

Monitoring of a stormwater settling tank: how to optimize depollution efficiency

Instrumentation d'un bassin de décantation : comment optimiser l'efficacité de dépollution

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RÉSUMÉ

Dans le but de se conformer aux nouvelles réglementations relatives à la protection des milieux récepteurs (ex.: Directive Cadre sur l'Eau), de nouvelles stratégies de réduction de la pollution rejetée par les systèmes d'assainissement doivent être mises en œuvre. Pour évaluer la faisabilité de la gestion de la qualité en temps réel de ces systèmes, stratégie qui en est encore à un stade précoce, l'étude de cas d'un bassin de dépollution à Bordeaux est présentée dans cet article. Ce bassin a été équipé de préleveurs automatiques (entrée/sortie) ainsi que de sondes de turbidité en ligne. Des campagnes de mesures ont été menées au cours d'évènements pluvieux en 2011-2012. La pertinence de la mise en œuvre des capteurs de turbidité dans le bassin pour son suivi opérationnel et pour une meilleure compréhension de la dynamique de sédimentation a été démontrée. Il a également été montré que jusqu'à 80% du flux de MES entrant dans le bassin en temps de pluie pouvaient être éliminés avant leur rejet dans la Garonne. Globalement, les résultats obtenus montrent le fort potentiel de cette approche novatrice pour réduire la pollution des milieux récepteurs même si des améliorations dans la mise en œuvre d'une stratégie en temps réel sont encore nécessaires.

ABSTRACT

To comply with new regulations for the protection of receiving water bodies (e.g. Water Framework Directive), new strategies of reduction of the pollution discharged from the urban drainage systems need to be implemented. To assess the feasibility of real-time quality based management, still at its early stage, the case study of a depollution tank in Bordeaux is presented in this paper. This tank was equipped with automatic samplers (inlet/outlet) and on-line turbidity sensors. Field campaigns were conducted during rainfall periods and storm events in 2011-2012. The relevancy of turbidity sensors' implementation within the tank for its operational monitoring and for a better understanding of the sedimentation dynamics in the tank was demonstrated. It was also showed that up to 80 % of the TSS flux entering the tank during rain events could be eliminated before discharge into the Garonne river. Globally, the results obtained show the high potential of such an innovative approach to minimize pollution to receiving bodies although improvements in the implementation of a real-time strategy are still needed.

MOTS CLES

Depollution tank, Management of sewer systems, Monitoring, Protection of receiving waters, Sewer overflows, Total suspended solids, Turbidity

1 INTRODUCTION

Current operational approach regarding quality issue in urban drainage sewers can be complementarily based on: i) quality measurements, especially at CSOs, to better understand the functioning of the sewer system in link with waste water treatment plant (WWTP) (e.g. Métadier et Bertrand-Krajewski, 2012), ii) quality modelling, for a better sizing of efficient depollution devices (e.g. Dotto *et al.*, 2011) and iii) real-time management for an improved control of the pollution discharges to receiving water bodies (e.g. Lacour, 2009).

However, despite huge progresses of these last 20 years, notably from French, Australian and Austrian research teams (Deletic *et al.*, 2012; Métadier et Bertrand-Krajewski, 2012; Hannouche *et al.*, 2011; Francey *et al.*, 2010; Lacour *et al.*, 2011), this approach mainly remains in the field of applied research: i) quality measurements are still mainly based on periodical samplings coupled with laboratory analysis (TSS, BOD, COD, ...) and implementations of continuous sensors are quite scarce, ii) advances in modeling are limited by the restricted data sets and the uncertainties on the pollution production processes (Maninna et Viviani, 2010), and iii) despite some initiatives (e.g. Boutayacht *et al.*, 2010; Roger *et al.* 2010), quality based real-time management is still at its first step.

Nevertheless, the evolution of European regulations, such as the Water Framework Directive WFD (2000/60/CEE) and the bathing water Directive (2006/7/EC) and national (self-monitoring, e.g. the so-called "auto-surveillance" in France) regulations along with the increasing environmental concern on the quality of receiving waters more and more lead local authorities to adopt a prospective behavior and look forward for more efficient ways to deal with pollution issues. While looking for a quality parameter that may become a good continuous quality indicator, a growing number of municipalities have turned toward turbidity measurement for which advanced on-line in-sewer monitoring techniques are today available. In France, this question is largely supported by research groups and associations, such as the HURRBIS network of the French observatories on urban hydrology (<http://www.graie.org/hurrbis/>) or the French national association ASTEE (Scientific and Technical Association). The latter organized in 2010 (Chebbo *et al.*, 2010) a specific conference on this topic, which lead to the launch of the production of a technical guide for the application of on-line turbidity measurements in sewers with examples of case studies (final version planned for 2013).

This paper presents the results of a pilot study handled by the Suez Environnement group on 2011-2012 which investigated the implementation and use of continuous turbidity sensors inside a settling tank as support for operational quality based management.

2 SITE, MATERIALS AND METHODS

2.1 Experimental site

The Bastide depollution tank (9550 m³), located in Bordeaux (France), on the right bank of the Garonne, is part of the Urban Community of Bordeaux sewer system. It has a circular shape and is composed of two separated compartments that communicate through electro-valves placed at different levels along the water column: the (main) outside compartment is intended for sedimentation whereas the central compartment acts as a well for emptying pumps. The tank receives water from the 90 ha Bastide catchment which is equipped with a mixed urban drainage system and includes a single 9 ha separated system sub-catchment. During a rain event, as illustrated in Figure 1, the tank is fed by a tangential ramp, allowing a rotation of the liquid that creates a vortex effect favoring the accumulation of sediments towards the center of the tank.

2.2 Monitoring equipment

The tank is equipped with 12 pumps: i) 1 dry weather pump (EU; 0.02 m³/s) at the inlet of the tank discharges wastewater to the treatment plant before they enter the tank, ii) 2 low flow pumps (EC; 0.05 m³/s) empty the lower part of the tank (polluted waters) towards the WWTP, iii) 1 upper high flow pump (ED; 0.4 - 1.05 m³/s) transfers settled water toward the Garonne and iv) in the upper part, 8 high flow pumps (0.8 – 1.05 m³/s) are devoted to fight against flooding. The water flow at the inlet of the tank, the functioning of pumps and the water level in the tank are recorded at a 5 minutes time step. The nearest rain gauge managed by the Urban Community of Bordeaux is the Jourde rain gauge.

In addition, the tank was equipped within the project period from March 2011 to January 2012 with 6 measurements points for quantity and/or quality samplings and online measurements (Figure 1): i) flow was measured at a 5 minutes time step at the outlet of the separated catchment, upstream the network (point P1), ii) quality samples during rainfall events were taken at P1, at the inlet of the tank (P3), at the outlets towards the WWTP (P6) and towards the Garonne river (P7) in order to assess the depollution efficiency of the tank and iii) continuous turbidity measurements at 5 minutes time steps were performed in the tank in order to evaluate the settling processes, either in derivation (P4) or at fixed levels in the tank (P5).

Due to the high variability of rainfall on the basin area and the potential influence of Garonne on the base flow, sampling periods in P1 and P3 were started manually on the basis of weather forecast. 100 mL samples were taken every 6 minutes, i.e. filling 1 L in 1 hour, on the basis of 14 (P1) or 24 (P3, P6 and P7) 1L bottles. Due to the laboratory constraint of a 2 L minimum volume per analysis, it was not possible to proportionally reconstitute samples on a volume basis as initially planned. Hourly sub-samples were mixed together within each analysis period (beginning, middle and end of rainfall event). In P6 and P7 this issue was overcome, as the analysis was done on water whose flow is nearly constant over time. Parameters analyzed include TSS along with COD and other organic and physicochemical parameters.

P5 point includes 6 nephelometric turbidimeters (Solitax sc.; range from 0.001 to 4000 NFU) at 4 levels, from top to bottom: levels 1 (-4.50 mNGF) and 2 (-7.60 mNGF) lay in the settled part, levels 3 (-12.60 mNGF) and 4 (-15.50 mNGF) in the polluted part with a doubling of the sensors because of the disturbance due to high polluted flow (calles 3/3bis and 4/4bis). P4 point is a mobile platform equipped with a pump going up and down inside the external compartment of the tank, taking water at different levels and sending it to a channel up the tank where the measurements are performed. The purpose was to gather data supporting a comparative study of these measurement strategies regarding the data quality, the maintenance constraints and potential use in the frame of operational use.

The maintenance frequency of the sensors has been established in accordance with the recommendations of Joannis *et al.* (2010). The inspection visits were performed on a weekly basis, the sensors cleaning was operated on a monthly basis, and the data acquisition chain was checked every three months. Calibration of the turbidity probes was done once in the campaign on the whole measurement range.

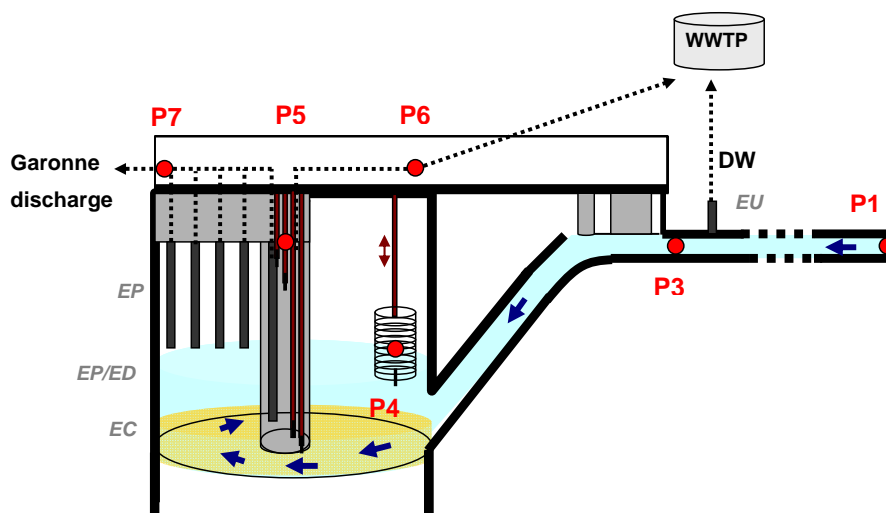


Figure 1 : Illustration of Bastide tank functioning and location of the 6 measurement points.

2.3 Data processing

The raw data have been processed on the basis of the methodology applied by Métadier and Bertrand-Krajewski (2011a; 2011b) and implemented in the EVOHE software (INSA Lyon/Alison, 2012). Validation was performed using the test of sensor measurement ranges and gradient test to detect outliers. Incorrect values due to the extraction data step and data ceiling were detected. Data classified as doubtful and finally invalidated include: i) short dysfunctions of sensors over one or two time steps with null values recorded, ii) drifts in measurements due to the fouling of the sensors,

especially for flow in P3 and turbidity in the lowest part of the basin, iii) erroneous measurements, e.g. very high variations over 1 or 2 time steps, or invariant values on a period, especially evidenced for flow measurements in P3, water level of the tank and flow discharged in P7 which is not measured (only starting and stopping time are recorded), iv) abnormalities during long periods regarding EC flow measurement during starting phases of the pumping, overestimated due to the turbulence in the forced main and P3 flow meter for which flow at small velocities could not be properly measured given the large diameter (2500 mm) of the pipe.

The detected bias on the water level in the tank was corrected (i.e.) and the missing data over one time step filled by linear interpolation. In order to be able to calculate the hydraulic balance of the tank during storm events, EC flowmeter data were reconstituted during starting phase on the basis on mean flow values encountered in the release phase. Low flow values in P3 and flow in P7 were reconstituted from a volume balance approach.

2.4 Definition of rainfall periods and storm events

Storm events were defined according to the tank functioning, from the first filling discharge until the level of water in the tank returns to its initial level, i.e. at dry weather conditions. A two steps approach was applied for their delimitation: i) delimitation of rainfalls periods from Jourde rain gauge records, ii) comparison between rainfall events and water level in the tank, so as to relate them. In the case of successive rainfalls and tank reactions, these events were considered as a single storm even if the tank was not emptied between the successive reactions. The delimitation of rainfall events was done automatically in MatLab® considering the following criteria: i) a minimum of 4 hours of dry weather between two rainfalls events, ii) a mean intensity of rainfall higher than or equal to 0,1 mm/h and a minimum total rainfall depth of 2 mm and iii) a duration of rainfall higher than or equal to 10 minutes (two time steps). 116 events were distinguished over the whole observation period.

The analysis of tank reactions to rainfall events was performed under graphical observation of the flow at P1 and P3 and water level in the tank. This method has allowed pointing out: i) the influence of dry weather clear water infiltration, the base flow changing over time, ii) the coherence of the measurements themselves, with the possible identification of doubtful measurements. From the 116 rainfall events delimited, 99 storm events were identified.

3 RESULTS AND DISCUSSION

3.1 General presentation of the database

Due to the exceptional drought period on the first 2012 semester, only 8 significant storm events could be monitored. For this reason, the measurement campaign was extended from January 2012 until May 2012, enabling the capture of 3 additional storm events. Over the 11 events (Table 1), only 4 storm events included quality measurements on all measurement points. For these events, the basin was filled enough so that storm water was both pumped to WWTP (P6) and discharged to Garonne River (P7). Table 1 summarizes the main characteristics of the recorded storm events. The rainfall return periods were estimated based on local rainfall characteristics, by calculating return period over different durations and keeping the maximum one. Four main categories of storm events, including single and multi peak flows, can be distinguished: i) small storm events with low return periods inferior or equal to 15 days, ii) recurrent storm events with 1 month return period, for which the tank level rises more significantly, iii) 6 months to 1 year return period storm events for which ED pump will start and iv) the exceptional 10 years return period storm event of August 2011, with 41 mm over 1.33 hour, a maximum 3 000 L/s flow in P3 and a maximum water level of 12.8 m reached in the tank (filling rate of 88%).

The maximum height was reached on April, 22nd 2012 with a value of 13.81 m. It must also be noted that only 7% of the events resulted in triggering ED pumps and that 17% exceeded the level of turbidity probe P5 3/3bis of Point P5. Changing the starting level for ED pumps and their timing affected the levels of loading of the tank for a greater number of starts (see paragraph 3.2).

Table 1: Characteristics of the 11 storm events of the final database, in grey events for which quality samples on all points could be performed

N°	Event	Return period	Duration Associated (h)	Event duration (h)	Rainfall duration (h)	Rainfall depth (mm)	Max hourly Intensity (mm)	Max. water level (m)
1	Jul. 2011, 20 th - 21 st	1 month	1	18.6	3.75	7	5.4	2.05
2	Aug. 2011, 2 nd - 3 rd	10 years	1	24.1	1.33	41.2	40.6	12.77
3	Aug. 2011, 24 th - 25 th	6 months	3	38.9	6.00	29.4	10.4	7.94
4	Sept.2011, 1 st - 2 nd	1 month	1	26.9	7.67	11.2	6.2	3.36
5	Nov. 2011, 4 th - 5 th	<15 days	-	19.8	13.92	8.8	1.4	0.21
6	Dec. 2011, 5 th - 6 th	<15 days	-	27.5	23.42	11.4	1.6	0.87
7	Dec. 2011, 13 th - 20 th	6 months	12	174.3	111.92	89.2	8	10.33
8	Jan.- Feb. 2011, 30 th - 1 st	1 month	12	29.7	16.25	15	3.6	5.13
9	Apr.2012, 22 nd - 27 th	1 month	12	134.0	61.00	50.4	2.6	13.81
10	Apr.- May 2011, 27 th - 1 st	1 year	24	87.5	38.34	61.8	6.8	8.66
11	May 2012, 19 th - 22 nd	15 days	6	83.3	31.08	21.6	1.8	4.78

3.2 Functioning modes of the tank

Two ways of functioning have been experienced during the campaign. In its initial setup, from March 2011 to mid-October 2011, the ED pump starting and stopping level were set at respectively -2 mNGF and -12 NGF. The EC pump was automatically turned on once the level reached -15.40 mNGF, stopped at the start of ED pumping and then restarted until -16.40 mNGF was reached (complete emptying of the tank). Due to its high starting level, the ED pump only functioned for the decennial frequency event of the 2nd of August 2011. For this reason, from mid-October to the end of the campaign, the starting level was lowered to -10 mNGF along with a 2 hour delay to enable the particles to settle. Moreover, in order to facilitate the filling of the tank, the ability to remotely monitor the operation of the EC pump was set up: its stop at the beginning of the rain allowed the tank to fill up during moderate rain events. For both periods of the campaign, hydro-ejectors were started automatically after the stop of the ED pump and for water levels higher than -1.90 mNGF, the tank operated in protection against flooding (1 to 8 EP pumps are turned on – not encountered during this campaign).

3.3 Depollution efficiency

Figure 2 shows the reconstituted water balance volumes for the whole database and Table 2 the TSS depollution efficiency for the events where samples could be taken in both P6 and P7 discharges, along with a 95% confidence intervals (CI). This latter was estimated at +/-2*8.4% on the basis of a recent study of French Agence de l'eau RM&C and INSA de Lyon (2010) which assessed to 8.4% the mean standard uncertainty of the suspended solid concentration due to the absence of reconstitution volume in reference to the reconstitution method.

The calculation of the depollution efficiency, η , is based on the mass balances between tank inflow Q_{P3} and outflow to the river Garonne, Q_{ED} , with C_{P3} and C_{ED} the associated TSS concentrations:

$$\eta = 1 - \frac{Q_{ED} \times C_{ED}}{Q_{P3} \times C_{P3}}$$

Flow balances are satisfactory for all the events (above 85%) while TSS balances depend on the event. 2 over the 4 events, namely the 13th of December 2011 (multi-peaks 6 months return periods event) and the 20th of May 2012 (single peak small event), the balance is satisfactory (above 70%) and the tank has a very good efficiency, between 70% and 80%.

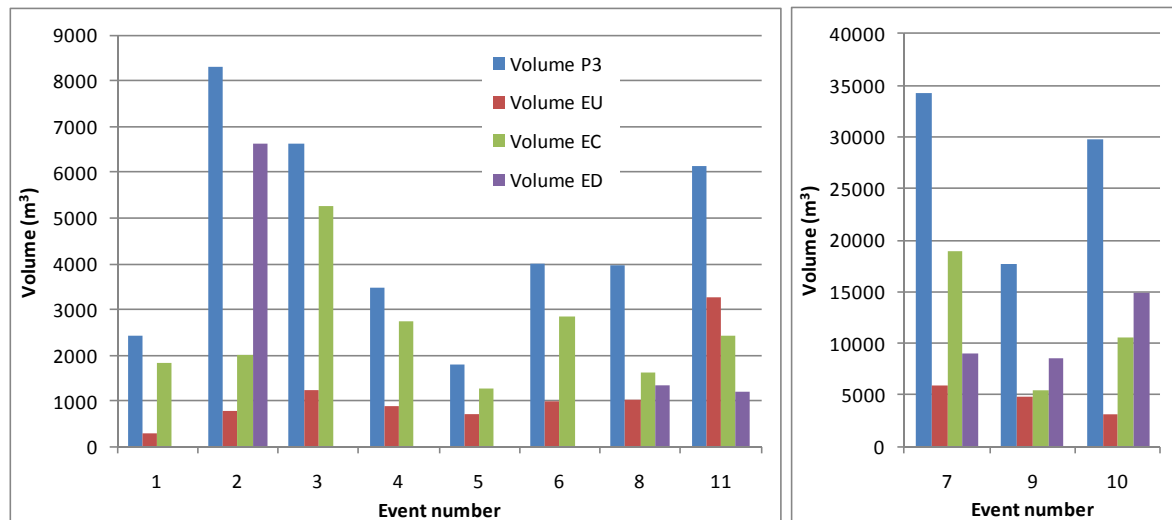


Figure 2: Flow balance volumes for the whole database: EU, P3, EC and ED volumes

Table 2: Depollution efficiency of the tank for the 4 events of the database for the events where samples could be taken in both P6 and P7 discharges

Storm event	Depollution efficiency (%) [95% CI]
2 02/08/2011	-47 [-76,-26]
7 13/12/2011	74 [69,78]
10 27/04/2012	-125 [-171,-93]
11 20/05/2012	80 [76 83]

However the 2 other events, the 10 years frequency and single peak August 2011 and the 1 year frequency event multi-peak April 2012 events, show a negative balance and tank efficiency. This would mean that TSS loads leaving the tank (P7) are higher than the TSS load entering the tank (P3), which is *a priori* incoherent and may be due to measurement errors of values and/or representativeness over the storm event periods. In order to better understand this issue, a test was performed by assuming that TSS concentration is proportional to the flow over the whole storm event period: hourly pollutograms were reconstituted from the flow and the overall concentration of the global sampling period. This is known to be a very strong assumption but however that could be lead to a quite good magnitude of order of the event load. The method leads to more realistic results, with depollution efficiency of 76% and -25%, however the value remaining negative for the April event.

These results clearly show the limits of traditional quality sampling methods in an operational context with huge rainfall events variability and local constraints: not only it is impossible to get the dynamic of the TSS loads, but this can also result in high uncertainties in the quality balance.

Thus, the Bastide tank plays a role of depollution tank during storm events that can be evaluated as up to 80 % of the particulate pollution (TSS). Results obtained can hardly conclude on the influence of the 2 hour period delay before the start of the ED pump set after August 2011 to enhance sedimentation. However based on the proportional reconstitution test, December and May events resulted in higher removal efficiencies (above 90%) than for August and April events. We can hypothesis that for the August event, the level of water rose suddenly during the event preventing the sedimentation from being efficient and given no settling delay was set at that time.

3.4 Settling dynamic of the tank

Due to technical problems, data acquired with mobile platform in P4 measurement point were not sufficient for an advanced analysis. If several improvements have been made following the incidents or field observations, it was not possible to make it fully reliable for an operational use and some other improvements are still required. Detailed feedbacks are not provided here. But we can underline that

fixed sensors seem more adapted to operational context than mobile platform, even if they don't allow performing measurements at various levels in the water column.

Inversely, the system of fixed turbidity probes in the central column gave quite good results. Depending on the functioning mode of the tank, turbidity levels attained along with information on ED pumping in the tank during the storm events are summarized in Table 3.

Table 3: Summary of the storm events database characteristics regarding settling processes in the tank

Storm event		Return period	Water level max (m)	Turbidity levels reached				Starting delay for pump ED (h)	ED Pump starting level attained	Number of ED pumping episodes
N°	Date			4/4b	3/3b	2	1			
1	Jul. 2011, 20 th - 21 st	1 month	2.05	x	x			0	No	-
2	Aug. 2011, 2 nd - 3 rd	10 years	12.77	x	x	x	x	0	Yes	1
3	Aug. 2011, 24 th - 25 th	6 months	7.94	x	x	x		<i>Not launched</i>	Yes	0
4	Sept. 2011, 1 st - 2 nd	1 month	3.36	x	x			-	No	-
5	Nov. 2011, 4 th - 5 th	<15 days	0.21	x				-	No	-
6	Dec. 2011, 5 th - 6 th	<15 days	0.87	x				-	No	-
7	Dec. 2011, 13 th - 20 th	6 months	10.33	x	x	x		2 hours	Yes	4
8	Jan.- Feb. 2011, 30 th - 1 st	1 month	5.13	x	x			2 hours	Yes	1
9	Apr. 2012, 22 nd - 27 th	1 month	13.81	x	x			2 hours	Yes	5
10	Apr.- May 2011, 27 th - 1 st	1 year	8.66	x	x	x		2 hours	Yes	4
11	May 2012, 19 th - 22 nd	15 days	4.78	x	x			2 hours	Yes	1

The sedimentation dynamic in relation with pump functioning and general tank operations could be analyzed on the 9 events for which at least the level 3 was attained, as illustrated Figures 3 to 5 with the examples of the 30th - 31st of January, the 27th of April - 1st of May and the 2nd - 3rd of August, which correspond respectively to a 1 month, 6 month and 10 year return period.

Turbidity homogenization is clearly observed after ED pumping (e.g. on Figure 3) due to the start of the hydro-ejectors. During this phase, turbidity measurements may be not representative of the overall amount of material in the tank: velocity increases due to EC pumping and the biggest settled particles are re-suspended. Moreover, this phenomenon can also be observed at the start of the EC or ED pumps (e.g. Figure 7) due to a re-suspension of the particles in the central column.

Regarding redundant sensors for the 2 lower levels, the two signals of level 4 are highly variable with values up to 4000 FNU whereas measurements are rather consistent for level 3. This can be explained by the location of the probe in the highly polluted water phase just above the triggering level of the EC pump with associated re-suspensions at its start. Moreover the presence of floating material at the water mirror tends to produce noisy signals. These observations confirm the high sensibility of turbidity probes to sewage water, despite maintenance, favoring the fast development of a biofilm and inducing significant drifts in the measurements and thus preventing a reliable use of the signal for any real-time decision making.

On the other hand, despite turbidity spikes at the air/water interface (e.g. in Figure 4) during immersion and emersion of the probes, decrease of turbidity values over time between pumping episodes, ranging from 1 to 5 per storm event, can be observed for levels 2 and 3 (e.g. as indicated Figure 4). This can be explained by both settling process and the positions of the probes that change in the water volume as water is decreasing. Leaving out turbidity spikes, variations at level 2 range from 0 to 300 FNU, with decreasing gradients between 70 and 100 FNU over 6 hours time.

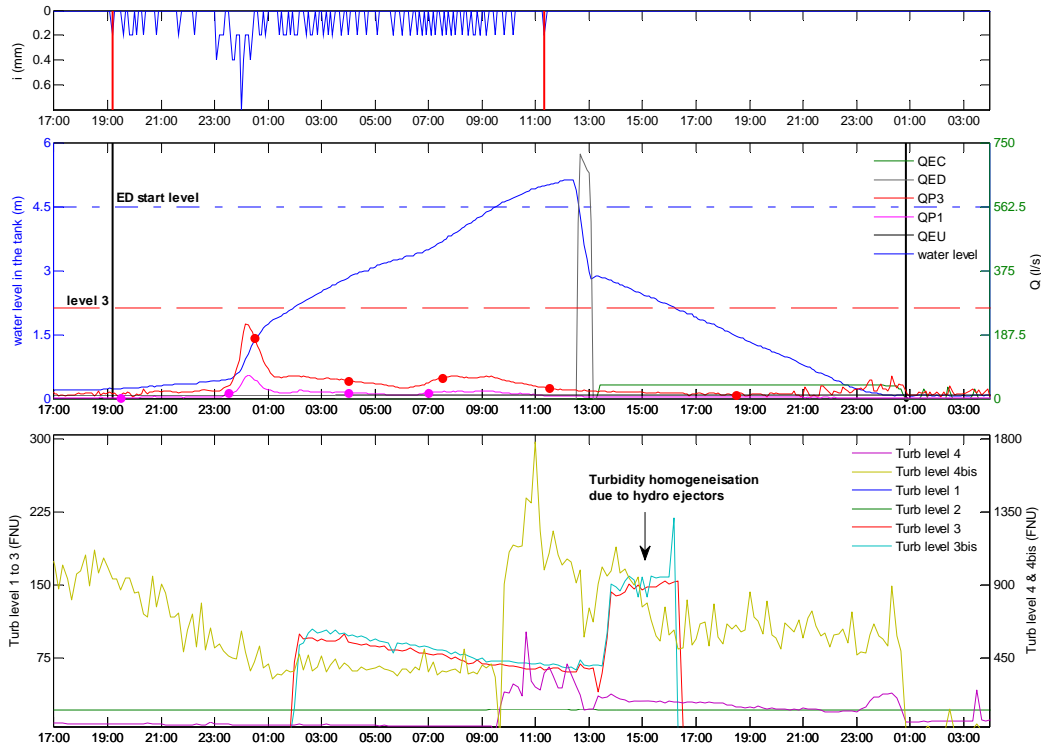


Figure 3: Storm event of the database, from 30th to 31st of January, 2012

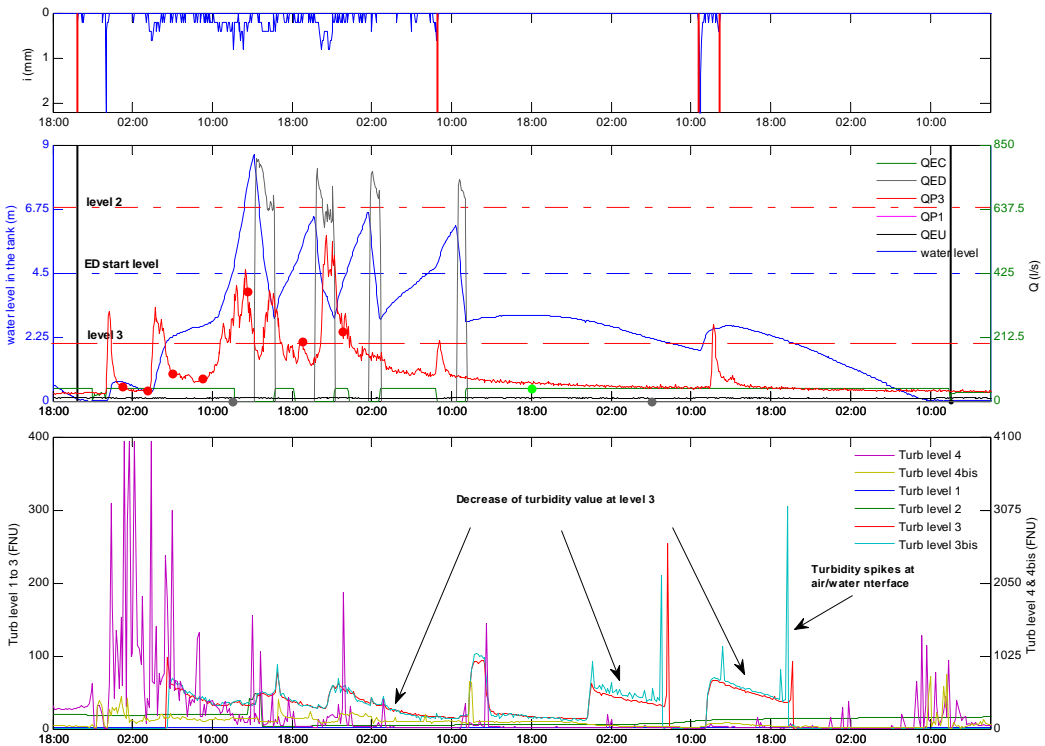


Figure 4: Storm event of the database, from 27th of April to 1st of May 2012

A notable exception is the event of the 20th - 21st of July with values up to 750 FNU. Despite the moderate rainfall return period, this can be explained by a very long antecedent dry weather period along with a fast dynamic single peak flow inducing the significant wash off of surface sediments. Turbidimeters are measuring during 1,25 hours, whereas this duration ranges from 9 hours to 3 days

for the other events.

For events with measurements at level 3 and 2 (e.g. Figure 5), no significant stratification of turbidity between the two levels could be observed, or if any, not significant enough and reproducible to be reliably interpreted. For the event of 2nd of August (Figure 5), levels 1 and 2 were attained with maximum values above 400 FNU: no settling could be observed at level 1 due to limited time the level was attained and the quick trigger of the ED pump and comparable values between 200-300 FNU for all the 3 levels could be observed. These results suggest a homogenous concentration in the upper levels of the tank, despite the additional 2 hours delay set after mid-October 2011.

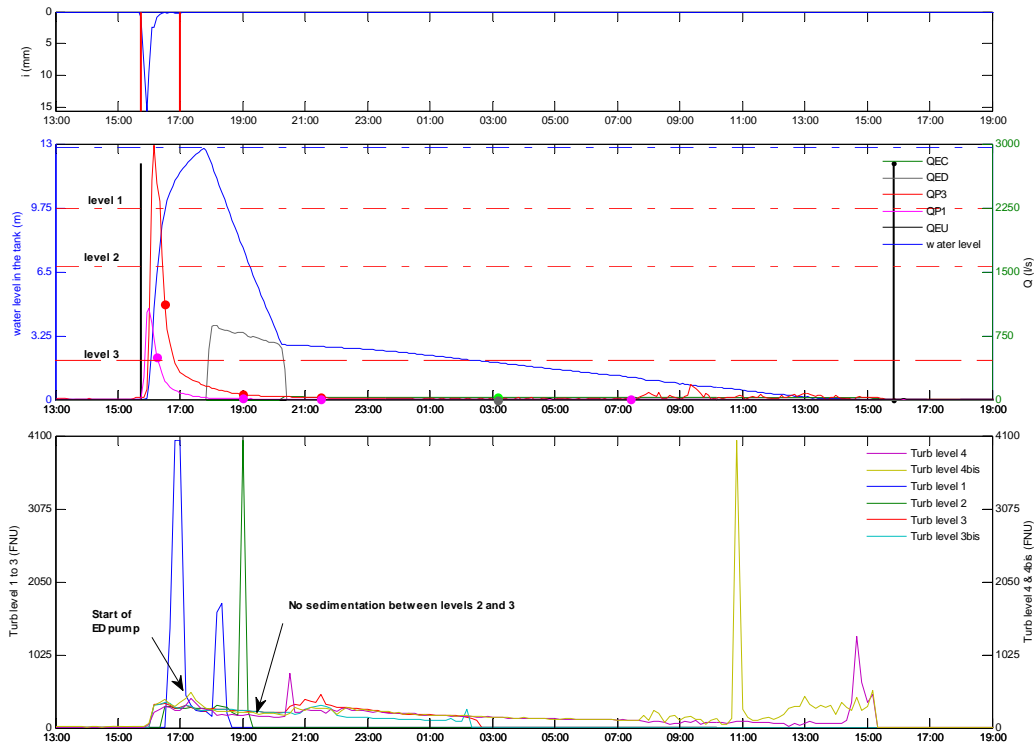


Figure 5: Storm event of the database, from 2th to 3th of August, 2011

4 CONCLUSION

This study brings feedbacks on the feasibility to fully instrument a depollution tank in nearby operational conditions with continuous quality measurements and as a prerequisite to the development of a real-time quality based management. The main conclusions are the following:

- Though it was possible to assess the depollution balance of the tank with efficiency up to 80%, the results clearly outline the limit of traditional quality sampling methods in operational conditions for a reliable estimation of the TSS load. In medium and long term measurement campaigns, a more effective cost/reliability combined solution that the authors propose is the systematic implementation of continuous turbidity probes, at least at strategic points of the sewer. This not only enables to reduce uncertainties in the estimation of real pollution load, provided previously [TSS]-Turbidity are established, but also to better assess observed variability by capturing much more storm events.
- What can also be learnt from this experience is the importance of ensuring the representativeness of flow measurements by paying attention to specific issues, such as: i) the positioning of the water level and velocity sensors in the pipes, especially in the case of low flow in dry weather and ii) the estimation of effective pumps capacities.
- The comparison of derivation and in situ techniques for the measurement of turbidity in the tank concludes on the reliability of the second option for an operational use: except for the probes located in the lowest part of the tank with highly polluted water, representative measurements could be obtained for the 3 highest levels in normal operational maintenance conditions and

despite the fact that the probes were not continuously immersed.

- Analysis of the sedimentation dynamics confirms the interest of following turbidity in a tank: it allows checking or estimating in real-time its effective depollution efficiency and then proposing optimized functioning modes.
- Additional measurements regarding dry weather, [TSS]-turbidity correlations, settling velocities of the particles and concentrations dynamics entering the tank are now required for the design of effective real-time management rules to minimize the pollution discharged to receiving bodies. The gathering of larger data sets from turbidity measurements would also help investigate the relation between sedimentation dynamics and storm events characterization.
- These results will serve as a basis for the test of a continuous TSS concentration model, to help sewer managers improve the design of efficient depollution tanks.

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