Circular water management transition plan 2020-2030: follow-up report 2022

1. Framework and principles

Climate change is leading to more hydrological extremes: both longer dry periods and more intense rainfall. Flanders is among the regions with "extremely high water stress", according to the World Resources Institute. This is mainly due to our high population density. Other aspects such as a lot of paving, large-scale drainage of (agricultural) land, a lot of cut open space, the large number of water-intensive farms and poor water quality are all directly or indirectly related to it.

In fact, Flanders is not only highly vulnerable to drought and heat, but also to flooding. Calculations indicate that sewer flooding will increase in the coming decades, possibly by a factor of 5 to 10 by 2100, if no measures are taken to adapt to the changing climate.

At the same time, we note that our tap water travels hundreds of kilometres every day, while more than enough water falls on our roofs. Our wastewater - after treatment - eventually flows through kilometres of sewers to the sea, as does much of the rainwater without useful application.

We will have to adapt to the new reality of climate change. We now know how best to do this: softening, buffering rainwater and letting it infiltrate into the subsoil, reusing more water and better interlacing green areas and water in the landscape, the so-called 'blue-green network'. In short, a transition to a circular water cycle.

Ghent University committed to the following target in 2021:

Ghent University is working on an integrated water policy that closes water cycles locally as much as possible and mitigates the effects of climate change.

This means that the Ghent University:

- **achieve an additional 15% reduction in tap water by 2030 compared to 2020;**
- **make maximum use of alternative water sources in function of the application[1] and strive for 80% reuse in new buildings and renovations;**
- **makes room for water by removing (unnecessary) paving and converting it to an area where water can infiltrate;**
- **actively contribute to improving the water quality and quantity of ground and surface water;**
- **from now on works on an integrated approach to new construction and renovation in the field of water management and joins forces with experts, students and policy staff to do so;**
- **set up living labs around circular water management to help enable innovation.**

This ambition was made concrete for the next 10 years in the transition plan circular water management 2020-2030. Five strategic pillars were put forward:

- Reduction of water consumption
- Use of alternative water supply sources according to the application
- Space for water (link with biodiversity plan)
- Increasing water quality
- Working towards an integrated approach in new construction and renovation projects

[1] *High-quality applications: human consumption, kitchens, showers, hand washing, lab applications, water treatment (softening, filtration,...)*
Medium-grade applications: washing machines, cleaning offices, auditoriums, labs, drinking water animals, refrigeration,...
Low-grade applications: sanitation, cleaning stables, watering greenery

- Deploy Ghent University expertise and commitment, for its own projects and to help enable innovation

First concrete actions were proposed for these pillars.

The circular water management transition plan is part of Ghent University's climate plan and is being followed up by the circular water management working group.

This follow-up report provides a status report and explains the actions taken. Depending on the outcome of the actions taken, follow-up actions are needed or adjustments need to be made. For this purpose, input was provided by the circular water management working group and suggestions gathered in the think tank Transitie UGent.

2. Evolution indicators

2.1 Water consumption

Consumption of mains water decreased by 51% since 1998, the start of water accounting, (situation 2021). The cost price has increased by 96% since then, mainly due to sanitation contributions, which increased and expanded significantly (from €0.42m to €0.83m/year) (Figure 1). Water consumption per m² of building area has decreased by 63% since 1998 (figure 2), per Ghent University staff (staff + student) by 76% (figure 3).

Compared to 2019, water consumption decreased by 16% in 2021. However, the figures for 2020 and 2021 are not representative because of reduced activity in the buildings due to lockdowns and telecommuting.

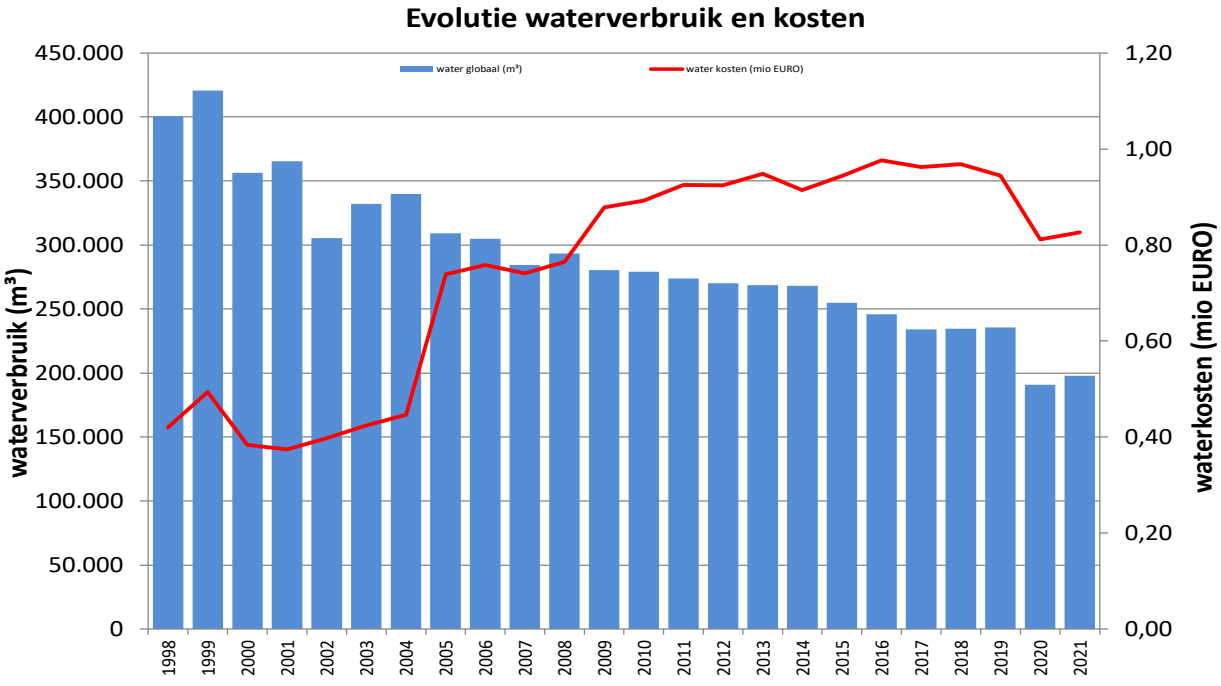

Fig. 1: Water consumption and costs from 1998 to 2021

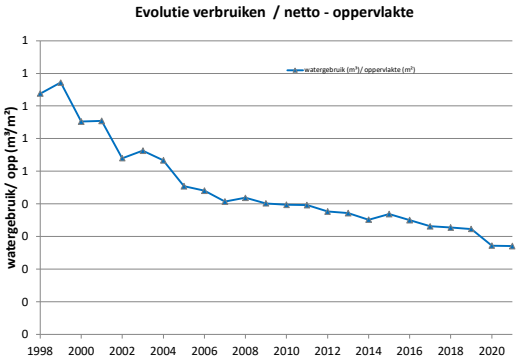

Fig. 2: Water consumption per m² of building area from 1998 to 2021

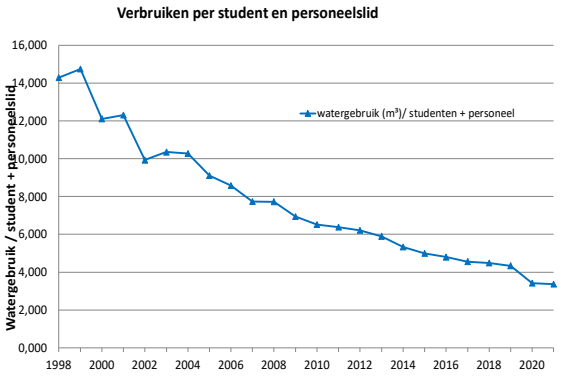

Fig. 3: Water consumption per person from 1998 to 20

2.2 Water resources

Figure 4 shows the origin of the water used. The majority is tap water, the proportion of alternative water supply sources is just over 10%.

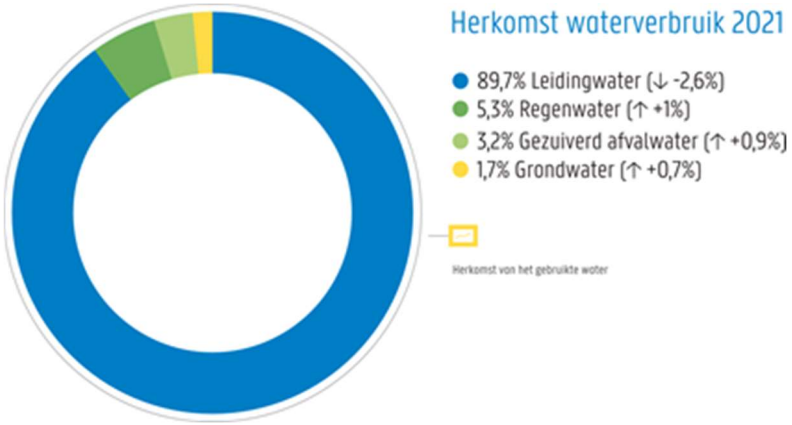

Fig. 4: Origin of water used in 2021 and evolution compared to 2020

The main alternative water source is **rainwater**. Since 2000, rainwater installations have been commissioned, as also mandated by the rainwater ordinance. Table 1 gives an overview of rainwater consumed per campus. The erratic pattern of consumption indicates various problems with the plants that were not remedied or were remedied far too late. Occasionally, even 'negative' consumption is recorded, meaning that mains water overflowed due to refill problems. In the meantime, however, all plants have been equipped with meters that allow consumption and refilling with mains water to be monitored and faster action to be taken when errors are detected.

	Rainwater consumption (m³)			
	2018	**2019**	**2020**	**2021**
Campus Ledeganck	603	272	67	389
University Street Campus, Braun School	155	202	104	96
Campus Dunant, HILO/GUSB/HIOW	758	474	171	175
Mercator block B	161	296	74	29
Campus UFO, Veyrac and Coach House	158	106	43	32
Campus Tweekerken/Saint Peter's Square	970	959	505	505
Campus Melle	377	231	258	206
Campus UPlateau library	265		105	252

Campus Dunant	negative	564	369	311
Campus UFO, building UFO	487	404	10	611
Campus Proeftuinstraat, building N1	33	28	37	Out of use
Campus Coupure	1139	158	395	550
Campus Sterre	1.547	1.710	1.319	2347
Campus Kortrijk, Vegitech				11
Merelbeke campus, Heidestraat	58	70	42	33
Hhome Vermeylen				547
Home Kantienberg	1.914	1.139	352	1063
Campus Ardoyen	0	3.416	5.019	3390
Campus Island, Capture				114
Merelbeke campus	501	665	373	456
Heymans Campus, MRB II		514		416
Campus Heymans, docolab				155
Total	9.126	11.208	9.243	11.688

Table 1: Summary of rainwater consumed per campus in m³/year

Table 2 lists the available **groundwater extraction wells** and Table 3 shows the evolution of use. As the deep aquifers in the base are under heavy pressure, Ghent University no longer uses groundwater at great depth. Although rainwater and purified wastewater are preferable to groundwater for low-grade applications, groundwater is the best choice in certain cases, e.g. when the supply of rainwater or purified wastewater is limited or when a certain degree of purity is desired that cannot be guaranteed with rainwater. Nevertheless, the use of groundwater for medium-grade applications should be carefully considered in order to avoid overly intensive pre-treatments (e.g. in iGent, groundwater undergoes deferrization and nanofiltration before cooling, where significant amounts of water are lost in both processes).

Location	Depth	Permitted flow rate	Applications
Campus Ledeganck, botanical garden	38 m 48 m 52 m	5,000 m³/year	Replenishment of the pond used in turn for watering the plants
Campus Melle, plant cultivation	42 m	250 m³/year	Watering plants, preparation of spraying liquid
Campus Ardoyen, iGent	37 m	6,000 m³/year	Cooling
Merelbeke campus, high-rise building	18,5 m	4,000 m³/year	Cleaning stables, drinking water animals

Table 2: Overview of available groundwater extraction wells (all in the Elm Acquifer)

Location	2015	2016	2017	2018	2019	2020	2021
Campus Ledeganck, botanical garden	1.467	1.577	3.058	1.557	650	1.307	439
Campus Melle, plant cultivation	87	942	112	60	239	470	232
Campus Ardoyen, iGent		1.917	2.278	3.974	1.289	3.286	1.560
Merelbeke campus, high-rise building	892	5.110	2.276	1.539	146	49	1.604
Total	2.446	9.546	7.724	7.130	2.324	5.112	3.835

Table 3: Evolution of groundwater use expressed in m³/year

Purified wastewater is also increasingly being used. For example, at the Veterinary Medicine campus and in the University Sports Complex GUSB, treated wastewater is reused for cleaning stables on the one hand and flushing toilets on the other. Aerated helophyte filters were installed on the Heymans campus, Gontrode campus and the Proeftuinstraat campus. The treated wastewater is used to flush the toilets. The filter on campus Heymans has been in operation since spring 2021, while the installations in Gontrode and Proeftuinstraat will be started up in spring 2022.

Table 4 summarises consumption.

Location	2016	2017	2018	2019	2020	2021
Merelbeke campus, high-rise building	4.363	4.485	5.576	5.946	4.880	4.721
HILO campus, GUSB sports complex	1.402	1.445	1.432	1.313	1.456	1.543
Campus Heymans, Pharmacy						830
Total m³	5.765	5.930	7.008	7.259	6.336	7.094

Table 4: Summary of treated wastewater used expressed in m³/year

2.3 Water quality

To protect the receiving watercourse from the discharge of hazardous substances, ensuring the quality of the discharged wastewater is an important concern.

Wastewater is discharged into the public sewer system on almost all campuses, where it is discharged into surface water after treatment in a sewage treatment plant. Consequently, the environmental impact on the receiving surface water is low. Only on campus Proeftuinstraat is untreated waste water still discharged into the surface water of the Scheldt; the sewage works are scheduled for 2022 and are in the hands of the City of Ghent. Also, since early 2022, wastewater there has been treated in a helophyte filter and partly reused for toilet flushing, reducing the amount of untreated water discharged into the Scheldt. On the Veterinary Medicine campus there is a wastewater treatment plant with discharge to surface water.

Water emissions are monitored with measurement campaigns at the various lab sites. When emission limits are exceeded, the cause is sought together with the departments concerned. However, the situation is not always so clear-cut for the discharge of micropollutants such as medicines, pesticides, microplastics, endocrine disruptors,... These pollutants are not included in VMM's standard analysis packages or the self-monitoring programme. Upon notification of a potentially relevant discharge of such substances by the departments, this can be investigated ad hoc. But as there are often no water quality standards for this, an objective assessment is not easy.

2.4 Water adaptation

In recent years, awareness has grown that good water management is much more than using as little water as possible and striving for good water quality. Good water management can mitigate the effects of climate change and is becoming a crucial issue in climate adaptation. Ghent University can contribute to this by making space for water, reducing the paved surface area and managing existing water bodies in such a way that water is maximally supplied, captured and kept in situ.

Thus, when constructing outdoor spaces, efforts are made to keep paving to a minimum. However, there is still a lot of superfluous paving, especially for oversized streets and car parking. The biodiversity plan and the company transport plan have already set a direction for this.

3. Evaluation action plan and adjustment

Given the high level of ambition of the transition plan for circular water management and the urgency of the issue, it is very important to closely monitor the set objectives and the progress of

the action points. Depending on the results of the actions taken, adjustments will have to be made. The evaluation below will therefore also determine the action plan for the coming year.

Pillar 1: Reducing water consumption

A reduction in water consumption is an important step in the transition to circular water management. **Water consumption in the various buildings is monitored monthly via the water accounts. In case of anomalous uses, the cause is sought.**

Water consumption is recorded manually by recording counter readings. This is labour-intensive, as well as often incomplete and prone to errors. By switching to a digital system, registration will be more correct and faster action can be taken in case of abnormal consumption.

This data can help in water audits to **detect and, where possible, remedy large water consumption**.

A thorough analysis must also be made of the large water-consuming technical installations, such as softening, de-ironing, micro- or nanofiltration, RO, adiabatic cooling, etc., which consume a lot of water. It should be investigated whether the treatments are always needed (everywhere), whether there are no alternatives available and whether the effluent can be reused (e.g. for toilet flushing). Currently, water consumption plays little or no role in the choice of an installation or in determining the number of distribution points.

In addition, rainwater systems should be critically examined in these audits. Poorly functioning solenoid valves often interfere with the control of the choice between rainwater or mains water, resulting in mains water being used despite the availability of sufficient rainwater, or the refill with mains water remains activated, causing pure mains water to overflow into the sewerage system.

The following actions were proposed:

Action 1.	First phase: installation of digital meters on critical and high-consumption plants (water treatment systems) and on the various water systems during new construction and renovation. Second phase: general changeover to digital meters with software for analysis and alarms, as will be done for electricity, natural gas and heat.
Evaluation	Digital meters (Shayp) were purchased, which continuously record consumption in the water accounts. They were installed in the Ghent University-VIB research building (5) and in home Kantienberg (4), two large consumers with a strong suspicion of water wastage. In the most recent new buildings (Capture, Technicum, Veg-i-tech, etc.), more particle counters are being installed, which allow high consumption levels to be identified more specifically. The review of the draft guideline in 2022 will include the installation of digital counters.
Adjustment and planning	The number of digital counters will be increased, including in Plateau and Blandijn buildings. For the digital meters in the most recent buildings, a pilot project is being set up for reading and processing the meter readings as they are not processed in Ghent University's existing energy accounting system (Erbis).

Action 2.	Performing water audits of technical installations, water appliances in labs, rainwater installations, ...

Evaluation	One digital meter in the Ghent University-VIB research building indicated very high continuous consumption of the RO plant. By adjusting the regulation (better balance between quality and flushing), the consumption of the unit fell by about 90%. Due to this finding, all RO installations at Ghent University were screened. The digital meters in home Kantienberg indicated very high continuous consumption. This was reported to the private partner. Building physics students monitored water consumption in the homes to look for the causes of high water consumption in the homes. The meter readings of the rainwater installations are recorded monthly, alarms were placed on a number of installations and there are quarterly meetings with DGFB to follow up on action points.
Adjustment and planning	Acquired insights are embedded in decision-making tools and processes (monitoring digital meters, settings and good practices of RO plants, water softeners, cooling circuits,...). A structural consultation (or at least a point of contact) with private partner Kantienberg is needed to discuss high water consumption in the homes.

Action 3.	Development of policy instruments to better match large water-consuming devices (plants, distribution points, etc.) to actual needs, e.g. for: - cooling water: connection to a closed cooling system, either centralised or decentralised; the department must provide its own closed circuit; - softened water: the lab applications and devices requiring softened water need to be identified; the trade-off for central or decentralised provision of softened water is made by DGFB in terms of management and energy/water consumption (central facilities are centrally funded, decentralised facilities decentralised).
Evaluation	These agreements were included in the note 'Financing equipment in investment projects and adaptation works'.
Adjustment and planning	

Action 4.	Raising awareness about water saving, especially in homes (very high water consumption compared to the consumption of a normal family (100 m³ vs 50 m³/y).
Evaluation	Toilets flushed with rainwater or greywater were given a sticker on the flush button, informing people about this. A survey was organised in the homes on water consumption and shower timers were hung in the showers. The high water consumption was discussed at the home meeting. Building physics students monitored water consumption in the homes to look for the causes of high water consumption.
Adjustment and planning	Consumption will continue to be monitored and results fed back.

Pillar 2: Use of alternative water supply sources

89% of the water used is tap water. This precious drinking water can be replaced by alternative water supply sources in many applications. Here, it is important to completely separate water streams of different quality in order to arrive at an optimal treatment technique for each partial stream. Gradually, new technologies can increase the quality of a particular water stream, thus widening the scope of application.

The preferred option is to use treated wastewater (grey water). This keeps rainwater available for maximum infiltration on campus and replenishment of the groundwater table.

Secondarily, rainwater can be used.

Groundwater can only be used for applications for which the quality of rainwater or treated wastewater is not sufficient. No water will be pumped from the Plinth, so only water from the relatively shallow layers will be considered.

Groundwater for cooling can, provided no pre-treatment is required. Pre-treatment of groundwater (de-ironing, nanofiltration,...), as happens in iGent is very expensive, difficult and wasteful of water.

Groundwater is also extracted at construction sites to artificially lower the groundwater level (drainage water). It is already recommended that extracted groundwater be returned to the ground (return drainage) via infiltration wells, basins or trenches. If return drainage is not possible, the drainage water should initially be diverted to the nearest watercourse or, in the case of a separate sewerage system, to the stormwater drain. Only if previous solutions are not feasible may discharge to the public sewerage system. Useful use of groundwater may be considered during prolonged periods of drought.

The following actions were proposed:

Action 5.	Complete separation of wastewater and stormwater, in line with legal requirement.
Evaluation	In a number of places, Ghent University does not comply with fully separate stormwater and wastewater drainage, as in: - Control engineering building on Ardoyen campus - complex Plateau - Blandine building - home Fabiola/Boudewijn/Astrid In addition, on many campuses there is no possibility of discharge into a separate public sewerage system, as on: - Coupure campus - Dunant campus, FPPW - campus Sterre side De Pintelaan
Adjustment and planning	A number of buildings with mixed sewers are being renovated in the near future, where the drains will be separated. However, if separate sewers are not available on the public domain, these efforts will be undone. Therefore -in addition to the disconnection of rainwater- rainwater should be infiltrated on site or discharged into surface water in a delayed manner as much as possible. In those places where there is no separate public sewerage system (inner city), no reuse of rainwater is necessary (by using treated wastewater) and there is no place to infiltrate on campus, disconnection is less interesting (e.g. Blandijn).

Action 6.	Maximum use of treated or recirculated wastewater for sanitary purposes.
Evaluation	The effluent from the pool filters at GUSB and the treated effluent from the water treatment plant on campus Veterinary Medicine were already being used for

	flushing toilets and cleaning the stables. In addition, helophyte filters were installed on campus Pharmacy, campus Gontrode and campus Proeftuinstraat, where the wastewater is partially purified and reused for flushing toilets. There are no negative experiences with the installations used yet. In all new construction and renovation projects, opportunities for greywater reuse are being investigated. Currently, helophyte filters are planned for campus Volderstraat (renovation Paddenhoek) and renovation Rectorate 1. A central helophyte field is planned on the Ardoyen campus to supply purified wastewater to all Ghent University buildings. Also on campus Sterre, according to the master plan, 2 central helophyte filters will be opted for (the first of which will be operational when S11 is commissioned). On campus Veterinary Medicine, the use of treated wastewater was expanded by connecting additional buildings (deanery and high-rise) to the existing wastewater treatment plant.
Adjustment and planning	The review of the draft directive in 2022 will include the use of treated or recirculated wastewater for sanitary purposes. Due to lack of open space, in a number of locations, the total demand for sanitary water cannot be covered by treated wastewater. Here, hybrid systems are opted for, where the shortfall is supplemented by rainwater.

Action 7.	Investigate opportunities to use alternative water sources for broader applications than currently allowed (e.g. for showers, dishwashing, cooling water,...) to make the 80% alternative water sources target realistic in student homes and lab buildings as well.
Evaluation	On campus Ardoyen, treated wastewater will be used for the cooling towers. It is being investigated whether this water also qualifies for other cooling applications and what pre-treatment is necessary. No research has yet been done for use of treated wastewater or rainwater in showers or (dish) washing machines.
Adjustment and planning	Possible new techniques for upgrading treated wastewater and stormwater will be followed up. Consultations are being held with Aquafin, VMM, Flanders and external partners (Colruyt, Durabrik,...) on new applications for alternative water sources, adapting legislation, working out incentives and control mechanisms.

Action 8.	Define the restrictions on groundwater consumption in the design guideline (no use of groundwater unless as a very last step if it can replace mains water).
Evaluation	This will be adjusted in the draft directive following the new 2022 version.
Adjustment and planning	The use of groundwater is evaluated through the water barometer: this visually presents all water flows and related costs and identifies the risks of water sources. At the same time, an environmental analysis indicates nearby alternative, sustainable water sources. Suitable treatments are also suggested for these water sources. The water barometer helps to select appropriate measures.

Action 9.	Work out process-flow to use drainage water to supplement water shortages in periods of drought (in the context of climate adaptation).

Evaluation	The legal framework has been extended (Guidelines on drainage for environmental protection (2019)) and will soon be updated again (Vlarem train 2019). The preference is for return drainage and reuse. This should already be considered at study and design stage. The process flow was included in the design guideline.
Adjustment and planning	It will be considered whether the choice of technique, permit application,... will be left to the contractor or Ghent University will impose certain things. The Lansink Ladder applies as a guideline: 1. limit by automatic control and monitoring, 2. return drainage, 3. reuse, 4. discharge into surface water, 5. discharge into separate sewer, 6. discharge into non-separated sewer.

Action 10.	In new construction and renovation projects, commit to splitting supply lines for different types of water quality (drinking water, hygienic water, sanitary water) to enable rapid changeover.
Evaluation	This was not yet applied anywhere.
Adjustment and planning	Consideration is being given to how this can be implemented in the renovation of home Baudouin and following. The added value in office and lab buildings is being investigated. A strategy is being worked out for next issue: - Can treated wastewater also be used for cooling, cleaning stables? What degree of purification is required? Is a helophyte filter sufficient or is an additional treatment step required?

Pillar 3: Space for water

Space for water means that water becomes visible on campus and infiltration and buffer basins are part of the public space. More and more wadis are being constructed at Ghent University, such as on campus Heymans, campus Sterre and campus Kortrijk. On campus Ardoyen, a central infiltration facility is being installed that also forms a meeting place for students and staff. Free space in the densely built-up inner city will also be used for infiltration. For instance, small wadis will be provided during the renovation of the houses in Sint-Pietersnieuwstraat, and on the student square, rainwater will drain integrally into the tree level of the high-rise. Ponds are present on campus Merelbeke, campus Proeftuinstraat and campus Ledeganck.

But it also means that open space is not increasingly being carved up for new construction or additional paving. Infill rather than expand is one of the priorities of the 2019-2028 property policy plan and can be done by using available infrastructure more efficiently.

Giving space to water has many other benefits besides replenishing the groundwater table. In urban environments, it provides cooling, less flooding, less heat stress, biodiversity, pleasant blue-green campuses and a higher quality of life, among others.

Rainwater from roadways, car parks and other paved surfaces, which cannot be considered for reuse or is redundant due to the use of treated wastewater, should infiltrate maximally on site. The ecosystem needs water, runoff from roadside water is a necessary need for the surrounding green spaces.

The following actions were proposed:

Action 11.	Expanding infiltration opportunities.
Evaluation	This action point is also addressed in the biodiversity plan and the corporate transport plan, where action points are proposed to de-soften and green redundant infrastructure (e.g. more efficient use of underground car parks can redevelop ground-level car parks).
Adjustment and planning (proposal)	Further efforts are being made on softening projects (campus Dunant, campus Coupure, Rozier, Sint-Pietersnieuwstraat, campus Pharmacy, campus Sterre, etc.). Softening projects always consider whether the 'gain' can be increased by infiltrating rainwater from permanent pavement into the part to be softened. Every new construction or renovation project considers how to maximise rainwater infiltration on site. For construction works, measures are taken to prevent compaction of the soil by heavy machinery so that infiltration capacity remains optimal.

Action 12.	Working with permeable materials for necessary surfacing, e.g. for bicycle sheds, footpaths, fire lanes, ...
Evaluation	This was included in the draft directive. *Bioswales* were provided at the new roadside at Ardoyen campus.
Adjustment and planning	Efforts continue.

Action 13.	**(New)** Give more visibility to hard water infrastructure to increase support for circular water management.
Evaluation	This is a new action.
Adjustment and planning	There is communication (e.g. info panels) about water treatment infrastructure, stormwater drains and buffers, confronting staff, students and visitors with the importance of circular water management and the need for space for water.

Action 14.	**(New)** Determining the Green Blue Level of the Ghent University patrimony, an instrument that scores a plot or building on rainwater collection, use and infiltration and biodiversity, CO_2 -storage, air quality and cooling. The score indicates the extent to which your plot is already climate-proof and provides suggestions for improvement.
Evaluation	This is a new action.
Adjustment and planning	The Green-blue level of the Ghent University patrimony is determined (student project) and improvement proposals are implemented.

Pillar 4: Increase water quality

All wastewater discharges from Ghent University buildings are connected to the public sewer system, with the exception of the Proeftuinstraat campus and the Merelbeke campus. The Proeftuinstraat campus is expected to be connected by 2024 at the latest (depending on the city of

Ghent). Since spring 2022, the wastewater from the Proeftuinstraat campus has been partially purified in the helophyte filter, resulting in a significant reduction of the wastewater discharge flow, which is an improvement of the situation. On campus Merelbeke, wastewater is treated in its own wastewater treatment plant to surface water quality.

Water emissions are monitored with measurement campaigns at the various lab sites. When emission limits are exceeded, the cause is sought together with the departments concerned. Norm violations and incidental discharges, mainly due to student practices or new procedures where staff are insufficiently familiar with good lab practices, are to be avoided. The impact of discharge of non-standardised micropollutants (antibiotics, microplastics, pesticides, endocrine disruptors,...) by Ghent University is very small. Nevertheless, we should not be blind to this issue and Ghent University should take a pioneering role in research into the presence of and technologies for the removal of micropollutants.

As long as wastewater enters the public sewer system and can be treated at a sewage treatment plant, environmental damage from incidental discharge of pollutants may be very limited. **But the entry into force of overflows can result in large quantities of untreated wastewater entering surface water. This must therefore be avoided, particularly** at our own plant on campus Ardoyen, but also by putting a strong focus on the complete separation of waste and rainwater (see action 5).

The following actions were proposed for this purpose:

Action 15.	Sustained focus on prevention, communication, training, sharing good working practices, ... in lab environments.
Evaluation	There is an annual self-monitoring programme at lab sites, monthly follow-up for problem parameters at some campuses, with thorough follow-up in case of norm violations. Water analysis results are reported through the environmental committees, through the environmental coordinator's annual report and transmitted to the licensing and regulatory authorities.
Adjustment and planning	Efforts continue.

Action 16.	Avoiding overflows on campus Ardoyen by completely disconnecting rainwater and wastewater (Ghent University and companies), purifying and reusing wastewater and avoiding the discharge of diluted wastewater flows from lab buildings.
Evaluation	A special condition from the environmental permit requires VZW Ardoyen to carry out a study on the origin of diluted wastewater by 2024. This study will be launched shortly. Proposed actions to avoid dilution must be implemented by 2025. When the parvis is constructed, a central infiltration facility will be available for much of the existing buildings and paving. This moment should be used to achieve complete disconnection from the Ghent University buildings. Wastewater reuse is being prepared and will reduce the load on the pumping station. Due to the vacancy of the Chevron building, the mixed wastewater pumping pit can be temporarily connected to the stormwater drain so that stormwater is no longer diverted to the pumping station.

Adjustment and planning	Companies that still discharge rainwater as wastewater are urged to disconnect and infiltrate rainwater. They are not legally obliged to do so, which limits their willingness to take action. The construction of central infiltration infrastructure may convince them. The possibility of avoiding overflows through technical adjustments in the pumping station (adjusting level measurement, overflow height, pump flow rate, etc.) will be examined.

Action 17.	Investigating technologies for micropollutant removal in effluent.
Evaluation	No action has yet been taken on this.
Adjustment and planning	A collaboration with Prof Stijn Van Hulle is being considered.

Pillar 5: Integrated approach in new construction and renovation

A water transition plan for each campus, based on a water balance sheet, draws the direction. This includes the 4 previous pillars, namely reducing water consumption, maximising the use of alternative water sources, giving space to water and working on improving water quality. **Every new construction or major renovation provides the opportunity to address part of the water transition plan.** (Student) research or experiments can also implement the plan step by step.

The following actions were proposed:

Action 18.	Drawing up water balances for entire campuses: - as part of master plans, environmental permits, ...; - to compare monitored consumption with theoretically expected consumption as a control tool to detect excessive consumption ; - To dimension treatment and reuse systems, infiltration facilities, water features, softening projects,...
Evaluation	Water balances were prepared for Sterre campus, Ardoyen campus, Gontrode campus and Proeftuinstraat campus. The water balances for Sint-Pietersnieuwstraat and campus Aula are under preparation.
Adjustment and planning	The water balances for St Peter's New Street and campus Aula are being finalised.

Action 19.	Draw up water transition plans per campus and adjust planned renovation and new construction accordingly. This means mapping out the various consumption items and the desired water quality for renovation and new construction and aligning measures with the water transition plan, together with experts. The design office will be made aware of this in the tender. These water transition plans form part of the zoning study/master plan required for the submission of an environmental permit application.
Evaluation	A water transition study was prepared for Sterre campus. The master plan including water layer has been finalised.

	The water transition studies for Sint-Pietersnieuwstraat and Ardoyen campus are underway. Due to new construction or renovation plans, (partial) transition studies are also being prepared or carried out for the following sites: campus Aula-Paddenhoek, campus Heymans, campus Coupure.
Adjustment and planning	A water transition study for Ardoyen campus is being prepared. Consultations will be started with external partners of areas where Ghent University is active (Ostend Science Park, campus Eiland, campus Schoonmeersen, UZGent) to include the objectives of the transition plan circular water management there too and apply them in a water transition plan.

Action 20.	**(New)** Campuses climate-proof, adapting to long droughts and against the risk of flooding.
Evaluation	This is a new action item.
Adjustment and planning	Through flood maps (www.waterinfo.be), current and future flood risk is estimated and designs are adjusted accordingly by providing buffer basins and smart building design. Emergency rainwater buffers are provided for irrigation of landscaping, plant gardens, greenhouses,... to bridge long dry periods. If rainwater cannot infiltrate on site, buffering with delayed runoff is used.

Pillar 6: Deploying Ghent University expertise and engagement

The range of emerging, new technologies is growing every day. However, the flow to innovative application in water management is more laborious. The water transition still requires a lot of technical, process and social innovation. As a university, we can act as a living lab and investigate which technical, regulatory, administrative, financial and emotional barriers hinder innovation and how they can be eliminated.

Our own experts can help in the concrete translation of the present water policy plan. We need to link the available expertise together to create a powerful collaboration that helps shape water-robust and water-independent campuses. Ghent University as a testing ground ensures that technologies and concepts gain the trust of the market more quickly.

But the wider network can also mean a lot in the further roll-out and realisation of this plan. Especially for the pillar 'space for water', but also for awareness campaigns on reducing water consumption, promoting tap water, reducing the water footprint, ... a lot of people can be mobilised. **With a broad commitment and with the fiat and trust of Ghent University, even a number of things can be realised without costing much**.

For this, the following action was proposed:

Action 21.	Establish working group on circular water management and follow up on transition plan.
Evaluation	The circular water management working group consists of a group of water management and water technology experts, policy staff from DGFB, DBZ-Milieu and the external partner BOSAQ. There is also a broader group that is kept informed via the think tank Transition UGent.

	The working group is following up on the circular water management transition plan.
Adjustment and planning	Efforts continue.

Action 22.	Create frameworks and space in which own, bottom-up initiatives can be realised. Actively encourage staff and students to launch proposals to make their campus more water-robust and get involved in this themselves.
Evaluation	Together with students and staff, car parks were softened and greened on campus Coupure, campus Sterre, campus Gontrode and campus Dunant (see also follow-up report biodiversity plan). A website circular water management (NED, ENG) pools information and spurs action.
Adjustment and planning	Efforts continue.

Action 23.	Consultation with legislative and licensing bodies to give a chance to new techniques, for which there is not yet a legal framework (regulatory-free zones).
Evaluation	The aerated helophyte filter and the reuse of treated wastewater is an innovative technique. Moreover, the reuse of treated wastewater means that too little rainwater is reused in accordance with the regional town planning regulation. Such files were always thoroughly discussed with the licensing and advisory bodies (VMM, city or municipality, province, Flemish Waterway, sewer manager, green services), with success (provided that only the proportion of water that is itself reused is treated).
Adjustment and planning	

Action 24.	**(New)** Optimise water management through collaboration with adjacent sites and buildings, other water and sewerage operators,...
Evaluation	This is a new action item.
Adjustment and planning	Cooperation with other partners allows for more optimal use of free space and better matching of water supply and demand. On the Ardoyen campus, all wastewater, including that from private companies, will be treated in a helophyte field and reused in the Ghent University buildings and the Ghent University-VIB research building. This could possibly be extended to use by a private company. This case can serve as a pilot project for later collaborations on a technical, financial and legal level.

Following collaborations have already been set up:

Testing ground 1	Students of the 'integrated water management' course of the EA faculty worked out a water balance and a water transition plan for Sterre campus, as part of the Sterre campus master plan.

	Who: Prof Renaat De Sutter, BOSAQ, DGFB, environment department *Where: Sterre campus*
Testing ground 2	The Department of Green Chemistry and Technology at the Faculty of BW follows the quality and control of a helophyte filter on the Pharmacy campus.
	Who: Prof Diederik Russeau, DGFB, environment department *Where: Pharmacy campus*
Experiment 3	Students of the 'integrated water management' course at the EA faculty are working on a water balance and water transition plan for campus UFO, as part of the St Peter's New Street master plan.
	Who: Prof Renaat De Sutter, BOSAQ, DGFB, environment department *Where: site St Peter's New Street*
Testing ground 4	The EA faculty's Building Physics research group monitored water consumption in the homes, looking for excessive and avoidable water consumption.
	Who: Dr Elisa Van Kenhove, DGFB, environment department *Where: Homes Fabiola, Baudouin, Kantienberg, ...*
Testing ground 5	BW Faculty's Isotope Bioscience Laboratory investigates the greenhouse gas balance of small artificial ponds.
	Who: Samuel Bodé *Where: including pond campus Proeftuinstraat*

4. Funding

The transition to water-robust and water-independent campuses must become an **inclusive story**. The costs involved must be integrated in an investment plan, in a building project, ... However, Investment Plan 3 does not yet go that far. **The measures to be taken to infiltrate and reuse rainwater or reuse greywater are anchored in the project budgets, but additional experimental budgets for innovative projects are not yet foreseen.** To finance this in the meantime, the budgets below can be tapped:

Provision sustainable measures:

The 'provision for sustainable measures' is supplemented annually with 'proven' savings[2] in energy and water consumption. In the next budget, it will be proposed to transfer the proven savings in terms of water consumption, being **EUR 20,000**, from Section I to Section II (see Annex 2 of follow-up report Energy Policy Plan 2020-2030).

Grants and research funds:

By setting up living labs on circular water management in cooperation with Ghent University experts, research funds can be tapped. After all, various Flemish and European-funded projects stimulate innovation in the field of integral water management. In addition, an open innovation platform will be set up within the 'coordination committee integrated water policy' to better align innovative projects of companies in order to increase the chances of support.

[2] *Guidelines for commissioning sustainable measures: see Energy Policy Plan 2020-2030*

A large number of project calls were also launched under the Blue Deal and support measures are available. A dossier was submitted or prepared for the calls listed below:

Call 1	Drought trial gardens (VMM) Partnerships of at least 3 parties that want to jointly implement a project that increases circular water use and water availability. The focus is on water-saving partnerships that effectively provide solutions on the ground. New in this call is that non-profit and public companies can now fully participate in the partnership and thus also receive funding. Projects must be completed by mid-2026 at the latest.
	What: Drought pilot project Circular water use on Ardoyen campus: grant application has since been approved (EUR 237,000) *Where: Tech Lane Ghent Science Park campus Ardoyen*
Call 2	Green Blue Pearl (Flemish Community, Department of Environment) Partnerships working around the softening, greening and blackening of public and private parts of sites of educational and healthcare institutions, youth movements, residential areas or neighbourhoods as well as sports and business sites. A grant application consists of at least three sub-projects, each of which is in a different location.
	What: De-surfacing and greening of the Dunant/Coupure axis by interventions on both the public domain, the Balans school and the Dunant and Coupure campuses: grant application has since been approved (EUR 132,000) *Where: Coupure campus and Dunant campus*
Call 3	Water-conscious building (COOCK) With this project, VLARIO, the Flemish Construction Confederation, Vlakwa, WTCB and NAV aim to strengthen the resilience of the built environment to drought and water scarcity through the application of individual and collective innovative technologies. The main objective of the project is to fill the rising knowledge gap among the target group by collecting information from (almost) completed projects, further building knowledge and expertise by supervising ongoing or new projects and conducting research on water quality. For the duration of the project, selected projects will be assisted and followed up.
	What: Renovation and new construction Paddenhoek *Where: Campus Aula - Paddenhoek*

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Input from: DGFB, Transition UGent