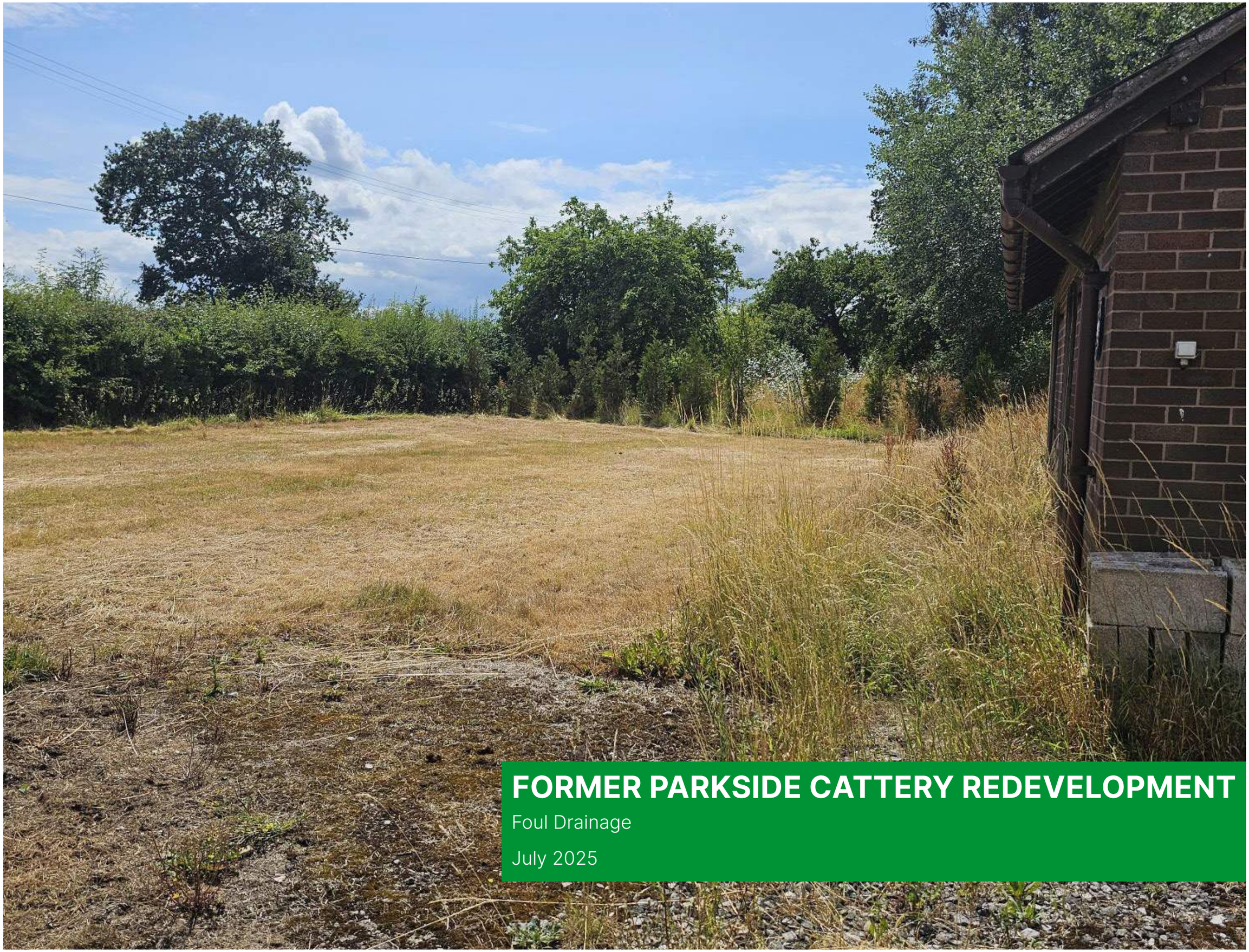
LandStudio



FORMER PARKSIDE CATTERY REDEVELOPMENT

Foul Drainage

July 2025

Document Control			
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P02	Final Planning Issue		28.07.2025

This document has been produced by Land Studio on behalf of Miss Ella Lewis and Mr Ben Woodburn. The contents of the document are intended for a planning submission related to the proposed residential development at the Former Parkside Cattery, Park Lane, Marford. Land Studio has prepared this report in accordance with the instructions of the above-named client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.

Former Parkside Cattery: **INTRODUCTION**

01

FORMER PARKSIDE CATTERY: THE SITE



Figure 1 Site Location

Land Studio have been appointed by Grimster Planning on behalf of Miss Ella Lewis and Mr Ben Woodburn to produce a Foul Drainage Strategy in support of a planning application for change of use and conversion of an existing building from a cattery to a dwelling and associated works including single storey extension and creation of a new driveway.

During the planning consultation stage Natural Resources Wales (NRW) have expressed concerns on the location of the development and the potential increase in nutrients being discharged from the site in relation to the River Dee and Bala Lake Special Area of Conservation (SAC).

The development site is located in Park Lane, Parkside, Trevalyn, LL12 0BW.

The site is located at grid reference SJ 37572 55046 and indicated in Figure 1.

The proposed planning application red line boundary equates to 0.96 hectares with the developed area equating to 68m^2.

In preparation of the report and performance of any other services, Land Studio has relied upon publicly available information, information provided by the client and information provided by third parties. Accordingly, the conclusions reached in this report are valid only to the extent that the information provided was accurate and complete. Land Studio cannot accept liability for the accuracy or otherwise of any information derived from third party sources.

Former Parkside Cattery: **BASELINE REVIEW**

02

FORMER PARKSIDE CATTERY: BASELINE REVIEW

Flood Risk

Flood risk is a combination of the probability and the potential consequence of flooding. The Natural Resources Wales Flood Map for Planning have been reviewed which indicates the site is located in a Flood Zone 1 for fluvial and tidal flooding which is land that has been assessed as having a less than 1 in 1000 annual probability of river flooding (<0.1%). This can be seen in Figure 2 in blue._Overland flow occurs when the infiltration capacity of the ground or capacity of the drainage systems is exceeded in a storm event. This can result in water travelling over land or ponding. The Natural Resources Wales Flood Maps for Planning indicates that there is no surface water flooding within the site redline boundary or wider land ownership boundary. This can be seen in Figure 2 in purple.

Geology

Soil mapping information available online from LandIS.org.uk indicates that the site is located within an area of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils with impeded drainage, indicated by green hatching in Figure 3.

Nitrate Vulnerable Zone (NVZ)

The site is not located within a Nitrate Vulnerable Zone (NVZ) impact on surface water as indicated in Figure 4.

Source Protection Zone (SPZ)

The site is located within a Source Protection Zone (SPZ). A SPZ is an area designated by Natural Resources Wales that require protection to public drinking water sources. A sewage treatment plant, rather than a septic tank, will be required and additional treatment may be required, prior to discharge to surface water. An Environmental Permit with NRW is likely to be required to approve the discharge.

Special Areas of Conservation (SAC)

The site is located within a NRW Phosphorus Sensitive Special Area of Conservation (SAC). In SAC catchments failing to meet revised nutrient targets, it is possible that new developments can be authorised if it can be demonstrated they will not lead to further deterioration of water quality and will not undermine the ability for the SAC to meet its conservation objectives.

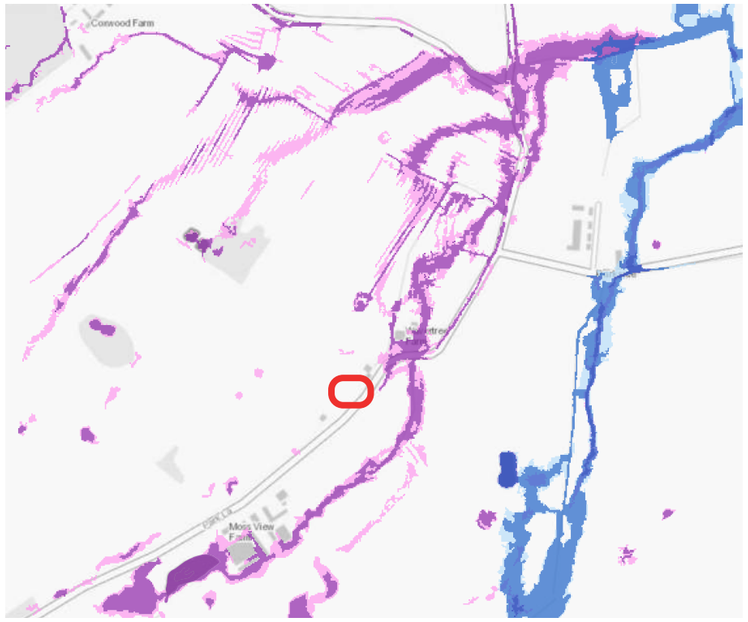


Figure 2: Natural Resources Wales Flood Map For Planning

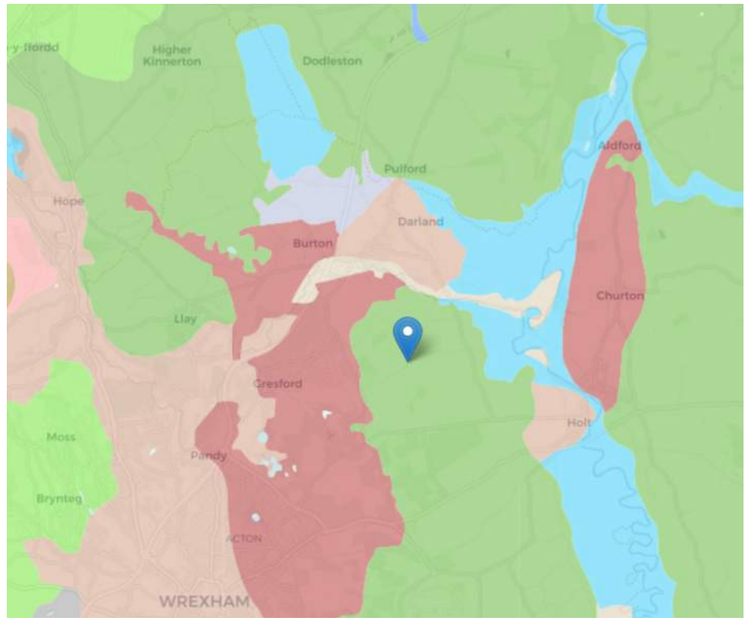


Figure 3: Soilscapes Mapping - landis.org.uk/soilscapes

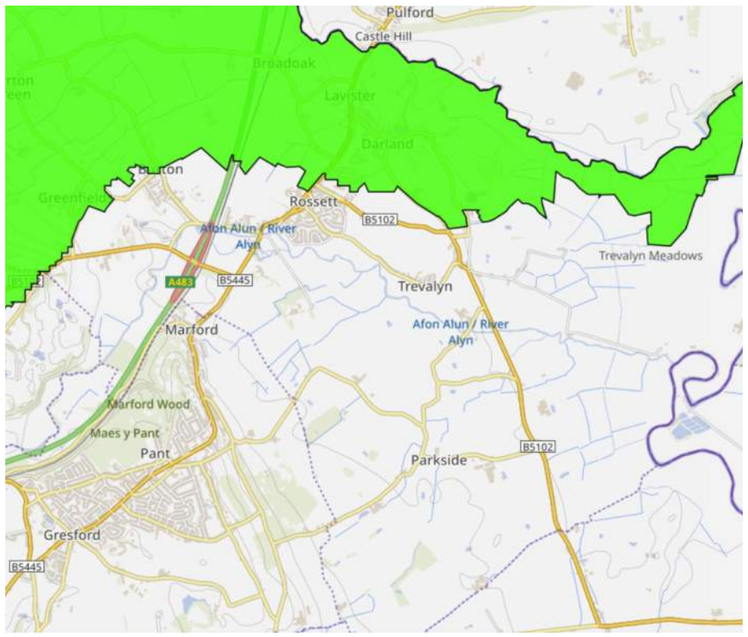


Figure 4: Nitrate Vulnerable Zone

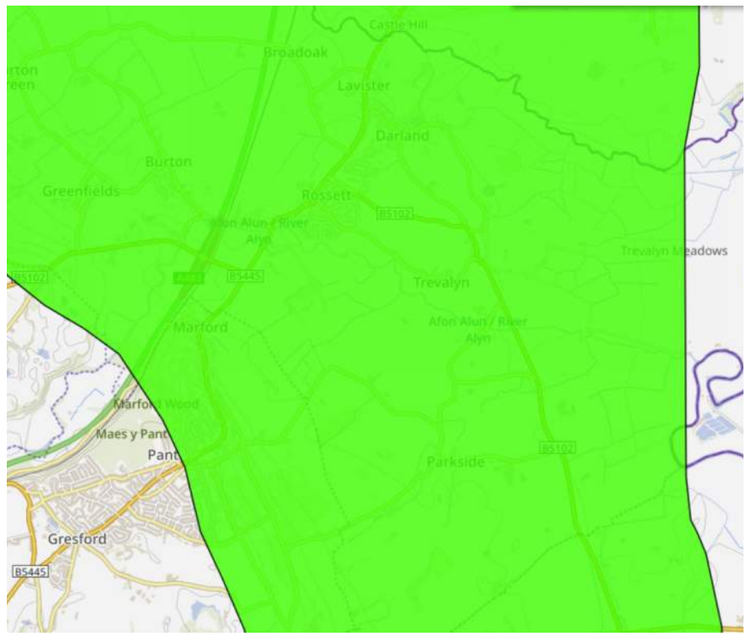


Figure 5: Source Protection Zone

Former Parkside Cattery: **FOUL DRAINAGE STRATEGY**

03

FORMER PARKSIDE CATTERY: FOUL DRAINAGE STRATEGY

Foul Water Discharge Hierarchy

The following hierarchy for discharge has been reviewed.

- Local Foul Public Sewer System
- Local Combined Public Sewer System
- Package Treatment Plant to either
  - Infiltration to ground
  - Discharge to watercourse
- Septic tank
- Cesspool

Dwr Cymru/Welsh Water public sewer records have been purchased for the site. These indicate that there are no public sewer assets close to the site.

Whilst infiltration testing has not been undertaken a review of the ground information online and an understanding of the site by the owners indicates that discharge to ground from treated foul drainage will not be possible.

An existing open ditch is located to the north of the site, north of Wavertree Cottage. It is believed that the foul drainage from the existing Wavertree Cottage septic tank (which has recently been replaced) discharges into this open ditch towards the front of the site. The ditch also collects land drainage runoff from the adjacent agricultural land as seen in Figure 8.

Existing Foul Water Flows

There is a kitchenette within the existing cattery building which currently discharges directly into the ground adjacent the building with no treatment.

Proposed Foul Water Flows

The proposed development is for a 2 bed house (1 double and 1 single). Using the daily discharge calculator for domestic properties this equates to a discharge of 0.75 m^3/day.

Proposed Foul Water Design

The private drainage within the development site will be designed in accordance with BS EN 752:2017. Separate foul and surface water systems will be provided until the point of discharge.

A domestic sewage treatment plant is proposed with discharge into the existing land drainage ditch but 50m upstream of the existing connection from the Wavertree Cottage septic tank discharge. The treatment plant will give greater treatment than a septic tank. If additional treatment downstream of this is required before discharge then polishing can be undertaken in a reed bed or a green SuDS features within the landscape as there is land available for this within the ownership boundary.



Figure 7: Existing land drainage ditch

A British Water certified small package treatment plant, the Clenviro Matrix Topas Plus 7 is specified due to its ability to reduce phosphate levels dur to being located within the SAC.

A Environmental Permit will be required with NRW to confirm the detail of this design post planning.



Figure 8: Incoming land drainage connection from adjacent agricultural land

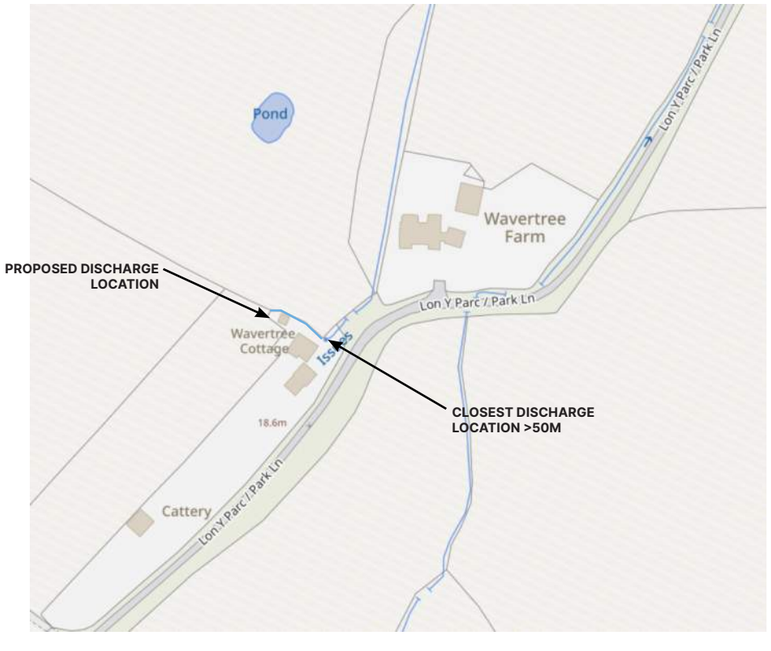


Figure 9: Land drainage connection to River Alun

Former Parkside Cattery: **APPENDICES**

04

Proposed Foul Treatment Plant: **APPENDIX 1**

Strojírenský zkušební ústav, s.p., Brno, Česká republika
Engineering Test Institute, Public Enterprise, Brno, Czech Republic

CERTIFIKÁT
CERTIFICATE

Číslo:
Number: **E-30-00322-14-rev. 2**

Držitel certifikátu - výrobce: *Owner of Certificate - Manufacturer:*	TopolWater, s.r.o. Nad Rezkovcem 1114, 286 01 Čáslav Česká republika - *Czech Republic* IČ/*Company ID No.*: 26212943
Výrobky: *Products:*	Čistírny odpadních vod *Wastewater treatment plants*
Typové označení: *Type designation:*	TOPAS Plus viz 2. a 3. strana / *see Pages 2 and 3*
Aplikovaná harmonizovaná norma: *Applied harmonized standard:*	ČSN EN 12566-3+A2:2014
Podklad pro vydání certifikátu: *Basis of Certificate issuance:*	Protokol o posouzení vlastností stavebního výrobku č. 30-12648/I ze dne 2015-02-06 *Report on assessing the performance of construction product 30-12648/I of 2015-02-06*

Strojírenský zkušební ústav, s.p., potvrzuje, že posoudil vlastnosti stavebních výrobků v souladu s ustanovením bodu 1.4 (b) Systém 3 přílohy V nařízení Evropského parlamentu a Rady (EU) č. 305/2011 ze dne 9. března 2011 (nařízení o stavebních výrobcích neboli CPR), v platném znění, a stanovil vlastnosti základních charakteristik stavebních výrobků.

Tento certifikát nenahrazuje příslušný dokument vydaný oznámeným subjektem.

Strojírenský zkušební ústav, s.p., (Engineering Test Institute, Public Enterprise) hereby confirms that it has carried out an assessment of the performance of the construction products in accordance with Item 1.4 (b), System 3, Annex V of Regulation (EU) No. 305/2011 of the European Parliament and of the Council of 9 March 2011 (Construction Products Regulation - CPR) as amended, and has determined the performance of essential characteristics of the construction products.

This Certificate is not a substitute for relevant document issued by Notified Body.

Brno, 2015-02-06

STROJÍRENSKÝ ZKUŠEBNÍ ÚSTAV, s.p. CZ

Ing. Tomáš Hruška
ředitel - *Director*

Strojírenský zkušební ústav, s.p., Hudcova 56b, 621 00 Brno, Česká republika
Engineering Test Institute, public enterprise, Hudcova 56b, 621 00 Brno, Czech Republic
www.szutest.cz

Strojírenský zkušební ústav, s.p.
(Engineering Test Institute, Public Enterprise)
Hudcova 424/56b, 621 00 Brno, Czech Republic
Testing Laboratory 1045.1, accredited by the Czech Accreditation Institute, Workplace 1

L 1045.1

TEST REPORT
30-12648/I/T

Product:	Wastewater treatment plants
Type designation:	TOPAS Plus 7
Customer:	TopolWater, s.r.o. Nad Rezkovcem 1114, 286 01 Čáslav Czech Republic ID No.: 26212943
Manufacturer:	TopolWater, s.r.o. Nad Rezkovcem 1114, 286 01 Čáslav Czech Republic
Responsible employee:	Ing. Michal Manhalter
Report issue date:	2015-01-20
Distribution list:	1 copy to the Engineering Test Institute (SZU) 1 copy to the Customer

This report may be copied in its entirety without written consent of the Engineering Test Institute. Partial copies are subject to approval. The results of tests and verifications only apply to the products tested

Strojírenský zkušební ústav, s.p.
(Engineering Test Institute, Public Enterprise)
Hudcova 424/56b, 621 00 Brno, Czech Republic
Testing Laboratory 1045.1, accredited by the Czech Accreditation Institute, Workplace 1

Step No.		10								
Measurement No.					2			3		
Date:		2013-12-03		η	2013-12-18		η	2014-01-02		η
Observed values:		Inlet	Outlet		Inlet	Outlet		Inlet	Outlet	
Wastewater temperature	°C	11.1	13.2		9.1	11.3		10.4	11.4	
Electric power consumption	KWh/day	1.70			1.70			1.70		
Daily flow	m^3/day	1.04			1.05			1.04		
COD	mg/l	1 880	49.7	**0.97**	840	42.4	**0.95**	1 730	47.4	**0.97**
BOD	mg/l	548	2.0	**1.00**	314	2.3	**0.99**	437	3.0	**0.99**
SS	mg/l	728	3.2	**1.00**	484	22.0	**0.95**	420	4.0	**0.99**
pH		7.7	7.7		7.9	7.7		7.7	7.0	
Ammonia nitrogen	mg/l	111.00	2.26	**0.98**	115.00	2.12	**0.98**	117.00	1.70	**0.99**
Kjeldahl nitrogen	mg/l	163.64	2.89	**0.98**	173.55	2.63	**0.98**	158.51	3.88	**0.98**
Total nitrogen	mg/l	164.00	6.31	**0.96**	174.00	7.05	**0.96**	159.00	36.60	**0.77**
Total phosphorus	mg/l	10.20	0.17	**0.98**	14.00	0.24	**0.98**	22.50	0.23	**0.99**

Average efficiency (under rated load)		
COD_{Cr}	96.8	%
BOD_5	99.4	%
SS	98.7	%
Total phosphorus	98.6	%
Total nitrogen	87.1	%
Ammonia nitrogen	97.6	%
Kjeldahl nitrogen	96.0	%
Average efficiency (under low load)		
COD_{Cr}	97.4	%
BOD_5	99.6	%
SS	99.3	%
Total phosphorus	98.7	%
Total nitrogen	89.4	%
Ammonia nitrogen	99.5	%
Kjeldahl nitrogen	98.9	%
Average efficiency (under overload)		
COD_{Cr}	97.3	%
BOD_5	99.5	%
SS	99.4	%
Total phosphorus	99.4	%
Total nitrogen	79.6	%
Ammonia nitrogen	99.9	%
Kjeldahl nitrogen	98.8	%
El. power consumption (under rated load)	1.76	kWh/day

Tested by: Ing. Jan Hořák Date: 2014-12-10 Signed:

Reviewed by: Ing. Michal Manhalter Date: 2014-12-10 Signed:

CE conformity marking
"WWTP TOPAS Plus 7"

CE	
TopolWater, s.r.o. Nad Rezkovcem 1114, 286 01 Čáslav, Czech Republic **14**	
EN 12566-3 + A2 Packaged domestic wastewater treatment plant for treatment of waste (domestic) water – Product's reference code (number): **TOPAS Plus 7** – Material: Polypropylene	
Effectiveness of treatment :	
Treatment efficiency ratios (at tested organic daily load BOD_5 = 0,42 kg/day)	COD: 97% BOD_5: 99% SS: 99% $P_{tot.}$: 99% $N_{tot.}$: 87% N_{NH4}: 98% $N_{Kjeldahl}$: 96%
Treatment capacity (nominal designation):	
– Nominal organic daily load (BOD_5)	0,42 kg/day
– Nominal hydraulic daily flow (Q_N)	1,05 m^3/day
Watertightness (water test):	Meets the standard
Crushing resistence:	Backfill: 0,00 m WET: 1,00 m
Durability:	Meets the standard
Reaction to fire:	E
Release of dangerous substances:	NPD

Operating manual

MATRIX - TOPAS PLUS.

EN12566-3 + A2 : 2014 Fully Certified

TOPAS

wastewater treatment plant with a control unit TOM

Firmware: 2.0007, updated: 2022-06-02

TOPOLWATER

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2. APPLICATION RANGE OF THE WASTEWATER TREATMENT PLANT

TOPAS wastewater treatment plants (WWTPs) are designed to treat wastewater from small sources of contamination that means from households, recreation centres and small businesses if the characteristics of these waters are as specified in Table 1. When used for other than the household type of wastewater, wastewater must be biologically treatable and its volume and BOD load should correspond to the capacity of the plant.

SUBSTANCES WHICH ARE NOT ACCEPTABLE WASTEWATERS

The following substances may not get into the inflow pipe of the WWTP unless they are part of wastewater in the volume permitted by water management regulations:

a. Wet wipes;
b. Radioactive substances;
c. Infectious substances;
d. Poisonous substances;
e. Caustic substances;
f. Explosives;
g. Herbicides;
h. Flammable substances, or substances which when mixed with air or water produce explosive, choking or toxic mixtures;
i. Petroleum substances in the quantity exceeding 20 mg per l of wastewater;
j. Other substances harmful to WWTP operators' health or safety
k. Rainwater.

PERMITTED LIMITS

The following table shows the limit values for the pollution of domestic sewage and basic civic amenities. The specific indicators given in the table should be monitored especially if the installed waste water treatment plant TOPAS provides operations and services assuming the content of these substances in waste water (e. g. car repair shops, medical facilities, laundries, dry-cleaners, meat industry, livestock production, oil stores etc.).

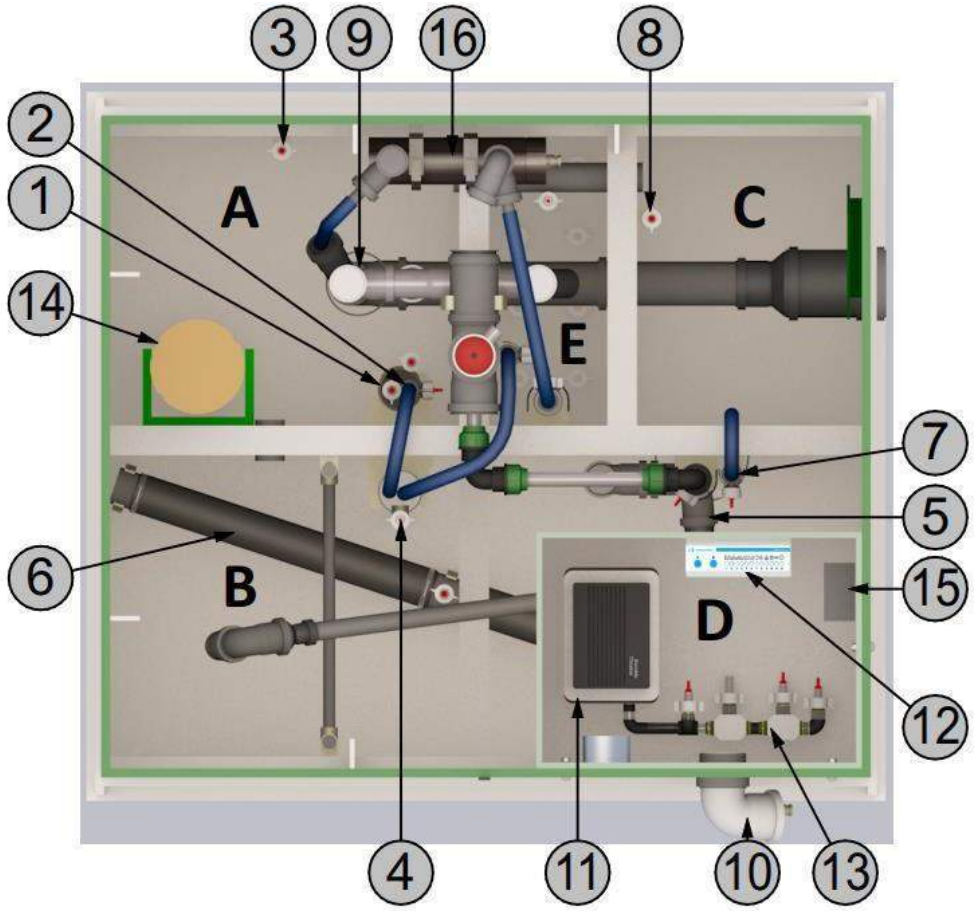
INDICATOR	PARAMETER	LIMITED VALUE	UNIT
Biochemical oxygen demand	BOD	150 - 500	mg/l
Chemical oxygen demand	COD	300 - 1000	mg/l
Total nitrogen	N_T	25 - 100	mg/l
Total phosphorus	P_T	5 - 20	mg/l
Water reaction	pH	6,5 – 8,5	
Suspend solids	SS	200 - 700	mg/l
Temperature	t	30°C	°C
Dissolved inorganic salts	DIS	1000	mg/l
Petroleum and petroleum products	TPH	5	mg/l
Grease	O&G	80	mg/l
Anionic surfactants	AS	10	mg/l
Chlorides	CL´	400	mg/l
Adsorbed organic substances	AOS	100	µg/l

Table 1: Limit values of indicators of polluted waste Water

3. BASIC DESCRIPTION OF THE WATER TREATMENT PLANT

The WWTP consists of four separate tanks:

- Inflow (accumulation) tank, pumping station
- Activation tank (bio-reactor)
- Sludge tank
- Sand filter (SF)



Description of tanks:	Standard equipment:	*Extra equipment:
A - Accumulation tank **B -** Activation tank **C -** Sludge tank **D -** Box for technology **E -** Sand filter	**1 -** Pressure probe in the accumulation tank **2 -** Raw filter with raw sewage air-lift pump **3 -** Aeration of the accumulation tank **4 -** Pressure probe in the activation tank **5 -** Decanter with a treated water container **6 -** Aeration of the activation tank **7 -** Desludging air-lift pump **8 -** Aeration of sludge tank **9 -** Outlet of treated water + Emergency overflow of the WWTP **10 -** Electrical cable connection **11 -** Blower **12 -** Control unit **13 -** Electrical valves	**14 -** Dosing container **15 -** Dosing pump **16 -** UV lamp

Figure no. 1: Ground plan of TOPAS

Functions of the respective tanks and the decanter in the WWTP are as follows:

INFLOW TANK (ACCUMULATION TANK)

Wastewater enters the WWTP by flowing in this tank. The inflow (equalising, accumulation) tank is highly important for the functioning of the WWTP.

The following processes occur there:

- Balancing the irregular inflow of wastewater;
- Drawing sewage to the activation tank which has operating water levels above the sewage inlet;
- Capturing and disintegrating rough impurities;
- Pre-treatment; and
- Wastewater de-nitrification.

ACTIVATION TANK (BIO-REACTOR)

This tank is the place where biological treatment itself is carried out using micro-organisms hovering in sludge. To stay alive, micro-organisms (activated sludge) need both organic pollution, supplied in wastewater, and oxygen, supplied in the compressed air by the compressor (blower) of the WWTP. Compressed air mixes the activated sludge with wastewater. The activated sludge is heavier than water. After the end of aeration, which is accompanied with a stirring of the content of the tank, the activated sludge forms a layer at the bottom of the activation tank, separated from the layer of treated water which is periodically drawn from the plant.

SLUDGE TANK

It is used for accumulating excess activated sludge which is produced during the treatment process in the activation tank and must be regularly drawn from the WWTP.

DECANTER

The decanter is a special, patented system which is used for drawing treated water from the activation tank. Treated water is drawn from the layer approx. 15 cm below the water level in the activation tank. The decanter consists of a decanter arm, with a movable (revolving) connection to a tank (via a vertical pipe) with a treated water air-lift pump.

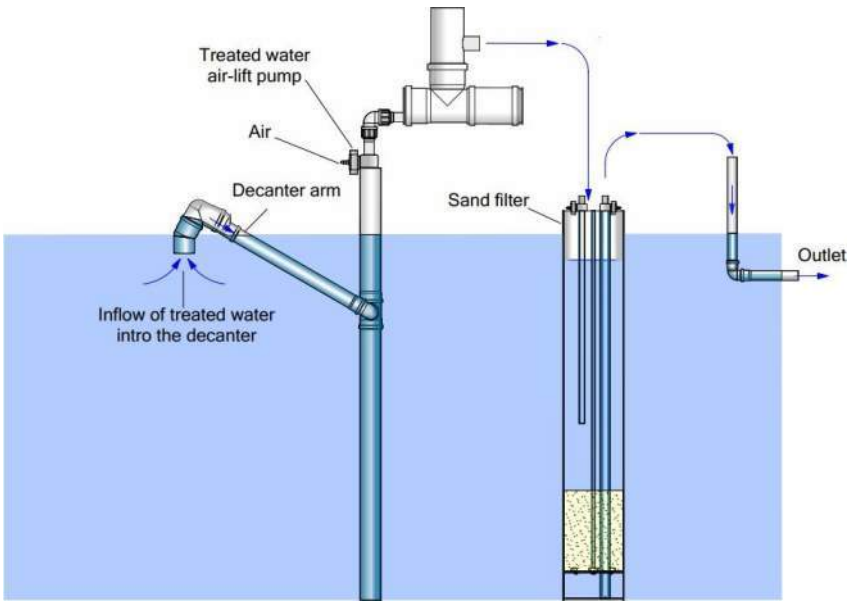


Figure no. 2: Principle of the decanter functioning

SAND FILTER (SF)

It is used for a mechanical fine cleaning of biologically treated wastewater which is drawn from the activation tank. Filtration through a sand layer captures fine sludge which has not been sufficiently separated during sedimentation from treated water.

4. TREATMENT PROCESS TECHNOLOGY

Wastewater treatment in the WWTP is performed in two stages:

- Flow (nitrification) stage
- Backward (denitrification, desludging) stage

An increased water level in the accumulation tank is a sign of a sufficient inflow of wastewater. This is a pre-requisite for the continuation of the flow stage, during which treated water flows out of the WWTP.

FLOW STAGE (NITRIFICATION)

Wastewater flows into the accumulation tank and is continuously drawn by the air-lift pump to the activation tank which is being filled from the default minimum water level to the default maximum water level. During the filling, the activation tank is being aerated, and biological treatment is thus carried out and ammonia oxidises (nitrification). When the activation tank is filled up to the maximum level, aeration is interrupted and sedimentation starts, i.e. sludge settles at the bottom and treated water is drawn via the decanter out of the activation tank. The quantity of treated water drawn off usually represents 10–15% of the volume of the activation tank. When the activation tank is not being aerated, air from the compressor is directed to the accumulation tank. Wastewater is pre-treated by aeration and mixing of the accumulation tank before it is drawn to the activation tank. During the nitrification the water level in the accumulation tank may vary between the minimum and maximum levels (or even up to the level of emergency overflow).

The flow stage is finished and changed to the backward stage if three conditions are met:

- The default minimum duration of the flow stage elapsed.
- The water level in the accumulation tank dropped below the default operating level. (It is a sign of a reduced inflow of wastewater.)
- The water level in the activation tank has not reached the maximum level.

If these 3 conditions do not occur concurrently, the flow stage continues even after a lapse of the default time. Each cycle of the flow stage consists of the following processes:

A. FILLING OF THE ACTIVATION TANK

The activation tank is aerated, water is drawn from the accumulation to the activation tank, and filtration on the SF is in progress (the draw-off of the filtrate). Usually, the sludge tank is also aerated. The filling time is primarily defined by the hydraulic delivery of the raw sewage air-lift pump (drawing water from the accumulation to the activation tank). The air-lift pump delivery grows with its sinking, i.e. with the depth of water in the accumulation tank. At an increased sewage inflow and the filled-up accumulation tank, the filling time of the activation tank from the minimum to the maximum water level is thus significantly shorter than when the accumulation tank is partly emptied. This secures a high hydraulic flexibility of the WWTP operation. When the maximum water level in the activation tank is reached, the filling of this tank stops and then sedimentation follows.

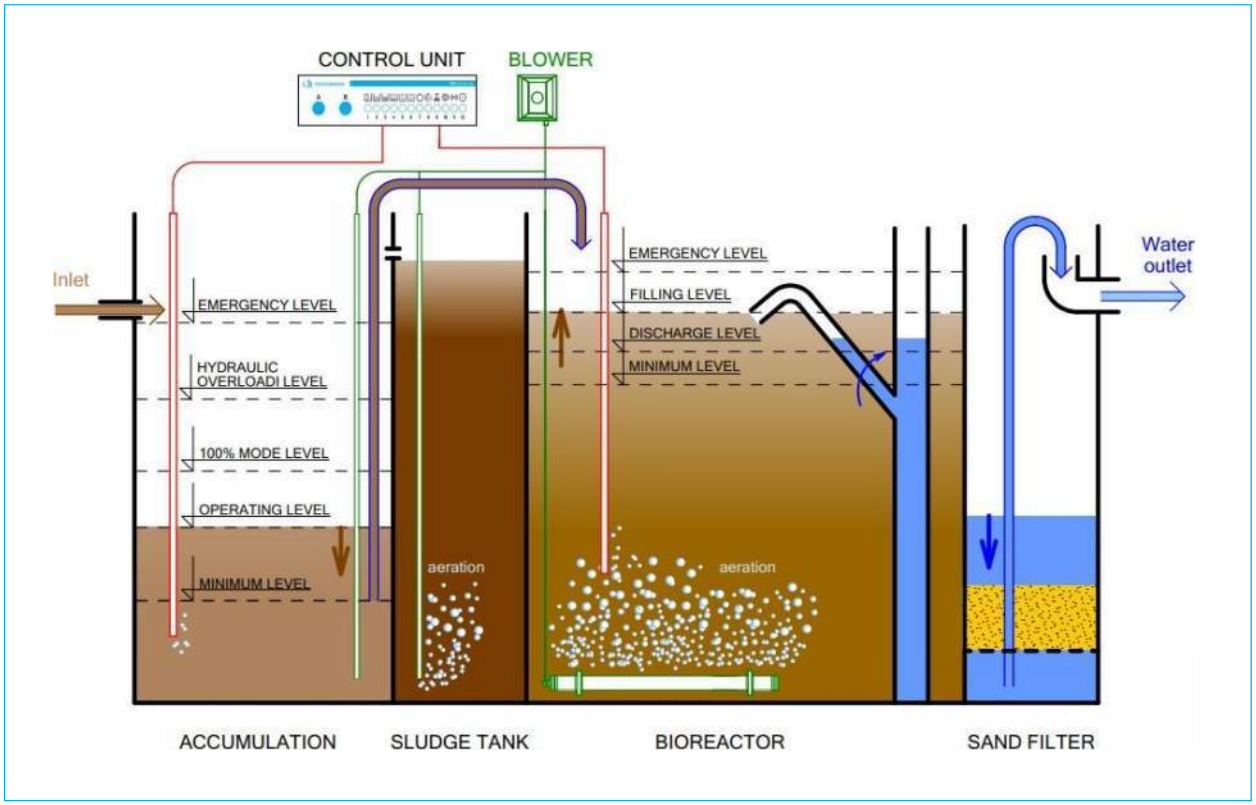


Figure no. 3: Flow (nitrification) stage – filling of the activation tank (bioreactor)

B. SEDIMENTATION

Aeration of the activation tank stops. Sludge settles at the bottom of the activation tank and treated water is thus separated from the sludge layer. The sedimentation process lasts for a default time (usually for 10 minutes). During that time, the accumulation tank is being aerated and wastewater pre-treated. SF and the sludge tank are without air supply, which means in standstill.

C. DESLUDGING

The accumulation tank is being aerated. The desludging air-lift pump is running in the activation tank. Excess sludge is being drawn from the activation tank to the sludge tank. The desludging causes drop of the water level by a defined layer (usually 5 cm). The desludging lasts until the defined drop of the water level in the activation tank is reached, however, no longer than for the defined desludging limit.

Then, the desludging stops (even if the water level in the activation tank does not decrease to the pre-set value) and the activation tank starts being drawn off.

D. DRAWING WATER OUT OF THE ACTIVATION TANK (DECANTING)

The treated water air-lift pump is in operation, being located in the decanter to draw water from the activation tank to the treated water container which has an overflow leading to the SF tank. In addition, the SF draining air-lift pump is in operation and the divider of sand filter is being aerated. When the minimum water level in the activation tank is reached, water stops being drawn out of the activation tank, which is followed by another filling of the activation tank.

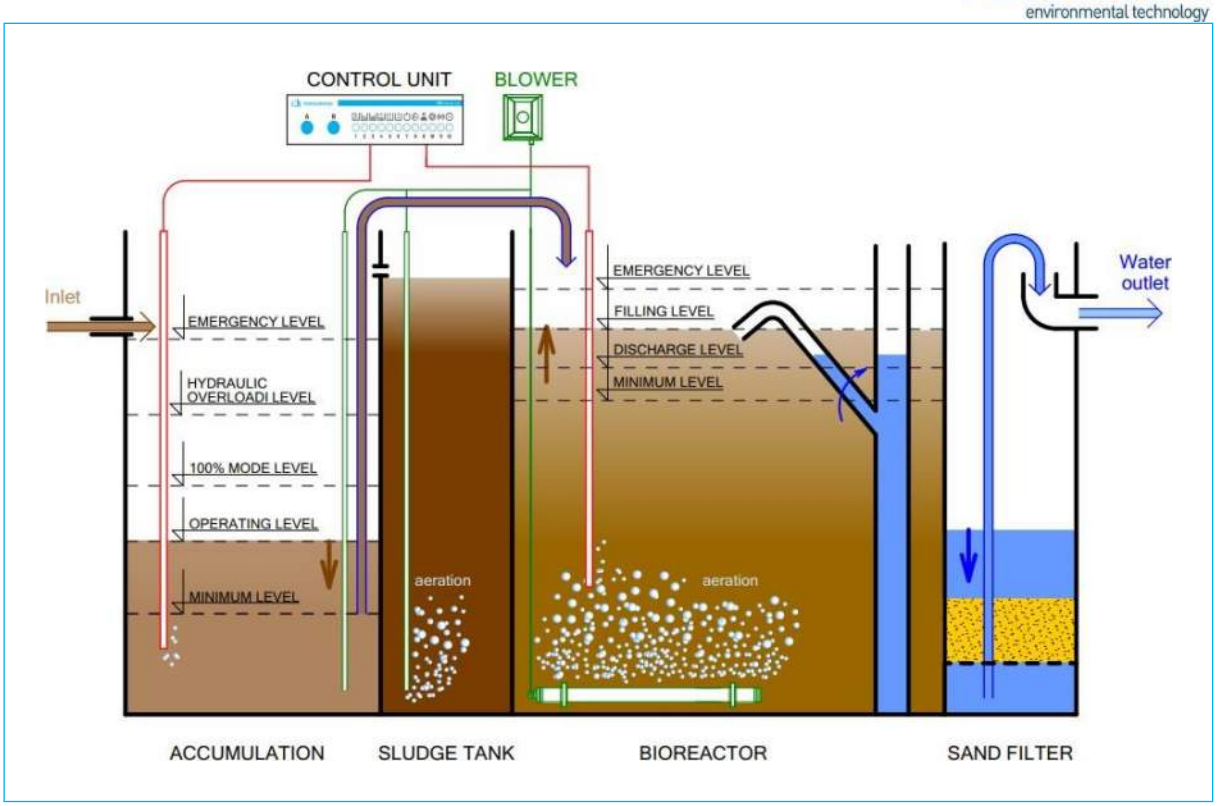


Figure no. 4: Flow (nitrification) stage – drawing water out of the activation tank (decanting)

The flow stage (nitrification) may last for the duration of one cycle (A–E) or multiple cycles as long as there is a sufficient amount of wastewater in the accumulation tank – the water level is above the pre-set operating level.

BACKWARD STAGE (DENITRIFICATION)

The backward stage starts with an interruption of the filling of the activation tank, when the water level in the activation tank is below the maximum level, whereas the water level in the accumulation tank is below the operating level and the minimum time of the flow stage elapsed. The backward phase starts with an interruption of the aeration in the activation tank. After the present time (usually 20 minutes) is desludging air-lift pump included in the operation. The nitrified layer with excess sludge is drawn from the desludging air-lift pump from the activation tank via the sludge tank to the accumulation tank. This results in lowering the water level in the activation tank and simultaneously in filling the accumulation tank. The backward phase lasts until the water level **does not rise above the default operating level in the accumulation tank.**

Completion of the backward stage starts another flow stage with filling the activation tank. At the same time, the duration of the flow stage starts being measured. Denitrification is a result of mixing the treated nitrified water in anoxic environment of the accumulation tank with a sufficient amount of organic substrate in raw sewage, when bacteria consume nitrate oxygen, liberating gaseous nitrogen to the air.

5. ADDITIONAL EQUIPMENT OF THE WWTP

SAND FILTER (SF)

The sand filter (Figure no. 6) is a separate tank with a divider. A sorted sand layer of approx. 40 cm, with a grain size of 1 – 3 mm, lies on a divider. Water permeates through the sand layer to the bottom of the SF, under the divider.

There are openings smaller than the sand grain size in the divider. Hydrostatic pressure pushes the filtered water, free of small solid particles, through the sand layer and divider to the treated water tank from which it is drawn to the outlet.

The difference between the water levels above the sand layer in the SF and in the filtered water container maintains overpressure necessary for the filtration process. The filtered water container is usually a vertical plastic pipe in which an air-lift pump is inserted, drawing the filtered water to the outlet. Filtration is in progress at the time the filling of the activation tank and the drawing water out of the activation tank (i.e. filling of SF).

The sand filter is being cleaned and desludged during the flow stage at the time of the . During the SF cleaning, compressed air is directed under the divider, goes through filtration openings to the sand layer, clarifies sand and brings turbidity to the surface. The volume of treated water (ca. 15-20%) is returned back into the accumulation tank. The control unit doesn't mention this volume. The actual volume of treated water is therefore about 20% less than the display shows.

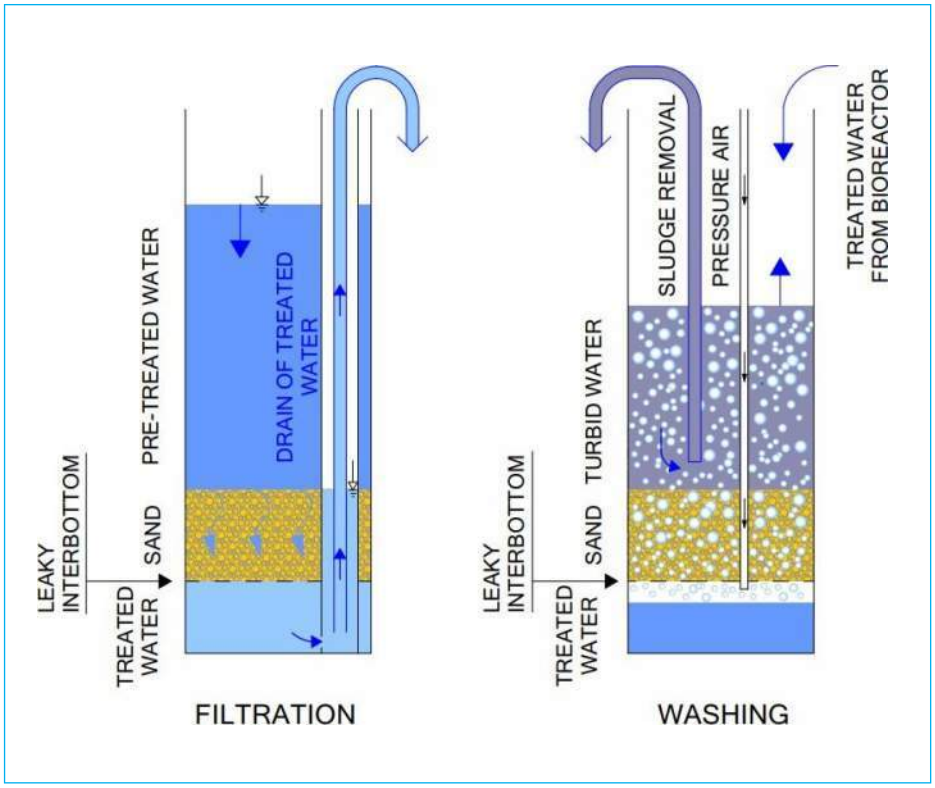


Figure no. 5: Technological diagram of the sand filter functioning

CHEMICAL ELIMINATION OF PHOSPHORUS

The WWTP is programmed to be ready for a controlled dosing of chemicals to eliminate phosphoric salts. The WWTP is retrofitted with a dosing pump and a coagulant tank. Depending on a sewage composition, a required phosphorous concentration at the outflow and a type of coagulant, a required concentration of coagulant per volume of treated wastewater is to be determined first, i.e. volume of chemical in 1 m^3 of wastewater. The control unit monitors the volume of water that was flown into the activation and accumulation tank during its filling from the minimum to the maximum water level. After the activation tank is filled to the maximum water level, the chemical is dosed in such a quantity to achieve, after mixing, the required concentration of coagulant.

Sedimentation thus does not occur immediately, but the filling continues together with the aerating of the activation tank for a pre-set time (usually 5 minutes) which is necessary for mixing the chemical.

A precise chemical dosing is thus provided even at various hydraulic load of the WWTP. This is followed by the next process of the flow stage – by sedimentation.

If the volume of the chemical storage tank and the delivery of the dosing pump are set in the control unit, the display shows the number of days that remain until the storage tank becomes empty.

The Topas-Plus unit has been tested for efficiency using the following different coagulant chemicals:

Polyaluminium Chloride – Al2O3

Aluminium Sulphate – Al2(SO4)3

Ferric Chloride – FeCl3

Ferric Sulphate – 41%Fe2(SO4)3

Depending on the chemical preferred the relevant dosing rates are programmed into the controller.

6. REGULATION OF THE WWTP OPERATION (DEPENDING ON THE VOLUME OF WASTEWATER)

AUTOMATIC MODE

When the WWTP is put into operation, data are entered in its control unit to include the area of the activation tank at the height between the maximum and minimum water levels and the design capacity of the WWTP, i.e. the maximum volume of wastewater which the WWTP is designed for. The control unit compares the actual volume of treated wastewater that was drawn from the activation tank with the design volume. If the actual volume exceeds 90% of the design capacity, the plant operates at 100% capacity, i.e. the blower operates continuously for 24 hours a day. If the actual volume of sewage is lower 90% of the design capacity, the oxygenating activity of the WWTP starts being regulated (decreasing).

Regulation of the WWTP operation consists in that at the filling of the activation tank, which is accompanied with its aeration, the blower switches on and off automatically at pre-set intervals depending on the amount of inflowing wastewater. The pre-set minimum duration of the nitrification stage thus extends, because the time when the blower is off is not counted in the total duration of the flow stage. At the backward stage and at the time of other processes of the flow stage, the blower does not switch off. The regulation stops at the reduction of the WWTP capacity at 10%. The blower is only 12 minutes in operation during the 120-minute interval, being off for the remaining 108 minutes. If the inflow of sewage stops entirely and the minimum duration of the flow stage is set e.g. at 6 hours, the filling process, consequently the nitrification stage, takes approx. 50 hours. The system switches only then to the backward stage. After the re-started inflow of sewage the WWTP capacity increases gradually. However, if the inflow is so extensive to raise the water level in the accumulation tank above the pre-set limit, the WWTP switches to 100% capacity immediately.

For holiday homes with a complete cut off of the inflow, it is advisable to adjust the standard factory settings as follows:

Basic. reg. interval:	1 day
Acc. operating level	95 cm
Acc. level P = 100%:	105 cm

In case of holiday homes, it is assumed that the wastewater treatment plant is in maintenance mode before the wastewater inflow. The blower switches at intervals of 2h for 12min. and after about 50 hours the backward phase is realized. If the inflow is restarted, the plant must react immediately. For these reasons is set the level 100% low mode so that even a small inflow causes an increase in the level in the accumulation tank and the plant is put into full operation, at least on completion of the plant's operating day. At the registration interval of 1 day, the next day of operation the plant will work according to the load of the previous day. If this is not enough, the level will rise again and then temporarily 100%. After the inflow is interrupted, the plant continues to operate for one more operating day according to the inflow of the previous day. It then goes into hold mode until the inflow is restored.

The actual volume of wastewater which is compared with the design capacity of the WWTP is assessed based on the volume of the most recent day or as an arithmetic mean of several recent days (3 days are usually set).

The accuracy of the measurement is given by the level sensing accuracy in the activation tank by the pressure probe. The level sensing accuracy is approx. ± 15 mm. In individual treating cycles, errors can be summed and canceled. Because the measurement error can be up and down. in the total, longer-term, summation measurement, it is possible to realistically count on a statistical measurement error of 15 mm.

For smaller plants (up to approx. 15 PE), the set level difference is usually 200 mm. Then the measurement accuracy and thus the recording of the amount of treated water is 5%. For larger sizes of WWTP the level difference is usually set to 300 - 350 mm. Then the measurement accuracy is about 4%. The actual measurement accuracy can be verified by comparing the manually measured water depth in the reactor with the depth shown on the display.

CAPACITY CONTROL DEPENDING ON WASTEWATER CONTAMINATION

Depending on wastewater contamination, the contamination coefficient is set via the display. At a standard (design) contamination, the coefficient is set up at 10/10. The WWTP can be entered by heavily organically polluted waters (water brought from septic tanks, water saving, food-processing industry) as well as diluted waters (waste of water, groundwater). Regulation of WWTP capacity depending on the wastewater volume is not optimal at these situations. Therefore, the operating time of the blower regulated depending on the measured volume of wastewater is additionally multiplied by the contamination coefficient. If water is heavily contaminated, the coefficient is set higher than 10/10 and the operating time of the blower calculated based on the wastewater volume extends. At diluted wastewater, on the contrary, the contamination coefficient is set up lower than 10/10 and the operating time of the blower is reduced. **For case of increased wastewater contamination than is the standard, just to be sure the coefficient is factory set up at 13/10**.

MANUAL MODE

In the situation when the WWTP has been switched off or out of operation for a rather long time, the blower needs to operate continuously for several days. Then the 100% run is set manually, i.e. the blower does not switch off. This also applies to heavily contaminated waters when the maximum oxygenating capacity of the WWTP has to be utilised permanently.

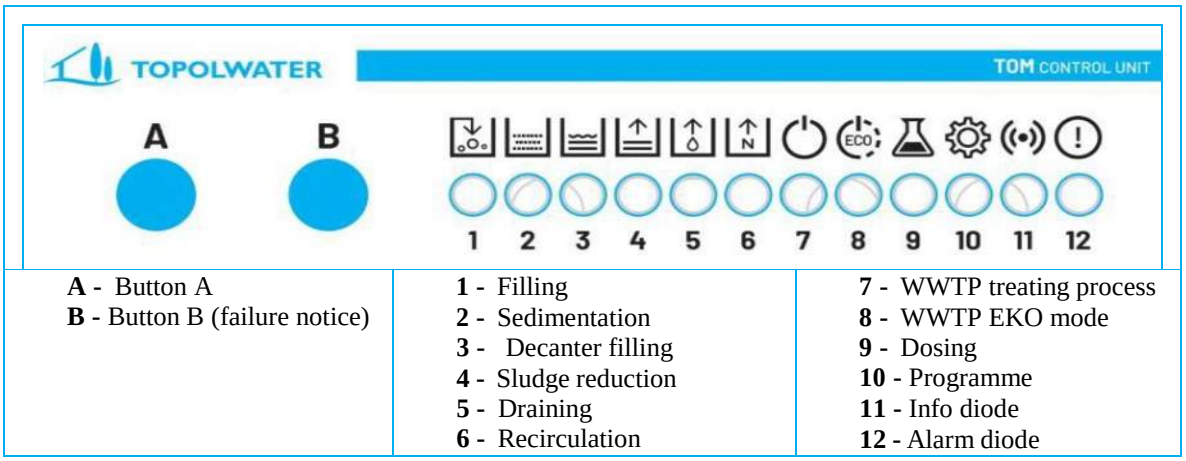
PUTTING THE WWTP INTO OPERATION AND ELECTRICITY FAILURE

After a power supply cut and at starting up the WWTP, the water level in the activation tank must be measured first. If the water level is below the maximum level, the filling process starts and the start of the nitrification stage begins to be measured. The filling process ends with the maximum water level reached or after 10 minutes if the maximum water level is reached earlier. **After the power supply is restored, the WWTP starts always working in the automatic mode!**

WATER LEVEL MEASUREMENT

The control unit measures the water level in the accumulation tank and the water level in the activation tank separately by pressure sensors. Measurement is conducted with two pressure probes. Each of them is inserted in either of the tanks. Hydrostatic pressure is transferred from plastic tubes located in tanks via 2 thin small hoses to the control unit. For the hydrostatic pressure transfer to be reliable, a small amount of air is directed to the tubes from the blower. The compressed air distribution to sensors must be tight. If the blower is in operation and sensors detect no pressure, the control unit signals a failure of the blower.

7. CONTROL UNIT



A - Button A **B -** Button B (failure notice)	**1 -** Filling **2 -** Sedimentation **3 -** Decanter filling **4 -** Sludge reduction **5 -** Draining **6 -** Recirculation	**7 -** WWTP treating process **8 -** WWTP EKO mode **9 -** Dosing **10 -** Programme **11 -** Info diode **12 -** Alarm diode

Figure No. 6: Control panel description

CONTROL PANEL OPERATING

BASIC DISPLAY

The diodes (LEDs) always lit according to actual process in compliance with the control panel at the starting process:

LED	Signalization	Process description
1	**On**	The **filling phase** is in progress
2	**On**	The **sedimentation phase** is in progress
3	**On**	Inactive
4	**On**	The sludge reduction phase is in progress
5	**On**	The **drain phase** – pumping of treated water
6	**On**	The **recirculation phase** is in progress
7	**On**	WWTP operates in a treating mode in the range of **90 - 100%** output**,** ie the blower operates 24 hours/day without shutting down
8	**Flashes**	WWTP operates in maintenance mode **below 10%** of output
8	**On**	WWTP operates in Eko mode, ranging from **10% to 90%** of output
9	**On**	Chemical dosing in progress
10	**On**	Signalling of additional equipment switched on, e.g. UV lamp, pump, etc.
11	**On**	Information signalling, e.g. network connection (WiFi)
12	**Flashes**	**Warning or non-standard action** during treating process (WWTP check recommended)
	On	**Serious error** - immediate check of the WWTP is necessary, there is a risk of outflow of untreated water

Table 3: Meaning of individual LEDs signalling

SIGNALIZATION OF DEFECTS (LED FLASHES) AND (LED LITS)

Emergency or malfunction in WWTP is indicated by LED 12 (see Table 3). If:

- LED 12 flashes - this is an **emergency**

- LED 12 is on - this is a **malfunction.**

If LED 12 is on or flashing, we can identify the type of fault state by **pressing the "B" button**. The type of emergency or malfunction can then be determined according to the following table.

„12" ON + PRESS „B"

Defect type	Error	LED	State	Cause	Method of removal
Emergency	**E002**	-	-	Electricity power on	-
	E 104	**1**	**Flashes**	Raw water air-lift pumpdefect	- Remove and clean the raw water air-lift pump with the primary dirt filter if necessary
	E 105	**8**	**Flashes**	The increased level in the accumulation tank lasts longer than the set interval - Danger of drainage untreated water from theWWTP	- Check the volume of wastewater and the raw water-air lift pump function
	E 106	**4**	**Flashes**	Recirculation stage lastsover a max. set interval– defect of excess sludgeair-lift pump	- Check the excess sludge air-lift pump function – remove and clean
	E 107	**4**	**On**	Desludging stage lasts over a max. set interval –defect of excess sludge air-lift pump	- Check the excess sludge air-lift pump function – remove and clean
	E 108	**5**	**Flashes**	Emergency water level inbioreactor - increased wastewaterinflow - long interval of postaeration	- Check the function of decanter - Reduce post aeration interval -
	E 110	-	-	Air pressure drop in theaccumulation tank	- Check the air supply to the sensor for leaks (the sensor must be bubbled through)
	E 111	-	-	Air pressure drop in thebio-reactor	- Check the air supply to the sensor for leaks (the sensor must be bubbled through)
	E 130	**9**	**On**	Dosing container is empty	- Fill in dosing container
	E 131	**9**	**Flashes**	Filling in dosing containergives out	- Fill in dosing container
	E 150			Critical temperature ofcontrol unit	- Check air inlet into the technical box
	E 155			Low voltage of backupbattery of control unit	- Check the battery
Malfunction	**E 001**			Electricity power off	-
	E 101	**1**	**On**	Emergency water level inaccumulation tank - emergency of outflow of untreated waste water: - increased	- Check the volume of wastewater - Remove and clean the raw water air-lift pump with the primary dirt filter

				- clogged raw sewage air-lift pump	- Check and, if necessary, clean the regulation nozzle on the air supply to the raw water air-lift pump
	E 102	**2**	**On**	Air pressure drop: - blower failure - leakage in air pressure distribution systems	- Check or repair the blower (in case of overheating, the blower is switched off by a thermal fuse until it has cooled down.) - Check the air supply to the sensor for leaks (the sensor must be bubbled through)
	E 103	**5**	**On**	The drainage stage lasts over a max. set interval - the decanter failure	- Remove, check and clean the decanter
	E 109	**8**	**On**	In the long term (more than 7 days) the treatment plant is overloaded above its design capacity	- Reduce wastewater and its pollution
	E 003			License is not valid (more than 10 day is WWTP overloaded 200% over the designed capacity)	-
Information					
	E131			Dosing container is nearly empty	- Fill in dosing container
	E151			External fault of input on D1 (230V)	-
	E152			External fault of input on D2 (5V)	-
	E153			External fault of input on D3 (5V)	-
	E154			External fault of input on D4 (5V)	-

Table 4: Defects scheme

Pressing the "B" button for 2 seconds clears the specific error that is lit. If the error is not corrected, the fault will be signalled again. The display returns to the basic state after 30 seconds from the first press!

DISPLAY OF OUTPUT STATUS – OPERATION OF MACHINES

When the **"A" button is pressed**, energized (running) devices light up:

1 - Blower 1
2 - Inactive
3 - Valve V 1
4 - Valve V 2 – treated water
5 - Inactive
6 - Inactive
7 - Dosing pump
8 - UV lamp – if installed- Inactive

60 seconds after the last press or by pressing the **buttons "A" and "B" together**, the control panel returns to the basic display.

CHECKING THE WWTP FUNCIONALITY

Pressing **the "A" button** and then pressing the **"B" button repeatedly** will switch the phases and thus check the functionality of the device. In this mode, repeated pressing of the "B" button allows switching of the WWTP between the individual phases to check the function (see Table 3), ie 1x Filling, 2x Sedimentation, etc.…. The selection is confirmed by 3 seconds without pressing "B". At the same time, the active option is signalled by a fast flashing diode for a particular option. After 30 seconds, the plant returns to its original state.

Diode nr.	Ongoing phases	Process description
1	**The filling phase**	The bioreactor is aerated and filled (the raw water air-lift pump works), the sludge tank is aerated **Variant with sand filter**- sand filter air - lift pump pumps treated water into the outlet
2	**The sedimentation phase**	The bioreactor not works, the blower is off
3	**The filling of decanter phase**	The bioreactor not works, the accumulation is aerated, the desludging air-lift pump works
4	**The sludge reduction phase**	The bioreactor not works, the accumulation is aerated, the excess sludge air-lift pump works
5	**The drain phase**	**Variant without SF** – the treated water air-lift pump works, the bioreactor not works, the accumulation is aerated **Variant with SF** – the bioreactor not works, the accumulation not works, the treated water air-lift pump works, the sand filter is aerated and drained
6 - 12	**Not used**	

Table 5: Testing of WWTP functionality by repeated pressing of button „B"

Attention! When switching on „3"– the drain phase without previous sedimentation for at least 10 min, the sludge mixture is drained into the treated water outlet.

WIFI SETTING

WWTP CONNECTION

TOPAS WWTP enables well-arranged setup and control via Wi-Fi application. Any device with OS Android or Windows can be used for control and you will choose connection to WiFi network of WWTP, SSID: Topas – serial number, **password: tom123456**.

If you do not have installed the application it is possible to access the WWTP directly by entering the address into the browser. Please see link: **http://www.topol.tom**
This address opens the WWTP baseline. There is information about the WWTP operation on this page.

It is also possible to download the application to device with Android system for WWTP control from **Google Store.** The application is called TOPAS and the logo is as follows.



8. INSTALLATION INSTRUCTIONS

BASIC DATA

The TOPAS WWTP is a complete free-standing plastic tank with an external dimensions of 1.20x1,40 m and a total height of 2.3 m. The WWTP is usually installed in an excavation, so that its lid is placed approx. 100 mm above the adapted ground securing the WWTP against rainwater penetration.

Just below the lid, the blower is vented through a DN 60 mm pipe, which must always be safely above the ground and secured against the ingress of rainwater. The WWTP is equipped with a DN 110 mm outlet pipe. The outlet consists of a smooth pipe end.

The inflow is made on site when the WWTP is installed or on the basis of specific order it is possible to make the inlet in the factory. The inflow is fed into the accumulation tank of the WWTP, which also has the function of a pumping station. It is therefore possible to install the inflow at different levels according to the depth of inflow sewer in the range of 0.5 - 1.4 m. For installation details see the Technical Sheet.

When ambient temperature is below 5°C, the WWTP must be handled with increased caution (transport and installation). When the temperature is below -5°C, we recommend not performing any handling of the WWTP at all.

Persons carrying out the delivery and installation of the plant must be provably trained in fire regulations; the plant shall be operated in compliance with the legal regulations valid at the place of installation.

To install the WWTP in an excavation the customer must have necessary machinery available.

INSTALLATION PROCESS

Under common foundation conditions with the groundwater level below the foundation joint, shall be made an excavation with dimensions of approximately 1.3 x 1.3 m and a total depth of approximately 2.4 m. At the bottom of the excavation, shall be a compacted gravel sand bed with a thickness of min. 150 mm. It is suitable to stabilize the sand sub-base "dry" with cement or dry concrete mixture. In the case of an unstable subsoil, the foundation concrete is set up and reinforced by a welded steel mesh as required.

The substrate under the WWTP must in all cases be rigid and stable. The WWTP is installed on the prepared substrate. It can be fitted manually (the WWTP weighs about 115 kgs) or better by mechanization.

In the case of machine installation, the handles in the upper part of the WWTP are used. During installation it is necessary to ensure that the substrate under the WWTP remains clean without stones, etc.

The WWTP must be installed with an accuracy of ± 50 mm. After the plant installation the horizontal position of plant must be checked by a spirit level on the plant ceiling.

The horizontal level is checked by a spirit level on the lid.

Subsequently, the sand or gravel-sand backfill up to the height of 300 mm above the plant bottom must be done. The backfill must be around the entire excavation area.

A round hole in the WWTP is usually cut with a punch on a drill at the height of the inflow pipe. The hole is sealed with a rubber ring (supplied), into which the inlet pipe is fed.

If we know the exact height of the inlet, the inlet can be made before the WWTP is installed in the excavation. The inlet can be made by the manufacturer or distributor´s service. The lower the inflow, the smaller the equalizing volume of accumulation. It is therefore preferable for the WWTP to have an inflow higher. The accumulation tank is pumped up to a depth of 0.7 m above the bottom of the WWTP (approx. 1.6 m below the ground). The accumulation level may temporarily rise above the inflow level before the water is pumped into the reactor. The maximum level in accumulation is set by a safety overflow to a height of 1.45 m above the bottom of the WWTP.

Subsequently, the WWTP is filled with water to a depth of approx. 1.0 m and then it is covered with sand or the original "swapped" soil. The backfill material must be without sharp gravel or stones of dimensions larger than approx. 10mm which could damage a plastic tank wall.

The backfill under the inflow and outflow pipe must be always compacted (min. 100% PS) gravel-sand at the entire height of backfill from the plant bottom up to pipe vertical alignment. Otherwise the inflow or outflow pipe could be damaged when the backfill is settling down.

INSTALLATION OF PLANT BELOW THE UNDERGROUND WATER

These rules also apply in cases where increased groundwater levels occur only occasionally. It is essential to ensure a stable sub-base under the WWTP at all times. The bottom and walls of the WWTP are designed to the buoyancy of 1m of water it means 1,3 m under the terrain.

If the excavation is made at a time when the ground water level is below the foundation joint, it is possible to set up a 100 mm thick sand sub-base and an iron mesh reinforced concrete of 150 mm thickness directly on it.

If the WWTP is installed at a time when the ground water level is above the foundation joint, first it is necessary to make a drainage layer of gravel thickness of approximately 300 mm, with a depression for a pump to reduce the level below the foundation concrete.

Then the base concrete reinforced with iron mesh is made and after its hardening the WWTP is installed.

After the WWTP has been installed, the groundwater level will be lowered below the base concrete and the WWTP should be concreted to a height of approx. 300 mm above the base concrete. The concreting must be done directly on the WWTP casing. The bottom of the tank exceeds the WWTP casings by approx. 50 mm. This overhang trapped in the concrete prevents the WWTP from flooding with ground water buoyancy. Subsequently, the WWTP is filled with water to a depth of about 1.0 m and covered with compacted gravel.

COMMISSIONING

After connection to the inlet and outlet pipes, the WWTP is filled with water. The accumulation tank - 0.7 - 1.2 m. The activation tank - between the lines on the casing of the sludge tank 1.6 - 1.8 m. Then the fixation of the decanter and the blower is released and the connection to the el. energy. The container of treated water of decanter is filled with treated water (approx. 3 l) until the arm of decanter is dropped. Only the inner bend of the elbow at the end of the decanter remains above the surface.

CONNECTION OF THE WWTP TO THE POWER NETWORK

The TOPAS WWTP is equipped with a blower with a power input of 80 W and a voltage of 230 V. Connection from the property is carried out with a CYKY 3 J x 2.5 cable to the power supply box.

A fault indication (230 V) is also carried into this supply box. The CYKY 3 J x 1.5 signal cable is connected to a free terminal block, black live wire for fault indication. The fault signaling is solved by the customer individually by a cable with 230 V connection. It can be solved by a garden lamp next to the WWTP or by placing the cable(230V) in another place where light or sound signaling is placed. It is already el. installation of the WWTP complete and it is not allowed to interfere with it under warranty.

The WWTP of capacities up to 40 PE are retrofitted with compressors for 230 V, larger types for 380 V.

TOPAS WWTPs are designed to be permanently connected to the fixed wiring of mains voltage. The fixed wiring of the TOPAS WWTP must have an in-built device for switching it off – a main switch, adequate protection and a security element – the current protector with the release current of 30mA.

The electricity connection and the connection of the real estate with the main switch, protected by the current protector, is not part of the WWTP delivery and are carried out separately for each construction.

Maintenance and repairs of the TOPAS WWTP wiring may be carried out only by a qualified dedicated company or an authorized person with the necessary electrical and electronic qualification, while it is vital to take into account all the advice and warnings mentioned in this Operating Manual. Installation must be performed in compliance with the current standards and regulations!

It is prohibited to carry out repairs and maintenance of electric devices of the TOPAS WWTP in adverse weather conditions (rain, snow)!

9. SANITARY REQUIREMENTS

VENTILATION

Air from outside is drawn inside the WWTP and it is expected that venting will go through the sewerage inflow pipe to the area above the roof of the building. If the sewerage system is not vented (in old buildings or when a vacuum valve is used on the last floor of the house), the WWTP is vented to the outflow piping or to the surroundings, which is not an appropriate solution. During a regular operation the WWTP does not smell bad, because anaerobic processes are not in progress there.

NOISE

Noise levels of blowers are listed in the operating manual of each blower. The blower is under the insulated lid of the WWTP, therefore the running of the WWTP with membrane blowers is almost noiseless.

10. PUTTING THE WWTP INTO OPERATION

PRINCIPLES FOR THE WWTP CORRECT INSTALLING, COMMISSIONING AND RUNNING-IN

When installing the WWTP, instructions must be observed that are specified in the Technical Sheet of the respective WWTP, particularly with regard to the necessity to place the WWTP on an adapted ground and filling it with water when backfilling the plant.

At the commissioning of the WWTP water in the activation tank must be between the minimum and maximum level, i.e. it must be at least 10 cm above the movable connection of the decanter arm and the vertical plastic pipe. The decanter arm must be released from the fixed transport position.

After connecting to the electricity and to the sewage inflow piping, the WWTP starts its normal operation. Unless the activation tank is implanted with activated sludge from another WWTP, the running-in period of the WWTP is about 1 month long. The initial fine sludge, mostly light-brown coloured, appears after approx. 10 days of operation and after that time improvement of out flowing water can be already seen. Subsequently, the sludge in the activation tank becomes thicker and usually turns darker, even to a dark-brown colour.

Further improvement is both in treatment and quality of outflowing water. After the running-in period, the water out flowing from the plant is absolutely clear and odourless.

Until the sludge in the activation becomes thick enough (14–30 days), can be a considerable amount of foam in the activation tank. It is caused by use of detergents in the household. With the growing concentration of sludge in the activation tank the foam gradually disappears.

During the running-in period of the WWTP (approx. 1 month), using detergents in the household should be reduced and most importantly, using the washing machine and dish-washer should be reduced, as it utilizes chemicals increasing pH of wastewater.

To speed up the running-in period of the WWTP, the activation tank is implanted by an activation mixture from another wastewater treatment plant. Sludge needs to be slowly poured into the accumulation tank from which it is gradually drawn to the activation tank through the primary dirt filter. If the sludge is active (live), its processing will take several days only.

Sometimes it may happen that imported sludge cannot adapt to a composition of sewage different from that in which it had been formed, and then it dies and the processing lasts for rather a long time. This situation does not happen frequently; however, it can be neither avoided nor foreseen.

The run-in WWTP is then sufficiently resistant against all chemicals used in households in usual quantities, including all types of washing powders. In principle, the usually marketed should be only such products which are fully biologically degradable.

Bigger types of plants are activated by imported activation mixture from another plant. But the imported sludge must not be dead sludge from a sludge tank but always activation (live) mixture.

The end of the running-in period and proper functioning of the plant are checked by an activation-tank sample taken at the moment when the activation tank is filled up.

CHECKING THE SLUDGE VOLUME IN THE ACTIVATION TANK

If the sludge occupies less than 1/3 of the volume of the vessel, the processing in the WWTP has not ended yet. If the sludge quantity is larger, desludging does not run correctly or the sludge tank is already filled up. It means the WWTP is overloaded and requires desludging.



After taking the sample



After 5 minutes



After sedimentation

A sample of the activated mixture should be taken to a transparent vessel of 0.2 to 1 litre and let resting for about 30 minutes. After this time the activated sludge remains settled at the bottom with a layer of clear water above. The line between clear water and sludge must be distinctly visible. The volume of sludge should be of about 30% of the content of the vessel and clear water makes up about 70%.

Figure no. 11: Checking the sludge quantity in the activation tank

11. WWTP OPERATION AND MAINTENANCE

Operation, cleaning and maintenance of the WWTP is made as simple as possible. At normal wastewater, the WWTP does not require any adjustment and works in the automatic mode depending on the actual volume of wastewater. All potential defects, except for excess sludge in the WWTP, are signalled by the control unit. If a defect occurs, instructions in the Chapter no. 20 is to be followed (Chart of potential defects, their causes and methods of their removal). Standard preventive maintenance of the WWTP can be recommended in the intervals specified in the table below.

Once a day	- Check of sound or light signalling of the proper operation of the WWTP
Once a week	- Visual check of quality of treated water and of the overall functioning of the WWTP – by uncovering the lid
Once in 6 months	- Cleaning the dust filter of the blower - other actions as per manufacturer's operating manual - Checking the sludge concentration, or desludging of the sludge tank - Checking, or cleaning the primary dirt filter with the raw sewage air-lift pump
	-
As needed or once in 2 years	- Cleaning the calibrated nozzles in the air-lift pumps and air supply to the pressure probe - Cleaning air-lift pumps - Cleaning the decanting system - Cleaning the surface of the accumulation tank from plastics and fat
Once in 2 years	- Preventive replacement of membranes in the membrane compressor
Once in 3 years	- Emptying the inflow and activation tank entirely and cleaning them from mineralized sludge
Once in 10 years	- Replacement of aeration elements (carried out by a service engineer)

Table no.6: Intervals of WWTP maintenance

In terms of maintenance and servicing it is generally applicable that all the technological components of the WWTP can be easily removed and cleaned outside the plant (except for the aeration system in larger types of the WWTP). When mounting them back, it is necessary to keep the original location, connection and position of all the removed and maintained components.

Any handling of the decanting system requires the decanter as well as the treated water container to be filled with clean water!

The WWTP operation is fully automatic and does not require any adjustment or setup. Occasionally the proper WWTP operation should be checked visually by uncovering the lid. Operators of the WWTP are obliged to keep records about maintenance actions. Table no. 11 is designed for keeping these records. Activities described as maintenance do not fall under the warranty duties of the manufacturer.

DESLUDGING THE WWTP

The WWTP is equipped with a separate sludge tank. The sludge tank can be emptied periodically or when the sludge concentration in the activation tank exceeds 40 – 50% of the volume after 15-minute sedimentation. When the sludge tank is full, sludge returns back through the accumulation tank to the activation tank and consequently the sludge concentration in the activation tank increases. Desludging of the sludge tank is carried out by a sludge pump, in larger WWTPs by a septic truck preferably. During the desludging process, the sludge tank is emptied entirely. If the sludge tank is aerated, the sludge drawn from the sludge tank is aerobically stabile (biologically inactive) and it can be used as an excellent fertilizer for trees or a similar type of vegetation or poured into the compost. However, it is not secure bacteriologically. If there is a requirement for the sludge to be bacteriologically safe, it must be mixed with lime (lime powder preferably) still in the sludge tank. Disinfection is carried out by

increasing pH. At desludging by a septic truck which has a larger capacity than that of the sludge tank, it is useful to desludge the equalizing (accumulation) tank too, where a sludge layer is usually approx. 0.5 m above the bottom. This will extend time until next desludging.

SF WASHING

Under normal operation the SF is cleaned automatically before each discharge of the activation tank during the decanter filling. Compressed air is led under a double bottom and it pervades the filter openings into the sand layer which is stirred and it brings turbidity on the surface.

If a considerable amount of sludge leaks (e.g. due to a neglected desludging of the WWTP) and the sand filling gets clogged, the SF must be cleaned manually with pressure water. Sludge usually clogs only the surface layer of sand (less than 10 cm). Therefore, sometimes it is enough to disrupt this layer mechanically by tube into which is pressure water supplied. If it is necessary to wash the entire layer of sand, the SF washing process using the pressure water is as follows:

- The air hose is removed from the tube used for SF washing.
- The released end of the tube is attached to the pressure water hose.
- Water is turned on flowing into the hose.
- The volume of water is controlled so that pressure does not exceed 50 kPa (5 m of water column).
- Sand surface is disrupted mechanically (with a rod, a lath, etc.).
- Turbid water is let leave the SF via emergency overflow which leads it to the accumulation tank.
- SF is being washed for several minutes, depending on the contamination level.
- At the end of washing water need not be entirely clean, because at the proper operation SF will clean in the subsequent normal operation.
- Then we put the WWTP into normal operation, i.e. we disconnect pressure water and re-connect the air hose.

12. EVALUATING THE WWTP FUNCTIONING BY QUALITY OF OUTFLOWING WATER

When the WWTP is operated correctly, the out flowing water is clear, transparent and odourless. If these criteria for the out flowing water are not fulfilled, it may imply the following defects.

TURBID OUTFLOWING WATER

In such case water is incompletely treated (cleaned).It usually occurs during the running-in period before sufficient amount of activated sludge is created. It may take up to 1 month. Another reason may consist in the worsened chemical quality of wastewater, e.g. decreased pH, temperature drop, or chemical contamination by e.g. use of strong washing powders, or by wastewater from the dishwasher.

This trouble will gradually disappear if everything works technically in a standard manner. Permanently turbid out flowing water is a sign of material overload of the WWTP, or a lack of oxygen in the activation tank which may be caused by leakage in the air distribution or excessive reduction of the plant capacity due to incorrect setting of the contamination coefficient. Typically, a lack of air manifests itself by bad smell.

FOAM FORMING ON THE SURFACE OF THE ACTIVATION TANK

DETERGENT FOAM

Such foam is thin, in most cases white and is caused by detergents in cleaning agents. Biological degradation of these chemicals is relatively rapid. The pre-requisite is that there is enough biological sludge in the WWTP.

Occurrence of detergent foam is a consequence of either a small amount of sludge, or an immense amount of detergents used in the household. The small amount of sludge is usually reason for the foam forming soon after

the WWTP has been put into operation or during a prolonged low material load of the WWTP and the 100% running mistakenly manually set, when the biological sludge is suffering a lack of nutrients and gradually becomes mineralized.

BIOLOGICAL FOAM

When biological foam appears in some WWTPs, it does not represent a technical trouble of the WWTP that is covered by the manufacturer's warranty. The foam is caused solely by the nature of wastewater. The foam is usually thick, light to dark brown (of whipped cream consistency) and forms in the process of aeration of the activation tank. The foam represents biologically active sludge which treats water efficiently; however, its negative property is that it is lighter than water. The principle of biological treatment using hovering activated sludge is based on the fact that sludge is heavier than water and settles at the bottom after aeration is interrupted. If "filamentous" bacteria multiply, they make clumps (foam) which are, on the contrary, lighter than water, rising to the surface. When flowing to the outflow pipe, it worsens the quality of treated water and causes serious operating problems.

In some WWTPs a biological foam actually does not occur, in some only in certain seasons of the year – usually when temperature changes (spring, autumn) and some have problems of rather perennial nature. Nevertheless, those WWTPs differ neither in design, nor in the method of operation. Instructions for removing biological foam is never unambiguous and hundred percent effective.

What usually makes filamentous bacteria prosper?

- Fats in general, especially burnt plant oils;
- Very old sludge in the activation tank;
- Aerobic environment with enough oxygen.
-

Therefore, efforts should be made to set such environment that does not suit filamentous bacteria:

- To reduce the amount of fat in wastewater;
- To desludge the WWTP frequently – significantly more often than recommended in this Operating manual.

Provided these measures are not efficient enough, chemical or biological agents can be used against the biological foam. The WWTP manufacturer will send you these agents and application instructions upon your request.

TOPAS S has no settling tank; therefore, treated water is drawn from the layer approx. 20 cm below the water level in the activation tank. Therefore, unlike in other systems (with a settling tank) biological foam mostly does not worsen effluent parameters, because when treated water is drawn out, biological foam remains on the surface and sludge at the bottom of the activation tank. Water drawn to the outlet is from the layer which is not contaminated with foam or sludge.

CHEMICALS HARMFUL TO THE WWTP

With regard to the market variety and regular innovations, we do not have, de facto no one can have, an exact list of chemicals which are harmful to the WWTP. In general, we can however state that the less chemicals, the better for the WWTP. In a small amount almost everything what is available in the market can be used the WWTP can normally cope with it. Water quality can worsen temporarily at an increased inflow of chemicals (e.g. extensive laundry on weekends), which evens out within 1–2 days. However, beware of two types of chemicals:

First, **purely biocidal and disinfectant chemicals;** if they were used in a large quantity, there would be a risk they may get into the activation tank in such concentration which may destroy microorganisms there. In usual concentrations, such as those used for household floor washing or toilet disinfection, they become neutralised without any problem in the first tank of the WWTP, in the accumulation tank, where water is still not treated by means of bacteria. It protects processes in the other parts of the WWTP. They are chlorine-based chemicals, sodium hydrochloride etc., and also purely biocidal chemicals.

The second type includes **chemicals that change pH significantly**, either to alkalinity, or acidity. Again, these are detergents for cleaning waste pipes, etc. They are based on e.g. sodium hydroxide, or hydrochloric acid. The rule of "everything in moderation" applies here again. Detergents are usually alkaline and could change the pH. It is irrelevant whether they contain phosphorus or not. The colour of sludge in activation tank changes to light brown or even to yellow and the sludge loses structure (it is as a mud). It is recommended to stop the work of

washing machines and dishwasher to measure pH in activation tank and adjust the pH on 7. For pH measuring and adjusting use the same resources as for treatment of water in swimming pools where is also necessary to keep pH on 7. It's also possible to raise the inflow to WWTP then water will be diluted and subsequently the pH will be reduced. If the sludge becomes black it means that pH is reduced lower then 7.

WHAT SHOULD NOT GET INTO THE WWTP?

- Rainwater or other sinking waters
- Petroleum and oil substances;
- Medicaments and poisons;
- Plastics (including condoms);
- Sanitary towels;
- Wet wipes from nonwoven
- Newspapers and magazines.

WHAT CAN GET INTO THE WWTP ONLY IN A LIMITED QUANTITY?

- Dishwasher water during the running-in of the WWTP;
- pH-changing chemicals (acids and lyes);
- Disinfectants;
- Fats and oils (only in the amount corresponding to a usual washing up).

SAMPLE TAKING AND EFFICIENCY EVALUATION

TAKING SAMPLES OF TREATED WATER

Samples of treated water are taken at the outflow of the treated water inside the plant into a clean, closable jar or another vessel. **There is definitely no need to make a special point (well) behind the WWTP for taking samples.** Samples are taken directly from the SF air-lift pump which is in operation for most of the day.

TAKING SAMPLES OF SEWAGE

It is not usual to take samples of sewage. If required for an evaluation of wastewater quality at malfunctioning of the WWTP, the process of taking the sample is as follows:

1.	Switch off the WWTP at the moment when the water level in the accumulation tank has dropped to the minimum.
2.	The WWTP remains off until the accumulation tank fills up with inflowing sewage up to the emergency water level, i.e. approx. 5 cm below the emergency overflow.
3.	Then switch on the WWTP and set the valve no. 1 manually to mix the content of the accumulation tank (for about 2 minutes).
4.	After approx. 10 minutes after changing the valve no. 1 to the activation tank, when the accumulation tank is no longer being mixed, take a sample of the mixture from the accumulation tank.

The TOPAS S WWTP has a sufficient reserve capacity both in the activation system and in volumes, so that it can work efficiently at various loads. Essential is the quality of out flowing water.

13. MEASURES FOR WINTER OPERATION

The WWTP is designed for a sectional sewerage system, i.e. only for sewage waters temperature of which usually suits the WWTP operation in winter months. Generally, nitrification efficiency becomes significantly lower at temperatures below 11°C. In terms of elimination of organic contamination (BOD_5) the plant works reliably if the

temperature of water in the plant ranges from 5°C to 8°C. When temperature drops below 5°C, it impacts the operation and it takes a certain time before microorganisms adapt to the decreased water temperature. The WWTP is equipped with a thermally insulated lid and the whole plant is installed underground. If ambient temperature does not drop below -25°C and at least 20% of sewage flow in, the WWTP does not require any special winter measures. When long-term heavy frost, it is advisable to set the 100% manual operation, i.e. the blower does not switch off so as to ensure a stable recirculation of water in the plant.

14. WWTP RUN AND OPERATION IN CASE OF EMERGENCY

ELECTRICITY FAILURE

At electricity failure wastewater accumulates in the equalising tank temporarily and the WWTP user must reduce wastewater production to avoid an overfilling of the equalising (accumulation) tank and an outflow of untreated water via emergency overflow. The volume of the equalising tank is usually 30% of average daily volume of wastewater. After the power supply is restored, the WWTP starts always working in the automatic mode. The WWTP must be changed to the manual mode manually.

INFLOW OF WASTEWATER INTERRUPTED IN THE LONG TERM

At interrupted inflow of wastewater, the WWTP in the automatic mode reduces its capacity gradually to 10% of the design capacity, which is the "stand-by mode". Under the stand-by mode, nutrients from the sludge tank are added, in a controlled manner, to the system, so that the flow stage lasts for about 50 hours, always followed by the backward stage, when organic substrate from the sludge tank is transferred to the accumulation tank. Through this process the WWTP remains biologically functioning for up to 3 months and is ready to restore its operation immediately. At an interrupted inflow of wastewater longer than 3 months or always when the WWTP is not supplied with electricity for a rather long time and sewage may decay and hydrogen sulphide may generate, it is necessary to remove the control unit from the WWTP. Both the blower and electric valves should also be removed.

INFLOW OF TOXIC SUBSTANCES

TOPAS WWTPs are designed primarily for a sectional sewerage system and only for municipal wastewater; therefore, the risk of contamination by hazardous substances is minimal. At any inflow of a toxic substance to the WWTP it is necessary to switch off the WWTP, prevent an outflow of contaminated water and call a dedicated company to liquidate the content of the WWTP safely. At the same time, the place of toxic substance leak to the WWTP must be secured and further contamination of wastewater prevented.

FIRE OR FLOOD

In case of fire, flood or at any similar cases of emergency, follow these steps:

- Switch off the circuit breaker of the WWTP first, i.e. disconnect the power supply from the network!
- If there is time available and if you are not in imminent danger of life, dismantle from the WWTP such components that can be damaged by water, fire or another element and put them to a safe place.

This applies particularly to blower, valve and control unit. (If in danger of your life, switch off the circuit breaker of the WWTP only.)

LONG-TERM TEMPERATURE DECREASE

If the WWTP is long exposed to frosts (with temperatures of -20°C or lower), switch it to the 100% manual operation, i.e. the blower does not switch off in order to ensure continuous water recirculation in the plant. If, however, some tanks have partly got frozen, it is recommended to supply lots of hot water from the house to the WWTP via the waste pipe or to pour hot water directly into the frozen tank. Try to melt ice or at least to break it into pieces in order to prevent expansion of the tank by ice pressure. Once the water circulation in the plant is resumed, set the 100% manual operation via the control unit.

15. SAFETY, FIRE AND SANITARY INSTRUCTIONS

At each and every work related to the maintenance and operation of the WWTP please follow general occupational health and safety instructions to protect not only your own health but also health of people being near the WWTP.

In particular, observe these rules:

- At each and every work related to the maintenance and operation of the WWTP please follow general occupational health and safety instructions to protect not only your own health but also health of people being in the vicinity of the WWTP.
- In particular, observe these rules:
- Always use adequate work clothes to prevent a direct contact with wastewater.
- Always use protective equipment at work, especially rubber gloves, or goggles.
- At exposure of your skin to wastewater from the WWTP disinfect the contaminated spot.
- In case of ingestion of water from the WWTP seek medical attention.
- In case of occurrence of an infectious disease follow instructions and orders by sanitary authorities.
- Do not eat, drink or smoke when working on the WWTP and after work, always wash your hands with water and soap.
- Prevent children from access, especially when the WWTP is open.
- Never leave the WWTP with its lid open!
- After opening the lid of the WWTP always make sure that the lid is secured by a safety catch against unwanted closing.
- Enter the inside of the WWTP only when absolutely necessary and in presence of another person (all the technological components of the WWTP are removable; therefore, their standard maintenance can be done only after their removal).
- Prevent slippage and subsequent fall to the inside of the WWTP!
- Any action on the WWTP wiring can be carried out only by an authorized person with necessary electro technical qualification!
- Wash and store safely all the tools used for maintenance of the WWTP and sludge sample taking.
- Do not store samples taken in the fridge that you use for food storage.

16. PRODUCT LIFETIME AND DISPOSAL

The WWTP is made of plastic (polypropylene) with almost unlimited lifetime. Lifetime of the aeration component is 5–10 years. Lifetime of the membrane blower is approx. 10 years. Lifetime of membranes in the blower depends on the type and manufacturer of the blower. Membranes must be usually replaced within 18,000 operating hours. Lifetime of the electric valves is long, approx. 1 million of operations.

Required service and spare parts are supplied by respective dealers!

At disposing and recycling the WWTP or its components, use waste collection points or other recycling facilities for a disposal of hazardous and bulky waste.

17. TECHNICAL DATA

DESCRIPTION OF THE WWTP OPERATION DURING THE FLOW STAGE

Nitrification stage	The valve V1 regulates air into:	In operation:
A. ACTIVATION TANK FILLING	Activation tank	• Central blower (potentially with interruption) • Raw sewage air-lift pump • Aeration of the activation tank • Aeration of the sludge tank
B. SEDIMENTATION approx. 10 minutes	Inflow tank	• Central blower– continuously • Aeration of the inflow chamber
C. DESLUDGING a decrease in the water level by 4 cm max. 10 minutes	Inflow tank	• Aeration of the inflow chamber • Desludging air-lift pump
D. EMPTYING OF THE ACTIVATION TANK (DECANTING)	Inflow tank	• Treated water air-lift pump • SF air-lift pump

Table no. 7: Nitrification

DESCRIPTION OF THE WWTP OPERATION DURING THE BACKWARD STAGE

Denitrification stage	The valve V1 regulates air into:	In operation:
DENITRIFICATION	Inflow tank	
0 - 10 minutes		Central blower - continuously
after the 10th minute		Central blower – continuously Desludging air-lift pump

Table no. 8: Denitrification

CE conformity marking
"WWTP TOPAS Plus 7"

CE	
TopolWater, s.r.o. Nad Rezkovcem 1114, 286 01 Čáslav, Czech Republic **14**	
EN 12566-3 + A2 Packaged domestic wastewater treatment plant for treatment of waste (domestic) water – Product's reference code (number): **TOPAS Plus 7** – Material: Polypropylene	
Effectiveness of treatment :	
Treatment efficiency ratios (at tested organic daily load BOD_5 = 0,42 kg/day)	COD: 97% BOD_5: 99% SS: 99% $P_{tot.}$: 99% $N_{tot.}$: 87% N_{NH4}: 98% $N_{Kjeldahl}$: 96%
Treatment capacity (nominal designation):	
– Nominal organic daily load (BOD_5)	0,42 kg/day
– Nominal hydraulic daily flow (Q_N)	1,05 m^3/day
Watertightness (water test):	Meets the standard
Crushing resistence:	Backfill: 0,00 m WET: 1,00 m
Durability:	Meets the standard
Reaction to fire:	E
Release of dangerous substances:	NPD

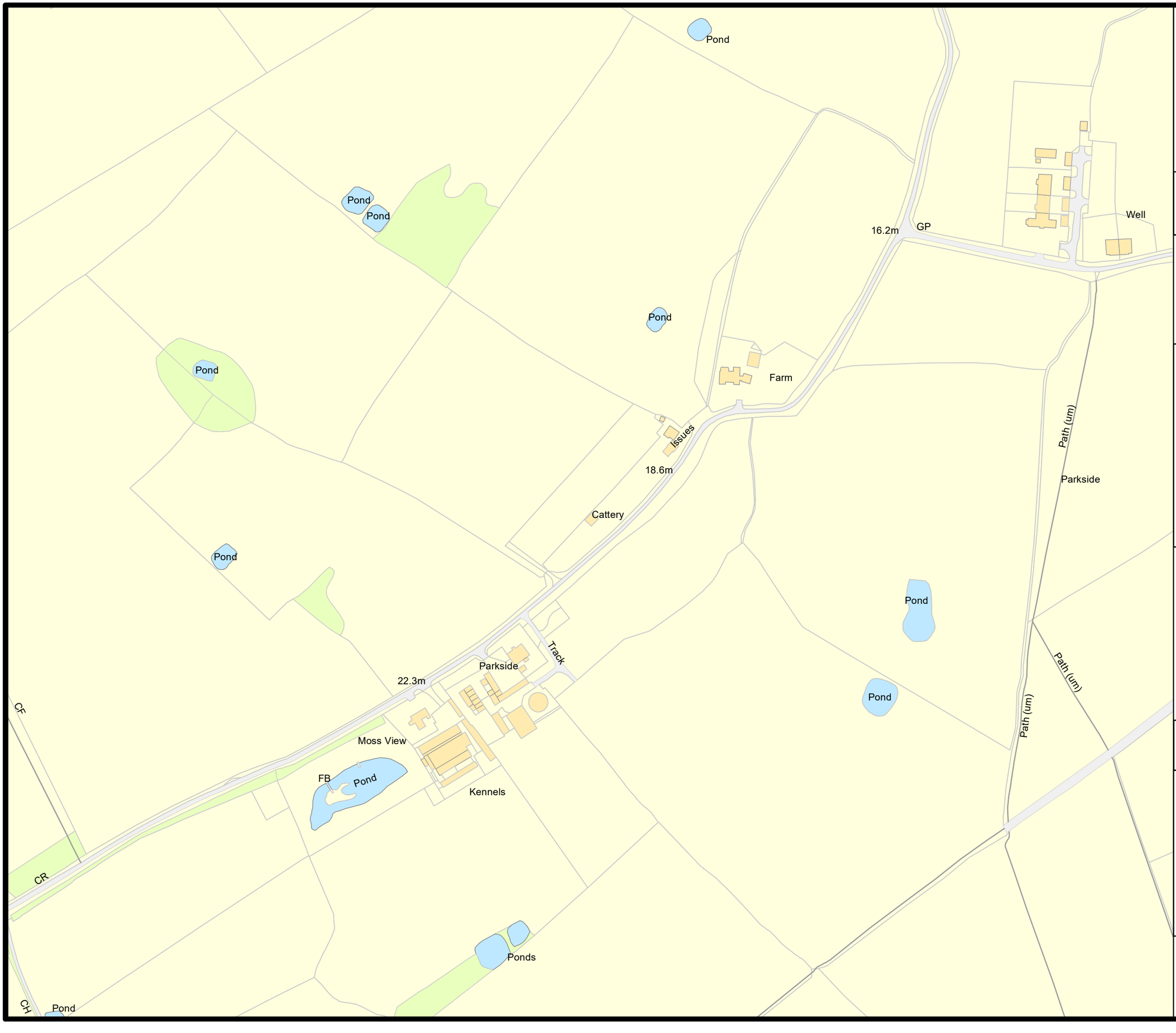
CE conformity marking
"WWTP TOPAS Plus 50"

CE	
TopolWater, s.r.o. Nad Rezkovcem 1114, 286 01 Čáslav, Czech Republic **14**	
EN 12566-3 + A2 Packaged domestic wastewater treatment plant for treatment of waste (domestic) water – Product's reference code (number): **TOPAS Plus 50** – Material: Polypropylene	
Effectiveness of treatment :	
Treatment efficiency ratios (at tested organic daily load BOD_5 = 3,00 kg/day)	COD: 97% BOD_5: 99% SS: 99% $P_{tot.}$: 99% $N_{tot.}$: 87% N_{NH4}: 98% $N_{Kjeldahl}$: 96%
Treatment capacity (nominal designation):	
– Nominal organic daily load (BOD_5)	3,00 kg/day
– Nominal hydraulic daily flow (Q_N)	7,50 m^3/day
Watertightness (water test):	Meets the standard
Crushing resistence:	Backfill: 0,18 m WET: 1,00 m
Durability:	Meets the standard
Reaction to fire:	E
Release of dangerous substances:	NPD


Clenviro
environmental technology


TOPOLWATER

Welsh Water Sewer Records: **APPENDIX 2**



Dŵr Cymru
Welsh Water

Rossett Wrexham

N
W E
S

LEGEND(Representative of most common features)

Waste network:

	Foul chamber		Outfall
	Surface water chamber	LH	Lamphole
	Combined chamber		Storm Overflow
C O	Combined sewer overflow		Rising main
SPC	Special purpose chamber		Gravity sewer
	Treatment works	P	Private sewer
	Pumping station	S 104 P	Private sewer subject to Sect. 104 adoption agreement

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

T	Private Sewer Transfer
L	Lateral Drain
	Inspection Chamber

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dŵr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the company's apparatus. The onus of locating apparatus before carrying out any excavations rests entirely on you. The information which is supplied by the Company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 which is based upon the best Information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a water main, service pipe, sewer, lateral drain or disposal main and any associated apparatus laid before 1 September 1989, or, if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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