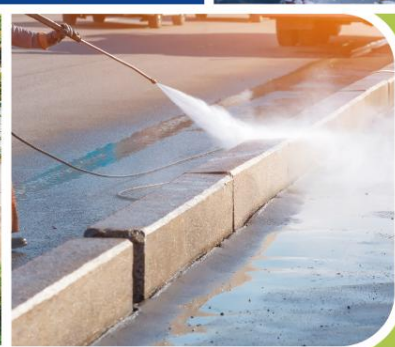
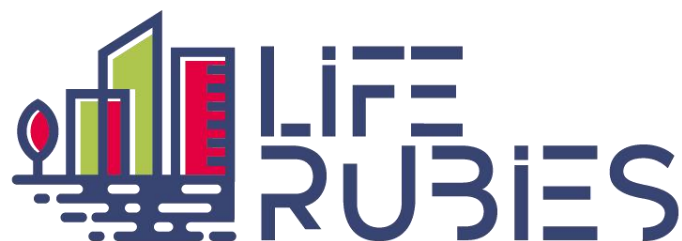


French pilot operational tests report

Deliverable DB4.3



Real-time pollution-based control of urban drainage and sanitation systems for protection of receiving waters

Document Title: LIFE RUBIES DB4.3 - French pilot operational tests report	
Partner responsible: SUEZ SMART SOLUTIONS, LYRE	
Authors: SUEZ SMART SOLUTIONS, LYRE	Date: July 2026

Modifications (dates)
February 2025 : First version with hydraulic tests
September 2025 : New elements with quality operational tests and KPIs methodology
December 2025 : Update version with quality tests
July 2026 : Addition of elements regarding the rain events during the observation period – last validated and FINAL version

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AUCUNE ENTREE DE TABLE D'ILLUSTRATION N'A ETE TROUVEE.

1 Introduction

The aim of this report is to detail the tests carried out on the instructions sent from AQUADVANCED to the PLCs. Throughout the deployment of the solution, several types of tests were carried out, firstly coherence checks to verify the correct communication between Aquadvanced and the Topkapi, then 'unit' tests to verify the correct operation of the complete communication loop between Aquadvanced and the PLCs. Once these have been validated, the application runs normally but is monitored to check that it is working properly in all weathers

For quality control, the tests consisted of verifying communication between the quality controller and AQUADVANCED, followed by analyzing the consistency of the quality control rules transmitted to AQUADVANCED. Finally, as with the hydraulic tests, the last step was to activate the quality controller and monitor it continuously with an assessment of the impact.

2 Operational Hydraulic control tests

2.1 Coherence checks

The aim of this tests is to validate the possibility for AQUADVANCED to read and to write with the SCADA (and PLCs connected to it). It was carried out on each controlled site.

The main objective of this verification phase was to guarantee:

- The values received from Topkapi corresponded to those supplied by the PLCs.
- These values were within the expected orders of magnitude and units (meters, NGF meters).

The tests were carried out using the following methodology:

- Comparison of the values received in the Topkapi interface with those of the PLCs.
- Checking the units of measurement
- Checking the orders of magnitude to detect any inconsistencies or transmission errors.

The tests confirmed that:

- The values received from the Topkapi were consistent with those sent by the automated systems.
- All the values complied with the expected units.
- There were no significant deviations in the orders of magnitude.

BASSIN GUY LEFORT

Variable (mnémonique)	TYP E	Transmissio n	Commentaires	Contrôle cohérence
MESURES				
Possibilité pour les niveaux d'avoir l'unité en m simple (retirer «_NGF»)				
B47.C1.NIVEAU_NGF_US1	REEL	API → TPK → PC	Hauteur US1 compartiment 1	Ok
B47.C1.M_US1_HIS	BOOL	API → TPK → PC	Défaut US1	Ok
B47.C1.NIVEAU_NGF_SP1	REEL	API → TPK → PC	Hauteur Piezo1 compartiment 1	Ok
B47.C1.M_SP1_HIS	BOOL	API → TPK → PC	Défaut Piezo 1	Ok
B47.C2.NIVEAU_NGF_US2	REEL	API → TPK → PC	Hauteur US2 compartiment 2	Ok
B47.C2.M_US2_HIS	BOOL	API → TPK → PC	Défaut US2	Ok
B47.C2.NIVEAU_NGF_SP2	REEL	API → TPK → PC	Hauteur Piezo2 compartiment 2	Ok
B47.C2.M_SP2_HIS	BOOL	API → TPK → PC	Défaut Piezo 2	Ok
B47.DEVERSOIR.NIVEAU_NGF_US3	REEL	API → TPK → PC	Hauteur US3 collecteur	Ok
B47.DEVERSOIR.M_US3_HIS	BOOL	API → TPK → PC	Défaut US3	Ok
B47.DEVERSOIR.NIVEAU_NGF_US4	REEL	API → TPK → PC	Hauteur US4 collecteur	Ok
B47.DEVERSOIR.M_US4_HIS	BOOL	API → TPK → PC	Défaut US4	Ok
B47.DEBIT_DEULE.MESURE	REEL	API → TPK → PC	Débit rejet vers Deûle	Ok

Figure 1: Guy Lefort data exchange table

The exchange table, like the one shown above, are useful tools during this step, as it allows to keep track of which variable are tested.

Although relatively simple, this verification stage was necessary to guarantee the integrity of the data before embarking on the unit testing phase. The results obtained ensure that the basic data is reliable, which is an essential prerequisite for the subsequent tests.

2.2 Unit testing

The aim of this test is to verify the complete loop for the real time control of actuators, it was carried out on each controlled site by ensuring that:

- The strategy changes correctly apply the instructions requested.
- The instructions are correctly transmitted to Topkapi.
- The instructions reach the PLC correctly.
- The machine correctly applies the instructions received.
- The controlled structures send back the expected information, such as its new position and the active control mode.
- This information is correctly sent to the Topkapi and then back to Aquadvanced.

To do this, a test book is drawn up in advance, describing each stage to be completed to bring the tests to a successful conclusion. Each step is then validated one by one

Sequence 3: Testing the GC functions on the Guy Lefort site (VS1 valve controller)	
DATE: 14/04/2023	
VÉRIFIÉ PAR: Quentin MARUEJOULS	
Transition « gestion locale » à « GD temps sec »	
1. The site is under local management (GC not authorized) and available for GC, the valve is under local management.	Ok
2. The operating mode calculated and returned by the PLC is 1 for the valve controller (PLC, supervision and AQDV HMI).	Ok
3. Disable automatic strategy switching from the AQDV HMI (manual switching active)	Ok
4. Request the 'Dry Time' strategy from the central station (if this is not already the case).	Ok
5. The 'Dry weather' strategy is visible in Topkapi.	Ok
6. Set the controller to 'GC authorized' from the supervision. Start the stopwatch.	Ok
7. In accordance with the control concepts, the valve applies the position setpoint configured in the PLC.	Ok
8. The operating mode is 101 and the setpoint sent is open (100% opening 16.5m NGF)	Ok
9. The setpoint numbers are the same in AQDV, Topkapi and the PLC (they increment every 5 minutes).	Ok
10. The controller and valve animation on the AQDV HMI is correct.	Ok
Transition from 'GC dry weather' to 'GC wet weather - WWTP not saturated',	
11. From the central station control panel, request the Rainy weather - WWTP Not saturated strategy	Ok
12. When the Rainy weather - WWTP Not saturated strategy is applied, the operating mode calculated and returned by the PLC is 103 for the valve (PLC, supervision and AQDV HMI) with upstream level regulation at 16.5 mIGN	Ok
13. The setpoint numbers are the same in AQDV, Topkapi and the PLC (they increment every 5 minutes).	Ok

Figure 2: Test Book extract

During this phase, the faults are also tested as well as their consequence, the deactivation of the site from the Global Control and the safe retreat of the structured under local control. This need to be apply to the structured in fault, but can also be applied to structures that are dependent. For example, if the gate at the entry of the Guy Lefort stormwater tank is in default, the pumping station of Café des Fleurs must get back to local control, to prevent the situation where the gate is stuck closed due to a fault and the pumps stopped because of an instruction sent from Aquadvanced, thus creating a spill.

Rainy weather GC valve fault	
14. Force a fault on valve VS1	Ok
15. The alarm is sent to the supervisor and the central station (VS1 valve fault summary).	Ok
16. The controller's GD impossible alarm is active and visible on the AQDV HMI.	Ok
17. The PLC tries to apply the local management rules to control the valve.	Ok
18. The operating mode is still 103	Ok
19. Deform the valve fault. The GD impossible alarm disappears. The valve resumes upstream level control. Loss of communication fault in wet weather GD	Ok
Loss of communication fault in wet weather GD	
1. Disconnect the communication between the local station and the supervision.	Ok
2. After a few minutes, the 'communication fault' alarm is activated in the PLC (because the setpoint number remains frozen).	Ok
3. The operating modes are always 103 in the supervision system.	Ok
4. The PLC must try to apply the local management rules.	Ok
5. The supervision and AQDV detect this loss of comm (after a few minutes).	Ok
6. The central station updates the valve status in the model (based on the local management rules).	Ok
7. Reconnect the communication between the local station and the supervision.	Ok
8. After a few minutes, the 'communication fault' alarm disappears from the PLC.	Ok
9. The valve resumes upstream level control.	Ok
10. The supervision system and the central unit detect that communication has been restored.	Ok

Figure 3: Extract from the test book for VS1 faults

2.3 Real time test

Once all the elements had been independently tested, the Dynamic Control was activated on the controlled sites, initially only during working hours, to ensure that the application works properly in real conditions. The aim is to ensure that the strategies are calculated correctly and that the instructions are sent to the PLCs. This phase also allows us to fine-tune the settings and strategies to optimize the control of the sewer network and avoid any possible spillage.

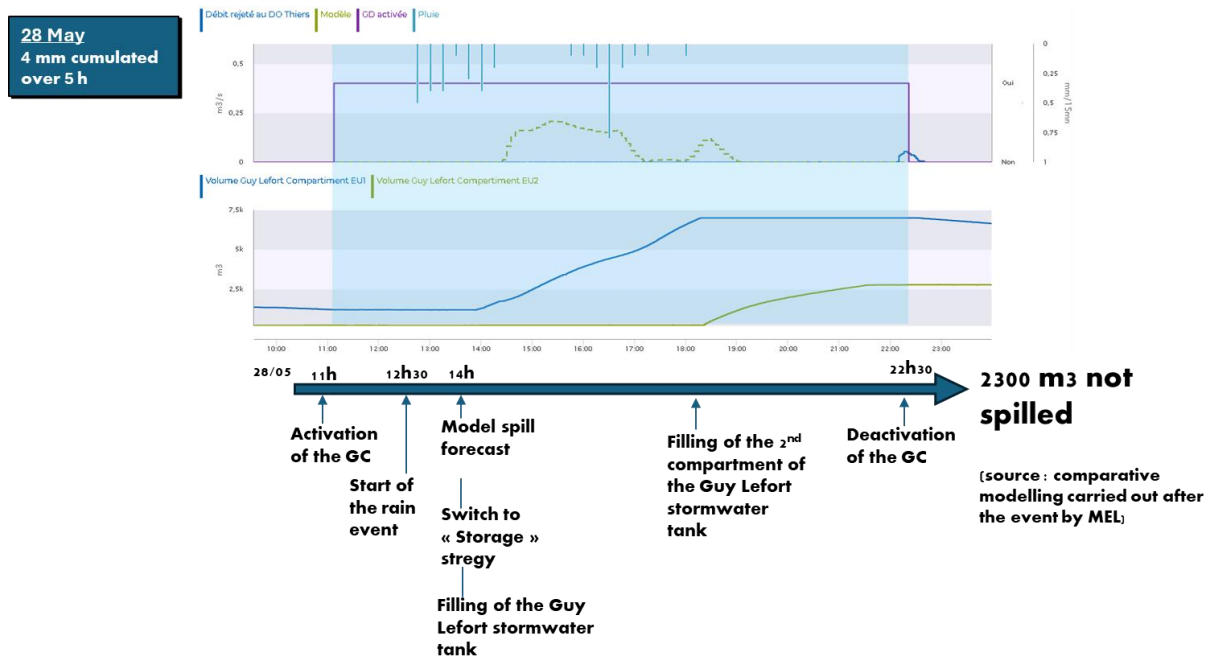


Figure 4: Rain Event during an activation of the Global Control

Real-time testing also enables anomalies to be detected, whether they be configuration errors or problems in the network, as well as errors in the choice of instructions and strategies that have been devised upstream and which are now confronted with the reality of operating a sewerage network.

3 Operational Quality control tests

Based on the previous virtual tests carried out on a pre-production platform (see deliverable DB4.2), the quality module has been deployed on the MEL production platform and tests were very similar to the hydraulic control tests but included an additional layer since the quality controller is integrated with the existing hydraulic module.

3.1 Remote control tests

The Quality Controller sends two types of data to AQUADVANCED: informational data and data that provide control rules. It is important to verify that these control rules are properly integrated into AQUADVANCED's decision tree, and therefore correctly applied in the control of the PLCs.

The methodology consists in verifying that the control rule sent triggers the correct control strategy. Indicators have been added to the synoptic diagram in order to monitor in real time both the control rule sent by the Quality Controller and the hydraulic control strategy applied.



Figure 5: Illustration of the synoptic diagram showing the display of control strategies.

3.2 Real time test and fine tuning

In the same way as for the hydraulic tests, once all the elements had been independently tested, the Dynamic Control was activated with the Quality controller.

Initially only during working hours, to ensure that the application works properly in real conditions. The aim is to ensure that the strategies are calculated correctly and that the instructions are sent to the PLCs. This phase also allows us to fine-tune the settings and strategies to optimize the control of the sewer network and avoid any possible spillage.

This step provided an opportunity to observe that the hydraulic model sometimes exhibited a delay on certain overflow events, which impacts the control rules. This delay was taken into account in the calculation parameters to ensure that it does not generate inappropriate control rules.

4 Impact assessment methodology

The purpose of this impact assessment is to quantify the gains achieved through the implementation of dynamic management within the sewer system. The methodology applied consists of the following steps:

4.1 Calibration of the hydraulic model using 2023 data

The first step consisted in calibrating the hydraulic model based on operational data from the year 2023. The calibration process consists in adjusting the hydraulic model parameters so that simulated flows, water levels, and quality accurately reproduce the measurements recorded in the field. This step ensures that the model behaves like the real system under comparable conditions. The calibration focused on the main control points of the network: Pasteur, Batelier, Café des fleurs, and overflow locations.

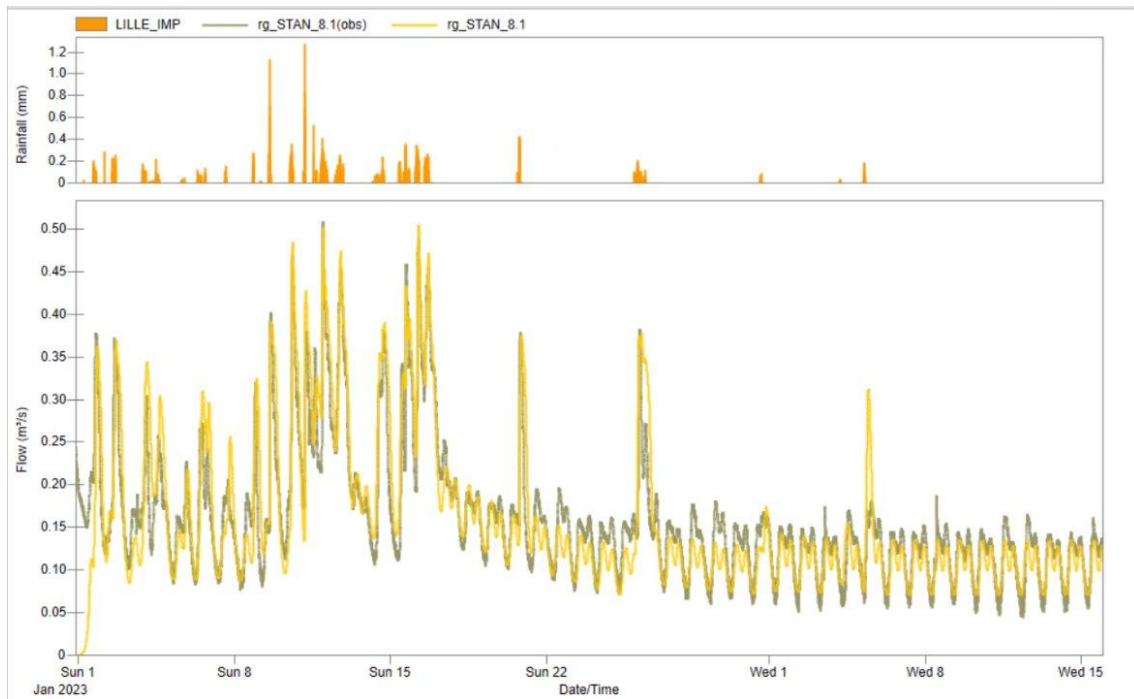


Figure 6: Model Calibration at Pasteur control point

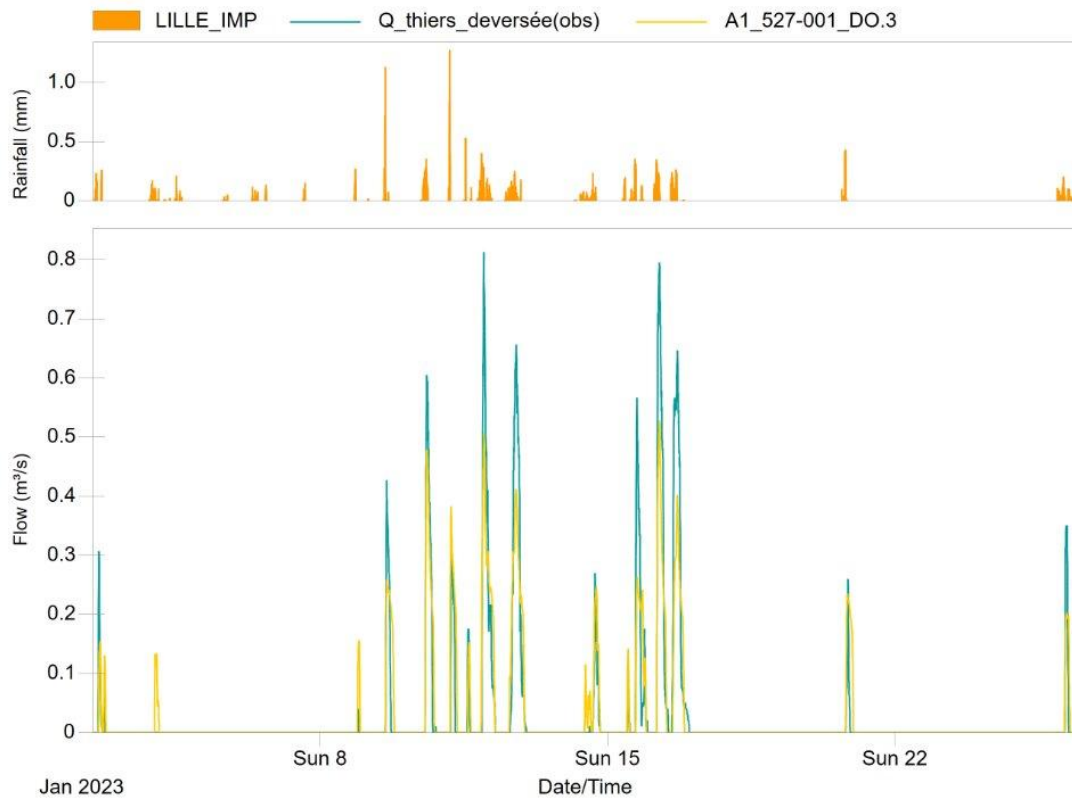


Figure 7: Model calibration at Thiers overflow point

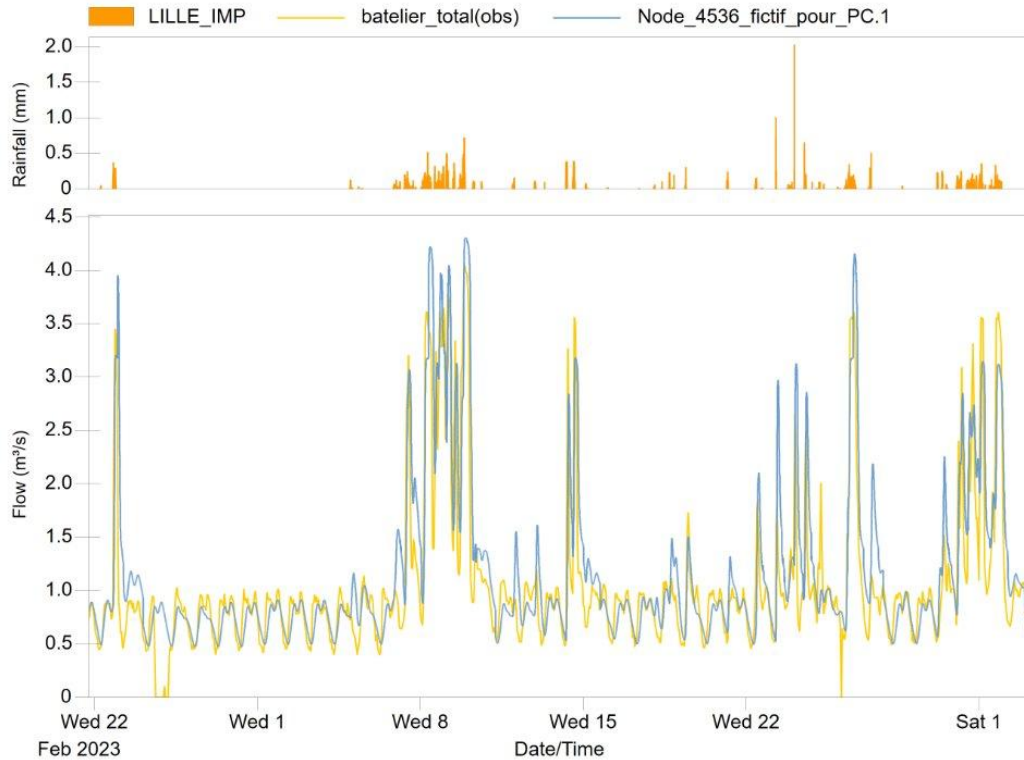


Figure 8: Model calibration at Batelier control point

4.2 Construction of a hydraulic model based on real field collected operational data

A second model was then developed using real-time operational data. The model integrates:

- The actual position of the VS1 gate recorded on site,
- The real operation status of pumps (starts/ stops), including Guy Lefort pumps and pumps of the Café des fleurs station.

In addition, the model includes a reproduction of the dynamic management strategy whenever it was active during the study period. A comparison between the model outputs and the observed operational data was carried out to validate the accuracy of this dynamic management strategy.

The figures below show the calibration results at Café des fleurs overflow. The model provides a good reproduction of the spill dynamics, closely matching the observed flow variations and operational statuses recorded on site. This indicates that the integration of the actual gate positions and pump start and stop events is well captured.

It is important to note that the data processing and integration phases were lengthy and complex. Nonetheless, the model reflects correctly the system's behavior.

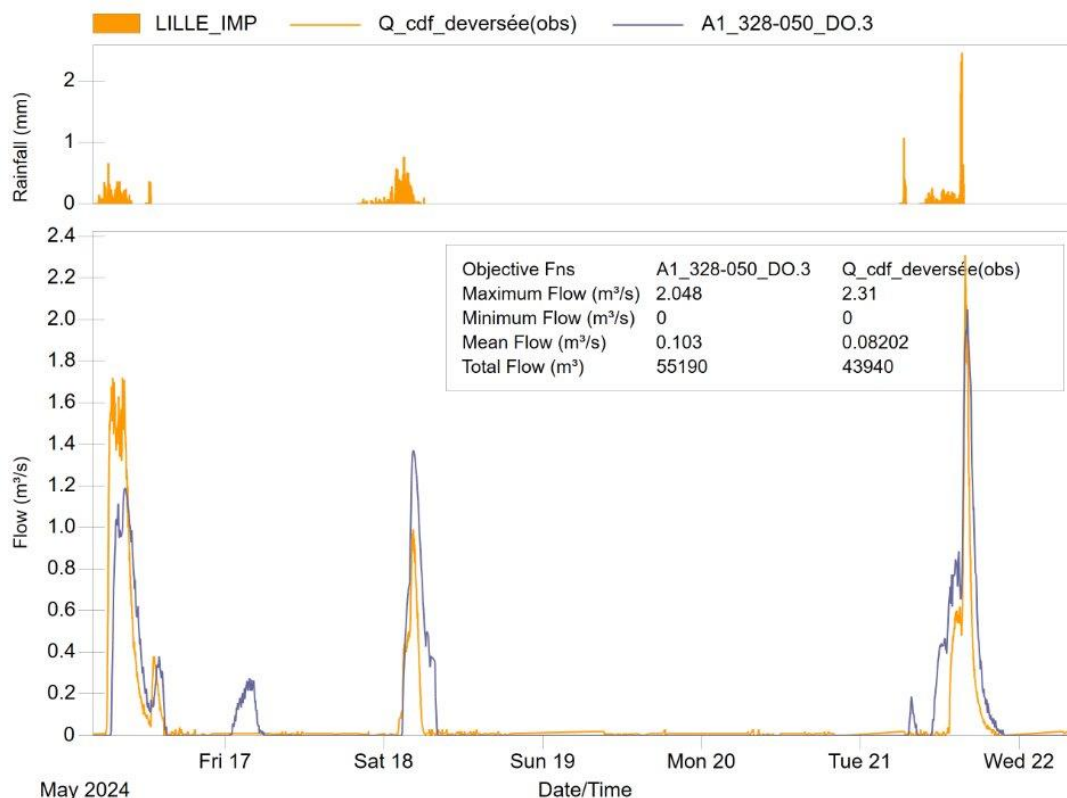


Figure 9: Overflow event at Café des Fleurs

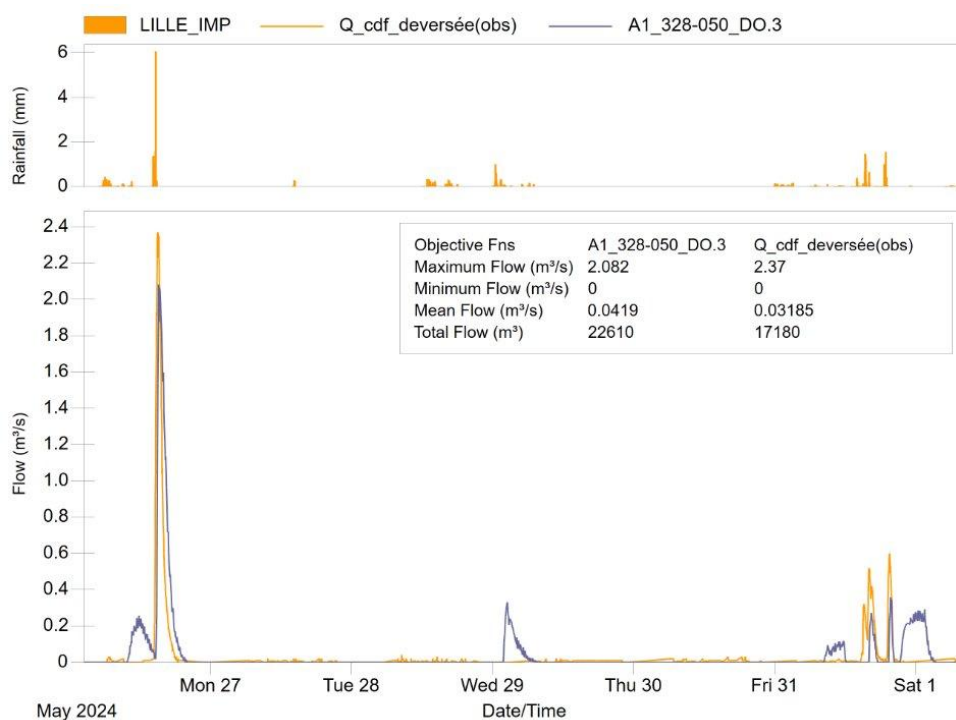


Figure 10: Overflow event at Café des Fleurs

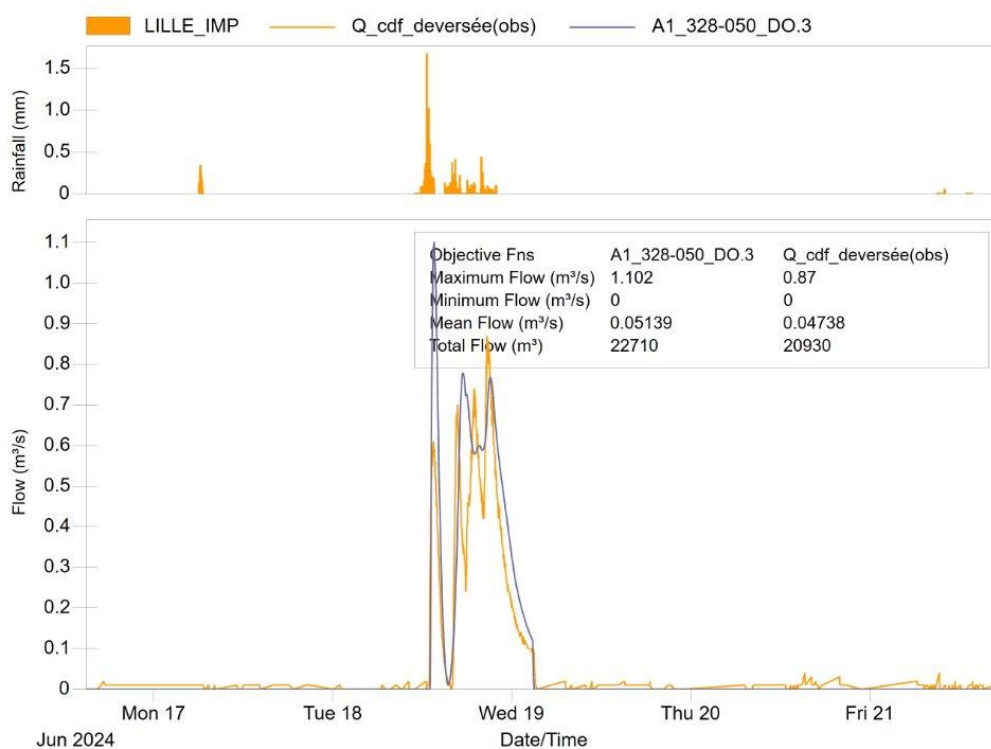
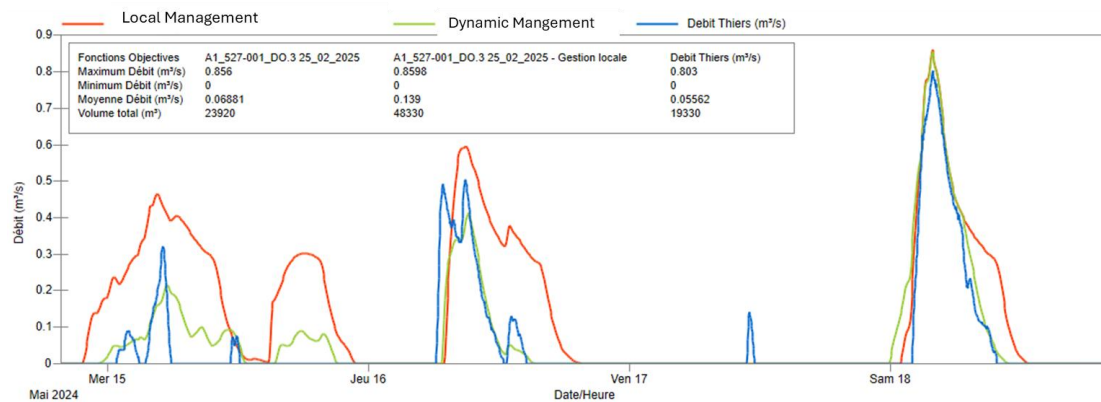


Figure 11: Overflow event at Café des Fleurs

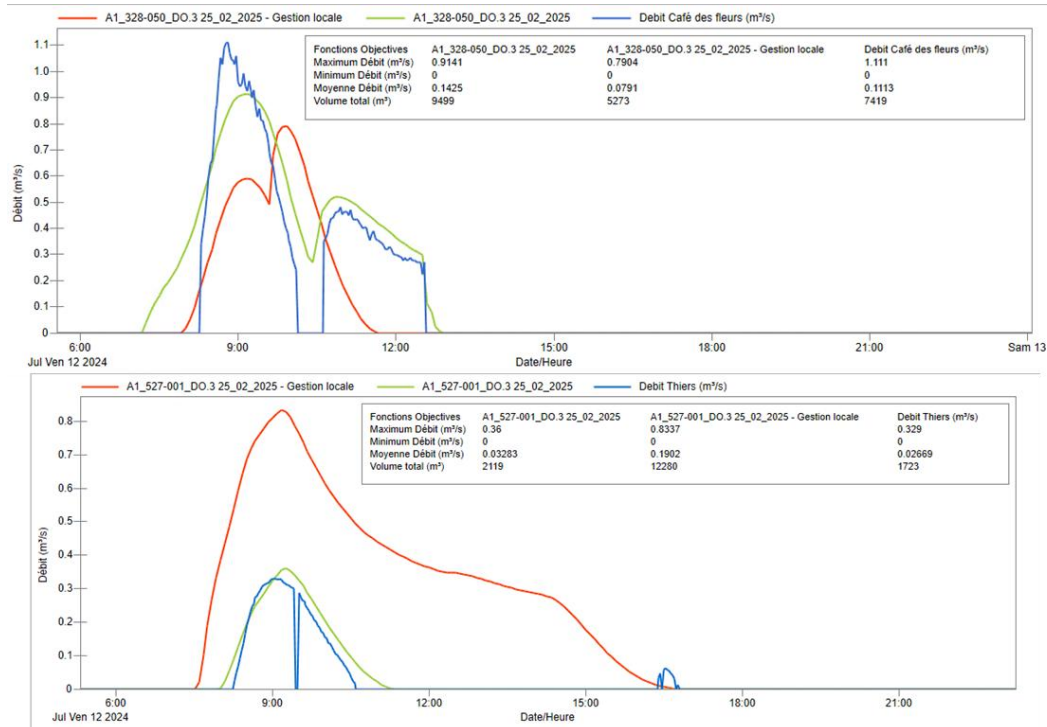
4.3 Comparison of the two hydraulic model scenarios

Once both models were established, their results were compared to evaluate the performance of dynamic control:

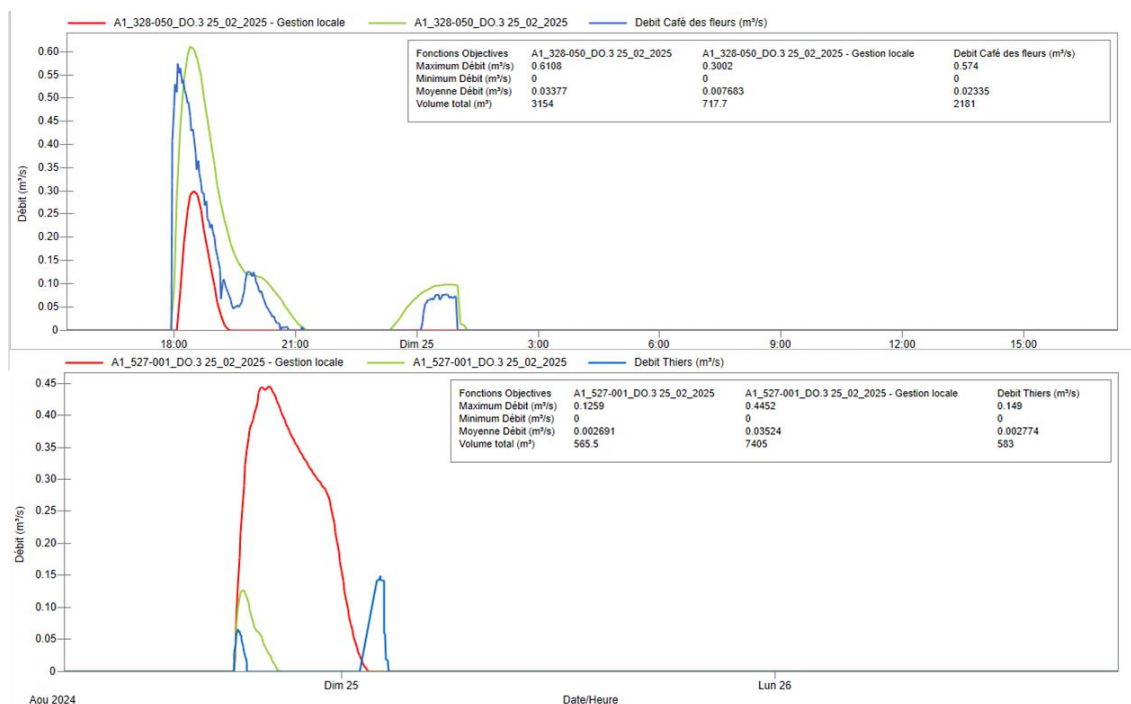
- Forced model: representing the dynamic management scenario (green line)
- Control-rules model: representing the local management scenario (red line)
- Observed data (blue line)



Zoom in a rain event – 12 July 2024:



Zoom in a rain event – 1st August 2024



For the hydraulic component of the assessment, the selected KPI is the total overflow volume over the system (Café des fleurs, Pasteur and Thiers) from May 2024 to May 2025. Two complementary approaches were considered. The first is a global approach, which evaluates the overall performance gain across the entire period without distinction. The second is a selective approach, which consists of identifying all technical incidents, excluding the overflow volumes directly caused by these operational failures, and recalculating the performance gain under normal operating conditions.

Using this methodology, dynamic management achieved an **8% reduction** in overflow volume over the full period of May 2024 to May 2025. When isolating operational issues such as the blockage of the VS1 gate, pump failures, or mechanical issues with the screen. The reduction increases to **17%**, highlighting the system's full potential under optimal conditions.

4.1 Calibration and implementation of the quality model

The calibration and implementation of the water quality model were carried out using a new library developed by LyRE SUEZ. This library extends the capabilities of SWMM (Storm Water Management Model), the open-source software developed by the United States Environmental Protection Agency (US EPA), by incorporating advanced representations of water quality processes occurring in sewer networks.

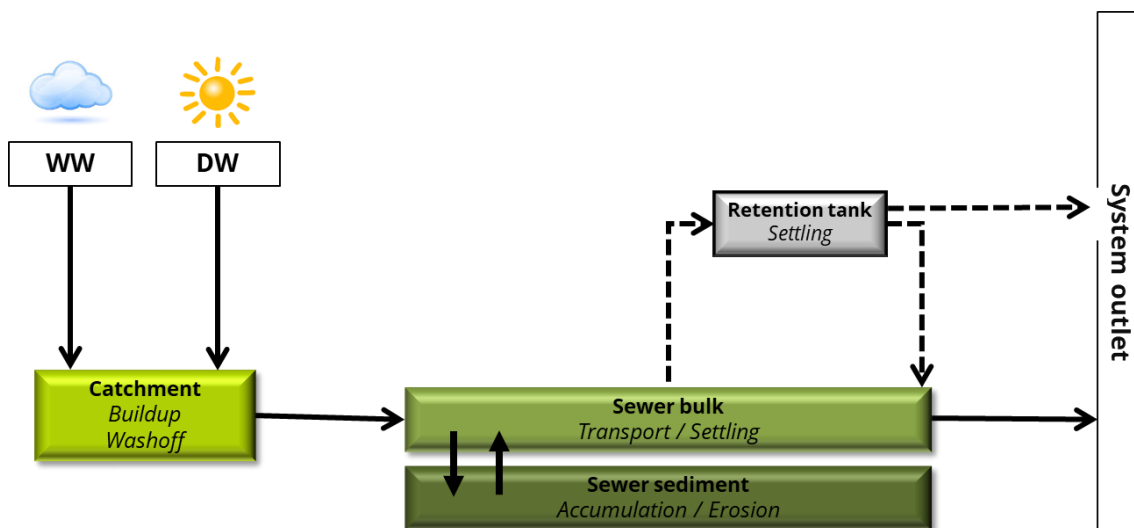
The model is structured around several interconnected modules designed to simulate the buildup and transport of particulate pollutants from urban catchments to downstream sewer infrastructures.

The **buildup module** represents the accumulation of particles on land surfaces during dry weather periods. Pollutants progressively accumulate on catchments (e.g. streets, roads, and other impervious surfaces) as a function of time since the last rainfall event.

The **wash-off module** simulates the removal of surface pollutants during rainfall events. Pollutant washoff is driven by surface runoff and is typically expressed as a function of runoff rate or rainfall intensity. The fraction of accumulated pollutants entering the sewer network therefore depends on rainfall intensity, event duration, and washoff coefficients.

The **transport and settling module**, once pollutants enter the sewer network, their transport is governed by hydraulic conditions, while settling and erosion processes depend on particle concentration, physical properties, and size fractionation.

Finally, the **hydraulic storage module** represents pollutant behavior within storage such as tanks. This module simulates pollutant accumulation, separation, and settling within storage units.



The calibration of the water quality model was performed by comparing simulated results with observed data collected within the sewer network. The adopted calibration strategy relies on in situ continuous monitoring combined with laboratory-based water quality analyses.

Five monitoring stations were installed at key locations within the sewer system. Each station is equipped with sensors measuring turbidity and electrical conductivity, providing high-frequency time series during both dry weather and wet weather events.

In parallel, dedicated measurement campaigns were conducted within sewer network to obtain discrete samples for laboratory analysis of key water quality parameters, including Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD₅), and ammonium (NH₄⁺). These datasets were used to establish empirical relationships between continuously measured parameters (turbidity and conductivity) and target water quality variables.

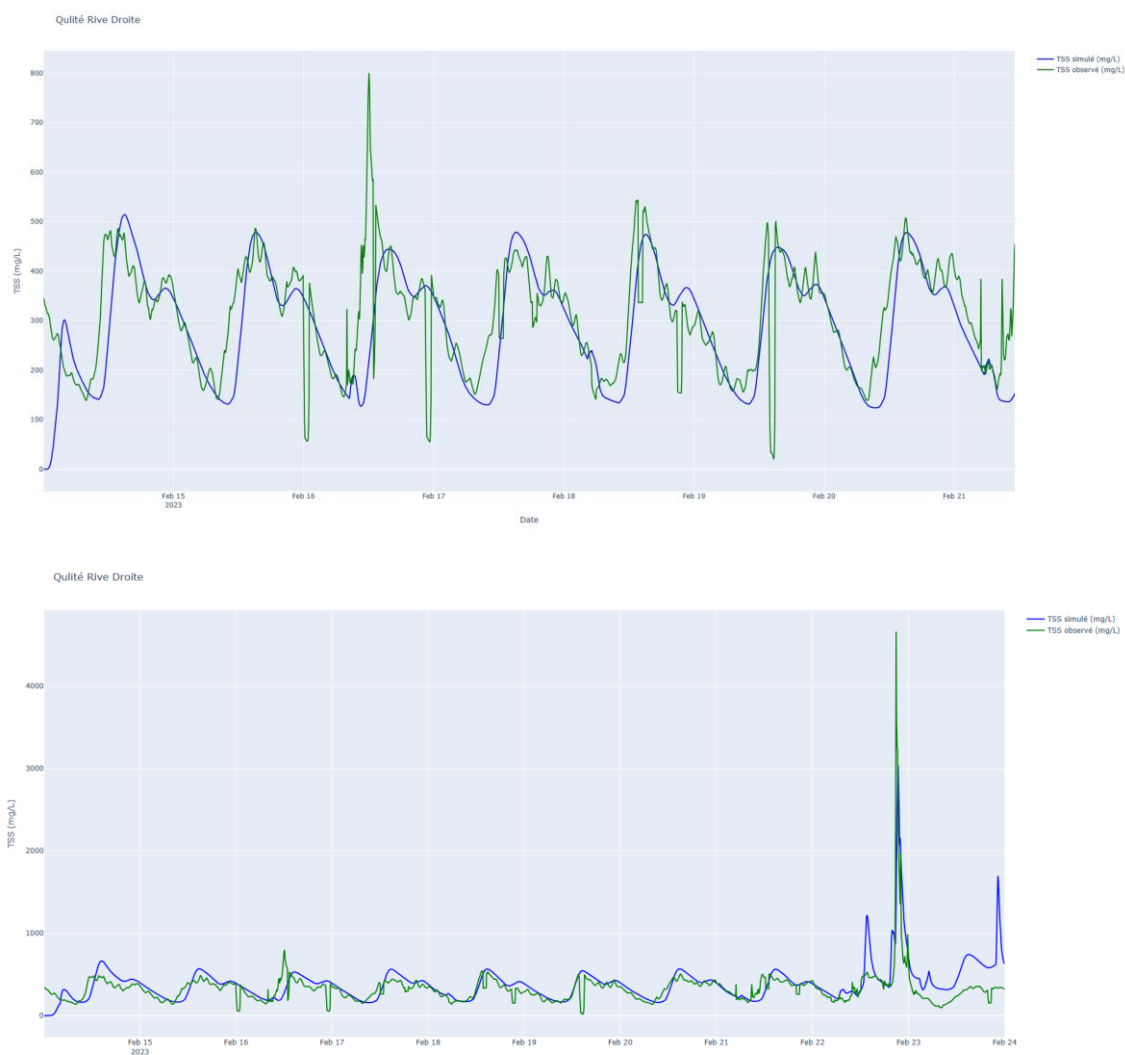


Figure 12: TSS water quality simulation results at Café des Fleurs during dry weather and wet weather; simulated data in blue and observed data in green.



Figure 13: Turbidity and conductivity water quality simulation results at Thiers during dry and wet weather conditions, used to estimate pollutant loads through correlation relationships.

For the water quality component of the assessment, the selected KPIs are the total loads of total suspended solids (TSS) and biochemical oxygen demand (BOD5), discharged over the system (Café des Fleurs, Pasteur and Thiers) from May 2024 to May 2025. By following the same methodology as the hydraulic assessment, the local and dynamic models were used to simulate the two scenarios to estimate the reduction of pollutant load. TSS and BOD5 loads were derived using correlation relationships established from turbidity and conductivity data. Results show that dynamic management led to a reduction of **23%** in TSS loads and **25%** in BOD5 loads over the study period, highlighting the significant potential of dynamic control to improve receiving water quality under optimized operating conditions.

5 Observed impact between May 2024 and May 2025

The complete control loop was operational on the Guy Lefort branch at the beginning of 2024 and monitored between May 2024 and May 2025. We had regular meetings between MEL, 3S, ULILLE and LYRE to check the behavior of the solution after each rain event. Based on the methodology explained in the chapter 4,, we had a consolidated table to gather all results and observations day after day and to assess the impact for each rain event with a calculation of the total gain over all the period taking into account operational issues (pump failures, valve blockages or clogged screens..):

Date	Rain	Reality (observed data from the field)				Model with local control rules (without the LIFE RUBIES solution)						Model forced with observed states of equipments (with the LIFE RUBIES solution)						KPIs								
		Overflowed volumes				Overflowed volumes						Rejected pollution (quality)		Overflowed volumes				Rejected pollution (quality)		Saved volumes	Saved TSS pollution	Saved DBO5 pollution	KPIs related to the Deule river			
		CSO Ste Hélène Thiers	CSO Café des fleurs	CSO Guy Lefort	Total overflows	CSO Ste Hélène Thiers	CSO Café des fleurs	CSO Guy Lefort	Total overflows	Rejected of amount TSS	Rejected of amount DBO5	CSO Ste Hélène Thiers	CSO Café des fleurs	CSO plein Guy Lefort	Total overflows	Rejected of amount TSS	Rejected of amount DBO5	Time gained above the average environmental quality threshold (>0.5mg/L)	Time gained above the poor environmental quality threshold (> 2mg/L)				Average concentration during the rain events (chronic toxicity)	Average peak concentrations (percentile 95) during rain events (acute toxicity)		
	(mm)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(tons)	(tons)	(m3)	(m3)	(m3)	(m3)	(tons)	(tons)	(m3)	(tons)	(tons)	hour	hour	mg/L	mg/L			
TOTAL		294 947	423 305	8 104	726 356	829 615	110 453	0	940 068	346	49	349 677	512 438	0	862 115	265	37	77 953	81,00	12,51	3%	28%	5%	9%		
01/05/2024	0,4	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0		
02/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0		
03/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0		
04/05/2024	2,8	1 590	0	0	1 590	3 806	0	0	3 806	1,65	0,23	1 732	0	0	1 732	1	0	2 073	0,38	0,03	-0,5	0	-0,00313868	-0,04682933		
05/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	-0,16666667	0	0,00441869	0,09010543		
06/05/2024	0,6	0	0	0	0	449	0	0	449	0,28	0,11	0	0	0	0	0	0	449	0,10	0,04	2,5	0	0,03088313	0,17033599		
07/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	1,11E-06	0		
08/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0		
09/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0		
10/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0		
11/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0		

12/05/2024	5,4	3 693	1 238	0	4 931	4 073	1 143	0	5 216	7,30	0,47	3 480	1 108	0	4 588	7	0	628	0,53	0,01	0	0	-7,80E-05	0,00108955
13/05/2024	0	83	0	0	83	2 439	0	0	2 439	0,87	0,08	1 307	0	0	1 307	1	0	1 132	0,28	0,02	0	0	0,02628206	0,06967419
14/05/2024	4,2	0	0	0	0	998	0	0	998	0,47	0,15	1 294	0	0	1 294	0	0	-296	-0,02	-0,03	0	0	-0,00033187	0,00109698
15/05/2024	4,9	1 897	0	0	1 897	18 683	25	0	18 708	4,72	0,82	9 622	3 760	0	13 381	4	1	5 327	0,51	0,18	0	0	0,05333304	0,22259528
16/05/2024	17,9	6 642	20 017	0	26 659	13 612	1 421	0	15 033	3,26	0,57	8 775	11 203	0	19 978	3	1	-4 944	0,20	0,05	-0,16666667	0	0,00131026	0,02709828
17/05/2024	0,4	211	0	0	211	0	0	0	0	0,02	0,00	0	0	0	0	0	0	0	0,02	0,00	1	0	0,00842308	0,06745253
18/05/2024	10,4	10 586	5 464	0	16 049	15 035	6 527	0	21 562	5,23	0,73	14 943	9 619	0	24 562	4	1	-2 999	0,77	0,01	-1,16666667	0	0,00944348	0,08393517
19/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0,00035261	0
20/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
21/05/2024	10,7	6 344	11 304	0	17 647	19 522	6 947	0	26 469	8,65	1,13	12 264	15 749	0	28 013	7	1	-1 544	1,19	0,30	0,66666667	0	0,0644732	0,01858862
22/05/2024	0	0	0	0	0	0	0	0	0	0,02	0,00	25	0	0	25	0	0	-25	0,02	0,00	7,33333333	0	0,00963477	0,02006418
23/05/2024	0,6	103	0	0	103	307	0	0	307	0,27	0,07	172	0	0	172	0	0	135	0,09	0,02	-0,33333333	0	0,01052461	0,06771174
24/05/2024	0	105	0	0	105	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,83333333	0	-0,00031769	-0,00662524
25/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
26/05/2024	4,9	8 451	9 764	0	18 215	17 345	3 693	0	21 039	10,32	1,10	12 694	9 681	0	22 376	9	1	-1 337	1,49	0,23	0,66666667	0	0,04758573	0,21486214
27/05/2024	1,7	0	0	0	0	8	0	0	8	0,06	0,02	32	0	0	32	0	0	-24	0,01	-0,01	6,33333333	0	0,02607347	0,1394823
28/05/2024	4,5	141	0	0	141	6 221	0	0	6 221	1,67	0,44	2 142	0	0	2 142	1	0	4 079	0,71	0,18	1,16666667	0	0,04699061	0,27030312
29/05/2024	2,4	1 147	0	0	1 147	4 828	0	0	4 828	0,85	0,25	3 239	1 438	0	4 677	1	0	151	0,18	0,01	-0,83333333	0	0,07241075	0,45783796
30/05/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
31/05/2024	9,2	2 280	3 160	0	5 441	12 163	601	0	12 763	3,49	0,61	11 610	635	0	12 244	3	1	519	0,26	-0,06	0	0	-0,01131658	0,02139862
01/06/2024	2	87	0	0	87	1 064	0	0	1 064	0,16	0,08	2 681	0	0	2 681	0	0	-1 617	-0,23	-0,18	4,5	0	-0,00435832	0,02472852
02/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,33333333	0	0,00466228	0,03325279
03/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	1,11E-16
04/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	5,55E-17
05/06/2024	0,6	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
06/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	1,11E-16
07/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0

08/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0	
09/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0
10/06/2024	3,3	845	0	0	845	5 441	0	0	5 441	3,23	0,43	1 081	82	0	1 163	2	0	4 278	0,79	0,10	1,33333333	0	0,01716247	0,09657574		
11/06/2024	3,3	4	0	0	4	1 797	0	0	1 797	0,54	0,17	0	4	0	4	0	0	1 793	0,40	0,12	2,66666667	0	0,05020159	0,51032678		
12/06/2024	9,2	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	-0,00233035	-0,02083039	
13/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0	
14/06/2024	7,6	1 000	4 018	0	5 018	6 253	109	0	6 363	3,90	0,60	228	1 675	0	1 903	4	0	4 460	0,21	0,21	0,83333333	0	0,03585039	0,08987407		
15/06/2024	5,5	3 858	946	0	4 804	7 851	0	0	7 851	2,46	0,49	5 399	0	0	5 399	2	0	2 452	0,37	0,02	-0,33333333	0	-0,00243524	-0,09297095		
16/06/2024	3,1	1 338	0	0	1 338	4 286	0	0	4 286	1,03	0,33	5 532	0	0	5 532	1	0	-1 246	-0,17	-0,07	-1,83333333	0	-0,00442715	-0,06793409		
17/06/2024	1,1	24	0	0	24	937	0	0	937	0,46	0,13	624	0	0	624	0	0	313	0,17	0,01	4	0	0,02106527	0,0922931		
18/06/2024	12,9	2 114	15 559	0	17 673	15 942	2 699	0	18 640	6,77	0,98	1 903	16 584	0	18 487	6	1	153	0,52	0,35	-0,16666667	0	0,00904696	-0,03387359		
19/06/2024	0	276	1 449	0	1 724	2 403	0	0	2 403	0,29	0,08	0	2 139	0	2 139	0	0	265	0,17	0,06	1,16666667	0	0,05240365	0,23724075		
20/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0,01390759	0,11637364	
21/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0	
22/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0	
23/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0	
24/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0	
25/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	6,58E-07	0	
26/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0	
27/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0	
28/06/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0	
29/06/2024	2,3	243	0	0	243	2 243	0	0	2 243	2,39	0,23	0	0	0	0	0	0	2 243	2,26	0,17	0	0	4,93E-06	0		
30/06/2024	2,4	162	57	0	219	645	0	0	645	0,31	0,09	8	0	0	8	0	0	637	0,25	0,06	3,16666667	0	0,10380614	0,79118688		
01/07/2024	0,3	30	0	0	30	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	2,16666667	0	0,04805062	0,41929596	
02/07/2024	1,4	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	-0,00014099	0	
03/07/2024	3	241	0	0	241	1 436	0	0	1 436	1,21	0,19	180	0	0	180	0	0	1 256	1,08	0,10	10	0	0,16691948	0,58133598		
04/07/2024	0,5	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0,66666667	0	0,00283881	0,01641654	

05/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
06/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0
07/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0
08/07/2024	0,5	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0
09/07/2024	3,6	62	0	0	62	5 262	0	0	5 262	3,56	0,44	10	1 030	0	1 039	3	0	4 223	0,61	0,20	0,5	0	0,01880314	0,17170396
10/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	3,33333333	0	0,10218723	0,55879596
11/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
12/07/2024	11,9	1 723	7 418	0	9 141	12 276	5 273	0	17 549	10,62	0,91	2 124	9 498	0	11 622	11	1	5 927	-0,73	0,32	1,66666667	0,16666667	0,02057705	0,19021491
13/07/2024	0	0	0	467	467	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0,00019386	0,00018086
14/07/2024	0	0	0	2 071	2 071	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	-0,04	-0,02	0	0	-0,01991375	-0,16752968
15/07/2024	1,7	0	0	0	0	290	0	0	290	0,45	0,10	804	0	0	804	0	0	-514	0,12	-0,05	0	0	4,91E-07	0
16/07/2024	1,2	0	0	0	0	1 336	0	0	1 336	0,65	0,18	0	0	0	0	0	0	1 336	0,39	0,09	-0,16666667	0	0,02212801	0,19562083
17/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,16666667	0	0,0101479	0,06335733
18/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
19/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
20/07/2024	1,5	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
21/07/2024	6,1	1 327	1 442	0	2 769	109	0	0	109	0,41	0,06	211	0	0	211	0	0	-102	0,08	-0,02	0	0	-0,0035337	-0,01526365
22/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
23/07/2024	2,2	0	0	0	0	941	0	0	941	1,35	0,13	322	0	0	322	0	0	619	0,91	0,03	0,83333333	0	0,02471911	0,19625313
24/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
25/07/2024	2,9	0	0	0	0	497	0	0	497	0,75	0,11	0	79	0	79	0	0	418	0,65	0,09	0	0	-4,20E-08	0
26/07/2024	1,3	68	0	0	68	5 842	0	0	5 842	2,61	0,37	0	97	0	97	1	0	5 745	1,87	0,27	2	0	0,07028599	0,27291847
27/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
28/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
29/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
30/07/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
31/07/2024	1,2	63	0	0	63	1 174	0	0	1 174	1,74	0,10	0	0	0	0	0	0	1 174	1,47	0,05	2,5	0	0,03860451	0,30111298

01/08/2024	16	9 881	19 973	0	29 854	22 060	23 736	0	45 796	36,95	1,71	19 656	21 548	0	41 204	40	1	4 591	-2,91	0,43	0,16666667	0	0,10448382	0,22892231
02/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	7,36E-05	0,00015637
03/08/2024	4,3	0	1 480	0	1 480	385	0	0	385	0,51	0,09	0	930	0	930	0	0	-545	0,40	0,05	0	0	-8,94E-08	0
04/08/2024	1,5	314	6 972	0	7 287	7 508	0	0	7 508	1,68	0,33	0	11 068	0	11 068	1	0	-3 560	0,78	0,19	6,5	0	0,05996689	0,19905228
05/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
06/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
07/08/2024	0,9	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
08/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
09/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
10/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
11/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
12/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
13/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
14/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
15/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
16/08/2024	7,5	410	266	0	676	12 750	65	0	12 815	9,26	0,97	40	3 210	0	3 250	5	0	9 566	4,49	0,58	3,33333333	0	0,07921557	0,3171305
17/08/2024	0	0	0	0	0	360	0	0	360	0,06	0,02	162	0	0	162	0	0	198	-0,17	-0,05	0,66666667	0	-0,04523364	-0,08383157
18/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
19/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
20/08/2024	16,7	2 088	15 938	0	18 026	14 476	7 306	0	21 782	11,55	1,01	3 302	20 844	0	24 146	10	1	-2 364	1,54	0,39	0	-0,33333333	-0,00178633	-0,18653711
21/08/2024	0	305	612	0	916	508	0	0	508	0,18	0,03	0	766	0	766	0	0	-258	0,04	0,01	1,5	0	0,03971253	0,01807529
22/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	7,11E-05	0,0004335
23/08/2024	1,1	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	2,78E-17
24/08/2024	7	112	1 973	0	2 085	7 077	718	0	7 795	4,60	0,52	566	2 793	0	3 359	4	0	4 436	0,77	0,21	0	0	-0,00089619	-0,01369576
25/08/2024	0	235	208	0	443	328	0	0	328	0,10	0,02	0	361	0	361	0	0	-33	0,03	0,00	0,33333333	0	0,0072579	-0,15697855
26/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
27/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0

28/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0,00	0,00	0,00	0	0	0	0
29/08/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	-9,11E-08	2,78E-17
30/08/2024	0,3	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	8,33E-17
31/08/2024	1,8	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
01/09/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
02/09/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	-8,33E-17
03/09/2024	0,7	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0,0010019	0,00974755
04/09/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
05/09/2024	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
06/09/2024	16,4	4 052	26 583	0	30 635	23 828	8 930	0	32 758	13,63	1,35	3 264	31 665	0	34 929	12	1	-2 171	1,61	0,59	0	0	0,05635296	0,23015842	
07/09/2024	0,3	105	610	0	716	0	0	0	0	0,03	0,00	213	500	0	713	0	0	-713	-0,01	0,00	1,66666667	0,16666667	0,05490902	0,17783612	
08/09/2024	7,2	111	7 831	0	7 941	2 063	1	0	2 064	1,02	0,19	204	5 689	0	5 893	1	0	-3 829	0,16	0,06	0	0	0,00514699	0,0289973	
09/09/2024	1,9	166	9 767	0	9 933	8 727	21	0	8 748	1,59	0,29	53	14 064	0	14 117	1	0	-5 369	0,47	0,13	6,83333333	0	0,12817434	0,52415328	
10/09/2024	5,9	474	71	0	544	5 416	0	0	5 416	1,38	0,37	1 214	56	0	1 271	1	0	4 145	0,65	0,19	0	0	-0,00807424	-0,06146037	
11/09/2024	7,7	2 968	17 718	0	20 685	13 298	2 869	0	16 167	3,24	0,51	2 306	21 235	0	23 541	3	0	-7 375	-0,20	0,17	2,83333333	0	0,15193445	0,25796714	
12/09/2024	0	0	0	0	0	143	0	0	143	0,05	0,01	0	0	0	0	0	0	143	0,05	0,01	3,83333333	0	0,06554858	0,28595716	
13/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	
14/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	-0,0049896	0	
15/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	
16/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	
17/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	
18/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	
19/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	
20/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	
21/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	
22/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0	
23/09/2024	5,5	317	45	0	362	489	0	0	489	0	0	160	0	0	160	0	0	329	0,22	0,02	0	0	0,00608534	0,02609206	

24/09/2024	0,3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	-1,39E-17
25/09/2024	16,8	2 313	6 113	0	8 426	11 253	1 274	0	12 527	11	1	5 677	2 899	0	8 576	12	1	3 951	-1,14	0,11	0,33333333	0	0,00187299	0,0567886
26/09/2024	0,6	1 303	2 013	0	3 316	7 332	696	0	8 027	2	0	5 530	1 159	0	6 688	2	0	1 339	-0,14	0,04	0	0	0,04558737	0,02426188
27/09/2024	2,8	0	4 195	0	4 195	5 623	0	0	5 623	2	0	52	7 792	0	7 843	1	0	-2 220	1,00	0,27	1,16666667	0	0,04096253	0,38247255
28/09/2024	0	0	2	0	2	29	0	0	29	0	0	333	0	0	333	0	0	-304	-0,07	-0,04	3,33333333	0	0,06109214	0,70848825
29/09/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	-9,64E-06	0
30/09/2024	5	70	3 686	0	3 756	6 210	0	0	6 210	2	0	1 837	6 896	0	8 733	1	0	-2 523	1,24	0,19	6,66666667	0	0,22517393	0,30295202
01/10/2024	5,3	0	6 208	0	6 208	1 608	56	0	1 664	1	0	93	5 443	0	5 536	1	0	-3 872	0,28	0,05	2,83333333	0	0,0290199	0,21824182
02/10/2024	0,8	85	2 272	0	2 357	3 129	0	0	3 129	1	0	0	3 295	0	3 295	0	0	-167	0,57	0,02	4	0	0,05104867	-0,044585
03/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
04/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
05/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
06/10/2024	0,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	-5,55E-17
07/10/2024	0	0	0	0	0	320	0	0	320	1	0	0	0	0	0	0	0	320	0,56	0,00	3,16666667	0	0,06380331	0,57008577
08/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
09/10/2024	7,5	233	8 338	0	8 570	9 831	0	0	9 831	4	1	2 553	11 956	0	14 509	1	0	-4 678	3,43	0,46	3,16666667	0	0,07156055	0,59877209
10/10/2024	9	76	18 180	0	18 256	12 181	660	0	12 841	3	0	1 357	20 148	0	21 505	2	0	-8 665	0,70	0,08	7,5	0	0,12226654	0,08081084
11/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	2,5	0	0,00840112	0,04331866
12/10/2024	0,6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
13/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	5,55E-17
14/10/2024	13	1 907	3 922	0	5 830	14 488	2 008	0	16 495	6	1	11 687	2 654	0	14 340	7	1	2 155	-0,40	0,35	2,66666667	0,16666667	0,03571308	0,05164973
15/10/2024	0	0	0	0	0	519	0	0	519	0	0	375	0	0	375	0	0	144	0,05	0,02	8	0	0,11518107	0,25769656
16/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	3	0	0,03295367	0,16874566
17/10/2024	1,1	0	0	0	0	0	0	0	0	0	0	184	0	0	184	0	0	-184	0,00	0,00	0	0	0	0
18/10/2024	3,8	33	0	0	33	6 054	0	0	6 054	2	0	2 353	1 131	0	3 484	0	0	2 570	2,11	0,20	0	0	0,20559357	0,97378844
19/10/2024	3,8	0	280	0	280	2 977	0	0	2 977	1	0	180	1 438	0	1 619	1	0	1 359	0,45	0,04	0	0	-5,45E-05	0
20/10/2024	0	0	0	0	0	2 502	0	0	2 502	0	0	0	0	0	0	0	0	2 502	0,37	0,00	5,5	0,33333333	0,1889667	1,21614906

21/10/2024	18,9	6 581	9 810	0	16 391	16 040	5 401	0	21 441	5	1	16 375	12 292	0	28 668	5	1	-7 226	-0,27	0,20	0	0	0,01407922	0,00223987
22/10/2024	0,6	928	396	0	1 324	6 208	1 484	0	7 692	1	0	6 056	1 763	0	7 819	1	0	-126	0,23	0,11	0	0	0,01280997	-0,01278929
23/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0,00952293	0,04614547
24/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
25/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
26/10/2024	1,1	38	0	0	38	1 026	0	0	1 026	1	0	379	0	0	379	0	0	647	1,14	0,00	0	0	0,07512423	0,5399416
27/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0,00038851	0,00216081
28/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
29/10/2024	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
30/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
31/10/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
01/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
02/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
03/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
04/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
05/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
06/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
07/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
08/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
09/11/2024	0,7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
10/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
11/11/2024	0,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
12/11/2024	1,5	11	0	0	11	1 872	0	0	1 872	3	0	750	0	0	750	0	0	1 122	3,46	0,00	4,83333333	0	0,13629857	0,8840644
13/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
14/11/2024	2,2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	-1,11E-16
15/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0

16/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	-1,11E-16	-1,11E-16
17/11/2024	4,1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0,00020802	0
18/11/2024	5,9	1 427	0	0	1 427	4 815	0	0	4 815	4	0	4 532	0	0	4 532	0	0	282	3,49	0,27	7,5	0	0,15524828	0,59654967
19/11/2024	26,4	16 397	29 341	5 566	51 305	35 076	18 914	0	53 990	18	2	29 224	20 935	0	50 159	16	1	3 831	2,18	0,99	5,66666667	2,5	0,18671679	0,05550838
20/11/2024	0	653	115	0	768	323	0	0	323	0	0	868	0	0	868	0	0	-544	0,07	0,01	2,16666667	0	0,03759278	0,06566667
21/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	-1,11E-16	0
22/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
23/11/2024	1,8	0	0	0	0	121	0	0	121	0	0	0	0	0	0	0	0	121	0,14	0,00	0	0	0,00787691	0,0057559
24/11/2024	0	0	0	0	0	28	0	0	28	0	0	0	0	0	0	0	0	28	0,04	0,00	0	0	0,0519207	0,14839639
25/11/2024	6,3	6 293	0	0	6 293	10 510	0	0	10 510	4	1	9 071	3 121	0	12 193	2	0	-1 683	1,42	0,18	0	0	0,07386557	0,19409329
26/11/2024	6,8	3 732	6 245	0	9 978	2 765	0	0	2 765	1	0	4 628	0	0	4 628	0	0	-1 863	0,53	0,19	0	0	0,00213515	0,0069153
27/11/2024	3,7	2 584	900	0	3 484	290	0	0	290	0	0	1 585	0	0	1 585	0	0	-1 295	0,15	0,05	-0,16666667	0	0,02676043	0,00744137
28/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0,00196667	0
29/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
30/11/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
01/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
02/12/2024	1,6	0	0	0	0	1 958	0	0	1 958	1	0	0	0	0	0	0	0	1 958	1,07	0,00	0	0	0,12969247	0,8869479
03/12/2024	3,8	1 348	145	0	1 492	5 897	0	0	5 897	1	0	636	0	0	636	0	0	5 261	1,02	0,16	0	0	0,09592526	0,20605936
04/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
05/12/2024	7,2	2 250	168	0	2 418	4 270	0	0	4 270	1	0	1 117	0	0	1 117	0	0	3 152	0,91	0,24	0	0	0,04985108	0,23106292
06/12/2024	0,9	3 282	184	0	3 466	7 009	0	0	7 009	2	0	2 538	0	0	2 538	1	0	4 471	0,89	0,18	0	0	0,0414205	0,00665419
07/12/2024	7	6 520	296	0	6 816	11 439	0	0	11 439	2	0	5 172	0	0	5 172	2	0	6 267	0,61	0,18	0	0	0,10654053	0,23064638
08/12/2024	3,9	2 223	268	0	2 491	6 850	0	0	6 850	1	0	1 980	0	0	1 980	0	0	4 870	0,45	0,16	0	0	0,05735124	0,14657394

09/12/2024	0,4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	1,11E-16
10/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
11/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	-2,22E-16
12/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
13/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
14/12/2024	0,4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	1,11E-16
15/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
16/12/2024	0,8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	-1,11E-16
17/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
18/12/2024	0,4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
19/12/2024	3,3	674	0	0	674	10 878	0	0	10 878	5	0	704	111	0	815	1	0	10 064	4,35	0,24	0	1	0,37659526	1,28391946
20/12/2024	1,5	0	0	0	0	69	0	0	69	0	0	0	288		288	0	0	-219	0,00	-0,03	0	0	-0,00960314	-0,0430902
21/12/2024	5,1	675	6 139	0	6 814	2 534	0	0	2 534	0	0	0	3 687		3 687	1	1	-1 153	-0,29	-0,48	0	0	0,08642673	0,43044276
22/12/2024	1,2	710	950	0	1 660	1 428	0	0	1 428	0	0	43	2 837		2 879	1	1	-1 451	-0,32	-0,48	0	0	-0,09392993	-0,33741246
23/12/2024	0	349	174	0	523	1 613	0	0	1 613	0	0	1	1 755		1 756	0	0	-143	0,05	0,01	0	0	-0,00715862	0,04370969
24/12/2024	0,5	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	-1,11E-16
25/12/2024	0,5	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
26/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
27/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
28/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
29/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
30/12/2024	0,5	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	1,03E-07	0
31/12/2024	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	1,20E-07	0
01/01/2025	12,2	5 042	8 491	0	13 532	6 638	3 451	0	10 090	3	0	2 746	4 487		7 233	4	0	2 857	-0,70	0,18	0	0	0,01191058	0,09352183
02/01/2025	4,4	9 412	476	0	9 887	14 102	2 185	0	16 287	2	0	8 149	203		8 353	1	0	7 934	0,83	0,27	0	0	0,08604979	-0,02906497

03/01/2025	0	0	0	0	0	0	0	0	0	0	0	5 284		5 284	0	0	-5 284	-0,05	-0,11	0	0	-0,12855249	-0,18689799
04/01/2025	0,8	0	0	0	0	0	0	0	0	0	0	5 683		5 683	0	0	-5 683	0,00	0,00	0	0	-0,20952588	-0,36414153
05/01/2025	12	3 884	24 685	0	28 569	23 280	166	0	23 446	3	1	2 154	35 351	37 505	5	1	-14 059	-2,48	0,22	0	-5,83333333	-0,76480596	-1,25411621
06/01/2025	3,2	796	8 198	0	8 994	7 776	0	0	7 776	1	1	407	16 984	17 391	2	1	-9 615	-0,81	-0,16	0	0	-0,09571168	-0,06119702
07/01/2025	9	4 463	21 780	0	26 243	17 130	0	0	17 130	1	1	1 737	19 660	21 397	2	1	-4 268	-0,80	0,06	0	-0,33333333	-0,25126913	-0,58637195
08/01/2025	9,9	6 441	0	0	6 441	8 162	0	0	8 162	1	0	3 684	5	3 690	1	0	4 472	0,31	0,14	0	2,33333333	0,07802177	0,57474954
09/01/2025	8	16 881	0	0	16 881	16 520	0	0	16 520	1	1	8 414	0	8 414	1	0	8 105	0,47	0,26	0	6,83333333	0,42609878	1,11664349
10/01/2025	0,3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0,00445592	0,03407696
11/01/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
12/01/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
13/01/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
14/01/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
15/01/2025	0,3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	-1,11E-16
16/01/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	-1,11E-16
17/01/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
18/01/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
19/01/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
20/01/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
21/01/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
22/01/2025	11,7	8 818	4 624	0	13 442	10 891	0	0	10 891	5	1	6 492	5 280	11 772	5	1	-881	-0,20	0,11	0	0	0,1208845	0,30629633
23/01/2025	0	1 508	61	0	1 569	2 988	0	0	2 988	1	0	1 234	1 775	3 008	0	0	-20	0,12	-0,02	0	-0,33333333	-0,08044466	-0,12134959
24/01/2025	9,1	10 080	48	0	10 129	16 223	0	0	16 223	3	1	7 451	4 549	12 000	3	1	4 223	-0,17	0,23	0	0	0,06717359	0,18791455
25/01/2025	10,9	19 508	5 985	0	25 493	19 060	367	0	19 427	3	1	15 757	10 318	26 075	4	1	-6 648	-1,59	-0,13	0	0	-0,01297781	0,01520432
26/01/2025	2,3	1 363	0	0	1 363	5 897	0	0	5 897	1	0	453	4 452	4 905	0	0	991	0,17	0,13	0	0	0,04867305	0,03933028

27/01/2025	4,1	6 127	0	0	6 127	6 680	0	0	6 680	1	0	3 613	3 342		6 955	1	0	-275	-0,26	-0,10	0	0	-0,03398113	-0,02425295
28/01/2025	3,5	2 692	255	0	2 947	3 464	0	0	3 464	1	0	1 635	4 568		6 203	1	0	-2 739	-0,20	-0,11	0	0	-0,00857576	-0,00293765
29/01/2025	5,9	3 066	2 119	0	5 185	8 240	0	0	8 240	1	1	1 549	1 820		3 369	0	0	4 871	0,67	0,45	0	0,16666667	-0,00023955	-0,112603
30/01/2025	13,6	22 855	7 079	0	29 935	23 631	26	0	23 657	2	1	15 698	648		16 347	2	0	7 310	0,14	0,26	0	3,66666667	0,22073576	-0,05134252
31/01/2025	0	2 643	0	0	2 643	188	0	0	188	0	0	255	0		255	0	0	-67	-0,05	-0,04	0	0	-0,00659247	-0,00783436
01/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
02/02/2025	0,3	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
03/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
04/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	2,22E-16
05/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
06/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
07/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	2,22E-16
08/02/2025	0,6	0	0	0	0	1 111	0	0	1 111	0	0	0	0		0	0	0	1 111	0,18	0,14	0	0	0,06422393	0,28863902
09/02/2025	3,5	2 196	0	0	2 196	8 223	0	0	8 223	3	0	1 065	0		1 065	0	0	7 159	2,78	0,36	0	1,5	0,21660987	0,88477891
10/02/2025	11	4 110	3 090	0	7 199	8 729	536	0	9 265	2	1	2 404	416		2 820	3	0	6 444	-0,78	0,45	0	3	0,23387787	1,2663661
11/02/2025	1,9	9 019	1 910	0	10 929	6 469	302	0	6 771	2	0	5 488	217		5 705	2	0	1 066	-0,44	0,07	0	0	0,02759026	0,01386848
12/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0,00129562	0
13/02/2025	0,5	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
14/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
15/02/2025	0	0	109	0	109	555	0	0	555	0	0	0	453		453	0	0	102	0,01	0,07	0	0	0,00040948	0,00257204
16/02/2025	0	582	1 300	0	1 882	2 212	0	0	2 212	1	0	0	3 735		3 735	1	0	-1 522	0,27	0,06	0	-1,66666667	-0,03794844	-0,41322051
17/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	5		5	0	0	-5	0,00	0,00	0	0	-0,00074262	0

18/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	1,11E-16
19/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
20/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	1,45E-07	0
21/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	-1,11E-16	0
22/02/2025	6,4	2 559	2 054	0	4 613	11 130	0	0	11 130	4	1	1 185	50		1 235	1	0	9 895	2,36	0,88	0	2	0,30901266	1,44593604
23/02/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	-0,05	-0,10	0	0	0,01396689	0,11386595
24/02/2025	0,5	314	0	0	314	1 588	0	0	1 588	0	0	0	0		0	0	0	1 588	0,26	0,26	0	0	0,1070992	0,46423107
25/02/2025	3,7	1 543	0	0	1 543	1 032	0	0	1 032	0	0	290	0		290	0	0	741	0,03	-0,05	0	0	0,02379205	0,12127106
26/02/2025	2,6	3 910	0	0	3 910	6 185	0	0	6 185	1	1	1 437	21		1 457	1	0	4 728	0,35	0,13	0	0	0,08880283	0,3243113
27/02/2025	1,8	0	0	0	0	1 001	0	0	1 001	0	0	0	9		9	0	0	992	0,03	0,07	0	0	0,0347747	0,24264159
28/02/2025	0,5	250	0	0	250	429	0	0	429	0	0	0	0		0	0	0	429	-0,15	-0,21	0	0	0,05489994	0,24980415
01/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	-0,01	-0,03	0	0	0	-1,11E-16
02/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	-1,11E-16
03/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	1,11E-16
04/03/2025	0	15	0	0	15	0	0	0	0	0	0	2 371		2 371	0	0	-2 371	-0,04	-0,19	0	0	-0,13107109	-0,61575056	
05/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	-0,00228333	1,11E-16
06/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
07/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	-0,02	-0,07	0	0	0	-1,11E-16
08/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	-4,03E-06	-2,22E-16
09/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	-3,36E-07	0
10/03/2025	0	0	0	0	0	0	0	0	0	0	0	160		160	0	0	-160	0,00	-0,02	0	0	-0,00027673	-1,11E-16	
11/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	-0,01254242	-0,11546017
12/03/2025	0	0	0	0	0	867	0	0	867	0	0	0	2 095		2 095	0	0	-1 228	0,00	-0,11	-1,83333333	0	-0,08657942	-0,23164063

13/03/2025	0	0	0	0	0	7 066	0	0	7 066	5	1	603	2 390		2 992	1	0	4 074	3,75	0,32	0	0,66666667	-0,00863852	-0,5196425
14/03/2025	0	0	0	0	0	491	0	0	491	0	0	0	0		0	0	0	491	0,12	0,03	0	1,33333333	0,1954828	1,47308334
15/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	-1,11E-16
16/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
17/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
18/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	-0,01	-0,03	0	0	0	-1,11E-16
19/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
20/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
21/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
22/03/2025	4,8	1 176	1 762	0	2 939	1 530	597	0	2 127	5	0	1 183	1 365		2 549	4	0	-422	0,92	0,03	0	0	9,97E-05	5,55E-17
23/03/2025	0	313	8	0	321	4 136	0	0	4 136	5	0	817	87		904	1	0	3 232	3,20	0,23	4,83333333	0	0,04441052	0,04112573
24/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	814		814	0	0	-814	-0,14	-0,34	0	0	-0,00284589	1,11E-16
25/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	627		627	0	0	-627	-0,05	-0,13	-11,6666667	0	-0,1042324	-0,12268867
26/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
27/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	-1,32E-05	0
28/03/2025	0	0	0	0	0	59	0	0	59	0	0	0	0		0	0	0	59	0,01	0,02	0	0	0,00033019	0
29/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0,00492545	0
30/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	312		312	0	0	-312	0,00	0,00	0	0	6,31E-07	0
31/03/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	-0,02434109	-0,1627742
01/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
02/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0
03/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	-1,47E-06	0
04/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0,00	0,00	0	0	0	0

05/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
06/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
07/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
08/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
09/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
10/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
11/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
12/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
13/04/2025	3,2	0	0	0	0	11 747	248	0	11 995	11	1	157	3 569	3 726	2	0	8 268	8,82	0,60	6,16666667	0	0,23966347	-0,30722649
14/04/2025	0	0	0	0	0	5 131	0	0	5 131	2	0	0	3 715	3 715	0	0	1 416	1,49	0,00	3	2,33333333	0,26357104	1,99657876
15/04/2025	3,8	0	1 982	0	1 982	4 276	0	0	4 276	2	0	0	3 514	3 514	1	0	762	1,32	0,06	-10	0	-0,35494346	-0,47021735
16/04/2025	0	0	0	0	0	484	0	0	484	0	0	0	3 841	3 841	0	0	-3 357	-0,02	-0,34	1,66666667	0	0,05455416	0,39152655
17/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	4 204	4 204	0	0	-4 204	-0,09	-0,39	-14,6666667	0	-0,50475141	-0,77675721
18/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	3 678	3 678	0	0	-3 678	-0,09	-0,43	0	0	-0,13992958	-0,28542368
19/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	2 242	2 242	0	0	-2 242	-0,06	-0,27	-2	0	-0,24644456	-0,53047138
20/04/2025	4,2	0	3 090	0	3 090	13 623	0	0	13 623	5	1	2	2 512	2 514	1	0	11 110	4,29	0,83	3,83333333	0	0,06472019	-0,16961125
21/04/2025	0	0	0	0	0	245	0	0	245	0	0	0	3 489	3 489	0	0	-3 244	-0,16	-0,30	2	0	-0,0389545	0,13386155
22/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	3 833	3 833	0	0	-3 833	-0,11	-0,32	-6	0	-0,26351641	-0,83252766
23/04/2025	5,8	189	3 184	0	3 373	6 415	0	0	6 415	2	0	171	3 375	3 546	1	0	2 870	1,56	0,26	-4,5	0	-0,09908775	0,17954458
24/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	50	50	0	0	-50	0,00	0,00	0	0	-0,00359342	-0,00254631
25/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
26/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0	0	0	0
27/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	1 259	1 259	0	0	-1 259	-0,03	-0,15	-3,33333333	0	-0,09488846	-0,41762904
28/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	1 573	1 573	0	0	-1 573	-0,04	-0,20	0	0	-0,07712165	-0,25595122
29/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	1 335	1 335	0	0	-1 335	-0,03	-0,17	-3,5	0	-0,13004702	-0,4080253
30/04/2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	-2,66666667	0	-0,07711813	-0,30868715

6 Conclusion of operational tests

At the end, the final and consolidated environmental KPIs are those one:

CONTEXT ITEMS	FIRST LEVEL DESCRIPTOR	START VALUE	END VALUE	BEYOND END VALUE	UNIT
[FRE11, France / L'ESCAUT, LA SOMME ET LESEEA_31-02-7 - Total suspended solids		481	401		370 tonnes/year
[FRE11, France / L'ESCAUT, LA SOMME ET LESEEA_3133-01-5 - BOD5		672	660		504 tonnes/year

(see also the LPI webtool to have an overview all KPIs computed during the project).

In addition, the benefits are very interesting and validate the interest of such a solution, but it could be improved with the main following items:

- Extension of the controlled perimeter to have an impact on a larger amount of CSOs (due to the encountered difficulties during the project, the final controlled perimeter is not as big as we would have expected)
- Improve the long term weather data forecast reliability as it is a critical input for the quality controller (especially for the volume replacement strategy). Unfortunately, it depends mainly on the suppliers such as Meteo France but we also intend to work on a kind of “machine learning” algorithm to assess the weather forecast data reliability in real time (based on previous rain events).
- Monitor and improve the quality model calibration as it is also a critical input
- Monitor potential drifts in the quality controller to make sure it doesn't penalize the hydraulic control
- Improve actuators reliability with MEL operational teams since we had some « field issues” during the tests (gates breakdown, pump obstructions, etc). Those issues penalized the performance of the system for some rain events. For instance, most of the rain events with negative benefits (cells in red) are mainly due to those kind of issues.