



Directie Natuur en Milieu

Results and ‘best practices’ for wastewater management by the hotel industry members of Aruba

Results and analysis of the AHATA wastewater 2023 survey

Research and Monitoring and Policy Department (DNM)
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Ministerie van Transport, Integriteit,
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Contents

Introduction	2
Background	2
Summary of results of AHATA wastewater survey 2023	2
Best practices for hotels [6]–[9].....	2
Summary of Q&A Session June 22 nd , 2023	3
Reference list	5
Appendix A. Graphs and charts Results AHATA Questionnaire: Produced Liquid Waste 2023	6
Appendix B. Types of pre-treatments applied to properties.....	14



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Introduction

DNM in collaboration with the Aruba Hotel and Tourism Association (AHATA) carried out the survey on wastewater management (Appendix A and B) within the hotel industry for the third time in 10 years. The aim of the study is to reflect the results that inventory wastewater types produced by the AHATA members, how decentralized wastewater management can lead to higher instance of water recycling and reduced complaints within a company, how better wastewater quality produced by hotels reduce the pressure at Wastewater Treatment Plant Bubali (WTPB), which can lead to wastewater volume reduction and types that go to the RWZI Bubali. In that way we all contribute to reducing risks and impact to Aruba's nature and environment.

Background

The WTPB processes sewage water from the areas of Oranjestad, Bushiri and the low & high-rise hotel area. Population growth, tourism sector growth and visitor increase over the past 30 years has resulted in more connections to the sewage system and increased sewage water discharges [1], [2]. In addition to poor management and maintenance of the WTPB, these factors have exacerbated the wastewater processing capacity of the WTPB. The inadequate processing capacity of the WTPB has left the community and users of the Oranjestad, Bushiri, low & high-rise hotel area dissatisfied and the seawater quality in a poor condition [3].

Yet, other factors that hinder the wastewater processing capacity include: 1) high volumes of poor-quality wastewater reaching the WTPB, 2) Fat, oils, and grease (FOG) clogging the sewer system, 3) chlorine, paints, and medicines entering the sewer system. Especially during the rainy season, the WTPB does not get the time to process wastewater adequately, which allows runoff water of lesser quality to reach the sea. The rainy season coincides with the visitor high season. The WTPB is not designed for waste streams other than blackwater. Fats, oils, and grease (FOG) are not allowed to be discharged to the sewer system [4]. If FOG is discharged in high quantities, the pumps of the sewer system get clogged and interrupted. Resulting in sewer water overflow onto public roads and soils, contaminating the natural area, nuisance to visitors and local business owners, and causing damage to infrastructure (Fig. 1).



Figure 1. Images of Fat, Oil, Grease (FOG) discharges into sewer system Bubali area, taken June 2023. (Left) (brown) FOG at pumping station. (Right) Wastewater overflow onto public domains.

Chlorine, paints and medicines kill the bacteria needed for processing of organics within the tanks at WTPB. When these colonies die-off in the tanks, the processing time is extended, causing additional odor nuisance. It takes about 7 days before the microbial activity is normalized after a major die-off event at WTPB. Therefore, these substances are not allowed to be discharged in the sewer system.

In 2021, the water consumption of the hotel industry amounted to almost 2.6 million m³, accounting for 22% of the total water consumption in that year [5]. Best practice within the hospitality sector regarding liquid waste management can significantly contribute to reducing water consumption, volumes of wastewater reaching the WTPB, reduce clogging of the sewer system and microbial die-off in the WTPB. Additionally, the Coral Reef Study 2019 [3] highlighted the need to apply combined efforts to enhance environmental quality in the near-shore (within 150m from the coast) area of Aruba. Which further highlights the need to reduce wastewater volume produced by the hospitality sector and enhance the quality of wastewater discharged to the sewer system as part of a combined effort.

Summary of results of AHATA wastewater survey 2023

On the 22nd 2023 the results of the questionnaire were presented to the members of AHATA. In appendix A the results and graphs are summarized. Through the continuation of this type of survey in the future, trend analysis can take place.

The important results highlight that most properties who participated in the survey are connected to the sewer system (18 out of 21), thus make use of public WTPB. Of these 18 properties, decentralized wastewater recycling and treatment is taking place in at least 13 properties. Recycling water (a.k.a. water reclamation) is the process of enhancing wastewater quality by treating it so that it can be reused for various applications. Recycling water reduces the volume that is discharged to WTPB as the water is reused on the property. When wastewater is untreated, yet reused for example in irrigation, there is a high risk of introducing contaminants in the environment. This should always be avoided. Wastewater treatment methods used by properties in the survey are presented in Appendix B.

Most properties (18 out of 20) separate their waste cooking oil from their wastewater tanks. Seventeen (17) companies reported to have a grease interceptor in their septic tank. Separating waste cooking oil in a waste oil tank and additionally making use of a grease interceptor in the septic tank are two highly effective actions to avoid FOG clogging the pumps at Bubali and they reduce the risk of backlogging and discharges to public roads in the area, pollution to the environment, and nuisance of odors and insects attracted by backlogged water on the road.

Only six (6) properties reported to have a (waste)water management policy. The (waste)water management policy has many benefits including:

- Avoidance of energy use for heating/cooling;
- Leakage identification;
- Water consumption level;
- Lead to reduction of water use > cost-reductions.

Best practices for hotels [6]–[9]

Best practices are derived from current activities carried out by hotel properties in Aruba and what literature advises.



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1. Generally, localized wastewater management prerequisites a water management plan. These plans involve monitoring and benchmarking of all processes that consume water to identify leaks and areas of opportunity to reduce water consumption and enhance water recycling. Benchmark indicators are characterized by the performance or application of major processes in the hotel-industry that contribute to high water consumption, and thus high wastewater production. Benchmark indicators are usually decided between stakeholders (e.g. AHATA members) when there are limitations to the national wastewater and water use framework. The proposed benchmark indicators are [6], [9]:
 - a. Toilet flush volumes (l/flush) and frequency;
 - b. Laundry generation (kg/guest/night);
 - c. Laundry efficiency (L/kg);
 - d. Dishwashing (L/rack);
 - e. Fitting flow rate (L/min);
 - f. Kitchen (L/cover);
 - g. Pool (L/m²/yr);
 - h. Irrigation (L/m²/yr);
 - i. By identifying total water consumption in L/guest/night, properties can work on reducing this consumption to an optimal level (e.g. 140 L/guest/night). Regular inspections and maintenance of points that leak and appliances, reduce wastewater production. Additionally, the best method to identify liquid waste volume and enhance recycling capacity is by using a unit system for collecting wastewater. That is, the kitchen waste is separated from the laundry or pool collection tanks and so on or submetering per activity.
2. When greywater from showers and laundromats are separated from the central unit catchment and then pre-treated, it can reduce water costs through application in irrigation. In some systems, nutrient (fertilizer) reclamation can be achieved which in turn can be applied in green areas or even sold.
3. Condensation water from air-conditioners/cooling towers, if separated, can be recirculated to fill toilets and depending on the system, can be used for irrigation.
4. Efficient fittings can be applied in guest areas reducing (tap) flow rates.
5. Ameliorate housekeeping and laundromat.
 - a. Apply ISO Type I ecolabel when using linens and other bedroom textiles to reduce weight in laundromats.
 - b. Allow for behavioral change and only collect linens and towels when guests ask for it.
 - c. Exclusively use laundry detergents with ecolabels.
6. Separation of FOG before washing kitchen units, use of a grease interceptor in the septic tank and kitchen wastewater separation from central wastewater unit enhances quality of discharges to WTPB.

Summary of Q&A Session June 22nd, 2023

After the presentation of results (Appendix A and B), AHATA members were eager to receive advice on best practices and areas of improvement and asked for a summary of results. Which led to the production of this report. Other questions are shown below, with the answer DNM provided.



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Ministerie van Transport, Integriteit,
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- 1) Would you DNM like to meet with companies that apply best practice?
 - a) In September 2021 DNM asked companies to meet to provide best practices related to the Sustainable Development Goals (SDG) which was published in the Voluntary National Report of July 2022. Companies are invited to provide their good practices in the future.
- 2) Which SDG does DNM focus on?
 - a) Planet pillar, but DNM supports some of the other SDG such as #12 Responsible consumption and production. The focus is on #6: Clean Water and Sanitation; #14: Life Below Water; #15 Life on Land, #13 Climate Action.
- 3) Does DNM know anything about maintenance of the local treatment plants?
 - a) The Government of Aruba is busy with a masterplan to install a new plant in the next 3-5 years. Especially after the Coral Reef Study 2019 [3]. DNM aims to stimulate the application of sustainable practices. E.g. one company reported that their other sewage waste was connected to the grease tank which has low capacity, and this would overflow and perhaps clog the system. We receive the data on what the WTPB is producing as treated wastewater which needs to improve.



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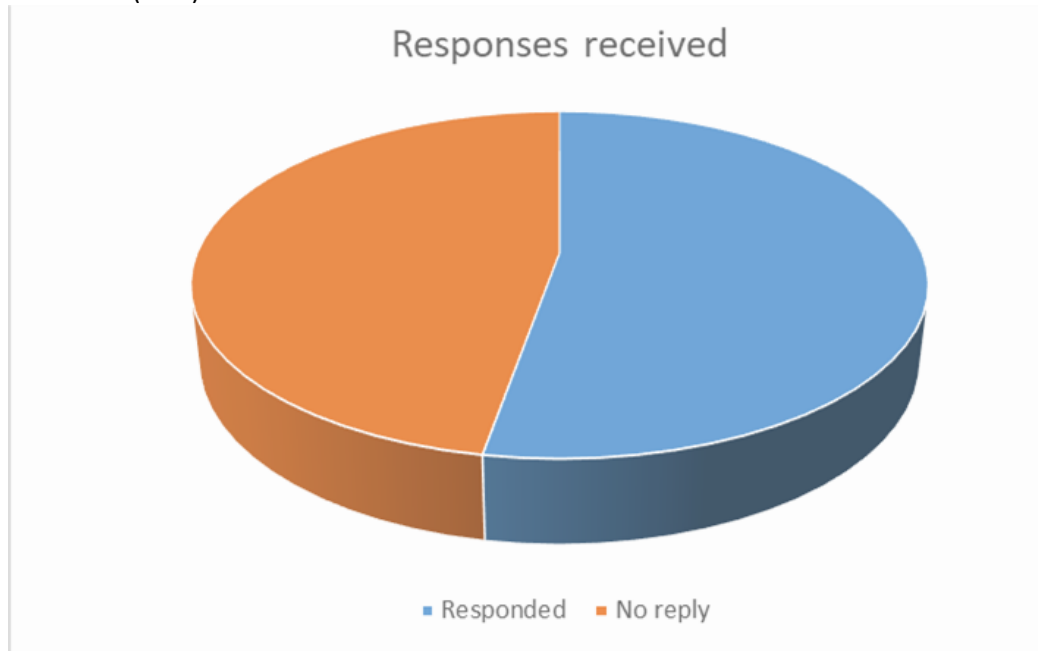
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- [1] TNO Caribbean, “TNO report Preliminary Business Case for RWZI Bubali Aeration,” 2018.
- [2] R. van Halewijn, L. W. G. Higler, and A. L. Spaans, “Ecologisch onderzoek Bubali-plas, Aruba,” 1992, [Online]. Available: http://www.dcbd.nl/sites/www.dcbd.nl/files/documents/HalewijnEtAl%281992%29_EcologischOnderzoekBubali-plasAruba.pdf
- [3] Carmabi Foundation, “Coral Reefs Study Aruba 2019,” 2020.
- [4] Dienst Openbare Werken, “Verplichting tot goed rioolgebruik/ waarschuwing en handhaving.” 2022.
- [5] CENTRAL BUREAU OF STATISTICS Aruba, “Total Water Consumption per month/sector 2021,” 2022. [Online]. Available: <https://cbs.aw/wp/index.php/2020/06/15/water-consumption-per-month-by-sector-2020/water-consumption-per-month-in-m3-by-sector-2021/>
- [6] I. A. Sadi and E. O. Adebitan, “Waste Water Recycling in the Hospitality Industry,” *Academic Journal of Interdisciplinary Studies*, Nov. 2014, doi: 10.5901/ajis.2014.v3n7p87.
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- [9] S. Estévez, G. Feijoo, and M. T. Moreira, “Environmental synergies in decentralized wastewater treatment at a hotel resort,” *J Environ Manage*, vol. 317, Sep. 2022, doi: 10.1016/j.jenvman.2022.115392.

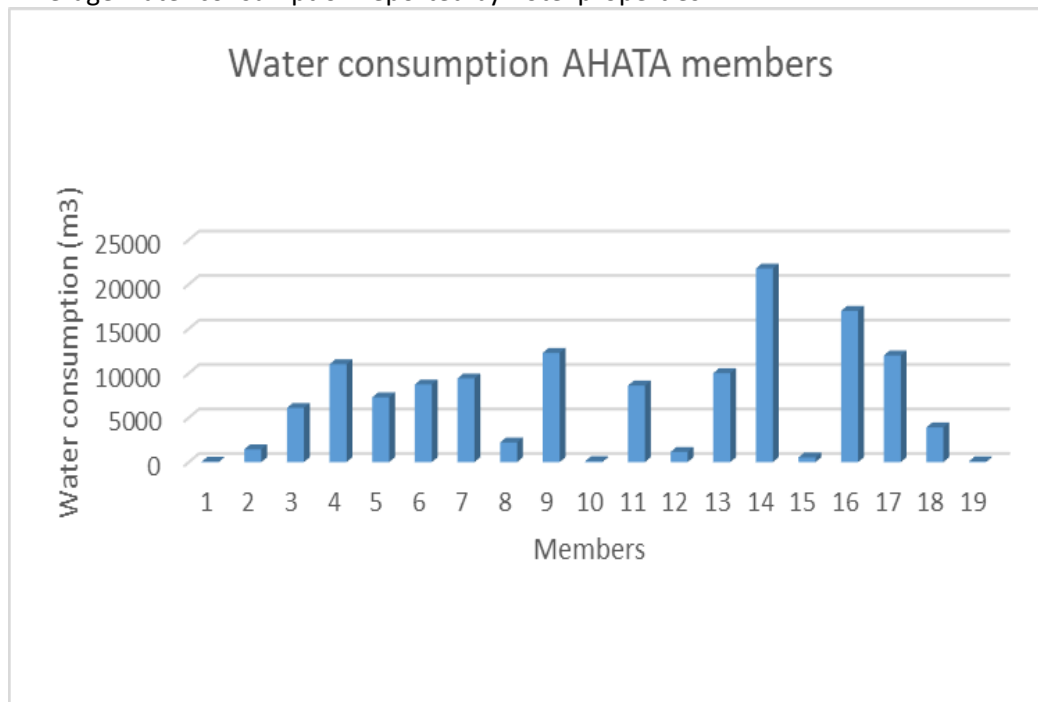


Appendix A. Graphs and charts Results AHATA Questionnaire: Produced Liquid Waste 2023

1. Number of participants that participated in the wastewater management survey 2022 was 21 out of 36 (58%)



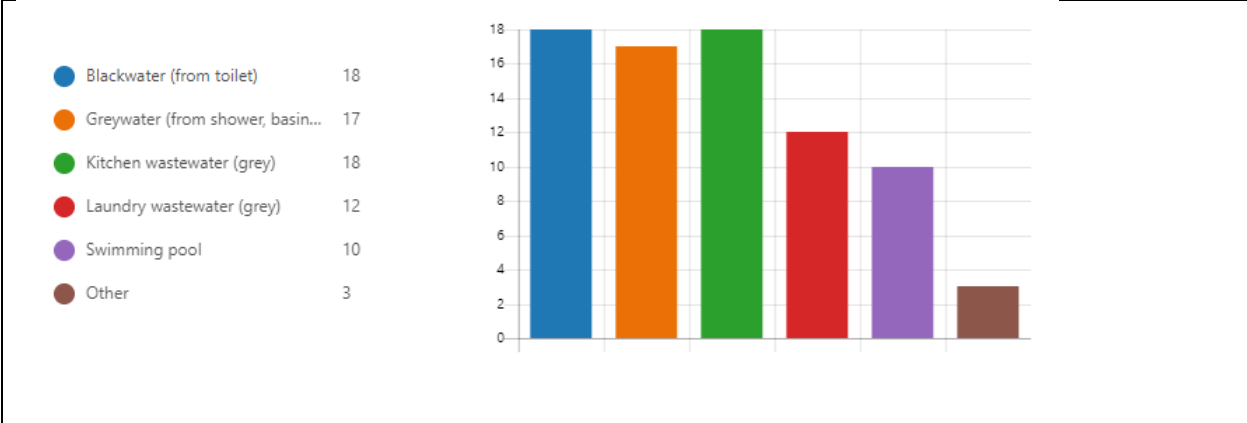
2. Average water consumption reported by hotel properties.



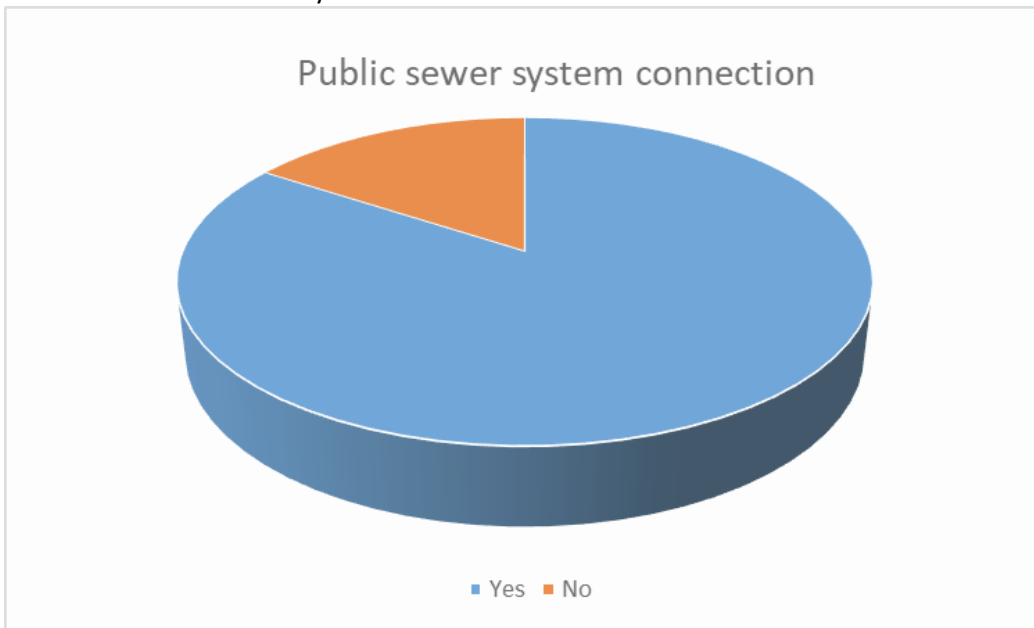
3. Types of wastewaters produced by hotel properties. "Other"- group was identified as air conditioning, cooling towers, and koi pond water.



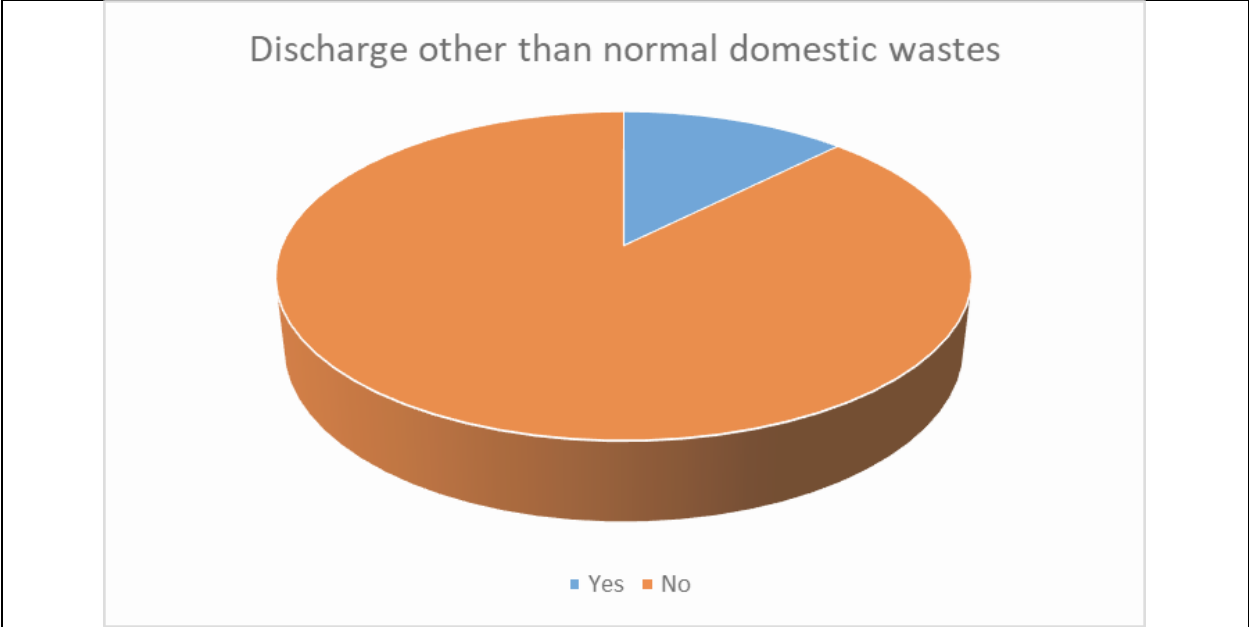
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4. Number of hotel properties connected to public sewer system. 18 out of 21 properties are connected to the sewer system.

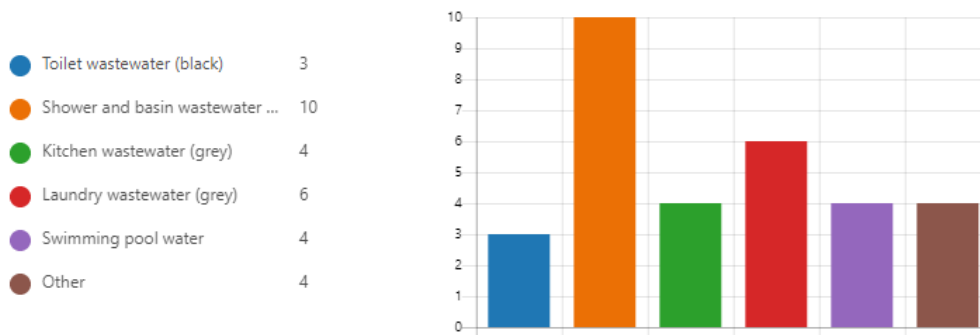


5. Wastewater discharged other than domestic wastewater such as grey water from restrooms. 16 properties reported that they do not discharge other types of water and 2 reported that they do discharge pool water and koi pond water which is picked up on a monthly/weekly basis. One company reported re-use wastewater for irrigation purposes.



6. 13 Properties connected to the sewer system also re-used wastewater on their property. 8 Properties did not re-use wastewater.

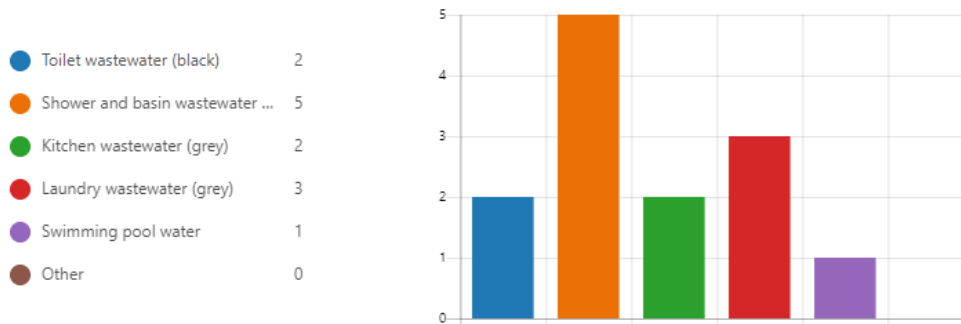
16. Which type of wastewater do you collect for reuse?



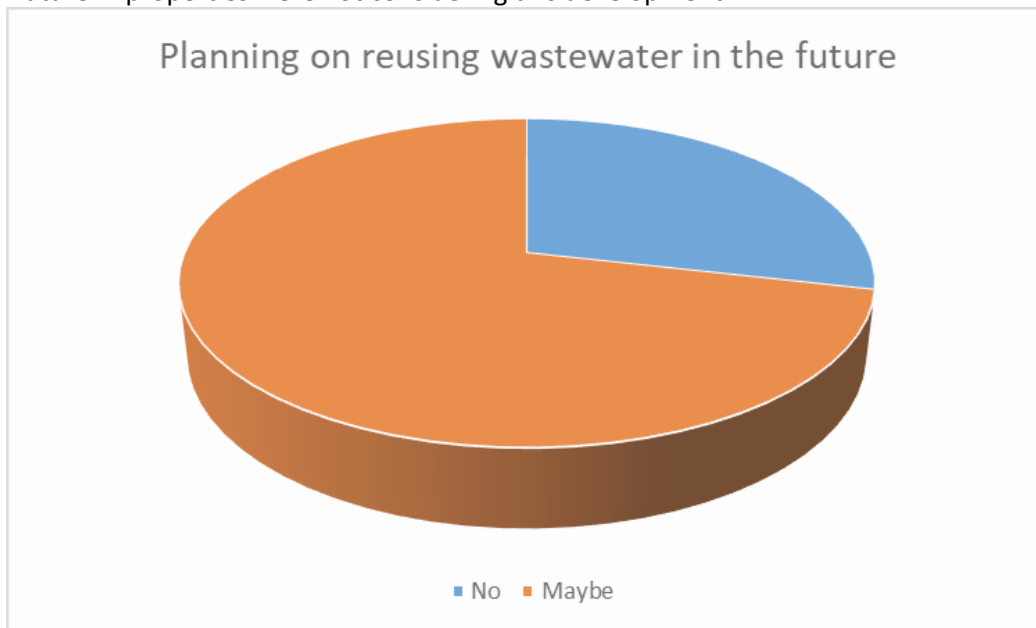
7. 6 companies reported pre-treating their wastewater before re-use. 7 companies do not pre-treat their wastewater before re-use. Types of wastewaters that are pre-treated by those companies is shown.



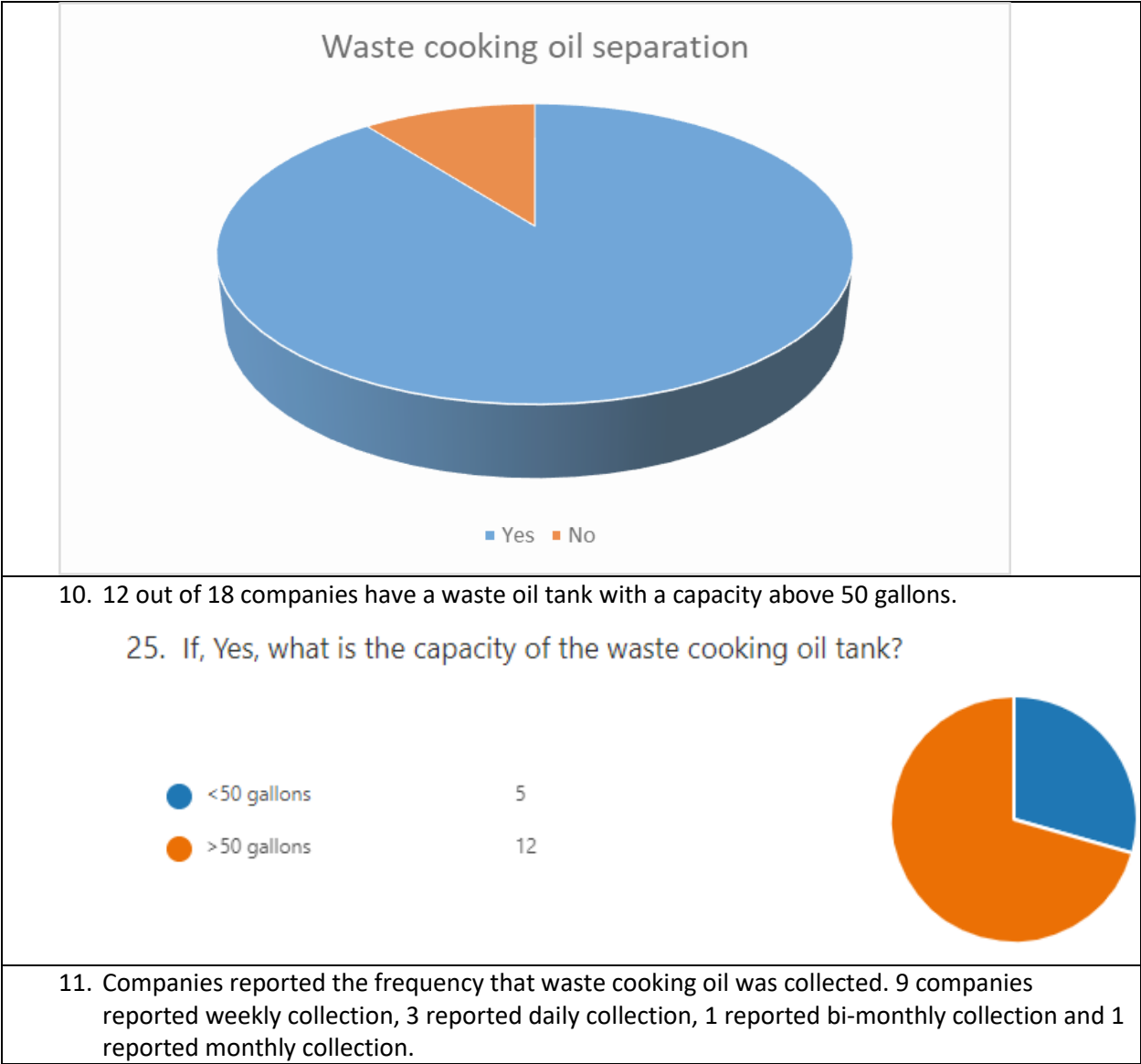
18. Which type of wastewater is pre-treat?

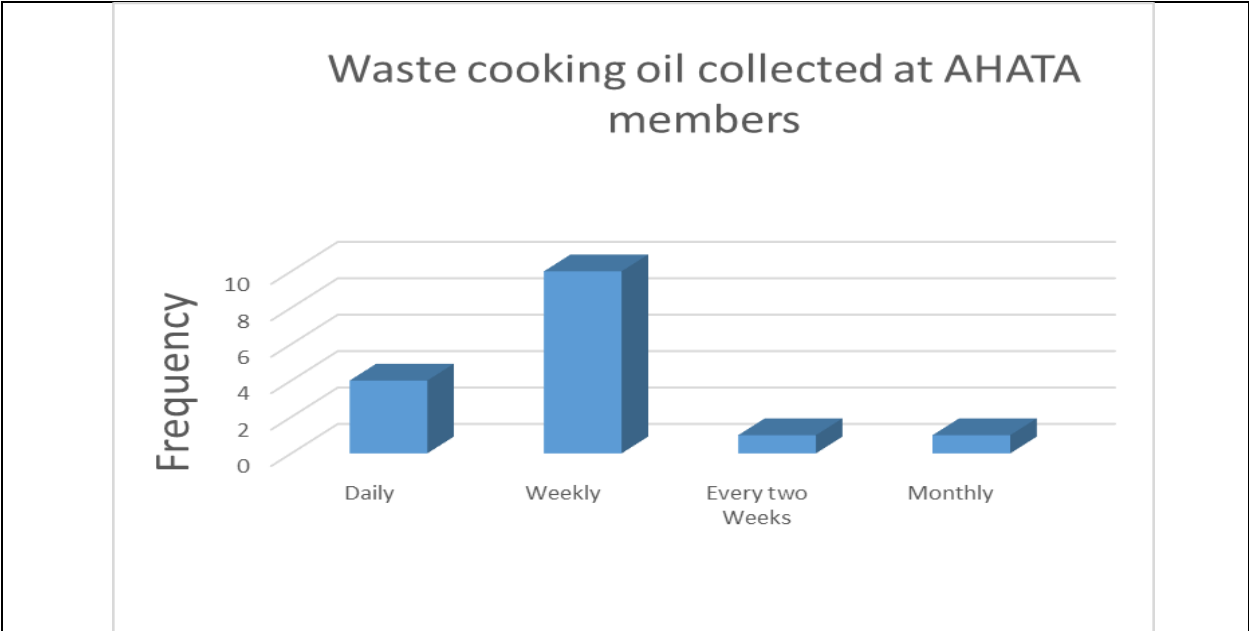


8. 6 out of 8 companies that do not re-use wastewater are planning to re-use wastewater in the future. 2 properties were not considering this development.



9. 18 out of 20 companies separate their waste cooking oil from their wastewater system.





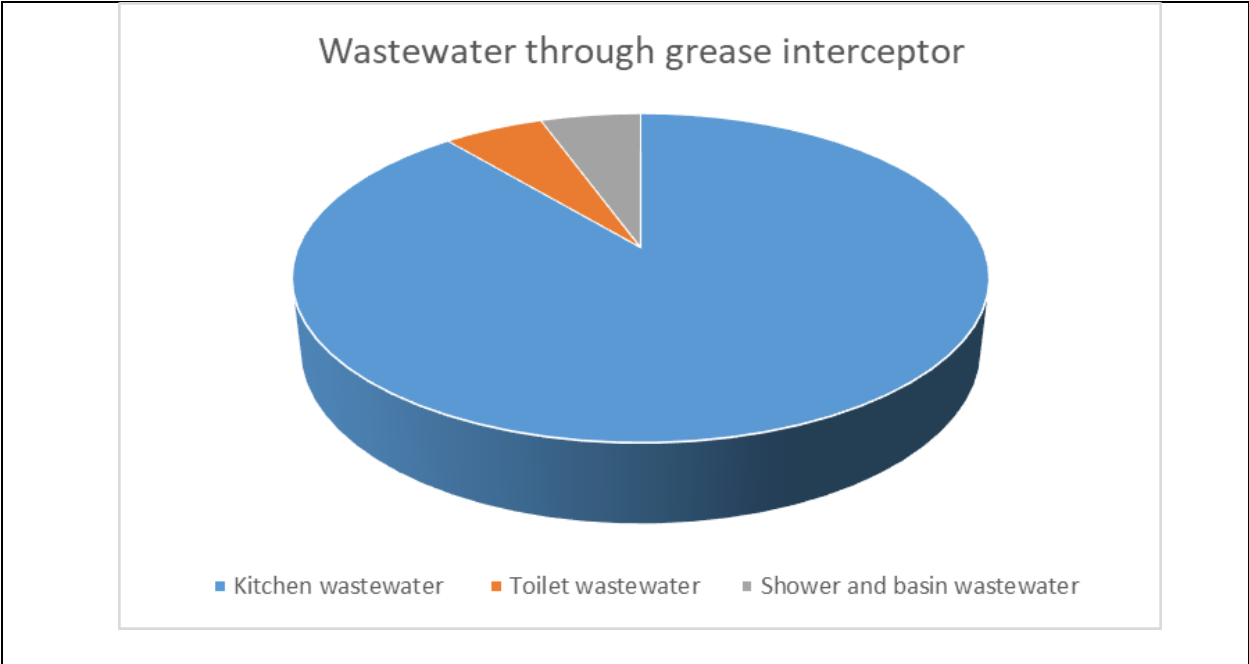
12. 17 properties reported to have a grease interceptor and 4 did not have one. The capacity of the interceptor is reported below by 14 companies.

28. What is the (combined) capacity of the grease interceptor(s) of your company?

● < 25 pounds	0
● 25 - 50 pounds	2
● 50-75 pounds	4
● > 100 pounds	8



13. Most properties containing a grease interceptor also separate kitchen wastewater from the other grey water tanks.



14. 9 properties reported that the grease interceptor was connected to the Public Sewer System, 6 properties reported connection to a septic tank and 1 reported to have no connection.

30. Is the grease interceptor(s) connected to the public sewer system or septic tank?

Connection Type	Count
Public sewer	9
Septic tank	6
None	1
Other	0

15. 7 properties reported that inspect the grease interceptor on a monthly basis, 4 reported inspections on a weekly basis, 1 reported inspection on a daily basis and 3 properties reported other scheme of inspection such as quarterly.

32. How often is the grease interceptor inspected and maintained?

Inspection Frequency	Count
Daily	1
Weekly	4
Monthly	7
Other	3



16. 6 out of twelve properties reported to have a wastewater management policy. Additionally, 6 companies reported to seldomly encounter liquid waste issues, 3 reported to never have liquid waste issues, 2 reported to often have liquid waste issues and 1 reported very often.

35. Does your company has a liquid waste management policy?

● Yes	6
● No	6



36. Does your company regularly encounter liquid waste issues?

● Very often	1
● Often	2
● Always	0
● Seldom	6
● Never	3





Appendix B. Types of pre-treatments applied by properties.

Wastewater type	Pre-treatment
Shower and basin wastewater (grey)	Enzymes and citrus
Shower and basin wastewater (grey)	Nalco chemical treatment
<ul style="list-style-type: none"> • Shower and basin wastewater (grey) • Laundry wastewater (grey) 	Ozone, filter, aerate, filter and UV
Laundry wastewater (grey)	Filtration
<ul style="list-style-type: none"> • Toilet wastewater (black) • Shower and basin wastewater (grey) • Kitchen wastewater (grey) 	There is a treatment plant
<ul style="list-style-type: none"> • Toilet wastewater (black) • Shower and basin wastewater (grey) • Kitchen wastewater (grey) • Laundry wastewater (grey) • Swimming pool water; 	Sand/ gravel filtration