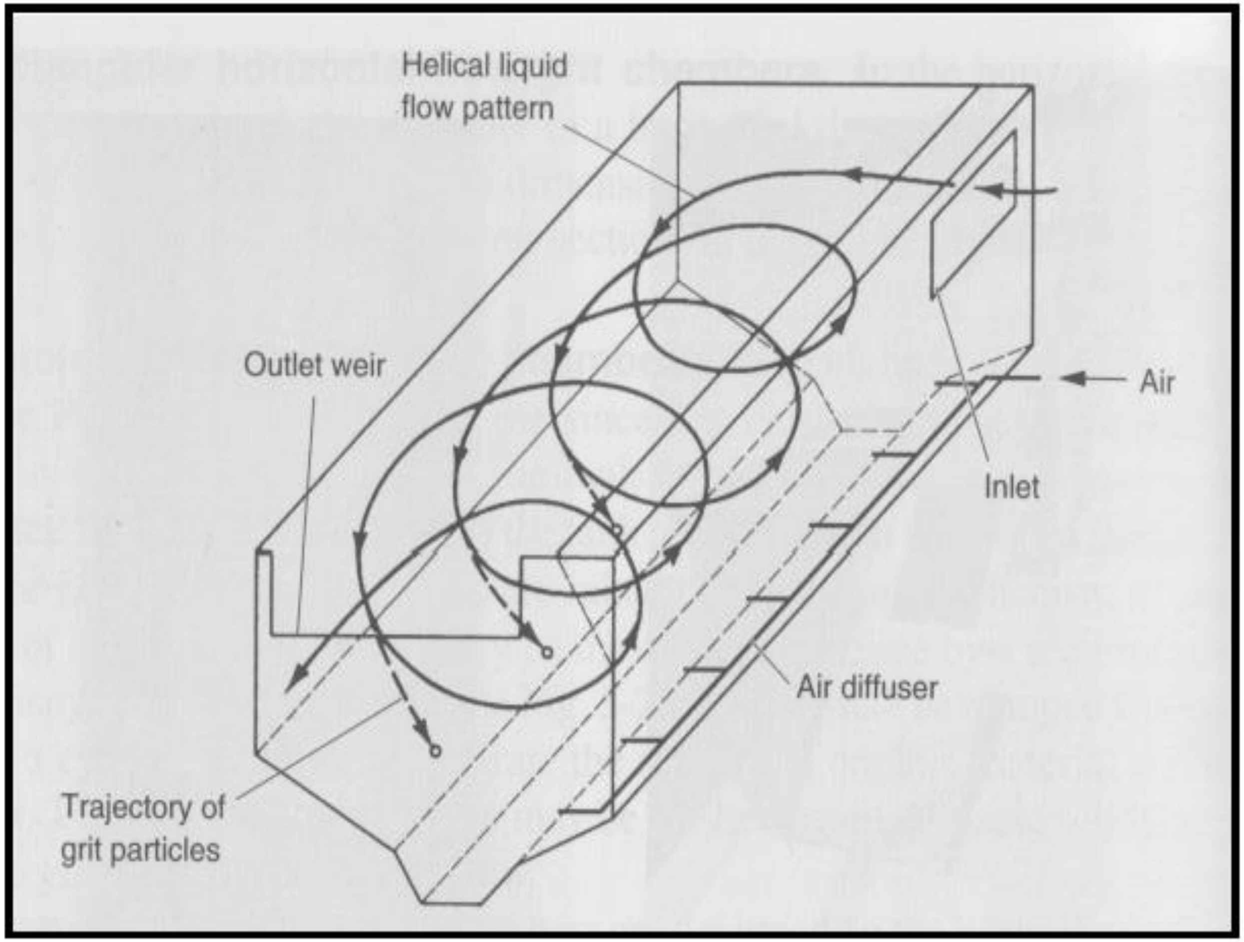
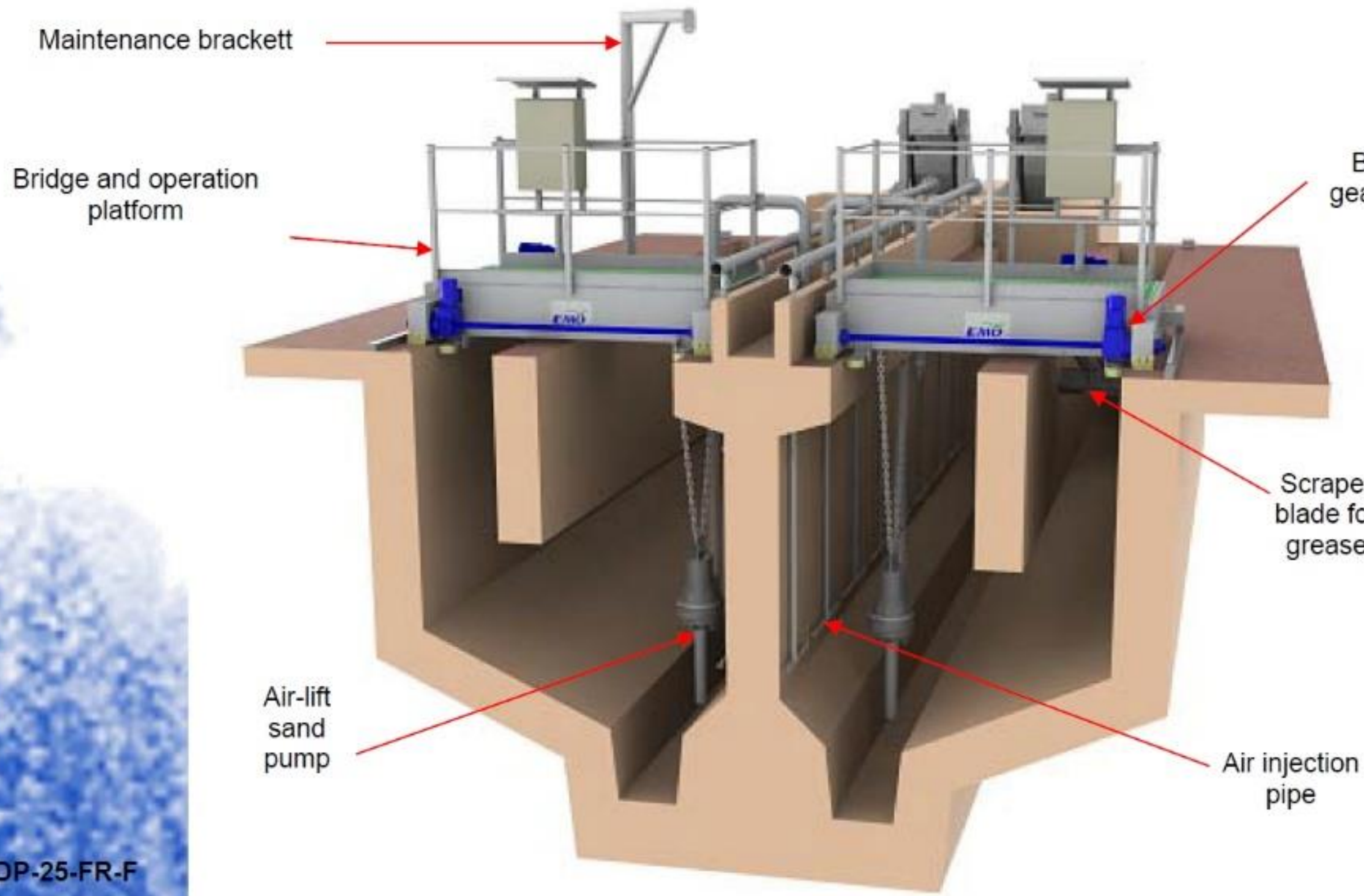
HELICAL FLOW PATTERN IN AERATED GRIT CHAMBERS

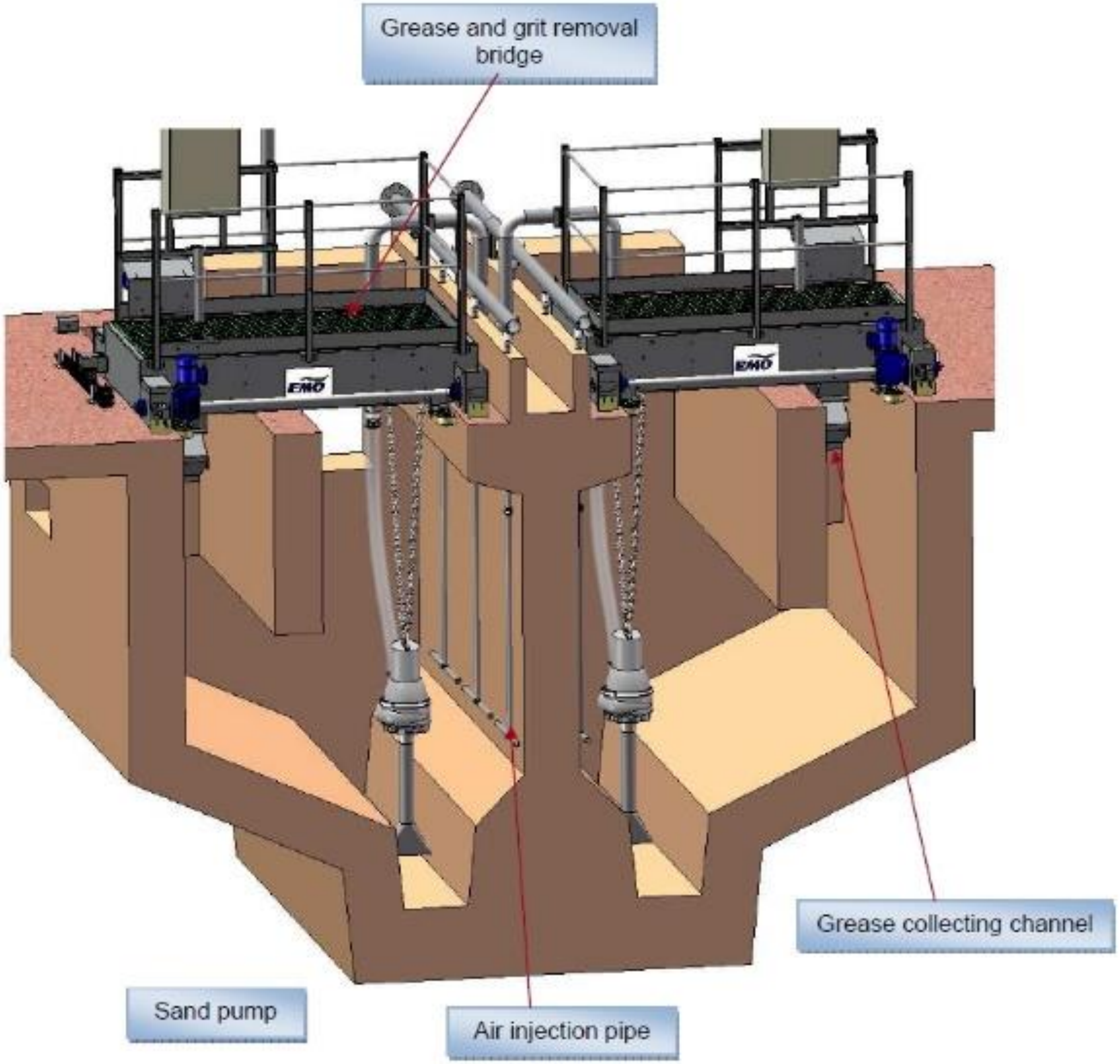


AERATED GRIT CHAMBERS WITH AIR LIFT PUMPS

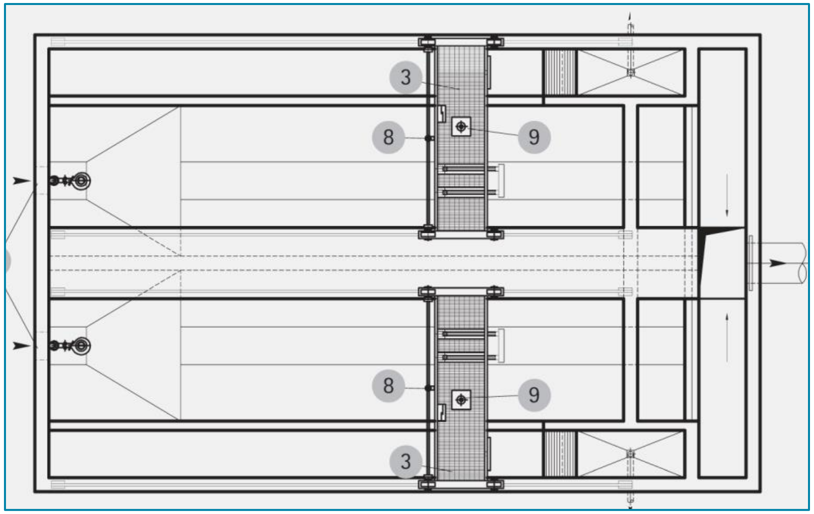


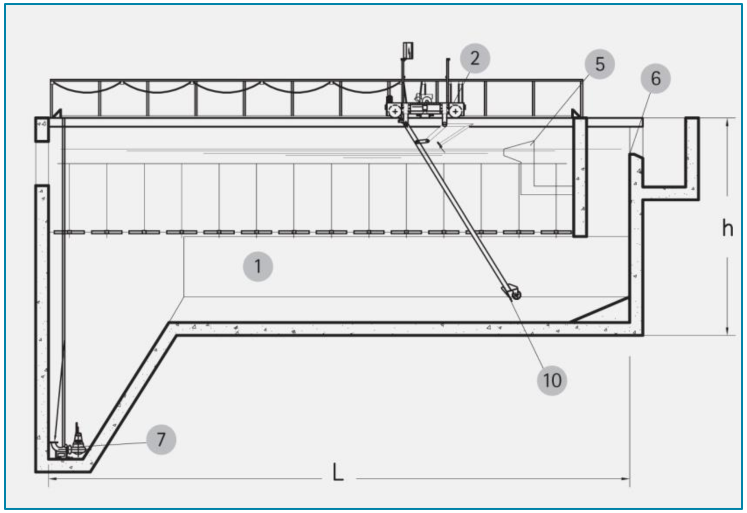
DP-25-FR-F

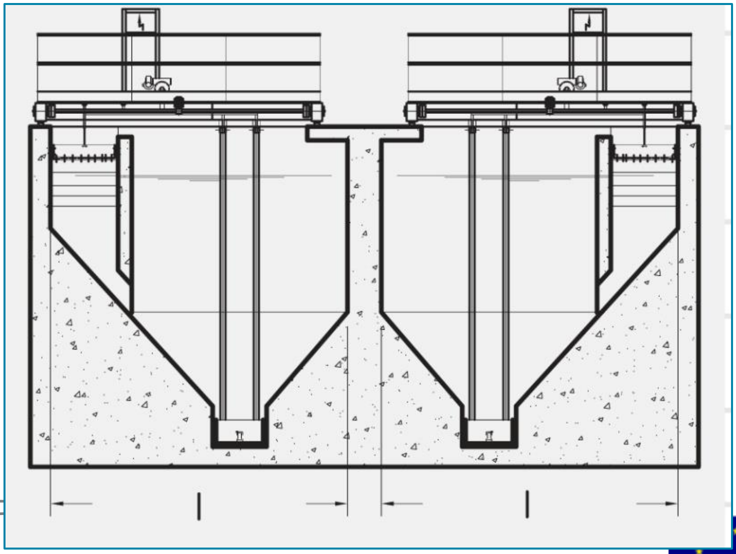
AERATED GRIT CHAMBERS WITH GRIT PUMPS



AERATED GRIT CHAMBER WITH HOPPER







TYPICAL DESIGN PARAMETERS FOR AERATED GRIT CHAMBERS

Item	Unit	Range	Typical	Source
Min. detention time at peak flow rate	min	3-10	5	MOP-8
Depth	m	3.7-5		MOP-8
Length	m	7.5-20		M&E
Width	m	2.5-7		M&E
Width-depth ratio		0.8-1		MOP-8
Length-width ratio		3-8 to 1	4:1	MOP-8
Air supply	m3/m.min	0.2-0.5		M&E
Grit quantities	m3/10^6 m3	4-200	15	M&E

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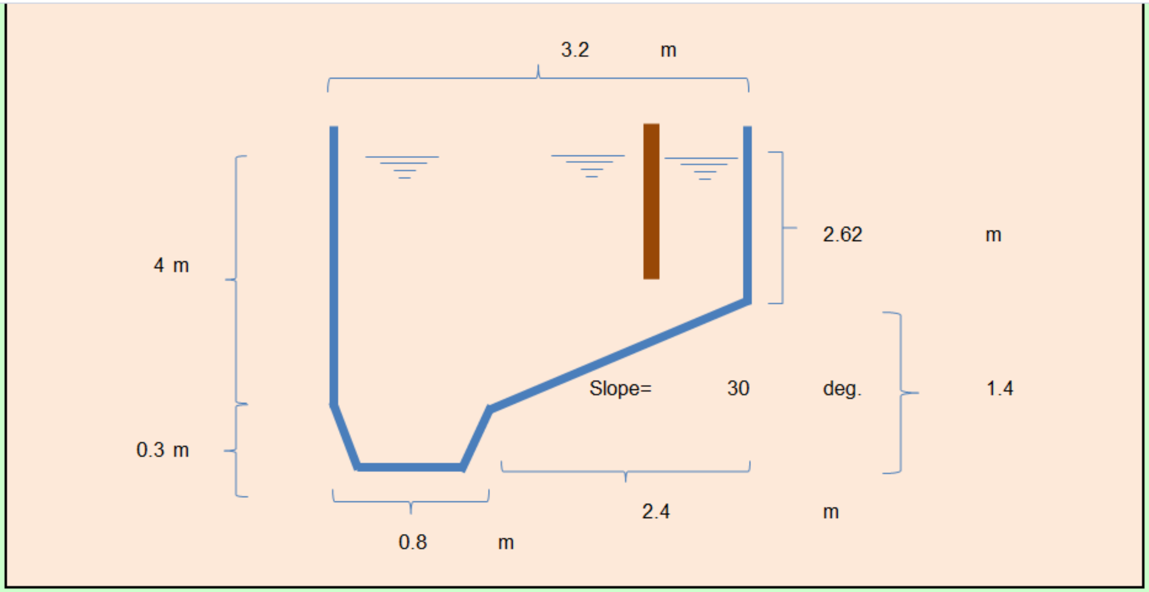
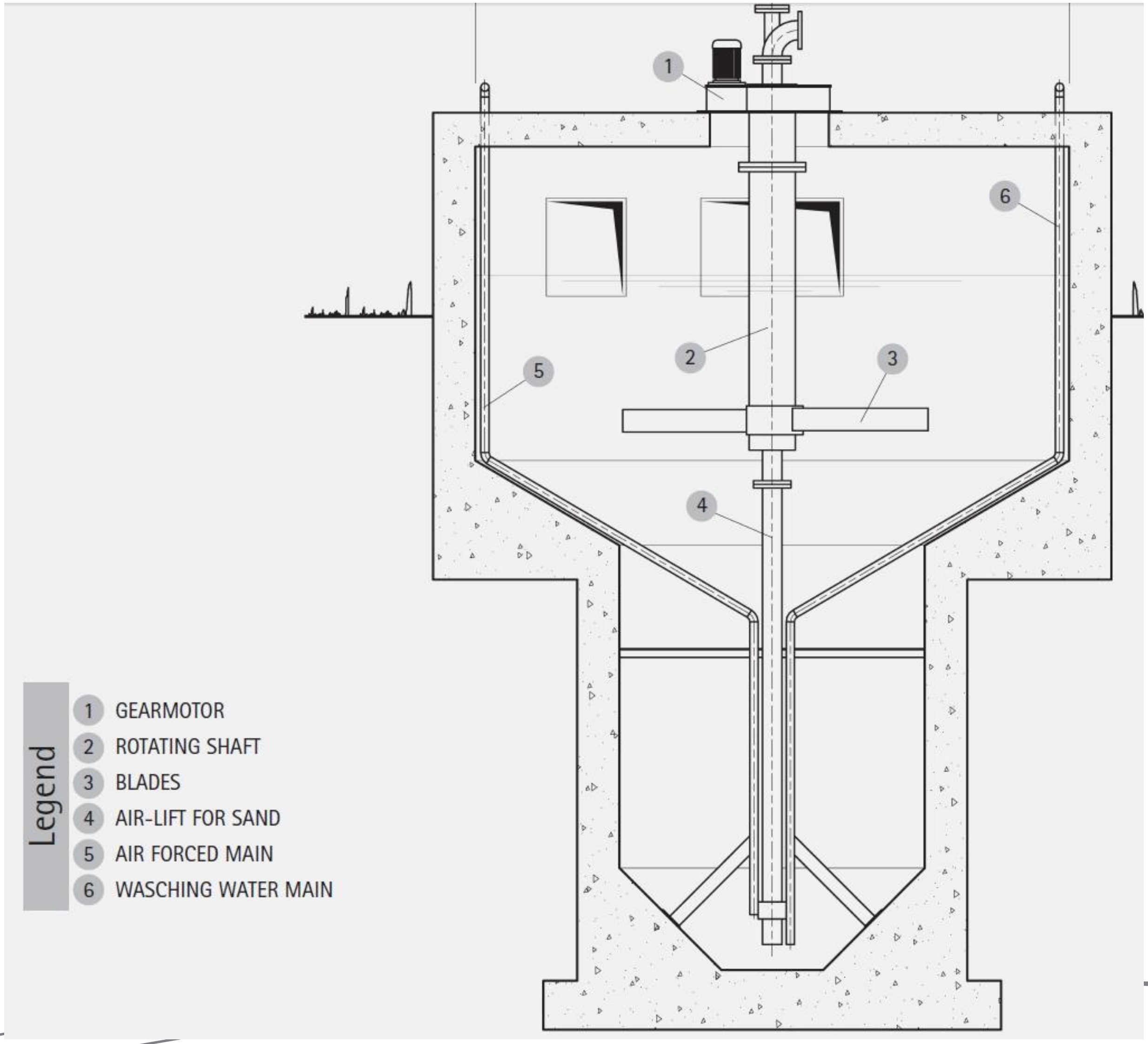
EXAMPLE GRIT CHAMBER DESIGN



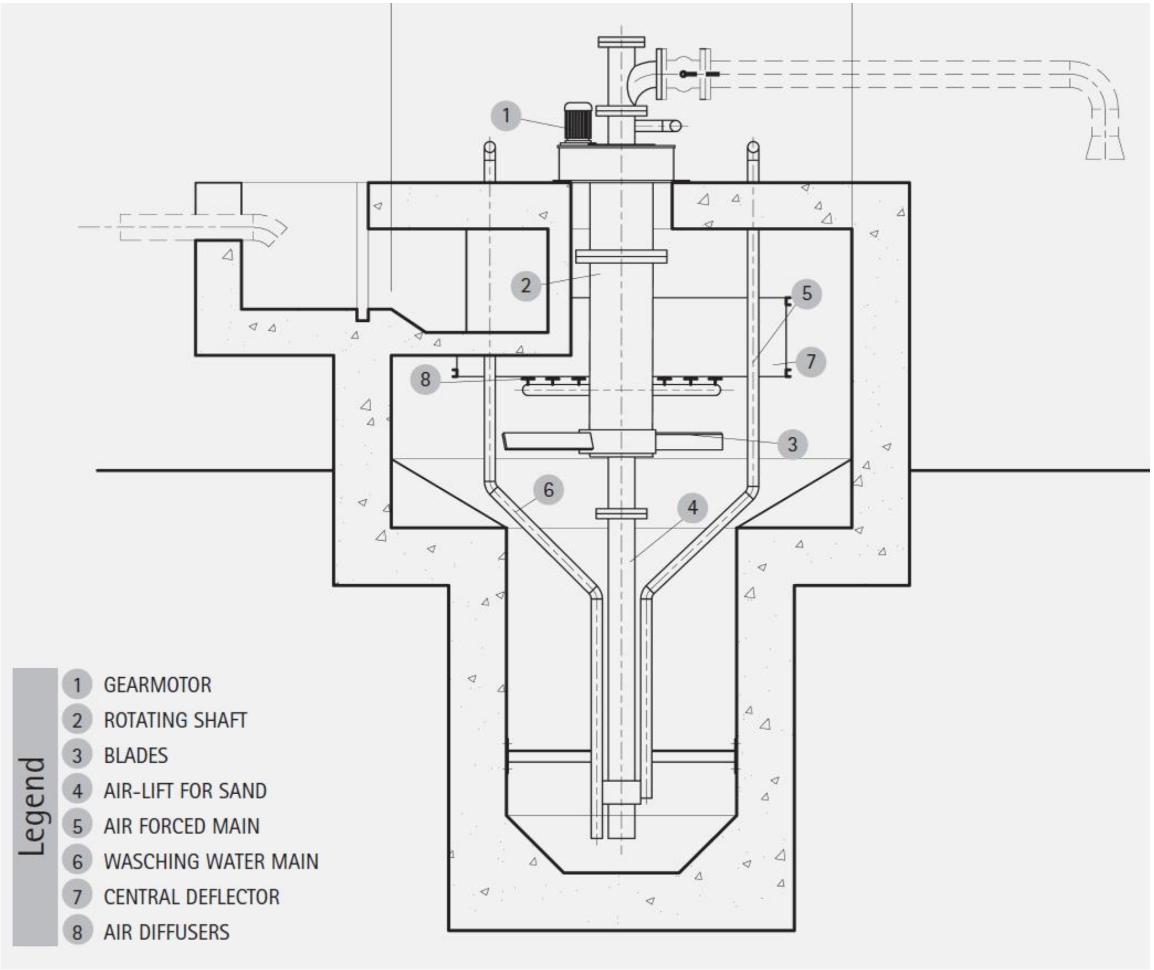
Min. Design Rentention Time @ Maximum Flow	mins	Recommended	3-10	5	Input
Volume Required For Maximum Flow	m³			132	Input
No of Tanks	-	Recommended	2	1	Input
Minimum Volume Per Tank	m³			132	Calculated
Tank Depth	m	Recommended	3.7-5	4.0	Input
Required Min. Surface Area				33	Calculated
Width:Depth Ratio		Recommended	0.8:1	0.80	Input
Tank Width				3.2	Calculated based on w/d
Length To Width Ratio	m	Recommended	3 - 8:1	5	Input
Tank Length	m³	Calculated	16.0	17.0	Input
Cross Sectiona Area per chamber	m^2			11.14	Calculated
Actual Surface Area				54.40	
Actual Total Volume	m³			189.4	Calculated
Actual Volume per chamber	m³			189.4	Calculated
Actual Retention Time	mins	28.7	57.4	7.2	Calculated

Grit Chambers Design

ROTATING BLADES GRIT REMOVAL



ROTATING BLADES GRIT REMOVAL WITH OIL REMOVAL

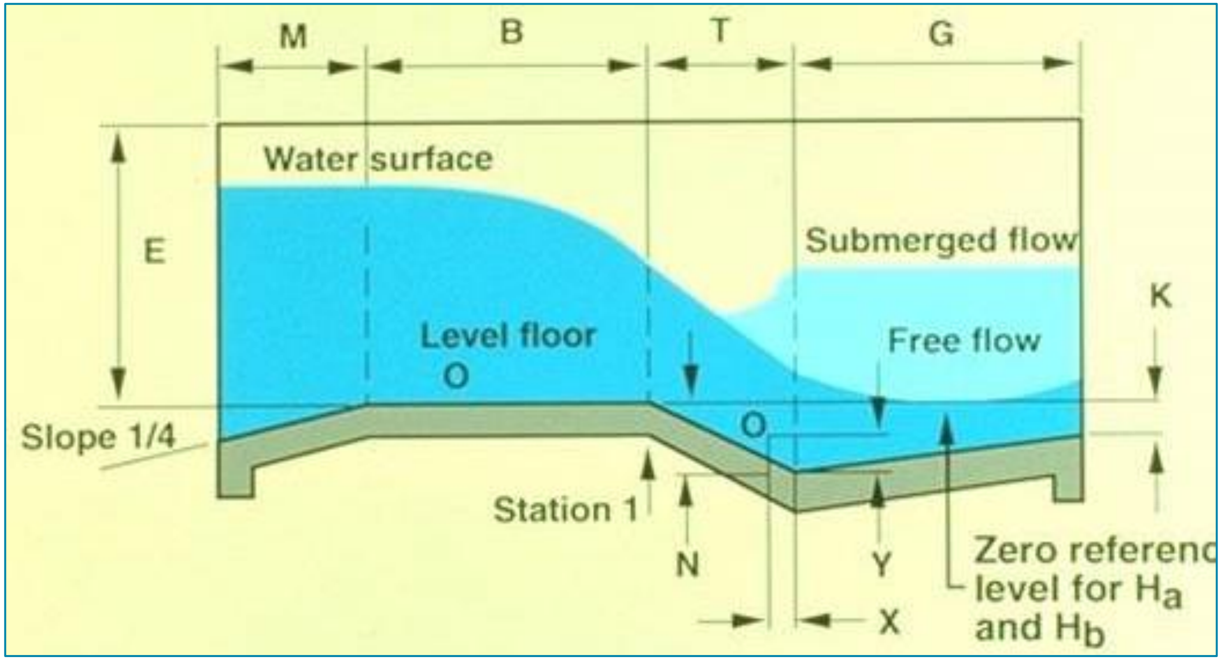


SIZING FOR ROTATING BLADES GRIT TANKS

MAIN FEATURES	UNIT	DIMENSIONAL DATA								
MODEL		20	25	30	35	40	45	50	55	60
TANK DIAMETER (d)	mm	2000	2500	3000	3500	4000	4500	5000	5500	6000
BLADES REVOLUTION SPEED	r.p.m.	34	28	26	20	20	17	16	15	13
SEWAGE MAX FLOW RATE	m^3/h	150	300	450	600	1000	1250	1850	2200	2650
AIR FOR SAND MIN FLOW RATE	m^3/h	60	100	100	100	100	100	150	150	150
SAND WASHING WATER MIN FLOW RATE	m^3/h	3,6	3,6	3,6	3,6	7,2	7,2	7,2	7,2	7,2
GEARMOTOR POWER SUPPLY	kW	0,37	0,37	0,55	0,75	1,1	1,5	2,2	3,0	4,0
DIFFUSERS BLOWER POWER SUPPLY	kW	0,37	0,55	0,55	1,1	1,5	1,5	2,2	4,0	4,0
AIR-LIFT BLOWER POWER SUPPLY	kW	3,0	3,0	3,0	5,5	5,5	5,5	7,5	7,5	7,5
WEIGHT	daN	280	300	330	350	380	400	420	440	500

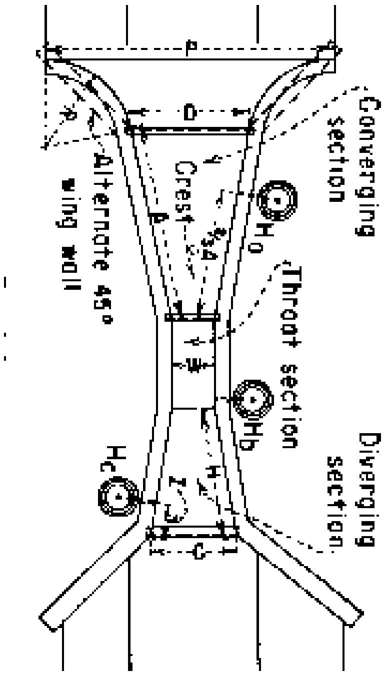
FLUMES

- Known geometry gives a predictable head discharge relationship, measured upstream of the flume, usually via ultrasonics.



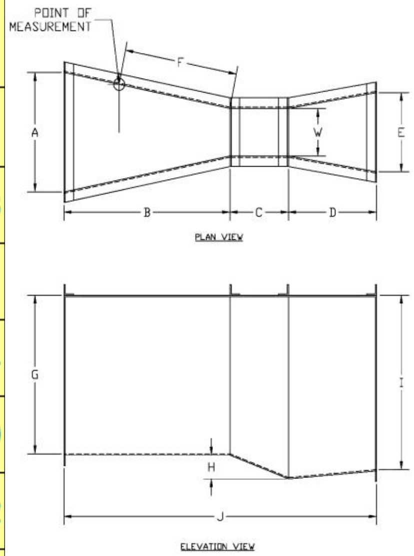
FLUME PARTS

- A flume has three basic parts
  - Entry transition - this is where the channel width is reduced
    to the flume throat width via curved sections. The throat should be central to the channel.
  - Throat- this is where the flow passes through the critical depth. The throat length must be at least twice the depth upstream. The throat is usually around half the channel width.
  - Exit transitions - this is where the flume throat is widened out to the downstream channel width. This is done using straight tapers.



DIMENSIONS & FLOW RANGES

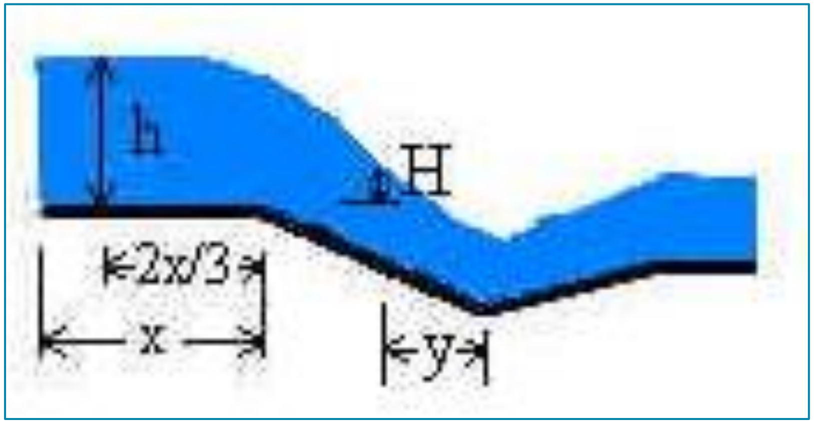
Throat Width (W)		(cm)										Flow (m3/hour)	
Inch	(cm)	A	B	C	D	E	F	G	H	I	J	Minimum	Maximum
1	**2.5**	16.7	35.6	7.6	20.3	9.3	24.2	22.9	2.9	24.8	63.5	0.5	19.3
2	**5.1**	21.4	40.6	11.4	25.4	13.5	27.6	22.9	4.3	25.1	77.5	0.7	44.1
3	**7.6**	25.9	45.7	15.2	30.5	17.8	31.8	61.0	5.7	63.5	91.4	0.9	115.4
6	**15.2**	39.7	61.0	30.5	61.0	39.4	41.4	61.0	10.8	68.6	152.4	5.2	313.9
9	**22.9**	57.5	86.4	30.5	45.7	38.1	58.7	76.2	10.8	83.8	162.6	9.3	636.2
12	**30.5**	84.5	134.3	61.0	91.4	61.0	91.4	91.4	22.9	99.1	286.7	33.2	1666.2
18	**45.7**	102.6	141.9	61.0	91.4	76.2	96.5	91.4	22.9	99.1	294.3	52.0	2507.5
21	**53.3**	111.6	145.7	61.0	91.4	76.2	96.5	91.4	22.9	99.1	298.1	59.3	2936.5
24	**61.0**	120.7	149.5	61.0	91.4	91.4	101.6	91.4	22.9	99.1	301.9	67.2	3373.5
30	**76.2**	139.1	157.2	61.0	91.4	106.7	106.7	91.4	22.9	99.1	309.6	83.1	4252.0



PARSHAL FLUME HEAD EQUATION

$$h = \left[\frac{Q}{m}\right]^{\left(\frac{1}{e}\right)}$$

Where:
h : head,ft
Q : flow,cfs
e,m : empirical constants dependent on the throat width



Flume Throat Width (W)		e Value	m Value
ft	m		
0-0.25	0-80	1.550	4xW
0.25-0.5	80-150	1.547	4xW
0.5-0.75	150-230	1.580	4xW
0.75-1	230-300	1.530	4xW
1-1.5	300-460	1.522	4xW
1.5-2	460-610	1.538	4xW
2-3	610-910	1.550	4xW
3-4	910-1220	1.566	4xW
4-5	1220-1520	1.578	4xW
5-6	1520-1830	1.587	4xW
6-8	1830-2440	1.595	4xW
8-10	2440-3050	1.607	4xW
>10	>3050	1.600	3.688xW+2.5

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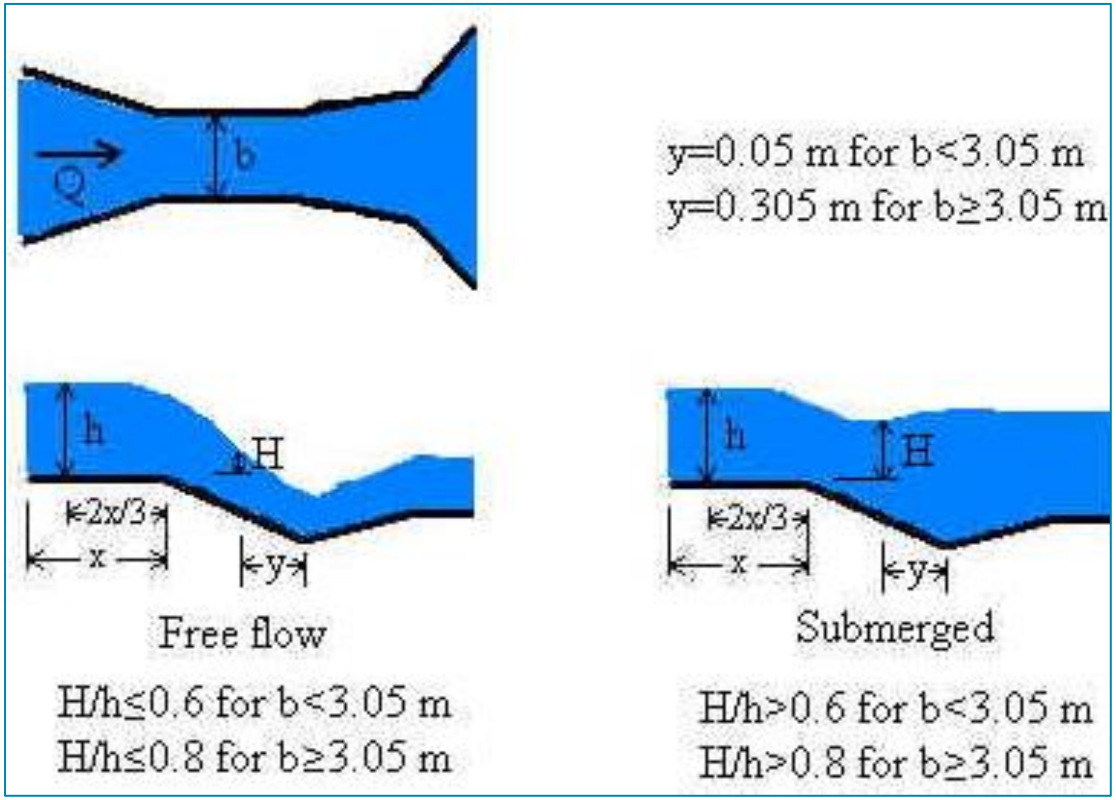
FREE FLOW & SUBMERGED FLUMES

The upstream head must be at least 1.25 times the downstream head. If it is not then the flume is drowned out. This means that the head discharge relationship will no longer be true. The flume will be over recording, I.e. it will indicate that a greater flow has passed than has actually passed.



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PRIMARY SEDIMENTATION TANKS(PST)

A tank in which suspended solids are allowed to settle out of a liquid under the influence of gravity.

Functions of the primary clarifiers include:

- Remove floating material, thereby minimizing operational issues such as the buildup of scum in the secondary treatment process.
- Concentrate primary sludge before pumping to gravity thickeners, and
- Reduce suspended solids and biochemical oxygen demand (BOD) loading to the downstream treatment processes

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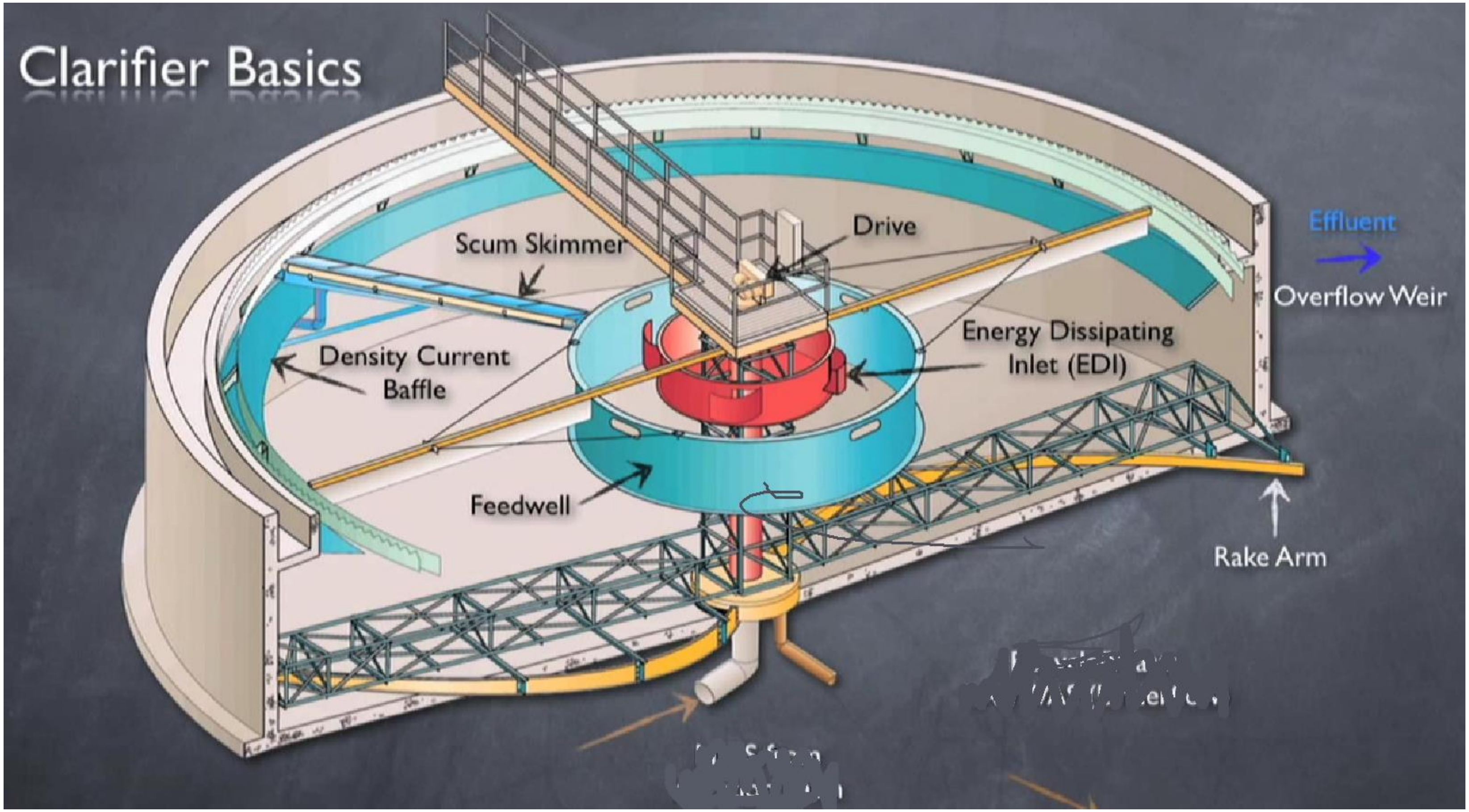
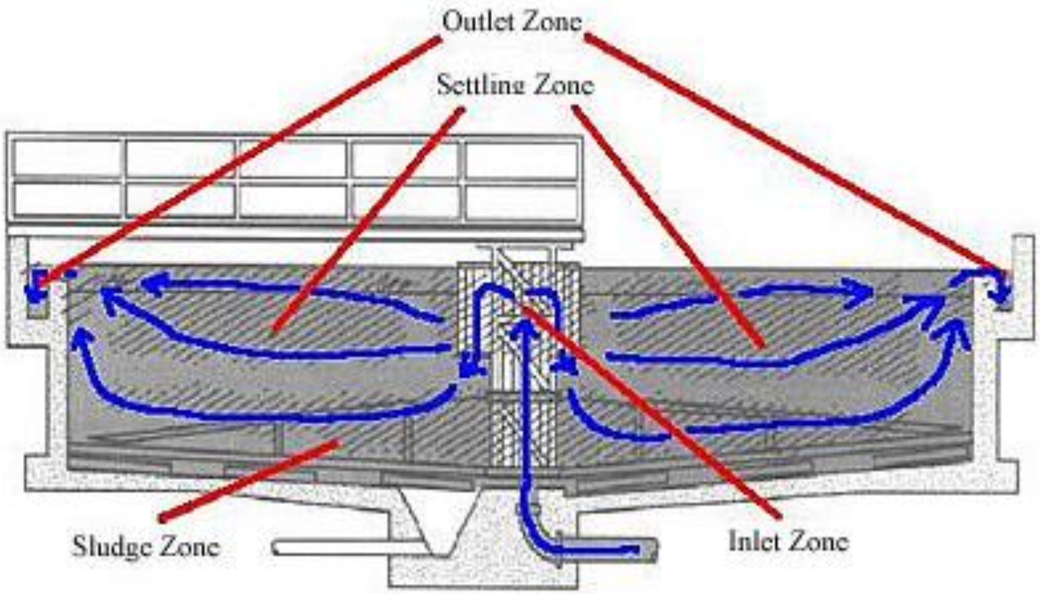
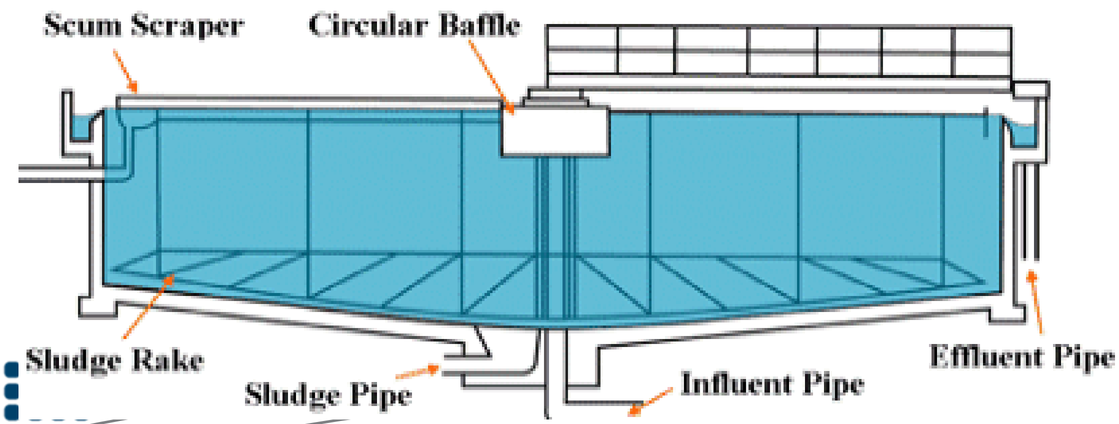
PST COMPONENTS



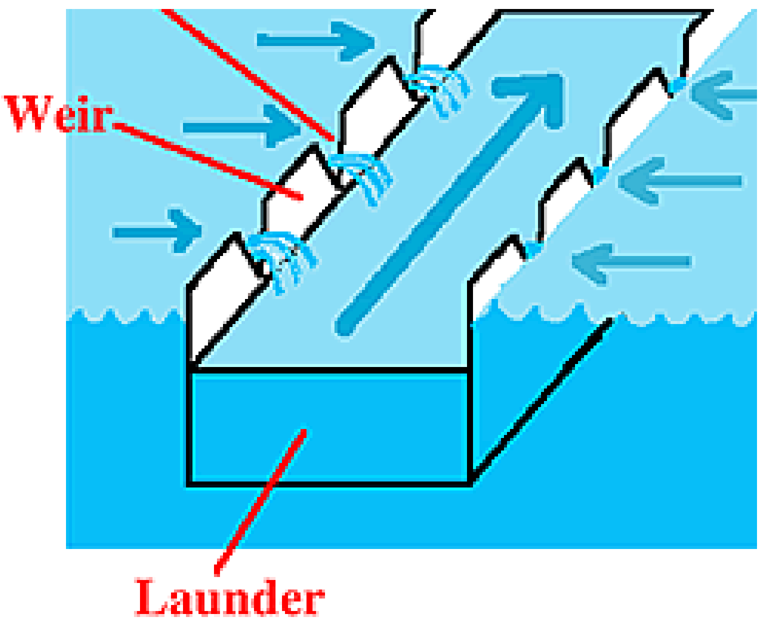
FLOW PATTERN & ZONES IN PSTs





EFFLUENT LAUNDER

Trough which collects the wastewater flowing out of the sedimentation tank and directs it to the effluent pipe. One or both sides of a launder typically have weirs attached. Weirs are walls preventing wastewater from flowing uncontrolled into the launder



TYPICAL DESIGN PARAMETERS FOR PRIMARY SEDIMENTATION TANKS

Item	Unit	PST Followed by Secondary Treatment		PST with Waste Activated Sludge Return	
		Range	Typical	Range	Typical
Detention Time	hours	1.5-2.5	2	1.5-2.5	2
Overflow Rate/Surface Loading rate @ Average flow	$m^3/m^2.d$	30-50	40	24-32	28
Overflow Rate/Surface Loading rate @ Peak flow	$m^3/m^2.d$	80-120	100	48-70	60
Weir Loading	$m^3/m.d$	125-500	250	125-500	250
Depth	m	3-4.9	4.3	3-4.9	4.3

Average %TSS removal = 60%

SURFACE LOADING RATE

The surface loading rate is the quantity of wastewater passing over 1 m2 of tank per day

$$SLR = \frac{Flow\_Rate}{Tank\_Surface\_Area}$$

$$Tank\_Surface\_Area = \frac{Flow\_Rate}{SLR}$$

WEIR OVERFLOW RATE

The weir overflow rate is the amount of wastewater leaving the settling tank per linear meter of weir

$$WOR = \frac{Flow\_Rate}{Tank\_Weir\_Length}$$

$$Detention\_Time = \frac{Effective\_Volume}{Flow\_Rate}$$

HYDRAULIC DETENTION TIME

Sufficient time for contact between solid particles is necessary for flocculation and sedimentation.

$$Detention\_Time = \frac{Effective\_Volume}{Flow\_Rate}$$

DESIGN EXAMPLE FOR PST

Item	Unit	@Qav	@Qpdwf	@Qpwwf
Flow	m3/day	133,900	233,300	295,000
Required Surface Overflow Rate	m3/m2.d	28		
Typical Depth	m	3.5	3.5	3.5
floor slope	deg.	7.5	7.5	7.5
Computed Area based on Qav SLR	m2	4782	4782	4782
No. of Tanks		8	8	8
Area Each	m2	598	598	598
Diameter	m	27.6	27.6	27.6
Used diameter	m	28.0	28.0	28.0
Computed area each tank	m2	616	616	616
Used Total Area	m2	4926	4926	4926
Volume each tank	m3	2155	2155	2155
Calculated Surface loading rate	m3/m2.d	27	47	60
Requied typical SLR	m3/m2.d	28		60
Weir over flow rate @ Qav	m3/m.d	190	332	419
Effective Detention time	hour	3.1	1.8	1.4

PST Sizing

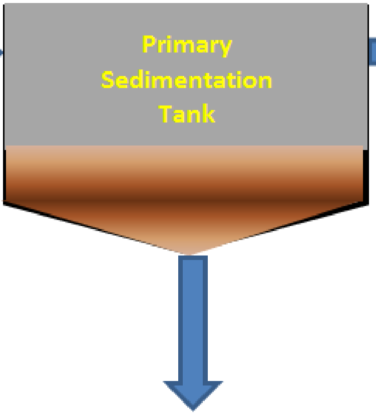
PERCENTAGE POLLUTANTS REMOVAL IN PST

SS removal= 0.65

Soluble	Particulate
262.0	488.0
133.8	256.9
61.0	14.0
5.2	4.8
	305.0
	363.1

Q= 134300 m3/day

Item	Conc. mg/l	Load Kg/day
COD	750	100,725
BOD	391	52,471
TKN	75	10,073
TP	10	1,343
VSS	305	40,962
TSS	363	48,764

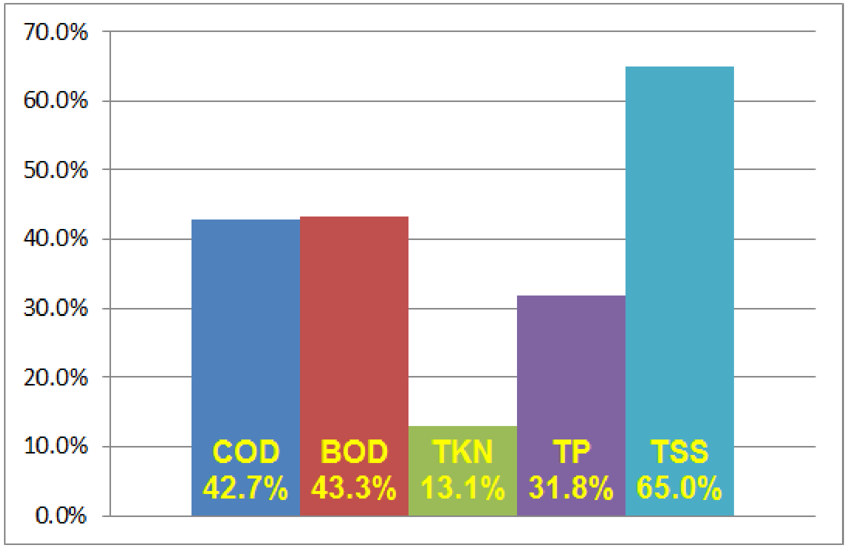


Q= 132729 m3/day

Item	Conc. mg/l	Load Kg/day
COD	434.8	57713.4
BOD	224.2	29,754
TKN	66.0	8,754.539
TP	6.9	916
VSS	108.0	14,337
TSS	128.6	17,068

Q= 1571 m3/day

Item	Conc. mg/l	Load Kg/day	% Removal	Removed Soluble	Removed Particulate
COD	27,378	43,011.6	42.7%	411.6	42600.0
BOD	14,460	22,716.8	43.3%	290.7	22426.1
TKN	839	1,318.0	13.1%	95.8	1222.1
TP	272	427.2	31.8%	8.2	419.0
VSS	16,948	26,625.0	65.0%		
TSS	20,176	31,696.8	65.0%		



PST Removal Rates

SWIM-H2020 SM

For further information

Website

www.swim-h2020.eu E: info@swim-h2020.eu

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SWIM and Horizon 2020 Support Mechanism

Working for a Sustainable Mediterranean, Caring for our Future

Thank you for your attention.

This Project is funded by the European Union