian and Beidaihe according to the 12th Oceanic Economic Development Five-year Plan of Hebei Province. The Area is planned to build a modern coastal city with industrial cluster of petrochemical processing, steel processing, equipment manufacturing, power generation and logistics. The infrastructure will be improved to support industrial development including road, water supply, energy, and power supply and information services.

The Plan promotes comprehensive utilization of seawater. The enterprises are encouraged to use seawater as industrial cooling water, desulfurization water and vegetation planation by seawater; residents are encouraged to use seawater for domestic purposes. Meanwhile The Plan promotes the seawater desalination projects and encourages power industries to have seawater desalination by residual heating. The salt chemical engineering technologies will also be further developed including calcium salt, magnesium salts and bromine series products. By the end of the 12th Five-year Plan, the designed capacity of seawater desalination will be over 1.2 million ton/day.

Echoing the provincial Plan, Cangzhou City Marine Science and the 12<sup>th</sup> Development Plan of Industrial development proposed the development mode of "Resource-Product-Waste-Renewable Resource-Product". The Plan also promotes power generation and chemical industries with high energy consumptions to develop seawater desalination by use of their residual heating and expands the seawater desalination industrial chain. Meanwhile, the crude salt will be fully utilized. The industrial

chain will be formed including power generation, seawater desalination, crude salt production, salt chemical and fertilizers.

### **3.2 Demonstration of Circular Economy**

According to the national plan, the new Bohai Area (hereafter the Area) will build the circular economy mode with industries that complement each other in a development that champions resource recovery, renewable energy, emission reduction and environmental protection. The State Council issued “the Opinion on Accelerating the Circular Economy” in 2005 to promote reduce, reuse and recycle in the process of production, distribution and consumption. The Area has been selected as the pilot site to demonstrate this new concept. At the policy level, the local government has developed “the Implementation Scheme of the Circular Economy in the New Bohai Area”; at the planning level, the leading industries have been designed including equipment manufacturing, petro chemical, power supply and logistics etc; each of them has developed its respective industry chain; at the planning implementation level, each industry chain is marked with different colours to show the existing and new business. Any matching new business has the priority to access; at the enterprise level, the horizontal integration between processing of different enterprises is arranged. The waste from one business will be the raw material feed to the other. The following good examples have proven the effectiveness of such arrangement.

Jizhong Energy Jinru Chemical Company and Cangzhou Dahua Juhai Company were two separate companies but were connected by two pipes. The Chlorine created in the process of PVC production from Jinniu Chemical was supplied to Juhai Company for their TDI product while the hydrogen chlorine, by-products of TDI production, was provided to Jinniu Chemical for their PVC manufacturing. In this way, both of them saved their investment in the production and waste treatment and achieved win-win solution.

Another example was Guohua Cangdian Company and Changlu Cangzhou Salt Company. The brine was ‘waste’ in the process of seawater desalination. It has the detrimental impact on the marine environment when discharged into the sea. But it is the raw material for the salt company. With its high concentration, it’s treated and processed at lower cost as raw salt. It’s said the salt company has increased their production of 150 thousand ton every year since their cooperation.

The proposed New Bohai Area Aqualyng 50,000ton/day SWRO project will also demonstrate this good practice. The framework agreement has been signed between Aqualyng, Administrative Committee of Cangzhou Bohai Development Zone (Committee) and China Salt Industry Changlu Cangzhou Salt Industry Group Co, Ltd ( CNSG). The brine from the proposed Aqualyng plant will be accepted by No.1 or 2 Salt Factory. The detailed information is attached behind.

### **3.3 Energy Saving**

The scarcity of clean fresh water is a global challenge nowadays and the seawater is regarded as the inexhaustible resource to obtain fresh water through seawater desalination technologies. So far there were over 13,000 seawater desalination plants with the capacity of 35 million m<sup>3</sup>/day, which has provided drinking water for over 100 million people in the world. However, the cost of seawater desalination is largely due to high energy consumption. Aqualyng’s Recuperator is an energy recovery device that allows waste energy recycling up to 98.5%. It uses the saline-reject(brine) from the membranes to pressurize pre-treated seawater in a sequential process to “recycle” its energy back. The Caofeidian 50,000m<sup>3</sup>/day SWRO Desalination Plant is the good demonstration case.

### **3.4 Water Resources Saving**

In recent 30 years, rapid socio-economic development has the water demand with the increase rate of 2.5 billion m<sup>3</sup> each year. Water shortage is an outstanding issue in China, especially in the north part of China. The average water resource per capita in Hebei Province was 306.69 m<sup>3</sup>, accounting for 14% of the national average. This situation has been worsened due to the increasingly severe water



pollution. 77% of the surface water was Grade IV and V (the worst quality of water according to GB3838-2002) in the Water Resource Information Disclosure of Haihe River Basin in 2013. The two combined has resulted in excessive exploitation of 50 m<sup>3</sup> billion in Hebei Province and 6 billion m<sup>3</sup> ground water in Beijing respectively. Currently the ground over funnel level in Cangzhou is about 100 metre, about 80 metre lower than the sea level. The ground water storage in Changzhou has been exhausted and not been allowed to exploit.

The government has realized this constraint and proposed to improve the water supply system in the 12th Five-Year Plan. The Plan will strengthen water resource management; pose the stringent control on ground water exploitation and find alternative sources water by the South-to-North Water Diversion Project and fresh water from the seawater desalination projects.

According to “the Specific Plan of New Bohai Area for Infrastructure”, the total water demand will be 1.5 million m<sup>3</sup>/d by 2020. However, the current water supply from two water supply plants, Juyuan and Shenhua, approximately 20,000 m<sup>3</sup>/d, which could meet domestic water use of the current population (about 40,000 persons) and water demands of partial small and medium-sized businesses. With the planned chemical, heavy industrial, manufacturing industry clusters established, they require stable and sufficient water supply to support their business development.

Although the South-to-North Water Diversion Project will divert 0.5 million t/d of water supply to the New Bohai Area, it's not very reliable due to the available water volume in Yangtze and water allocation between different provinces. While seawater is regarded as a potential inexhaustible resource and can serve as a useful supplement to the scarce fresh water resources. With the well-developed SWRO technologies, costs for producing fresh water from seawater have been substantially reduced. Moreover, costs will be further reduced when the brine from the RO process will be directly accepted by the Salt Company in the proposed project. The saved fresh water from those big industries can be reallocated to provide sufficient water for domestic and ecological purposes.

### **3.5 Cost-saving**

Currently, the existing companies, such as China Steel, have the water supply from Juyan Water Supply Plant, which diverts water from Daliangdian Reservoir. The water tariff was RMB 6 Yuan/m<sup>3</sup>. Companies have to spend additional costs on treating this raw water for industrial feed water. The final water fee was around RMB 8 Yuan. While according to the cost estimate from Aqualyng, the proposed product water price will be RMB 7 Yuan including initial starting water tariff of RMB 6.4 Yuan for water production plus RMB 0.6 Yuan for pipeline (product water transmission), which is cheaper than the treated surface water for the industrial purposes. So far Aqualyng has received water demands of over 50,000m<sup>3</sup>/d from 6 companies.

### **3.6 Labour Impacts**

#### **3.6.1 Direct Construction and Operation Employment Benefit**

It is possible to estimate employment impact brought in by the proposed Project. Aqualyng will engage the Engineering Procurement Construction (EPC) contractors to manage the construction process through invited tenders. According to the estimated person-day requirements for the construction of the project in the Feasibility Study Report (FSR) by HWTT, about 200 labor positions at peak time will be created, based on an assumption that each labour will work for 7.5 months during the construction period( about 8 months). Using an average local rate of RMB 150 Yuan per day, a total of RMB 7.2 million Yuan will be paid to the temporary labourers.

Further, assuming 50% of the laborers (about 100 persons) will be selected from the poor, and then at least RMB 3.6 million Yuan will be earned by the poor during project construction. This will average RMB 360,000 Yuan per person, which is about 3 times the average annual per capita income for most poor households. Although project activities are not aimed at income generation, the extra incomes

earned from construction work will give households the opportunity to build savings and improve their ongoing farming or future employment situation, finance new income-generating activities, and lower the risk of them falling back into poverty.

The discussion with Aqualyng management team find, there will be about 30~40 staffs to be employed in the operation and management of the proposed plant. The proposed job positions will include operation, maintenance, water laboratory test, IT, procurement, administration, human resource and financial management. All of them will be recruited from local area except the senior manager. The human resource management policies and procedures will be developed on the basis of national and local relevant employment and labour laws and regulations, IFC policies and guidelines and good practices from the Caofeidian SWRO Plant.

### **3.6.2 Indirect Construction and Operation Employment Benefit**

Other employment opportunities will be generated in those industries who supply construction materials, machinery and equipment during the construction period. Small servicing businesses in the locality are likely to directly benefit from the proposed project, particularly in the retail, food, entertainment and leisure business sectors. Also indirect benefits will be created during the operation stage from those transport, energy and chemical industries that supply the proposed plant with ongoing services.

### **3.6.3 Plant Operation Benefit-Demonstrated Good HR Management Practices**

The good human resource (HR) management example was the existing SWRO plant in Caofeidian Industrial Zone, operated since October 2011. There were 25 staffs in the operation and management of the plant including financial, administration, procurement, water testing, operation and maintenances. The average age of the staff was about 30 years old. Their education background was graduates from junior college and above. 95% of them were from local area.

There were two types of employment. One is services contract for cook, cleaner and guard. They signed service contracts with Aqualyng according to 'Civil Laws' and 'Economy Law' and were paid the monthly salary of about RMB 2,000 Yuan in cash, which was higher than the minimum monthly wage level of RMB 1,320 Yuan at local area. The social security benefits and other forms of welfares are not supposed to be provided according to the Law.

Another type is direct workers who directly employed by Aqualyng and signed the employment contract. A set of human resource management policies and procedures has been developed to manage workers in compliance with national and local labour laws:

- Recruitment. Open and transparent. Prepare clear job description and skill requirements, then advertise the information in the Tangshan (local) human resource internet. The position is open to any qualified persons with no discrimination on genders, races and physical disabilities.
- Onboarding. The new staffs are provided with staff manual to explain work conditions, terms of employment including wages and benefits, wage deductions, hours of works, overtime, leave for illness, vacation, maternity and holiday, code of conducts etc. Also the employment contract is signed between Aqualyng and the employee, which include employment duration, wages and benefits, hours of work, overtime, rest days, breaks, grievance procedures, termination procedures and occupational safety and health etc.
- Training. The new staffs are trained to understand the technical process, operational procedures and occupational safety and health measures. On the job trainings were conducted from time to time to continuously improve their technical qualification.
- Terms of Employment. The average salary level was about RMB 2500~3000 Yuan per month, which is a little higher than the similar companies. The social security payments provided include pension, medical care, unemployment, injuries and maternity and public housing fund,

which is the most attractive part for the job seekers. The front-line workers adopted flexible work time. Two shifts of workers were arranged to have 24-hour non-stop water supply.

- Grievance Mechanism. Any grievances will be dealt with according to the relevant national and local laws and regulations. Any grievances/disputes are consulted and negotiated internally first. If failed, the disputes are lodged to the local labour dispute arbitration committee to settle down. So far, no disputes have happened. Staffs are generally satisfied with the company. No worker's organization was established, like worker union.

### **3.6.4 Demonstrated Good Occupational Health and Safety Practices**

Aqualyng has committed to achieve high standards of environmental quality and product safety, and providing a safe and health workplace for its employees, contractors and communities. Its policy is to perform work in the safest manner possible.

The Health and Safety Plan of the existing SWRO Plant in Caofeidian has been reviewed. The plan has cleared defined Aqualyng commitment, policy, health and safety structure and responsibility, filing system, the identified list of hazardous activities on the construction sites and chemical hazards, personal protection equipment (PPE), procedures of accident reporting, investigation, analysis and correction actions, emergency preparedness. It's suggested that the similar plan will also being developed to manage the project-specific health and safety for the proposed project in New Baohai Area.

The finding from the site visits to the SWRO plant in Caofeidian and consultation with the management about the health and safety practices in the plant was:

- The general facility design and operation was in good condition: buildings structurally safe, floor even and non-skid, workplace and exit adequate for safe execution of all activities, fire precautions, natural lighting plus artificial illumination, portable drinking water, clean eating area, clean toilets and washing areas, showering facilities in case of skin contamination or exposure to poisonous substances and suitable work environment temperate.
- Occupational health and safety (OHS) training: all new employees were provided OHS orientation training to ensure they are familiar with the basic site rules of work, safe work practice, personal protection and emergency responses.
- Area signage and labelling of equipment: hazardous area( e.g. chemical storage room, etc) was marked appropriately and located separately ; all vessels containing hazardous chemical or toxicological properties was labelled; piping systems containing hazardous substances were labelled with the direction of flow.
- Noise: the noise level was lower than 85dB(A) according to the record during the plant operation. Hearing protection was adopted for any period of noise exposure in excess of 85dB(A).
- Chemical hazards: they have potential for illness or injury due to exposure to toxic, corrosive, sensitizing or oxidative substances. All the new employees were training basic hazard awareness, site-specific hazards, safe work practices and emergency procedures etc. chemical lists were placed in the bulletin board to remind all the operators. The showering and eye wash facilities were set in case of skin contamination or exposure to poisonous substances.
- Personal Protection Equipment (PPE).PPE is the last resort beyond the other facility controls and safety systems. The employed PPEs include eye and face protection, head protection, hearing protection, foot protection, hand protection and body/leg protection etc.

## **4. Identification of Negative Impacts of the Proposed Project**

### **4.1 Risks Associated with Government**

Government is an important stakeholder and regarded as 'third party', on which, businesses/Aqualyng has little ability to control or influence the outcome and hence, possible associated impacts. In the proposed project, local government will provide land, power supply, intake pipelines, distribution pipe and wastewater pipe according to the agreement between the government and Aqualyng.

In China, all the land belongs to the nation. The government manage the land use through a regional planning approach or zoning code. The information received was that the proposed land plot for Aqualyng was acquired from the ocean department for the industrial purpose several years ago and required environment, social impact assessment had been conducted and approved at that time. However, it takes a few legal steps for local government to issue the land use certificate to Aqualyng. The potential risks will include any delay in land supply, resulting in delayed construction and operation; cost recovery; loss of potential water users.

In the proposed project, government promised to provide intake pipelines, distribution pipe and wastewater pipe. They are associated facilities, which are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable. The potential risks will include inability to build pipes in timely manner, lack of capacity to treat wastewater and sludge.

Power supply is also very important. The discussion with SWRO in Caofeidian found that there was not very stable power supply for the Plant due to lack of sufficient electricity generated. Therefore, this risk should be carefully watched.

#### **4.2 Risks related to Contractors**

Contractors are important third parties as well. Aqualyng will select EPC contractors by pre-qualified tender, who involves SWRO Plant construction. Compared with directly employed staff, Aqualyng has less control and influence on the workers engaged by contractors but are obliged to ensure contractors follow relevant IFC, national and local labor laws and regulations.

#### **4.3 Impact on the Adjacent Industries and Access**

Construction of intake and distribution pipelines will have the potential impact on the nearby industries and access. The laying of the pipelines and power cable from the intake pump station to the plant, may affect industries and access to their factories in the short term. If trenches are left open for some days, this may force vehicles to try to find dangerous alternative routes to cross trenches and access these. This may result in industries potentially losing business.

With the pipe laying and power supply from the intake pump station to the plant and product water distribution pipelines, existing services such as sewer, water supply, and electricity may be accidentally damaged by digging works cutting services to nearby industries.

As the pipeline from the intake pump station to the plant and product water distribution pipelines are being constructed along the easement and crossing some roads, construction vehicles such as excavator and trench digger would be used to construct these lines and as such there may be disruption to local traffic access.

As there are a number of construction activities in the Industrial Zone, there are a large number of labour forces that live on-site during the construction and tend to walk outside their construction areas. With the construction of trenches, people may accidentally fall in to trenches or be struck by equipment.

#### **4.4 Impacts on Local Residents**

Housing. It's estimated that about 200 workers inflow at the peak time of the construction site about 30~40 staff during the operation. However, this additional accommodation demand is manageable given the proposed project is located in a metropolitan setting and close to the residential area, about 5 kilometre away from the nearby village. Noises, dust, vibration impacts during the construction

phase are minor on the local residents. Impacts on access to public services, including health cares and public utilities are negligible.

#### **4.5 Traffic Risks**

During the construction, there will be large increase of heavy vehicles for the transport of construction material and equipment, large vehicles operating at the site. This will increase the risk of traffic-related accidents and injuries to workers and local communities.

#### **4.6 Disease Risks**

During construction, with the accumulation of a large project workforce, there may be increasing incidence of communicable and vector-borne diseases (such as HIV/STD), which poses potential health threat to project personnel and residents of local communities. Sometimes, migrant workers might take their families or members of their families to the placement of employment. The negative impacts could include children exposed to dangerous or hazardous conditions, poor living conditions and lack access to services such as healthcare and education.

#### **4.7 Health Risks during the Construction**

The following lists of hazardous activities are those most commonly found on construction sites.

- Over-exertion, repetitive motion and manual handling are among the most common causes of injuries at construction and decommissioning sites.
- Working in heights. Fall from ladders, scaffolding and partially built or demolished structures are among the most common causes of injuries at construction and decommissioning sites.
- Slips and falls. The most frequent causes are excessive waste debris, loose construction materials and liquid spills etc.
- Struck by objects. At the construction site, the potential fall of materials or tools, or ejection of solid particles can result in injury to the head, eyes and other parts of body.
- Moving machinery. Aerial lifts, cranes, or earthmoving equipment are heavy vehicles to work at the construction site. Any mis-operation or machinery failure will have the hazardous impact.
- Dust and noise. During construction, the major sources of dusts emissions are sloping field levelling, earthwork construction, transport & storage of construction materials & wastes, construction site. The major noise sources at the construction site include construction machinery and vehicles. The noise value at 5m from the noise source is 80-90dB(A) ).
- Excavations. Ditches, trenches and excavation activities may result in possible cave-in due to slope instability.
- Chemical substances. Construction personnel may be at risk of exposure to chemical or hazardous materials, including oxidant, coagulant, hydrochloric acid, sodium hydrogen sulphite, antisludging agent, sodium hydroxide etc.

#### **4.8 The impact of the elder migrant workers/women workers**

With more and more young people moving out of the rural areas, the elder, women and young children were left behind in many rural areas. It's not easy for the elders to find well-paid jobs due to their old ages and poor education. Most of them do cleaning, cooking or simple daily labours, with the wage level of about RMB 50~100 Yuan per day and are paid on actual working days. The discussion with some of them at the construction site nearby the proposed project site had proven this. The basic personal protection equipment, including gloves weren't provided to them even. They are vulnerable to health hazards and special care should be taken of them.

#### **4.9 Risks of Child Labour**

Especially for the infrastructure projects, the construction phase may raise child labour issues. Chinese Labour Law defines labour forces less than 16 years old as child labour and prohibits use of Child Labor. They are not fully mentally or physically developed to adequately withstand and cope with many of the labour risks. Any workplace exposure to machinery, toxic substances, dust or noise, have increased risk of detrimental impact on children than on adults.

#### **5. Mitigation and Monitoring Measures**

Based on those identified risks, relevant monitoring and mitigation measures should be taken:

##### **5.1 Associated with Government**

Remember that government is an important stakeholder and its support is critical to the success of the project. Aqualyng should establish and maintain good working relationships with government agencies at different levels, understanding regulatory and legal requirements and keeping them informed of project activities and anticipated outcomes. Routine communication and visits to relevant local authorities are important to strengthen the relationship. Key agreements related to the core operation of the new business between Aqualyng and local government should be formally signed in writing and filed at the proper place.

##### **5.2 Associated with Contractors**

Aqualyng should have the HR policy in place in full compliance with IFC and national and local laws and regulations to manage these contracted workers through contractor. Aqualyng should incorporate assessing the capacity of potential contractors in HR management as a key indicator of its selection criteria when engaging them and include these in the contract specifications. Practically the measures for managing and monitoring the performances of contractors are:

- Assess/audit the employment relationship between contractor and workers, and ensure that all contractors comply with legal requirements covering but not limited to minimum wage, hours of work, overtime payments, health and safety conditions, health insurance and pension schedules, and other legally mandated employment terms.
- Making unannounced visits and visual inspections at the construction site.
- Monitoring the compliance of the construction contractors as specified in the tender document.
- Providing training for the construction contractors to explain labour and working conditions for the project.
- Providing OHS training to all contractors in Aqualyng OHS policy, plan, procedures, practice and reporting to ensure health and safety of all workers.
- Have a grievance mechanism in place allowing for the workers of the contractors to directly bring complaints to Aqualyng, which then bring to the attention of contractor for resolution.

##### **5.3 Mitigation on the Adjacent Industries and Access**

- Firstly the pipeline alignment design should avoid or minimize disruption to the nearby industries and access. If unavoidable, adjacent industries shall be formally notified that works shall be commencing shortly by both a formal letter and in person prior to work commencement.
- During the construction, common and safe construction approaches and construction management should be adopted to minimize disturbances. In areas where access will be affected by the works, temporary/alternative access should be provided over the trench to allow continued access.
- In case parts of the road are blocked during the construction, contractors should make a traffic management plan to manage the traffic conditions.

- When trenches are excavated and left unattended in publically accessible areas, signage or barriers should be placed by contractors to avoid any accidental fall or injuries.

#### **5.4 Mitigation on Traffic**

Traffic accidents have become one of the most significant causes of injuries. The safety measures to be taken include underscoring safety awareness among drivers; requiring licensing of drivers; daily check and regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment failure.

#### **5.5 Disease Control**

Contractors improving health awareness through various forms of trainings; distributing control of transmittable diseases (HIV/STD) posters and pamphlets at construction sites; encouraging condom use; providing on-site or community health care facilities; promoting collaboration with local authorities to enhance access of construction workers families to public health and sanitary services.

Contractors providing workers with clean, dry dormitories to prevent any vector-borne diseases; adopting use of repellents, clothing, netting and other barriers to prevent insect bites; collaborating with local authorities to promote education, prevention and available treatment.

#### **5.6 Occupational Health and Safety during the Construction**

It's contractors and Aqualyng's obligations to protect the safety and health of workers. Prior to commence of construction, Aqualyng should train its site staffs and contractors about its OHS policy, plan and procedures. Contractors should provide more specific trainings to their staffs including basic hazard awareness, site-specific hazards during the constructions, safe work practices and emergency procedures etc. The respective mitigation measures for risks of injuries are:

- Protection of over-exertion. Training workers in lifting and material handling techniques; planning the site wisely to minimize the need for manual transfer of heavy loads; applying tools and machinery to reduce force requirements and holding times;
- Protection of slip and fall. Slip and fall at the same elevation is usually due to poor housekeeping. Good housekeeping should be maintained, including designating special area for storage of construction material and tools; collecting and removing trashes and other debris at regular intervals; providing slip-resistant footwear.
- Protection of fall/slippery in heights. Training workers use of temporary fall prevention devices, such as barriers able to hold a weight of 200 pounds or even larger; use of personal protection equipment and training workers rescue procedures when fall.
- Protection from being struck by falling objects. Wearing appropriate PPE is essential including safety glass with side shields, face shields, hard hats etc.
- Safety in machine and equipment operation. Only certified and trained personnel are permitted to operation machine and equipment at the construction site. This machinery should be checked and inspected every day before use and maintained at regular basis to ensure safe operational conditions. Any defective or broken parts should be removed and replaced timely.
- Protection from dust and noise. Based on empirical calculation, the noise level with the distance of 200m will be below 60 dB, which won't have impact on the nearby industries. But machine operator should wear PPE, such as ear shields.
- Excavation protection. Any excavated trenches deeper than 1.2 meter should be protected with sloping, shoring and shielding. Fencing and barricades should be installed and marked with bright colors. The inspections should be conducted by the competent person prior to the start of work.

- Protection of Chemical substances. Safety training should be provided to workers on the correct transfer and handling of chemical substances. Providing emergency response facilities at the site and training in the chemical container deployment. PPE should be provided including eye, face, head, hand, body, foot and respiratory protections.

### **5.7 Special protection on the elder migrant/women workers**

Aqualyng may like to consider having its contractors to employ local community members with priority given to the poor and other vulnerable people or work closely with local social and civil affairs bureaus to identify alternative approaches to helping these groups of people in terms of better job opportunities, skill training and low-income subsidies.

### **5.8 Protections of child labours**

It's illegal to employ labours under the age of 16 in China. Aqualyng should set a minimum work age for the proposed project construction and require its contractors to review and retain copies of verifiable documentation concerning the age and employment profile of all personnel working at the construction site.

## **6. Stakeholder Engagement**

According to IFC standards, stakeholders are defined as persons, groups or communities external to the core operations of a project, which may be directly or indirectly affected by the project or have interest in it. Start with understanding the project's geographic sphere of influence, not only the primary project site, but also all related facilities including pipelines to establish project's area of influence and determine who might be affected and in what way. The identified stakeholders include planning, water /environment, human resources government agencies, the potential water users (several companies), the salt company receiving the brine discharge and the adjacent industries and villages.

### **6.1 Methodology**

The ESIA team conducted two periods of site visits to see the proposed project site inspections and meetings with relevant stakeholders on 10~12 April and 23 to 25 April 2013 respectively. The main approaches and methods adopted include key informant interview, focus group discussions and the collection and analysis of secondary data.

### **6.2 Consultation Outcomes**

The main outcomes of the stakeholder consultation were recorded and summarized as follows.



Date	Stakeholders Visited	Brief Introduction	Key Discussion Points
April 11 ,25	Planning and Environment Bureau	<p>The New Bohai Area Management Committee was established in 2007. Planning and Environment Protection Bureaus are part of the Committee.</p> <p>The major responsibilities of Planning Bureau are urban development and industrial planning, village/town development planning and infrastructure management.</p> <p>The major responsibilities of Planning Bureau are pollution control on air, water, soil, solid waste and toxic chemical etc and ecological environment protection; project EIA approval according to national and local laws and regulations</p>	<p>The Planning Bureau</p> <ul style="list-style-type: none"> <li>● Introduced the proposed land plot, which was acquired by the Committee from the Ocean Department for industrial purpose several years ago.</li> <li>● Provided water Supply planning document.</li> <li>● Advised that the intake pipelines construction will minimize the occupation of public access and impact on the adjacent industries.</li> </ul> <p>Environmental Protection Bureau</p> <ul style="list-style-type: none"> <li>● was briefed with project information, including project owner, scope and cost estimates.</li> <li>● Provided regulatory requirements on environmental assessment impact approval.</li> </ul> <p>Data Collected:</p> <p>Cangzhou New Bohai Area Business Investment Service Manual</p> <p>Cangzhou New Bohai Area Water Supply Plan</p>
April 24 p.m.	Human Resource Bureau (HRB)	<p>A stated owned-human resource management company in the New Bohai Area, jointly sponsored by China North Human Resource Market (CNHRM), Cangzhou New Bohai Area Management Committee and Cangzhou Social Security and Human Resource Bureau.</p>	<ul style="list-style-type: none"> <li>● HRB can be used to help all new business with recruitment, labour dispatching, training, labour disputes and consulting service on relevant national and local labour laws and regulations.</li> <li>● Understanding the detailed procedures of recruitment and labour disputes</li> </ul> <p>Data Collected:</p> <p>Useful Website: Social Security and Human Resource Bureau-</p>
24 April a.m.	Yuyang Chemical Cangzhou Company, one of representative water users among several companies	<p>A subordinate company of Yuyang Group, established in 1995 and the leading supplier of hard coke and coal chemical products and ranking 13<sup>th</sup> among top 500 Chinese chemical companies. Currently, its proposed caprolactam assembly line is under construction in the Equipment Zone of New Bohai Area. They have</p>	<ul style="list-style-type: none"> <li>● Understanding company profile and progress of on-going construction project.</li> <li>● Verifying the water demand in terms of quality (conductivity, turbidity, total hardness and PH) and quantities ( 10,000m<sup>3</sup>/d), time requirement(by the end of 2013).</li> <li>● Identifying alternative water sources from Yancheng Reservoir with higher water cost</li> </ul>

		shortage of supply reliable water of adequate quality.	<p>if Aqualyng delay the supply.</p> <ul style="list-style-type: none"> <li>● Discussing with construction workers to understanding their working conditions, terms of employment and OHS.</li> </ul>
23 April p.m.	Changlu Cangzhou Salt Company	Founded in 1958 with over 4000 staffs. State-owned enterprise, with total assets of RMB 600 million Yuan. The major production capacity is 1 million ton industrial salt, 0.1 million cooking salt, 0.03 million baysalt/day, 4 thousand ton of industrial bromine and 2 thousand sea products	<ul style="list-style-type: none"> <li>● Verifying the signed agreement between Aqualyng, the New Bohai Area Management Committee and Changlu Cangzhou Salt Company.</li> <li>● Verifying that the brine from Aqualyng SWRO plant in New Bohai Area will be received and reused by No.1 or 2 Salt Factory of the Salt Company.</li> <li>● The brine received will supplement with existing salt field, which is shrinking due to excessive land development.</li> <li>● The brine has the higher yield of salt and low cost compared with seawater but have to remove residual the chemicals resulting from the SWRO process.</li> </ul>
24 April	Yugou Village	It's about 5 kilometres away from the proposed project site. The village has been there about 30 years since migration from other parts of the County. Currently, there are over 1000 people. The village has no farmland but rely on fishing. But they stopped fishing over 10 years since the Huanghua Port development.	<ul style="list-style-type: none"> <li>● Identifying the major sources of incomes. Most of young people are working closely to their hometowns at the industries in the New Bohai Area with better paid jobs (about RMB 3,000 Yuan) while the elder doing the cleaning or garden virescence, not well paid, with the monthly salary of around RMB 1,500 yuan.</li> <li>● Identifying the water supply conditions. There is stable tap water supplied for each household with the water tariff of RMB 4 Yuan/m<sup>3</sup>.</li> </ul>
25 April	SWRO Plant in Caofeidian, Tangshan City	Aqualyng operation SWRO Plant in Caofeidian Industrial Zone, the demonstration site of seawater desalination of National Development and Reform Commission, NDRC. Is constructed in 2009 and operated in late 2011 to provide domestic water to local government. The proposed project will adopt the similar technical and management policies and procedures.	<ul style="list-style-type: none"> <li>● Conducting labour assessing including numbers of workers, types of jobs and skills, work force composition, working conditions and terms of employment and found that good HR management practices have been followed;</li> <li>● Identifying the occupational health and safety issues during the operation and found that good facility design, procedures have been followed;</li> <li>● Discussion with the senior management and staffs. The overall staff satisfaction level was high, which demonstrated</li> </ul>

			<p>good employer-work relationship.</p> <ul style="list-style-type: none"><li>● Future improvement. Higher salary should be paid to the technical positions rather than administrative positions; more trainings should be provided to improve their skills; promotion channels should be designed for technical staffs.</li></ul>
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Annex 1: Site Visit Plan in 23~25 April 2013

DATE 时间	VENUE 地点	STAKEHOLDER TO BE VISITED 访问对象	KEY DISCUSSION POINTS 主要讨论内容
Apr. 23	Its Office	Planning Authority	了解新区产业发展规划; the industrial planning 与产业规划配套的需水情况; water demand 水价制定; water tariff setting
Apr. 23	水利部门办公室 Its Office	渤海新区水利环保部门 Water/Environmental Authority	了解新区的水资源状况; water resources 了解项目所在园区的现有供水/需水情况; current water supply/demand 水价制定; water tariff setting
Apr. 24	人力资源部办公室 Its Office	渤海新区人力资源部 Human Resources Authority	了解有关国家和当地法律法规; national/local labor laws 了解园区工业企业用工情况; employment status in the industrial zone 园区企业对周边社区劳动就业的带动作用; employment benefit to local community 劳动保障工作条件/员工福利; working conditions, staff welfare; labor security 劳动争议的处理等; labor disputes
Apr. 24	Its Office	正元公司(项目受益人) Zhengyuan Company who get the fresh water	了解公司概况及发展战略; company overview and its development strategy 公司用水需求(水质、水量); water demand in terms of water quality and quantity 替代水源; alternative water sources 公司对供水水价的支付能力; affordability 公司对供水的支付意愿; willingness to pay
Apr. 26	Its Office	华润公司(项目受益人) Huarun Company who get the fresh water	了解公司概况及发展战略; company overview and its development strategy 公司用水需求(水质、水量); water demand in terms of water quality and quantity 替代水源; alternative water sources 公司对供水水价的支付能力; affordability 公司对供水的支付意愿; willingness to pay
Apr. 26	Its Office	盐业公司 Salt Company	了解盐业公司概况及发展战略; company overview and its development strategy 公司对原料的需求情况; demand on brine 公司与Aqualyng达成的合作意向; agreement between Salt Company and Aqualyng
Apr. 27	村里 Village	项目临近鱼排的村干部/村民 代表 Village leaders and villagers nearby	了解鱼排的整体情况; village overview 了解鱼排的供水情况(自来水?地下水); water supply sources( tap water or underground water) 了解当地村民的主要生计来源以及可能受到的项目影响; main livelihoods and possible project impact
Apr. 25	曹妃甸海水淡化 厂 Caofeidian	厂方管理人员及员工代表 Plant manager and staff	了解厂在建设及运行中产生的影响及采取的相应措施; impacts during construction and operation and the measures taken 资源效率和污染防治; resource efficiency and pollution control 人力资源政策(招聘、工作时间、条件、工资、加班、薪酬福利、劳动争议等) ; human resources policies, including recruitment, salary, social welfare etc 职业健康和安; occupational health and safety
Apr. 25	项目点 Project Site	Aqualyng 公司代表	了解项目取水口有关信息; intakes 了解项目输水管道走向(可能涉及临时征地)及可能受影响的单位; water distribution pipeline layout and its possible impact 项目拟采取的人力资源政策; proposed HR policies

			员工职业健康和安全等; occupational health and safety
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**Annex 2: the Summary of Consultation Lists of Government Agencies, Companies and Persons Interviewed**

Date	Name	Organization	Position	Location
April 11	Mr.Xiao	Planning Bureau of New Bohai Area	Section Chief	New Bohai Area
April 11	Mr.Zhang	Environmental Protection Bureau	Section Chief	New Bohai Area
April 11	Mr.Hao	Hubei Institute of Environmental Science	Chief Engineer	Shijiazhuang, Capital City of Hubei Province
April. 11	Mr.Zhao	Hubei Institute of Environmental Science	Engineer	Shijiazhuang, Capital City of Hubei Province
April. 23	Mr.Wen	Changlu Cangzhou Salt Company	Deputy General Manager	Cangzhou City
April. 23	Mr.Li	Changlu Cangzhou Salt Company	Chairman of Work Union	Cangzhou City
April. 24	Miss Liu	Human Resources Company	Staff	New Bohai Area
April 24	Mr. Zhao	Yuchang Chemcial Group Project Site	Administration Manager	New Bohai Area
April 24	Mr. Liu	Individual	Daily labours	New Bohai Area
April 24	Ms. Li	Individual	Daily labours	New Bohai Area
April 24	Mr.Zhang and his team	individuals	Skilled labors	New Bohai Area
April 24	Ms. Wang	Individual	Owner of a small supermarket	Yugou village
April 24	Ms. Zhao	Individual	Cleaner in New Bohai Area	Yugou village
April 24	Ms. Ma	Individual	Owner of grocery store	Yugou village
April 25	Mr. Zhang	Aqualyng SWRO Plant in Caofeidian	Operation & Maintenance Manager	Caofeidian Industrial Zone
April 25	Ms. Ji	Aqualyng SWRO Plant in Caofeidian	HR Coordinator	Caofeidian Industrial Zone

# Appendix B Environmental Management Plan

## Appendix B Draft Environmental Management Plan

July 2013





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## 9. Introduction

### 9.1 Objectives

The objective of establishing an environmental management plan (EMP) is to propose appropriate mitigation measures, and recommend establishment mechanisms to monitor and ensure compliance with environmental regulations, and implement these proposed mitigation measures. Such mechanisms will seek to ensure continuously improving environmental protection activities during project preparation, construction, and operation, in order to prevent, reduce, or eliminate adverse impacts.

The EMP includes: (i) objectives, (ii) summary of impacts and mitigation measures, (iii) environmental monitoring and inspection, (iv) public consultations, (v) responsibilities and authorities for implementation, (vi) institutional strengthening and training, (vii) reporting and supervision, and (viii) mechanism for feedback and adjustment. The EMP should be reviewed and updated at the end of the detailed design, in order to be consistent with the final detailed design.

### 9.2 Summary of Potential Impacts and Mitigation Measures

Potential environmental issues and impacts during the pre-construction, construction and operation phases were identified in the Environmental and Social Impact Assessment (ESIA). Mitigation measures designed to minimize the impacts are summarized in Table 1.

The mitigation measures will be incorporated into the construction contracts and operational management plans, and will be undertaken by the Project owner and the contractors, under the supervision of the Bohai New Area Environmental Protection Department of Cangzhou (BEPD). The effectiveness of these measures will be evaluated based on the results of the environmental monitoring; this will confirm whether these measures will be continued or improvements should be made. Improvements need to be confirmed through stipulated environmental management procedures. Particular focus is given in the EMP to three areas: (i) chemicals storage and use; (ii) wastewater discharge; (iii) construction impacts on the local environment (hydrology, water quality, soil, air), and (iv) staff and contractor health and safety.

Table 10 Summary of Potential Impacts and Mitigation Measures

Impact Factor/ Stage	Potential Impacts and/or Issues	Mitigation Measures	Project Implementing Company	Supervising Agency
<b>A. Pre- Construction</b>				
1. Detailed design phase	Brine discharge to the environment	<ul style="list-style-type: none"> <li>All brine wastewater will be discharged directly to existing salt works operated by CCGC. The salt works will use evaporative ponds to precipitate salt from solution to be reused as an industrial product.</li> <li>The salt works will maintain compliance with BEPB licence conditions and relevant government laws and regulations.</li> <li>No brine will be discharged directly to the environment.</li> </ul>	Contractor, CCGC (salt works)	BEPB
	Wastewater discharge	<ul style="list-style-type: none"> <li>Wastewater from the plant will be discharged to sewer to be treated by the Local Government wastewater treatment facility.</li> <li>Wastewater discharged from the plant will meet the acceptance criteria for the receiving wastewater treatment plant.</li> <li>The wastewater treatment facility will operate within their - BEPB licence conditions and relevant government laws and regulations.</li> </ul>	Contractor, Government WWTP operator	BEPB
	Energy consumption <ul style="list-style-type: none"> <li>Seawater desalination is often more energy intensive than other water supply options, particularly if the current water supply comes from local elevated catchments which operate by gravity.)</li> <li>Increased energy use has implications for issues such as climate change, and also local infrastructure limitations if power is limited.</li> </ul>	<ul style="list-style-type: none"> <li>Energy efficiency has been incorporated into the process design</li> <li>The process design includes the use of energy recovery technology, which will recover 98.5 of energy from the RO process to be directly reused in the system.</li> </ul>	Aqualyng, Contractor	BEPB
	Update EIA	<ul style="list-style-type: none"> <li>Review and update mitigation measures defined in the EMP</li> </ul>	Aqualyng, Contractor	BEPB

Impact Factor/ Stage	Potential Impacts and/or Issues	Mitigation Measures	Project Implementing Company	Supervising Agency
		and incorporate into the detailed design to minimize adverse environmental impacts		
	Public consultations	<ul style="list-style-type: none"> <li>Conduct public consultation and stakeholder consultation as outlined in Table B3</li> </ul>	Aqualyng, Contractor	BEPB
2. Bidding and Construction Preparation	Bidding documents and contractors qualifications	<ul style="list-style-type: none"> <li>Environmental section and provisions will be included in the bidding documents</li> <li>Construction and supply contracts for contractors will include environmental clauses which specifically and fully address the issues listed in this EMP and monitoring plan</li> <li>The ESIA report, and this EMP will be included in the contract documents</li> </ul>	Aqualyng	BEPB
	Environmental operation and supervision manual	<ul style="list-style-type: none"> <li>Contractors must prepare an environmental operation, health, safety, and supervision manual for approval by the Aqualyng</li> </ul>	Contractors	BEPB
	Complaint and information office or appointed person	<ul style="list-style-type: none"> <li>A complaint and information contact number will be established before construction begins</li> <li>Staff responsible for answering the complaints and information requests will be suitably trained to handle complaints from residents relating to environmental and cultural impacts</li> </ul>	Aqualyng, Contractors	BEPB
<b>B. Construction Phase</b>				
1. Soil and Sediment	Soil erosion and sediment run- off due to construction activities	<ul style="list-style-type: none"> <li>Implement erosion protection measures such as terraces and silt barriers during excavation works</li> <li>Stabilize all excavation slopes, embankments, and other erosion-prone working areas during excavation works</li> <li>All earthwork areas must be stabilized within 30 days after earthworks have ceased at the sites</li> <li>Divert drainage around areas of excavation during channel rehabilitation and lake excavation works</li> <li>Undertake excavation in segments, minimizing the area of active open excavations at any one time during channel</li> </ul>	Contractor	Aqualyng, BEPB

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Impact Factor/ Stage	Potential Impacts and/or Issues	Mitigation Measures	Project Implementing Company	Supervising Agency
		rehabilitation and lake construction activities <ul style="list-style-type: none"> <li>• Provide temporary detention ponds or containment to control silt runoff</li> <li>• Construct intercepting ditches and drains to prevent runoff entering construction sites, and divert runoff from sites to existing drainage</li> <li>• Strip and stockpile topsoil, cover or seed temporary soil stockpiles</li> <li>• Limit construction and material handling during periods of rains and high winds</li> <li>• Properly slope or re-vegetate disturbed surfaces</li> <li>• Appropriately set up temporary construction camps and storage areas to minimize the land area required and impact on soil erosion</li> </ul>		
2. Soil, groundwater, marine water	Potential soil, groundwater, marine waters contamination	<ul style="list-style-type: none"> <li>• Properly store petroleum products, hazardous materials and wastes on impermeable surfaces in secured and covered areas, and use the best management practice to avoid soil contamination</li> <li>• Remove all construction wastes from the site to approved waste disposal sites</li> <li>• Establish emergency preparedness and response plan (Spill Management Plan) in compliance with PRC regulations</li> <li>• Provide spill clean-up measures and equipment at each construction site and require contractors to conduct training in emergency spill response procedures</li> </ul>	Contractor	Aqualyng, BEPB
3. Noise	Noise from equipment and vehicles	<ul style="list-style-type: none"> <li>• Noise from equipment and machinery will comply with GB12523-1990</li> <li>• Provide adequate routes for large trucks to keep away from residential areas</li> <li>• Construction activity will be stopped between 22:00 and 06:00 hours or in accordance with public consultation</li> </ul>	Contractor	Aqualyng, BEPB
	Community complaints about noise	<ul style="list-style-type: none"> <li>• Interviews with community in the area will be conducted to identify community complaints about noise, and seek suggestions from community members to reduce noise annoyance if any.</li> </ul>	Contractor	Aqualyng, BEPB

Impact Factor/ Stage	Potential Impacts and/or Issues	Mitigation Measures	Project Implementing Company	Supervising Agency
4. Air Quality	Dust from construction sites	<ul style="list-style-type: none"> <li>• Community suggestions will be used to adjust work hours of noise-generating machinery if required</li> <li>• Extra care must be paid during dry, strong windy days</li> <li>• Spray water on construction sites and material handling routes where fugitive dust is being generated</li> <li>• Upon completion of civil works, all construction sites must be required to be re-vegetated with trees and grasses</li> <li>• Cover materials during truck transportation, in particular, the fine material, to avoid spillage or dust generation</li> </ul>	Contractor	Aqualyng, BEPB
	Air emission from asphalt pavement, vehicles and construction equipment	<ul style="list-style-type: none"> <li>• Locate asphalt mixers as far away as possible (at least 200 m downwind) from sensitive receptors</li> <li>• Initiate a regular inspection and certification system for vehicle and equipment emission</li> <li>• Store petroleum or other harmful materials in appropriate places and cover to minimize fugitive dust and emission</li> <li>• Maintain vehicles and construction machinery to a high standard to ensure efficient running and fuel-burning and compliance with PRC national emission standards, GB18352-2005, GB17691-2005, GB 11340-2005, GB3847-2005, and GB18285-2005</li> <li>• Equipment and machinery emissions must comply with GB16297-1996, and will be subject to regular inspection and certification system must be initiated</li> </ul>	Contractor	Aqualyng, BEPB
5. Solid Wastes	Domestic waste from construction camps	<ul style="list-style-type: none"> <li>• Multi-compartment collection bins will be provided to facilitate reuse, recycling and composting of solid waste</li> <li>• Waste will be stored away from water bodies and will be regularly collected by the HPG waste collection and hauled to the municipal sanitary landfill</li> <li>• Hold contractors responsible for proper removal and disposal of any significant residual materials, wastes and contaminated soils that remain on the ground after construction. Any planned paving or vegetating of the area shall be done as soon as the materials are removed to protect and stabilize the soil</li> <li>• Burning of waste is strictly prohibited</li> </ul>	Contractors	Aqualyng, BEPB

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Impact Factor/ Stage	Potential Impacts and/or Issues	Mitigation Measures	Project Implementing Company	Supervising Agency
7. Social Considerations	Traffic disturbance	<ul style="list-style-type: none"> <li>• Select transport routes to reduce disturbance to regular traffic</li> <li>• Divert traffic at peak traffic hour if required</li> </ul>	Contractor	Aqualyng, BEPB
8. Health and Safety	Occupational health and safety	<ul style="list-style-type: none"> <li>• Appoint Environmental, Health and Safety Officer to implement and supervise the Environmental, Health, and Safety Management Plan</li> <li>• Develop and implement an Environmental, Health and Safety Management Plan (EHSMP) which shall include the following provisions:               <ol style="list-style-type: none"> <li>(i) Provide a clean and sufficient supply of fresh water, for construction camp,</li> <li>(ii) Provide an adequate number of latrines and other sanitary arrangements at the site and work areas, and ensure they are maintained in a clean and hygienic state</li> <li>(iii) Provide sufficient garbage receptacles at construction sites and camps</li> <li>(iv) Provide personal protection equipment (PPE) in accordance with relevant health and safety regulations</li> <li>(v) Develop an emergency response plan to take actions on accidents and emergencies, including hazardous material spills and similar events, in compliance with PRC regulations</li> <li>(vi) Provide a fully equipped first-aid base in each construction camp</li> <li>(vii) Establish a Records Management System that will store and maintain easily retrievable records</li> <li>(viii) Train all construction workers in general health and safety matters, and on emergency preparedness and response procedures</li> <li>(ix) Implement SITs/HIV/AIDS and other communicable diseases awareness and prevention program</li> <li>(x) Buy insurances before construction for casualty accident (for workers) and third party insurance (for public)</li> <li>(xi) Implement safety measures around the construction sites to protect the public, including warning signs to alert the public to potential safety hazards, and barriers to prevent</li> </ol> </li> </ul>	Contractor	Aqualyng, BEPB

Impact Factor/ Stage	Potential Impacts and/or Issues	Mitigation Measures	Project Implementing Company	Supervising Agency
C. Operation Phase	Chemicals management	<p>public access to construction site (xii) Strictly prohibit smoking on the construction site</p> <ul style="list-style-type: none"> <li>• Two tanks in bunded area for each chemical. The total volume for two tanks together is the maximum of either 14 days or 1.5 times delivery tanker size;</li> <li>• The liquid chemical delivery system shall include a tanker unloading bay, duty/standby unloading transfer pumps, monorail for transfer pump maintenance, and safety equipment at the unloading station;</li> <li>• The liquid chemical storage area shall include chemicals segregated into separated appropriate bunded tanks, bund volumes greater than 11% of the volume of the largest tank, access platforms to reach the top of tanks and stairs to access each bunded area.</li> <li>• The chemical building shall be heated (to prevent freezing of chemicals), be ventilated, have easy safe access, be secure and have provisions to allow future tanks to be removed and replaced;</li> <li>• Dry chemical storage shall have equipment to transfer pallets from the trucks into the storage area, batching tanks including mixer, dust extraction equipment and duty and standby pumps for transfer of mixed chemicals to the bulk storage tank; and</li> <li>• The chemical pipework shall have valves for isolation at each end and to allow pumps to be removed for maintenance, be sleeved for safe transfer and leak containment, insulated and heat traced to prevent freezing</li> </ul>	Aqualyng	BEPB
	Wastewater discharge	<ul style="list-style-type: none"> <li>• Discharge wastewater to the government owned wastewater treatment plant within the BNAIZ for treatment.</li> <li>• Wastewater quality will be monitored to ensure it is within the acceptance criteria for the wastewater treatment plant</li> </ul>	Aqualyng	BEPB
	Noise	<ul style="list-style-type: none"> <li>• Adopt low-noise equipment and shields.</li> <li>• Lay sound-insulation materials for adjacent walls</li> <li>• Mount of shock absorption base and installation of the equipment within the workshop.</li> </ul>	Aqualyng	BEPB
	Solid and Hazardous Wastes	<ul style="list-style-type: none"> <li>• General waste will be managed in an efficient manner, with all</li> </ul>	Aqualyng	BEPB

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Impact Factor/ Stage	Potential Impacts and/or Issues	Mitigation Measures	Project Implementing Company	Supervising Agency
		<p>wastes collected by a licence waste management contractor and transported to suitably licenced landfill.</p> <ul style="list-style-type: none"> <li>• Hazardous wastes including used membranes and chemicals packaging will be collected and disposed of by a BEPB licensed hazardous waste contractor.</li> </ul>		
	Employment Contracts	<ul style="list-style-type: none"> <li>• Prepare clear job description and skill requirements, and then advertise the information in the local human resource internet. The positions will be open to any qualified persons without discrimination on gender, race or physical disability.</li> <li>• New staff will be provided with a staff manual to explain work conditions, terms of employment including wages and benefits, wage deductions, hours of works, overtime, leave for illness, vacation, maternity and holiday, and code of conducts. An employment contract will be signed between Aqualyng and the employee, which includes employment duration, wages and benefits, hours of work, overtime, rest days, breaks, grievance procedures, termination procedures and occupational health and safety.</li> <li>• New staff will be trained to understand technical process, operational procedures and occupational health and safety measures. On the job training will be conducted from time to time to continuously improve their technical qualification.</li> <li>• The average salary level will be approximately RMB 2500~3000 per month, which slightly higher than that offered by similar companies. The social security payments to be provided will include pension, medical care, unemployment, injuries and maternity and public housing fund.</li> <li>• Any grievances will be dealt with according to the relevant national and local laws and regulations. Any grievances/disputes will be consulted and negotiated internally first in accordance with grievance redress mechanism established in the EMP. If issues can not be resolved, the disputes will be lodged to the local labour dispute arbitration committee to settle</li> </ul>	Aqualyng	BEPB
	Occupational Health and Safety	<ul style="list-style-type: none"> <li>• Appoint Environmental, Health and Safety Officer to implement</li> </ul>	Aqualyng	BEPB

Impact Factor/ Stage	Potential Impacts and/or Issues	Mitigation Measures	Project Implementing Company	Supervising Agency
		<p>and supervise the Environmental, Health, and Safety Management Plan</p> <ul style="list-style-type: none"> <li>• Develop and implement an operational Environmental, Health and Safety Management Plan (EHSMP) which shall include the following provisions:               <ol style="list-style-type: none"> <li>(i) Maintain general facility operation in good condition: buildings structurally safe, floor even and non-skid, workplace and exit adequate for safe execution of all activities, fire precautions, natural lighting plus artificial illumination, portable drinking water, clean eating area, clean toilets and washing areas, showering facilities in case of skin contamination or exposure to poisonous substances and suitable work environment temperate.</li> <li>(ii) Occupational health and safety (OHS) training: all new employees were provided OHS orientation training to ensure they are familiar with the basic site rules of work, safe work practice, personal protection and emergency responses.</li> <li>(iii) Area signage and labelling of equipment: Hazardous chemicals area was marked appropriately and located separately; all vessels containing hazardous chemicals were labelled appropriately; piping systems containing hazardous substances were labelled with the direction of flow.</li> <li>(iv) Noise: The noise level was lower than 85dB(A) according to the record during the plant operation. Hearing protection was adopted for any period of noise exposure in excess of 85dB(A).</li> <li>(v) Chemical hazards: All new employees were trained in basic hazard awareness, site-specific hazards, safe work practices and emergency procedures. Chemical lists were placed on the bulletin board to remind all of the operators. Emergency showering and eye wash facilities were located conveniently within the facility, in case of skin contact or exposure to chemicals.</li> <li>(vi) Personal Protection Equipment (PPE). PPE was the</li> </ol> </li> </ul>		

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Impact Factor/ Stage	Potential Impacts and/or Issues	Mitigation Measures	Project Implementing Company	Supervising Agency
		last resort beyond the other facility controls and safety systems. Employees were issued with PPE including eye and face protection, head protection, hearing protection, foot protection, hand protection and body/leg protection.		

## A. Environmental Monitoring and Inspection

The environmental monitoring criteria are presented in Table 2, and the proposed program schedule is presented in Table 3. This program considers the scope of monitoring, environmental media, monitoring parameters, time and frequency, implementing and supervising agencies. The monitoring will follow the methodology provided in the national standard methods for monitoring pollutants. Other associated standards are national environmental quality standards and pollutant discharge/emission standards.

Table 11 Applicable Evaluation Criteria

Environmental quality standards	<ul style="list-style-type: none"> <li>• Ambient air: Class II standard specified in Ambient Air Quality Standard (GB3095-1996) apply</li> <li>• Seawater: Category IV standard specified in Seawater Quality Standard (GB3097-1997) and marine sediment complies with Category III standard specified in Marine Sediment Quality Standard (GB18668-2002) apply</li> <li>• Acoustic environment: Category III standard specified in Acoustic Environment Quality Standard (GB3096-2008) apply</li> </ul>
Pollutant drainage standards	<ul style="list-style-type: none"> <li>• Wastewater(Freshwater): Class II discharge standard specified in Table 4 of Integrated Waste water Discharge Standard (GB8978-1996) and influent water quality requirements of wastewater treatment plant in the southern part of BNAIZ apply</li> <li>• Noise: Category III standard specified in Standard of Noise at Boundary of Industrial Enterprise (GB12348-2008) apply;;</li> <li>• For noise during construction, Noise limits for Construction Site (GB12523-90) apply;;</li> <li>• Solid wastes: Standard for Pollution Control on the Storage and Treatment Site for General Industrial Solid Wastes (GB18599-2001) and Standard for Pollution Control on Hazardous Waste Storage (GB18597-2001) apply</li> </ul>

Table 12 Environmental and Social Monitoring Program

Item	Parameters	Location	Time and Frequency	Implementation	Supervising Agency
1. Construction Contractor performance against EMP	Auditing and inspections	All sites	Weekly	Contractor	Aqualyng, BEPB
2. Wastewater Quality(freshwater)	Class II discharge standard	<ul style="list-style-type: none"> <li>Battery limit discharge point</li> </ul>	<ul style="list-style-type: none"> <li>Quarterly</li> </ul>	Aqualyng	BEPB
3. EOHS and employment contracts	Audit and inspection against parameters in Table B1	<ul style="list-style-type: none"> <li>All sites</li> </ul>	<ul style="list-style-type: none"> <li>Random inspections</li> <li>At least 1 per year</li> </ul>	Aqualyng	BEPB

## B. Public Consultation

### 1. Public Consultation during Project Preparation

Various public consultations were conducted in the course of the preparation of the feasibility study report and EIA. During the feasibility study report preparation, the local and provincial governments were consulted to support the project design. During EIA and ESIA preparation public consultations, with various groups of stakeholders, were conducted. The main focus of public consultation was to assess the environmental impacts of the Project on the closest village (Fengjiabao Village, 4.3 km away) and mitigation measures to address these impacts. These activities were carried out in accordance with *Interim Guidelines on Public Participation in Environmental Impact Assessment (2006)* of the Ministry of Environmental Protection. A grievance redress mechanism was also discussed with people who might be affected.

### 2. Future Public Consultation Plan

Future plans for public involvement during the design, construction, and operation phases were developed during the ESIA process. These plans include public participation in (i) monitoring impacts and mitigation measures during the construction and operation stages and (ii) interviewing the public after the Project is completed. They include several types of consultations, e.g., site visits, workshops, interviews, and public hearings.

Public participation plans are part of the project implementation and management plan. Aqualyng and their contractors are responsible for public participation during project implementation.

Table A2.3: Public Consultation Program

Organizer	Approach / Times	Subjects	Participants
<b>1. Project Preparation</b>			
Aqualyng	<ul style="list-style-type: none"> <li>EISA public opinion surveys</li> <li>Socioeconomic and AP surveys</li> <li>Public consultation meeting and questionnaire</li> </ul>	Priority, design, environmental benefits and impacts, social benefits and impacts, mitigation measures, attitudes toward project, and suggestions	Aqualyng, EIA/ESIA consultants, BEPB, other provincial, municipal, county government stakeholders, community representatives

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Organizer	Approach / Times	Subjects	Participants
<b>2. Construction</b>			
Contractor	<ul style="list-style-type: none"> <li>Public consultation and site visits: at least once a year</li> </ul>	Adjusting mitigation measures if necessary, construction impacts, comments and suggestions	Residents nearby the construction area
	<ul style="list-style-type: none"> <li>Public information session: at least once a year</li> </ul>	Adjusting mitigation measures if necessary, construction impacts, comments and suggestions	Representatives of residents and social sectors
<b>4. Operation</b>			
Aqualyng	<ul style="list-style-type: none"> <li>Site visit and public consultation: once every year by BEPB and interested stakeholders</li> </ul>	Operational performance, informal interviews with local residents	Nearby residence, local government, community representatives

## C. Reporting and Supervision

**Monthly Construction Reports.** During the construction period, the contractor will submit monthly construction reports to Aqualyng. The reports will summarise: (i) environmental issues during construction, land preparation and planting; (ii) mitigation measures taken, if any; and (iii) consequences of the impacts on the environment and/or surrounding communities.

The contractors will be trained to take immediate actions to remedy unexpected adverse impacts or ineffective or inefficient mitigation measures, as required by the EMP. Aqualyng will also respond to these reports in order to ensure that the contractors have taken appropriate and timely action. Additional measures may be taken, if needed, to ensure that all issues raised by the reports are appropriately addressed.

**Annual Environmental and Social Assessment Reports.** During plant operation, Aqualyng will prepare annual environmental and social assessment reports, documenting compliance with relevant local laws and regulations, and providing comment on operational management with regard to IFC Performance Standards.

## D. Mechanism for Feedback and Adjustment

Based on environmental reports, environmental authorities will decide whether: (i) further mitigation measures are required as corrective action, or (ii) some improvement is required to environmental management practices. If it is found during inspection that there has been substantial deviation from the EMP or any changes made to the project which may cause substantial adverse environmental impacts or increase the number of affected people, then Aqualyng should consult with the BEPB who would form an environmental assessment team to conduct additional environmental assessment and, if necessary, further public consultation. The revised EIA report, including the EMP, would be submitted to the BEPB for approval. The revised EMP would be passed to the contractor(s) for implementation.

## E. Grievance Redress Mechanism

Public participation, consultation, and information disclosure undertaken as part of the local EIA and the ESIA process have discussed and addressed major community concerns. Continued public participation and consultation has been emphasised as a key component of successful project implementation. As a result of the public participation and safeguard assessment during the initial

stages of the project, major grievance issues are not expected. However, unforeseen issues may occur. In order to settle such issues effectively, an effective and transparent channel for lodging complaints and grievances has been established, in parallel with the mechanism developed under the resettlement planning process (refer to Project resettlement plan).

In the event of a grievance issue, the basic stages established for redress are:

- (i) Stage 1: If a concern arises during construction, the affected person tries to resolve the issue of concern directly with the contractor and the project manager. If successful, no further follow-up is required.
- (ii) Stage 2: If not successful, the affected person can submit an oral or written petition/complaint to the village committee. For an oral complaint, the village committee must make written records. The village committee must give a clear reply within 2 weeks. Aqualyng will assist the village committee in replying to the affected person.
- (iii) Stage 3: If the affected person is not satisfied with the reply in Stage 2, he/she can appeal to the township government after receiving the reply in Stage 1 and the township government must give a clear reply within 2 weeks. Aqualyng will assist the township government in replying to the affected person.
- (iv) Stage 4: If the affected person is still not satisfied with the reply of township government, he can appeal to the BEPB. The BEPB must prepare a clear reply in consultation with the Aqualyng and give it to the affected person within 30 days.
- (v) Stage 5: If the affected person is still not satisfied with the reply of the BEPB, he/she can appeal to the HPG after receiving the reply of Stage 4. The HPG must give the reply to the affected person within 30 days.





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