

Tackling Food Waste in Catered Accommodation at the University of Exeter

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GREEN CONSULTANTS – Project A

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Completed on behalf of Joel Smith.



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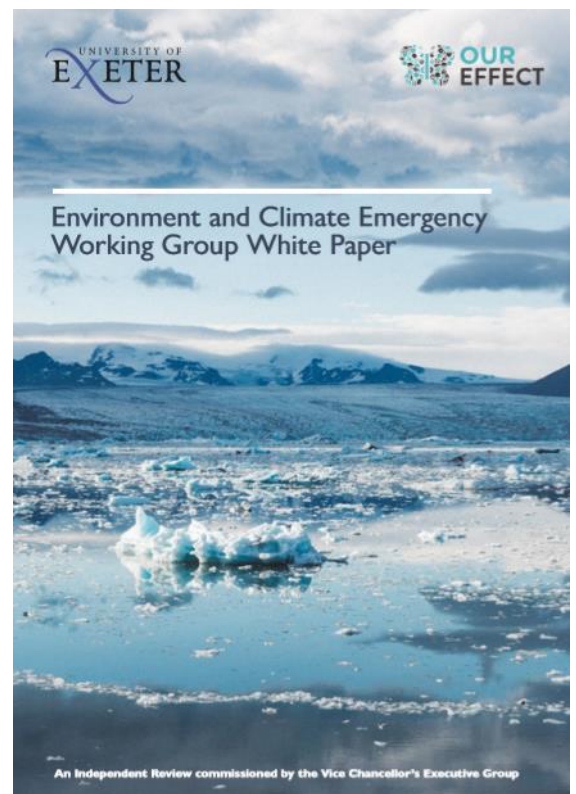
1. Executive Summary

Embedding sustainable discourses and practices within an institution requires both a holistic view of the current large-scale challenges and potential solutions, as well as bottom-up strategies to target individual behaviours and social regimes. The University of Exeter is beginning to explore such techniques, as highlighted in its 2019 Climate and Emergency Working Group White Paper (CEWP). This report reviews the progress of a current on-campus project, namely a plate waste weighing scheme, implemented to target food waste in both Lopes and Holland Hall's catering facilities in recognition of Recommendation 17 in the CEWP. To do this, a quantitative analysis of the plate waste data was undertaken, and subsequent comparisons were made against historic food waste data. Our results suggest that there has been no significant change in food waste since the scheme began. Structured interviews with students and staff revealed several possible reasons for this, including serving methods, individual behaviours, and environmental values. The limitations of this project, such as a lack of comparative control group data, have been latterly discussed. To conclude, a set of recommendations have been produced to be followed by the university to 1) improve the scheme, and 2) address barriers to change.

2. Introduction: Food Waste

Food production and consumption are considered key climate mitigation issues resulting from their intensive use of land and water resources⁽¹⁾. A report on the value of water determined that wasting 1kg of beef is equivalent to wasting 15415L of water, a number ~100x greater than the average volume of water used per person per day in the UK⁽²⁾. Reducing food waste is critical to ensure that environmentally taxing activities are not occurring in vain. Moreover, 1 in 9 people globally do not have sufficient access to food, yet 33-50% of all food produced is wasted, proving greatly unjust⁽³⁾. This percentage of food waste comes from ~ $\frac{1}{3}$ of agricultural land; land resources that could be used for more environmentally and economically profitable activities. Tackling food waste is a defined target within the United Nations Sustainable Development Goals, Target 12: Responsible consumption and production patterns, and 2: Zero Hunger⁽⁴⁾, and therefore is imperative to respond to at the University of Exeter (UoExeter) .

On the 20th May 2019, the UoExeter reacted to the growing consensus towards the need for sustainable transitions to mitigate climate impacts by declaring an Environment and Climate Emergency. Resultantly, the Environment and Climate Emergency Working Group White Paper (CEWP) was published on 11th November 2019, outlining the universities current practices and providing recommendations to improve its environmental status⁽⁵⁾. As aforementioned, food waste is a pressing climate issue, and in congruence, the CEWP highlighted its need for reduction in Recommendation 17: Hospitality, Catering and Retail, and further in R17, acknowledging food waste in on-campus catered accommodation. Academia highlights how tackling food waste from the bottom-up can be effective, as it largely stems from changes in consumer behaviour, attitudes, and beliefs, and thus tackling food waste on a smaller scale such as within these halls prove to be of significant value⁽⁶⁾.



From this consolidation of information, we created a relevant and evolutionary project designed and altered in line with the UoExeter's current requirements and food waste strategies. Our project, as commissioned by our client Joel Smith (Sustainability Officer at the UoExeter), has been reported from here on.

3. Project Overview

3.1. Scope

Upon determining the project's scope - addressing R17: food waste in catered halls - our initial idea was to undertake a food waste audit. This would have entailed assigning food waste bins to catered canteens and subsequently weighing these bins 3-5 times a week post dinnertime (the risk assessment for this is presented in Appendix 8.2). However, our client mentioned that a plate waste weighing scheme (PWWS) had been recently implemented in both Lopes and Holland Hall. This scheme involves students scraping their food waste into allocated bins, which are weighed and recorded after every meal. Resultantly, the project's scope was modified to rather review the success of this scheme. To do this, we were granted access to the weight datasheet by Simon Law (Director of Catering and Retail Services), Duncan Tarrel (Tradings Operations Manager), and Rob Doige (Head Chef). In line with our client's needs, we determined that our role was to quantitatively analyse this data to determine any trends in food waste. However, we also wanted to provide an insight into why these food waste trends may or may not be occurring. Resultantly, we determined the value of simultaneously acquiring qualitative data via surveys and interviews to better understand student and staff attitudes to the scheme. The following sections of this report highlight the main findings of this project and provides recommendations to the UoExeter on how best to proceed with the PWWS, and how to address the barriers to attitude change.

3.2. Aims

1. To determine food waste trends over time in Lopes and Holland Halls,
2. To understand whether the PWWS has reduced the quantity of food waste in both catered halls,
3. To understand if the PWWS has altered the students attitudes towards food waste,
4. To use the results of the data analysis and focus groups to create recommendations to the UoExeter regarding tackling food waste in catered accommodation.

3.3. Objectives

1. Analyse historic food waste data to determine trends over time,
2. Analyse the PWWS data to determine any differences or similarities with the historical data,
3. Interview students and staff at Lopes and Holland Hall to understand their opinions of the PWWS and how they perceive food waste,
4. Survey students and analyse their responses to quantitatively and qualitatively assess their attitudes towards food waste.
 - We could not meet this objective due to restraints posed by current circumstances, however, the survey has been included in the appendix of this report, and we suggest that it be used to gather information in the future.

4. Methodology and Results

4.1. Qualitative Data

Prior to the analysis of the PWWs data, ourselves and our client deemed it important to have a basic understanding of the normal quantities and variations of food waste within both halls for comparative purposes. Resultantly, we were granted access to a wastage dataset with quantities of general, cardboard, glass, cans, plastics, and food waste between September 2014 and September 2019. We used this data to produce two line graphs demonstrating the temporal trends in food waste as a percent of total waste (Fig.1a/1b), and monthly line graphs depicting when highs or lows in waste occurred through the academic year (Fig.2a/2b).

4.1.1. Historic Data: Food Waste as a Percentage of Total Waste

Food waste as a percentage of total waste was calculated by adding all of the aforementioned waste streams together, and then determining what quantity of this value food waste accounted for. Averages across the five-year data period determine that both Lopes and Holland Hall's food waste account for $\sim\frac{1}{3}$ of total waste per month, or more precisely 32.6% and 33.8%, respectively. However, the range of values in both Lopes (11.77-48.45%, Fig.1a), and Holland Hall (6.39-54.45%, Fig.1b) prove substantial, as do fluctuations over time. We determine that these results reflect changes in waste patterns, for example, where the percentage of food waste looks to have declined in both halls in August/September 2017, the percentage of other waste may have been higher. Consequentially, food waste appears lower irrespective of the fact that the raw value (tonnes) may be within the normal range of data. Linear regressions show that although food waste seems to have slightly increased over time, it has not significantly done so (Lopes $R=0.23$, $p>0.1$; Holland $R=0.11$, $p>0.1$).

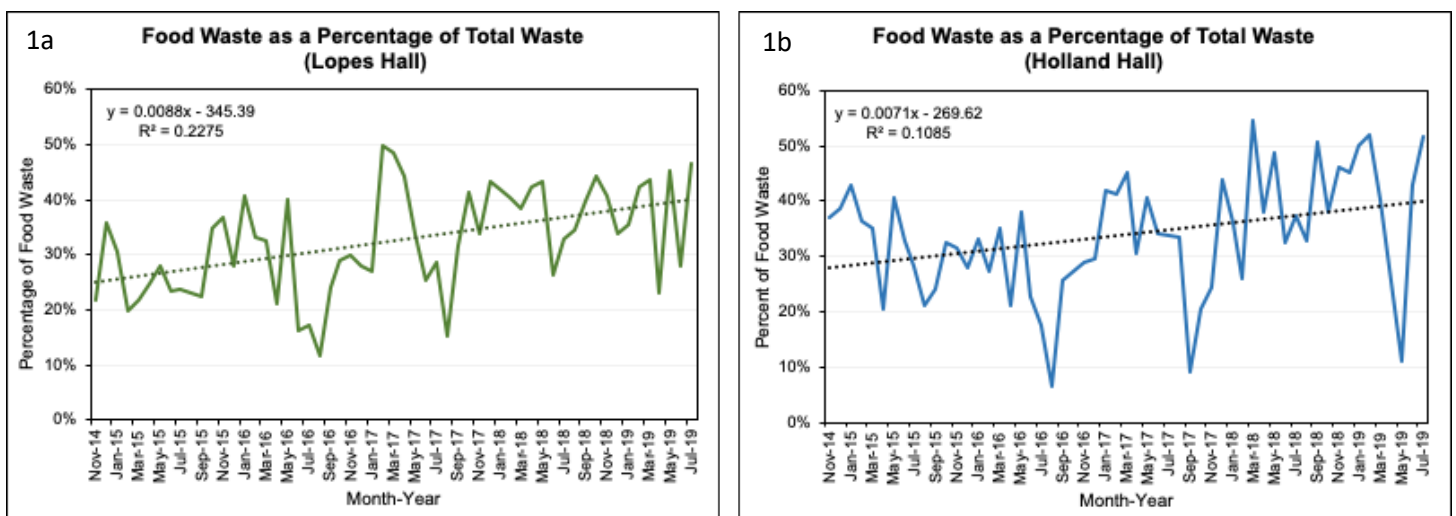


Figure 1: a) A line graph to show food waste as a percentage of total waste in Lopes from 2014-2019, and b) a line graph to show food waste as a percentage of total waste in Holland Hall over the same time period. Both figures have a trendline plot, with the statistical significance of this line presented in the top left corner of each figure.

4.1.2. Historic Data: Yearly Food Waste

When raw data is plotted on a year-to-year basis, the last academic year (September 2018 to August 2019) presents the highest average food waste in both halls (Fig.2a/2b). During this period, Lopes accounted for 22.2t food waste, with an average of 1.85t/month, and Holland Hall similarly produced 20.5t in total, averaging 1.86t/month. Similar trends are depicted in both accommodations, with peaks in food waste occurring in October/November, February/March, and May. The maximum amount of food waste observed at Lopes occurred in March 2019, equating to 2.8t, and Holland Hall exceeded this value producing 3.3t during the previous month. We hypothesise that these observable peaks are a result of term times as similarly suggested by lows in both December and April which coincide with public holidays.

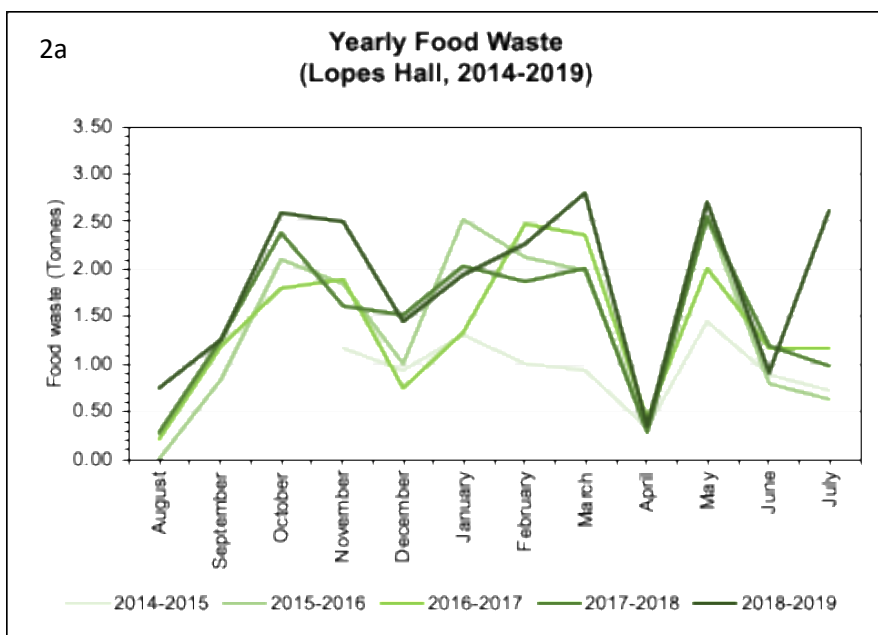
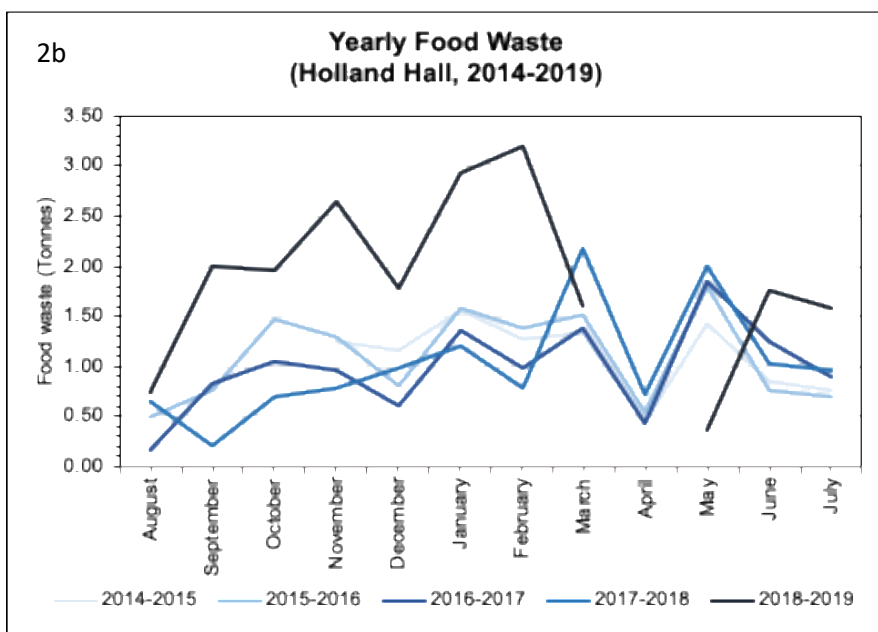


Figure 2: a) yearly food waste data plotted for each academic year since 2014 in Lopes Hall, and b) yearly food waste data plotted for each academic year since 2014 in Holland Hall. In both figures, gradients from light to dark represent years from furthest in the past to closest to the present. Raw food waste data is plot here as opposed to percentage of food waste in figures 1a/1b, and therefore is presented in tonnes.



4.1.3. Current Data: PWWS

Since the PWWS began, there has been no significant change in the quantity of food wasted over time in both Lopes (Fig.3a: $R=0.044$, $p>0.1$), and Holland (Fig.3b: $R=0.0046$, $p>0.1$) Halls. Lopes' waste data fluctuates between 0.032-0.069t/day, whereas Holland halls data is more variable at 0.02-0.096t/day.

Within the one month period since plate weighing began (10th February-10th March), Lopes' food waste totalled 1.23t, and Holland's food waste equated to 1.59t. Although direct comparisons could not be made to the prior months before the scheme as data was not recorded, we referenced these figures against the historical data analysed previously (Fig.4). Plate waste monthly totals are within the normal range of historic data, however, plate waste data exceeds the mean monthly values of the past 5 years in both halls. This would suggest that plate weighing so far has been ineffective, however, several uncertainties mean we cannot draw upon any significant conclusions. Firstly, our months PWWS data aligns with the observation that February/March totals are generally higher than other months (Fig.2a/2b), and thus could be why it exceeds the mean monthly value. And secondly, the student body varies from year-to-year, which may bear influence on the data.

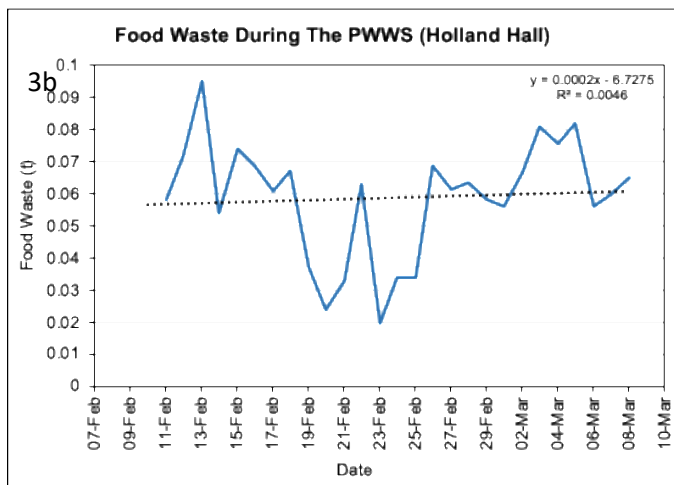
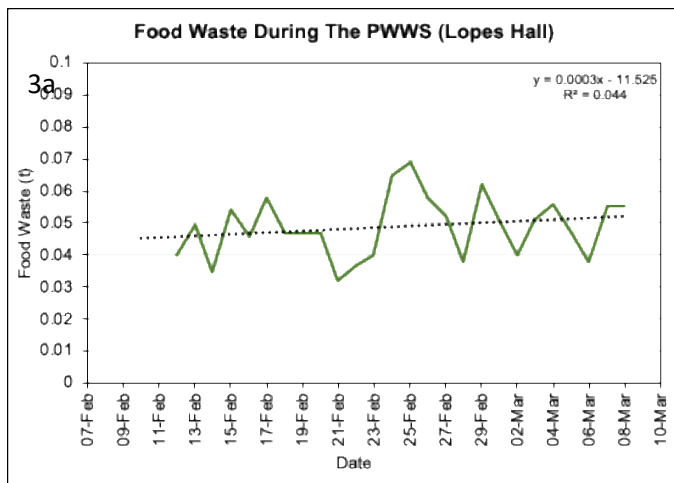
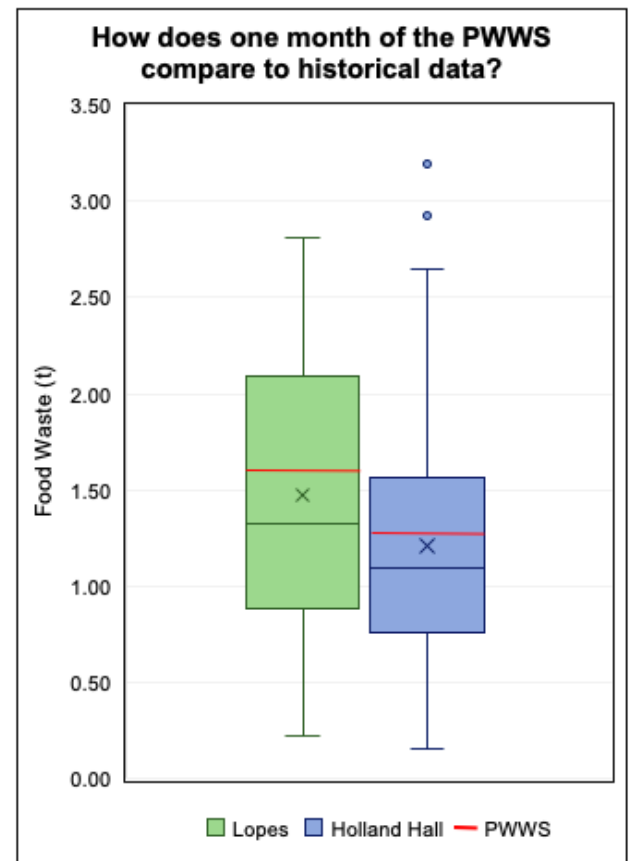


Figure 3 (Above): a) a line graph showing PWWS data since the scheme began for Lopes Hall, and b) a line graph showing PWWS data since the scheme began for Holland Hall. Linear regressions have been presented in the top right hand corner of both figures. Food waste is presented in tonnes.

Figure 4 (Below): Two box plots showing how the PWWS (red) aligns with historic data for both Lopes (green) and Holland (blue) halls. The boxplots show outliers (dots), the maximum and minimum food waste quantities recorded, the interquartile ranges (at 25%), the median (line within box), and the mean (x) for both halls.



4.2. Quantitative Data

To obtain qualitative data regarding personal attitudes towards food waste and the PWWS, we interviewed ~30 students in 6 focus groups, and 4 staff members, in both halls. Four key questions were devised and asked to each group, as displayed below.

Student interview questions

1. Do you think food waste is a problem in your catered halls?
2. Do you think weighing plate waste is a good idea?
3. Has it made you change your habits or be more conscious about your behaviour?
4. Do you have any ideas on how best to reduce food waste?

Staff interview questions

1. Have you seen a reduction in the amount of food students serve themselves?
2. Have you had any feedback regarding the plate weighing scheme?
3. How does the kitchen manage food waste?
4. Do you have any recommendations on how to reduce food waste in catered halls or make the new scheme more effective?

4.2.1. Student Responses

Student responses were expectedly varied; this was clearly evident between genders. Some students resonated strongly with the idea of making conscious pro-environmental choices regarding their own food waste, whereas others did not care enough to change their behaviour. The key observations of these interviews are presented in Table 1 below.

Table 1: Observations from student focus groups*

1. Some students made conscious efforts to take only the food that they could eat in order to reduce their food waste.
2. Some students felt that the scheme was encouraging them to try harder to finish all of their food.
3. Some students said that their habits had not been altered by the scheme.
4. A couple of students mentioned that they “could not be bothered” to scrape their plate waste and so ate all of the food they were plated.
5. There were vastly mixed opinions on whether food waste had been reduced since the scheme began.
6. Some students did not realise that there was a sign highlighting how much food waste is produced each day.
7. Most students felt that a large proportion of their food waste resulted from the food served by catering staff (carbohydrate dense main meals such as pasta, rice, potatoes).

*We did not quantify student responses to these interviews as the survey (as mentioned in objective 4) was produced to do this, however, it could not be undertaken.

4.2.2. Staff Responses

Staff responses were less varied than the students, likely resulting from the smaller focus group. The key observations from the staff interviews are similarly highlighted in table 2.

Table 2: Observations from staff interviews

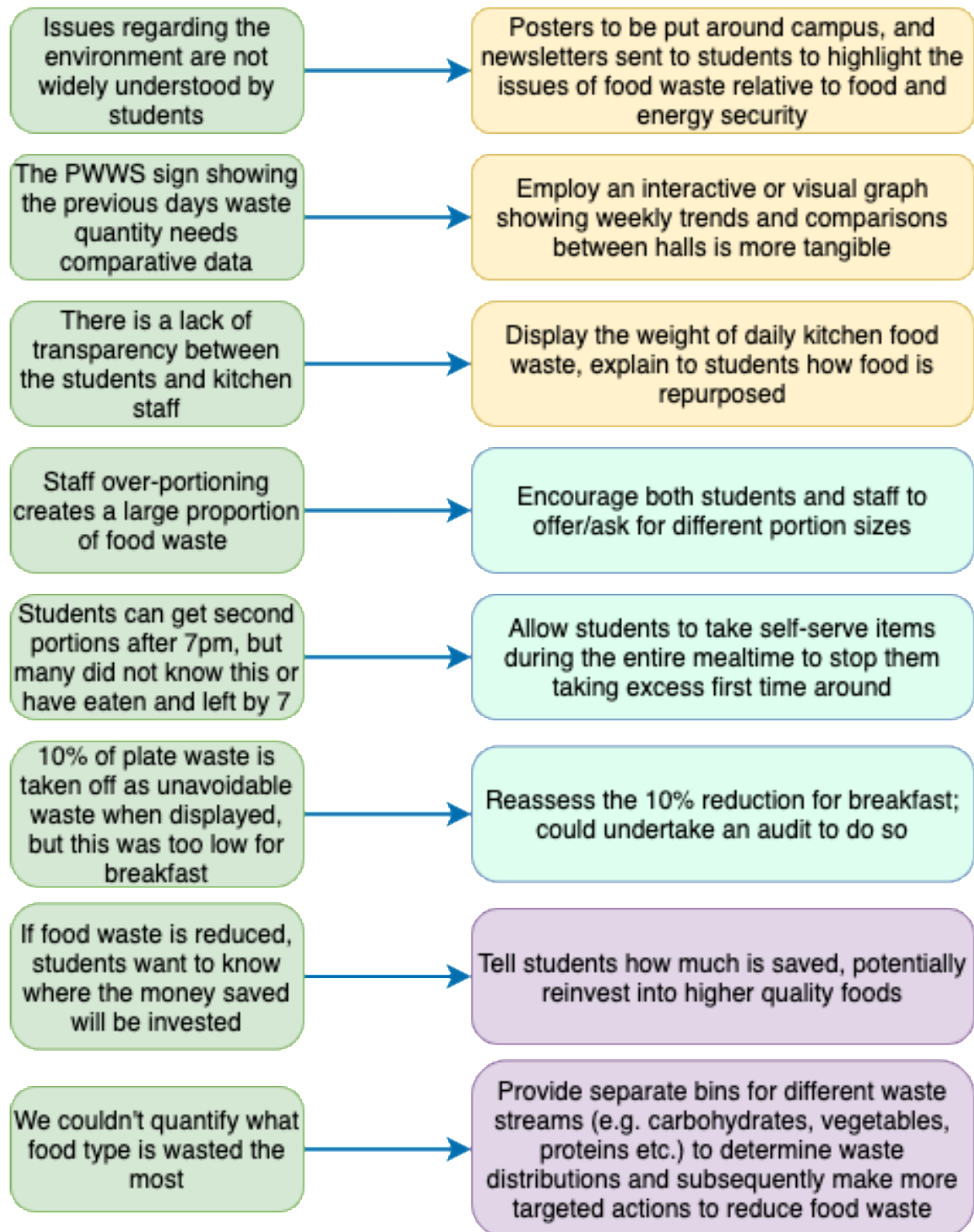
1. Staff reported that they had received mixed feedback from students concerning the plate waste weighing scheme: some students praised the proactiveness of the University whilst others were displeased at having to scrape their plates or did not understand the benefit.
2. Staff noticed some students still piling their plates fairly high rather than taking smaller amounts and going up again if they needed to.
3. Staff explained how food was produced via batch cooking depending on how many students they expect based on that day's student count 1 week and 1 year prior.
4. Staff explained how the majority of kitchen waste is unavoidable as they repurpose as much food as possible. Any food that is thrown away largely consists of peels, scraps or high-risk foods such as rice and chicken.
5. Staff were met with resistance when plastic plates and utensils were used in replace of crockery as the dishwasher was being repaired, yet few students raised concerns over food waste. This highlights the large focus certain environmental actions have been given e.g. plastics, and the lack of attention other areas have received e.g. food waste.

5. Key Findings and Recommendations


We have presented the following recommendations based on the key findings from our quantitative data analysis and qualitative interview responses. These recommendations highlight and address the success of the PWWS, how the issue of food waste is perceived, why certain behaviours are carried out, and any further suggestions to reduce food waste in catered accommodation at the UoExeter. The timeframes in which we suggest these recommendations are implemented by are colour coded.


Finding

Recommendation



 = Short Term

 = Mid Term

 = Long Term

6. Conclusions

There is plentiful scope for reducing food waste within catered accommodation at the UoExeter, as explored in this report. We have determined this through the analysis of historical and PWWS data, which has highlighted the temporality and variability of food waste in catered halls. Although statistically there has been no significant change in plate food waste at both Lopes and Holland Halls since the PWWS began, the conducted interviews highlight the positive impact that the scheme has had on several students regarding their behaviour and attitudes towards food waste. We have recognised that unwillingness to change attitudes or behaviours e.g. continuing in a business-as-usual way, inadequate knowledge of the issues of food waste, and initial over-portioning, may be the greatest barrier to the scheme's success. Recommendations have been formulated to address these barriers, and if they're successfully implemented at the UoExeter we expect that the PWWS will begin to produce statistically significant results showing a decrease in food waste in catered accommodation in the future.



7. References

- 1 - Juvan, E., Grün, B. and Dolnicar, S. (2018). Biting off more than they can chew: food waste at hotel breakfast buffets. *Journal of Travel Research*, 57(2), pp.232-242.
- 2 - Mekonnen, M.M. and Hoekstra, A.Y. (2010). *The green, blue and grey water footprint of farm animals and animal products (Vol. 1)*. Delft: UNESCO-IHE Institute for water Education.
- 3 - OLIO. (2019). *A chronic market failure*. [Online] Available at: <<https://olioex.com/food-waste/the-problem-of-food-waste/>> [Accessed: 6th March 2020]
- 4 - United Nations. (2015). *Transforming our World: The 2030 Agenda for Sustainable Development*. [Online] Available at: <<https://sustainabledevelopment.un.org/post2015/transformingourworld/publication/>> [Accessed: 24th March 2020].
- 5 - University of Exeter. (2019). *Environment and Climate Emergency Working Group White Paper*, Exeter, Vice Chancellor's Executive Group
- 6 - Hebrok, M. and Boks, C. (2017). Household food waste: Drivers and potential intervention points for design—An extensive review. *Journal of Cleaner Production*, 151, pp.380-392.

8. Appendix

8.1. Student survey

Online link:

<https://docs.google.com/forms/d/e/1FAIpQLSeo55JnQAc7pXKHvcyvbd9Q5MhbVSHyMoVNZCKI6GL4LIZRMg/viewform>

Q1. What gender do you identify as? *

- Female
- Male
- Non-binary
- Other
- Prefer not to say

Q2. Where do you eat? *

- Holland Hall
- Lopes Halls

Q3. Do you think food waste is an issue in your halls? *

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

Q4. Are you concerned about food waste in your halls? *

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

If you selected agree, what concerns you the most?

Your answer

Q5. How do you feel about the new food waste weighing system in your halls of residence? (Please tick all that apply). *

- It is a good idea
- It is a bad idea
- I have no overriding opinion
- It has made a difference to how much food I waste
- It has not made a difference to how much food I waste
- It is inconvenient
- I am more conscious about how much food I initially plate myself
- Other (please write in the box below)

Q6. How much food do you think that you scrape off of your plate at the end of the meal (not including unavoidable food waste such as chicken bones, banana peel etc.)? *

- I do not waste any food
- Below 1/4 of your plate
- Between 1/4 and 1/2 of your plate
- Between 1/2 and 3/4 of your plate
- Above 3/4 of your plate

Q7. What type of food do you most often scrape off of your plate? (Please tick all that apply). *

- Fruit
- Vegetables
- Salad Bar Items
- Meat and/or Fish
- Other Proteins (Lentils, beans, nuts etc.)
- Carbohydrates (Bread, pasta, potatoes, rice etc.)
- Desserts
- Other (e.g. condiments)
- I do not waste any food
- I do not know

Q8. Have you read the University of Exeter's Environment and Climate Emergency Working Group White Paper? *

- Yes
- No
- I don't know what that is

Q9. Optional question: Do you think food waste is a necessary issue to address, and if so, how else could the problem be tackled in catered halls at the university?

Your answer:

8.2. Food Waste Weighing Risk Assessment (Prior to change of project).

Hazard	Risk Level (1-5)	Control Measures
Manual Handling – moving bin bags, lifting heavy objects, reaching, bending, twisting	3	<ul style="list-style-type: none"> - Lift and move bags in pairs - Take regular breaks to prevent fatigue - Wear appropriate footwear for heavy lifting - Avoid unnecessary lifting where possible
Contaminated food waste – if people have poured liquids into the bins	2	<ul style="list-style-type: none"> - Wear gloves at all times - If any spillages occur, ensure they are dealt with instantly to prevent slips and falls
Sharp Objects – if accidentally placed non-food waste in the bin e.g. glass, cans, cutlery, cartons, or unavoidable food waste such as bones	2	<ul style="list-style-type: none"> - Wear gloves at all times - Handle bags carefully - If you notice a sharp object protruding through the bag, make others aware
Slips and Falls	3	<ul style="list-style-type: none"> - Wear suitable footwear - Ensure the setting is clean before undertaking the audit - Ensure a first aider is on call
Falls of objects or materials – if bags break	3	<ul style="list-style-type: none"> - Do not overfill bags - Ensure that a floor cover is down to prevent mess - Two people to one bag
Storage – of bins post audit	1	<ul style="list-style-type: none"> - Ensure that bin bags are directly put into the correct waste bins outside
Operating electrical equipment	3	<ul style="list-style-type: none"> - Ensure weighing scales have been electronically approved - Avoid spillages onto electrical items - Area must be kept tidy such as cables being secured

8.3. Raw PWWS Data

Lopes Halls: Plate Waste Weighing Scheme Raw Data 10th Feb 2020 - 08 March 2020.									
Testing Week	Day	Date	Breakfast (kg)	Dinner (kg)	Brunch (kg)	Day Total (kg)	Day Total (tonnes)	Week Total (tonnes)	Month Total (tonnes)
1	Monday	10-Feb							
	Tuesday	11-Feb							
	Wednesday	12-Feb		40		40	0.04		
	Thursday	13-Feb	11.2	38		49.2	0.0492		
	Friday	14-Feb	8.4	26		34.4	0.0344		
	Saturday	15-Feb		34	20.4	54.4	0.0544		
	Sunday	16-Feb		30	16	46	0.046	0.224	
2	Monday	17-Feb	8	50		58	0.058		
	Tuesday	18-Feb	9	38		47	0.047		
	Wednesday	19-Feb	11	36		47	0.047		
	Thursday	20-Feb	9	38		47	0.047		
	Friday	21-Feb	11	21		32	0.032		
	Saturday	22-Feb	2	19	16	37	0.037		
	Sunday	23-Feb	2	21	17	40	0.04	0.308	
3	Monday	24-Feb	11	54		65	0.065		
	Tuesday	25-Feb	17	52		69	0.069		
	Wednesday	26-Feb	11	47		58	0.058		
	Thursday	27-Feb	9	43		52	0.052		
	Friday	28-Feb	8	30		38	0.038		
	Saturday	29-Feb	3	31	28	62	0.062		
	Sunday	01-Mar	4	29	18	51	0.051	0.395	
4	Monday	02-Mar	6	34		40	0.04		
	Tuesday	03-Mar	7	44		51	0.051		
	Wednesday	04-Mar	14	42		56	0.056		
	Thursday	05-Mar	9	38		47	0.047		
	Friday	06-Mar	8	30		38	0.038		
	Saturday	07-Mar	3	26	26	55	0.055		
	Sunday	08-Mar	3	32	20	55	0.055	0.342	1.269

Holland Halls: Plate Waste Weighing Scheme Raw Data 10th Feb 2020 - 08 March 2020.									
Testing Week	Day	Date	Breakfast (kg)	Dinner (kg)	Brunch (kg)	Day Total (kg)	Day Total (tonnes)	Week Total (tonnes)	Month Total (tonnes)
1	Monday	10-Feb							
	Tuesday	11-Feb	18	40		58	0.058		
	Wednesday	12-Feb	19	53		72	0.072		
	Thursday	13-Feb	19	76		95	0.095		
	Friday	14-Feb	11	43		54	0.054		
	Saturday	15-Feb	2	41	31	74	0.074		
	Sunday	16-Feb	1	39	29	69	0.069	0.422	
2	Monday	17-Feb	4	57		61	0.061		
	Tuesday	18-Feb	12	55		67	0.067		
	Wednesday	19-Feb	0	37		37	0.037		
	Thursday	20-Feb	10	14		24	0.024		
	Friday	21-Feb	17	16		33	0.033		
	Saturday	22-Feb	1	49	13	63	0.063		
	Sunday	23-Feb	2	12	6	20	0.02	0.305	
3	Monday	24-Feb	6.41	27.84		34.25	0.03425		
	Tuesday	25-Feb	14.22	19.8		34.02	0.03402		
	Wednesday	26-Feb	14.76	54		68.76	0.06876		
	Thursday	27-Feb	6.65	54.9		61.55	0.06155		
	Friday	28-Feb	19.08	44.64		63.72	0.06372		
	Saturday	29-Feb	2	44	12	58	0.058		
	Sunday	01-Mar	3	39	14	56	0.056	0.3763	
4	Monday	02-Mar	15.8	50.75		66.55	0.06655		
	Tuesday	03-Mar	14.04	66.96		81	0.081		
	Wednesday	04-Mar	16.74	58.86		75.6	0.0756		
	Thursday	05-Mar	20.88	60.84		81.72	0.08172		
	Friday	06-Mar	16.2	39.78		55.98	0.05598		
	Saturday	07-Mar	3	43	14	60	0.06		
	Sunday	08-Mar	4	48	13	65	0.065	0.48585	1.58915

