E+B Umwelttechnik GmbH

E+B Environmental Protection Technology Co., Ltd.

CONTENTS

Company Overview

E+B UMWELTTECHNIK GMBH

Company Overview

Mr.R.Brenner (Dipl.Ing.)

Karlsruhe Institute of Technology (KIT)

- CEO of Philip Muller, Germany
- Co-inventor of BAF
- Co-originator of BHU
- Initiator of E+B GmbH
- BAF Senior Expert

Dr.C.Hubele

Doctor at KIT
Post doctor at MIT

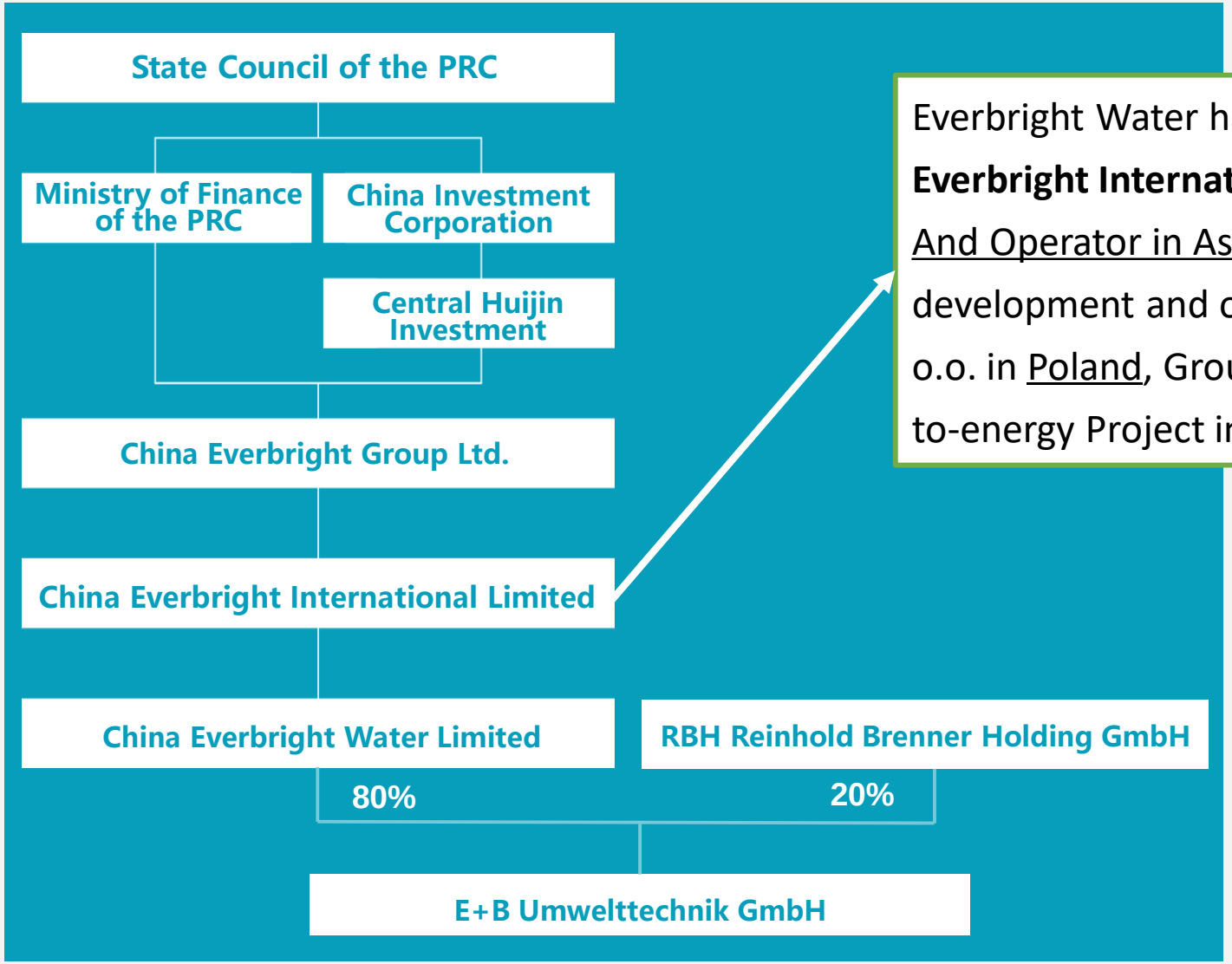
- Technical Director of Philip Muller, Germany
- Co-inventor of BAF
- Co-originator of BHU
- BAF Senior Expert

- E+B Umwelttechnik GmbH is a company registered in Stuttgart, Germany by Mr. R. Brenner, co-inventor of BAF. It provides advanced technology and systematic solutions for water and wastewater treatment, water treatment equipment and facilities and overall management.

- Mr. R. Brenner and Dr. C. Hubele jointly invented **BAF technology** in Philip Muller, Germany. And in 1999, they designed and implemented the first BAF in China, namely the Dalian Malanhe Phase I Project with a daily wastewater treatment capacity of 120,000 m^3. Philip Muller was acquired by Suez in 1999. Mr. R. Brenner and Dr. C. Hubele co-founded BHU Umwelttechnik GmbH in 2000 and developed business in Europe and China with the third generation BAF technology.

- In order to better expand the Chinese water market, Mr. R. Brenner, as the initiator, founded **E+B (Germany)** with the investment of **Everbright Water**. E + B operates in China either by EPC or by providing technology packages and core equipment. Its Chinese branch is located in Nanjing, Jiangsu Province.

Company Overview



Shareholding Structure

Everbright Water has strong support from its parent company, **Everbright International**, which is the Largest Waste Power Investor And Operator in Asia and has rich experience in overseas project development and operation, including acquisition of Novago sp. z o.o. in Poland, Ground Solar Energy Project in Germany and Waste-to-energy Project in Vietnam.

Everbright Water is a Leading Service Provider of Water Environment Management in China. It's dual listed on the Mainboard of Singapore Exchange Securities Trading Limited("SGX")and the Main Board of The Stock Exchange of Hong Kong Limited("HKEX") (U9E.SG & 1857.HK).

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PART TWO

Business Overview

E+B & EVERBRIGHT WATER LIMITED

Service Scope of E+B

Technology Consulting

- Water Treatment Plant
- Build/Expand/Upgrade
- Partial & Overall Solutions

Process Package Providing

- Preliminary & Detailed Design
- Pipeline & Instrument Design
- Detailed Structure Design
- Drawings involved
- Equipment List

On-site/After-sales

- Supervision/Installation/Training
- Debugging/Commissioning/ Quality Assurance

Project Management

- Project Design & Implementation
- Core Equipment Supply
- Quality & Cost Control

Core Technology

EBHES®

High-efficiency sedimentation tank

Application

- Pre-treatment at WWTP or PWTP
- Advanced treatment at WWTP
- River-basin ecological restoration

EBAF®

Biological activated filter

Application

- Advanced treatment at WWTP
- Upgrading of WWTP

EBOC®

Biological deodorisation

Application

- Deodorization at WWTP

EBOAC®

Ozone catalytic oxidation

Application

- High-density wastewater treatment
- Advanced treatment at WWTP

Intelligent Water System

Application

- Precise aeration
- Precise dosing
- Intelligent water plant

EBMED®

Low-temperature sludge drying

Application

- Sludge treatment plant
- Various types of chemical sludge
- Food waste, organic waste, etc.

Business Scale of Everbright Water

** As at 30 June 2019*

101 Wastewater Treatment

101 Wastewater Treatment Projects

With Investment Approximately RMB**14.83** Billion.

7 Reusable Water

7 Reusable Water Projects

With Investment Approximately RMB**532**Million.

2 Wastewater Source Heat Pump

2 Wastewater Source Heat Pump Projects

With Investment Approximately RMB**141** Million.

6 Water Environment Treatment

6 Water Environment Treatment Projects

With Investment Approximately RMB**4.085** Billion.

4 Water Supply

4 Water Supply Projects

With Investment Approximately RMB**2.776** Billion.

1 Leachate Treatment

1 Leachate Treatment Project

With Investment Approximately RMB**51** Million.

Aggregate Project Investment over RMB 22 Billion (US$ 3.259 billion)

Project Photos of Everbright Water

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PART THREE

EBHES™

HIGH EFFICIENCY SEDIMENTATION

EBHES™-Principle

Mixing and Coagulation Zone

- In rapid mixing, raw water and coagulant form tiny flocs

Flocculation Zone

- With the help of flocculants, tiny flocs and return sludge can form denser and heavier flocs

Maturation Zone

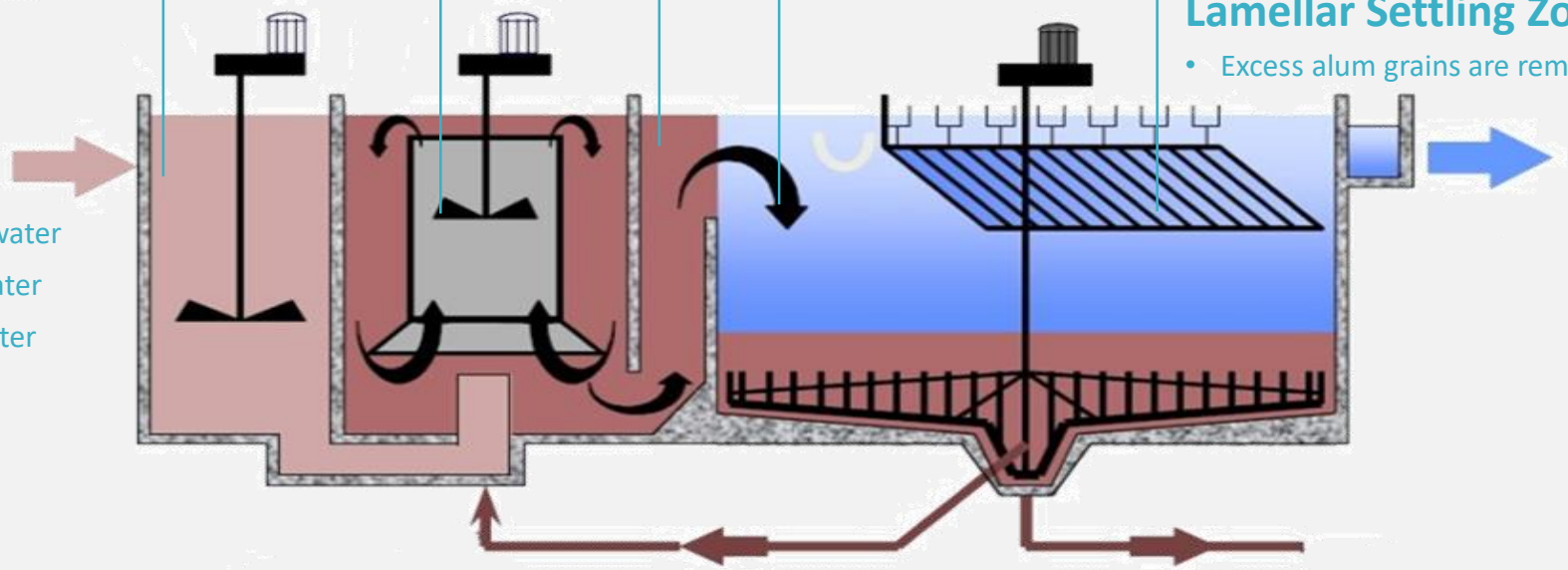
- Water flows slowly to the sedimentation zone to ensure the increase and integrity of alum grains

Pre-settling and Concentration Zone

- Most alum grains are concentrated and settled here

Lamellar Settling Zone

- Excess alum grains are removed by inclined pipe sedimentation



Raw Water

- Drinking water
- Industrial process water
- Municipal Wastewater
- Industrial Wastewater

Effluent

- Removal of SS, turbidity
- Removal of TP
- Removal of partial COD_{cr}、BOD_5

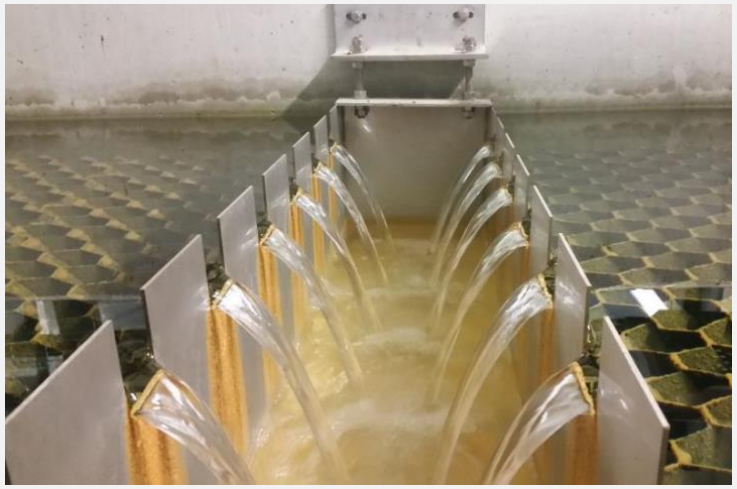
Return Sludge

- To form larger flocs with higher density

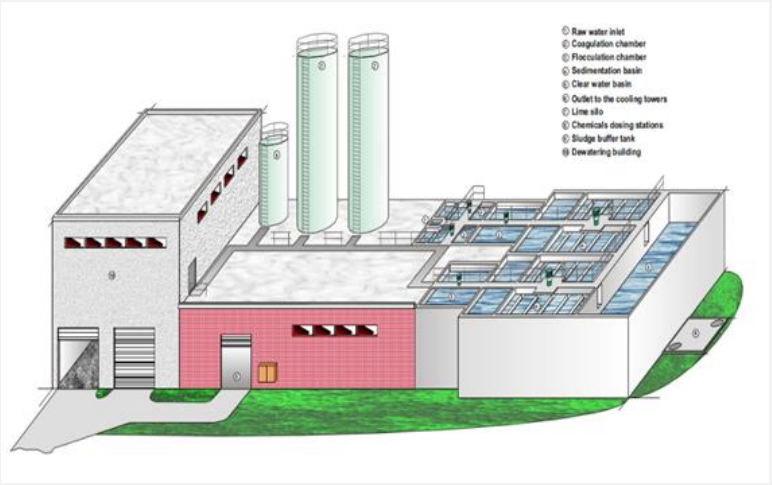
Excess Sludge Discharge

- To further treatment

EBHES™-Characteristics



Effluent from Lamellar Settling Zone



EBHES Concrete Type

EBHES Steel Type (2,000 m^3/d)

E+B Environmental Technologies GmbH presents an optimized clarification reactor, which combines all required treatment steps with characteristics:

01 Cost efficiency related to investment and operating cost

02 High quality of the treated effluent related to the removal of Suspended Solids and TOC

03 Small footprint of the treatment plant in order to reduce the requirement for land

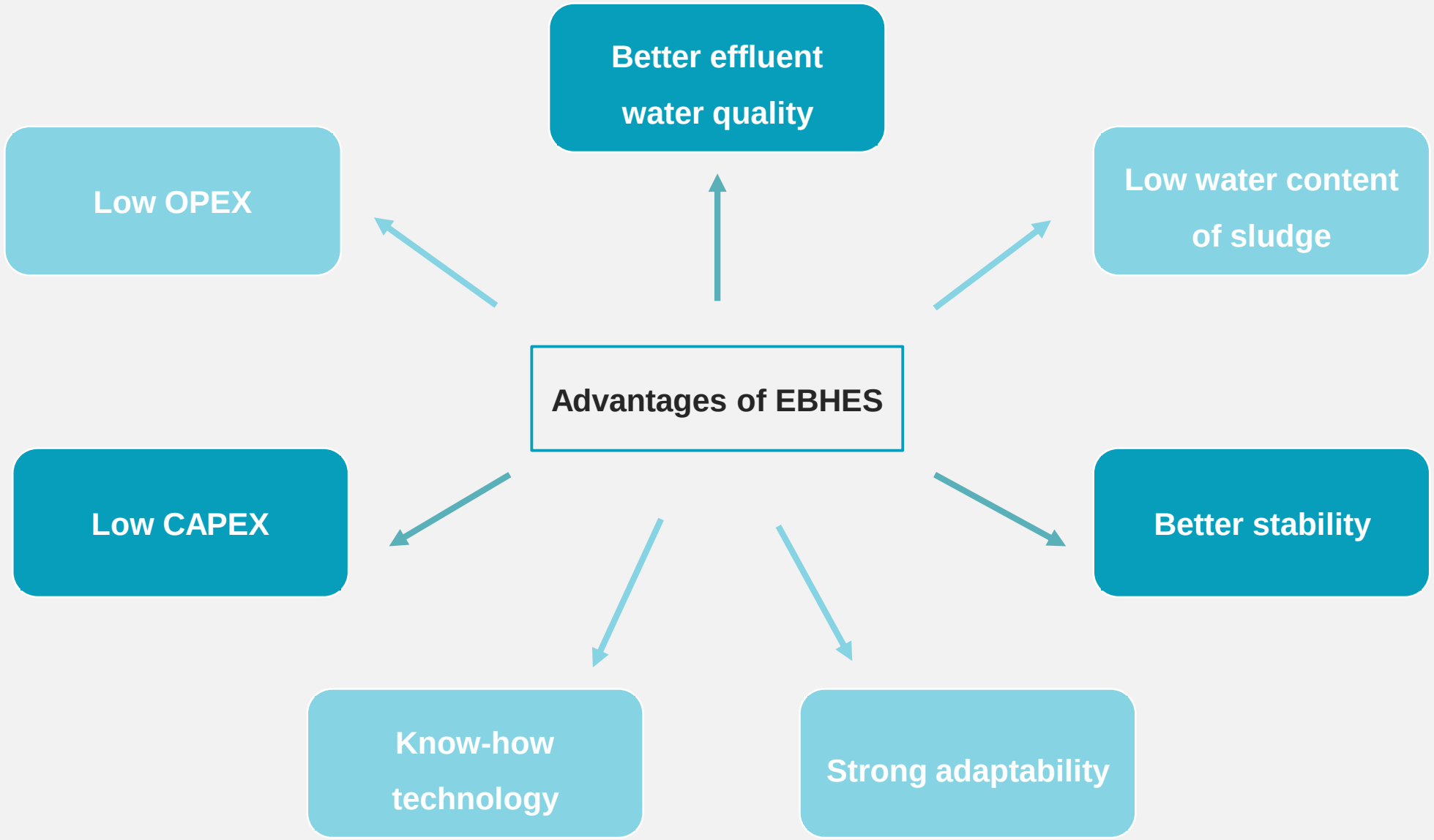
04 High concentration of the settled sludge for cost efficient sludge treatment

EBHES™-Characteristics

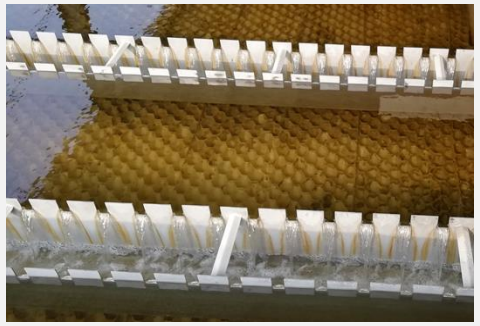
Comparison of EBHES and Traditional Clarifier

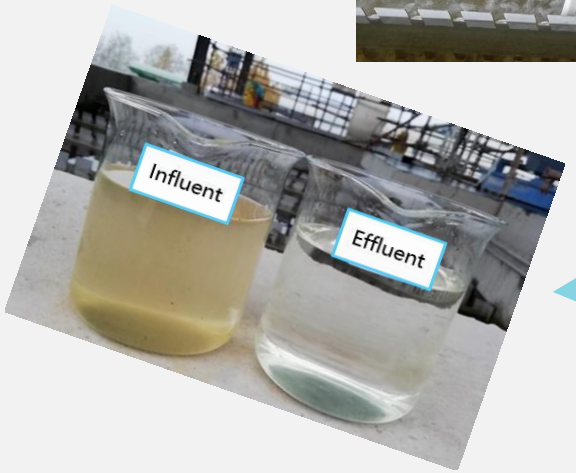
Content	Traditional Clarifier	EBHES
Foot print	Big	Small (1/3 to 1/4 of traditional one)
Effluent Quality	Unstable (SS 8-10 mg/L)	Very Stable (SS < 3 mg/L)
Sludge water content	≥ 98%	< 97%, no need of sludge thickener
Anti-shock load	Normal	Well adapt to both hydraulic/water quality variations
Hardness & alkalinity removal effect	Complicated system, hard for operation	Simple system, operation friendly
Power consumption	Large (mechanical accelerated clarifier)	Relatively larger
Work range	Narrow	Broad (applicable to low temperature, low turbidity conditions)
Following sludge treatment	Thickener needed	Thickener omitted, save investment
Cost on Civil work	Huge	Much less
Maintenance	Frequently	Seldom

EBHES™-Advantages



EBHES™-Applications





Applications of EBHES Technology

Treatment of surface water (lakes, rivers, seawater) for tap water supply and industrial water supply.

Clarification of wastewater from municipal sewage and industrial wastewater (hydrocarbon industries, etc.) , removing TOC and total suspended solids.

Lime Softening (removal of carbonate hardness) for pretreatment of water desalination, to reduce operation load of RO system.

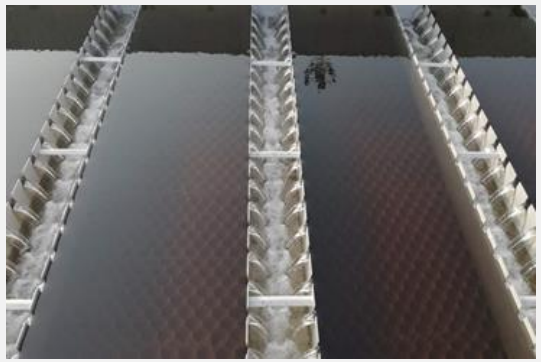
Sodium carbonate softening (removal of non-carbonate hardness) for surface water treatment.

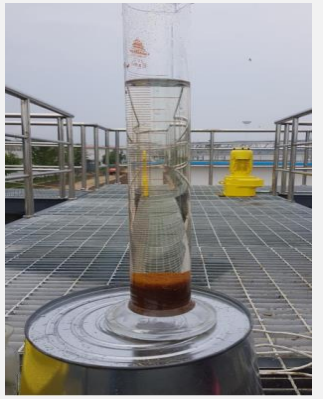
Silica removal for special water quality requirements.

EBHES™-Main References

Main references of HPC Reactor

Christ AG	Surface Water	15,000 m³/d	Power Plant	Poland
City of Thalheim	Municipal WW	20,000 m³/d	WWTP	Germany
City of Bijie	Municipal WW	120,000 m³/d	WWTP	China
Biowanze	Surface Water	14,500 m³/d	Sugar Factory	Belgium
Malcenize	Surface Water	8,000 m³/d	Power Plant	Slovakia
Dezhou	Surface Water	30,000 m³/d	Power Plant	China
Wuhan	Surface Water	240,000 m³/d	Recycling	China
Wuhan	Surface Water	30,000 m³/d	Power Plant	China
Sinopec GPC	Surface Water	36,000 m³/d	Refinery	China
Langley Gulch	Surface Water	15,000 m³/d	Power Plant	USA
MalanHe	Municipal Water	120,000 m³/d	WWTP	China
Pailles Port Louis	Surface Water	80,000 m³/d	PWTP	Mauritius





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PART FOUR

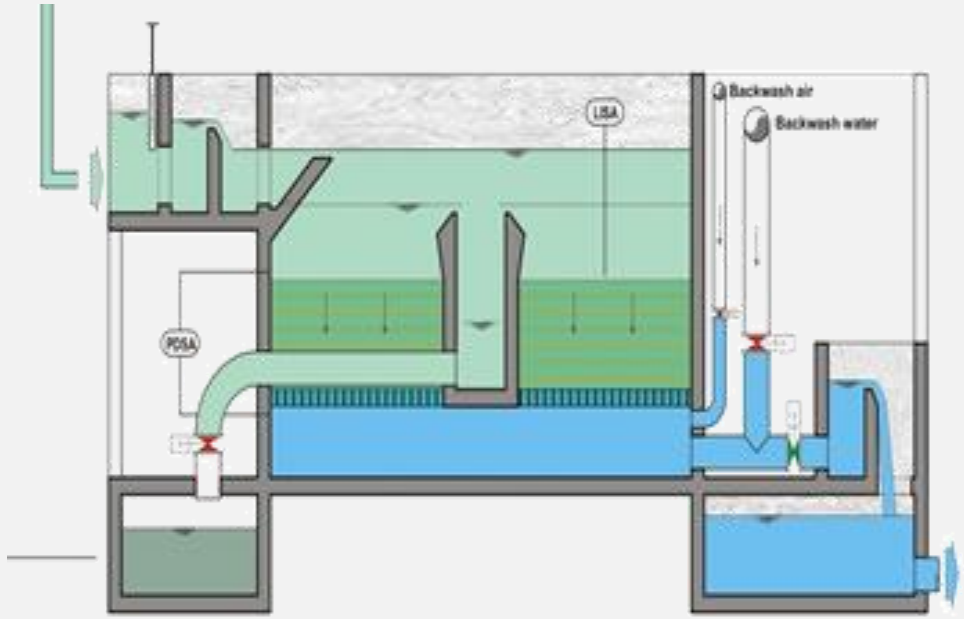
Sandfiltration

SINGLE-MULTI MEDIA FILTRATION

Sandfiltration-Introduction

Single media filtration (SMF) and **Multimedia filtration (MMF)**

- Optimized Filtration And Removal Of Suspended Solids



Single Media Filtration (SMF)

- used for the separation of particles and solids from water through a filtration media.
- Mostly **sand** is used as filtration media (homogeneous grain).
- The height of the filter sand usually ranges between **1.0 - 1.5 m** in **gravity filters** and **1.0 - 2.0 m** in **pressure filters**.
- Usually filtration velocities of **5 – 20 m/h** are applied.
- Retention capacity varies from:
  - 1.1 kg SS/m³ media for very light particles
  - 6.6 kg SS/m³ media for dense mineral matter
- SMF need **relatively constant** flows and loads for best performance, increasing loads are leading to shortened operation cycles and higher backwash demands.

Sandfiltration-Introduction

Single media filtration (SMF) and **Multi Media filtration (MMF)**

- Optimized Filtration And Removal Of Suspended Solids

MMF (operation mode)

BiosS-Treat®- plant 550 m³/h

Multi Media Filtration (MMF)

- Best alternative of SMF in case of high suspended solids (SS) influent, stringent requirements on effluent SS, long operation cycles required, etc..
- Two or three layers of different filtration media, such as filter sand, anthracite, expanded clay, etc.
  - media having the largest grains and lowest density in the upper layer
  - media having the finest grains with highest density in the lowest layer

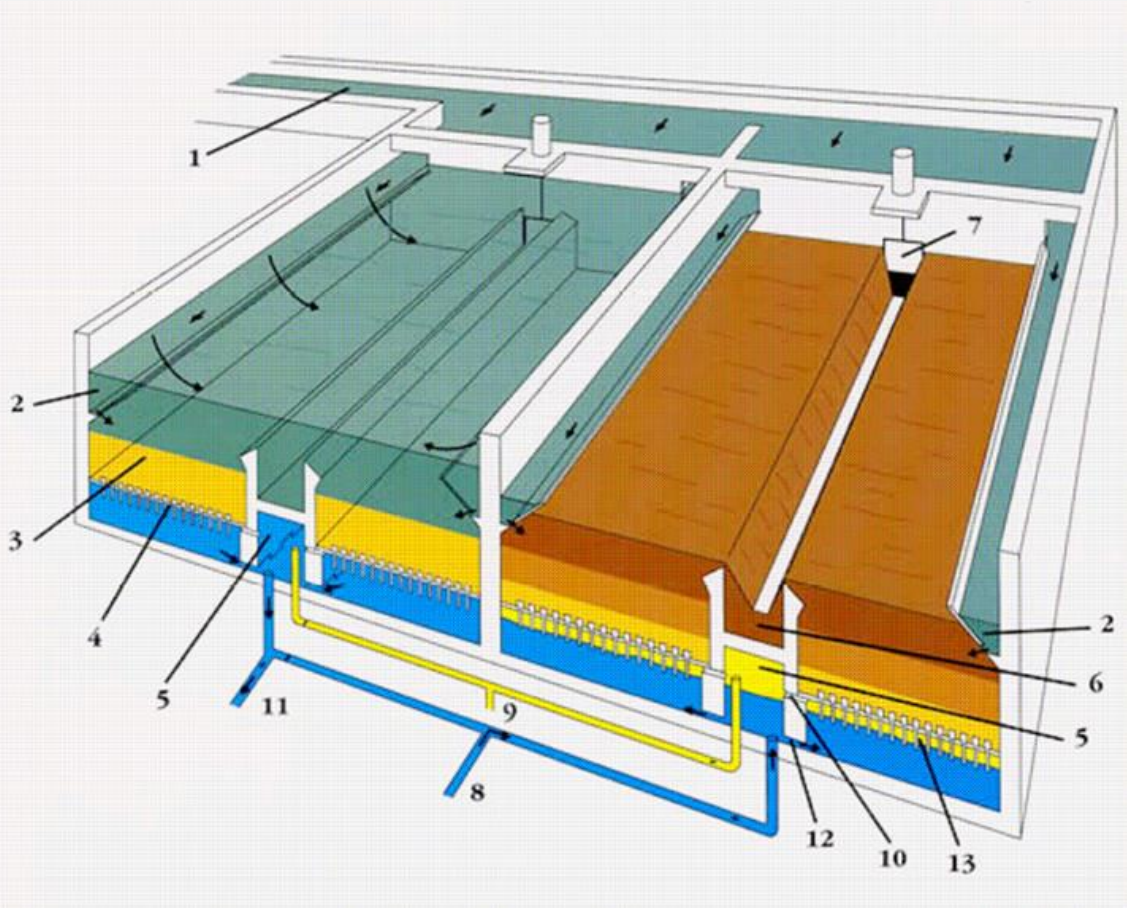
Advantages of Multi Media Filtration

- Higher particle retention capacity
- Better adapted to high SS loads in raw water
- Better filtrate quality
- Higher operation flexibility
- Longer filtration cycles

Sandfiltration-Introduction

Filtration Design and Function

1 – Inlet of raw water
2 – Weir for distribution of raw water flow
3 – Media
4 – Nozzles
5 – Outlet of filtered water
Inlet of water and air for backwash
6 – Outlet of backwash water
7 – Discharge valve for backwash water
8 – Inlet of filtered water (for backwash)
9 – Inlet of air
10 – Repartition orifice of air
11 – Outlet of filtered water
12 – Repartition orifice of water
13 – Air “mattress”



Sandfiltration-Introduction

Filter Backwash (BW)

Each media filter needs a backwash after some operation time in order to remove the retained particles and solids and to prepare the filter for the next filtration cycle.

For both filtration types,
SMF as well as MMF,
backwash is done by a series of different steps, using **water, air and/or water and air together**.

Filter in Backwash Mode

- **SMF** can be backwashed with filtrate or with raw water
- **MMF** need to be backwashed with filtrate

BW Phase	Medium	SMF		MMF	
		Flow (m^3/h)	Time (min)	Flow (m^3/h)	Time (min)
1 Drain	./.	Same as feed		Same as feed	
2 Air wash	Air	50-70	2-5	50-70	2-5
3 Mixed wash	Air & Water	50-70 10-25	2 -5	50-70 10-25	0 - 5
4 Water wash	Water	15-20	5 - 15	50-70	2 - 8
5 Filter to waste	Feed water	Same as feed	0 - 20	Same as feed	0 - 20

Typical design data for filter backwash

Filter to waste for highest effluent requirements

Sandfiltration-Main References

Main References

Formosa Plastic, Taiwan	16.000	m³/h	Surface water
Steelworks Wuhan, P.R. China	10.000	m³/h	Surface water recycling
WW Budapest, potable water, Csepel, Hungary	6.250	m³/h	River water
Abadan Refinery, Iran	1.500	m³/h	Surface water
Leuna Power Plant, Germany	550	m³/h	Surface water
Sugar Factory Wanze, Belgium	550	m³/h	Surface water
Kozienice Power Plant, Poland	450	m³/h	Surface water
Sotravic – Mauritius, potable water treatment	3330	m³/h	Surface water,

In operation

Final preparation

Testing - washing cycle running

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PART FIVE

EBAF™

BIOLOGICAL ACTIVATED FILTER

EBAF™-Introduction

BAF Technology

- **Biological**
- **Activated**
- **Filtration**

Process applications

- SS removal
- COD/BOD reduction
- Nitrification/Denitrification
- Phosphorus removal
- AOX elimination
- Waste water recycling

The biological activated up-flow filtration - BAF - can be used in its single stage design as an

- additional treatment step for enhancing existing WWTPs or in its multistage design as
- alternative replacing the conventional WWTP technology.

EBAF™-Introduction

The general benefits of BAF technology are:

- High product water quality
- Very low area demand
- Fully covered, compact systems
- Simultaneous removal of biological and organic load as well as suspended solids
- High process stability and fully automated plants
- Well adapted to cold water temperatures
- Low operation costs due to high O2-transer efficiency
- Low investment cost compared with achievable standards

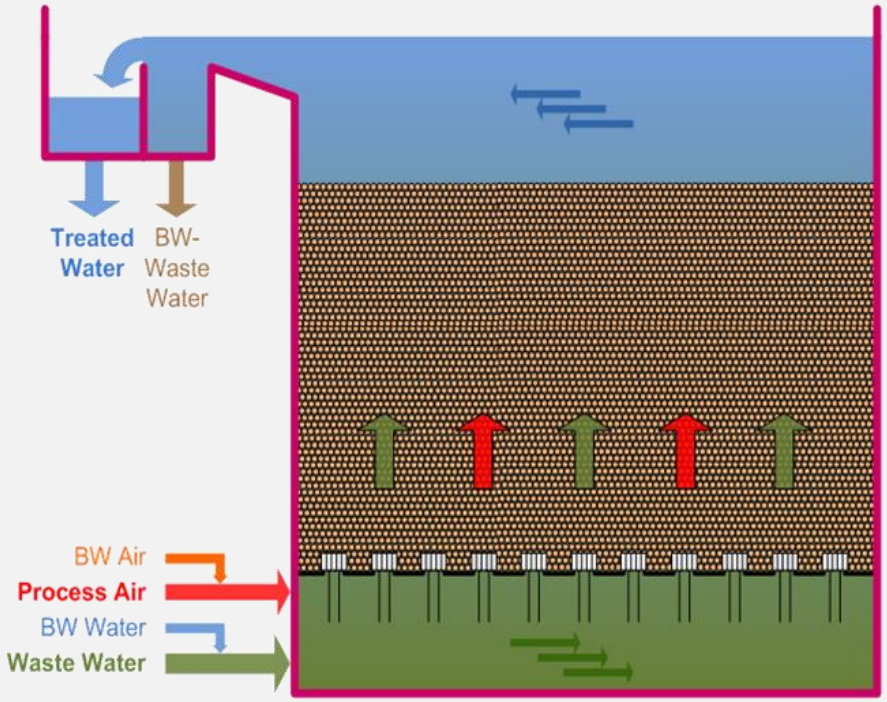
EBAF in operation

EBAF™-Principle

BAF technology

The BAF-concept works in up flow mode for both water and process air

- This means that wastewater and process air, providing the necessary oxygen for the microorganisms, are flowing in a co-current stream from the bottom to the top of the filter



This concept has several major advantages:

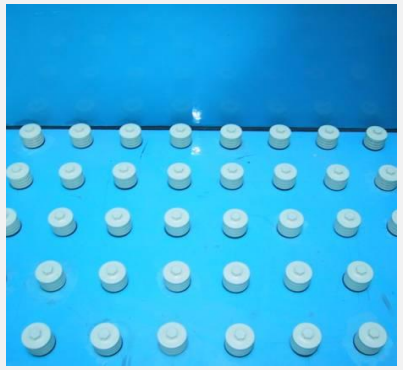
- No clogging of the filter by entrapped air inside the pore volume
- No clogging of the filter by entrapped N2 gas (produced during denitrification) inside the pore volume
- High O_2 transfer and highest O_2 concentrations where they are needed most, namely at the raw water influent
- No compression of the filter media at in-creasing head loss inside the filter, as it is the case for floating media

EBAF™-Principle

BAF technology

Air injection

- specifically designed **nozzle system** installed in the **nozzle floor**
- injection of process **air together with water**
- very high O_2 transfer efficiencies, no additional process air distribution system is required



Nozzle Floor

Biomass

- microorganisms growing on the filtration material: form "**Biofilm**", responsible for **biological degradation** of the pollutants
- The produced biomass and the suspended solids containing in the influent, which are **accumulated** in the system, need to be washed out regularly in order to maintain proper operation of the filters.
- Therefore **the BAF system operates in two modes**.
  - During the **filtration mode**, pollutants are removed & solids are trapped inside.
  - After the depletion of retention capacity, the filter passes into the **backwash mode** at regular time intervals, to remove accumulated solids.

Bioflim on Filtration Material

Backwash mode

EBAF™-Application

BAF technology-very flexible application

Abbreviation & term definition		
BAF		**Biological activated filter** BCI - BHU Definition *Literature: Biological aerated filter, it would exclude the pre DN and post DN*
BAF C	-	aerated BAF to reduce the C a **BOD, COD reduction** without Nitrification
BAF **CN**	CN	aerated BAF to eliminating the rest of C and for the Nitrification
BAF N	N	aerated BAF for the Nitrification (the term is not used as always a rest of BOD has to be removed
BAF **pre DN**	Pre DN	Anoxic BAF for the C- reduction and for the **Denitrification, downstream of the BAF CN**
BAF **post DN**	Post DN	Anoxic BAF for Denitrification, upstream of the BAF CN

Main References		BAF Technology
Thalheim / GER	30.000 PE	BAF DN/N
Velenje / SLO	60.000 PE	BAF DN/N
Bijie – Guizhou / P.R.C.	160.000 PE	BAF DN/N
Rostock / GER*)	300.000 PE	BAF N/DN (Methanol)
Dalian – Liaoning / P.R.C.*)	430.000 PE	BAF C/CN
Budapest / HUN*)	440.000 PE	BAF N/DN (Methanol)

*) Personal reference of

PART SIX 6

Typical Project Cases

WISCO WWTP & PAILLES PWTP

Typical Project Cases

Wuhan International Steel Corporation (WISCO) WWTP

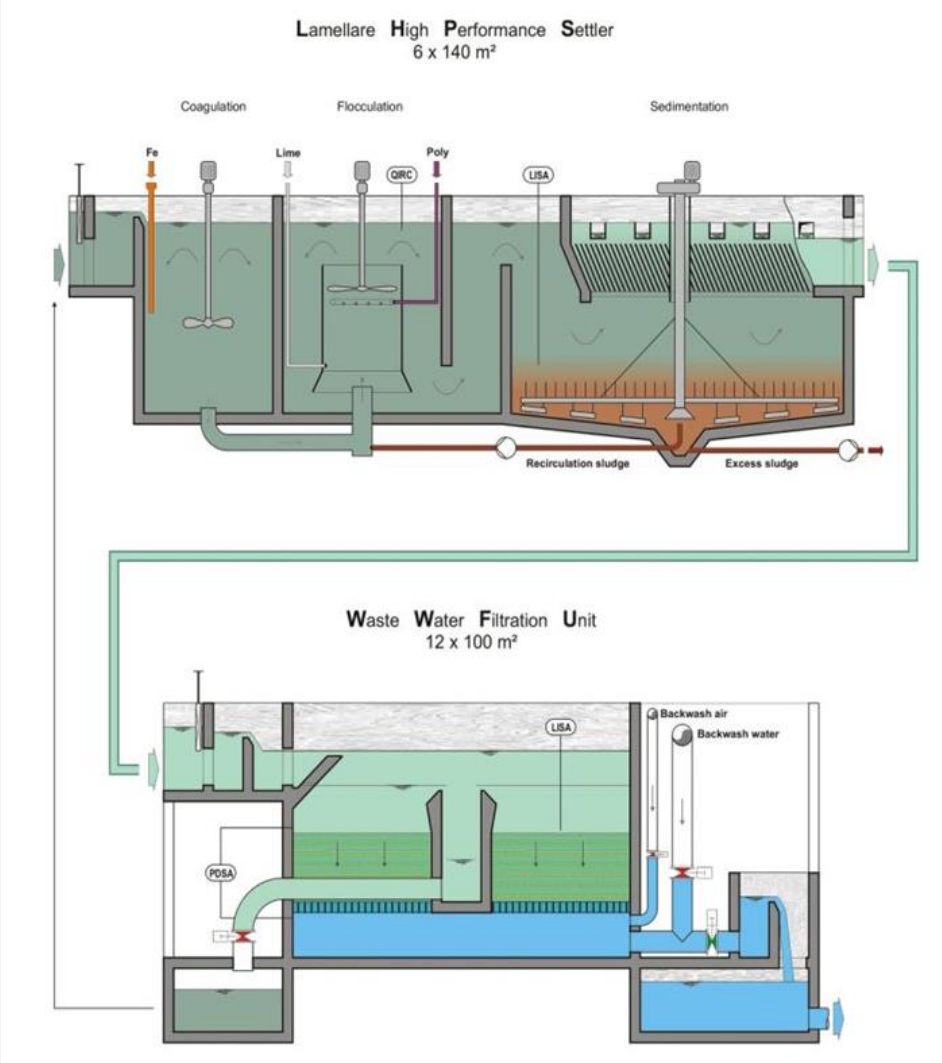
Project Location Wuhan, P.R.China

Treatment Capacity **240,000** m³/d

Main Challenges Treatment of wastewater from production area of WISCO for process recycling, removal of SS, COD and other pollutants.

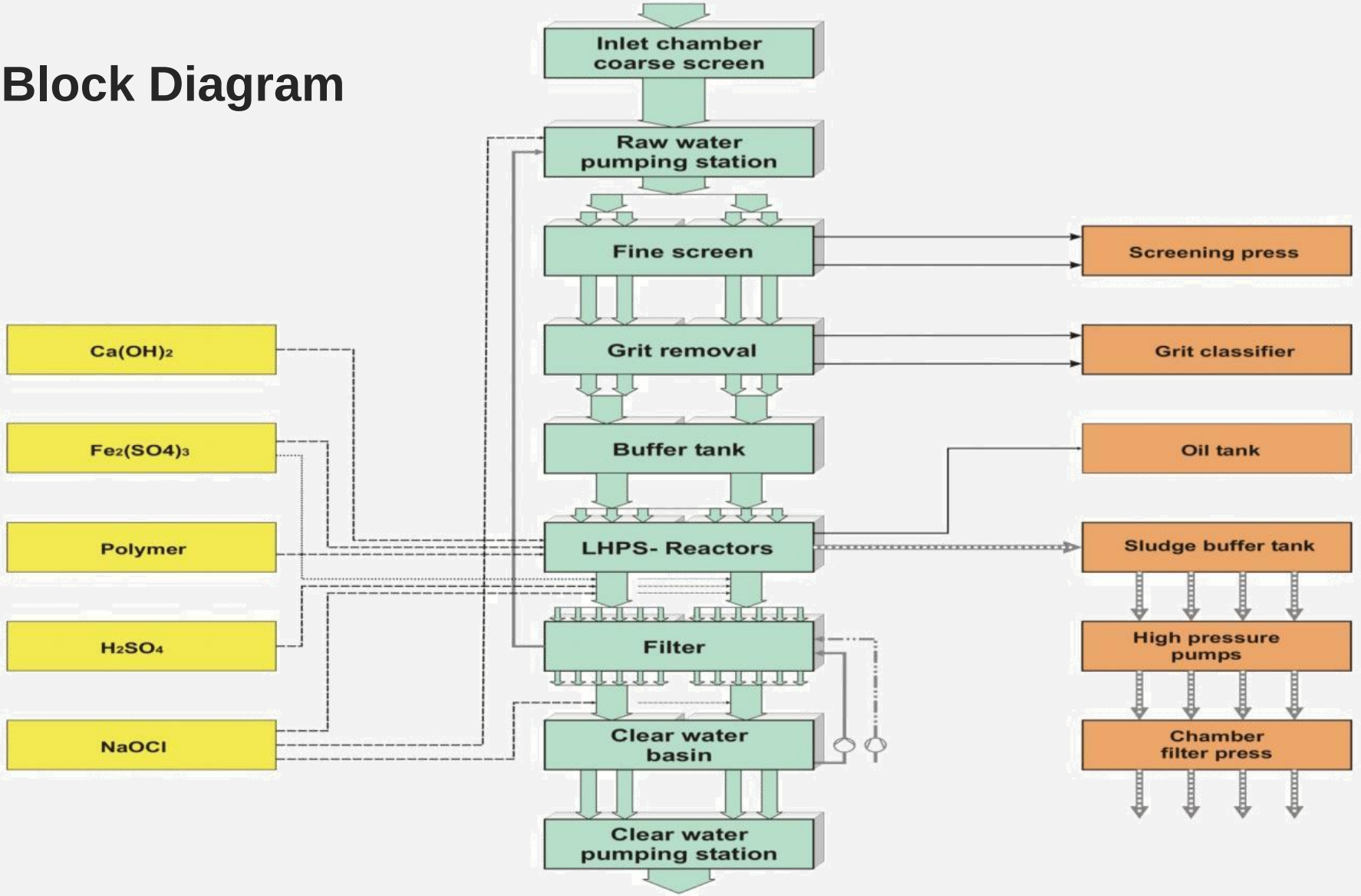
LHPS	6 units
Coagulation	200 m³/unit
Flocculation	425 m³/unit
Sedimentation	225 m²/unit
Lamella	140 m²/unit

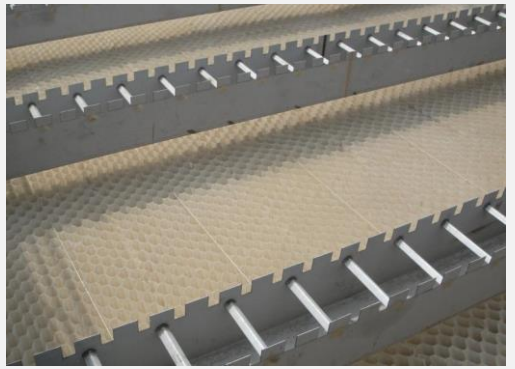
Filtration	12 units
Filter area	100 m²/unit



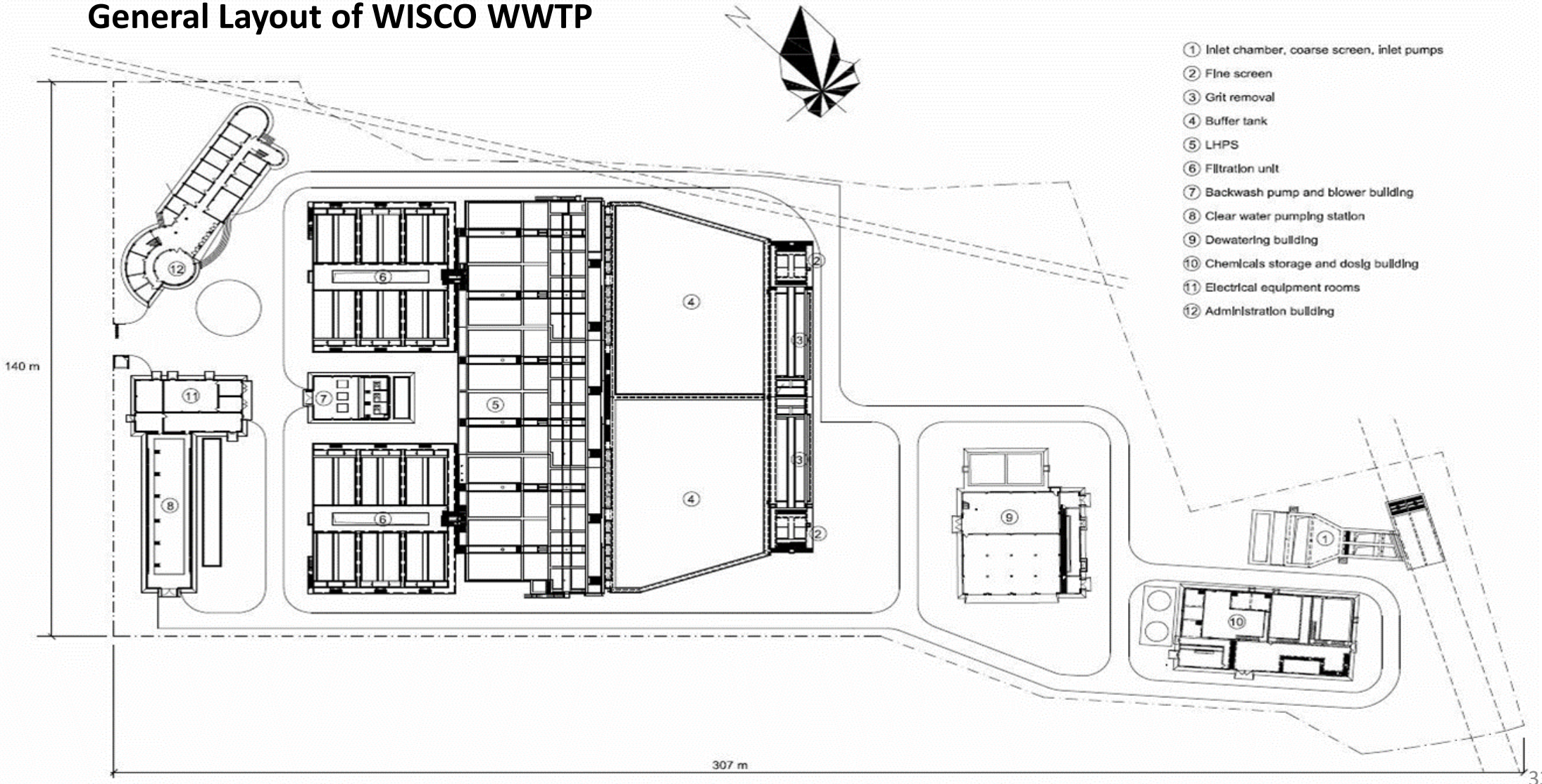
Main Units
(EBHES 6 Units +Filtration 12 Units)

Block Diagram





General Layout of WISCO WWTP



Pailles Potable Water Treatment Plant (PWTP)

Project Location

Pailles, Port Louis, Mauritius

Treatment Capacity

Q_{max} = **80,000** m³/d (high turbidity condition)

Q_{min} = **50,000** m³/d (low turbidity condition)

Main Challenges

Treatment of surface water to remove turbidity

Raw water quality

- Surface water

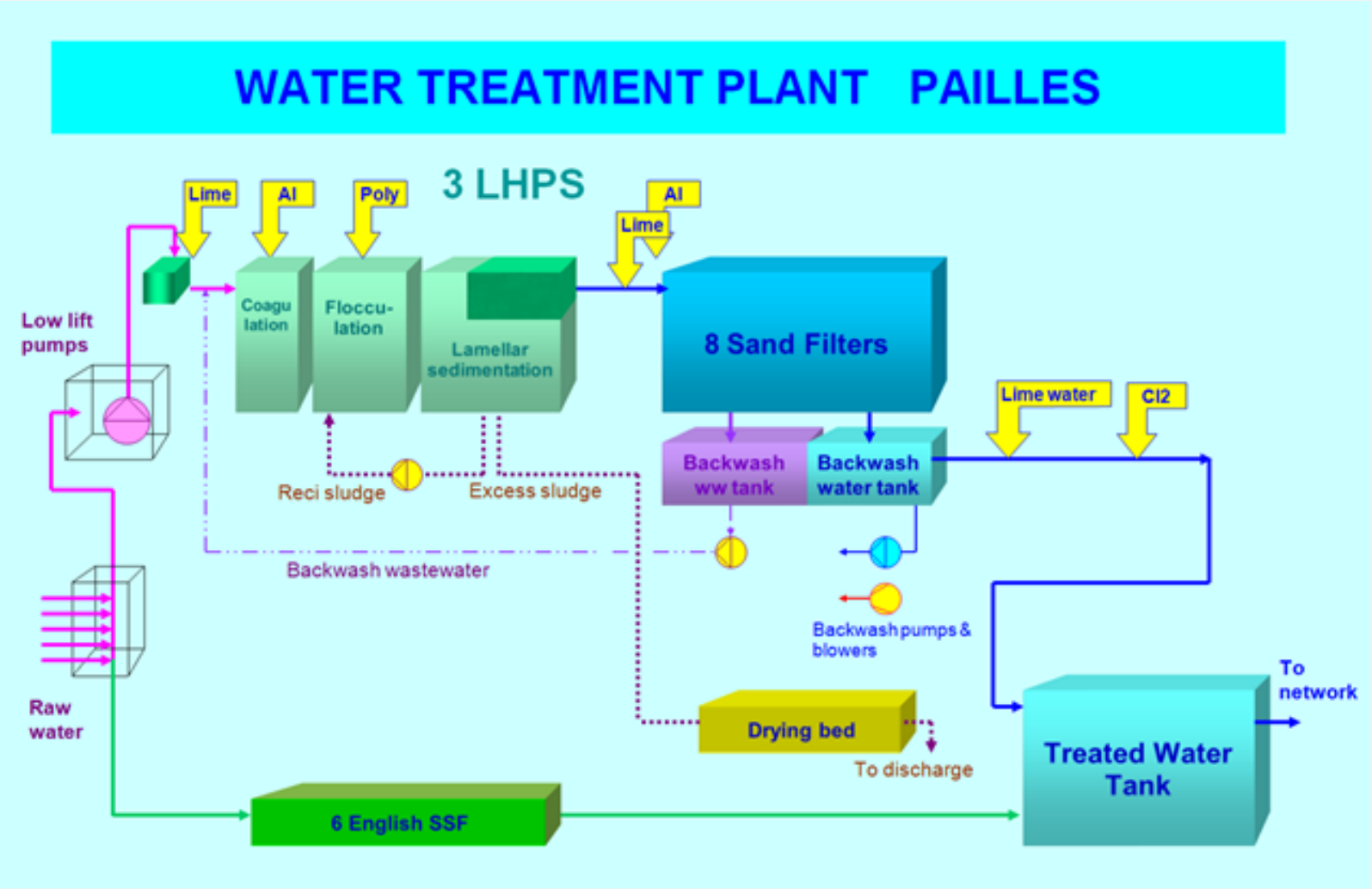
  2 supply lines
- **NTU 400 max**

EBHES+SMF

Treated water quality

- **NTU 0.5 - 95% of the time**
- NTU 1.0 maximum

Block Diagram



- Bypass of **30.000 m³/d** to the **English Slow Sand Filters (ESSF)** in case of low turbidity
- full flow of **80,000m³/d** to the **LHPSs and SMFs** in case of high turbidity.

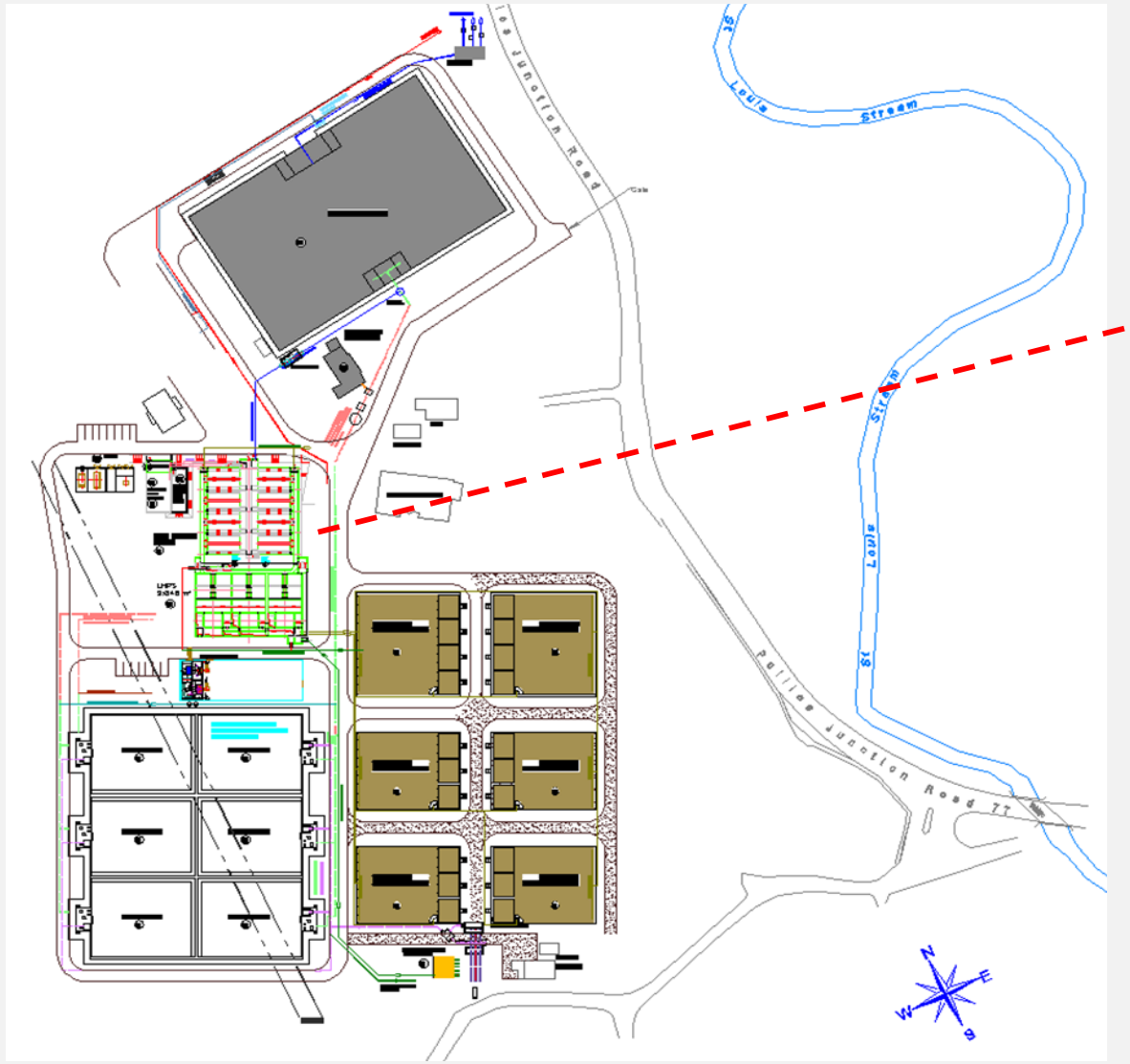
Filtration
- 3 pcs EBHES
- 8pcs Sandfilter

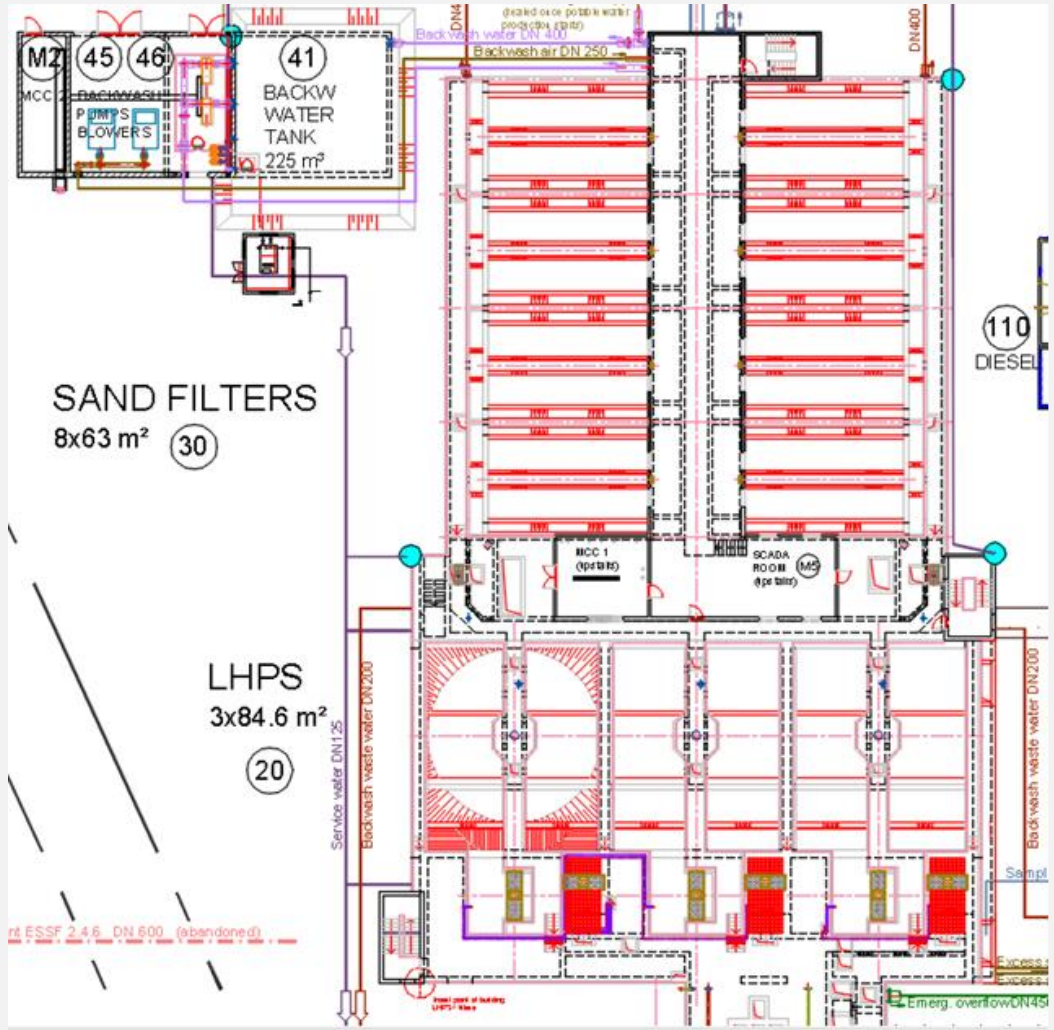
Chlorination Station

Chemical Stations
- Polymer system
- Alum sulphate systems
- Lime milk and pH correction systems

Sludge Treatment
- 6 sludge drying systems

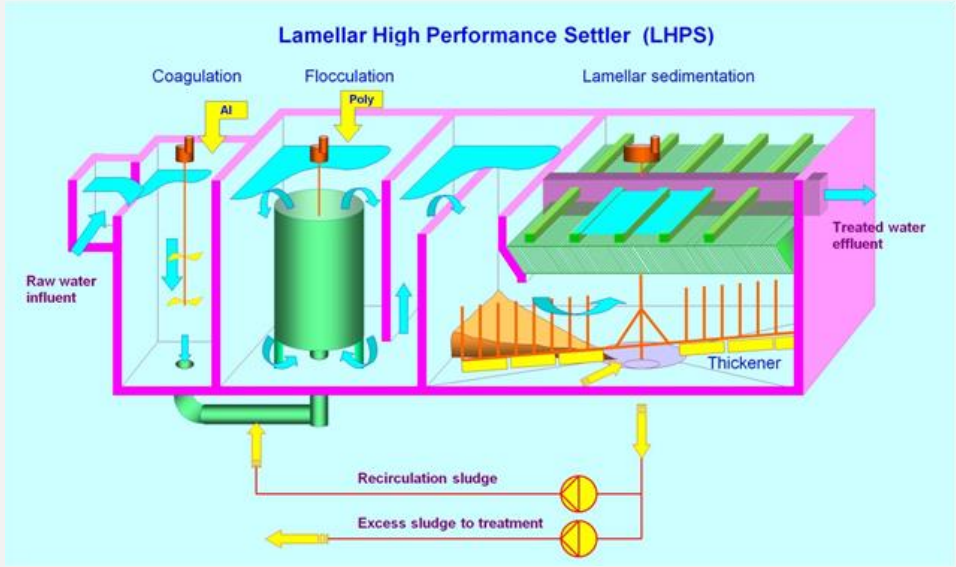
General Layout of Pailles PWTP

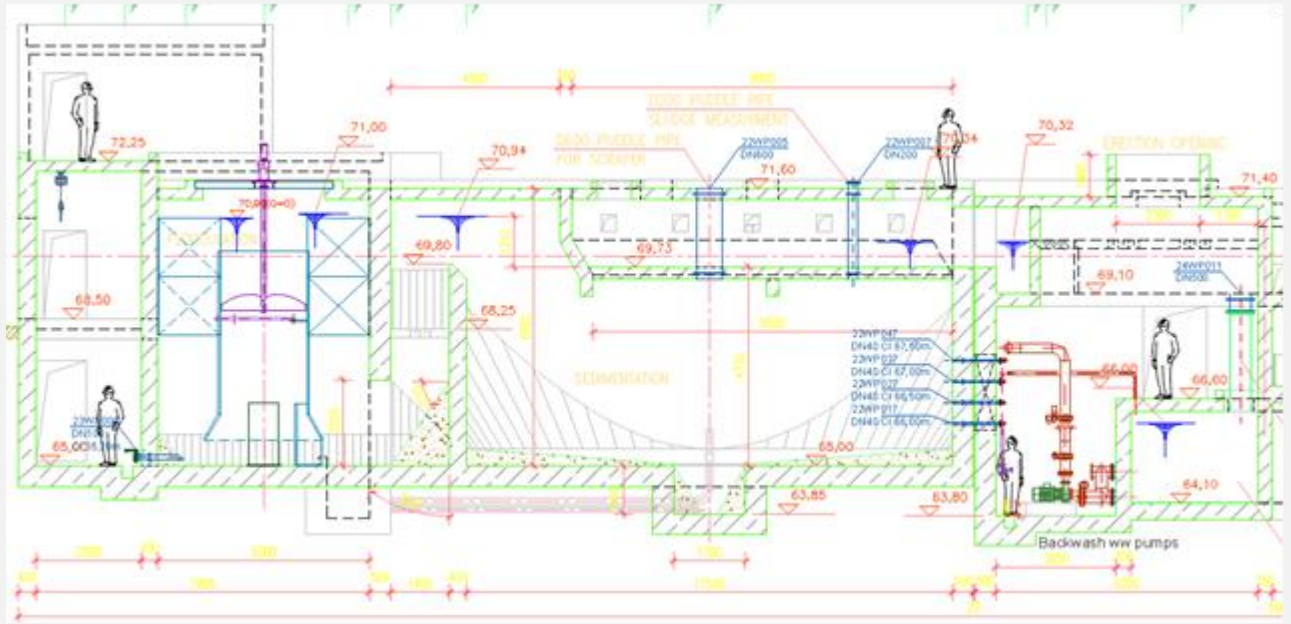




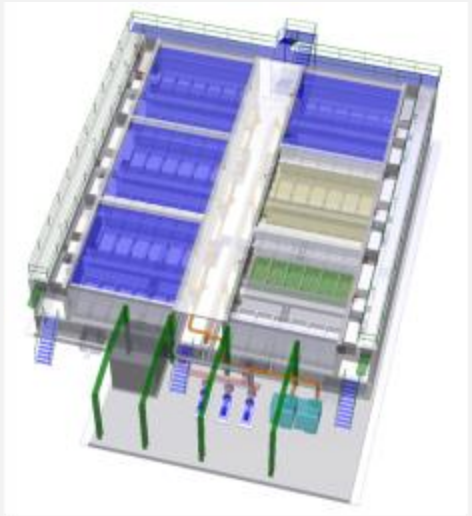
Typical Project Cases

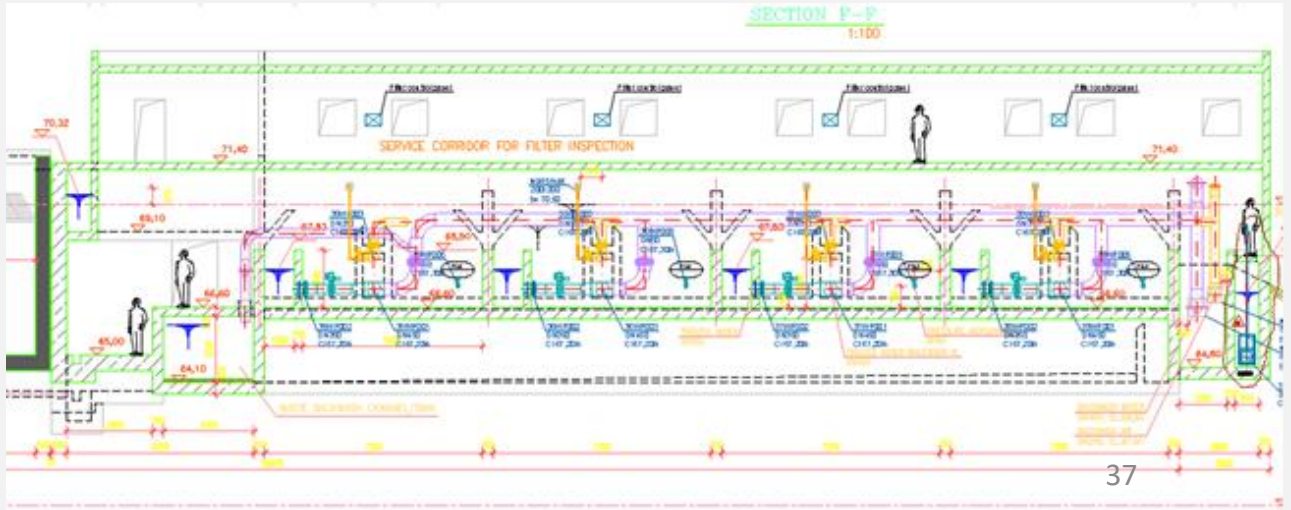
EBHES





Sandfilter (SMF)





Phase II Technical Modification Project of Dalian Malan He Wastewater Treatment Plant (WWTP)

Project Location

Dalian, Liaoning, P.R.China

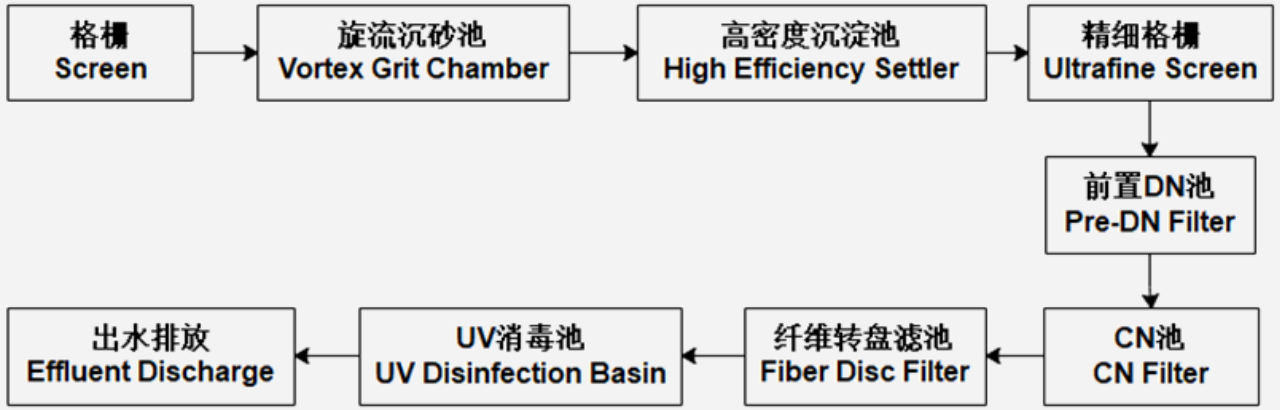
Treatment Capacity

wastewater, Q = **80,000** m³/d, with a peak factor of 1.3

Designed Water Quality

Parameters	COD_{cr}	BOD_5	SS	NH_3-N	TN	TP
Influent (mg/L)	380	200	300	25	35	5
Effluent (mg/L)	≤50	≤10	≤10	≤5（8）*	≤15	≤0.5

(Figures in parentheses devotes T≤12 ℃)



Phase II Technical Modification Project of Dalian Chunliu He Wastewater Treatment Plant (WWTP)

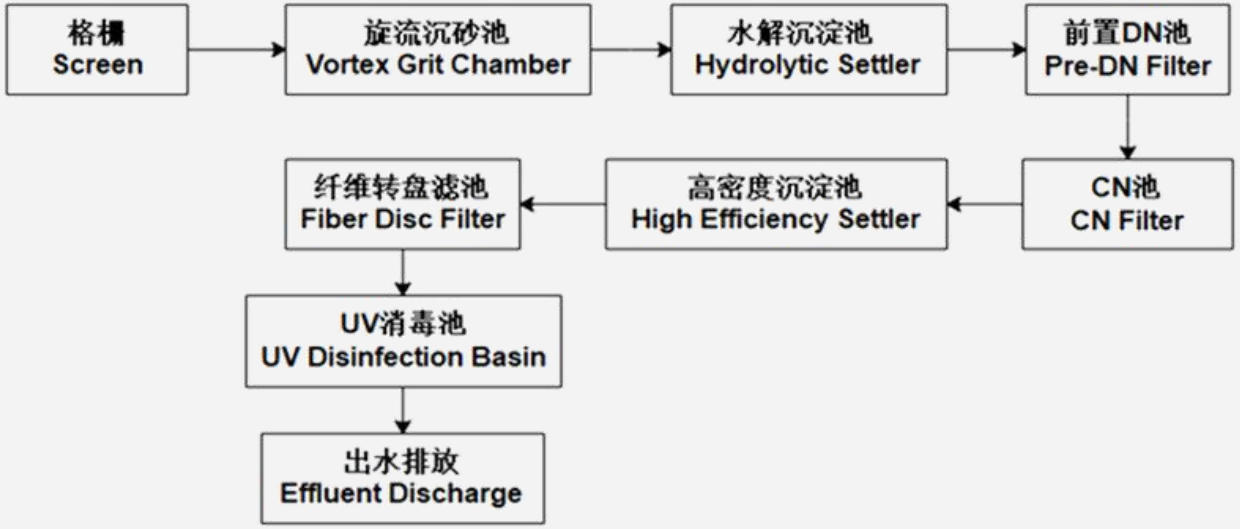
Project Location Dalian, Liaoning, P.R.China

Treatment Capacity wastewater, Q = **120,000** m³/d, with a peak factor of 1.3

Designed Water Quality

Parameters	COD_{cr}	BOD_5	SS	NH_3-N	TN	TP
Influent (mg/L)	400	180	220	45	50	5
Effluent (mg/L)	≤50	≤10	≤10	≤5（8）*	≤15	≤0.5

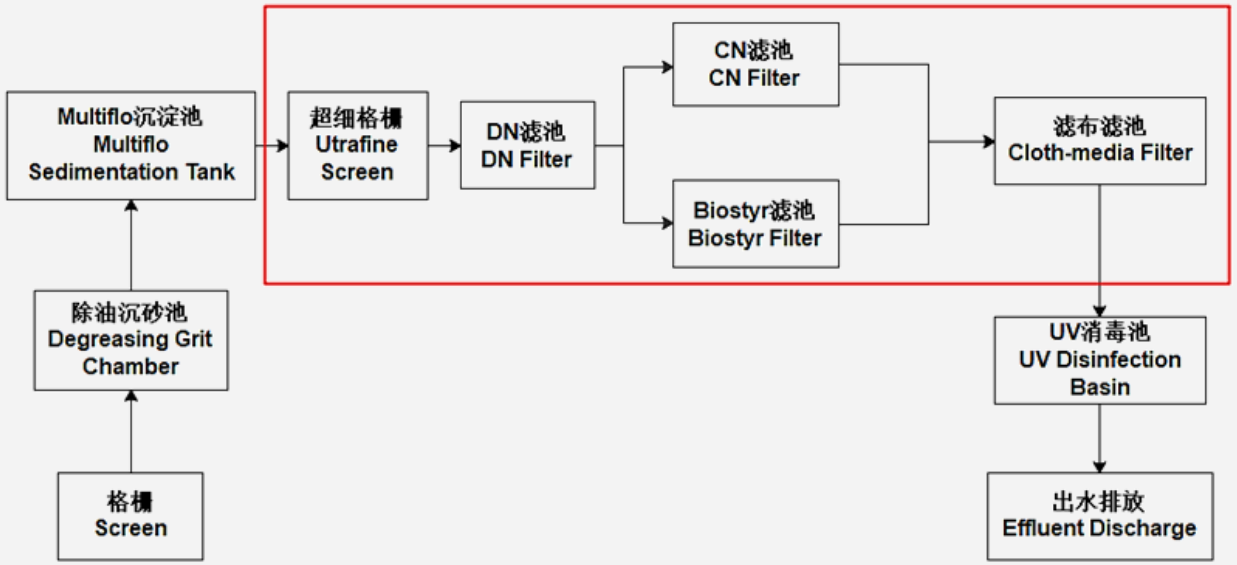
(Figures in parentheses devotes T≤12 ℃)



Phase III Upgrading Project of Maidao Wastewater Treatment Plant (WWTP)

Project Location Qingdao, Shandong, P.R.China

Treatment Capacity wastewater, Q = **140,000** m³/d, with a peak factor of 1.3



Designed Water Quality

Parameters	COD_{cr}	BOD_5	SS	NH_3-N	TN	TP
Influent (mg/L)	700	320	350	56	70	8
Effluent (mg/L)	≤50	≤10	≤10	≤5（8）*	≤15	≤0.5

(Figures in parentheses devotes T≤12 ℃)

THANKS

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