As-Samra Plant

SAMRA
WATER RESOURCES

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SAMRA WWTP BOT – Key highlights

- **First BOT in Jordan**, signed in 2003 between **Government of Jordan** & **VEOLIA & CCG**
- **Phase 1** completed in 2008 **& Phase 2** completed in 2015
- **364 800 m3/d** Capacity equivalent to **3.5 million inhabitants**
- **60%** of wastewater in Jordan is treated and reused in irrigation
- **Operation & Maintenance** up to 2037
- **230** long-term jobs. **100%** Jordanian employees. **70%** from local areas.
- **Almost 90% energy self-sufficient** with renewable resources (hydro & biogas)
- **40 000 Tons CO2eq/year** of GHG emissions reduction
- **140 Tons/day** of dry solids (reusable sludge)
- **6 ISO Certifications** - Know how & Excellence: ISO 9001, 14001, 17025, 45001, 50001, 55001

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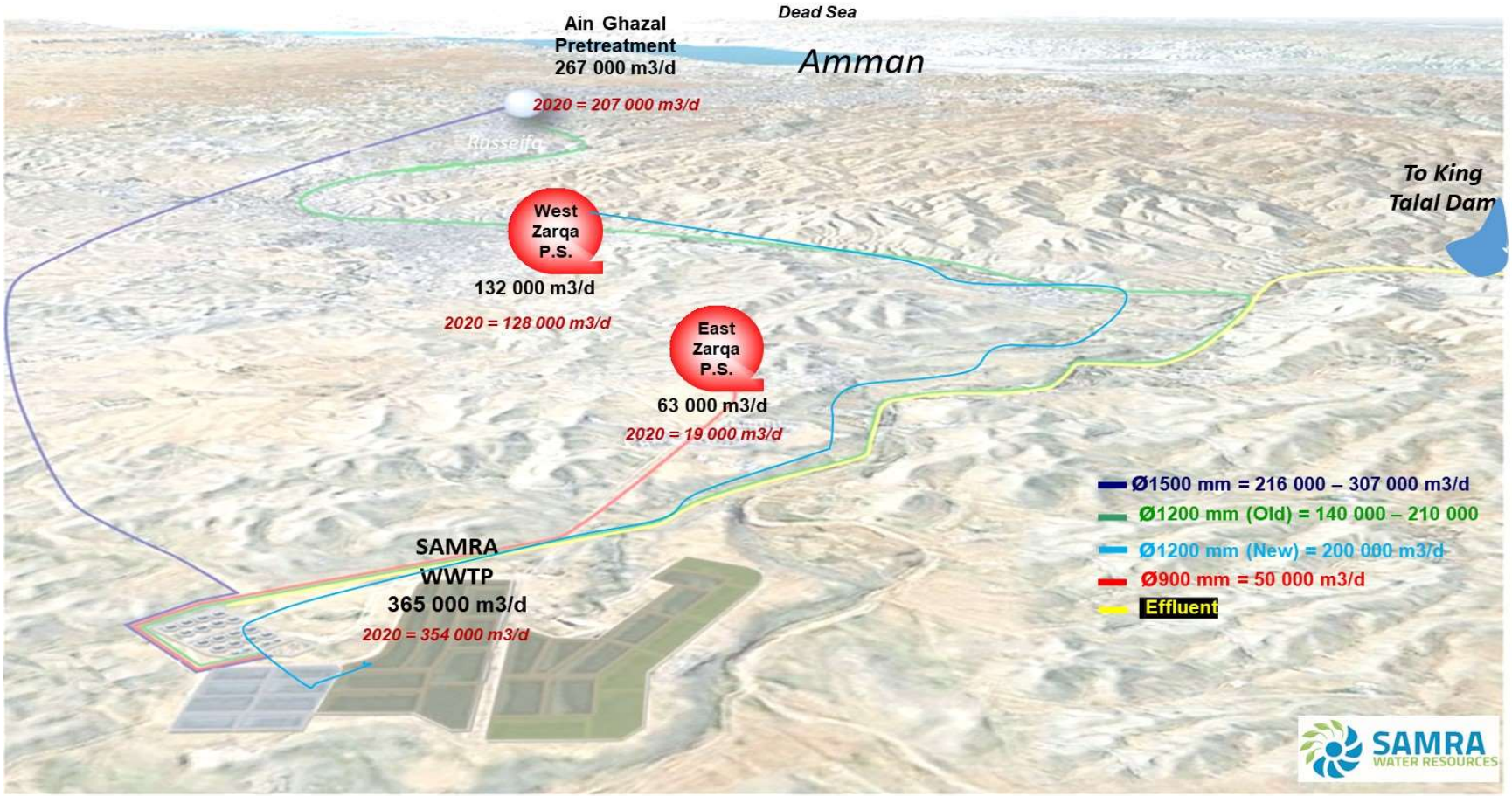
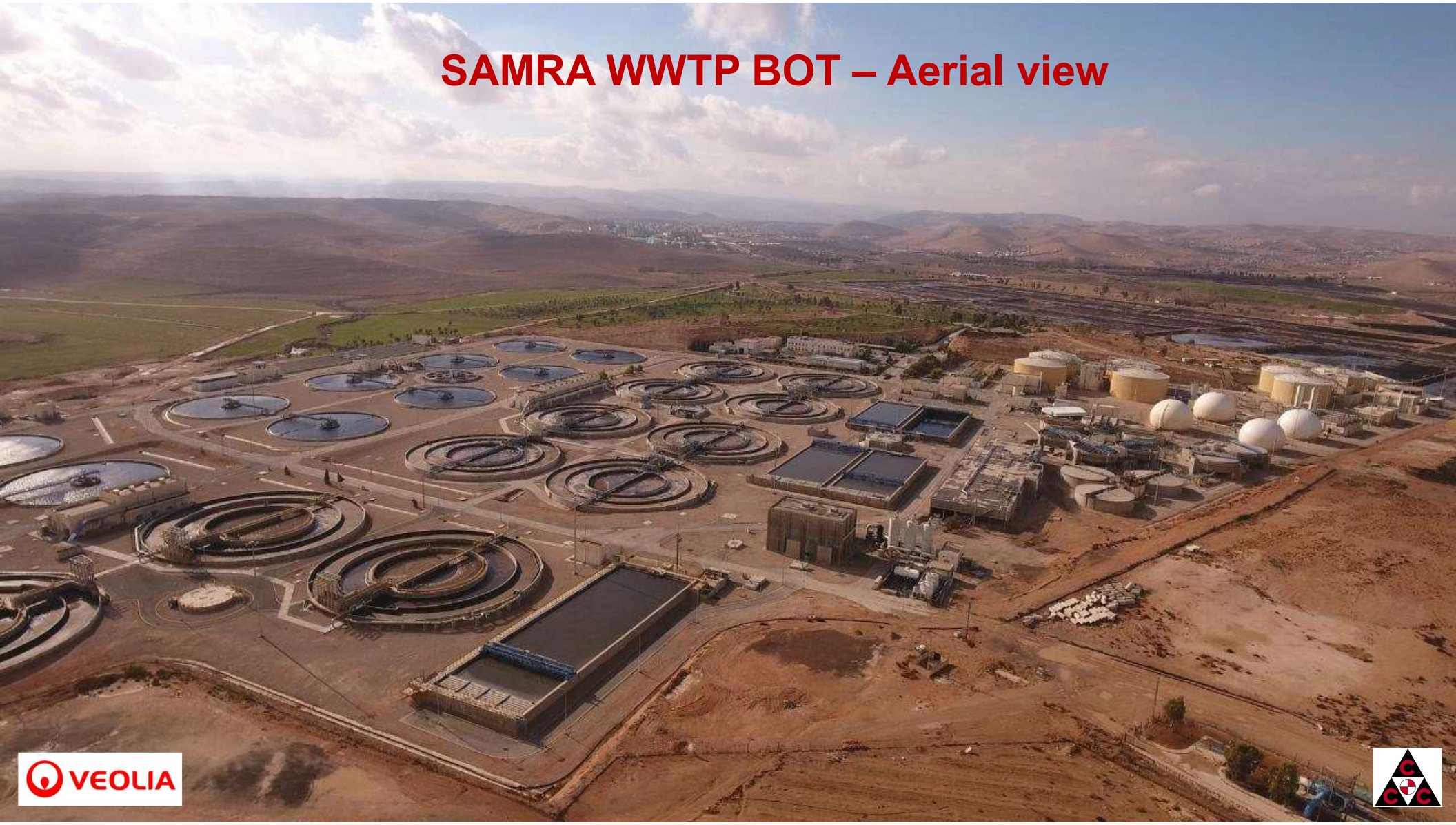
VEOLIA

SAMRA WWTP BOT - General Layout



SAMRA WWTP BOT – Aerial view



Plant's Design Figures

Average annual Design load		
Flow (m3/d)	364,800	3.2 million PE
BOD5 (kg/d)	232,200	+ 30% Max daily load
TSS (kg/d)	236,800	+ 30% Max daily load
TN (kg/d)	36,300	+ 30% Max daily load

Process

parameters	Inlet	Outlet
BOD5	637 mg/l	5-30 mg/l
TSS	649 mg/l	15-30 mg/l
TN	100 mg/l	15-30 mg/l

Sludge requirements

The sludge treatment facility is designed to deliver a stabilised digested sludge. The sludge after being sent to the solar drying beds is expected to reach a minimum dry solids content of 30 %.

Odour requirements

The odour treatment facility is designed to treat air with efficiency of 95 %.

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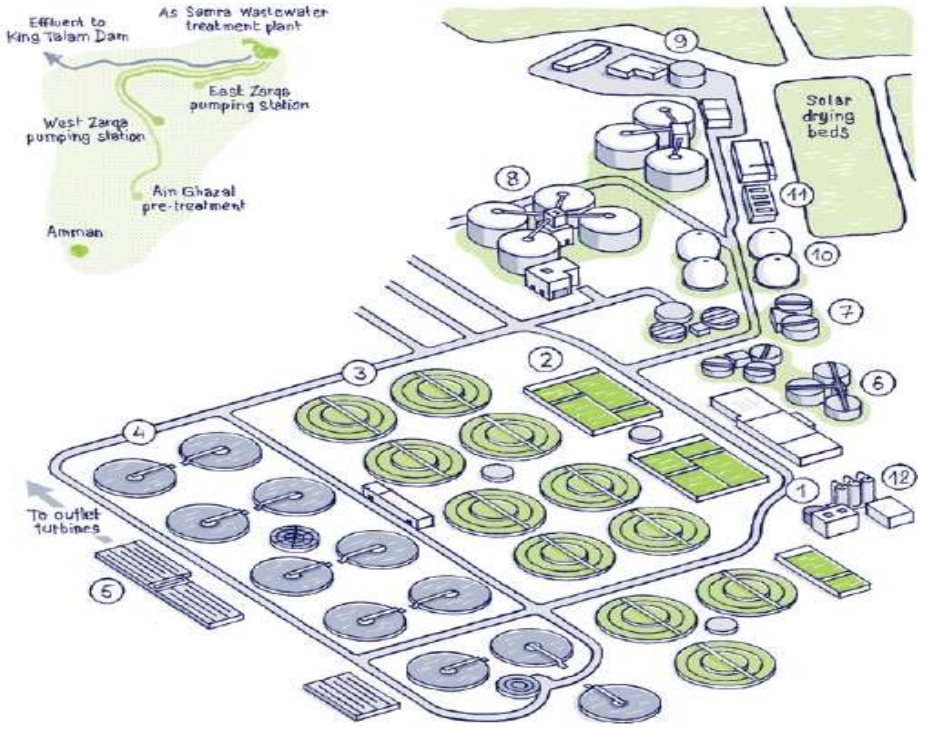
Plant overview

1 - Raw water inlet
2 - Primary settling
3 - Biological treatment
4 - Clarification
5 - Final disinfection
6 - Primary sludge thickening
7 - Activated sludge flotation
8 - Anaerobic digestion
9 - Mechanical dewatering system
10 - Biogas holders
11 - Gas power generation
12 - Odour control



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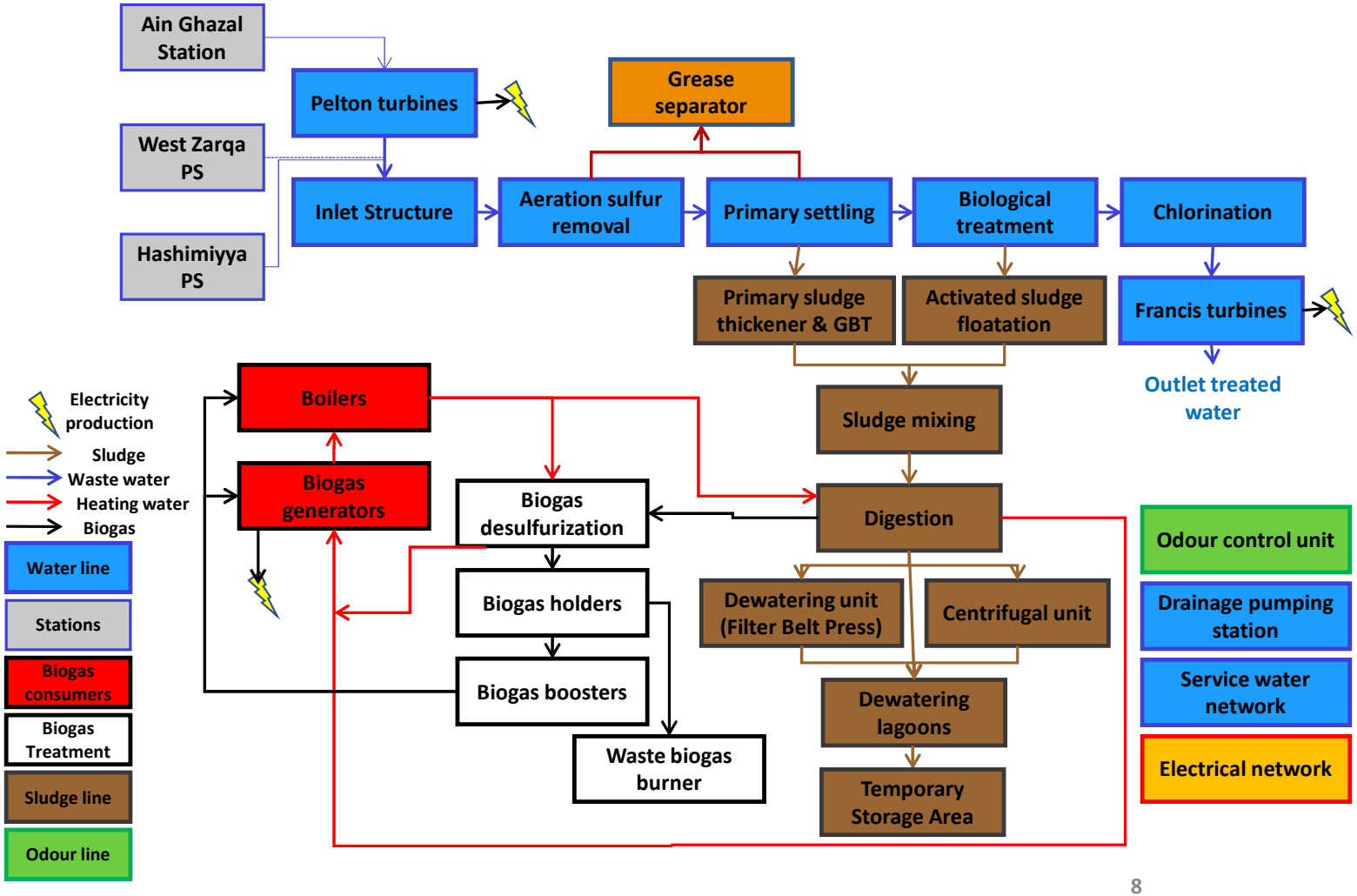
Plant overview

Process



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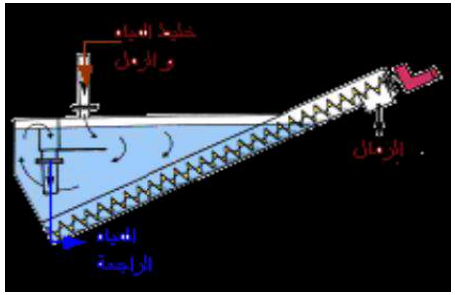
Inlet structure and Grit/Grease/Sulphur removal

Water Line

The wastewater enters the treatment plant through the inlet structure (21), where 2 Pelton turbines are installed for producing energy. This structure is equipped with a by-pass enabling maintenance on the turbines.

Then the influent is diverted into 2 desulfurisation-degritting tanks, in order to remove grits and reduce H2S content below 10 mg/l. H2S is removed depending on the inlet concentration : catalytic oxidation by air plus catalyst ferric chloride and by chemical precipitation using ferric chloride in addition to the oxidation when H2S is higher than the catalytic oxidation capacity. Scum is also removed in the last section of the tanks.



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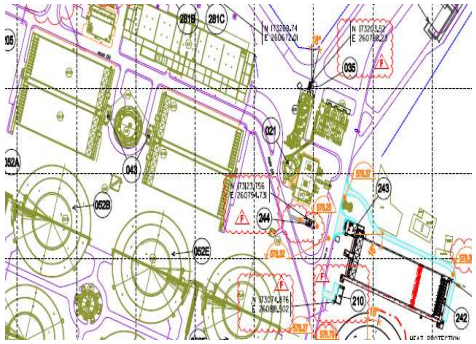
Primary Settlement Tanks

Water Line

The first solids/water separation is done in the five primary settling tanks, the bridges scrubbers are collecting the sludge from the bottom and scum from the surface. The primary settled sludge is pumped to the six thickeners through sludge extraction pumps in the bottom of each tank, the scum is sent to grease seperator. Removal : TSS = 65%. BOD = 35%. TN = 15%.



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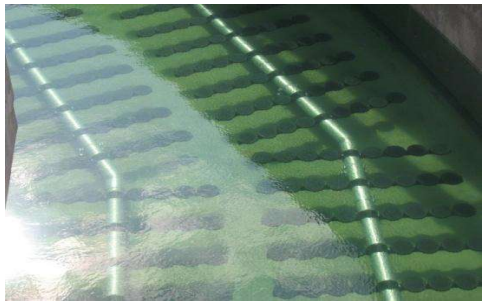
Biological Aeration and Secondary Settlement

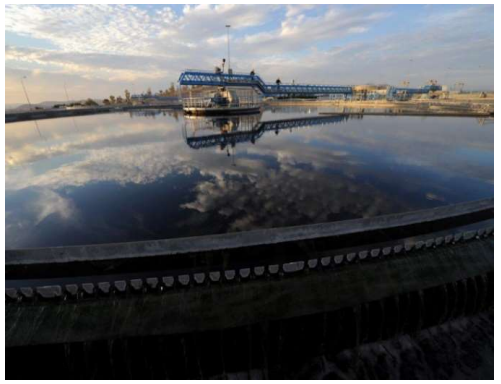
Water Line

The settled water goes then to the eleven aeration tanks in order to remove Carbon pollution and to reduce Nitrogen level in the treated water by nitrification and denitrification processes, BOD5 removal around 95% due to low F/M ratio, the MLSS is vary between 2 g/l and 3 g/l.

In the Aeration tanks, the required oxygen is delivered through fine bubbles diffusers by 14 air blowers



The final separation is done in the eleven final clarifiers where the activated sludge settles and returns back to the aeration tanks through the recycling pumping station, in order to maintain the needed biomass concentration, the excess sludge is sent to flotation units (DAF) for thickening before it mixed with primary sludge and feed the anaerobic digesters.



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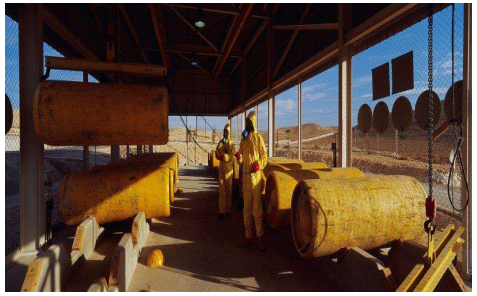
Chlorination and Effluent Turbines

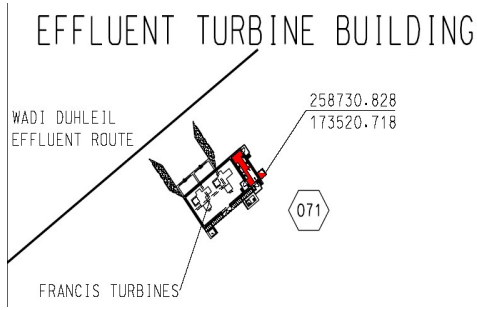
Water Line

The clarified water is then directed to the chlorine contact tank for disinfection purposes before leaving the plant with the guaranteed treated water quality. Chlorine is injected in gas form mixed with treated water. Chlorine gas is generated by evaporators and dosed by chlorinators into the clarified water, the contact time is > 30 minutes in chlorine contact tank to guarantee the full disinfection. Part of chlorinated treated water is used as service water in the plant and for Irrigation.

The last structure passed by the effluent is the outlet structure, where three Francis turbines are installed for energy recovery.

A by-pass of the turbines is also available for maintenance purpose.





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Thickeners and Flotation

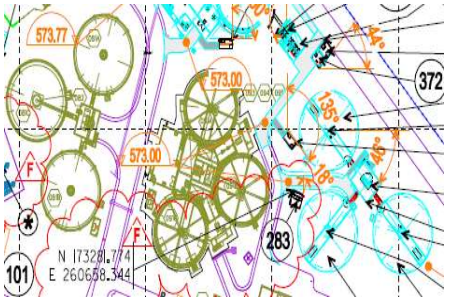
From the primary sedimentation tanks, the primary sludge (5 – 10 g/l) is pumped by the primary sludge pumping station to six sludge thickeners, before entering the thickeners the sludge is passing through step screen to remove the material that causes clogging for bridges and pumps. These are static settlement thickeners units (gravity thickening) used to increase the sludge concentration (45 – 55 g/l) before being sent to the digesters.

Sludge Line

The waste activated sludge (WAS) is extracted from the sludge recirculation tank.

The activated sludge is sent to five dissolved air flotation tanks by excess sludge pumps.

These units are used to increase the excess sludge concentration up to 35 g/l before being sent to the digesters.



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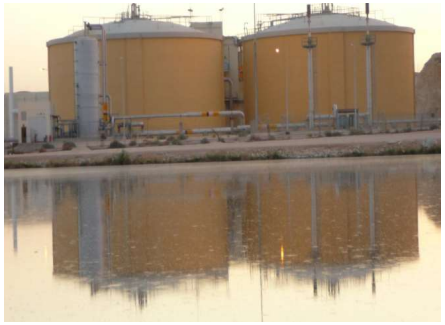
Digesters and Dewatering Machines

The two distinct sludge called as fresh sludge coming from thickeners and floated sludge coming from the flotation are then mixed in the mixing tank before being fed to seven sludge digestion tanks for anaerobic sludge digestion, the VS removal efficiency in digester is 43%, each kg VS removed produced 0.9 NM3 of biogas 65% CH_4, 35% CO_2 and 5000 ppm H_2S.



Sludge Line

The digested sludge at 3% DS is sent to the dewatering machines to increase the concentration to 18% using polymers and 16 belt filter press machines, the dewatered sludge is transferred by conveyers to trucks then weighted before sending to the drying beds, the sludge in drying beds is mixed periodically till it reach 50% DS then it transferred to temporary storage area where it stored their in piles till the mono landfill become in operation.

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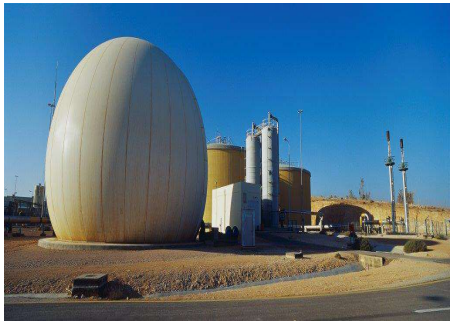
Biogas Lines

Sludge Line

The methane gas, produced during the sludge digestion process, is used by the biogas generators for energy recovery which is around 60% of total power recovery of the plant and by the boilers in order to heat the digesters to 35°C. Two gas holders are installed for storing the biogas and excess methane gas produced is burnt in the flare stack.

In order to limit the H2S concentration in the biogas before being used by generators/boilers, the produced gas is treated through biogas desulphurisation towers.



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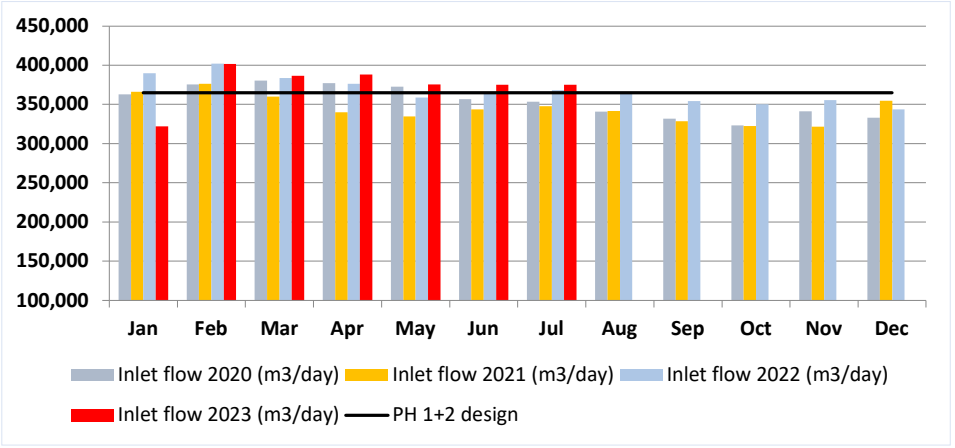
Design And Operation Figures

Process

INFLUENT		
Parameter	Design	Unit
Inlet flow	364,800	m3/day
COD	1,273	mg/l
BOD5	637	mg/l
TSS	649	mg/l
TKN	100	mg/l

EFFLUENT		
Parameter	Design	Unit
Treated flow	364,800	m3/day
pH	6-9	
COD	150 >	mg/l
BOD5	30 >	mg/l
TN	30 >	mg/l
TSS	30 >	mg/l
Faecal Coli	1000 >	CFU/100ml
Oil & Grease	8.0 >	mg/l
DO	1 <	mg/l
TDS	1500 >	mg/l



	inlet flow m3/d	Treated flow m3/d	flow to Wadi m3/d
2020	353,876	354,690	330,357
2021	344,543	346,182	320,422
2022	367,371	365,433	340,316
2023 (July)	374,437	376,371	354,064

SAMRA EXTERNAL FLOW AND LOAD 2022

Samra external flow	SPECIFICATIONS						
	COD	BOD5	TKN	N-NH4	TSS	%VSS	Total P
m3/day	mg/l	mg/l	mg/l	mg/l	mg/l	%	mg/l
367,371	1,110	579	94.4	55.3	545	72.0%	11.4

EFFLUENT 2022

Total Outlet flow	SPECIFICATIONS																			
	pH	Temp	COD	BOD5	TKN	N-NH4	N-NO3	N-NO2	TN	TSS	Total P	P-PO4	Faecal Coli	Faecal Coli	Oil & Grease	Free Cl2	Total Cl2	DO	Nematode egg	TDS	Turbidity
m3/day		°C	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	CFU/100ml	MPN/ 100 ml	mg/l	mg/l	mg/l	mg/l	egg/l	mg/l	NTU
365433	6.98	23.9	42.4	3.5	6.8	3.1	9.45	0.62	16.9	8.9	4.87	4.54	43	82	7.0	0.33	1.62	4.4	0.06	1060	5.4

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