JOHN MEUNIER

VEOLIA WATER Solutions & Technologies

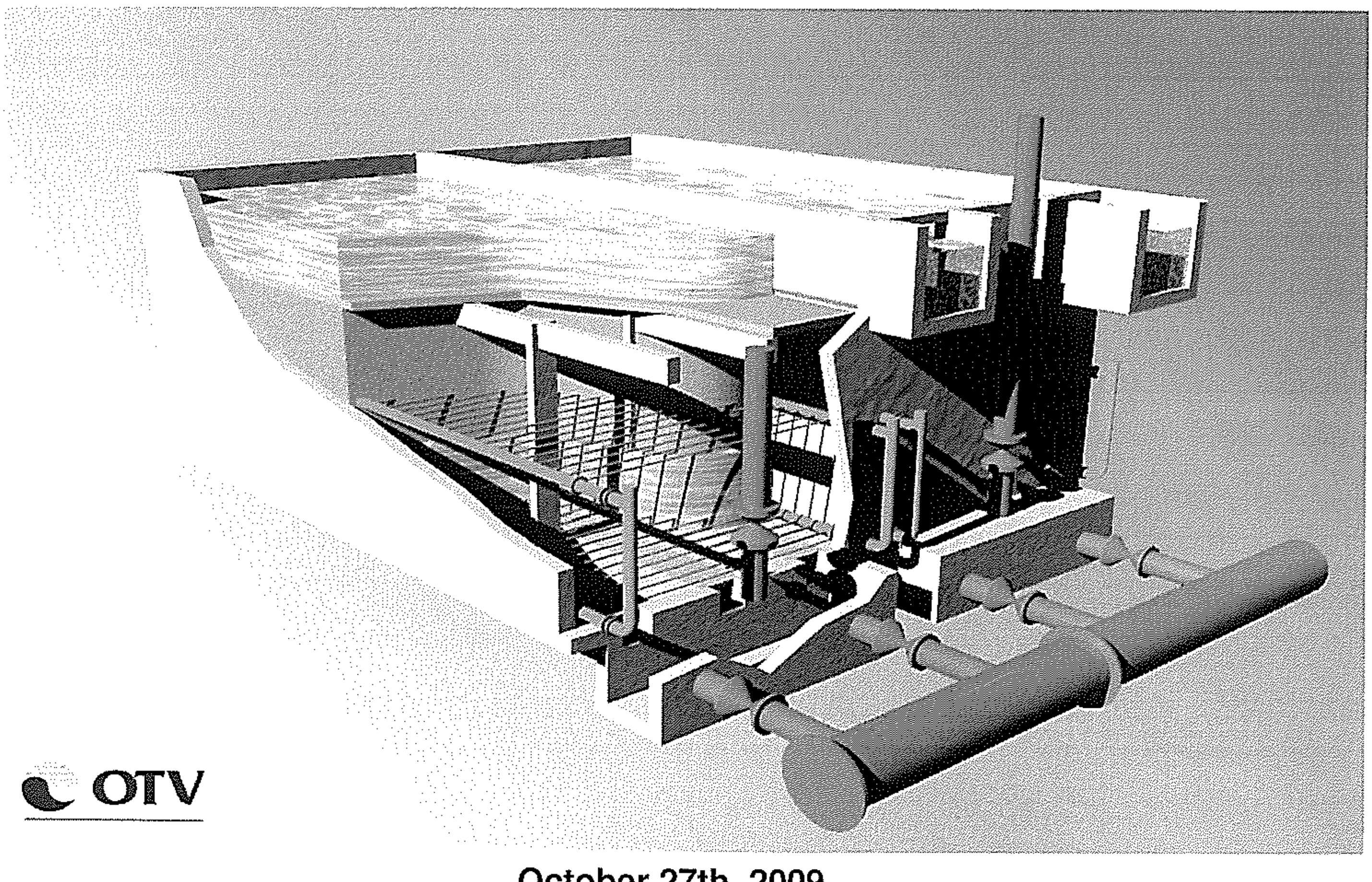
Cornwall WWTP Secondary Treatment Upgrade

BAF option – Biostyr technology

BUDGET PROPOSAL

N° 08T206

Rev.4



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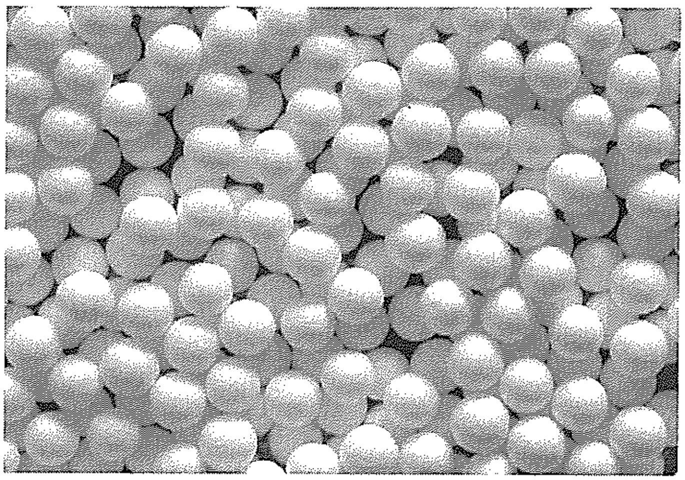
1. Biostyr® general process description

1.1 Biostyr® overview

The Biostyr® process belongs to the family of the biological aerated filters and can be designed to accomplish BOD and TSS removal, nitrification, and/or denitrification. The filter media acts as a filter for the physical removal of the suspended solids, while providing plenty of surface area for attachment of a biofilm, which achieves biological treatment of the soluble influent contaminants, resulting in an overall good effluent quality. Picture of that media below.



As shown in Figure 1, the influent wastewater is first brought to a common inlet feed channel above the Biostyr® cells where it flows down to the individual cells by gravity. Upon entering the Biostyr® cells, the wastewater flows upwards through the filter media. The media is composed of specially treated expanded polystyrene beads covered by active biomass. Ceiling plates with regularly spaced nozzles are used to retain the filter media in the cell. The nozzles allow the treated water to enter a common water reservoir above the filters, which in turn is used to provide water during backwash sequences.

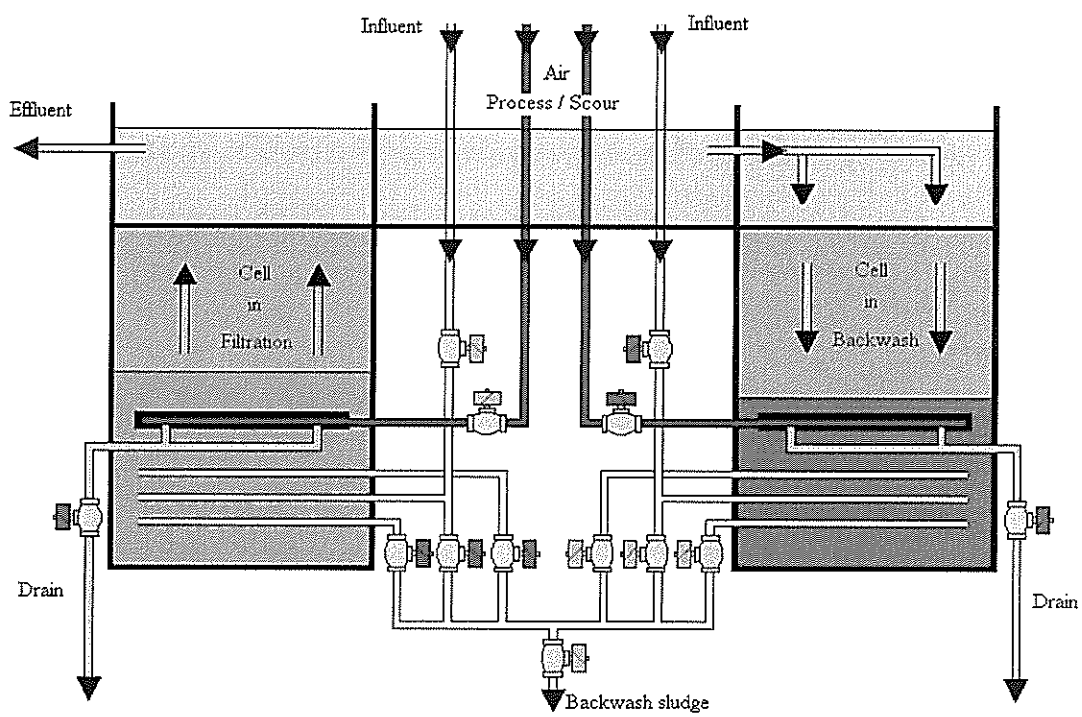
In a system designed for carbon removal and/or nitrification, a process air grid is located below the filter media so that the whole filter bed is aerated. BOD is oxidized by the biomass in the lower section of the filter. As the wastewater continues up the filter, additional BOD is consumed. When the BOD:TKN ratio falls below a certain limiting level, nitrification occurs, thereby reducing the ammonia level in the wastewater by converting it to nitrates.

If denitrification is also required in the same cells, another process air grid could be placed within the filter media, dividing the bed into a lower anoxic zone and an upper aerobic. Nitrates produced by the nitrification process in the aerobic zone are recycled to the feed channel and are denitrified in the anoxic zone. The denitrification process utilizes BOD in the influent waste stream as a carbon source for cell growth. In some cases, an additional carbon source such as methanol is required to enhance the denitrification process. Another alternative is to use only one air grid (at the bottom of the filter), and operate the filter in a simultaneous nitrification/denitrification mode.

A separate tertiary denitrification unit can also be installed to achieve a higher degree of total nitrogen removal. In tertiary denitrification units, methanol (or another carbon source) is injected into the influent stream to provide a carbon source for the denitrification process. Since the process occurs under anoxic conditions, there is no need for a second process air grid.

Growth of biomass and the retention of suspended solids in the filter media make periodic backwashing necessary. The Biostyr® process is designed for a backwash interval of 24-72 hours (typically), depending on the application. The backwash phases are fully automatic and are triggered either when an operator adjustable time limit has expired or when the head loss across the filter exceeds a pre-determined setpoint. Water from the common treated water reservoir flows down through the filter by gravity, thereby fluidizing the media. The process air grid located below the media is also used to supply scouring air during the backwash sequence. The grids are regularly spaced pipe laterals with small orifices that produce a uniform, coarse-bubble pattern over the full cross-section of the filter

Figure 1 - Biostyr® System for BOD Removal and Nitrification



The primary effluent is fed to a common feed channel. From there the flow is evenly distributed to each cell by overflow weirs located at the entrance of each cell influent feed channel, where it reaches the bottom of the filters and is distributed inside each filter cell. The water flows upward through the Biostyrene® media and eventually the false-ceiling nozzles, and reaches the common treated water effluent channel / backwash water holding tank. When the volume above each cell and the effluent channel is filled with water, the treated water overflows above the effluent weir to reach the effluent channel, leaving the BAF plant.

In backwash mode, the feed to the cell to be washed is stopped, and the backwash valves at the bottom of the filter are opened to allow gravity flow of the water from the top clear water storage tank (above all cells filter false-ceiling plus effluent channel) to a backwash residual tank located at the end of the filter gallery. The waste backwash storage tank receives the water produced during a backwash. The plant is designed to allow only one cell in backwash at a time. The backwash storage tank acts as a flow and TSS load equalization tank, as backwash water is produced over a very short period of time. From this tank, the backwash water would normally be pumped on a continuous or semi-continuous basis, to further treatment. Some of the backwash treatment alternatives could be the following:

1- Co-thickening: The backwash water could be sent back to the primary clarifiers, to allow co-thickening of the sludge with the primary sludge. This option however requires the primary clarifiers to have sufficient capacity to treat the additional approximately of backwash water daily. Also, co-thickening of the sludge means recycling around 10% if the inlet flow upstream of the process, and this water has to flow through the BAF before reaching the final effluent. The BAF inlet flow is then equal to the plant inlet flow + backwash recycle stream, and the BAF system must therefore be oversized accordingly, typically by about 10% to 15%. The co-thickening option was considered in the preliminary design of the Biostyr that we provided.

2- Thickening, with overflow recycling upstream: the waste backwash water could be sent to a sludge thickening system, for example a simple gravity thickener or an high-rate clarifier like the Actiflo® ballasted clarification system. The overflow water may however not have a good enough quality to be discharged to the river directly, so the thickener/clarifier overflow would be recycled back to the BAF inlet, reducing the primary clarifier loads.

1.2 Biostyr® design features and advantages

The Biostyr® process offers many advantages over other secondary treatment technologies, namely:

a. small footprint, with possibility to fully cover the system, makes it a "good neighbour";
b. no possibility of loss of biomass associated with secondary clarification;
c. no sludge bulking problems;
d. fully automated;
e. low maintenance – no wearable parts needing periodic replacement;
f. modular – easily expandable;
g. efficient for nitrification, even under cold temperature conditions, because of the development of a fixed-film biomass over the media;
h. highly oxygenated effluent;

Moreover, when compared with other BAF technologies, the Biostyr® process provides several significant improvements over other conventional fixed-film systems.

a. The Biostyrene® media is a stable, inert media, that do not undergo any attrition or degradation over time. Moreover, no media loss is experienced during backwashes, so that there is no need for replacing or adding any media over time. This significantly reduces the operating costs as well as remove the hassles associated with the carryover of media everywhere in the plant (primary clarifiers, digesters, pumps, valves, holding tanks etc...), which is experienced with dense type media;

b. Using a floating media bed in conjunction with an upflow system ensures that the nozzles used to retain the media are only in contact with treated effluent. This prevents the nozzles from clogging and provides easy access to the nozzles if maintenance or replacement is required. Moreover, as the influent does not pass through nozzles, fine screening of the influent is not required (while coarse screening of 12mm is still needed at the headworks to remove the bigger solids. If existing screens must be reused, screening up to 15mm, 19mm at the most may be acceptable but 12mm or less remains the preferred solution).

c. The counter-current backwashing sequence ensures efficient removal of accumulated solids. During backwashing sequences, the downward flow expands the filter media and utilizes gravity to aid in flushing solids from the bottom of the filter. Additionally, the backwash water is supplied from a common reservoir above the filter cells and thereby eliminates the costs associated with backwash pumping.

d. The upflow filtration mode ensures that only treated water is in contact with the atmosphere at all times, eliminating the problems of odor generation. In backwash mode, since backwash is performed downflow, the used backwash water is collected in drain pipes/channels at the bottom of the filters without exposure to the atmosphere, thereby eliminating again odor problems.

2. Cornwall WWTP Biostyr® design

For the Cornwall WWTP, the Biostyr influent will be a screened primary effluent our of the existing primary clarifiers. The Biostyr® is designed to achieve BOD and TSS removal, as well as partial nitrification of the incoming nitrogenous compounds.

Enhanced primary sedimentation using a coagulant in the primary clarifiers will be used to control plant effluent TP concentration. Also, the Biostyr backwash water will be sent back to the primary clarifiers for sludge co-thickening.

2.1 Design conditions

The following tables summarize the design conditions of the Biostyr.

FLOW CONDITIONS

The initial flow description received by JMI was based on a peak daily flow of 160 000 m3/d. The summary of the different design flows under this initial design basis are summarized in table 1A.

Table 1A: Summary of flow conditions, original design

Condition	Units	Value	Comments
Average Daily Flow (ADF)	m^3/d	65 318	
Peak Daily Flow (PDF)	m^3/d	160 000	
Peak Hourly Flow (PHFW), wet weather	m^3/h	6667	= 160 000 m3/d

As presented in section 2.1, the Biostyr design is hydraulically limited, the limit being the peak daily flow of 160 000 m3/d. If sewer infiltration were reduced resulting in lower flow but still with the same pollutant loads (in kg/d), then the Biostyr size could be reduced. An second flow condition scenario is thus presented here under table 1B, where the peak daily flow is reduced down to 135 000 m3/d.

Table 1B: Summary of flow conditions, reduced daily peak flow

Condition	Units	Value	Comments
Average Daily Flow (ADF)	m^3/d	65 318	
Peak Daily Flow (PDF)	m^3/d	135 000	
Peak Hourly Flow (PHFW), wet weather	m^3/h	5625	= 135 000 m3/d

BAF INFLUENT CHARACTERISTICS

Modulation of the coagulant dosage in the primary clarifiers will be required to ensure a good reduction of the total phosphorus concentration. However, coagulant should not be overdosed since this would result in excessive P removal, creating a P limited condition in the BAF. If phosphorus concentration is too low within the BAF, the bacterial growth could be affected which could result in a reduced BOD, TSS and N-NH4 removal performance. Also, P limitations within the BAF could stress the biomass and cause a bacterial production of exopolymers, having detrimental effects on the BAF operation. It is therefore important to maintain sufficient phosphorus at the BAF inlet to fully support bacterial growth. On the other hand, based on a plant influent TP of 4.0 mg/L and the tight effluent requirement of less than 0.8 mg/L TP, a large coagulant dosage is required in the primary to reduce the plant TP to that level. For the actual design, a coagulant dosage of 35 mg/L in FeCl3 was used in reach down to 0.8 mg/L TP at the Biostyr effluent. This high coagulant dosage results in a high BOD and TSS removal into the primary clarifiers, so a reduced load to the Biostyr process.

As indicated in table 2, XCG also provided a primary clarifier effluent design basis. According to Veolia's design software, this primary effluent quality would be obtained using a very limited ferric chloride dosage of 5 mg/L (100% concentration basis). This new primary effluent characterisation does not impact on the Biostyr design, meaning that the same Biostyr sizing is obtained using one or the other primary effluent characteristics, since the Biostyr is hydraulically limited for both primary effluent conditions. The Biostyr would then reach the effluent requirement wherever between the two described primary effluent characterisations of table 2. However, the effluent TP requirement of 0.8 mg/L at the Biostyr effluent would not be reached under the low coagulant dosage configuration, and would therefore require tertiary P removal, using as an example an Actiflo high-rate ballasted clarification process.

Table 2: Summary of pollutant concentrations (Primary effluent)

Parameter	Units	Primary influent	Primary effluent (estimated by JMI internal design software, considering Biostyr backwash primary co-thickening)	Primary effluent (as per XCG)
BOD_5	mg/L	110	52	72
TSS	mg/L	165	45	70
TKN	mg/L	26	20	26
$N\text{-}NH_4$	mg/L	20*	17	23*
TP	mg/L	4.0	1.60	2.4**
Alkalinity	mg $CaCO_3$/L	250*	211	245*
Minimum water Temperature	°C	7*	7*	7*
Maximum Temperature	°C	20*	20*	20*
*** : Hypothesis**				
**** Further reduction required to achieve plant effluent TP objectives.**				

EFFLUENT REQUIREMENTS

The following table presents the effluent requirements, both effluent Objectives and Compliance limits.

Table 3: Effluent requirements

Parameter	Unit	Objective	Compliance	Basis
BOD_5	mg/L	15	25	Monthly average
TSS	mg/L	15	25	Monthly average
TP	mg/L	0,5	0,8	Monthly average
N-NH4 - April - September	mg/L	5.0	7.0	Monthly average
N-NH4 - October - December	mg/L	9.0	11.0	Monthly average
N-NH4 - January - March	mg/L	7.0	9.0	Monthly average

2.2 Phosphorus removal

The effluent requirements for TSS, BOD and ammonia are not difficult to meet, and the limiting design parameter is really the hydraulic load in peak day condition (160 000 m3/d). However, a word should be said regarding phosphorus removal. The effluent TP objective and requirement can be challenging to meet according to the final process configuration. The least expensive way to reach a low effluent TP is to simply dose coagulant into (upstream) the primary clarifier, and with high coagulant dosages, the effluent TP can be reduced typically down to the 0.2 to 0.5 mg/L range. However, in the actual application the primary effluent goes into a biological treatment step, and soluble phosphorus (in the form of orthophosphate) must be available for the biomass to allow bacterial growth. A minimum of about 0.3 mg/L orthophosphate should therefore be kept at the Biostyr inlet. This value of 0.3 mg/L would actually depend on the BOD concentration, which determines the amount of biomass growth within the BAF. Variations in inlet BOD would require modulation of the soluble P available. If the effluent TSS is 15 mg/L, then the particulate P associated to the TSS would represents about 0.25 mg/L. If the TP objective is 0.5 mg/L, this would leave 0.25 mg/L available for the soluble P. However, the soluble P is not only composed of the orthophosphate but also polyphosphate. The polyphosphates concentration depends on the raw wastewater, and is influenced strongly by industrial contributors. Let assume 0.1 mg/L of Poly-P in the effluent, which would leave room for 0.15 mg/L in orthophosphate (which is what is controlled through coagulant dosage in the primary). A little overdosage of coagulant could then lead to P limitation in the Biostyr, which could result in stressing of the biomass, that would then excrete some exopolymers who could end up clogging to a certain degree the biofilters. Even though this exopolymer secretion mechanism is not instantaneous (could happen after several hours or even a full day of deficiency), this situation should be avoided as much as possible. On the other hand, underdosage of coagulant would lead to an effluent TP higher than 0.5 mg/L. Some feedback from Kingston Ravensview operation results can be added to this discussion. After getting to "feel" their process for a couple of months, the plant operation staff have managed to maintain the Biostyr effluent TP between about 0.50 and 0.60 mg/L, while the orthophosphates concentration remained around 0.25 mg/L. A 0.50 mg/L objective would thus seem to be quite manageable in their case.

In conclusion, an effluent TP less than 0.5 mg/L based on primary P precipitation could be a challenge but seems to be manageable as per the Ravensview plant operation data. However, plant operation (coagulant dosage) could be easier if some analyzers were added (as examples, primary effluent soluble P analyzer, Biostyr effluent soluble P analyzer, maybe in-line Biostyr inlet COD analyzer to calculate theoretical P requirement to support growth). These would all help control coagulant dosage to minimize the plant effluent P while preventing P deficiencies within the biological reactor. JMI offer a complete line of field instruments which could help you for this application.

2.3 Biostyr design summary

The Biostyr design parameters are described in the following table.

Table 4A: Biostyr® Design Summary, option 1A

Parameter	Units	Design condition
Number of cell off-line at all times (N-1)	-	0
Number of cell in backwash at one time	-	1
Total number of cells required (N)	-	7
Total number of cells installed (N)	-	7
Cell surface area	m^2	147
Total installed filtration area (N filters)	m^2	1029
Total required filtration area (N filters=7 cells in operation)	m^2	1029
Media height	m	3,5
Media size	mm	3.6
Filtration rate ADF (including BW recycle), N	m/h	3.0
Filtration rate PHF (including BW recycle), N	m/h	7.0
Filtration rate PHF (including BW recycle) @ N-1 (one cell in backwash, 6 cells in filtration)	m/h	8.1
Aeration rate ADF, summer (average flow)	m/h	4.2
Maximum Number of backwash per day per cell	-	1
Design backwash rate	m/h	60
Unit backwash water volume	m^3/backwash	1286
Maximum daily backwash water volume (7 cells in operation)	m^3	9003

The Biostyr design is based on meeting the effluent objectives and as such, the media size was selected as 3.6mm. this finer media allows better TSS removal, and will help obtaining an effluent with less than 15 mg/L in BOD and TSS, while promoting maximum nitrification.

Attached drawings show a proposed layout for a eight (8) Biostyr cells of 147m2 each, which is the same cell size as for the Kingston Ravensview WWTP (11 cells of 147 m2, design at N-1). This layout uses an influent distribution channel to distribute by gravity the influent evenly over all eight cells using overflow weirs.

As presented in section 2.1, the Biostyr design is hydraulically limited. If sewer infiltration were reduced resulting in lower flow but still with the same pollutant loads (in kg/d), then the Biostyr design could eventually be reduced. As an example, a six (6) cells Biostyr could be used (instead of 7 cells for the base option) if the daily peak flow was reduced from 160 000 m3/d down to 135 000 m3/d. The design summary for this option 1B scenario is presented below.+

Table 4B: Biostyr® Design Summary, option 1B

Parameter	Units	Design condition
Number of cell off-line at all times (N-1)	-	0
Number of cell in backwash at one time	-	1
Total number of cells required (N)	-	6
Total number of cells installed (N)	-	6
Cell surface area	m^2	147
Total installed filtration area (N filters)	m^2	882
Total required filtration area (N filters=7 cells in operation)	m^2	882
Media height	m	3,5
Media size	mm	3.6
Filtration rate ADF (including BW recycle), N	m/h	3.4
Filtration rate PHF (including BW recycle), N	m/h	6.8
Filtration rate PHF (including BW recycle) @ N-1 (one cell in backwash, 6 cells in filtration)	m/h	8.2
Aeration rate ADF, summer (average flow)	m/h	4.8
Maximum Number of backwash per day per cell	-	1
Design backwash rate	m/h	60
Unit backwash water volume	m^3/backwash	1286
Maximum daily backwash water volume (7 cells in operation)	m^3	7716

2.4 Air requirement

Air (process and backwash) is provided by a central set of blowers which discharge to a common air header. Each cell in filtration receives the same air flow. The flow rate is controlled by a modulating valve and air flow meter in each cell process air branch line. The aeration control algorithm provides the cell air flow setpoint. In order to achieve minimum energy consumption related to aeration, and also to ensure optimum process performance, the aeration rate of the cells is controlled by a dual instrumentation system, dissolved oxygen (DO) and on-line effluent ammonia analyzer. The combination of these two parameters allows for a fast response-time, with high efficiency treatment and reduction of the energy consumption from aeration to meet the process requirements, and not more (that would be lost to the atmosphere).

The aeration system is a coarse bubble type system. However, when reaching the media, the air bubbles break into smaller bubbles, flowing upward through the media, with the media acting as packing, increasing the air-water interface area and also increasing the gas retention time inside the column. Oxygen transfer efficiency overall in the system is then about 22% to 25%.

2.5 Sludge production

Sludge is removed from the process through backwash operations. The backwash water is produced at a very large flow over a short period of time. A backwash residual storage/equalization tank is thus needed, with a minimum volume of a little more than one complete backwash. However, in order to increase operation flexibility, a larger backwash tank is proposed here, allowing for storage of two complete backwashes (which is a very safe design approach). The following table presents the backwash water flows, along with information on the residual storage tank. Since the backwash operation is performed by gravity, the elevation of the residual storage tank is very important, and must be determined by JMI.

Table 5: Backwash residual production (1A), ADF

	Units	ADF, 20°C	ADF, 7°C
Predicted cycle duration	h	35	36
water production per backwash	m3/d	1286	1286
Filters in operation	-	7	7
Total Backwash Water production @ Predicted cycle duration	m3/d	6173	6349
Backwash volume % of ADF (65 318 m3/d)	%	9.5%	9.7%
Backwash residual tank minimum volume	m3	1607	1607
Proposed Backwash residual tank volume	m3	2400	2400

2.6 Control logics

The Biostyr® process is controlled based on numerous parameters and logical sequences, to take into account the variable nature of the influent flow and composition, to achieve the best treatment efficiency at the overall minimal operating cost. Some of the main features of the control system are described below. Of course, the complete control system does include many other features, which can be described in more details at a later stage of the project.

2.6.1 Headloss and backwash

A backwash sequence of a filter cell is triggered from a high headloss detection, or through a timer-based control. The headloss detection comes from the pressure differential between the inlet and the outlet to each cell. The inlet pressure is measured by pressure transducers located at the bottom of each individual filter cell, while the outlet pressure is measure by the water level in the effluent channel. A third input is used for the measurement of the media bed expansion during backwash, allowing to detect malfunctioning of a backwash sequence. This third parameter consists in a pressure measurement just below the bottom of the media.

2.6.2 Process performance

The pollutant removal performance of the system is monitored continuously to ensure optimum efficiency, and trigger alarms at needs. The quality of the influent is monitored by means of various analyzers, which can include pH, temperature, ammonia and even on-line COD, while usually only pH and temperature are used. The effluent quality is on its part monitored using on-line ammonia analyzer, along with dissolved oxygen monitors and pHmeter. Again, additional analyzers, including COD could be added for data acquisition. Since alkalinity is limited in this project, effluent pH monitoring would be mandatory to a certain process performances.

2.6.3 Aeration control

The aeration of the BAF system is controlled to ensure sufficient oxygen availability to suit the biomass needs, including the autotrophic nitrifying bacteria demand to achieve high nitrification efficiency. The optimization of the control system includes the use of a dissolved oxygen analyzer, used to determine the oxygen utilization rate in the system. The process could be controlled solely with this parameter. However, further optimization includes the use of an effluent ammonia analyzer. This analyzer is used on the one hand for process efficiency measurement and datalogging, but also to adjust the air requirement to suit the nitrification needs. It is known that nitrification rate is strongly dependent on dissolved oxygen concentration, when DO is maintained below a value of about 3 mg/L or so. The ammonia analyzer is thus used to adjust the dissolved oxygen concentration in the cells to increase or reduce the nitrification efficiency to reach the effluent requirement, while at the same time minimizing the energy consumption associated with aeration. When the effluent ammonia concentration goes up, then the DO set point is increased to promote the nitrification. When the ammonia goes down however, the DO set point is reduced to minimize the energy requirement from aeration, while still ensuring that the effluent ammonia requirement is maintained.

2.6.4 Seasonal flow variations

If important seasonal variations in the flow received by the plant are experienced, usually caused by seasonal touristic activities, the Biostyr can be operated such that the numbers of filters in operation during low flow periods is reduced, to reduce the plant operating costs, but also to maintain a constant pollutant load over the cells in operation. However, it is not desirable to keep some cells out of service for a long period, since these cells would not be "alive" when flow would resume. The control system would thus maintain all cells "alive" by alternating the flow to each cell. The plant capacity and performance would thus be available as soon as the flow would increase, or resume.

2.7 Piloting

Since the Cornwall WWTP Secondary Treatment Upgrade project is quite typical of a municipal-base application, quite similar actually to the Kingston Ravensview project, piloting would not be required on JMI side.

3. Scope of supply

The scope of supply for the Biostyr proposal includes all the mechanical equipment associated with the technology, but does not include work related to field installation, apart from media installation. The media, by its fabrication technology, is somehow explosive and needs to be handled by companies specialized in that field. Our offers thus automatically include the media installation, which is typically performed by the media manufacturer.

3.1 Scope of supply and services included

The following table present the scope of equipment supply and services included in our offer, based on option 1A – 7 cells of 147m2 each.

Table 6: Scope of supply and services

Description	Units Per Cell	Total No. of Units
Secondary nitrification Biostyr ----- Cell size (m^2)	147	7
Scope of supply		
Biostyr Nozzle Slabs – per filter		
Nozzle slabs to be assembled into nozzle decks for each cell. One slab in each cell will be fitted with access manways. The remaining slabs will have media ports that will facilitate media loading. Slabs to be assembled into nozzle decks by Installation Contractor.	20	140
Precast slabs with reinforcing and embedded items (nozzle tubes, fill ports and manways)	20	140
Nozzles, nozzle tubes and gaskets	7000	49000
Media fill ports	20	140
Manways	1	7
Cell Feed/Backwash Channel Cover Plates		
Feed/Drain channel precast concrete cover plates for each cell.	3	21
Multiple plates per channel	-	-
Reinforced concrete construction	-	-
50 mm diameter orifices	-	-
Biostyrene Media		
Sufficient for 3.5 m of media bed depth per cell	555 m3	3885 m3
4,0 mm nominal diameter	-	-
John Meunier Inc. supply of media **includes the installation** (filling) of the media into the Biostyr cells. During installation, cells are overfilled to account for initial media consolidation.	-	-
Process/Scour Air Blowers		
Three (3) complete blower assembly consisting of 2 units in operation + 1 spare blower (final quantity to be determined later).	-	2 + 1
Helical screw type	-	-
250 HP motor, 575/3/60	-	-
Direct drive, VFD controlled (VFD by others)		-
c/w PRV, check valve and manual isolation valve	-	-
Aeration Grids		
One complete 304L SS air diffuser system within each cell, located at the bottom of the cell to provide process and scouring air. This includes the wall brackets and lateral supports required to assemble the air grid in each cell. Each grid to include:	1	7
Coarse bubble aeration grids, made of 304L SS	-	-

header sections, per drawing	-	-
wall brackets	-	-
32 mm lateral pipes	-	-
support beams for aeration laterals	-	-
wall brackets for attachment of aeration support beams – with hardware excluding anchors	-	-
support stanchions from floor to aeration support beams – with hardware excluding anchors	-	-
U-bolt clamps to anchor laterals to support beams	-	-
Process Valves, Biostyr Facility		
Feed valve, butterfly type, c/w pneumatic actuator, 20"	1	7
Air feed valve, V-port ball-type c/w pneumatic actuator, 4"	1	7
Air feed isolation valve, butterfly type, manual, 4"	2	14
Air blow-off valve, V-port ball-type c/w pneumatic actuator, 4"	-	1
Air blow-off isolation valve, butterfly type, manual, 4"	-	1
Air grid purge valve, butterfly type, c/w pneumatic actuator, 4"	1	7
Air grid purge isolation valve, butterfly type, manual, 4"	2	14
Backwash filter valve, butterfly type, c/w pneumatic actuator, 36"	3	21
Main backwash header valve, butterfly type, c/w pneumatic modulating actuator, 48"	-	1
Inlet Weirs		
SS weir used to ensure equal flow feeding to each Biostyr cell	1	7
Material: Stainless Steel 304	-	-
c/w neoprene gaskets, mounting angles, supports	-	-
Cell Influent isolation gate and Frames		
Isolation gate frames for the influent channel to each cell and four (4) isolation gates. This will allow isolation of the feed piping to the actuated feed valve for maintenance on the valve or to isolate the line to the valve.	-	-
Frames for isolation gate. Stainless steel construction. Wall mounted.	1	7
Isolation gates. Stainless steel. Handle lift. UHMW poly guides and rubber J-bulb side and bottom seals.	-	2
Cell Effluent isolation sluice gates and frames, Biostyr Cells		
Sluice gates for each effluent channel window in each cell. This provides a means of isolating one individual cell in the eventuality of cell needing to be fully drained and isolated. Another alternative (less expensive) is to use stop logs, which are however less operator friendly.	-	-
Frames and sluice gates	4	28
Wall Sleeves		
Sleeves for passage of piping through the concrete walls. Fabricated out of 304 SS.		

Process air, 6"	1	7
Air grid purge, 4"	1	7
Sampling points (2 per cell + 2 cells with 3 addiitonal)	2	20
Pressure transmitter port	2	14
Cell feed, 20" (1 at feed box and 1 at external channel)	2	14
Cell backwash, 36"	3	21
Influent channel drain, 6"		1
Instrument Air Compressor System		
Air compressor, type Duplex	-	1
ASME receiver tank on compressor	-	1
Refrigerated air dryer, 115 V / 1 ph / 60 Hz.	-	1
Receiver tank for backwash header valve	-	1
Manway Inserts, Biostyr Cells wall		
One manway mounted in wall sleeve for casting into the pipe gallery wall of each cell.	1	7
750 mm nominal diameter access door; bolted in place	-	-
Cast in place insert body, 900 mm nominal diameter	-	-
304 Stainless steel construction	-	-
Backwash residual tank		
Residual tank pump	-	2
Type: submersible	-	-
Motor: 20HP (TBD)	-	-
c/w guiding brackets and accessories	-	-
Check-valve, ball type	-	2
Isolation valve, plug type	-	2
Submersible mixers	-	2
Type: submersible	-	-
Motor: 15 HP (TBD)	-	-
c/w guiding brackets and accessories	-	-
	-	-
Field Instruments		
Refer to process drawings for details.	-	-
Influent flowmeter on 2 cells, 20"		2
Influent pH/Temperature transmitter	-	1
Influent channel level transmitter		1
Influent channel high level switch		1
Effluent Dissolved Oxygen analyzer	-	2
Effluent Ammonia analyzer	-	1

Effluent pH/Temperature transmitter	-	1
Effluent channel level transmitter	-	1
Cell clogging pressure transmitter	1	7
Cell bed expansion pressure transmitter	1	7
Cell air flowmeter, thermal-mass insertion type	1	7
Main air header pressure transmitter	-	1
Backwash residual tank level transmitter	-	2
Level switches	-	4
Control system		
Complete process control system, including control panels w/ PLCs, SCADA system. MCCs by others (could be provided by JMI).	-	1
Scope of services		
Design services		
John Meunier will attend project meetings to discuss the BAF design.		
Installation supervision		
Number of days on-site to be determined		
Start-Up and commissioning		
Number of days on-site to be determined		
Training of operators		
John Meunier Inc. and factory representatives of its main equipment suppliers will provide the required training for the Owner's operating and support staff. Training will include questions related to the process, the equipment and the control system.		
FOB jobsite		

3.2 Scope of exclusions

The following items are required but not included in VWS Canada's scope of supply:

1. Civil works and installation, including grouting.

2. Rebar to interlock the rebar loop extensions from each nozzle slab and between the nozzle slabs and the cell walls.

3. Rebar to interlock the rebar loop extensions from concrete cover channel slab and cell floors.

4. All manually operated isolation valves for process air inlet downstream and upstream.

5. All manually operated isolation valves for process cell drain.

6. Backwash header drain valve.

7. All sample port manually operated valves.

8. Piping, such as feed pipe from the feed chimneys to the cell plenum, drain pipes from the cell plenum to the backwash channel and any wall sleeves in the plenum or the backwash channel; sample pipes outside of the cells; air piping outside of the filter cells including the air header and the air grid purge lines to the backwash residual tank.

9. Grating, ladders, stairs and handrails.

10. Primary effluent flow monitoring equipment.

11. Electrical supply, MCC, starters, VFD's, wiring.

4. Pricing

The preliminary budget pricing is:

Option 1A – 7 cells .... 8 700 000$ CAD
Option 1B – 6 cells .... 7 900 000$ CAD

Price includes freight of the equipment to the job site.

Price excludes all applicable taxes.

<u>OPTION FOR HIGH EFFICIENCY NEUROS BLOWERS</u>

The base-bid scenario includes three (3, 2+1) 250HP positive displacement type Cycloblowers, from Garner-Denver. These can be replaced with four (4, 3+1) 150 HP Neuros Turbo blowers. The adder would be approximately .... **500 000$ CAD**

However, the Neuros package includes the following features:
- VFDs (3 VFDs of 250 HP must be added to the base option);
- No noise (3 noise enclosures could be added to the base option);

Please keep in mind that these numbers are all preliminary, and the final Biostyr design would allow to determine the final air requirement, and then the final blower cost for both the base and the Neuros options.

Please contact JMI if you have any question or need additional information.

Regards,

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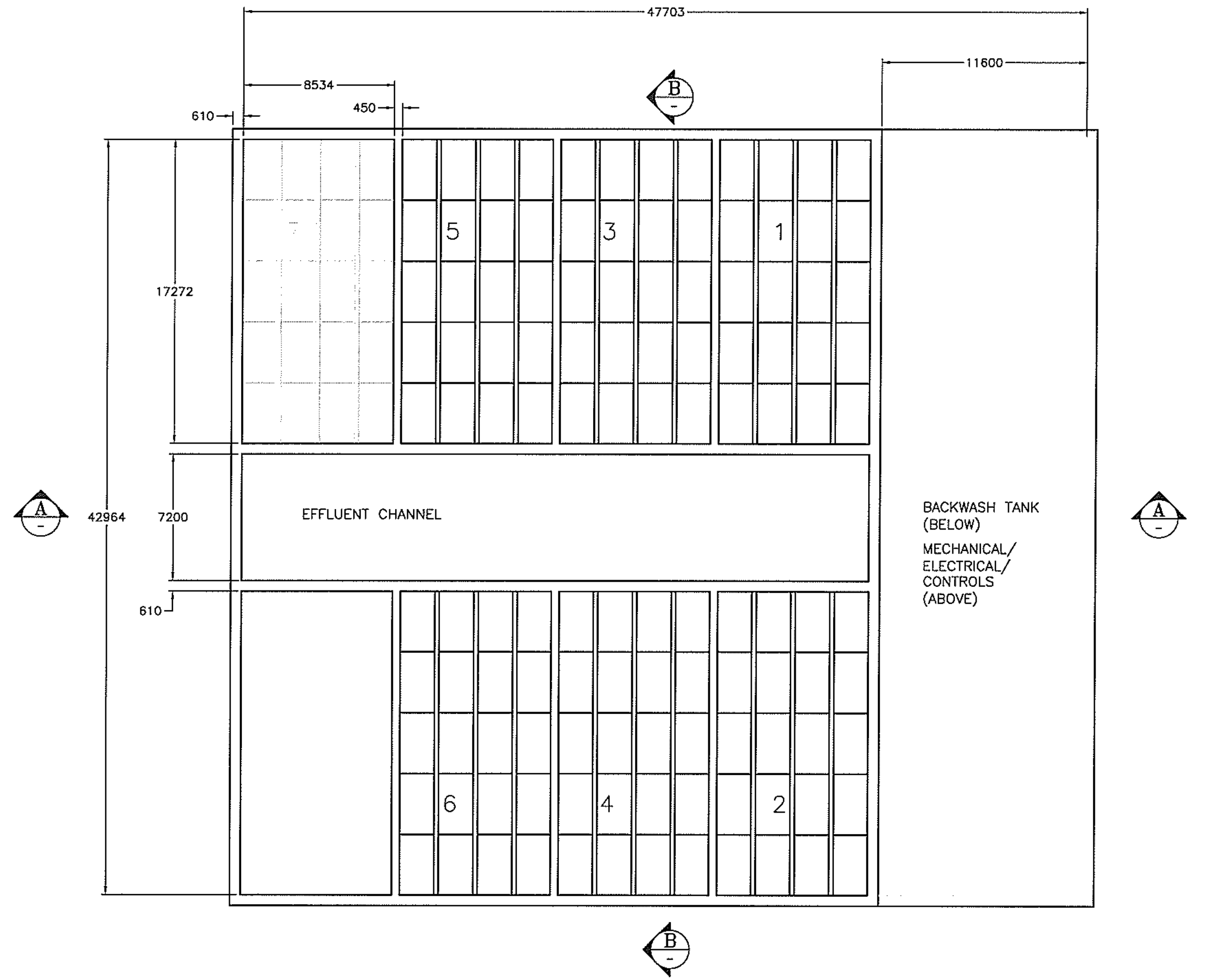


PRELIMINARY
John Meunier

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	PRELIMINARY	2009-11-12	D.M.	--	--	--
A	PRELIMINARY	2009-10-08	D.M.	--	--	--

STD: "D" 22x34

REF:

BAR = 1" AT PLOT SCALE

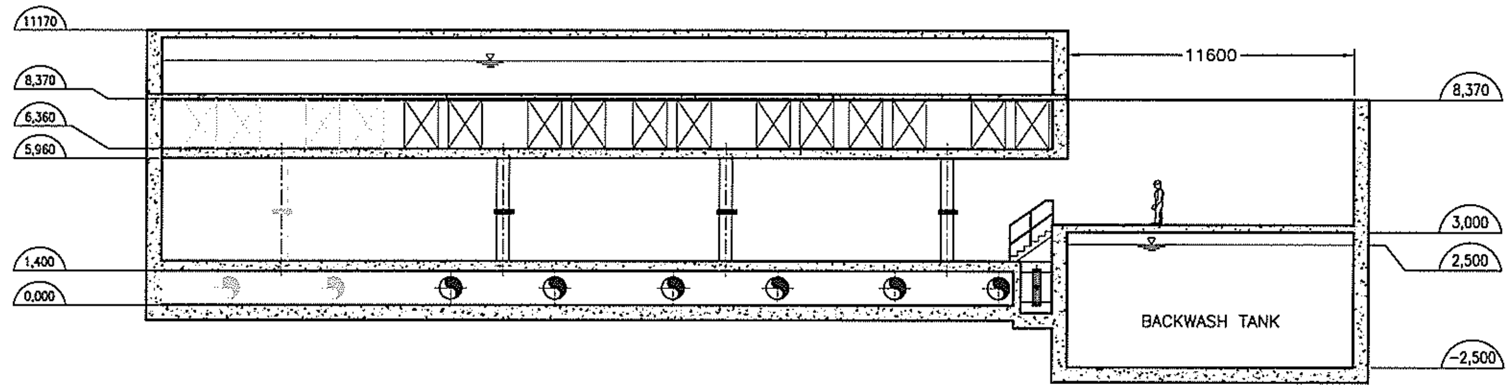
DESIGNER: D.M.	DATE: 2009-10-08	TITLE: BIOSTYR SYSTEM PLAN VIEW
CHECKER: --	DATE: --	CLIENT: CORNWALL WWTP
ENGINEER: D.L.	DATE: 2009-10-08	
MANAGER: C.S.	DATE: 2009-10-08	JOHN MEUNIER ISO 9001: 2000
SCALE: 1:150		PROJECT / DRAWING: 08T206 – LA001

4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070

INTERNAL:

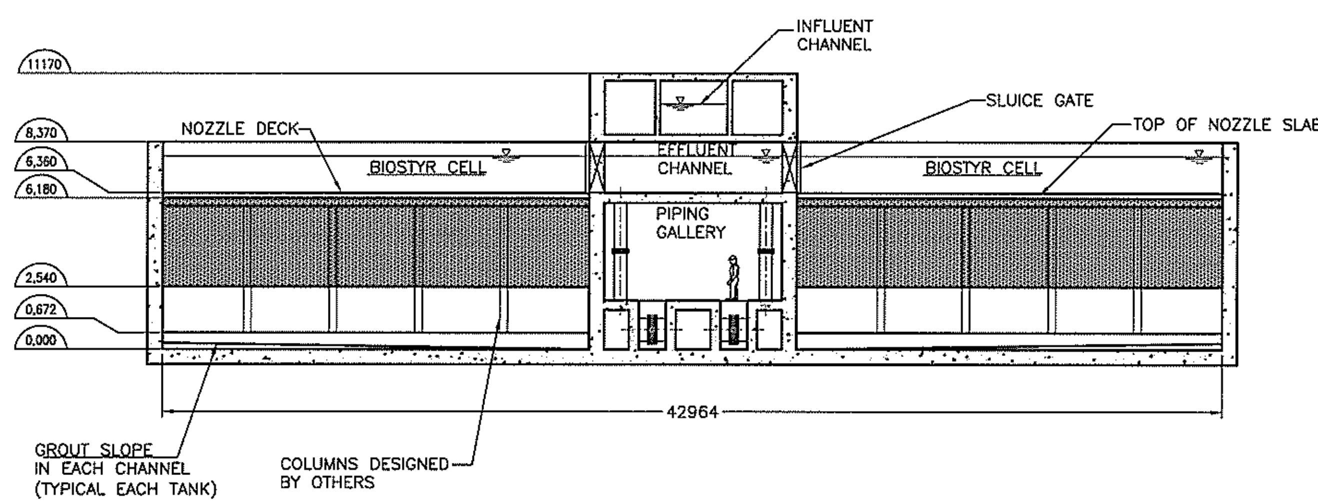
SHEET 1 OF 2

REV B



SECTION (A)

NOTE: TANK BOTTOM ELEVATION
CAN VARY AS LONG AS TANK
LIQUID VOLUME REMAINS UN CHANGED.



SECTION (B)

NOTE: ALL WALL THICKNESS DIMENSIONS SHOWN
ARE PRELIMINAIRY AND TO BE CONFIRMED
CALCULATED BY ENGINEER.

PRELIMINARY
John Meunier

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	PRELIMINARY	2009-11-12	D.M.	--	--	--
A	PRELIMINARY	2009-10-08	D.M.	--	--	--

DESIGNER D.M.	DATE 2009-10-08	TITLE	BIOSTYR SYSTEM SECTIONS A-A & B-B
CHECKER --	DATE --	CLIENT	CORNWALL WWTP
ENGINEER D.L.	DATE 2009-10-08		
MANAGER C.S.	DATE 2009-10-08		JOHN MEUNIER ISO 9001: 2000 4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070
SCALE: 1:150			PROJECT DRAWING 08T206 - LA001 · INTERNAL · SHEET 2 OF 2 · REV B

STD: "D" 22x34 REF: BAR = 1" AT PLOT SCALE