

青山湖污水处理厂工程

Qing Shan Hu Sewage Treatment Plant

优化初步设计

Optimized Preliminary Design

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青山湖污水处理厂工程

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优化初步设计

Optimized Preliminary Design

第一卷

设计说明书

Part One: Specification of Optimized Design

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前言 Preface

中国市政工程华北设计研究院受德国柏林水务国际有限公司的委托，对南昌市青山湖污水处理厂工程进行施工图阶段设计。

North China Municipal Engineering Design & Research Institute is commissioned by Berlinwasser International GmbH to the construction design of the Qing Shan Hu Sewage Treatment Plant in Nanchang city.

在此之前德国柏林水务国际有限公司根据已审批的《江西省南昌市青山湖污水处理工程初步设计》提出了初步设计优化方案设想，并通过了有关方面的审查论证。为此，在施工图设计之前，中国市政工程华北设计研究院需以柏林水务国际有限公司提出的初步设计优化方案设想为基础并充分体现柏林水务国际有限公司的宗旨，对原《江西省南昌市青山湖污水处理工程初步设计》进行修改即**优化初步设计**。双方就工程技术方案进行了认真讨论、交流、磋商形成共识后，我院于 2002 年 12 月 15 日开始了本项目的初步设计优化设计工作，于 2003 年 1 月 23 日完成。在文件的编制过程中，得到了柏林水务国际有限公司的专家的大力支持和协作，同时也得到了南昌市污水处理工程有限公司等有关部门的支持和帮助。

Berlinwasser International GmbH had put forward the conception of optimized preliminary design according to the audited “Preliminary Planning of Nanchang City Qing Shan Hu Sewage Treatment Plant in Jiangxi Province” which has passed through the audit. Therefore, the optimizing of preliminary design of NCMEDRI should be based on the

conception of optimized preliminary planning and the accomplished preliminary design, and take full consideration of the tenet of the Berlinwasser International GmbH. After a thorough discussion NCMEDRI start to work at 12.15.2002, and completed at 01.23.2003. During compiling, NCMEDRI received great help and support from Berlinwasser International GmbH and Nanchang Sewage Treatment Company.

本文件由三部分内容组成： 第一卷 优化初步设计说明书

第二卷 主要设备材料清单

第三卷 设计图纸

The whole document is composed of three parts:

Part One: Specification of Optimized Design

Part Two: Main Equipments and Material List

Part Three: Design Drawings

在第一卷中我们只对污水处理厂的工程设计部分做简要说明，其余方面可参见原初步设计，在本文件中不重复累述。

Only a brief description of the engineering design of the sewage treatment plant will be done in Part One, and others can be referred to in the original preliminary design, therefore, it will not be repeated here.

1 设计依据

Bases of Design

- 《江西省南昌市青山湖污水处理厂工程初步设计说明书》及图纸（上海市政工程设计研究院）（南昌市城市规划设计研究总院）2002年4月

“Specification of the Preliminary Design for Nanchang City Qing Shan Hu Sewage Treatment PlantProject” and corresponding drawings (Shanghai Municipal Engineering Design & Research Institute) (Nanchang General Urban Layout Design and Research Institute)

- 施工图设计合同

Construction Design Contract

- 《南昌市青山湖污水处理厂初步设计优化方案》（柏林水务国际有限公司）

Strategy of Optimized Preliminary Design for Nanchang City Qing Shan Hu Sewage Treatment Plant (Berlinwasser International GmbH)

- 《南昌市青山湖污水处理厂优化设计备忘录》（2002年12月13日）

Notes of optimizing design for Nanchang City Qing Shan Hu Sewage Treatment Plant (12.13.2002)

2 设计范围

Design Scope

本项目的设计范围为青山湖污水处理厂工程（围墙内）。对厂内的工艺、建筑、结构、总图、电气、自控、暖通进行优化设计。

Area for which design is to be performed: Complete sewage treatment plant premises up to the perimeter fence (inclusive): including optimizing of process, architecture and civil engineering, general drawing, electric & automatic control, and heating & ventilation.

3 工程规模

Scale of the project

根据污水量预测，青山湖污水处理厂最终规模 99 万 m^3/d ，分三期建设，一期规模 33 万 m^3/d 。本项目按一期规模设计，充分考虑与二、三期的衔接。

According to the prediction of the flow quantity, Qing Shan Hu Sewage Treatment Plant, Nanchang, consisting of the mechanical treatment stage ($990,000\text{m}^3/\text{d}$) and the biological treatment stage ($330,000\text{m}^3/\text{d}$). The design work is based on the scale of $330,000\text{m}^3/\text{d}$ and take full consideration of the further two stages.

4 污水处理厂进水水质

Raw sewage quality of the sewage treatment plant

确定青山湖污水处理厂进水水质为：

Raw sewage quality of Qing Shan Hu Sewage Treatment Plant is as the following:

COD_{cr} $\leq 250\text{mg/L}$

BOD₅ $\leq 130\text{mg/L}$

SS $\leq 200\text{mg/L}$

NH₃-N $\leq 20\text{mg/L}$

磷酸盐 Phosphate（以 P 计 calculated as P） $\leq 2.0\text{mg/L}$

根据排水协议，无需考虑水质波动。

No fluctuation of water quality need be considered according to the Supply Agreement.

5 污水处理厂出水水质

Effluent quality of Qing Shan Hu Sewage Treatment Plant

青山湖污水处理厂出水水质如下：

Effluent quality of Qing Shan Hu Sewage Treatment Plant is as the following:

COD_{cr} $\leq 120\text{mg/L}$

BOD₅ $\leq 30\text{mg/L}$

SS $\leq 30\text{mg/L}$

磷酸盐 Phosphate（以 P 计 calculated as P） $\leq 1.0\text{mg/L}$

NH₃-N $\leq 25\text{mg/L}$

6 污水处理厂处理工艺

Treatment Process of the Sewage Treatment Plant

依据德国柏林水务国际有限公司的初步设计优化方案，青山湖污水处理厂处理工艺如下：

According to the strategy of optimized preliminary design of Berlinwasser International GmbH, the treatment process will be as the following:

污水处理工艺采用普曝法工艺。曝气池为氧化沟形式，采用表面曝气机曝气。

Traditional aeration process will be applied in the treatment. The oxidation ditches are adopted as aeration tanks with upside-down surface aerators.

污泥处理工艺采用厌氧中温消化，消化后的污泥经机械脱水后外运。

Anerobic mild temperature digestion is adopted in the treatment of sludge, and digested sludge shall be transported out after mechanical dewatering.

对消化过程中产生的沼气进行综合利用，其用途有

The usage of the biogas produced during digestion:

(1) 用于拖动进水泵的沼气发动机

To drive the 2 screw pumps.

（2）用于加热消化池的沼气锅炉

To heat up the digestion tank through biogas boiler:

（3）用于厂区综合楼的集中空调溴化锂机组

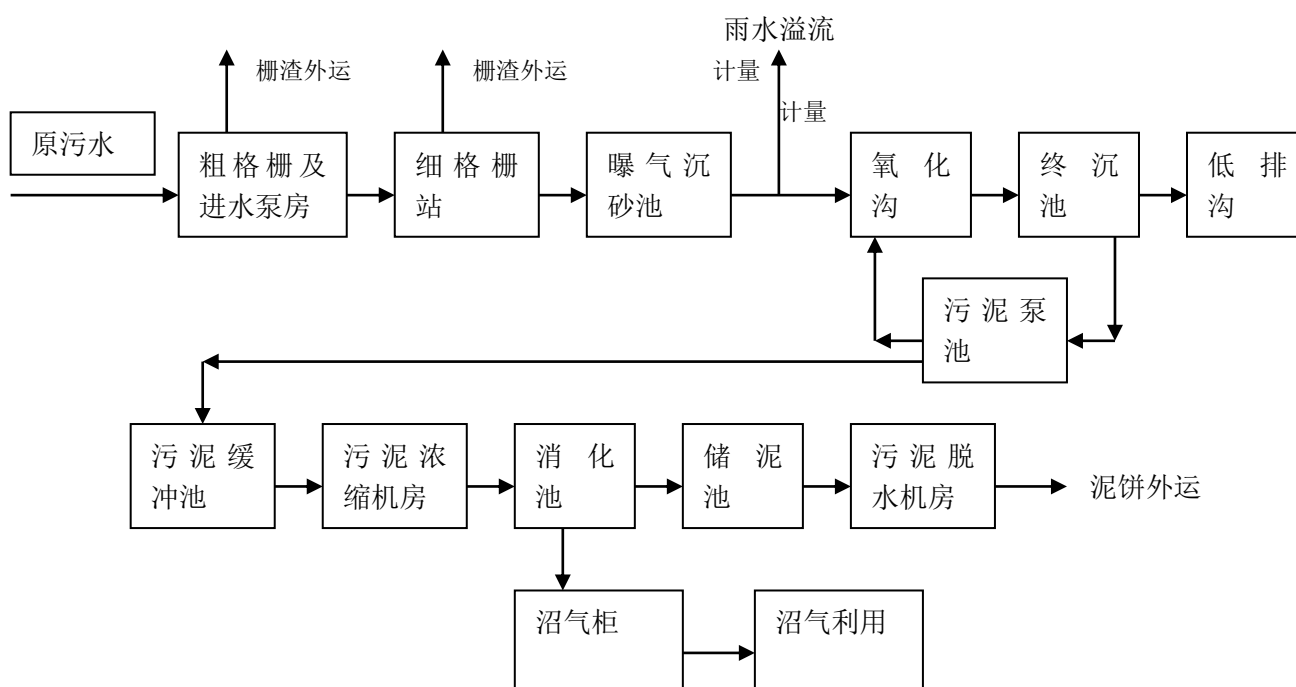
To the lithium bromide unit for central air-conditioning in the general office building.

沼气利用的气量及热量平衡图见污泥处理工艺设计部分

The amount and heat balance chart of the biogas please refer to the process design of sludge treatment.

青山湖污水处理厂处理工艺流程如下：

The flow of the Qing Shan Hu Sewage Treatment Plant is as the following:



7 污水处理厂工程设计

Engineering Design of the Sewage Treatment Plant

7.1 工程内容

Engineering Content

青山湖污水处理厂规模 33 万 m^3/d ，并预留二、三期规模发展用地，其主要内容包括：

The design scale Qing Shan Hu Sewage Treatment Plant is 330,000 m^3/d , and the developing area for further second and third stage is left. Main content is set as below:

- 污水提升与预处理系统

Sewage pumping and pretreatment system

- 污水生化处理系统

Sewage biological treatment system

- 污泥处理系统

Sludge treatment system

- 厂区附属建筑

Other buildings in plant

- 厂区动力系统（包括变配电系统）

Power system in plant (including transformer system)

- 自动控制监测仪表系统

Automatic control and instrument system

- 厂区总平面及配套设施

General layout of the plant and supporting system

7.2 处理单元工艺设计

Design of treatment process unit

设计规模 $Q=33$ 万 m^3/d

Scale: $Q=330,000\text{m}^3/\text{d}$

根据要求，截流倍数为 2 的雨水经污水处理厂预处理后（经曝气沉砂后）直接溢流至厂区南侧的低排沟。

Rain water whose interception multiple is 2 overflows to Dipai trough in front of the south of the plant after pretreatment (aeration grit chamber)

雨季最大设计流量 $Q_{\max}=11.46 \text{ m}^3/\text{s}(Q_{\max}=990000 \text{ m}^3/\text{d})$

The Rain season $Q_{\max}=11.46 \text{ m}^3/\text{s}(Q_{\max}=990000 \text{ m}^3/\text{d})$

旱季最大设计流量 $Q_{\text{旱}\max}=4.40 \text{ m}^3/\text{s}(Q_{\text{旱}\max}=380000 \text{ m}^3/\text{d})$

The dry season $Q_{\text{旱}\max}=4.40 \text{ m}^3/\text{s}(Q_{\text{旱}\max}=380000 \text{ m}^3/\text{d})$

旱季平均设计流量 $Q_{\text{平均}}=3.82 \text{ m}^3/\text{s}(Q_{\text{平均}}=330000 \text{ m}^3/\text{d})$

The dry season $Q_{\text{平均}}=3.82 \text{ m}^3/\text{s}(Q_{\text{平均}}=330000 \text{ m}^3/\text{d})$

(1) 粗格栅及进水泵房

Coarse screen and inlet pump station

设计参数及描述:

Design parameters and description

粗格栅及进水泵房土建及设备规模均按一期规模设计并充分考虑与二、三期规模的衔接。

Scale of civil Engineering and equipments are set forth according to the first stage and give full

consideration to the further second and third stage.

设计流量：雨季最大流量 $Q_{\max}=11.46 \text{ m}^3/\text{s}$

Design flow quantity: Rain season $Q_{\max}=11.46 \text{ m}^3/\text{s}$

旱季最大流量 $Q_{\text{旱}\max}=4.40 \text{ m}^3/\text{s}$

Dry season $Q_{\max}=4.40 \text{ m}^3/\text{s}$

旱季平均流量 $Q_{\text{平均}}=3.82 \text{ m}^3/\text{s}$

Dry season $Q_{\text{aver.}}=3.82 \text{ m}^3/\text{s}$

粗格栅间的设置，可去除污水中较大漂浮物以保证污水提升泵的正常运行，粗格栅间内安装有齿耙除污机和用于维修的闸门等设备。该格栅除污设备带有独立轨道及抓爪，根据时间间隔或格栅前后水位差，自动启闭悬挂在载重滑车上的机械抓爪，将污物排放至收集箱，完成栅渣的收集、输送和装箱。采用机械格栅与进水泵房合建，共设三条渠道，单沟宽 2000mm，正常情况下，三台格栅运行，事故时互为备用。

Coarse screen is designed to remove the relative big floaters to ensure the normal operation of the inlet pump. Rake and maintenance gates etc are installed in the coarse screen station. Rake brings itself independent trails and grippers, and remove the screens to the dustbin automatically according to time intermittent or water level difference. It accomplishes the collection, transportation and incasement. The coarse screen and inlet pump station are joined together. There are altogether 3 channels designed in the coarse screen station with individual width 2000mm. 3 coarse screens are in operation normally and be standby by each other

when accidents happen.

设置进水泵房，用来提升污水以满足后续污水处理流程及竖向的衔接要求，为地下式钢筋混凝土矩形集水池，泵房与粗格栅合建，污水经泵房提升后通过渠道，进入细格栅站。进水泵采用螺旋泵型式，以提高效率减少维护。内设 6 台螺旋污水泵，旱季 3 用 3 备，雨季 6 台全开。根据沼气平衡计算，其中两台进水泵采用沼气发动机驱动，当运行初期无沼气时可用天然气暂时替代。根据实际运行情况租用天然气子站用专用车。每台螺旋泵前均设有闸门以便检修。在集水泵池上部建有泵房，用于防护螺旋泵的电机和沼气发动机及配套的余热利用系统，室内装有现场电控柜及 PLC 柜。

The inlet pump station is designed for pumping sewage to satisfy the treatment flow and vertical link up. It is an underground reinforced concrete rectangular tank, will be built together with the coarse screen. Sewage is pumped to the fine screen station through channels. 6 screw pumps are adopted to improve efficiency and reduce maintenance. 3 are in operation and three standby in dry season and 6 in operation in rain season. 2 of the 6 screw pumps are drove by biogas engines due to the balance calculation of the biogas. In the first period of operation when there is not enough biogas, the 2 biogas engines will use natural gas as fuel. Special trucks will be leased from the natural gas substation according to operation requirement. A rectangular gate is set before each of the screw pump for its maintenance. A pump house is built on the

channels in which are engines for screw pumps, heat recycling systems and PLC & control panels.

粗格栅间尺寸:

长 X 宽 X 高 7m x 8m x 5.8m

Dimensions of the coarse screen:

Length x width x height 7m x 8m x 5.8m

B. 主要设备及参数

Main equipments and parameters

齿耙除污机

Rake

数量: 3 套

Quantity: 3 sets

格栅宽度: B=2.0m

Width of the screen: B=2.0m

栅条间隙: b=80mm

Clearance of the bars: b=80mm

栅条倾角: $\alpha=70^\circ$

Inclination of the bars: $\alpha=70^\circ$

栅前水深: 2.25m (雨季)

Water depth before screen: 2.25m(rain season)

1.47m (旱季最大)

1.47m (max.in dry season)

过栅流速: 0.65m/s 旱季流速

velocity : 0.65m/s(Dry season)

1.0m/s 雨季流速

1.0m/s (rain season)

电动闸门

数量: 3 套

Quantity: 3 sets

规格: 2m x 1.8m N=2.2kw

Specification: 2m x 1.8m N=2.2kw

螺旋泵及配套设备

Screw pumps and its accessories

设备数量: 6 套 (雨季全开, 平均旱季 2 台, 最大旱季 3 台)

Quantity: 6 sets (all in operation in rain season, aver. 2 and max. 3 in dry season)

流量: Q=1910 L/s

Flow quantity: Q=1910 L/s

提升高度: H=8.28m (设计水位 13.30m, 提升后水位 21.58m)

Head: H=8.28m (min. water level 13.30, and 21.58 after pumping)

螺旋直径: D=2.850m

Diameter of the screw: D=2.850m

配套电机

Engines

设备数量: 4 套

Quantity: 4 sets

单台功率 N=250 kw

Power for each: N=250 kw

沼气发动机

Biogas engines

设备数量: 2 套

Quantity: 2 sets

单台功率 N=250 kw

Power for each: N=250 kw

所需沼气量 6178N m³/d

Biogas needed: 6178N m³/d

可利用余热 1237x10⁴Kcal/d

Usable remain heat: 1237x10⁴Kcal/d

---热回收系统 300KW

---Heat recovery system 300KW

---紧急冷却系统 96Kcal/s

---Emergency air cooler 96Kcal/s

---油泵 40l/h

---Oil pump 40l/h

叠梁闸门

Pensrock

数量：6 套

Quantity:6 sets

(2) 细格栅站

Fine screen station

设计参数及描述

Description of the design parameters

细格栅站土建及设备规模均按一期规模设计并充分考虑与二、三期规模的衔接。

Scale of civil Engineering and equipments are set forth according to the first stage and give full consideration to the further second and third stage.

设计流量：雨季最大流量 $Q_{\max}=11.46 \text{ m}^3/\text{s}$

Design flow quantity:Rain season $Q_{\max}=11.46 \text{ m}^3/\text{s}$

旱季最大流量 $Q_{\text{旱}\max}=4.40 \text{ m}^3/\text{s}$

Dry season $Q_{\max}=4.40 \text{ m}^3/\text{s}$

旱季平均流量 $Q_{\text{平均}}=3.82 \text{ m}^3/\text{s}$

Dry season $Q_{\text{aver.}}=3.82 \text{ m}^3/\text{s}$

设置细格栅可去除原水中漂浮物以及杂物，保证后续处理流程的通畅，设有八条渠道。八条渠道格栅前后分别装有闸门以便检修。细格栅的栅渣由螺旋传送至栅渣压实后送往栅渣箱中，污水经过细格栅后进入曝气沉砂池。细格栅站与进水泵房联建，单渠宽 2.0m。

The fine screen station is designed to remove floaters in the raw

sewage to ensure a smooth flow in the following treatment. 8 channels, each is equipped with penstorks for maintenance, are set. Screens are removed by screw conveyor and crushed by screens presser, and sent into dustin. Sewage flows into aeration grit chamber after fine screen. Fine screen station is built together with inlet pump station, and single channel width is 2.0m.

主要设备及参数

Main equipments and parameters

机械旋转细格栅

Mechanical rotation fine screen

数量： 8 台

Quantity: 8 sets

格栅宽度： B=1.8m

Width: B=1.8m

栅条间隙： b=15mm

Clearance between bars: b=15mm

格栅倾角： $\alpha=70^\circ$

Inclination : $\alpha=70^\circ$

栅前水深： 1.6m

Water depth : 1.6m

单台功率 N=2.2 kw

Power for each: N=2.2 kw

螺旋输送机

Screw conveyor

数量: 1 台

Quantity: 1 set

规格: $6\text{m}^3/\text{h}$ $L=23\text{m}$

Specification: $6\text{m}^3/\text{h}$ $L=23\text{m}$

单台功率: $N=3.7\text{kw}$

Power for each set: $N=3.7\text{kw}$

栅渣压实机

Screen presser

数量: 1 台

Quantity: 1 set

规格: $6\text{m}^3/\text{h}$

Specification: $6\text{m}^3/\text{h}$

单台功率: $N=1.5\text{kw}$

Power for each set: $N=1.5\text{kw}$

a. 手动渠道闸门

Manual Channel Penstock

数量: 16 套

Quantity: 16 sets

规格: $2.0\text{m} \times 1.8\text{m}$

Specification: $2.0\text{m} \times 1.8\text{m}$

(3) 曝气沉砂池

Aeration Grit Chamber

A. 设计参数及描述

Description of the design parameters

曝气沉砂池土建及设备规模均按一期规模设计并充分考虑与二、三期规模的衔接。

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旱季平均流量 $Q_{\text{平均}}=3.82 \text{ m}^3/\text{s}$

Dry season $Q_{\text{aver.}}=3.82 \text{ m}^3/\text{s}$

沉砂池采用曝气沉砂池系统，可去除原水中粒径较大的无机砂粒，以保证后续流程的正常运行。

The aeration grit setting system of the grit chamber can remove the relative big inorganic granules to ensure a smooth flow in the following treatment.

吸砂泵提升沉砂至砂水分离器，进行砂水分离。污水经沉砂池后进入氧化沟。罗茨鼓风机放置于进水泵房一层内。

Grit removal pump raises grits to grit classifier, which separates grit from water. The sewage flows into oxidation ditch after settling. The blowers are put in first float of the pump station.

采用两组沉砂池系统（每组两池）。

Two groups of grit chambers are adopted (each with two chambers).

池数：4 池

Number of tanks: 4 chambers

雨季停留时间：2 min

Retention time in dry seasons: 5 min

池长：L=30m

Length of the chamber: L=30m

池宽：B=4.0m

Width of the chamber: B=4.0m

有效水深约 $H_{\text{效}}=3.0\text{ m}$

Effective water depth : $H_{\text{effective}}=3.0\text{ m}$

所需空气量：1788 m³/h

Air needed: 1788 m³/h

B. 主要设备及参数

Main equipments and parameters

a. 刮砂桥

Grit scraper

数量：2 套（两池共用 1 套）

Quantity: 2 sets(one for each two chambers)

桥长: $L=10\text{m}$

Length: $L=10\text{m}$

单台功率: $N=0.75\text{kw}$

Power for each set: $N=0.75\text{kw}$

b. 吸砂泵

Grit removal pump

数量: 4 套

Quantity: 4 sets

规格: $Q=40\text{m}^3/\text{h}$ $H=5\text{m}$

Specification: $Q=40\text{m}^3/\text{h}$ $H=5\text{m}$

单台功率: $N=2.2\text{kw}$

Power for each set: $N=2.2\text{kw}$

c. 罗茨鼓风机

Blowers

数量: 3 套 (二用一备)

Quantity: 3 sets(one standby)

规格: $Q=895\text{m}^3/\text{h}$ $H=3.5\text{m}$

Specification: $Q=895\text{m}^3/\text{h}$ $H=3.5\text{m}$

单台功率: 18kw

Power for each set: 18kw

d. 砂水分离器

数量： 2 套

Quantity: 2 sets

规格： $Q=70\sim 120\text{m}^3/\text{h}$

Specification: $Q=70\sim 120\text{m}^3/\text{h}$

单台功率： $N=1.1\text{kW}$

Power for each set: $N=1.1\text{kW}$

e. 手动渠道闸门

Manual channel penstock

数量： 4 套

Quantity: 4 sets

规格： $1.5\text{m} \times 1.5\text{m}$

Specification: $1.5\text{m} \times 1.5\text{m}$

f. 手动渠道闸门

Manual channel penstock

数量： 4 套

Quantity: 4 sets

规格： $1.5\text{m} \times 1.8\text{m}$

Specification: $1.5\text{m} \times 1.8\text{m}$

(4) 雨水溢流渠

Rain Overflow Channel

A. 设计参数及描述

Description of the design parameters

为矩形钢筋砼结构，池内设有调节堰板，雨季时可调节溢流量以保证进入氧化沟流量的稳定。在进入氧化沟渠道的入口处装有叠梁闸，雨季时可插入叠梁闸板以保证进入氧化沟流量的稳定。溢流后的雨水直接排入低排沟，该渠道按一期规模设计。

Rectangular reinforced concrete structure with adjustable weir in for adjustment of overflow quantity in rain seasons to ensure stability in the oxidation ditches. Stop logs are installed in the entrance of the oxidation ditches, to ensure the stable operation of the oxidation ditches in rain seasons. The overflowed rain flows into Dipai Trough directly, and the overflow channel is designed as the first stage (330,000m³/d).

主要设计参数：

Main design parameters:

最大雨水溢流量 6.49m³/s

Max.overflow quantity of the rain water: 6.49m³/s

池长：20m

Length of the tank:20m

B. 主要设备及参数

Main equipments and parameters

a. 电动调节堰板

Electric adjustable weir

规格：L=5m H=0.5m

Specifications: L=5m H=0.5m

单台功率: 0.75kw

Power for each set: 0.75kw

b. 叠梁闸

Stop logs

规格: L= 2.5m H=0.4m

Specifications: L= 2.5m H=0.4m

(5) 氧化沟

Oxidation Ditches

A.设计参数及描述

Description of the design parameters

池中设立式表曝机，获得动能和溶解氧的混合液在池中快速流动，可形成好氧、缺氧区，具有降解有机物和脱氮的功能。为钢筋砼池。池内预留出安装水下推进器的位置，可根据以后实际运行情况确定。每座氧化沟通过渠道分别经计量后进水，可通过调节安装在进口处的调节堰确定进入每座氧化沟的流量，进水调节堰亦可起关闭进水的作用。氧化沟出水处亦安装有调节堰以调整池内水位并可关闭出水。每池设有放空阀门。

Rectangular reinforced concrete structure with adjustable weir in for adjustment of overflow quantity in rain seasons to ensure stability in the oxidation ditches. Stop logs are installed in the entrance of the oxidation ditches, to ensure the stable operation of the oxidation

ditches in rain seasons. The overflowed rain flows into Dipai Trough directly, and the overflow channel is designed as the first stage (330,000m³/d).

主要设计参数

Main design parameters

设计流量 旱季平均流量 $Q_{\text{平均}}=3.82 \text{ m}^3/\text{s}$

Flow quantity: Average in Dry seasons: $Q_{\text{aver.}}=3.82 \text{ m}^3/\text{s}$

泥龄: 4 天

Sludge life: 4days

设计水温 18 摄氏度

Temperature of the sewage: 18degrees

污泥负荷 0.204kgBOD₅/kgMLSS · 日

Sludge loading: 0.204kgBOD₅/kgMLSS · day

污泥回流比 100%

Sludge return rate: 100%

污泥产率 1.35kgDS/kg BOD₅

Sludge production rate: 1.35kgDS/kg BOD₅

混合液浓度: 3.0~3.5g/L

Strength of mixed liquid: 3.0~3.5g/L

水深 5.0m

Water depth: 5.0m

池数: 8 池

Quantity of tanks: 8 tanks

曝气方式 立式表曝机

Way of aeration: vertical surface aerator

氧化沟总容积 8 x 9000 m³

Total volume of the oxidation ditches: 8 x 9000 m³

水力停留时间 5.1h

Hydraulic retention time: 5.1h

实际平均需氧量为 35154kgO₂/d

Actual average oxygen demand: 35154kgO₂/d

实际最大需氧量为 45700kgO₂/d

Actual maximum oxygen demand: 45700kgO₂/d

标准情况下平均需氧量为(SOR) 59410kgO₂/d

Average oxygen demand at standard conditions(SOR) 59410kgO₂/d

标准情况下最大需氧量为(SOR) 59410kgO₂/d

Maximum oxygen demand at standard conditions(SOR) 59410kgO₂/d

B. 主要设备及参数

Main equipments and parameters

a. 立式表曝机

Vertical surface aerators

数量: 16 台（每池 2 台）

Quantity: 16 sets(2 for each ditch)

单机功率: 132kw

Power for each: 132kw

转速: 25~35rpm

Speed: 25~35rpm

表曝机直径: 3500mm

Diameter of the surface aerator: 3500mm

动力效率: $2.0\text{kgO}_2/\text{kw} \cdot \text{h}$

Kinetic efficiency: $2.0\text{kgO}_2/\text{kw} \cdot \text{h}$

b. 水下推进器（预留）

Submerged Impellers(remained)

数量: 16 台

Quantity: 16 sets

单机功率: 4kw

Power for each: 4kw

c. 电动进水调节堰板

Electric adjustable inlet weir:

规格: L=3m H=0.5m

Specifications: L=3m H=0.5m

单机功率: 0.55kw

Power for each: 0.55kw

d. 电动出水调节堰板

Electric adjustable effluent weir:

规格: L=5m H=0.5m

Specifications: L=5m H=0.5m

单机功率: 0.55kw

Power for each: 0.55kw

根据溶解氧测定的溶氧值，由 PLC 控制，通过变频器调节表曝机电机转速，控制充氧量。同时考虑到进水流量对溶氧值的影响，将进水流量做为一个前馈信号引入进行补偿，构成前馈反馈闭环调节系统，改善调节质量，达到节能的目的。

A proper dissolved oxygen quantity in the ditch is kept through adjusting the speed of the motor of the aerator, which is controlled by PLC according to the measured dissolved oxygen quantity. Meanwhile, impact of influent on the dissolved oxygen is also considered. The quantity of influent is used as a signal for compensation to save energy.

(6) 终沉池

Sedimentation tank

A.设计参数及描述

Description of the design parameters

最终沉淀池将曝气后的混合液进行固液分离后，澄清水经集水井后排入水体，其类型为钢筋混凝土辐流式沉淀池，池中央进水，周边出水，池壁设导流板，采用三角齿形堰出水，经环形集水渠收集后直接排入低排沟。每池设有放空阀门。

A proper dissolved oxygen quantity in the ditch is kept through adjusting the speed of the motor of the aerator, which is controlled by

PLC according to the measured dissolved oxygen quantity. Meanwhile, impact of influent on the dissolved oxygen is also considered. The quantity of influent is used as a signal for compensation to save energy.

主要设计参数:

Main design parameters:

设计流量: 旱季最大流量 $Q_{\text{旱最大}}=4.40\text{m}^3/\text{s}$

Design flow quantity: Maximum in dry seasons $Q_{\text{max.}}=4.40\text{m}^3/\text{s}$

表面负荷: $q=1.00\text{m}^3/\text{m}^2 \cdot \text{h}$

Surface loading: $q=1.00\text{m}^3/\text{m}^2 \cdot \text{h}$

池数: 8 座

Number of tanks: 8 tanks

池径: 50 米

Diameter: 50m

池边有效水深: 4.5m

Effective water depth: 4.5m

停留时间: 3.35h

Retention time: 3.35h

B. 主要设备及参数

Main equipments and parameters

全桥式管式梁刮泥机及配套刮浮渣排渣等设备。

Full bridge of pipe style girder sludge scraper and its accessories, and scum scrapers and drainage etc.

台数： 8 台

规格： D=50m

单机功率： $N=2 \times 3.0\text{kw}$

(7) 污泥泵池

Sludge pump station

A.设计参数及描述

Description of the design parameters

污泥泵池为现浇钢筋混凝土矩形池，来自最终沉淀池的污泥分别通过污泥回流泵提升到往氧化沟的进水井，剩余污泥经剩余污泥泵提升后送到污泥缓冲池，共设八池与氧化沟一一对应。每池内设 3 台用于回流污泥的套筒式混流泵，1 台用于排除剩余污泥的潜污泵。

Reinforced concrete rectangular tank is adopted here. Sludge from sedimentation tank shall be pump into the influent well of oxidation ditch by sludge return pump and into sludge buffer tank by excess sludge pump. 8 tanks are set to match oxidation ditches. 3 sleeve formed mixed flow pump are installed in each of the tank and 1 is used for excess sludge drainage.

每座污泥泵池尺寸：

Dimensions for each sludge pump station

长 x 宽 x 高 : 5.2m x 4.8m x 4.6m

主要设计参数：

Main design parameters:

回流比: 40%~120%

Sludge return rate: 40%~120%

回流污泥量: 1.53~4.58m³/s

Sludge return quantity: 1.53~4.58m³/s

池数: 8 座

Number of tanks: 8sets

剩余污泥量: 6240m³/d

Excess sludge quantity: 6240m³/d

含水率: 99.2%

Water contention: 99.2%

B. 主要设备及参数

Main equipments and parameters

a. 回流污泥泵

Sludge return pump

回流污泥泵采用不堵塞型套筒式潜水混流污水泵

Non-clog sleeve formed submerged mixed flow pumps are adopted.

数量: 24 台

流量: 687m³/h

扬程: H=3.5m

单台功率: N=15kw

连续运行

Continuous operation

a. 电动闸门

Electric penstock

数量：8 套

规格：DN800

单台功率：N=0.37kw

b. 剩余污泥泵

Excess sludge pump

剩余污泥泵采用不堵塞型潜污泵（带有配套的阀门及逆止阀）

Non-clog sleeve formed submerged mixed flow pumps are adopted.(Valves and check valves are equipped)

数量：10 台（每池一台，2 台冷备）

流量：65m³/h

扬程：15m

单台功率：7.5kw

工作时间 12-18 小时

Works time: 12-18 hours

根据水位变化，由 PLC 控制潜水泵的开启，亦可现场手动控制。

Starting and stop of the submerged pumps are controlled by PLC according to changing of water level , and can also manual controlled infield.

(8) 污泥缓冲池

Sludge buffer tank

A. 设计参数及描述

Description of the design parameters

剩余污泥泵将剩余污泥提升至缓冲池中，再由污泥泵将池内污泥抽升送到浓缩机上，设置缓冲池以调整剩余污泥的排入与浓缩机工作的时间上的偏差，为运行管理带来方便。池内设有搅拌器防止污泥板结。

Sludge is pumped to sludge buffer tank by excess sludge pump, and then pumped to sludge thickening machine. The sludge buffer tank is set to adjust time difference between the drainage of excess sludge and the thickening machine, and bring convenience to operation. Mixers are set in the sludge buffer tank.

主要设计参数：

Main design parameters:

干污泥量：49800kgDS/d

Dry solid: 49800kgDS/d

进泥含水率：99.2%

Water contented in inlet sludge: 99.2%

进泥量：6240m³/d

Quantity of inlet sludge: 6240m³/d

总容积：2 x 1200m³

Total volume: 2 x 1200m³

池数：2 座

有效水深：H=4 m

单池平面尺寸：B x H=17.3m x 17.3m

B. 主要设备及参数

Main equipments and parameters

a. 水下搅拌机

Mixer

设备型式：三叶搅拌机

Type of equipment:mixer

设备数量：2 套（每池 1 台）

单台功率：N=4kw

(9) 污泥浓缩机房

Sludge dewatering house

A. 设计参数及描述

Description of the design parameters

减少污泥体积，以减少后续处理设施的规模，节省投资。土建驻设备按一期规模设计，用于消化池的进泥投配泵亦设于此。

It is set to reduce the volume of sludge , so as to reduce the scale of the following constructions and reduce investment.Civil Engineering and equipments are designed for the first stage,(330,000t/s), and the sludge feeding pumps for digestion tank are also here.

污泥浓缩机房尺寸：

Dimensions of sludge dewatering house:

长 x 宽 x 高：30m x 15m x 6.5m

主要设计参数

污泥干固量：49800kgDS/d

浓缩前污泥含水率：99.2%

设计污泥量：6250m³/d

Design sludge quantity: 6250m³/d

设计出泥量：830m³/d

Design sludge effluent quantity

浓缩后污泥含水率：94%

Water contented after thickening:94%

浓缩时间：18hr/d

Thickening time: 18hr/d

絮凝剂用量：1g/kgDS

Polymer amount: 1g/kgDS

由 PLC 控制污泥的进泥加药及脱水，亦可手动操作。

Dosing and dewatering of the sludge is controlled by PLC and also
can be controlled manually.

B. 主要设备及参数

Main equipments and parameters

a. 浓缩机

Sludge thickening machine

设备类型：螺旋污泥浓缩机

Type of equipment: screw sludge thickening machine

设备数量：4套（第4台根据实际运行情况安装）

Quantity: 4sets (The 4th one shall be installed later according to operation requirement)

单台设备能力：Q=100m³/h

Capacity for each: Q=100m³/h

单机功率：N=4.4kw

Power for each: N=4.4kw

b. 进泥螺杆泵

Sludge feeding screw pump

设备类型：偏心螺杆进泥泵

Type of equipment: eccentric screw feeding pump

设备数量：4套（第四台实际运行情况安装）

Quantity: 4sets (The 4th one shall be installed later according to operation requirement)

单台设备流量：Q=60~100m³/h

扬程：H=7m

单机功率：N=3kw

c. 污泥投配泵

Sludge feeding pump

设备类型：偏心螺杆进泥泵

Type of equipment: eccentric screw feeding pump

设备数量：3 套（二用一备）

单台设备流量： $Q=20\sim 30\text{m}^3/\text{h}$

扬程： $H=28\text{m}$

单机功率： $N=7.5\text{kW}$

d. 絮凝剂制备及投加系统

Polymer make up and dosing system

设备型式：固体高分子絮凝剂制备及计量投加系统

Type of equipment: solid macromolecule polymer make up and measurement dosing system

设备数量：2 套

设计参数：聚丙烯酰胺用药量： $2\text{-}4\text{gPE/kgDS}$

Design parameter: dosing amount of macromolecule: $2\text{-}4\text{gPE/kgDS}$

设备包括：

Equipments including:

- 1 台干物质螺旋式计量装置，包括药粉仓和药粉储量监测装置。

1 set of dry solid screw form measurement unit, including dosage cabinet and dosage quantity monitoring equipment.

- 1 个用于母液的本药罐，容量 1.05m^3 ，不锈钢钢板制成，包括电动螺旋浆搅拌装置、进水附件，并具有液位控制功能。当熟

化时间已到，并且储药罐有足够的空间，母液自动释放到下面容量 1.5m^3 的储药罐。储药罐由不锈钢钢板制成，具有药位控制装置。设备包括完备的内部管道系统。

1 dosage pot for pregnant solution make up with a volume of 1.05m^3 and made with stainless steel, water feeding accessories. It can automatically control water level. Electric screw propeller mixer unit and other accessories are needed here. Water is distributed by distributor. When polymer is made up and the dosage pot has enough room, the pregnant solution will be set free to the 1.5m^3 dosage pot. The dosage pot is made up of stainless steel and be of dosage level control unit. A complete inner pipe system is included.

- 2 台聚合物计量投加泵用于投加母液，通过特殊混合管，将聚合物溶液稀释到 0.1% 的活性物质，具有可调的驱动装置。

2 sets of dosing pumps are applied to invest pregnant solution. Through a special mixing pipe, the polymer solution will be diluted to 0.1%, and adjustable driving equipment is installed.

e. 高压冲洗水泵，用以反冲洗

High pressure flushing pumps are adopted for flushing

设备型式： 立式离心泵

Type of equipment: vertical centrifugal pump

数量： 2 台

流量： $25\text{m}^3/\text{h}$

扬程：50m

单台功率：N=7.5kw

(10) 消化池

Digestion Tank

A. 设计参数及描述

Description of the design parameters

设消化池对剩余污泥进行无害化处理，利用厌氧产酸菌群及厌氧产气菌将剩余污泥中的有机物进一步分解，使其达到稳定。为钢筋混凝土锥形中温消化池：

Digestion tanks are set go treat excess sludge to harmless sludge. It make use of anerobic bacterium groups to break up the organics in the excess sludge and made it stable.Reinforced concrete taper shaped middle temperature digestion tank is adopted.

设计规模：土建及设备安装按照一期工程规模设计

Design scale:civil engineering and equipments installation is designed according to the first stage (330,000t/d) of the project.

主要设计参数

池数：2 座

设计参数：

进泥干固量：49800kgDS/d

Dry solid of the inlet sludge: 49800kgDS/d

进泥含水率：94%

Water contented in sludge: 94%

进泥量: $Q=830\text{m}^3/\text{d}$

Sludge quantity: $Q=830\text{m}^3/\text{d}$

挥发份比例: 50%

Volatilization rate: 50%

污泥投配率: 5%

Sludge investment rate: 5%

水力停留时间: 20d

Hydraulic retention time: 20d

消化温度: $33\sim 35^{\circ}\text{C}$

Digestion temperature: $33\sim 35^{\circ}\text{C}$

单池容积: $V=8000\text{m}^3$

Volume for single tank: $V=8000\text{m}^3$

池径: 20m

池总高度: 33.65m

Total height of the tank: 33.65m

有机物负荷: $1.54\text{kgDS}/\text{m}^3 \cdot \text{d}$

Organic loading: $1.54\text{kgDS}/\text{m}^3 \cdot \text{d}$

B. 主要设备及参数

Main equipments and parameters

a. 污泥搅拌机

Sludge mixer

数量：2 台

单台设备能力： $Q=3000\text{m}^3/\text{h}$

单机功率： $N=22\text{kW}$

b. 集气罩及压力安全装置

Gas collecting channel and safe pressure control system

设备数量：2 套

(11) 污泥控制室

Sludge Control Room

A. 设计参数及描述

Description of the design parameters

进行新鲜污泥投配、维护消化池内的消化温度，保证设计的生化反应条件。为二层砖混结构并与沼气锅炉房联建。

Fresh sludge is feed to and digestion temperature is maintained to ensure the designed biological reaction condition. It is a two floor brick and concrete structure and built together with boiler room.

内设循环污泥泵 3 台（二用一备），空气压缩机 1 台，沼气过滤器 2 台，沼气脱硫塔 1 座，泥—水热交换器 2 套。热水来自沼气发动机冷却水的余热利用和沼气锅炉房。锅炉房内设沼气热水锅炉一台，制备 90/75 摄氏度热水补充给冬季污泥加热所需热量。

There are 3 sludge circulation pumps (1standby) , 1 compressor , 2 biogas filters, 1 biogas desulfurization tower and 2 sets of sludge-water heat transformers.Hot water is from the cooling

water of the biogas engines and also form the biogas boiler room. 1 set of biogas hot water boiler is set in the boiler room and 90/75°C hot water is made to heat sludge in winter.

设计规模：土建按照二期工程设计，设备安装按照一期工程配备
Design scale:civil engineering is designed according to the future second stage,while equipments installation to the first stage.

污泥控制室平面尺寸：24m x 15m

Dimension of the layout: 24m x 15m

主要设计参数：

数量：1 座

污泥投配量： $Q=1095\text{m}^3/\text{d}$

Sludge feeding quantity: $Q=1095\text{m}^3/\text{d}$

污泥投配时间： $T=18\text{hr}/\text{d}$

Sludge feeding time: $T=18\text{hr}/\text{d}$

设计加热时间： $T=18\text{hr}/\text{d}$

Design heating time: $T=18\text{hr}/\text{d}$

污泥加热量： $Q_{\max}=1000\text{kW}$

Heat quantity of the sludge: $Q_{\max}=1000\text{kW}$

B. 主要设备及参数

Main equipments and parameters

a. 循环污泥泵

Sludge circulation pump

设备类型：偏心螺杆污泥泵

Type of equipment: eccentric screw feeding pump

设备数量：3 套（二用一备）

单台设备流量： $Q=75\sim 90\text{m}^3/\text{h}$

扬程： $H=8\text{m}$

单机功率： $N=20\text{kW}$

控制方式：根据消化池温度由 PLC 进行自动控制

Way of control: automatic control by PLC according to the temperature of digestion tank.

b. 污泥加热换热器

Sludge heating heat transformer

设备类型：套管式泥—水换热器

Type of equipment: sleeve form sludge-water heat transformer

设备数量：2 台

单台热交换器能力： $Q_{\max}=600\text{kW}$

设计加热时间：18hr/d

污泥投配温度： $T_s=30^\circ\text{C}$

Sludge feeding temperature: $T_s=30^\circ\text{C}$

消化温度： $T_d=33\sim 35^\circ\text{C}$

Digestion temperature: $T_d=33\sim 35^\circ\text{C}$

进口热水温度： $T_{w1}=90^\circ\text{C}$

Water temperature in entrance: $T_{w1}=90^\circ\text{C}$

出口热水温度: $T_{w2}=75^{\circ}\text{C}$

Effluent water temperature: $T_{w2}=75^{\circ}\text{C}$

热水换热温差: $\Delta T=15^{\circ}\text{C}$

Temperature difference: $\Delta T=15^{\circ}\text{C}$

热交换器污泥管管径 DN150mm

Diameter of sludge pipe in heat transformer: DN150mm

热交换器热水管管径 DN250mm

Diameter of water pipe in heat transformer: DN250mm

控制方式: 根据热交换器的进出口温度调节热水流量, 由 PLC 自动控制。

Way of control: automatic control by PLC according to the temperature of influent and effluent.

c. 热水循环泵

Hot water circulation pump

设备类型: 立式离心泵

Type of equipment: vertical eccentric pump

设备数量: 3 套 (二用一备)

单台设备流量: $Q=40\text{m}^3/\text{h}$

扬程: $H=8\text{m}$

单机功率: $N=2.2\text{kw}$

d. 脱硫热水泵

Desulfurization hot water pump

设备数量：2 套

单台设备流量： $Q=2\text{m}^3/\text{h}$

单机功率： $N=1\text{kw}$

e. 热水分配器热水调节器及膨胀罐

Hot water distributor, hot water adjustor and expansion tank

设备数量：1 套

f. 沼气粗过滤器及细过滤器

Biogas coarse filter and fine filter

设备数量：2 套

g. 沼气锅炉及配套设备

Biogas boiler and accessories

设备数量：1 套（远期增加一套）

规格：0.7MW（配有两台热水循环泵）

Specifications: 0.7MW(2sets of hot water circulation pump)

(12) 贮泥池

Sludge Tank

A. 设计参数及描述

Description of the design parameters

泥量：37000kgDS/d

平面尺寸：D=20m H=4.0m

B. 主要设备及参数

Main equipments and parameters

a. 水下搅拌机

设备数量：1 台

功率：N=4kw

(13) 污泥浓缩机房

Sludge Dewatering House

A.设计参数及描述

Description of the design parameters

功能：将污泥的含水降到尽可能低的程度以减少污泥体积并可装卸作业，同时污水处理厂的 MCC3 与污泥脱水机房合建。

Function:to reduce as much as possible the water contented in sludge,so as to reduce the volume of sludge and make it can be load and unload.MCC3 is built together with the sludge dewatering house.

类型：框架结构钢筋混凝土污泥脱水机房

Type: reinforced concrete frame structure

设计规模：土建按二期规模设计，设备安装按一期规模设计

Scale:civil engineering is designed according to the second stage and equipments installation is designed according to the first stage (330,000t/d)

数量：1 座

污泥脱水机房平面尺寸：48m x 12m

Dimension of layout of the dewatering house:36m x 12m

泥棚平面尺寸：24m x 18m

Dimension of layout of the sludge shed: 36m x 12m

设计参数：

进泥干固量：37000kgDS/d

Dry solid rate after dewatering: 20~25%

进泥含水率：95.5%

Water contented in feeding sludge: 95.5%

进泥量：Q=830m³/d

Feeding sludge: Q=830m³/d

工作时间：16~24hr

脱水后污泥含固率：20~25%

Dry solid rate after dewatering: 20~25%

浓缩脱水后泥饼体积：197-247 m³/d

Volume of sludge cake after dewatering: 197-247 m³/d

絮凝剂用量：3~4.5g/kgDS

Quantity of polymer: 3~4.5g/kgDS

设3台带式压滤脱水机、污泥投配泵、聚合物配置及投加系统，

脱水后的污泥由2台无轴螺旋输送机运至室外外运。

3 complete sets of belt filter presser, dosing pump, polymer make up and dosing system. Sludge dewatered shall be removed outdoor by 2 screw conveyors.

B. 主要设备及参数

Main equipments and parameters

a. 污泥脱水机

Sludge dewaterer

设备类型：带式压滤机及全部配套设备

Type:belt filter presser and accessories

设备数量：3 台（第 3 台根据实际运行情况安装）

设计参数：

单机处理能力：22m³/h

设计工作时间：T=18~24hr

带宽：2.5m

Belt width:2.5m

进泥含水率：95.5%

Water contented in feeding sludge: 95.5%

出泥含水率：75%

Water contented after dewatering: 75%

单机功率：N=30kw

控制方式：根据污泥脱水量按比例控制絮凝剂投加量，亦可手动操作。

Way of control:Dosing is automatically controlled according to the water amount,but it can also be manually operated.

b. 污泥进料泵

Sludge feeding pump

设备类型：偏心螺杆污泥泵

设备数量：4 台（第四台根据实际情况安装）

Quantity: 4 sets (The 4th one shall be installed later according to operation requirement)

单台设备流量：Q=10~25m³/h

扬程：H=30m

单机功率：N=7.5kw

c. 冲洗水泵（用以清洗滤带）

Flushing pump, to flush belt

设备型式：立式离心泵

数量：3 台

流量：25m³/h

扬程：H=45m

单台功率：N=7.5kw

d. 空压机（用以调整滤带）

Compressor: to adjust belt

设备型式：移动式空压机

Type: mobile compressor

设备数量：3 台（第三台根据实际情况安装）

气量：0.1m³/min

Air quantity: 0.1m³/min

压力：0.7Mpa

单机功率：N=3.0kw

f. 絮凝剂制备及投加系统

Polymer make up and dosing system

设备型式：固体聚丙烯酰胺高分子絮凝剂制备及计量投加系统

Type: solid polyacrylamide Polymer make up and dosing system

设备数量：2 套

设计参数：聚丙烯酰胺用药量 3~4.5gPAM/kgDS

Design parameters: polyacrylamide amount 3~4.5gPAM/kgDS

设备包括：

- 1 台干物质螺旋式计量装置，包括药粉仓和药粉储量监测装置。

1 set of screw measuring unit including polymer cabinet and monitoring unit.

- 1 个用于母液的配药罐，容量 2.0m³，不锈钢钢板制成，包括电动螺旋桨搅拌装置、进水附件，并具有液位控制功能。当熟化时间已到，并且储药罐有足够的空间，母液自动释放到下面容量 3.0m³ 的储药罐。储药罐由不锈钢钢板制成，具有药位控制装置。

设备包括完备的内部管道系统。

1 dosage pot for pregnant solution make up with a volume of 2.0m³ and made with stainless steel, water feeding accessories. It can automatically control water level. Electric screw propeller mixer unit and other accessories are needed here. Water is distributed by distributor. When polymer is made up and the dosage pot has enough

room, the pregnant solution will be set free to the 3.0m³ dosage pot. The dosage pot is made up of stainless steel and be of dosage level control unit. A complete inner pipe system is included.

- 2 台聚合物计量投加泵用于投加母液，通过特殊混合管，将聚合物溶液稀释到 0.1% 的活性物质，具有可调的驱动装置。

2 sets of dosing pumps are applied to invest pregnant solution. Through a special mixing pipe, the polymer solution will be diluted to 0.1%, and adjustable driving equipment is installed.

g. 无轴螺旋输送机（水平安装）

Non-axial screw conveyor(horizontal installation)

设备规格：D=400 L=20m

设备数量：1 套

单台功率：N=5.5kw

脱水机房内设悬挂式起重机 1 台，起重量为 3T，用于设备的安装和维修。

A 3 tons suspension crane is set in the sludge dewatering house, for installation and maintenance of equipments.

(14) 沼气利用

Use of Biogas

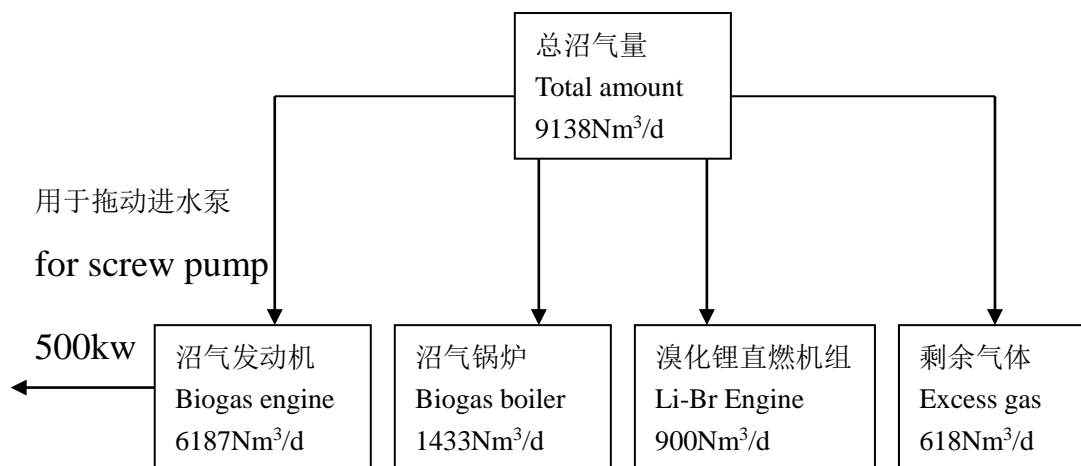
A.设计参数及描述

Description of the design parameters

污水处理过程中所产生的污泥在消化池内进行厌氧消化产生大

量沼气经过滤脱硫后存入沼气柜，沼气柜用于调节贮存沼气，出气用于进水泵房的沼气发动机、综合楼空调机组、沼气锅炉；多余气体燃烧器燃烧。以下为冬季和夏季的沼气利用及热平衡图。

Biogas produced from the sludge digestion tank enters into the biogas holder after desulfurization, and the cabinet is used for gas storage and adjustment. Biogas is used in inlet pump station, air conditioners in general office building and biogas boiler. Excess biogas is incinerated in gas torch. The usage of biogas in winter and summer and its heat balance drawing is set below:



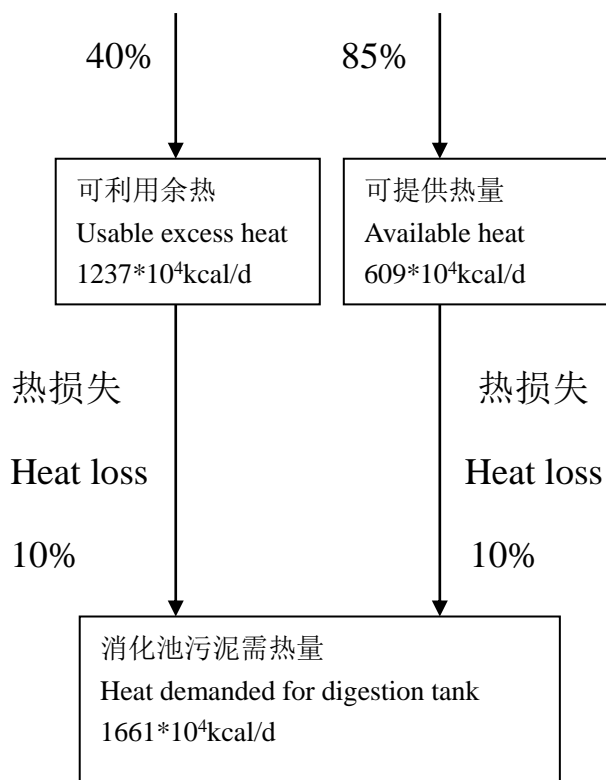
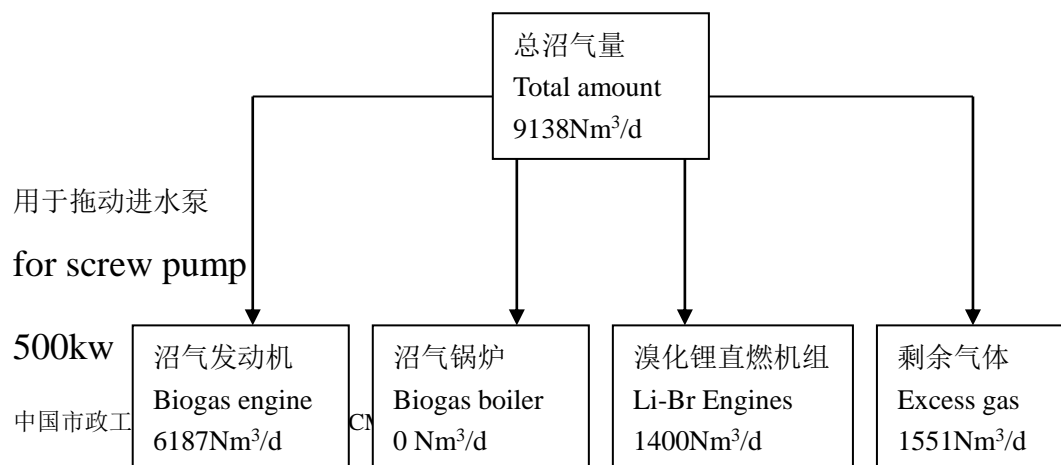


图 7.2-1 冬季沼气利用及热平衡图

Chart 7.2-1 Heat Balance of Biogas in Winter



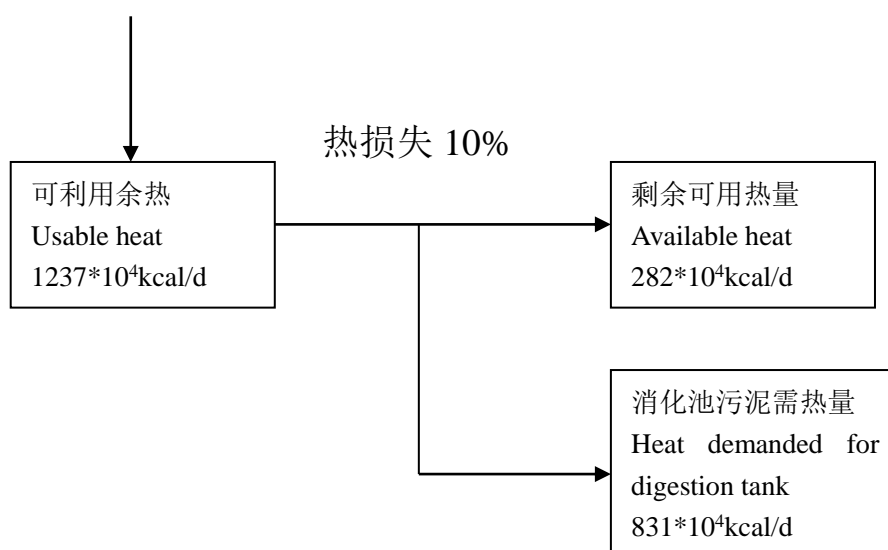


图 7.2-1 夏季沼气利用及热平衡图

Chart 7.2-1 Heat Balance of Biogas in Summer

主要设计参数

总沼气量：9138m³/d

Total biogas quantity: 9138m³/d

B. 主要设备及参数

Main equipments and parameters

a. 储气柜

Biogas holder

设备类型：柔膜密封干式储气柜

Type: soft membrane dry biogas storage

设备数量：1 套（远期增加 2 套）

Quantity: 1set(2 more sets will be installed in the further stage)

总容量: 3000m³

Total capacity: 3000m³

平衡时间: 7.9hr

Balance time: 7.9hr

工作压力: 0.004Mpa

b. 燃烧塔

Biogas torch

设备类型: 钢结构燃烧塔

Type: Steel structure biogas torch

设备数量: 1 套

规格: 500m³/h

7.3 总平面设计

General layout

7.3.1 平面布置

Layout

青山湖污水处理厂位于低排沟北侧，污水处理厂远期占地面积 40.0277 公顷，一期占地面积 21.4290 公顷。

Qing Shan Hu Sewage Treatment Plant lies to north of Dipai Trough, and totally occupies an area of 40.0277ha, while 21.4290ha in the first stage.

在与路相邻的厂区东侧共设两个大门：西门和北门。均与规划路

相通，交通便利。西门设于厂前区附近，作为污水厂的主要进出口，北门设于污泥区附近，以利于污泥及药剂等物品的运输。

There are two doors set in the east part of the plant, which is adjacent to road: west door and north door. The two doors are both joined to fore-planned road. As main entrance, the west door is near the area in the front of plant. The north door lies near to the sludge area for convenient transportation of sludge and dosage etc.

给水：厂区自来水由城市给水管网供给，接自城市供水管网。需管径为 DN200 的自来水管进厂，给水管在厂内形成环状，以满足消防给水需要，并有水表计量。

Water supply: tap water is supplied from the municipal water pipe net. The diameter of the general pipe is 200mm and forms a circuit to meet the demand of fire control. Measurement device is equipped.

排水：厂区排水按雨污分流制设计，厂区污水汇合后排入厂区进水水泵池，由泵提升至细格栅前与进城市污水一并处理，厂区雨水分三个系统排至厂低排沟。

Drainage: Rain and sewage are drained in separate system. Sewage in plant flows into the inlet pump station, and will be treated together with the municipal sewage. Rain will drain to the Dipai Trough through three independent systems.

7.4 高程设计

Design of Altitude

污水处理厂实际占地部分地形平坦，高程悬殊不大。

There is a relative plan landform in the sewage treatment.

根据原初步设计资料，低排沟设计控制水位为 16.0 米，综合考虑污水处理厂的运行费用确定沉淀池水位 17.30 米。

The design control water level is 16.0m according to the original preliminary design data. The final level of the sedimentation tank is confirmed at 17.30m in consideration of daily operation cost.

依据厂区自然标高，考虑周围坝顶的高度及构筑物的竖向布置，填挖土方量平衡，确定厂区地面平均标高 17.50 米。

The average ground altitude is 17.5m in consideration of the height of dam around, hydraulic flow and earthwork balance.

污水处理厂进水由进水泵提升至 21.58 米，靠重力流至各处理工段后，总水头损失 2.34 米。为保证污泥处理系统运行可靠，防止污泥管道堵塞，采用污泥泵压力输送污泥，泵的位置尽可能靠近排泥点。

Sewage is pumped to 21.58m within inlet pump station, and flows naturally to the following treatment constructions with a total hydraulic loss 2.34m. Sludge is transferred in pressurized pipe to prevent from clogging. Pumps is located near as possible to sludge drainage place.

各构筑物的高程设计详见附图。

Altitude of each construction please refer to the attached drawing.

7.5 附属设施

Other Facilities

(1) 运输工具

Transportation vehicles

污泥车 5.0-7.0 吨	5 辆
Sludge truck	5
客货两用车	1 辆
Double function truck	1
吊车 20 吨	1 辆
Hoist Truck 20tons	1
小型交通车	3 辆
Mini bus	3
合计	10 辆

(2) 通讯

Communications

在综合楼内设电话总机室，设置一台 50 门小型功能型电话程控交换机，主要办公室及各建筑物内设电话分机，共安装电话分机 30 部。

A telephone exchange station whose capacity is 50 branch exchangers is set in the general office building. 30 branch exchangers are installed in main offices.

(3) 化验室

Lab

化验室设在化验楼内，设有污水分析室、污泥分析室、预处理室、

微生物室、BOD 室、仪器分析室、天平室、药品库等。

Lab is set in the lab building, in which there are sewage analysis room, sludge analysis room, pre-treatment room, micro organics room, BOD room, instrument analysis room, balance room and dosage room etc.

(4) 机修

Machine maintenance

主要负责厂内水泵、鼓风机、电机、阀门、管道，水处理机械设备及其它零配件修理，特殊大型设备和零件配置的修理依赖社会服务。

It is responsible for the maintenance of pumps, blowers, motors, valves, pipes, sewage treatment mechanical machine and other accessories. Maintenance of special large equipment rely on the social service.

(5) 辅助性建筑

Accessories

根据国家颁布的《城镇污水处理厂附属建筑和附属设备设计标准》(CJJ31-89)，青山湖污水处理厂工程的规模 33 万 m^3/d ，远期规模 100 万 m^3/d ，各附属建筑按远期规模设计，面积见建筑设计部分。

Present scale of Qing Shan Hu Sewage Treatment Project is 330,000 m^3/d , and in the future it will reach to 1,000,000 m^3/d , and area please refer to architecture design.

7.6 建筑设计说明

Notes For Architecture

本工程建筑分生产和辅助生产二部分。

Architecture design is made of two parts: Production buildings and assistant production buildings.

生产性建筑图纸根据工艺专业提供的工艺资料进行设计，详见建筑设计图纸和建筑物一览表。

The architecture design of production buildings is based on process design. Refer to the architecture drawings and the list of buildings.

辅属建筑有综合楼车库、仓库、机修车间，辅属建筑的设计是根据建设单位的要求并结合实际生产需要确定的。

Assistant production buildings include: general office house, garage, storage and machine maintenance house. Design of the assistant production building is based on the opinions and demands of owner of the plant, and to meet the real requirement of the process production.

综合楼建筑由实验室、食堂、中心控制室、空调机房，职工宿舍办公室等部分组成。其中实验室 250 m²，食堂 260 m²，单身宿舍 4 间，空调机房 180 m²，职工浴室 95 m²，会议 85 m²，中心控制室 125 m²，还有办公和公共活动部分。总面积 2545 m²。

The general office house shall include: lab, dinning room, center control room, dormitory, etc. The building area is as following:

Lab: 250 m²

Dinning room: 260 m²

Dormitory: 4 rooms

Refrigeration machinery building: 180 m²

Bathroom: 95 m²

Meeting room: 85 m²

Center control room: 125 m²

Office and Activity room etc

Total area: 2545 m²

其它辅属建筑详见设计图纸和建筑物一览表。

Other assistant architectures see the drawings and list of buildings.

室内外装修采用中级标准。外详饰面选用高级外墙防水涂料，局部挂贴花岗岩或铝板。

Outdoors fitments adopts medium standard. High quality painting is chose to paint the outside of the walls, except some part pasted with granite or aluminium plates.

屋面防水采用 II 级标准，二道设防。

II standard is adopted in waterproof of the roof.

外檐门窗采用彩色铝合金门窗。

Doors and windows outside adopts colorful aluminum alloy.

建筑物一览表

编号	名称	建筑面积	建筑层数	结构形式	备注
1	粗格栅及进水泵房	404		钢筋砼框架	
2	污泥浓缩机房	478	一层	钢筋砼框架	
3	污泥控制室	810	二层	钢筋砼框架	地下一层，地上一

					层和楼梯井
4	污泥脱水机房	785	一层	钢筋砼框架	泥棚 650 m ²
5	1#变电站	323	一层	钢筋砼框架	带有半地下室
6	2#变电站	153	一层	钢筋砼框架	
7	综合楼	2545	三层、局部 一、三层	钢筋砼框架	
8	车库及仓库	468	一层	钢筋砼框架	棚 159 m ²
9	机修车间	314	一层	钢筋砼框架	
10	门卫	30	一层	砖混结构	

List of Buildings

No	Name	Area	Structure form	Layer
1	粗格栅及进水泵房	404	Reinforced Concrete frame Structure	Single
2	污泥浓缩机房	478		Single
3	污泥控制室	810		Multi-layer
4	污泥脱水机房	785		Single
5	1#变电站	323		Two layers
6	2#变电站	153		Single
7	综合楼	2545		Three layers
8	车库及仓库	468		Single
9	机修车间	314		Single
10	门卫	30	砖混结构	Single

7.7 结构设计说明

Structure Design Reference of Nanchang Qing Shan Hu
Sewage Treatment Plant

7.7.1 设计依据

Reference standards

国家颁布的现行结构设计规范及各专业提供的基本设计资料。

The latest edition codes and the dates provided by other specialties.

7.7.2 地质情况

Geologic condition

《地勘报告》已对地质情况做了较详细的叙述，在这里不再阐述。

Subgrade survey report has given a description, we don't detail here.

7.7.3 主要建筑物的结构形式及地基处理方案

Structure Method And Subgrade Treatment Of The Main Buildings(Houses)

结构形式：详见建筑设计说明中建筑物一览表。

Structure method: See *list of buildings* of design explanation.

地基处理方案：拟采用换填法，即将③-1 层以上的土全部清除掉，用级配砂石回填，分层碾压，压实系数不小于 0.96。

Subgrade treatment: plan to select the *permutation bad soil precept*, in detail, clean out all the soil up layer ③-1 and exchange it with grits and rocks. The grits and rocks must be layer-tamped and the tamped coefficient $\lambda_c \geq 0.96$

7.7.4 主要构筑物地基处理，抗浮措施，结构选型等

Construction Form And Subgrade Treatment Of The Main Buildings(Tanks)

7.7.4.1 氧化沟 Oxidation Ditch

平面尺寸约 120m*32m，深 5.5m，地上 3.1m，地下 2.4m，共 4

组（每组两池），拟采用挡水墙结构，刚性底板，整体抗浮。由于场地开阔且基底下为③-1 层粉质粘土，基坑可按一定坡度进行放坡开挖，但必须采取有效的降水措施，将地下水位降至垫层下不小于 0.5m。

The plane dimension is about 120m*32m, the depth is about 5.5m, the upground part is 3.1m and the underground part is 2.4m. The oxidation ditches have 4 groups and each group has two tanks. We plan to select the *ward off water wall* structure form for wall and select the rigid bottom. Self-weight prevents flotation. The field is plane and the subgrade is layer ③-1 (powder-clay), so the earthwork can be dug according to a certain slope. Artificial precipitation must be done while digging and the level of groundwater must be declined to the plane 500mm under concrete cushion.

7.7.4.2 终沉池 Sedimentation Tank

平面尺寸为 $\Phi 50\text{m}$ 的圆池，地上 2.24m，地下 2.76~7.26m，拟采用无粘结预应力结构，壁板砼标号为 C40，用 $\Phi 400\text{mm}$ 的沉管灌注桩抗浮，由于场地开阔且基底下为③-1 层粉质粘土，基坑可按一定的坡度进行放坡开挖，但基底已接近④层土，该层为细砂，含水量丰富，渗水性强，且具承压性，施工时务必采取可靠的降水措施，谨防产生涌砂现象。

The plane diameter is about 50m, the upground part is 2.24m and the underground part is 2.76m~7.26m. We plan to select concrete tank structure prestressed with unbonded tendons. The concrete class is C40.

We plan to select $\Phi 400$ pile foundation to prevent from flotation. The field is plane and the subgrade is layer ③-1 (powder-clay), so the earthwork can be dug according to a certain slope. However, the bottom of tanks is closed to soil layer ④ (silver sand), the layer ④ has abundant groundwater, the infiltration coefficient k of soil is big and the groundwater received pressure, so reliable measures must be adopted while digging.

7.7.4.3 消化池 Digestion Tank

消化池有 2 组、平面直径约 20m，地上部分 28m，地下部分 5m。计划采用无粘法预应力水池结构。拟采用 $\Phi 800$ 桩基础。桩基础施工和土方开挖时必须注意地下水且采取可靠措施。

The digestion tanks have 2 groups. The plane diameter is about 20m, the upground part is 28m and the underground part is 5m. We plan to select $\Phi 800$ pile foundation. Much attention must be paid to groundwater and reliable measures must be selected during constructing pile foundation and digging.

7.7.4.4 粗格栅及进水泵房 Coarse Screen And Raw Sewage Pumping Station

平面尺寸约 25m*35m，此构筑物分为三部分：粗格栅，进水提升泵池，设备机房。粗格栅，进水提升泵池为地下式水池，深约 8 米，钢筋砼结构。在粗格栅与进水提升泵池间设伸缩缝一道。设备机房 (9m*32m) 为钢筋砼框架结构，筏板基础。构筑物自重可以满足抗浮

要求，构筑物主要以③-1 层粉质粘土为持力层。基坑采用放坡开挖，并应采取有效降水措施。

The plane dimension is about 25m*35m,the building is made up of three parts: coarse screen and raw sewage pumping station are underground tanks, the depth is about 8.0m, and it is reinforced concrete structure. A stretching slot is set between the coarse screen and the raw sewage pumping station. Reinforced concrete structure and raft plate foundation are adopted in the equipment house. The building's deadweight can counteract the flotation. The subgrade is layer ③-1 (powder-clay), the foundation pit can be scooped according to a certain degree of slope and measures must be taken to reduce the level of groundwater.

7.7.5 防腐措施

Method Of Anti-Corrosion

《地勘报告》提示地下水对砼具弱腐蚀性，依据《工业建筑防腐设计规范》将采取降低水灰比，加大受力钢筋保护层厚度，埋入土中的墙柱，池体表面涂刷防护材料等一系列措施。

Subgrade survey report said: the groundwater is a bit caustic to concrete. According to the code, We plan to reduce the ratio of water/cement of concrete, enlarge the protective thickness of the main bars of concrete structure and painting to prevent from corrosion,etc.

7.7.6 抗震设计

Seismic Design

建、构筑物均按设防烈度为六度进行设计。并采取相应的构造措施。

According to the *code for seismic design of buildings*, all the buildings' Seismic fortification intensity is 6 degree and corresponding measure are taken.

7.8 电气设计

Electrical Design

7.8.1 设计依据及设计范围

Criteria And Design Range

本工程主要依据以下内容进行设计：

The criteria of the electrical design for this project are as follows:

7.8.1.1 与本工程有关的设计规范和设计标准

Requirement Chinese Design Codes

7.8.1.2 业主要求（详见会议纪要） The Requirement Of Employer(Meeting Minute)

7.8.1.3 工艺提供的设计资料 Data From Mechanical Engineer

本工程设计范围包括污水厂全部的动力及照明设计。10kV 供电线路不在本设计范围之内。

The electrical design includes all power and illumination for whole wastewater plant. The 10kV power source line is excluded.

7.8.2 负荷等级及供电电源

Load Class And Power Source

根据污水处理工艺的要求和大中城市污水处理厂的重要性，本工程用电负荷确定为二级负荷。

The load class of the project is class 2 according to the process requirement and importance of the project.

拟采用两路 10KV 电源供电，两路电源分别引自江纺变电站和高新变电站。

Power source are from Jiangfang transformer station and Gaoxin transformer station respectively.

7.8.3 用电负荷

Load

本工程全部用电设备的电压等级均为 AC220V/380V。总装机容量 4302KW，使用容量 4102KW。计算负荷 3213KW。经无功功率补偿后视在功率 3448KVA。

The rated voltage of all loads shall be AC220V/380V. The total equipment capacity is 4302KW, the operation capacity is 4102KW, and the calculated power is 3213KW. After reactive compensation, the apparent power is 3448KVA.

7.8.4 变配电系统设计

The Transformer And Distribution System Design

根据全厂总图布置和工艺处理区域的划分，拟建四座

10KV/0.4KV 变电站:

Totally four transformer stations should be built according to the general layout and process function partitions.

1#变电站设在进水泵站附近，作为全厂 10KV 配电中心，同时负责污水机械预处理区设备和一部分生化区设备的供电及控制。

1# transformer station shall be located near the saw sewage pumping station. It is not only the 10KV power distribution center but also responsible for the power distribution and motor control for whole mechanical pre-treatment section and part of the biological treatment section.

2# 变电站设在氧化沟与沉淀池之间，负责生化处理区设备的供电及控制。

2# transformer station shall be located between oxidation ditch and sedimentation tank. It is responsible for the power distribution and motor control for the rest part of the biological treatment section.

3# 变电站毗邻污泥脱水机房，负责污泥处理区设备的供电及控制。

3# transformer station shall be located beside sludge dewatering room. It is responsible for the power distribution and motor control for whole sludge treatment section.

4# 变电站设在生活区，负责综合楼等生活设施的供电。

4# transformer station shall be located within civil area and is

responsible for the power distribution for civil utilities, e.g. synthetic building.

10KV 配电系统采用单母线分段式结线，设母线联络开关。两路电源同时工作，互为备用。10KV 电源自 1#变电站以放射式向 2#～4#变电站供电。

The 10KV distribution system adopted in the project is a divided single-busbar system, the busbar is divided into two parts and linked by a liaison breather. The two power source shall be in operation simultaneously, and stand by for each other. The 10KV power shall be radiated to 2#～4# transformer station from 1# transformer station.

1#～3# 变电站各设两台变压器。1#、2#变电站 AC220/380V 低压侧采用单母线分段式结线，设母联开关。两台变压器同时工作，各承担一段母线的供电。3#变电站两台变压器一用一备，AC220/380V 低压侧采用单母线分段式结线，设母联开关。4#变电站设一台变压器，AC220/380V 低压侧采用单母线结线。详见附图。

There are two transformers in each transformer station except 4# transformer station. In 1# and 2# transformer station, the low voltage (220/380V) distribution system adopted is divided single-busbar system, i.e. the busbar is divided into two parts and linked by a liaison breaker. Under normal condition, both of transformers shall be in operation simultaneously to supply power to both parts of the busbar, one for each. The low voltage (220/380V) distribution system adopted in 3#

transformer station is single-busbar system; one transformer is in operation, while another is spare. There is one transformer in 4# transformer station, therefore the low voltage(220/380V)distribution system adopted is a single-busbar system.

For details, see the attached drawing(D-01~D-05).

低压系统采用以变电站为中心的放射式配电。详见附图。

The low voltage (220/380V)power shall be radiated from each transformer station. For details, see the attached drawing(D-07~D-11).

7.8.5 电气传动系统设计

Motor Control System Design

本工程工艺设备分为两种供电方式，即由 MCC 直接供电和由现场控制箱供电。每个单机设备的控制均采用现场手动和 PLC 自动两种控制方式。由 MCC 供电的设备均设机旁操作箱，箱上设“远程停—就地”选择开关，远程时由 PLC 控制，就地时可实施手动控制。由现场控制箱供电的设备在箱上设“手动—停—自动”选择开关，自动时由 PLC 控制，手动时可在箱上实施手动控制。手动控制仅在系统和设备调试时使用，正常运行时全部由 PLC 自动控制。

For each motor, the power shall be supplied from motor control center(MCC)located in transformer station or local control panel/box. Each motor can be controlled on local panel/box and /or by PLC.

There will be a local operation box (“OB”)beside the motor to which power is supplied from MCC. On the front face of the OB, there is a

Remote-O-Local switch. When Remote, the motor shall be controlled by PLC; when Local, the motor shall be controlled manually on the OB.

There will be a Manual-O-Auto switch on local control box(“CB”) for the motor to which power is supplied from MCC.

The motor shall be controlled manually only when commission or maintenance. Under normal condition, all of the motors shall be controlled by PLC.

格栅设备组、进水泵、表曝机、污泥浓缩和脱水机等设备的现场控制箱随工艺设备供货。

Some control boxes shall be delivered with plants such as screen plants, raw sewage screw pumps, sludge thickening machine and sludge dewatering machine, etc.

7.8.6 主要设备选型

Type Of Main Equipment

10KV 中压开关柜选用中置式金属铠装开关柜，开关选用真空断路器，继电保护装置选用集电量综合测量和保护于一体的智能保护装置。

10KV switchgear is metal clad center-located withdrawable type switchgear. Vacuum breaker shall be enclosed in the switchgear. Intelligent control devices that integrate measurement with protection are also adopted to protect the 10KV voltage system.

变压器采用树脂浇注型绝缘干式电力变压器。

Transformer is cast-resin type transformer.

10KV 系统直流控制和操作电源选用智能高频开关型直流电源屏，配进口铅酸免维护蓄电池。

The intelligent type high-frequency switch DC power set equipped with imported lead acid maintenance-free storage batteries is adopted to supply power to control and operate the 10KV system.

低压开关柜选用抽出式（抽屉式）开关柜，开关、接触器、热继电器、马达综合保护器等均选用知名品牌产品。

The low switchgear is withdrawable type. All circuit breakers, contactors, thermal relays, motor intelligent protection devices equipped inside the switchgear are manufactured by famous companies.

户外安装的配电箱、控制箱、操作箱、接线箱选用汉森公司生产的聚碳酸酯箱体，防护等级 IP65。

The body of outdoor boxes such as distribution box, control box, operation box and junction box shall be made of PC(polycarbonate), IP65, and manufactured by HENSEL.

7.8.7 设备安装和电缆敷设

Installation And Cable Laying

落地安装的开关柜、控制柜（箱）采用槽钢作基础，槽钢与柜间采用螺栓固定。

Floor mounted swithgear and control box shall be mounted directly

on channel steel, fixed by bolts.

户外安装的配电箱、控制箱、操作箱等一般采用支架安装，亦可视现场实际情况采用其它形式的安装方式，安装支架作防腐处理。

Generally, the outdoor boxes such as distribution box, control box, operation box and junction box shall be supported by bracket, or they can also be mounted in other way according to site condition. The bracket shall be anticorrosive treated.

室内电缆采用电缆沟和穿钢管敷设，电缆选用 YJV 型和 YJKV 型交联聚氯乙烯绝缘聚乙烯护套电力和控制电缆。

Inside cables shall be laid through cable trough or pipes. The cable shall be YJV type (power cable with cross-linked polythene insulation and PVC jacket) or KYJV type (control cable with cross-linked polythene insulation and PVC jacket).

室外电缆采用电缆沟和穿管敷设，各构筑物局部采用穿管明敷或电缆桥架内敷设。电缆桥架选用防腐型钢质桥架或玻璃钢桥架，电缆保护管、电缆沟内支架以及接地线等均采用镀锌材料。

Outside cables shall be laid through cable trough or concealed pipes, except that some shall be laid through cable trays or exposed pipes at part of structures. The cable trays shall be made of anticorrosive treated steel or fiber glass. All of the pipes, brackets and earthing wires shall be galvanized.

7.8.8 接地及等电位联接设计

Earthing And Main Equipotential Bonding

各变电站均设工作和电气系统保护综合接地系统，接地电阻不大于 1 欧姆。

Earthing system shall be adopted in each transformer station for working and protecting the electrical system, the earthing resistance shall be not more than 1 Ω .

在各构筑物和建筑物的进线处设电源的重复接地和等电位端子箱连成一体，形成总等电位，使人身接触电压降到安全值。

At each building and structure, repeat earthing and equipotential bonding shall be adopted. Repeat earthing shall be located in power inlet. While equipotential bonding means that all metal parts such as equipment shell, bracket, pipe, etc. shall be bonded together at the equipotential terminal box, so as to lower the prospective touch voltage to the safe value.

7.8.9 防雷及过电压保护

Lightning Protection And Overvoltage Protection

为防止因大气过电压和系统过电压而造成的电气设备损坏，在 10KV 母线处，10KV 馈线，220/380V 母线以及现场电源箱进线处安装过电压吸收装置。使过电压降低到设备绝缘电压以下。

Overvoltage arrestors shall be installed at 10KV busbars, 10KV feeders, 220/380V busbars and local distribution boxes to avoid the electrical equipment damage.

根据规范要求和当地的气象条件及习惯做法，主要建筑物和构筑物设防雷保护。

Lighting protection shall be adopted at main buildings and structures according to Chinese design code and local meteorologic condition.

7.8.10 照明设计

Illumination Design

办公及生活区室内照明以荧光以荧光灯为主，生产区采用高压汞灯或钠汞混光源照明。

Fluorescent lamp shall be used as the main light source in office and civil area, while mercuric and/or sodium lamp shall be used in production area.

厂区道路照明选用 6m 灯杆路灯，光源为钠灯。厂区路灯分别由门卫和变电站分区域供电，采用路灯控制器自动控制。

For road illumination, the road lamp with 6m-pole and sodium light source shall be adopted. The light power shall be supplied from transformer stations and warehouse where road lamp controllers can control the road lamps automatically.

室外构筑物根据需要设局部照明。

For outside structure, illumination is designed according to requirement.

变电站等重要场所设置事故照明，确保停电后人员安全疏散。

For the important place, e.g. transformer stations, emergency

lighting shall be designed to ensure safe escape in case of power failure.

7.8.11 其它

Others

污泥处理区中,处于防爆区的电气设计将根据防爆等级的划分采取相应的防爆措施。

Within explosive atmosphere in sludge treatment section, explosive-proof measure shall be designed in accordance with related Chinese code.

根据业主要求,本工程 10KV 配电站和各变电站均考虑了土建预留。

According to the requirement of the employer, spare space is considered in 1# transformer station and each transformer station.

厂区各建筑物内和生活区各主要房间和建筑内均设电话,全厂设一台约 100 门的程控交换机。

Telephone sockets shall be embedded in rooms in each building. A 100-set programmable telephone switchboard shall be installed for the plant communication.

7.9 自动化仪表及控制系统的设计

7.10 自动化仪表及控制系统的设计

Automatic Control System And Instrumentation Design

7.10.1 设计依据及设计范围

Design Principle And Design Range

1. 自控仪表设计依据工艺推荐方案及工艺对自控系统的要求并考虑污水厂运行管理的具体运行情况，结合自控仪表行业的特点并依据相关的设计规范进行设计。

According to the process scheme and requirements, the sewage running condition should be considered during make the automatic control system and instrumentation design. It combines the feature in automatic control system field and correlative design criterion.

2. 设计范围

按工艺要求完成自控系统的设计，范围如下：

According to the technical process requirements, automatic control system design is finished.

- （1）按工艺流程配置必要的液位、流量等检测仪表。

Based on the process flow diagram, we configure the necessary instrument. E.g. level, flow, pressure etc.

- （2）全部检测仪表及电气设备的运行信号的传送和显示。

By using PLC, it collects process parameters of the whole sewage treatment plant, electrical parameters and information of operating status of equipment.

- （3）根据电气设备的运行要求及主要工艺参数的控制要求，设置自动控制和自动调节系统。

According to the process requirement and the electrical equipment demand, automatic control and adjustment system is set up.

(4) 建立二级计算机管理及通讯系统。

It composes of two-level control system and communication system.

(5) 对大门等部分厂区安装闭路电视监视系统。

The closed-circuit television system is equipped in part area of plant.

(6) 对综合楼内的重要生产管理部门设置防盗报警系统。

The guard against theft and alarm system is equipped in the important department of plant.

7.10.2 控制系统的组成及系统通讯

Automatic Control system Structure And Communication

本设计采用集散型控制系统。该系统由中央控制室监控管理计算机和现场 PLC 子站组成，同时考虑到设备的分布情况，在部分 PLC 子站下设置分布式 I/O。当中控室监控管理计算机出现故障，各现场子站都能独立、稳定工作，从根本上提高了系统可靠性。而采用 PLC 为主体构成的集散系统性能价格比较高。

The integral computer control system is applied to the design, it is composed of monitoring and controlling computer, programmable controller in local control panel. And considering that the difference of equipment distributing, part programmable controller applies the distributing I/O modules. When monitoring and controlling computer occurs fault, each programmable logic controller all can work independently and stably. It improves radically the system reliability. If

we adopt the control system which main body is programmable controller, the price of system may probably more expensive.

二套监控管理计算机位于综合治理楼内的中心控制室，两套计算机位于综合楼内的中心控制室，两套计算机可分担不同功能，故障时可互为备用，计算机配有彩色显示器，打印机，键盘等。

The two monitoring computer seated in the central control room of office building, two redundant computers are equipped in different function. If one of them is in failure, other of them still works independently. Each computer is equipped in color monitor, printer, keyboard, etc.

监控管理计算机系统通过通讯网络采集污水厂各工艺过程的工艺参数，电气参数及主要设备的运行状态信息。对现场数据进行分析、处理、贮存，对各类工艺参数做出趋势曲线，通过简单的键盘操作，可进行系统功能组态，在线修改和设置控制参数，给下位机下达指令，CRT 可直观显示全厂动态流程图，并放大显示各工段工艺流程图，带有动态参数显示，趋势曲线显示，自动生成各类报表，可显示和打印记录；报警系统将现场设备的各种故障在中心控制室进行声、光报警，并能将故障分类打印。

By data transmission and communication in the whole plant, the monitoring and controller computer receives process parameters of the whole wastewater treatment plant, electrical parameters and information of operating status of the main equipment. These data and information

will be stored、analyzed、treated. For varies of process parameter, it presents their trend chart. By simple keyboard action, we can do system function configuration, modify and set online parameters, make instruction to lower control system. The monitor may display visually the dynamic flow diagram of plant, and enlarge partial flow diagram of plant; it displays dynamic parameters and trend graph, and produces automatically many kinds of reports, these report and chart can be printed. After the process or electrical equipment started, if there is a failure on site, the failure report will be sent to the monitoring computer and alarm with sound, print and classify fault records.

中心控制室内设有电动投影屏和投影仪，将工艺流程图动态地投影于屏幕上，投影仪通过以太网通讯与控制系统连接。用以直观显示全厂工艺流程和设备运行状态及主要工艺参数的实时值。这种配置克服了传统的马赛克模拟屏一次性制作，无法修改流程图的弊病，可随时在计算机上对流程图进行修改。经济合理。

The electrical projective device and large screen is installed in central control room, in order to project the technical process and operation state of the sewage treatment plant on screen. By the Ethernet, the projective device communicates with automatic control system, and it displays visually the dynamic flow diagram of plant, operation state of electrical equipment and real time value of main process parameters. Such as we can modify flow diagram in computer at any moment to avoid

the shortage that traditional mosaic mimic is produced only one time but no modified. This method is more economical and reasonable.

PLC 子站与中控室监控管理计算机之间采用 10/100Mbit/s 自适应工业以太网，通过光纤环网进行通讯，该通讯系统具有非环网双网冗余的功能，提高了系统的可靠性，又降低了硬件成本。PLC 子站与分布式 I/O 之间采用 profibus 现场总线连接，这样可减少大量的电缆。

The oneself adjustable Ethernet whose speed is 10/100M bit/s is adopted in the communication between monitoring and controlling computer and programmable logic controller substation. The communication system uses the double net that is redundant and non-circle optic fiber net. It both improves system reliability and reduces the hardware cost. The field bus with Profibus protocol is used in the communication between programmable logic controller substation and distribution I/O module, it may avoid large numbers of cables.

7.10.3 PLC 现场子站的划分

PLC Substation Location

根据工艺特点、构筑物的布置和现场控制的分布情况，设置四个 PLC 现场子站，PLC 现场子站选用可编程序控制器（PLC），PLC 为模块化结构，硬件配置较灵活，软件编程方便。并且 PLC 子站与相应的 MCC 置于同一地点，同时对于设备较集中又远离子站的现场设置远程 I/O 由通讯电缆连接。

According to the layout of the sewage treatment plant and

distribution of control equipment, we set up four PLC substation. The automatic control of the sewage plant is achieved by programmable logic controller (PLC). PLC structure is module structure, whose hardware configuration is agility and whose software program is convenient. Each PLC are all located in the same place with corresponding MCC. For those electrical equipment that are far from PLC substation and centralized, we set up distributing I/O modules. By field bus communication, the signal is sent to PLC substation.

各子站划分如下： Each PLC substation are located as follows

A. 机械预处理子站 PLC1 Mechanical pre-treatment substation
PLC1

PLC1 is located in the sub-control room of 1# transformer room, coarse screen and inlet pumping station, fine screen, aerated grit chamber, parshall flume, mechanical pre-treatment section, It concludes one distributing I/O module.

B. 生化处理子站 PLC2 Biochemical treatment substation PLC2

PLC2 置于 2#变电站，负责 2#变电站、氧化沟、污泥回流泵池、沉淀池、出水等部分全部设备的自动控制和数据采集。

PLC2 is located in the sub-control room of 2# transformer room, to be responsible for the signal sample and control in 2# transformer room, oxygen ditch and sludge pumping station, sedimentation tank, effluent, biochemical treatment section.

C. 污泥脱水机房子站 PLC3 Sludge dewatering treatment substation PLC3

PLC3 置于 3#变电站，负责 3#变电站、脱水机房、储泥池全部设备的自动控制和数据采集。

PLC3 is located in the sub-control room of 3# transformer room, to be responsible for the signal sample and control in 2# transformer room, sludge dewatering plant, sludge tank and sludge dewatering treatment section.

D. 污泥浓缩机房子站 PLC4 Sludge thickening and digester treatment substation PLC4

PLC4 置于浓缩机房控制室，负责 MCC3-1、MCC3-2、污泥缓冲池、浓缩机房、污泥控制室、消化池、沼气柜及沼气利用系统全部设备的自动控制和数据采集。该部分包括一个分布式 I/O。

PLC4 is located in the sub-control room of mechanical thickening plant, to be responsible for the signal sample and control in MCC3-1, MCC3-2, sludge suffer tank, mechanical thickening plant, sludge control room, digester tank, digester gas utilization and sludge thickening and digester treatment section. It concludes one distributing I/O module.

具体分配详见带控制点的工艺流程图和自控系统图。

The specification details are viewed in control flow diagram and automatic control system drawing.

7.10.4 仪表系统

Instrumentation System

根据工艺要求设置相关的仪表，并满足检测和控制系统的要求，传感器与变送器之间信号连续，变送器输出 4-20mA 的标准信号并且隔离。

The measuring instrument should meet the requirement of process, measuring and control system. The signal between sensor and transmitter is continues, and the transmitter sends out 4~20 mA standard isolated signals.

所有变送器应有工程计量单位的刻度和 LED 数字显示，可与传感器一体式分体安装。

All the transmitters should have graduation of engineering measurement units and LED digital display. The transmitter can be installed together with sensor or installed separately.

传感器和变送器符合 IP54 至 IP68 防护等级的要求，户外变送器安装在不锈钢的现场保护箱内，保护箱要带有显示窗口，保护箱的保护等级为 IP65。

The sensor and transmitter should meets the requirements of protection grades from IP54 to IP68. The transmitters should be installed in the stainless steel protective box with display window. The projective grade of the projective box is IP65.

防爆区内的仪表满足防爆要求，设计选用本安型防爆仪表，并设防爆隔离栅。

All instruments in explosion area must satisfy explosion proof request. The intrinsically safe explosion proof instrument is adopted in design, and we set some explosion proof isolation bar.

流量检测仪表：在渠道中流量计采用超声波明渠或方渠流量计；管道中流量计要采用电磁流量计。

Flow meter: Ultrasonic flow meter is suitable for the measurement of flow in open channel. Electromagnetic flow meter is suitable for the measurement of flow in the pipe.

液位检测仪表：在需要给出连续测量信号的环节，采用超声波液位计，一般环节的水位测量需给出位式信号，采用浮球位开关。

Level meter: The ultrasonic liquid level meter is suitable for the continue level measurement. The floating ball level switch is suitable for definite level measurement.

沼气柜的测量采用雷达物位计。

The level-radar meter is suitable for biogas storage.

温度检测仪表：采用传感器和变送器一体化的温度测量仪。热敏元件为铂热电阻（Pt100）。

Temperature meter: In the temperature measurement we adopts the meter that is together with sensor and transmitter. Its heat sensor use the platinum resistant-type probe (Pt100).

溶解氧测定仪，选用无隔膜固体电极传感器，并带自动清洗装置。

Dissolved oxygen meter: The sensor is composed of solid electrode

without diaphragm. It has auto-clean unit for the electrode.

酸度测定仪，采用玻璃电极式酸度计。

PH meter: The meter uses glass electrode, with temperature sensor and auto temperature compensation.

悬浮物测定仪，选用光电式传感器。

Solid suspending substance meter: The solid suspending substance meter is made according to the infrared optics principle.

COD 测定仪采用紫外光发测定离子含量。

COD meter: The COD meter is made according in principle that it determine ion content with ultraviolet light emission.

7.10.5 闭路电视监控及防盗报警系统

Closed-Circuit Television And Guard Against Theft And Alarm System

大门、进水泵站、粗细格栅、曝气沉砂池、氧化沟、沉淀池设摄像头，中控室内可监视到以上部分的情况。

We set up some camcorder sensor in the following plant place: Gate, inlet pumping station, coarse screen, fine screen, aerated grit chamber, oxidation ditch, sedimentation tank, etc. The circumstances in these place is inspected in central control room.

在综合楼内的重要部门设红外防盗报警器，并在中控报警。

The infrared guard against-theft and alarm system is set in important department of office building, and alarm in central control room.

7.10.6 防雷与接地

Lighting Protection And Grounding

整个污水厂采用等电位连接，仪表自控系统的接地采用联合接地方式，厂区联合接地网的接地电阻 <1 欧姆。仪表 PLC 柜的电源进线、户外现场仪表的电源、信号线接口及通讯道加装防雷保护及浪涌吸收装置。

The equipotential connection is adopted in sewage plant grounding. The unite grounding mode is used in grounding of instrumentation and automatic control system, the grounding resistance is not less than 1 ohm. The lighting protection device (surge arrestor) is installed on power supply incoming terminal in PLC panel, local instrument and signal communication interface.

8 设计依据

HV & AC Notes

8.1 室外气象参数

1. 冬季空调室外计算温度 -3°C

冬季通风室外计算温度 5°C

夏季空调室外计算温度 35.6°C

夏季通风室外计算温度 33°C

Outside design conditions

Outside winter design temperature (air-conditioning)

Outside winter design temperature (ventilating)

Outside summer design temperature (air-conditioning)

Outside summer design temperature (ventilating)

3. 综合楼设集中空调，冬季室内温度 18°C--22°C，夏季室内 24°C--28°C。冷热源采用溴化锂直燃机组，燃料为沼气。

General office building use Central Air-Conditioning system(s). Indoor winter air temperature is 18 ~ 22 and indoor summer air temperature is 24 ~ 28. Lithium bromide unit which use methane as fuel supply energy for system(s).

4. 水泵房、污泥浓缩机房、污泥控制室、脱水机房等产生有害气体的厂房均设机械通风，进行全面换气。

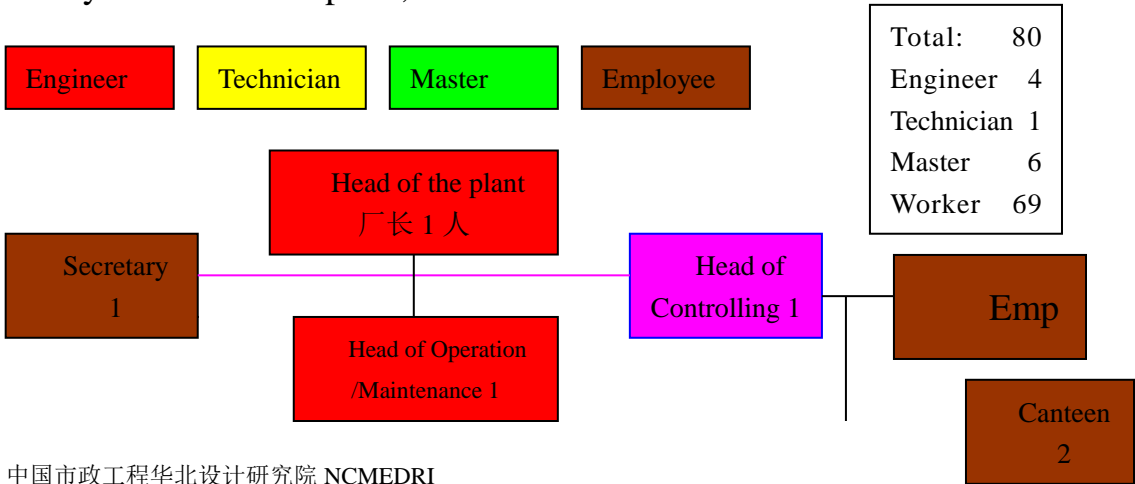
Pump station、Sludge thickening house、Sludge control room & Gas/Oil boiler house、Sludge dewatering house etc. Where produce nocuous gasses shall be installed with mechanical ventilation systems.

9 人员编制

Staff Arrangement

青山湖污水处理厂内设置相应的职能科室和生产工段负责全厂的行政和生产管理。全厂人员共计 80 人，其人员构成见下图：

Corresponding departments and workshop sections are set in plant to responsible for administration and production management. There are totally 80 staff in the plant, staff structure is as below:



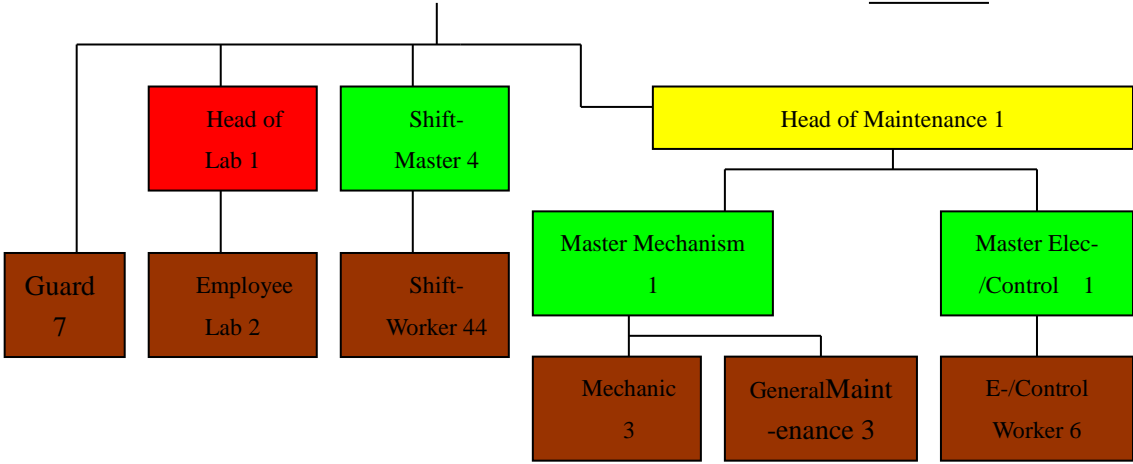


图 8-1 全厂人员分布图

Chart 8-1 Staff Structure of the Plant

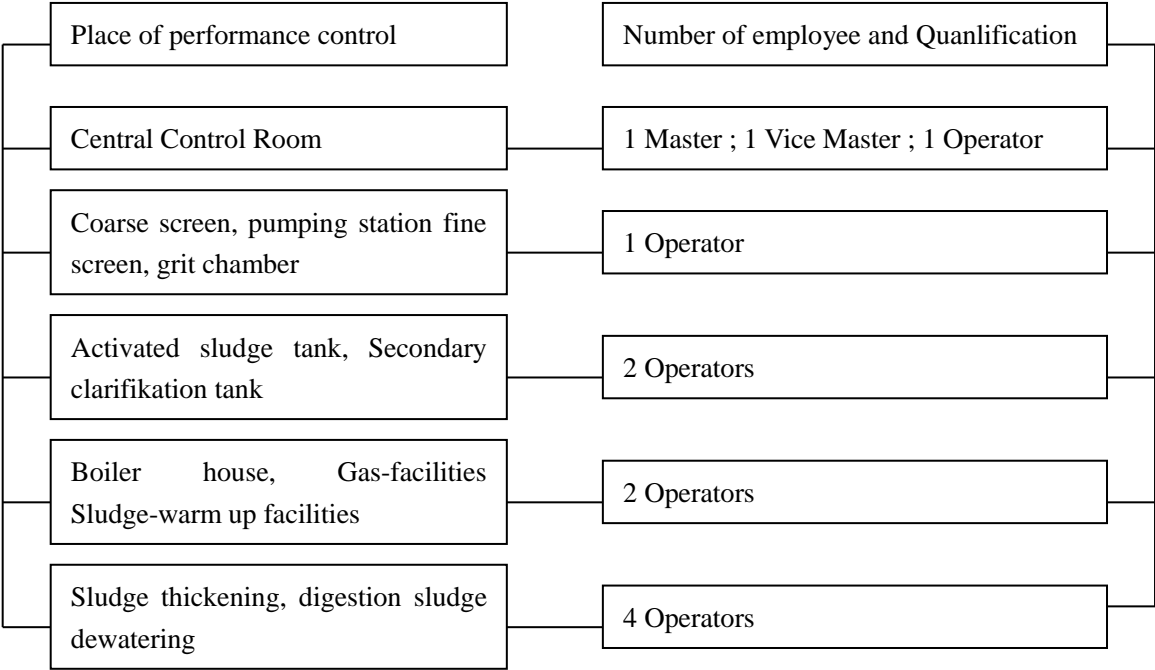


图 8-2 生产人员分布图

Chart 8-2 Staff Structure of the Production