EVALUATION: NOVEMBER 2018 PUBLICATION: FEBRUARY 2021

SUSTAINABLE WATER AND SANITATION IN ZAMBIA

Impact evaluation of the 'Urban WASH' project

Effectiveness Review Series 2018/19

The Chawama Environmental Health and Sanitation Committee works as a door-to-door health promotion team. Credit: Bekki Frost/Oxfam.

JAYNIE VONK

Data gathering led by CSK Consortium

OXFAM GB

www.oxfam.org.uk/effectiveness

OXFAM

ACKNOWLEDGEMENTS

The author would like to recognize and thank everyone who participated in and contributed to this Effectiveness Review. Thank you to those at Oxfam in Zambia, especially Dailes Judge, Takaindisa Sanangurai, Teddy Kabunda and Chantry Mweemba, for their engagement in the evaluation process, as well as Joseph Yondela, Yvonne Chibiya and others for their support. Also, thank you to Village Water Zambia, particularly Happy Nyasulu and Mampi Silumesii, for participating in the evaluation design workshop and supporting data gathering as needed.

All data gathering was done by CSK Consortium, including Kelvin Luputa, Chris Shanda and Kenneth Chola, and a team of 14 interviewers – thank you, together you were a great team to work with on this evaluation. Appreciation is also due to all the interviewees, representing institutions and households, who took time out of their days to share their knowledge and experiences as part of this evaluation.

Thanks also to Simone Lombardini and Alexia Pretari for their support throughout the evaluation, to the Oxfam GB sustainable water team – Joanna Trevor, Jola Miziniak, Louise Medland and Tom Wildman – for input and feedback on the Sustainable Water and Sanitation Index, and to the HWISE network, especially Sera Young, Josh Miller and Chad Staddon, for support during this initial collaboration using the HWISE scale.

Finally, thanks to Sarah Davies and Oxfam GB's publishing team for its publication.

MANAGEMENT RESPONSE

Oxfam in Zambia supports the findings and learnings that have emerged from this evaluation. As part of the process, key findings have been discussed together among Oxfam and Village Water Zambia staff who were involved in project implementation as well as the evaluation. Due to a change in strategic direction, WASH is no longer currently part of Oxfam in Zambia's portfolio, however we expect the Programme Learning Considerations that were co-developed will be useful for Village Water Zambia and other organisations that will continue to implement urban WASH projects now and in the future.

The learning with a broader scope, that goes beyond WASH interventions, is around ongoing power analysis. This learning has been reflected on by the Oxfam in Zambia team, and where possible will be incorporated into new programme design and implementation approaches going forward as Oxfam in Zambia transitions to the new Oxfam southern Africa cluster.

Signed off by: Dailes Judge, Country Director, Oxfam in Zambia

CONTENTS

EXECUTIVE SUMMARY

Oxfam GB's Global Performance Framework is part of the organization's effort to better understand and communicate its effectiveness, as well as enhance learning across the organization. Under this framework, a small number of completed or mature projects are selected each year for an evaluation of their impact, known as an 'Effectiveness Review' (ER).

During the 2018/19 financial year, one of the projects selected for an ER was 'Promoting the right to safe water, sanitation and hygiene (WASH) of peri-urban communities in Lusaka, Zambia' – referred to as the 'Urban WASH' project. It was carried out in George and Chawama compounds in Lusaka between July 2013 and June 2017 by Oxfam together with implementing partner Village Water Zambia. The project aimed to improve provision and sustainable management of WASH services by engaging citizens to hold duty bearers and service providers to account. Oxfam collaborated with local institutions on an array of activities, engaging stakeholders to create a conducive environment for service provision and improving capacities and practices.

EVALUATION APPROACH

The ER, for which the fieldwork was carried out in November 2018, aimed to evaluate the success of this project to increase the sustainability of water and sanitation systems and services. Using a quasi-experimental evaluation design, we assessed impact among the households in communities where the project was active in comparison to households in a similar community where we expected baseline characteristics would have been the same. We combined this household-level quantitative assessment with community-level qualitative key informant interviews (KIIs) with relevant institutional representatives. Using this approach, the evaluation identified effects of the project at the household level and the community level. Any impacts of broader activities conducted across the entire local area (e.g., radio programming, roadshows, district-level activities) were not evaluated.

The evaluation was carried out in three compounds of Lusaka, Zambia, the two compounds where the project was carried out – George and Chawama – and Kanyama Compound as the comparison community. Kanyama was chosen as the best possible comparison group area for two reasons. First, Oxfam ran a humanitarian response to a severe cholera outbreak in 2018 in the three compounds of George, Chawama and Kanyama. This outbreak and the response were key considerations in the evaluation design. Second, household characteristics in Kanyama were expected to be similar as those in George and Chawama before the project started.

Households were randomly selected for interviews (among the entire population within each compound), and the gender of the interviewee representing each household was randomly allocated. A total of 1,014 household interviews were completed – 383 in the intervention areas (George and Chawama) and 631 in the comparison area (Kanyama). At the analysis stage, propensity score matching (PSM) and multivariate regression were used to control for apparent baseline differences (using recalled baseline data) between the groups. Key informants were selected for interviews to represent the project's main compound-based institutional partners, with comparable institutional representatives selected in the comparison compound. In total, we interviewed two representatives in George, four in Chawama and two in Kanyama.

RESULTS

The evaluation results are summarized in Table 1 and discussed below. Because of large differences observed between the two compounds where the project was implemented – George and Chawama – all results are shown by compound. The primary aim of the evaluation was to investigate 'the extent to which inequalities brought about by poor water access, management, governance have been reduced and the significance of the intervention's contribution', as the final outcome indicator for all Sustainable Water ERs. We measured this concept using a multidimensional Sustainable Water and Sanitation Index comprised of six dimensions. We also assessed water and sanitation access as well as water insecurity, which was measured using the Household Water Insecurity Experiences scale (HWISE, 2019).

Table 1: Summary of Effectiveness Review results

Outcome	Evidence of impact in George Compound	Evidence of impact in Chawama Compound
 Improved Water Access	No	Positive
 Improved Sanitation Access	No	Positive
 Reduced Water Insecurity (HWISE)	Negative	Negative
 Sustainable Water and Sanitation: Overall	Mostly Negative	Mixed
 Sustainable Water and Sanitation: Water Security	Negative	No
 Sustainable Water and Sanitation: Equity	Negative	Positive
 Sustainable Water and Sanitation: Institutions	Negative	No
 Sustainable Water and Sanitation: Operations	No	Mixed
 Sustainable Water and Sanitation: Well-being	Negative	Negative
 Sustainable Water and Sanitation: The Environment	Negative	Negative

Figures 1 and 2 show the project impact by compound for the index and each of the six dimensions (top row) and 16 indicators (below each dimension). Overall, we find the project had a negative impact in George Compound for the Sustainable Water and Sanitation Index (-8.62, p<0.01) and Water Insecurity (HWISE: 6.34, p<0.01); no significant impact on water and sanitation access is observed. On the other hand, in Chawama, we find the project had a positive impact on access to piped water on premises (4.42, p<0.1) and improved sanitation (8.95, p<0.01). Despite this, we do not see a significant impact on the Sustainable Water and Sanitation Index overall (although several significant impacts are observed among the dimensions and indicators) and we find a significant negative impact on Water Insecurity (HWISE: 2.03, p<0.05).

Figure 1: Sustainable Water and Sanitation Index dimensions and indicators of project impact in George Compound (PSM estimates; * p < 0.1, ** p < 0.05, *** p < 0.01)

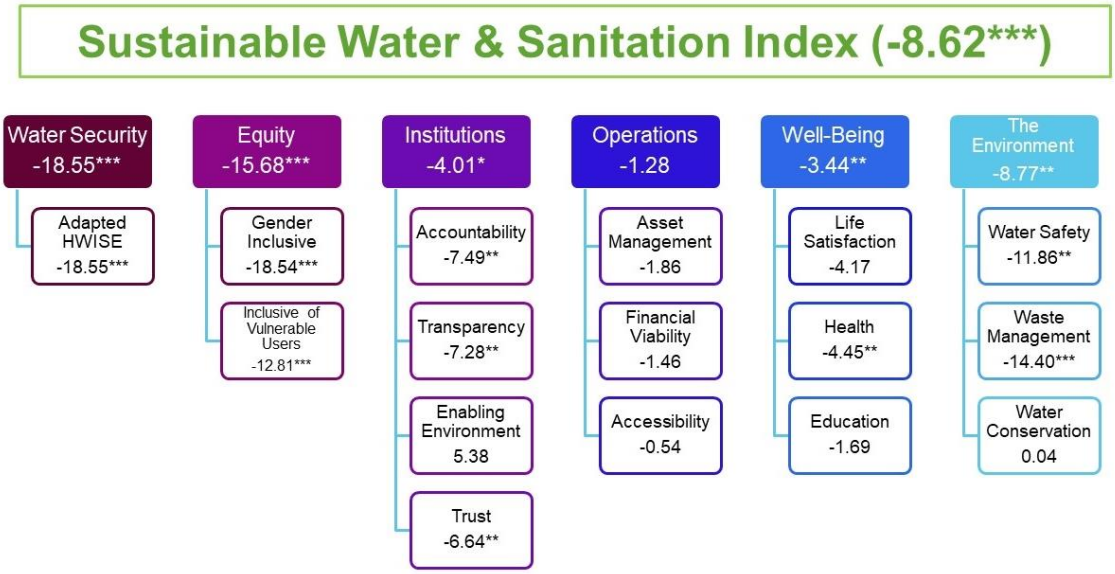
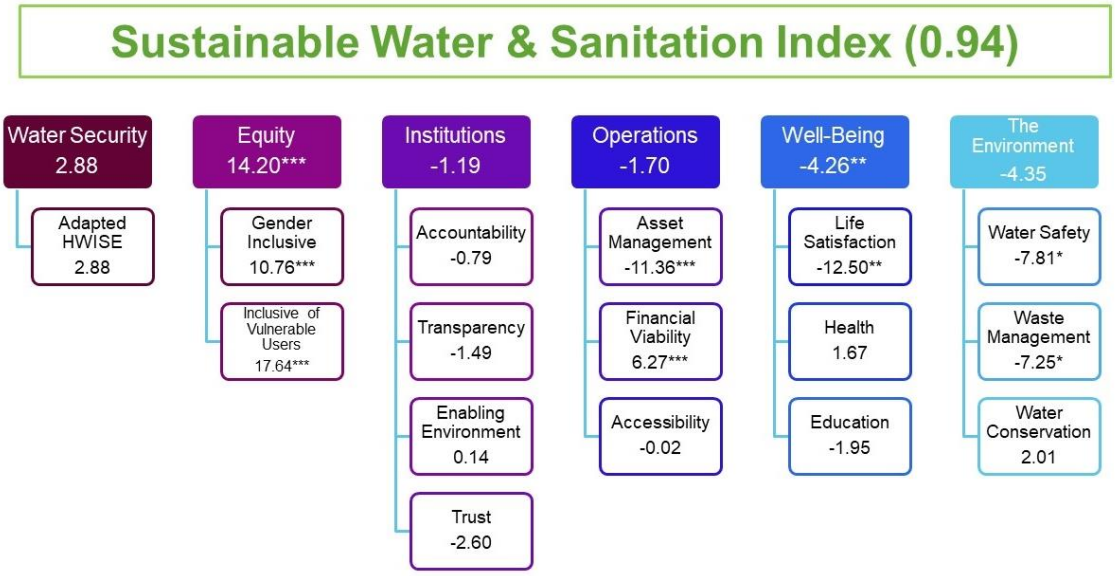


Figure 2: Sustainable Water and Sanitation Index dimensions and indicators of project impact in Chawama Compound (PSM estimates; * p < 0.1, ** p < 0.05, *** p < 0.01)



Based on subgroup analysis, we find differential impacts for the Sustainable Water and Sanitation Index by gender and disability, but not by home ownership status. In George we see a larger negative project impact among men than among women and in Chawama we see a positive impact among households having members with a disability.

Throughout this report, tangible and intangible impacts are combined in the indicators and dimensions of the Sustainable Water and Sanitation Index (see Table 2). Both the aspects are important for measuring this concept, to capture differences ranging from access to infrastructure to personal experiences and opinions. Physical infrastructure alone does not tell the whole story because that system may not work for everyone all the time. Personal experiences and opinions are key to understanding how people are really affected and what factors are contributing the sustainability of water and sanitation systems.

Table 2: Example tangible and intangible aspects of the Sustainable Water and Sanitation Index dimensions and indicators

Dimension	Tangible Aspects	Intangible Aspects
Water Security 	Water service interrupted or limited (low water pressure, less water than expected), not enough water for drinking, food preparation, washing (hands, body, clothes, etc.)	Worrying, feeling angry, ashamed, excluded, stigmatized because of problems with water
Equity 	Women and men equally share responsibilities for water collection and unpaid care work related to water (not measured in this evaluation)	Services are perceived to be equally inclusive for diverse groups (for women and men, young and old, people with disabilities)
Institutions 	Access to information, taking action to hold the government and service providers to account for water and sanitation systems and services	Confidence in holding the government and service providers to account, transparency of decision-making process, trust in institutions
Operations 	Infrastructure access (type and location), existence of a water and sanitation committee, calculation of household expenses on water and sanitation	Feeling safe accessing infrastructure, confidence in the water and sanitation committee to carry out duties (O&M, repairs, replacements), opinions service pricing and affordability
Well-Being 	Incidence of health problems (diarrhoea, fever, cholera, etc.), school attendance of children	Life satisfaction, feeling stressed, subjective health
The Environment 	Existence of water safety and waste management plans (not measured in this evaluation), household water conservation and source protection practices	Implementation and awareness of community water safety and waste management plans

This distinction between the tangible and intangible also helps with interpreting the impact of the project. Most negative impacts are related to the intangible – worry and anger due to problems with water, opinions about equity, confidence, satisfaction, trust, opinions on affordability and fairness of pricing, feeling safe and subjective health. Meanwhile, we see little to no impact on tangible aspects – water fee structure (including options for those who cannot pay), proportion of monthly expenses going to water, sanitation and health, types of water and sanitation services and systems used, physical terrain between the household and the water source, hours of access per day, incidence of specific health issues, school attendance and measures taken to conserve and protect water resources. This distinction is more apparent in George, where we see more negative impacts, than in Chawama, where we see more positive impacts.

The KIIs highlight the role of specific project activities, such as water quality monitoring and supporting community-based enterprises (CBEs). For example, there is evidence that water

quality monitoring is continuing and that the comparison area – Kanyama – is also benefiting by occasionally borrowing the water quality monitoring kits provided in George and Chawama. As for the CBEs, some are still active, but not as active as they used to be during the project. Some CBEs are mentioned as still working with the Lusaka Water and Sewerage Company (LWSC). At the same time, concerns were raised about solid waste management CBEs, some of which were said to not be disposing of waste properly. Overall, water systems and services were described as making good progress, with plans already underway to resolve issues such as intermittent water supply. However, sanitation remains an immense challenge, with clarity on how to set up safe, equitable and effective solid waste management systems still lacking.

In Chawama, the results are relatively straightforward – the project achieved several positive impacts, although alongside some negative impacts. On the other hand, in George, the mostly negative results may reflect increased awareness of water and sanitation issues among residents and subsequent frustration with seeing little progress made to remedy those issues. It is possible for mobilization to lead to negative results if residents are not listened to, or if those listening have little power to make real changes in their communities. A power analysis would help to illuminate such disconnects between the residents and duty bearers, extending beyond the compound to district and national levels as well (Hopkins, Brady & Brownlie, 2014).

PROGRAMME LEARNING CONSIDERATIONS

Consider conducting a power analysis during programme design and regularly revisit it during implementation

Based on the mixed impacts found through this evaluation – the same approach worked relatively well in Chawama but not in George – future programmes could use a power analysis as the basis for further tailoring project designs to specific populations and local structures. A power analysis should be done for each community, to understand the of centres of power both inside and outside that community (e.g., district and national level) and how these power relations might alter project effectiveness. Regular reflections on this analysis should be done with a broad cross-section of the community. Based on these reflections, the power analysis can evolve (and strategies may need to change) over time as power structures (hopefully) change throughout the course of the project.

Based on the findings in this evaluation, reflect on mobilization strategies

While the project activities were the same in George and Chawama, mobilization appears to have been more successful in Chawama because the project was able to work through established local-level structures. In George, local-level structures had to be set up as part of the project (e.g., Ward Development Committees – WDCs). The maturity of these local structures likely influenced the impact of the project in each compound.

Also, based on the low levels of project exposure seen in this evaluation, the project could have looked for additional ways to connect with more community members more often. Linking to the first recommendation above, mobilization can also be part of the power analysis. For example, look for ways to further develop mobilization strategies that account for how project implementation may be affected by differences in existing community structures.

When shifting from rural to urban WASH programming, build in training opportunities for staff to adapt their skills

This project was a first attempt at urban WASH programming in Lusaka. Together, Oxfam and Village Water Zambia (implementing partner) had successfully carried out various rural WASH projects in the past. Transitioning this work to an urban environment was both a new and different challenge, as well as a learning experience. Communities within peri-urban Lusaka can have very different experiences when it comes to water and sanitation systems and services.

Understanding this reflects a need for further training for staff when transitioning from rural to urban WASH programming, to improve knowledge and skills for working in such a different context. With shifts from rural to urban accelerating in the sector, driven at least in part by increasing urbanization, strategies are often being adapted from rural to urban contexts. In this process, ensure that training opportunities for staff are built in early on so they can adapt and learn about aspects that differ between rural and urban WASH programming.

1 INTRODUCTION

Every year since 2011, Oxfam Great Britain (GB) has conducted rigorous impact evaluations known as Effectiveness Reviews (ERs) as part of its Global Performance Framework. For these reviews, we randomly select projects that have been active for at least two years and have a minimum budget of £200,000. We look for evidence of a cause–effect relationship between the project activities and any observed outcomes and impacts to understand whether our work leads to positive changes in the lives of the women and men with whom and for whom we work.

For the financial year 2018/19, we selected from projects under five thematic areas – Livelihoods, Women's Empowerment, Resilience, Good Governance and Sustainable Water and Sanitation. The 'Promoting the right to safe water, sanitation and hygiene (WASH) of peri-urban communities in Lusaka, Zambia' project was selected under the thematic area of Sustainable Water and Sanitation. Throughout this report, this project is referred to as the 'Urban WASH' project.

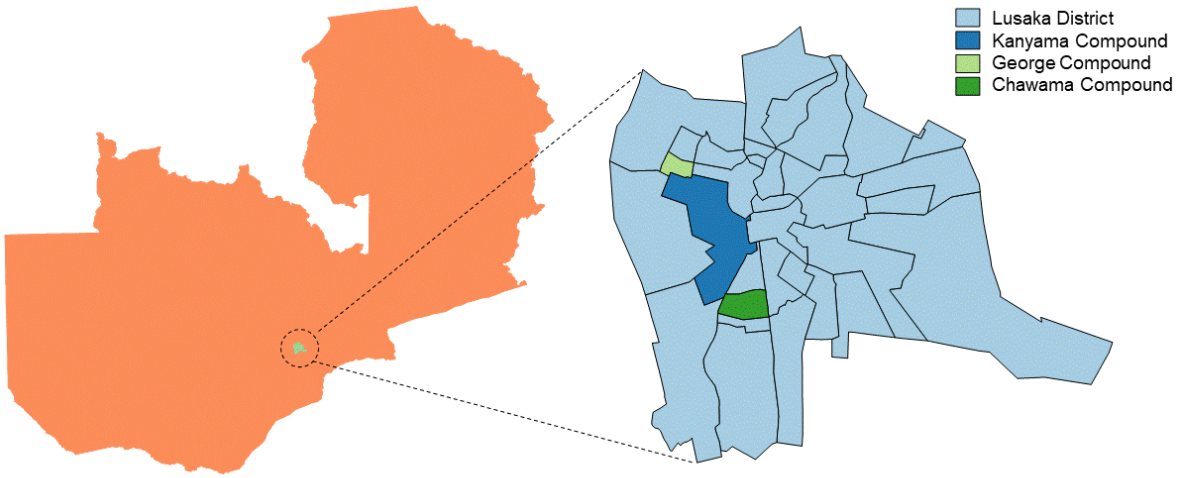
The Urban WASH project operated in two peri-urban areas of Lusaka – George and Chawama Compounds – from July 2013 to June 2017. These areas are characterized by dense, mostly informal settlement patterns, where water and sanitation access and management face ongoing challenges. Flooding, common during the wet season due to insufficient drainage, coupled with inadequate waste management, results in cyclical cholera outbreaks and other public health issues. Project activities to address these (and related) concerns were carried out with our implementing partner, Village Water Zambia. The overall budget was £1,098,813. An estimated 51,000 individuals benefited directly from the project, while 222,000 individuals benefited indirectly.

The ER data-collection phase, in November 2018, took place one year and five months after the end of the project in June 2017. It is important to note that Lusaka had a severe cholera outbreak from January to June 2018 (WHO Africa, 2018), to which Oxfam ran a humanitarian response in three compounds – George, Chawama and Kanyama. This outbreak and the response were key considerations in the evaluation design. Kanyama Compound was identified as the best possible comparison area (comparison group), since it was also included in the humanitarian response to the cholera outbreak and community characteristics were otherwise similar to the project areas. Figure 1.1 shows the locations of these areas. Note that the northernmost section of Kanyama is an industrial area and the southern section is residential, which means the evaluation comparison area did not border George Compound as indicated on the map.

The primary aim of the evaluation was to investigate 'the extent to which inequalities brought about by poor water access, management, governance have been reduced and the significance of the intervention's contribution', as the final outcome indicator for all Sustainable Water ERs. The questions guiding the evaluation were:

1. How did the project impact water and sanitation access and Water Insecurity at the household level?
2. How did the project impact Sustainable Water and Sanitation at the household level?
3. How do the perspectives of relevant institutional representatives relate to the household-level experiences?
4. How do impacts differ:
    a. by gender?
    b. for households with disabled or chronically ill members?
    c. by home ownership status?

Figure 1.1: Location of Lusaka in Zambia (left) and the intervention (George and Chawama) and comparison (Kanyama) areas within Lusaka (right) (Eubank, 2014)



2 PROJECT DESCRIPTION

2.1 PROJECT ACTIVITIES

The project collaborated with local institutions on an array of activities, engaging stakeholders to create a conducive environment for service provision and improving capacities and practices. A summary of project activities follows, grouped by institutional stakeholder:

- **Health Centres** to (a) support Environmental Health Technicians (EHTs) in water quality testing, through training and provision of test kits, (b) support volunteer Community Health Workers (CHWs) with hygiene promotion training and supplies for distribution (e.g., chlorine disinfection and soap), (c) generate Water and Sanitation (WatSan) and disease surveillance reports, and (d) mobilize the communities.

- **Schools** to (a) support EHTs to teach pupils about personal hygiene and sanitary pad disposal, (b) form sanitation clubs, (c) train teachers on key hygiene messages, (d) add a hygiene guide to the curriculum, and (e) place advocacy billboards.

- **Ward Development Committees (WDCs)** to (a) coordinate interactive fora to bring community members together with authorities, (b) form pressure groups, (c) train community members in activism for reporting issues to service providers, and (d) mobilize the communities.

- **Zambia Federation of Disability Organizations (ZAFOD)** to (a) identify people with disabilities, (b) train community leaders on inclusive WASH, (c) conduct a WatSan audit, (d) gather design input for inclusive WASH, and (e) provide inclusive WASH demonstrations (models).

- **Lusaka City Council – Public Health Department (LCC – PHD)** to (a) train community leaders on the Public Health Act (PHA), (b) train community-based enterprises (CBEs) to do proper and safe solid waste management, and (c) support the assessment of facilities for legal enforcement of the PHA.

- **National Water Supply and Sanitation Council (NWASCO)** to (a) share information on tariff setting and legal requirements in the interactive fora and (b) facilitate regulation.

- **Lusaka Water and Sewerage Company (LWSC)** to facilitate information sharing and establish new lines of communication between LWSC and communities.

- **Zambia Police (ZP)** to (a) provide security to CBEs and (b) support gender mainstreaming activities and sensitization.

- **District Health Office (DHO)** to (a) support the district with supplies for distribution (e.g., water quality test kits) and (b) facilitate awareness-raising events, including World Water Day (WWD), World Toilet Day (WTD) and Global Handwashing Day (GHWD).

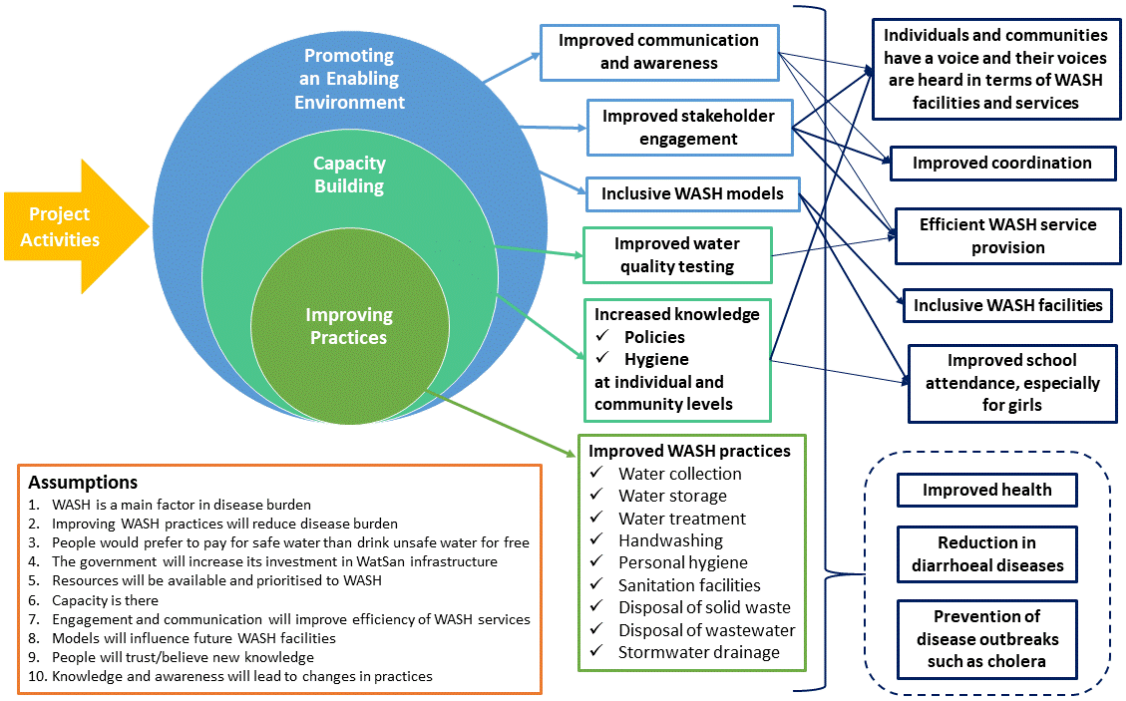
The project also supported city-wide activities, such as radio programming and roadshows, placing advocacy billboards in market areas, and forming a WhatsApp group. These activities were all focused on sharing and discussing information and issues related to WASH.

2.2 THEORY OF CHANGE

The project activities fit into three broad dimensions of change – (1) promoting an enabling environment, (2) capacity building, and (3) improving practices. While these dimensions are interconnected, the project did expect certain intermediate outcomes related to each dimension. For promoting an enabling environment, the expected outcomes were improved communication and awareness, improved stakeholder engagement, and inclusive WASH models. For capacity building, the expected outcomes were: improved water quality testing, increased knowledge about policies and hygiene at the individual and community levels, and improved WASH practices (e.g., water collection, storage and treatment, handwashing and personal hygiene, sanitation facilities, disposal of solid waste and wastewater, and stormwater drainage).

The project outcomes aimed for impact – positive change for people and their communities. The expected impacts were improved health (e.g., reduction in diarrhoeal diseases, prevention of disease outbreaks), improved school attendance (especially for girls), inclusive WASH facilities, efficient WASH service provision, improved coordination, and raising the people's voices and their voices being heard in terms of WASH facilities and services. Many impacts are linked but each also follows a distinct causal path from the project's activities and expected outcomes.

Figure 2.2.1: The project's Theory of Change (recreated with Oxfam and Village Water Zambia during a workshop held October 30–31, 2018, Lusaka, Zambia)



The Theory of Change made assumptions about how change would happen. Any invalid assumptions may reduce the impact of the project. The key assumptions raised during the workshop were (1) WASH is a main factor in disease burden, (2) improving WASH practices will reduce disease burden, (3) people would prefer to pay for safe water rather than drinking unsafe water for free (i.e., people value safe water and they can afford it), (4) the government will increase its investment in WatSan infrastructure, (5) resources will be available and prioritized to WASH, (6) capacity is there, (7) engagement and communication will improve the efficiency of WASH service delivery, (8) models will influence future WASH facilities, (9) people will trust and believe new knowledge and information that is shared with them, and (10) knowledge and awareness will lead to changes in practices.

3 EVALUATION DESIGN

The central problem in evaluating the impact of any programme is understanding what changes are attributable to project activities versus *what would have happened otherwise.* In this evaluation, the situation in project areas was examined through quantitative household surveys and qualitative key informant interviews (KIIs) – but clearly, we could not directly observe what the situation would have been without the project. This 'counterfactual' situation can only be estimated.

Given a large number of households, we follow the common practice of estimating the counterfactual by comparing households that were part of the project (intervention group) to households that were not (comparison group). Assuming these two groups are the same, except for the project, observing the situation in both groups provides a good estimate of the counterfactual.

The ideal approach from an evaluation perspective would have been to randomly assign households (or groups of households, communities, etc.) to the intervention and comparison groups. This type of randomization minimizes the probability of systematic differences between the groups and maximizes the confidence that any observed impacts were caused by the project. However, this approach is not possible when evaluating projects that have already been implemented and is often not ideal for large-scale implementation either.

Thus, we have adopted a 'quasi-experimental' evaluation design using propensity score matching (PSM) to answer the evaluation questions for households in the intervention group in contrast to similar households in the comparison group. The matching process was done with a pre-defined set of baseline characteristics, including information about the interviewee, household demographics, income sources, wealth, group participation, and water and sanitation access. In this case, we also included a matching variable to account for the effect of the 2018 cholera outbreak. To ensure sufficient data for the matching process, we interviewed three comparison interviewees for every two intervention interviewees.

The baseline data needed for PSM are not available, so survey interviewees were asked basic questions about their situation from 2012 (the year before project implementation began in 2013), thereby creating recall data (Nicola & Giné, 2012; Godlonton et al., 2018). While recall data may not be completely accurate, we do not expect it to bias the evaluation results because systematic variation between how interviewees remember information in the intervention and comparison groups is unlikely. Using recall data to recreate a baseline is not the ideal approach (methodologically); we opt to use it as a second-best option (pragmatically) when sufficient baseline data is not available.

To contextualize the household survey data, we also conducted community-level KIIs with institutional representatives in each compound. We used this qualitative data to contextualize quantitative results and further evaluate institutional differences between the intervention and comparison groups related to the project activities. Overall, this evaluation design allows us to see project impacts at the household and community level. Any impacts of broader activities conducted across the entire local area (e.g., radio programming, roadshows, district-level activities) are not explicitly evaluated.

4 DATA

4.1 INTERVENTION AND COMPARISON

For this evaluation, the intervention group includes George Compound (Lima Ward 26) and Chawama Compound (Ward 2), which comprise the entire area where the project was implemented. Through discussions with project staff, it was revealed that the project originally decided to work with these communities based on the range of water and sanitation challenges being faced, including their propensity to waterborne disease outbreaks, namely cholera.

The comparison group is Kanyama Compound (Ward 11), which has a similar settlement pattern to George and Chawama and is understood to have faced similar water and sanitation challenges back in 2012 (before the project), including cholera outbreaks. This comparison area was selected in consultation with project staff and CSK Consortium, all of whom have extensive experience working in peri-urban Lusaka. Project staff also explained that Kanyama would have been likely to be included in the project if more resources had been available. Population statistics for these areas are shown in Table 4.1.1. For a map refer to Figure 1.1.

Table 4.1.1: Population statistics for intervention and comparison compounds in 2018*

Group	Compound	Population*	Number of Households*	Average Household Size
Intervention	George	59,600	9,600	6.2 people
Intervention	Chawama	131,000	21,500	6.1 people
Comparison	Kanyama	169,250	28,000	6.0 people

*Central Statistical Office (CSO) of Zambia, projected figures based on the most recent census in 2010.

Another factor considered in selecting the comparison area was a severe cholera outbreak that occurred after the project was finished (but before this evaluation). It began in Lusaka in October 2017, peaked in January 2018, and spread to seven provinces before concluding in May 2018. In total, there were around 5,900 cases and 114 deaths (WHO Africa, 2018; CDC, 2018). Chawama, George and Kanyama compounds were all heavily affected. For example, of 210 new cases the week of 18 March 2018, Chawama sub-district had 22 (three in Chawama Compound), Matero sub-district had 41 (27 in George Compound), and Kanyama sub-district had 64 (28 in Kanyama Compound) (WHO Africa, 2018). These three sub-districts accounted for over 60% of that week's cases, with George most impacted considering population density.

The response to this outbreak involved many stakeholders working together with the Ministry of Health (MoH) (e.g., Zambia National Public Health Institute, WHO, CDC, LWSC) through an incident management system. Response activities, to which Oxfam contributed, included water trucking, chlorine and soap distribution, and hygiene education. Additionally, shallow wells were located and filled in and around 1 million people were vaccinated against cholera. According to WHO Africa (2018), vaccination rates were higher in Chawama (97%) and Kanyama (142%) sub-districts compared to Matero sub-district (82%), where George Compound is located.

Kanyama was the only non-project area that was also part of Oxfam's response to this outbreak, which occurred between the end of the project and this evaluation. While this was expected to influence the results in absolute terms, we did not expect our estimates to be biased due to the cholera outbreak as the subsequent response was seen as a constant factor across the intervention and comparison groups. However, it is also possible that the outbreak and response had disproportionate effects in the different compounds. To better understand how our results might be influenced by these events, we include additional information in the results section on the cholera outbreak gathered at both the household and institution level.

4.2 HOUSEHOLD SURVEYS

Following a three-day training course, a team of 12 interviewers (contracted and managed by the evaluation consultant, CSK Consortium) conducted the household surveys from 13–28 November 2018. The questionnaire was reviewed in English and Nyanja and Bemba languages during the training for translation quality and to develop a common understanding of all questions among the team. All surveys were conducted digitally with SurveyCTO on mobile devices (with daily uploading); paper questionnaires were available as a back-up. Throughout data gathering, privacy and data protection were prioritized, following principles and protocols based on Oxfam's Responsible Data Policy and GDPR (Vonk, 2019).

In each compound, survey interviewees were randomly selected from all current residents using a random walk protocol as follows:

1. From the health clinic, pairs of interviewers were assigned to zones in coordination with the Environmental Health Community Group. From the approximate centre of the assigned zone, they spun a pen (as a dial) to indicate in which direction to walk.

2. One interviewer counted households on the left and one counted those on the right.

3. At every 25th household, the interviewer asked to interview a household member of a specified gender (randomly indicated by SurveyCTO) who was knowledgeable about the household's water and sanitation situation.

    a. If a suitable interviewee was available and willing to participate in the survey, the interviewer proceeded with the interview.

    b. If a suitable interviewee was temporarily not available, the interviewer asked if they could come back at a more convenient time.

    c. If a suitable interviewee either did not exist in the household or was away for an extended period, the interviewer proceeded to interview a interviewee of the opposite gender, if possible.

    d. In case of refusal, or if a suitable interviewee could not be found after two attempts, the interviewer recorded the reason for no interview and proceeded to the next household according to the protocol.

We aimed for a sample size of 1,000 (600 comparison, 400 intervention). Interviewee gender was randomly indicated for each household, so we expect something close to a 50:50 ratio. In total, the interviewers visited 1,031 households, of which 16 had no interviewee available (e.g., not at home, too busy) and one did not consent to be interviewed, thereby completing 1,014 surveys (631 comparison, 383 intervention). Most those unavailable were in Chawama (n=8) and George (n=6). Of those surveys, 17 were dropped from analysis due to irreconcilable errors in the household roster. The final sample of interviewees is shown in Table 4.2.1. Additional summary statistics are provided in Appendix 2.

Table 4.2.1: Final sample of interviewees by compound and gender

Group	Compound	Total Sample (N)	Men	Women
Intervention	George	182	85 (47%)	97 (53%)
Intervention	Chawama	192	94 (49%)	98 (51%)
Comparison	Kanyama	623	295 (47%)	328 (53%)
Total	**All**	**997**	**474 (48%)**	**523 (52%)**

4.3 KEY INFORMANT INTERVIEWS

In each compound, representatives from the project's compound-based institutional partners were invited for interviews. From the list of project activities (Section 2.1), there were four partners with representatives based locally in each compound. These were key stakeholders in promoting an enabling environment and capacity building activities, as articulated in the project's Theory of Change. They were the local duty bearers the project sought to connect with compound residents – the right holders – to discuss and address their WASH challenges. We aimed to interview the following key informants in each compound:

- Environmental Health Technicians (EHTs) at the health clinic
- Health and nutrition (SHN) teachers at the local school
- Ward Development Committee (WDC) members
- Lusaka Water and Sewerage Company (LWSC) representative.

In George (intervention group), we completed interviews with representatives from the health clinic and LWSC. However, due to scheduling conflicts, we were unable to complete the WDC and school interviews in George. In Chawama (intervention group), we completed interviews with representatives from all four institutions. In Kanyama (comparison group) we completed interviews with health clinic and school representatives. However, due to security issues, we were unable to complete the WDC and LWSC interviews in Kanyama. All interviews were conducted independently by the evaluation consultant, CSK Consortium, following principles and protocols based on Oxfam's Responsible Data Policy and GDPR (Vonk, 2019). Table 4.3.1 summarizes which interviews were conducted by compound.

Table 4.3.1: Final set of KIIs by compound.

Group	Compound	Health Clinic	Local School	WDC	LWSC
Intervention	George	X			X
Intervention	Chawama	X	X	X	X
Comparison	Kanyama	X	X		

The KIIs were conducted in an open-ended manner with a pre-defined set of talking points. For all interviewees, we asked them to share information about specific topics (implicitly related to the project) and to describe any challenges they have faced in carrying out their mandate. The following is a list of the specific activities we asked about, by institution:

- **Health Clinic** – water quality monitoring activities, hygiene education activities.
- **Local School** – handwashing activities, sanitation club activities (if applicable), inclusiveness of WASH facilities at the school, absenteeism of students (by gender and reason, if possible).
- **WDC** – status of interactive fora (if applicable), activity of WASH CBEs, levels of communication and stakeholder engagement, WASH representation and prioritization within the committee.
- **LWSC** – current WatSan services provided in the compound, payment structures, plans for expansion and improvement, revenue and non-revenue water information, collaboration with or support of CBEs.

4.4 MATCHING PROCESS OVERVIEW

Because of large differences observed between the two compounds where the project was implemented – Chawama and George – all quantitative analysis, including PSM, was done separately by compound. Therefore, the sample of comparison households differs slightly for George versus Chawama. Before PSM, we filtered the data based on residence duration to exclude households that had moved to the community less than two years before the survey (i.e., towards the end of the project or after it ended). This resulted in dropping 119 households – 26 in George, 30 in Chawama and 63 in Kanyama – from the analysis. In the matching process for George, data from two intervention and 119 comparison households were dropped because no adequate matches existed. Similarly, in the matching process for Chawama, data for seven intervention and 43 comparison households were dropped. Table 4.4.1 shows the final sample sizes and gender distributions included in the analysis by intervention compound.

Table 4.4.1: Final sample of interviewees after PSM by compound and gender.

Compound	Intervention	Comparison (Kanyama)	Total Sample (N)	Men (Int. / Comp.)	Women (Int. / Comp.)
George	150	441	591	74 / 206	76 / 235
Chawama	151	517	668	74 / 239	77 / 278

An overview of the most pertinent information from the PSM process and other descriptive information is provided below. Further details on how we do PSM and full specifications for this evaluation are provided in Appendix 3. In short, before matching, we find several significant differences between intervention and comparison groups as shown in Table 4.4.2. By using PSM, we can adjust for these differences when estimating impacts; when we checked the balance variables after matching, we no longer find any significant differences.

One key matching variable we use is a wealth index, which is based on household ownership of various assets (e.g., furniture, livestock, equipment) and the condition of the house in 2012. When generating the index, we (1) verify internal consistency using Cronbach's alpha, following the guidance of Bland and Altman (1997), and (2) use principal component analysis (PCA) to assign appropriate weights to each variable in the index, following the approach of Filmer and Pritchett (2001). We ensure comparability of the wealth indexes from 2012 (based on recall data) and 2018 (based on the household's situation at the time of the survey), by pooling data by time period before undertaking PCA. We use wealth index quintiles for PSM, to avoid over constraining the matching process (i.e., households are matched to those with *similar* wealth).

The significant differences before matching can tell us a few important things. Many differences between the intervention group and comparison group are similar for George and Chawama – when compared with Kanyama, they both had slightly more household members in 2012, more of them moved to their respective communities after 2012, more of them owned their home in 2012, fewer of the household heads and interviewees were in the household back in 2012, and levels of education and literacy are lower among the household heads and interviewees.

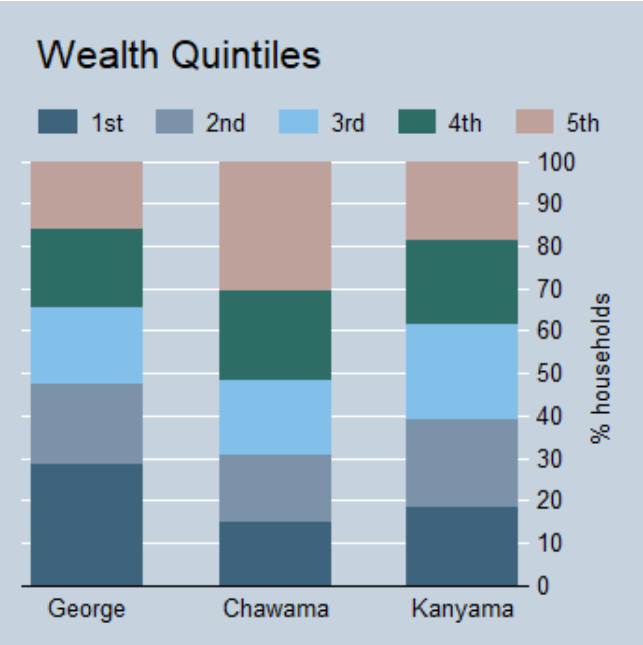
In comparison to Kanyama, fewer households in George had improved water, piped water, or improved sanitation in 2012 and they were also more affected by the 2018 cholera outbreak. But in Chawama we see the opposite trend, that in 2012 those levels were higher than in Kanyama (although the difference for improved sanitation is not statistically significant). We also find opposite trends for group participation, household members being fit to work (an indicator of disabilities), and wealth. Based on the 2012 wealth quintiles, we see that Chawama had more wealthy residents (in the fifth quintile) in comparison to Kanyama. At the same time, George had fewer wealthy residents (in the first quintile) than Kanyama (Figure 4.4.1 illustrates this point).

Table 4.4.2: Selected balance variables with significant differences before matching

Variable	Difference between George and Kanyama	Difference between Chawama and Kanyama
Interviewee age (years)	0.71	2.55*
Interviewee completed secondary school (%)	-10.11*	-4.74
Interviewee participated in a group in 2012 (%)	-20.17***	5.66
HH head age (years)	1.97	2.92*
HH head completed secondary school (%)	-14.16**	-9.63*
HH head is literate (%)	-8.91**	-7.66**
Number of HH members in 2012	0.54**	0.30
HH has at least 80% members over 5 years old fit to work (%)	6.17*	-9.36**
HH lived in the community in 2012	-3.87	-5.47**
HH owned their home in 2012 (%)	14.08**	20.42***
HH was in the lowest 20% of wealth distribution in 2012 (%)	10.19**	-3.81
HH was in the highest 20% of wealth distribution in 2012 (%)	-1.65	12.96***
Main drinking water source was improved+ in the dry season in 2012 (%)	-11.56***	4.46**
Main drinking water source was piped on premises in the dry season in 2012 (%)	-13.80***	20.05***
HH had an improved sanitation facility (e.g., toilet) in 2012 (%)	-32.72***	2.03
HH affected more by 2018 cholera outbreak relative to previous outbreaks (%)	30.98***	-32.95***
Observations	716	722

* p < 0.1, ** p < 0.05, *** p < 0.01. Variables dated 2012 are estimates, based on recall data. Construction of the wealth index is described in Section 4.4.

Figure 4.4.1: Wealth quintiles in 2012, by compound (descriptive only, before matching)



5 MEASURING SUSTAINABLE WATER AND SANITATION

Oxfam GB's Sustainable Water and Sanitation Strategy (Mizniak et al., 2017) states that to achieve sustainability, we must 'work with essential partners in a unified approach to connect poor and vulnerable communities to water and sanitation services, ensuring they are working equitably' to 'keep water and sanitation systems operational, accessible, and affordable'. For Sustainable Water ERs, our aim is to investigate 'the extent to which inequalities brought about by poor water access, management, governance have been reduced and the significance of the intervention's contribution', as the final outcome indicator.

The Urban WASH project under review was specifically aimed at sustainably improving water and sanitation facilities and services. Building on our approach for Effectiveness Reviews when measuring other complex themes, such as Women's Empowerment (Bishop & Bowman, 2014; Lombardini et al., 2017) and Resilience (Hughes & Bushell, 2013; Fuller & Lain, 2015), we gathered a set of 'dimensions' to create a household-level Sustainable Water and Sanitation Index, as shown in Table 5.1. These dimensions are based on the following:

1. Oxfam GB's Sustainable Water and Sanitation Strategy (Mizniak et al., 2017) and Outcomes-based Monitoring Framework (Medland, 2018)

2. Sustainable Development Goal 6 (UN, 2018)

3. A review of existing frameworks and indexes for assessing Sustainable Water and Sanitation (Banerjee & Morella, 2011; Bartram et al., 2014; Bratton & Gyimah-Boadi, 2016; Giné-Garriga & Pérez-Foguet, 2018; Kayser et al, 2013; Porteous, 2016; Shilling et al., 2013; Thomas et al., 2018; WHO/UNICEF, 2017; Wilbur & Danquah, 2015).

Table 5.1: Six dimensions of Oxfam's Sustainable Water and Sanitation Index

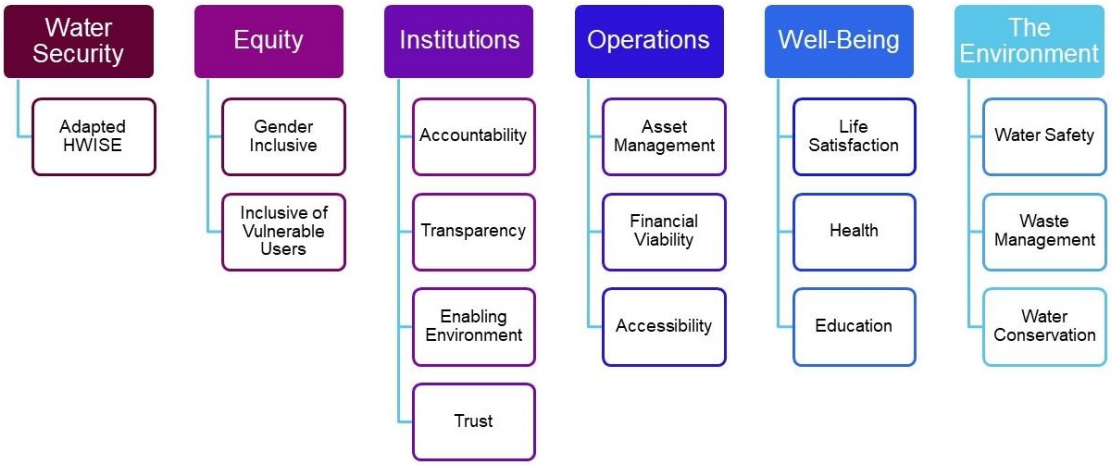
Dimension	Definition
Water Security*	People have consistent and sufficient access to preferable and acceptable water; water is not a source of worry, shame or anger.
Equity	WatSan facilities, services, and related management systems and decision-making processes are inclusive of all genders and vulnerable users.
Institutions	WatSan duty bearers are accountable and transparent, levels of trust are high, and there is an enabling environment for service provision.
Operations	WatSan systems and services have an asset management scheme in place to enable easy and continuous access that is affordable and financially viable.
Well-Being	People are satisfied with life, they are healthy and unburdened by waterborne diseases, and their children are attending school.
The Environment	Communities have plans in place for water safety, waste management, water conservation, etc. and people are aware of and participate in these systems.

*Adapted from the Household Water Insecurity Experiences (HWISE) scale by applying a threshold and averaging 12 items, as indicated in Appendix 1 (HWISE, 2019; Young et al., 2019).

The goal is to capture all key aspects that are known or suspected to contribute to the sustainability of water and sanitation systems and services. Having a single aggregate number (the index score) gives a general sense of the water and sanitation situation of a population. At the same time, we can look at different dimensions and indicators to understand possible stronger and weaker points. In terms of impact, comparing scores for intervention and comparison groups gives a more holistic measurement of our successes and failures (or both).

The index is designed to be adaptable to the given context. The six dimensions remain constant, but the set of indicators used to measure each dimension can vary, although indicators should not be removed simply because the project did not work on that aspect. The adapted version of the index for this evaluation shown below was developed together with Oxfam and Village Water Zambia staff and CSK Consortium. It is constructed using a total of 16 indicators that are assessed using 108 questions.

Figure 5.1: Sustainable Water and Sanitation Index dimensions (top row) and indicators



Each indicator is measured with one or more questions, where each question has a pre-defined threshold of acceptability, adapted from the approach of Alkire and Foster (2011). A positive result (at or above the threshold) receives a score of '1', while a negative result (below the threshold) receives a score of '0'. Each indicator is calculated by averaging the scores for the individual questions and is reported as a percentage on a scale from 0 to 100. Similarly, each dimension is calculated as the average of its indicators and the overall index is the average of the six dimensions, again on a scale of 0 to 100. Detailed tables of questions and thresholds by indicator are provided in Appendix 1 (see Table A1.1 through Table A1.6). Each table also shows whether each indicator is directly related to the project's Theory of Change.

We give equal weight to each dimension in the index; we have no theoretical justification to claim one is more important than another. Within each dimension, we also give equal weight to its indicators for the same reason. Therefore, individual questions are not given equal weight within the index; some indicators are measured with one question while others are measured by averaging 10 or more. Take the Equity dimension as an example. It has two indicators – Gender Inclusive and Inclusive of Vulnerable Users. Gender Inclusive is the average value across the following three variables: womanleaders, equalwat_gender, equalsan_gender. Inclusive of Vulnerable Users is the average value across the following five variables: pwdleaders, equalwat_disability, equalsan_disability, equalwat_children, equalsan_children. Then, Equity would equal Gender Inclusive plus Inclusive of Vulnerable Users, divided by two.

With the lens of the index focused on households, we also acknowledge the importance of other system-level, sub-national and national-level indicators that are key to monitoring overall sustainability of water and sanitation in these compounds and beyond. However, to evaluate project impact in this review, we mainly want to understand whether there have been any meaningful differences in the lives of individual residents and their households.

Alongside the index, we also consider the following information in this evaluation:

- Household water and sanitation access (primary system or facility used)
- Household Water Insecurity (12-item HWISE scale)
- Institutional perspectives
- Information on the 2017–2018 cholera outbreak.

6 RESULTS

Here we present combined results from household surveys and key informant interviews (KIIs). All quantitative information is based on two final datasets from 851 household surveys, after filtering and propensity score matching (PSM) the data gathered as described in Section 4.4. All qualitative information is based on eight KIIs, as described in Section 4.3. In this section, significant impacts are highlighted in light green if positive and red if negative. Insignificant results are not highlighted. Direct quotes from KIIs are shown in *italics.*

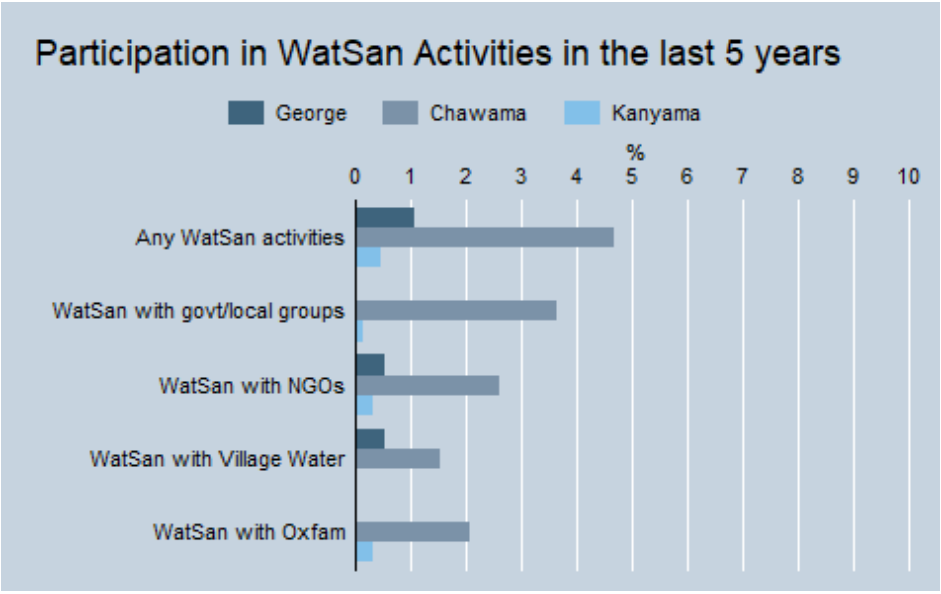
6.1 PROJECT EXPOSURE

In this section, we look at what proportion of interviewees said they had participated in water and sanitation (WatSan) activities in the last five years (which would include the period of project implementation) and in the last one year (after the project had ended). For those who reported participating in activities, we asked follow-up questions to better understand project exposure. We would expect interviewees in intervention areas – George and Chawama – to have participated in project activities mainly with Village Water Zambia, although they may have been made aware of Oxfam's role. It is also possible that interviewees in all three compounds may have participated in WatSan activities with Oxfam during the 2018 cholera response.

Overall, project exposure in the last five years appears to be low among a representative sample of all households in each compound. In Chawama, less than 5% of interviewees said they had participated, while in George that figure was only 1%. In the comparison area of Kanyama, less than 0.5% of interviewees said they had participated. This means to some extent Kanyama is a good comparison, with relatively higher levels of participation in WatSan activities in the intervention areas (particularly in Chawama).

In Chawama, interviewees said the activities they participated in were organized by the government, local groups, and NGOs, including Oxfam and Village Water Zambia. In George, they only referred to NGOs, including Oxfam and Village Water Zambia. In comparison, in Kanyama, interviewees said activities were organized by the government, local groups, and NGOS, including Oxfam (but not Village Water Zambia), likely related to cholera response.

Figure 6.1.1: Exposure to water and sanitation activities, by compound



6.2 WATER AND SANITATION ACCESS

To contextualize, we start with a descriptive overview of the water and sanitation situation in George, Chawama and Kanyama compounds. Figure 6.2.1 shows the proportion of households by primary drinking water source during the dry season (which was the current season during data collection). Water sources reported for the wet season were mostly the same as those for the dry season so, for simplicity, we focus on the dry season throughout this report.

As noted in the previous section, the situations in the two intervention compounds – George and Chawama – were different before the project in 2012. Households in Chawama reported no unimproved sources and much higher rates of piped water on premises (53%). Households in George were using unimproved sources at a higher rate (15%) and fewer reported piped water on premises (19%). In general, these trends persist in 2018.

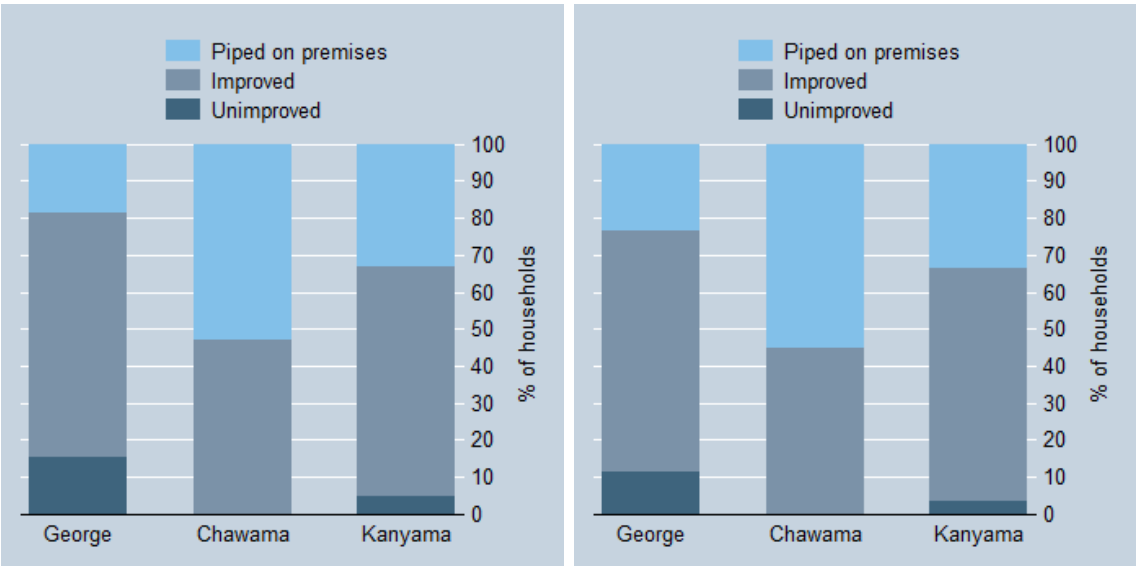
Water Source Categories
(WHO/UNICEF, 2017, p. 9)

Piped on premises – water tap in the house or on the plot/yard

Improved – public tap, standpipe or kiosk, tube well or borehole, protected dug well, protected spring, rainwater collection

Unimproved – unprotected dug well, unprotected spring, cart with a small tank/drum, tanker truck, surface water (river, dam, lake, pond, stream, canal, irrigation channel), bottled water

Figure 6.2.1: Primary drinking water source (dry season) in 2012 (left) and 2018 (right), by compound (descriptive only, before matching)



The KIIs help to illuminate the types of sources people have access to – boreholes and piped water connections from the Lusaka Water Works (water treatment plant) – through Lusaka Water and Sewerage Company (LWSC). Note that LWSC states that it is unable to meet the current demand in George, while in Chawama it has enough supply to promote more individual connections for piped water on premises.

WATER SYSTEMS IN GEORGE AND CHAWAMA COMPOUNDS

'We are providing piped water through a network around George. We have boreholes that are the main source of the water that we supply…we use individual connections and also communal taps. In terms of water, we are also trying to expand our water sources because currently we are not able to meet the demand. We are looking at additional water sources for George.'

– Lusaka Water and Sewerage Company Office Manager for George Compound

'[Everyone] from Chawama, they get water from Lusaka Water. We have two sources…one source coming from Lusaka Water Works feeding Chawama and we also have another source, which is coming from the boreholes that we have in Chawama. The [new connections] that we are putting in Chawama, the unit is individual, for individual households. We are encouraging people to get individual connections.'

– Lusaka Water and Sewerage Company Engineer for Chawama Compound

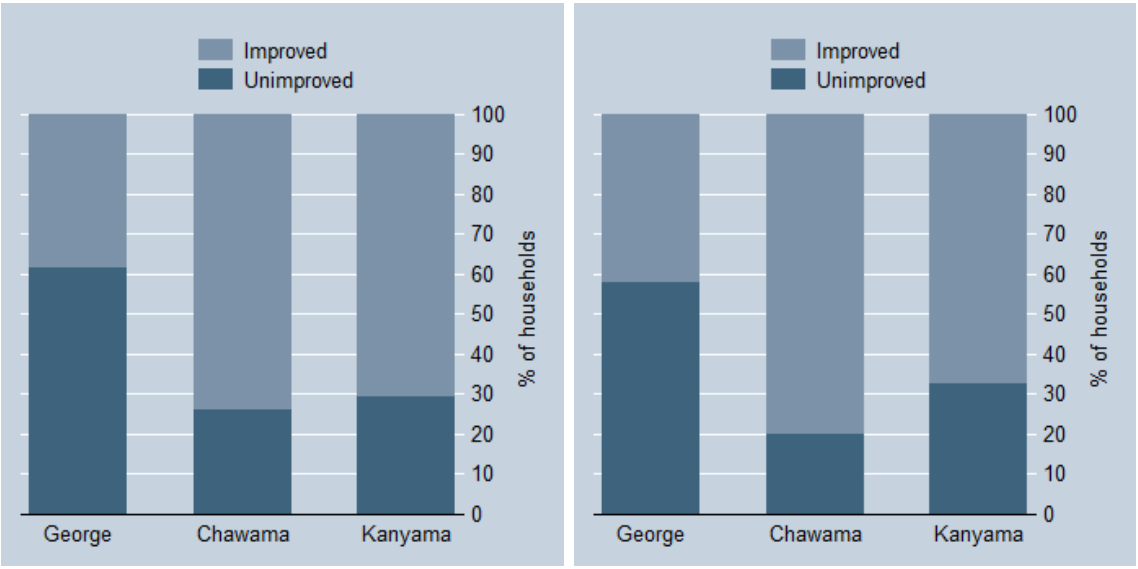
Figure 6.2.2 shows the proportion of households by sanitation facility category. In 2012, improved access levels were lower in George (39%) and higher in Chawama (74%) and Kanyama (71%). In all three compounds, most households with unimproved sanitation reported using an open/uncovered pit toilet/latrine. Again, these trends persisted in 2018. Of those reporting access to improved sanitation in 2018, many were sharing the facility with at least one other household. Those with *private* improved sanitation were 54% in George, 33%, in Chawama and 32% in Kanyama.

Sanitation Facility Categories
(WHO/UNICEF, 2017, p. 9)

Improved – pit toilet/latrine that is closed/covered, flush toilet/latrine

Unimproved – no facility (open defecation), pit toilet/latrine that is open/uncovered

Figure 6.2.2: Sanitation facility used most in 2012 (left) and 2018 (right), by compound (descriptive only, before matching)



Sanitation stands out as one of the biggest challenges faced in these communities. While the rates of improved water access are quite high, most households (77%) are using shared and/or unimproved sanitation facilities. Overall, 35% report using unimproved facilities and of those 75% report sharing with other households. Of those that do have access to an improved facility, 65% report sharing with other households. As we can see through the KIIs, the institutional stakeholders are aware of this situation. They spoke candidly about the challenges, including open defecation, in their communities. In George and Chawama, they also talked about plans to improve sanitation systems and services in the near future.

SANITATION SYSTEMS AND SERVICES: CHALLENGES

'There is a lot that has to be done to improve water and sanitation in the community. It's not healthy for five households to share one toilet…when one member of a household is using the latrine, the other members of the other households may be stranded...there is a big shortfall of toilets, they really need toilets.'

– Guidance Teacher at Chawama Primary School

'Kanyama sits on a rock. And they have to put up toilets. Toilets, pit latrines will require space, and after some time the toilet gets full. They've got to put up at another place. Where would they put it up? Because there's no space. Pit emptying services are there. It has helped to some extent. But also it has its own challenges.'

– Environmental Health Technician at Kanyama Health Clinic

'There are active Community-Based Enterprises (CBEs), but not as active as it used to be. There is no motivation now. We do not have an active formal CBE who is collecting solid waste now. There are some who do this informally. But they are not dumping this waste properly.'

– Ward Development Committee Representative in Chawama Compound

SANITATION SYSTEMS AND SERVICES: PLANS

'With regards to George, we don't have any sanitation services yet…we have a project that is on board, that is Lusaka Sanitation, and George is one of the areas that will be worked on in terms of sanitation. There will be 2,000 toilets that will be constructed…there will also be faecal sludge management facilities, that will be constructed.'

– Lusaka Water and Sewerage Company Office Manager for George Compound

'In Chawama, we went through with some donors who want to do sewer network…that's why [you can see the sewer network is being laid]. That sewer, it will come here. Otherwise, Chawama is also catered for… in the plans of doing sanitation, sewer network.'

– Lusaka Water and Sewerage Company Engineer for Chawama Compound

Now, we estimate the impact of the project on water and sanitation access using propensity score (PS) weighted difference-in-difference estimates (details provided in Appendix 3). Table 6.2.1 shows the results for improved water access, piped water on premises, and improved sanitation for George, we do not find any statistically significant impacts. In Chawama, we do see positive impacts for increased access to piped water (4.42 percentage points) and improved sanitation (8.95 percentage points).

Table 6.2.1: Impact of the project on water and sanitation access

	Improved water+ (%, dry season)	**Piped water (%, dry season)**	**Improved sanitation (%)**
Difference (Impact): George	1.87 (1.24)	3.55 (1.78)	3.30 (1.44)
Difference (Impact): Chawama	0.52 (0.76)	4.42* (2.50)	8.95*** (3.95)
Observations (intervention): George	150	150	150
Observations (intervention): Chawama	157	157	157
Observations (total)	851	851	851

+During the dry season; improved water includes piped water on premises. * p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions. Standard errors are in parentheses.

In reviewing differences between 2012 and 2018 for these three indicators, overall changes in the situation were modest. For example, only 4% of households in George, none in Chawama and 1% in the comparison area reported changing from unimproved in 2012 to improved water access in 2018 – it is not surprising we do not see any impact on improved water. For piped water, the figures are similar, although several households in the comparison area reported change in the opposite direction, from having piped water on premises in 2012 but not in 2018. That was also the case in the comparison area for sanitation, with 6% of households going from improved back to unimproved sanitation (this did not happen in the intervention areas, except for one household in George). This suggests that, while increases in piped water and improved sanitation were small, the project appears to have contributed to increased sustainability of these systems, largely preventing reductions in improved access.

6.3 WATER INSECURITY

Next, we look at household Water Insecurity using the Household Water Insecurity Experiences (HWISE) scale. The 12-item HWISE scale is a standardized set of 12 questions that has been tested for reliability and validity (HWISE, 2019; Young et al., 2019). The full list of HWISE scale questions can be found in Appendix 1 (see the first 12 questions for the Water Security dimension; ignore the threshold column). Households receive a score for each question based on their response. To calculate the scale, each question receives a score from zero to three and then the scores for all questions are added together. The final 12-item scale ranges from zero to 36, where higher scores indicate greater Water Insecurity.

Household Water Insecurity Experiences (HWISE) scale

The 12-item HWISE scale (0 to 36) is based on the following possible responses to a set of standardized questions about the frequency of water insecurity incidences over the past month (HWISE, 2019):

0 = Never (0 times)
1 = Rarely (1–2 times)
2 = Sometimes (3–10 times)
3 = Often or Always (>10 times)

Table 6.3.1 shows project impact on Water Insecurity, based on PSM estimates for HWISE. Overall, Water Insecurity is much higher in George compared with Chawama. In both intervention compounds, the results suggest that Water Insecurity has *increased* (negative finding, given the aim to decrease Water Insecurity). This negative impact, which is larger in George (6.34) than in Chawama (2.03), is statistically significant in both cases.

Table 6.3.1: Impact of the project on Water Insecurity (HWISE) by compound

	George Compound	Chawama Compound
Intervention group mean	16.77	9.84
Comparison group mean	10.55	7.79
Difference (Impact)	6.34***	2.03**
Standard error	(1.23)	(0.95)
Observations (intervention group)	136	138
Observations (total)	529	610

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

In Section 6.2, we did not see any significant differences in water access in George. The KIIs from institutional representatives in George show agreement, that demand is not currently being met and intermittent water supply is a known issue. At the same time, we did see a positive impact on improved water access in Chawama. The KIIs do not indicate the same level of challenges in meeting demand as those in George, although they do talk about ongoing issues, especially with low water pressure. Given the project's aim to raise people's awareness of water issues, it is possible that this actually led to an increase in experiences of Water Insecurity, in the absence of any big improvements in water supply coupled with ongoing challenges, such as intermittent supply and low water pressure.

LINKS TO WATER INSECURITY IN GEORGE COMPOUND

'Everyone is receiving but not really 24 hours. A few areas maybe receive 24 hours, but on average it's about 8 to 12 hours. So, we are looking at increasing our water sources [to] improve our supply hours.'

– Lusaka Water and Sewerage Company Office Manager for George Compound

'The other issue is of inconsistent [water] supply. Most of these communal taps, the report which we have been receiving and the complaint is that frequency of water supply at these communal taps is a little bit of a challenge. They open the taps maybe at five, then by seven they are closed. Two hours, in the morning. Then two hours in the evening.'

– Environmental Health Technician at George Health Clinic

LINKS TO WATER INSECURITY IN CHAWAMA COMPOUND

'Water is there 24 hours. Now, the problem is the network. Pipes are blocked. Some pipes are not there. But water is there. It's calcium [from the boreholes]. Those fed by the boreholes, we have a problem with calcium. Water is there in Chawama, but the network is old.'

– Lusaka Water and Sewerage Company Engineer for Chawama Compound

'Accessing clean water is a challenge in some areas because the tap has less pressure.'

– Ward Development Committee Representative in Chawama Compound

In Table 6.3.2, we review the differences in each of the 12 items in the scale to better understand which aspects are driving increased Water Insecurity in each compound (see Table 6.4.2). In George, the largest differences are seen for items 1 (worrying about not having enough water to meet all needs), 2 (experiencing interrupted or limited water supply), 3 (not having enough water to wash clothes), 4 (having to change schedules or plans due to water problems) and 9 (feeling angry about the water situation). In Chawama, the largest differences are seen for three of the same items – 1, 2 and 9 (worrying, experiencing interruptions and feeling angry).

Table 6.3.2: Impact of the project on Water Insecurity (HWISE) for each item

	George Compound	Chawama Compound
HWISE Worry (item 1)	0.66*** (0.11)	0.46*** (0.10)
HWISE Interrupt (item 2)	0.68*** (0.11)	0.38*** (0.11)
HWISE Clothes (item 3)	0.58*** (0.13)	0.15 (0.11)
HWISE Plans (item 4)	0.82*** (0.11)	0.06 (0.10)
HWISE Food (item 5)	0.44*** (0.14)	-0.14 (0.10)
HWISE Hands (item 6)	0.30** (0.12)	-0.07 (0.09)
HWISE Body (item 7)	0.40*** (0.13)	0.00 (0.09)
HWISE Drink (item 8)	0.20 (0.14)	-0.04 (0.09)
HWISE Angry (item 9)	0.55*** (0.13)	0.31*** (0.11)
HWISE Sleep (item 10)	0.08 (0.15)	0.05 (0.08)
HWISE No Water (item 11)	0.30** (0.14)	0.02 (0.10)
HWISE Shame (item 12)	0.36*** (0.12)	0.07 (0.10)

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions. Standard errors are in parentheses.

6.4 SUSTAINABLE WATER AND SANITATION

In terms of Sustainable Water and Sanitation, the results of the PSM estimates for the multidimensional index introduced in Section 5 (Table 6.4.1) indicate that the project had a significantly negative impact on the overall index in George, while there was no significant impact in Chawama. In George, these results are driven by significantly negative impacts in five dimensions. In Chawama, there are mixed results among the dimensions, with a significant positive impact for the Equity dimension and a significant negative impact for the Well-Being dimension, resulting in a null result overall.

Table 6.4.1: Impact of the project on the Sustainable Water and Sanitation Index

	George Compound	Chawama Compound
Intervention group mean	38.77	54.74
Comparison group mean	47.39	53.80
Difference (Impact)	-8.62***	0.94
Standard error	(1.52)	(1.49)
Observations (intervention group)	150	151
Observations (total)	585	662

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

In contrast, from the KIIs, an EHT in George spoke about the sustainability of their programme. They described ongoing community engagement, skills development and continuation of activities that began as part of the project (e.g., water quality monitoring and hygiene education). However, in Chawama the WDC explained that there has been a decrease in activity since the end of the project, mainly due to limited incentives and resources.

ON SUSTAINABILITY

'George is very vast, as us individuals we can't manage. We'll just be scratching on top. So that's why [there is] community involvement so that sustainability of the programme is there…it's a little bit difficult to say 'this is the impact'…there were trainings which were taking place, building skills in the community, there was proper community engagement. And those skills have remained in the community, of which they are still helping us right now...there's that sustainability because of the impact which had remained, the knowledge is there, definitely. The community is aware and there's that continuation phase of implementing these activities.'

– Environmental Health Technician at George Health Clinic

'The WDC is not very active now, people come and go for their own gain but if it doesn't work they leave their projects dormant…Now we are continuing the project activities with the community, but voluntary and without resources. It's not enough.'

– Ward Development Committee Representative in Chawama Compound

The overall impact for each dimension is shown by compound in Tables 6.4.2 to 6.4.7. For a visual overview of the index and impact measurements, see Figure 6.4.1 (George) and Figure 6.4.2 (Chawama). Each dimension is also discussed in more detail, focusing on significant differences observed. We also weave in quotes from the KIIs based on thematic links to each dimension (e.g., accessibility for people with disabilities in relation to Equity, water quality monitoring in relation to The Environment).

Figure 6.4.1: Sustainable Water and Sanitation Index dimensions and indicators of project impact in George Compound (PSM estimates; * p < 0.1, ** p < 0.05, *** p < 0.01)

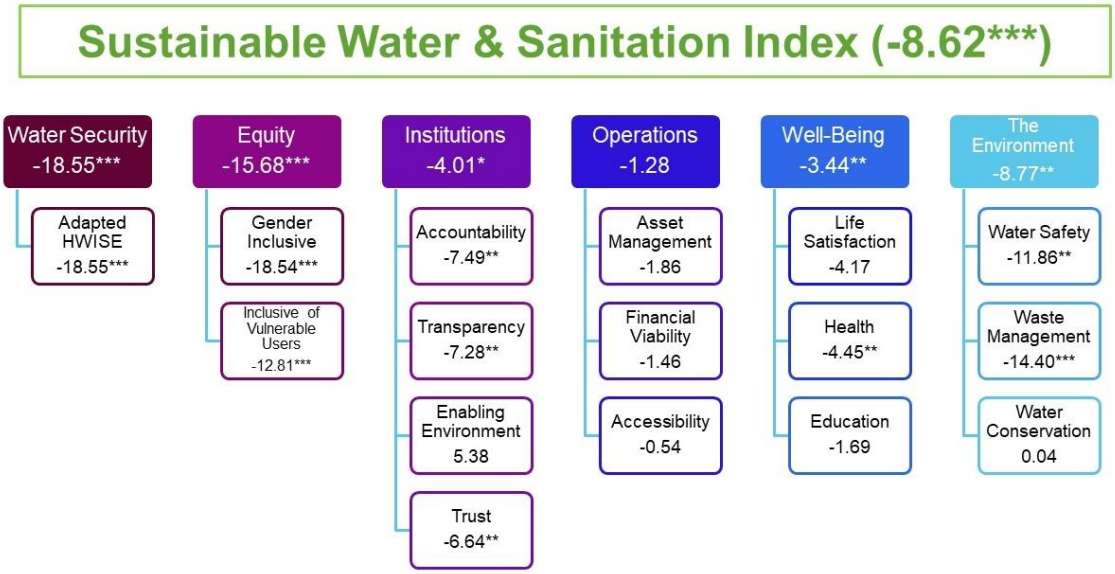
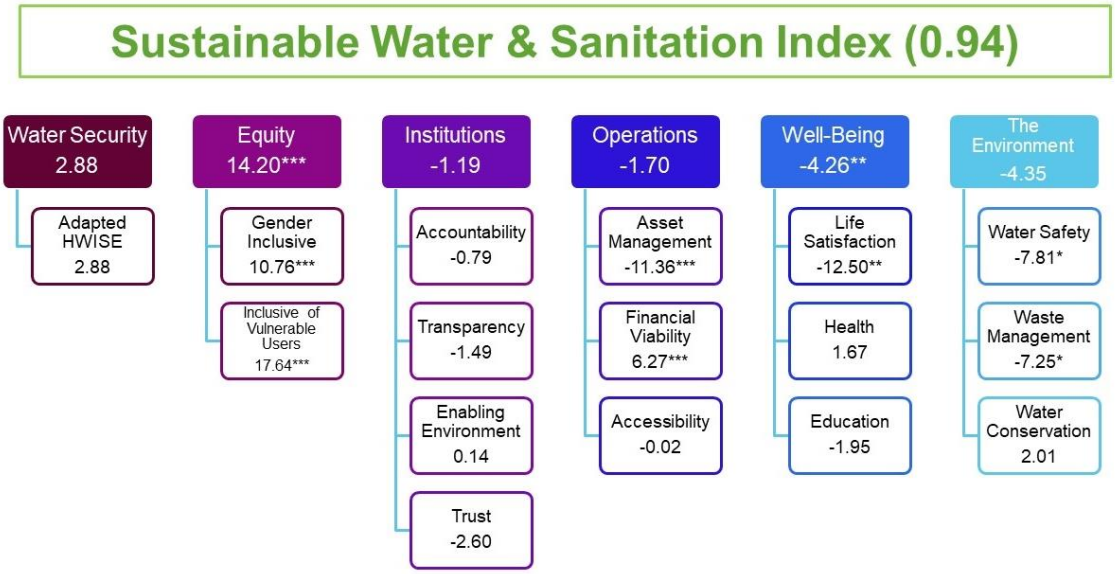


Figure 6.4.2: Sustainable Water and Sanitation Index dimensions and indicators of project impact in Chawama Compound (PSM estimates; * p < 0.1, ** p < 0.05, *** p < 0.01)



Water Security

In George, the overall impact for Water Security (-18.55) shows increased Water Insecurity, confirming what we saw with the HWISE scale. In Chawama, Water Security is higher (i.e., Water Insecurity is lower) relative to George, but we find no significant impact of the project.

Table 6.4.2: Impact of the project on the Water Security dimension

	George Compound	Chawama Compound
Intervention group mean	27.00	57.75
Comparison group mean	45.55	54.84
Difference (Impact)	-18.55***	2.88
Standard error	(4.48)	(3.89)
Observations (intervention group)	150	150
Observations (total)	585	661

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

Equity

For Equity, the negative impact in George (-15.68) is driven by negative results in both indicators – Gender Inclusive (-18.68) and Inclusive of Vulnerable Users (-12.81). The data suggest this is due to lower agreement that water and sanitation needs are being met equally for all genders and vulnerable people, including children and people with disabilities and chronic illness.

In Chawama, we see a positive impact for Equity (14.20), which includes a significant impact for Gender Inclusive (10.76) and Inclusive of Vulnerable Users (17.64). The data suggest the opposite of that which was seen in George, that there is higher agreement that water and sanitation needs are being met equally for all genders and vulnerable people.

In the KIIs we heard about ongoing inequities – violence against women and the lack of accessible facilities at schools – in Chawama and Kanyama, but there were no such references in George, and overall equity did not emerge as a major theme in the KIIs.

Table 6.4.3: Impact of the project on the Equity dimension

	George Compound	**Chawama Compound**
Intervention group mean	38.73	61.74
Comparison group mean	54.41	47.54
Difference (Impact)	-15.68***	14.20***
Standard error	(3.30)	(3.37)
Observations (intervention group)	150	151
Observations (total)	585	662

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

ONGOING INEQUITIES

'Sometimes people were opening the tap late at night and then there were issues of violence against women at those later hours.'

– Ward Development Committee Representative in Chawama Compound

'When it comes to inclusiveness, I should admit that we haven't done much in that area. Our buildings do not have facilities for the physically challenged. But for our classrooms, we have done something… we haven't yet extended this exercise to the [sanitation facilities].'

– Guidance Teacher at Chawama Primary School

'The facilities are not suitable for learners with [physical] disabilities…and we have such pupils.'

– Guidance Teacher at Kanyama Primary School

Institutions

For Institutions we find a negative impact in George (-4.01), with three indicators driving this trend – Accountability (-7.49), Transparency (-7.28) and Trust (-6.64). At the same time there was a positive, but not statistically significant, impact for the Enabling Environment indicator. The data suggest lowered confidence in being able to hold duty bearers to account for improved water and sanitation services, reduced understanding of how decisions are made regarding the water and sanitation management, less satisfaction in feeling that their needs are considered in decision-making processes and lowered trust in local government, water and sanitation service providers, and the Area Councillor.

In Chawama, there is no significant impact overall for Institutions. The data does suggest slightly more satisfaction with decision-making processes for water and sanitation systems and services management and increased trust in community-based organizations (CBOs), community-based enterprises (CBEs) and the Area Councillor.

From the institutional perspective in the KIIs, according to representatives from clinics, schools and the service provider, they are working together with the community and have networks and systems in place to manage concerns and complaints. However, challenges remain in serving such large communities with limited resources. They also cited discrepancies between knowledge and practice and explained that complaints are not always channelled efficiently.

Table 6.4.4: Impact of the project on the Institutions dimension

	George Compound	Chawama Compound
Intervention group mean	25.85	37.64
Comparison group mean	29.86	38.82
Difference (Impact)	-4.01*	-1.19
Standard error	(2.16)	(2.13)
Observations (intervention group)	150	151
Observations (total)	585	662

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

CHANNELLING CONCERNS AND COMPLAINTS

'We work closely with the community in general. Because when we just start with the selling of our water, or the product we are selling, we have vendors [including CBEs] who we identify through community leaders. So, we have the WDC, the water committees, the churches that we are working with who identify representatives, and those representatives make up the water committee. So, the water committee facilitates whatever activities between Lusaka Water and the community. If we have any kind of information we work with the water committee to go and disseminate this information to the community. Equally, if the community have got concerns, they come through the water committee and then they are put forward to Lusaka Water.'

– Lusaka Water and Sewerage Company Office Manager for George Compound

'We have a water committee, which we have in Chawama. We are working with them. They are helping us distribute bills, they are helping us sensitizing, those are the people that know the community. These are the people we are using. We pay them, as Lusaka Water [to do this work].'

– Lusaka Water and Sewerage Company Engineer for Chawama Compound

'[For our] human resources, we are adequate. The way we've done it now, even the health post that never used to have environmental health personnel, there are now environmental health personnel. So, accessibility and responding to complaints as well as finding out what's going on in the community has been improved from that aspect. The challenge which used to be there, although it's still there, was the issue of transport. Maybe we receive a complaint which is very far and now to move from here to that side to go and assess the situation, that was a challenge. But as of now, decentralizing and making sure that these health posts have got environmental health personnel [has helped].'

– Environmental Health Technician at George Health Clinic

'The sanitation club is very active, it was formed in February or March of 2018. Before that there was no sanitation club. We've formulated small groups in the school, a sanitation club, who may talk on behalf of the learners. They've approached us to say, "we don't have soap in the toilet or at the handwashing facility".'

– Guidance Teacher at Kanyama Primary School

'At times, they would even show you, because the way those water kiosks were built, they were built to have a standpipe on top. But the water pressure was so low that water would not come out on top, so most of those they had to remove the standpipe and put a [hose] which can easily bend so [the water comes out]. So, they complained, but the complaints are channelled to people like us. But even if they were to be channelled to Lusaka Water, somehow, people have gotten used to the situation. They've adapted. Because this situation has been like this, it has become normal to the people to just go for that. And that's why they've found comfort in shallow wells, they've found comfort in the same water that we say is not safe. Because for them, they feel even if they talk, even if they demand for safe water, it's just not there.'

– Environmental Health Technician at Kanyama Health Clinic

Operations

For Operations, we do not see any significant impacts in George for this dimension or any of its indicators. The data suggest the null result is due to mixed experiences. For example, households in the intervention group were more likely to report using an official water source, have better terrain between their house and water source and spend a reasonable amount on water and sanitation (less than 5% of their monthly expenses for each). At the same time, they were less likely to have access to more than one improved water source, use an official sanitation facility or feel safe while collecting water and accessing their sanitation facilities and more likely to say water and sanitation services are unfairly priced and that it is difficult to come up with the money to pay for sanitation. They also reported having more confidence in their water and sanitation committee to manage water system repairs but less confidence for operation and maintenance (O&M), system replacement and managing sanitation systems through a shock or crisis.

In Chawama, we also see no impact overall for Operations, although we do observe a significant positive impact for Financial Viability (6.27) and a significant negative impact for Asset Management (-11.36). In terms of Financial Viability, it appears that households in the intervention group were more likely to value paying for water and sanitation, spend a reasonable amount on water and sanitation (less than 5% of their monthly expenses for each) and say that both are affordable and fairly priced. For Asset Management, they had less confidence in their water and sanitation committee to do O&M for water systems and system replacement for both water and sanitation.

Table 6.4.5: Impact of the project on the Operations dimension

	George Compound	Chawama Compound
Intervention group mean	48.54	61.21
Comparison group mean	49.82	62.91
Difference (Impact)	-1.28	-1.70
Standard error	(1.43)	(1.24)
Observations (intervention group)	150	151
Observations (total)	585	662

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

The KIIs provide examples of water and sanitation payment systems in each compound. According to the service providers, demand for water is high and households are willing to pay, especially for piped water on their premises. For sanitation, the KIIs highlight a challenge – even for those paying for waste collection, it is not always disposed of safely – the problem is simply being moved from one place to another. Issues of vandalism were also raised, which adds additional challenges in terms of asset management, when resources are directed to fix such damages less is available for regularly scheduled O&M, repairs and replacements.

PAYING FOR WATER AND SANITATION

We have a rising block tariff…we want to cover [most] people between zero to six [cubic metres], and then there is another band from six to about 30 [cubic metres], and then anyone who consumes above 30 [cubic metres] has a different amount, so you pay as you consume. So, this is for the metered customers. Then we also have a fixed tariff for those who are not metered…in two folds – the ones who are using the communal taps are paying about 30 kwacha per month per household and then those who have individual connections, on average, they are paying about 76 kwacha per month…Then, [at] communal taps where we are using bucket sales, that is a 20-litre bucket at 10 ngwee. So, depending on how much somebody's able to spend on water then they can get an equivalent of the buckets.'

– Lusaka Water and Sewerage Company Office Manager for George Compound

'In Chawama, we have fixed and there are some who are metered. So, now our programme is to meter everyone… People, they are hungry [for water connections]. The challenge is we need to do the network so that people have water… Otherwise we need to go on the ground. In this area, there's no water. In this area, there's water. And they are eager to pay.'

– Lusaka Water and Sewerage Company Engineer for Chawama Compound

'Collection of that waste became a problem. The companies would say "we are willing to collect but the community is not willing to pay". The community would say "we are willing to pay but the companies are not willing to collect". They would give us evidence, for example, to say, what they do is they…collect the money…and then they don't come to collect. So, what happens is they now opt for those who just pass with wheelbarrows. But where they take, they just transfer the problem from your place and push it to another place…there is a heap where the council will come and collect but people still go and heap there. So, there are such areas…and that is where the biggest issue is.'

– Environmental Health Technician at Kanyama Health Clinic

ISSUES OF VANDALISM

'We have an issue of vandalism…there's just some extent of vandalism especially where it concerns our communal taps. Sometimes when there's low pressure, sometimes the community takes matters in their own hands. They would think maybe by removing the meter the pressure would improve. So, that is giving us a lot of work because now we have to find materials, fittings to go and reinstall that meter.'

– Lusaka Water and Sewerage Company Office Manager for George Compound

'The major [challenge] is vandalism by community members. If I take you around the school you will find water is just running from the taps. Taps are bought 10 times or more in a year.'

– Guidance Teacher at Kanyama Primary School

Well-being

For Well-being, we find a negative impact in George (-3.44). The indicator for Health (-4.45) indicates a significant negative difference, largely because intervention group interviewees rated their overall health lower and reported more often that they in the past month they had felt so unwell that it interrupted their usual activities. The impact for Well-being (-4.26) is also negative in Chawama, but largely due to a large significant negative impact for Life Satisfaction (-12.50).

Table 6.4.6: Impact of the project on the Well-being dimension

	George Compound	Chawama Compound
Intervention group mean	59.86	67.55
Comparison group mean	63.29	71.81
Difference (Impact)	-3.44**	-4.26**
Standard error	(1.74)	(2.12)
Observations (intervention group)	150	151
Observations (total)	585	662

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

Well-being was a less common theme in the KIIs, except for education in terms of school absenteeism. Representatives from the schools explained that, in the cases of erratic water supply, girls and boys may stay away from school to collect water for household needs. Additionally, boys often miss school to gather water for vendors (to earn money). They said that even having relatively good facilities as the schools does not stop students from missing school due to water and sanitation issues in the community.

SCHOOL ABSENTEEISM

'There is erratic water supply in the community. For two or three days, some locations have dry taps. Pupils would be sent by their guardians, by their parents, to go fetch water from alternative sources. When they are sent, they could stay away from school on that day because they are tending to chores that day. Cases of absenteeism cannot be attributed to lack of water in the school because we usually have water. But it could be due to challenges they have in the community where they live. From experience, what I have seen, usually it is the boys who would want to stay away from school because some of them would go out to do some piece work. They draw water for [vendors]. They pay boys to go and draw water for them. It is usually on Mondays and Fridays when we have the open market days in Chawama. There are so many people that want to take advantage of this day, this open market. Some of our boys go to make some money.'

– Guidance Teacher at Chawama Primary School

'Absenteeism, our school is small compared to any school in our area. We have around 1,000 plus, in the morning we have around 700 and 700 in the afternoon. Absenteeism is around 10%, in a week. Challenges include distance, they are sent for businesses by their parents. The reasons are similar for both boys and girls. I'm inclined to say that absenteeism is increasing because of the population growing.'

– Guidance Teacher at Kanyama Primary School

The Environment

For The Environment in George (-8.77), the overall dimension is negative, along with two indicators – Water Safety (-11.86) and Waste Management (-14.40). Interviewees in the intervention group were less likely to report being aware of any of the following in their community: water safety plans, drainage plans, sanitation system monitoring, solid waste management plans or water use planning for domestic and productive demands.

In Chawama, we do not see a significant impact for The Environment overall, but Water Safety (-7.81) and Waste Management (-7.25) do show significant negative impacts. In the intervention group, interviewees were less likely to say their community has sanitation system monitoring or water use planning for multiple needs, such as domestic and productive uses.

Water safety is not a prominent theme in the KIIs, but there is some recognition that the current sanitation issues pose a threat to groundwater protection. Representatives from all three compounds did share details on water quality monitoring – recall that the project supported environmental health technicians (EHTs) in water quality testing, through training and provision of test kits – including working with equipment and protocols. On this point, we note a possible spillover effect – in the comparison area, they said they work together with George and Chawama for water quality monitoring because in Kanyama they do not have their own test kits.

Table 6.4.7: Impact of the project on the Environment dimension

	George Compound	Chawama Compound
Intervention group mean	32.67	42.53
Comparison group mean	41.43	46.88
Difference (Impact)	-8.77**	-4.35
Standard error	(3.72)	(3.11)
Observations (intervention group)	150	151
Observations (total)	585	662

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions.

WATER SAFETY AND WATER QUALITY MONITORING

'We are mindful that eventually there may be some form of contamination. For us, with the incoming of Lusaka Sanitation, we are so happy. Because at least we'll be able to protect our groundwater.'

– Lusaka Water and Sewerage Company Office Manager for George Compound

'We do [water quality monitoring] in all the zones through engagement with the community, we routinely carry out random water point sampling for bacteriological and chemical analysis. We take the samples to the food and drugs lab for analysis…the results take at least two weeks to get back because they do analysis for the whole of Zambia [everyone takes their samples there, so we must wait in line]. We do have the [equipment here at the clinic], but the challenge we've had to do our own analysis here is due to the media, the reagent. Chemical analysis is firstly pH and residual chlorine; sometimes we also check for contaminants such as zinc and lead.'

– Environmental Health Technician at George Health Clinic

'To start with, water quality monitoring, what is done at the moment. We usually go in the community visiting the water sources that we have, where people have access to water. Then, the monitoring that is done there, we have gadgets that we usually use, we have a digital one which just measures chlorine residual. Then we use the Lovibond also to also check for chlorine residual as well as the pH. For suspected water points that could have been contaminated…we also use the H_2S kits...[if it is turned, we do further analysis]. Even before we receive the results, there are actions that are put in place that we take. We sensitise [those] accessing the water point, giving them health education, not only that, we provide chlorine to them [and] emphasise the point whereby in a situation where they don't have chlorine they have to boil water.'

– Environmental Health Technician at Chawama Health Clinic

'We don't have [our own laboratory]. But then we have sister facilities, like George and Chawama, that have portable labs…we can go and test within their clinic just to see if water is safe. This we do routinely. Because we cannot know at what point water will be contaminated. So, it's more like a routine.'

– Environmental Health Technician at Kanyama Health Clinic

6.5 DIFFERENTIAL IMPACTS BY SUBGROUP

We used PS-weighting with an interaction term to check for differential impacts by subgroup, to understand who may have experienced the effects of the project more or less (more details are provided in Appendix 3). In this section, we look at impact in terms of the Sustainable Water and Sanitation Index for three subgroups – (1) by interviewee gender, (2) by whether households have disabled or chronically ill members and (3) by home ownership status. For each subgroup, summary results are provided by compound below. Differential impacts are highlighted in blue.

First, we looked at the results by gender – do women and men experience impacts differently? In both George and Chawama, 51% of interviewees were women. In Table 6.5.1, we see that women have lower average Sustainable Water and Sanitation scores than men, irrespective of the project. In George, the impact of the project was significantly different for men (-12.10) and women (-6.34; not shown in table), mainly due to significantly more negative impacts for men in terms of Water Security and Well-being. In Chawama, we do not see a significant difference between women and men for the Sustainable Water and Sanitation Index overall, but we do for **Operations**, for which men did not experience a significant impact but women did (-6.35).

Table 6.5.1: Impact of the project by interviewee gender

Sustainable Water and Sanitation Index	George Compound	Chawama Compound
Effect of being a woman in the comparison group	-3.87* (2.11)	-2.19 (2.38)
Project impact for men	-12.10*** (1.92)	1.81 (1.95)
Differential project impact for women and men	5.76** (2.67)	-1.58 (2.93)

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions. Standard errors are in parentheses.

Next, we reviewed how vulnerable groups, namely those with disabilities or chronic illnesses, have been impacted by the project. Our data are insufficient to consider only households that reported this directly because the subgroup is too small (less than 2% of households). Instead, we formed subgroups based on households reporting that (1) 80% or more members are 'fit for work' or (2) fewer than 80% are. 'Fit for work' is indicated by interviewees for all household members over the age of five when asked whether they are 'fit and able to do domestic or livelihood work now if they wanted to?' We consider 'not fit for work' as a proxy for disability, recognising it an imperfect measure.

In George 38% of interviewees reported less than 80% of household members are fit to work, while in Chawama 44% did. In Table 6.5.2, we do not find differences between the two subgroups in the comparison group for Sustainable Water and Sanitation Index scores. We do see a significant negative impact in George and positive impact in Chawama, among households having members with a disability. In George, the negative impact is not significantly different between subgroups. However, in Chawama, we do find a significant differential impact. It shows that the impact among households that do not have members with a disability experienced a negative impact (-2.66) for Sustainable Water and Sanitation. The results suggest this is largely due to negative impacts for Water Security, Institutions and Well-being for this subgroup.

Table 6.5.2: Impact of the project by whether any household members have a disability

Sustainable Water and Sanitation Index	George Compound	Chawama Compound
Effect of having household members with a disability in the comparison group	0.81 (1.99)	2.13 (2.04)
Project impact among households having members with a disability	-11.02*** (1.98)	5.63*** (2.18)
Differential project impact for households with or without members with a disability	3.11 (2.52)	-8.29*** (2.81)

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions. Standard errors are in parentheses.

Finally, we looked for differential impact by home ownership status. We expected that homeowners could experience their water and sanitation situation differently than tenants (e.g., renters, caretakers), largely due to differing levels of autonomy with regard to altering their water connections and sanitation facilities. The KIIs described further some of the differences between homeowners and tenants, highlighting them as key subgroups in this context.

HOMEOWNERS AND TENANTS

'Most people here are tenants with landlords. The landlords stay longer, but the tenants come and go.'

– Ward Development Committee Representative in Chawama Compound

'At a household- or property-level, we are having a situation now where at a plot you have more than one household. That's a typical arrangement. Initially, of course, we would have two, three, and the like. But this time you will find so many rooms. And all those want water, individually. So, there's a growing demand for water, and also the infrastructures remain the same. Of course, we've added two boreholes, but that cannot really meet the growth in population and subsequently the demand for water.'

– Lusaka Water and Sewerage Company Office Manager for George Compound

In George 53% were tenants, while in Chawama 50% were tenants. In George, we see a significant positive difference for homeowners relative to tenants for Sustainable Water and Sanitation in the comparison group. We also see a negative project impact for tenants, but this impact is not significantly different from that of homeowners. In Chawama, we find no significant difference, impact or differential impact.

Table 6.5.3: Impact of the project by home ownership

Sustainable Water and Sanitation Index	George Compound	Chawama Compound
Effect of being a homeowner in the comparison group	3.53* (1.98)	-0.38 (1.86)
Project impact among tenants	-8.11*** (1.71)	-0.34 (1.83)
Differential project impact for tenants and homeowners	-2.21 (2.53)	2.83 (2.55)

* p < 0.1, ** p < 0.05, *** p < 0.01; PSM estimates are bootstrapped with 1,000 repetitions. Standard errors are in parentheses.

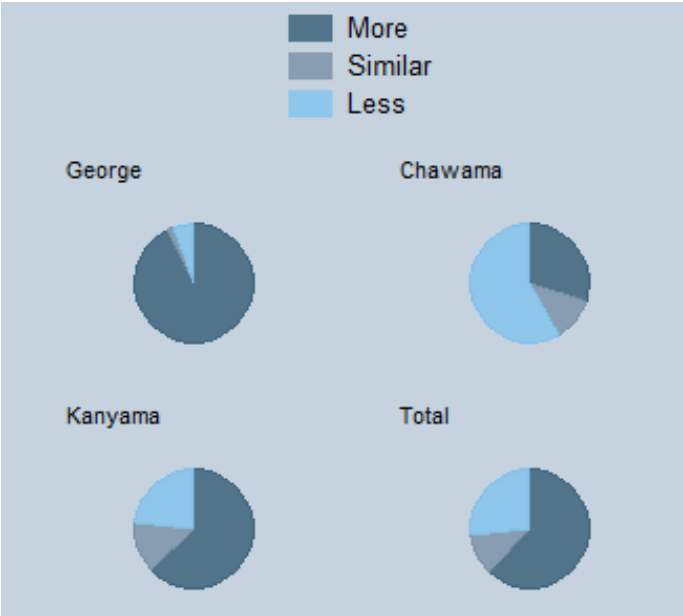
6.6 ON THE CHOLERA OUTBREAK

In this section, we further examine possible implications the 2018 cholera outbreak described in Section 4.1 for the results of this evaluation. Despite efforts to account for the outbreak and subsequent response throughout every stage from design to data gathering to analysis, we cannot rule out the possibility that the results may be biased. It is clear that both before and after the project, the water and sanitation situation in George was worse than that of Kanyama, which was in turn worse than Chawama.

In George, people were much more likely to say that the 2018 cholera outbreak affected them more than previous cholera outbreaks, while those in Chawama were more likely to say that it affected their household the same or less. The comparison area, Kanyama, was somewhere in between. This is illustrated in Figure 6.6.1. Not surprisingly, this trend correlates with what we noted regarding the water and sanitation situations in these communities. These data mostly align with information reported by WHO Africa and the CDC (see Section 4.1), both in terms of the number of cases observed (more in George and Kanyama) and vaccination rates (higher in Chawama and Kanyama).

To some extent, the severity of the cholera outbreak in each intervention community links to the *sustainability* of any impacts achieved by the end of the project in 2017 – more sustainable in Chawama, less sustainable in George. The KIIs also confirm the severity of the outbreak, with more challenges being described by institutional representatives in George and Kayama, relative to those in Chawama.

Figure 6.6.1: How much households were affected by the 2018 cholera outbreak compared to previous outbreaks (descriptive only, before matching)



IN THE WAKE OF THE CHOLERA EPIDEMIC

'In the wake of the cholera epidemic, we purchased an online chlorinator, it's installed, it's working. We purchased hand washing facilities, which are dotted around the school. We have integrated health hygiene into our lessons, a deliberated programme.'

– Guidance Teacher at Chawama Primary School

'As you are aware, in January we had an outbreak. This year we had an outbreak which almost hammered us too much. I would say that outcome was being seen because of activities which were being undertaken, because we had a lot of cases from January and February. But as we continued with the same activities we were doing with the community, you could see the decline of cases. They declined up to the declaration that there was no outbreak of cholera any more. As of now, I can say that we've got a rise again. There's that rise which is now spiking…you might give the health education, again it goes back to the community – if they see [the cholera outbreak is over], everyone now becomes reluctant, but us we have not relaxed, we have still continued with the same impact.'

– Environmental Health Technician at George Health Clinic

'Remember we had the dry spell for five years, from 2010 up until 2016. The last outbreak was in 2010 or 2011. So, after that it was dry, there was no cholera case recorded in Lusaka. And so, people got used to drinking water from shallow wells and the situation from the taps worsened. There was a situation where people would line up at 6:00 and after 10:00 the taps were closed. Then they come and open again at 14:00, by 16:00 or 17:00 it's closed. What of those who go for working? Where will they get the water from? They needed water. So, a lot of people opted for these [shallow] wells.'

– Environmental Health Technician at Kanyama Health Clinic

7 CONCLUSIONS

7.1 CONCLUSIONS

Overall, the project had mixed impacts that varied by compound, gender and disability. The project had a negative impact in George Compound for the Sustainable Water and Sanitation Index (-8.62, $p<0.01$; worse for men than women) and Water Insecurity (HWISE; 6.34, $p<0.01$); no significant impact on water and sanitation access is observed. On the other hand, in Chawama, we find the project had a positive impact on access to piped water on premises (4.42, $p<0.1$) and improved sanitation (8.95, $p<0.01$). Despite this, we do not see a significant impact on the Sustainable Water and Sanitation Index overall (although several significant impacts are observed among the dimensions and indicators, and there is a significant positive impact among households having members with a disability) and we find a significant negative impact on Water Insecurity (HWISE; 2.03, $p<0.05$).

Throughout this report, tangible and intangible impacts are combined in the indicators and dimensions of the Sustainable Water and Sanitation Index (see Table 7.1.1). Both the aspects are important for measuring this concept, to capture differences ranging from access to infrastructure to personal experiences and opinions. Physical infrastructure alone does not tell the whole story because that system may not work for everyone all the time. Personal experiences and opinions are key to understanding how people are really affected and what factors are contributing the sustainability of water and sanitation systems.

Table 7.1.1: Example tangible and intangible aspects of the Sustainable Water and Sanitation Index dimensions and indicators

Dimension	Tangible Aspects	Intangible Aspects
Water Security 	Water service interrupted or limited (low water pressure, less water than expected), not enough water for drinking, food preparation, washing (hands, body, clothes, etc.)	Worrying, feeling angry, ashamed, excluded, stigmatized because of problems with water
Equity 	Women and men equally share responsibilities for water collection and unpaid care work related to water (not measured in this evaluation)	Services are perceived to be equally inclusive for diverse groups (for women and men, young and old, people with disabilities)
Institutions 	Access to information, taking action to hold the government and service providers to account for water and sanitation systems and services	Confidence in holding the government and service providers to account, transparency of decision-making process, trust in institutions
Operations 	Infrastructure access (type and location), existence of a water and sanitation committee, calculation of household expenses on water and sanitation	Feeling safe accessing infrastructure, confidence in the water and sanitation committee to carry out duties (O&M, repairs, replacements), opinions service pricing and affordability
Well-Being 	Incidence of health problems (diarrhoea, fever, cholera, etc.), school attendance of children	Life satisfaction, feeling stressed, subjective health
The Environment 	Existence of water safety and waste management plans (not measured in this evaluation), household water conservation and source protection practices	Implementation and awareness of community water safety and waste management plans

This distinction between the tangible and intangible also helps with interpreting the impact of the project. Most negative impacts are related to the intangible – worry and anger due to problems with water, opinions about equity, confidence, satisfaction, trust, opinions on affordability and fairness of pricing, feeling safe and subjective health. Meanwhile, we see little to no impact on tangible aspects – water fee structure (including options for those who cannot pay), proportion of monthly expenses going to water, sanitation and health, types of water and sanitation services and systems used, physical terrain between the household and the water source, hours of access per day, incidence of specific health issues, school attendance and measures taken to conserve and protect water resources. This distinction is more apparent in George, where we see more negative impacts, than in Chawama, where we see more positive impacts.

The KIIs highlight the role of specific project activities, such as water quality monitoring and CBEs. For example, there is evidence that water quality monitoring is continuing and that the comparison area – Kanyama – is also benefiting by occasionally borrowing the water quality monitoring kits provided in George and Chawama. As for the CBEs, some are still active, but not as active as they used to be during the project. Some CBEs are mentioned as still working with the Lusaka Water and Sewerage Company. At the same time, concerns were raised about solid waste management CBEs, some of which were said to not be disposing of waste properly. Overall, water systems and services were described as making good progress, with plans already underway to resolve issues such as intermittent water supply. However, sanitation remained an immense challenge, with clarity on how to set up safe, equitable and effective solid waste management systems still lacking.

In Chawama, the results are relatively straightforward – the project achieved several positive impacts, although alongside some negative impacts. On the other hand, in George, the mostly negative results may reflect increased awareness of water and sanitation issues among residents and subsequent frustration with seeing little progress made to remedy those issues. It is possible for mobilization to lead to negative results if residents are not listened to, or if those listening have little power to make real changes in their communities – a power analysis would help to illuminate such disconnects between the residents and duty bearers, extending beyond the compound to district and national levels as well (Hopkins, Brady & Brownlie, 2014).

7.2 PROGRAMME LEARNING CONSIDERATIONS

Consider conducting a power analysis during programme design and regularly revisit it during implementation

Based on the mixed impacts found through this evaluation– the same approach worked relatively well in Chawama but not in George – future programmes could use a power analysis as the basis for further tailoring project designs to specific populations and local structures. A power analysis should be done for each community, to understand the of centres of power both inside and outside that community (e.g., district and national level) and how these power relations might alter project effectiveness. Regular reflections on this analysis should be done with a broad cross-section of the community. Based on these reflections, the power analysis can evolve (and strategies may need to change) over time as power structures (hopefully) change throughout the course of the project.

Based on the findings in this evaluation, reflect on mobilization strategies

While the project activities were the same in George and Chawama, mobilization appears to have been more successful in Chawama because the project was able to work through established local-level structures. In George, local-level structures had to be set up as part of the project (e.g., Ward Development Committees – WDCs). The maturity of these local structures likely influenced the impact of the project in each compound.

Also, based on the low levels of project exposure seen in this evaluation, the project could have looked for additional ways to connect with more community members more often. Linking to the first recommendation above, mobilization can also be part of the power analysis. For example, look for ways to further develop mobilization strategies that account for how project implementation may be affected by differences in existing community structures.

When shifting from rural to urban WASH programming, build in training opportunities for staff to adapt their skills

This project was a first attempt at urban WASH programming in Lusaka. Together, Oxfam and Village Water Zambia (implementing partner) had successfully carried out various rural WASH projects in the past. Transitioning this work to an urban environment was both a new and different challenge, as well as a learning experience. Communities within peri-urban Lusaka can have very different experiences when it comes to water and sanitation systems and services.

Understanding this reflects a need for further training for staff when transitioning from rural to urban WASH programming, to improve knowledge and skills for working in such a different context. With shifts from rural to urban accelerating in the sector, driven at least in part by increasing urbanization, strategies are often being adapted from rural to urban contexts. In this process, ensure that training opportunities for staff are built in early on so they can adapt and learn about aspects that differ between rural to urban WASH programming.

APPENDIX 1: DETAILED INDICATORS, QUESTIONS, AND THRESHOLDS

The following set of tables provide the detailed indicators, questions, and thresholds for each dimension of the Sustainable Water and Sanitation Index. The table also shows if each indicator is directly (highlighted in green) or indirectly (highlighted in yellow) linked to the Urban WASH project's Theory of Change (ToC).

Table A1.1: Water Security dimension = Water Security indicator

Indicator	Variable	Question	Threshold	ToC link?
Water Security (Average of 15 variables x 100)	*hwise1_i*	In the last month, how frequently did you or anyone in your household worry you would not have enough water for all of your household needs?	Never = 1 Rarely to Always = 0	Indirect
	hwise2_i	In the last month, how frequently has your main water source been interrupted or limited (water pressure, less water than expected, dried up)?		
	hwise3_i	In the last month, how frequently has there not been enough water to wash clothes?		
	hwise4_i	In the last month, how frequently has you or anyone in your household had to change schedules or plans due to problems with your water situation? Activities that may have been interrupted include caring for others, doing household chores, agricultural work, income generating activities, etc.		
	hwise5_i	In the last month, how frequently have you or anyone in your household had to change what was being eaten because there were problems with water (for washing foods, cooking)?		
	hwise6_i	In the last month, how frequently have you or anyone in your household had to go without washing hands after dirty activities (defecating or changing diapers, cleaning animal dung) because of problems with water?		
	hwise7_i	In the last month, how frequently have you or anyone in your household had to go without washing their body because of problems with water (not enough water, dirty, unsafe)?		
	hwise8_i	In the last month, how frequently has there not been as much water to drink as you would like for you or anyone in your household?		
	hwise9_i	In the last month, how frequently did you or anyone in your household feel angry about your water situation?		
	hwise10_i	In the last month, how frequently have you or anyone in your household gone to sleep thirsty because there wasn't any water to drink?		
	hwise11_i	In the last month, how frequently has there been no usable or drinkable water whatsoever in your household?		
	hwise12_i	In the last month, how frequently have problems with water caused you or anyone in your household to feel ashamed, excluded, and/or stigmatized?		
	hwise13_i	In the last month, how frequently have you or anyone in your household drunk water that looked, tasted, and/or smelled bad?		
	hwise14_i	In the last month, how frequently have you or anyone in your household drunk water that you thought was unsafe?		
	hwise15_i	In the last month, how frequently have you or anyone in your household been unable to access the water that you preferred?		

Table A1.2: Equity dimension = (Gender Inclusive indicator + Inclusive of Vulnerable Users indicator)/2

Indicator	Variable	Question	Threshold	ToC link?
Gender Inclusive (Average of 3 variables x 100)	*womanleaders*	Which of the two statements do you agree with most: 1 – A woman can be a leader in making decisions for water and sanitation in my community. 2 – Men are by nature better leaders than women when it comes to making decisions about water and sanitation in my community.	Option 1 = 1 Option 2 = 0	Direct
	equalwat_gender	The water needs of people of all genders are being met.	True = 1 False = 0	
	equalsan_gender	The sanitation needs of people of all genders are being met.		
Inclusive of Vulnerable Users (Average of 5 variables x 100)	*pwdleaders*	Which of the two statements do you agree with most: 1 – A person with a disability can be a leader in making decisions for water and sanitation in my community. 2 – A person with a disability is not able to be a leader when it comes to making decisions about water and sanitation in my community.	Option 1 = 1 Option 2 = 0	Direct
	equalwat_disability	The water needs of people with disabilities and/or chronic illnesses are being met.	True = 1 False = 0	
	equalsan_disability	The sanitation needs of people with disabilities and/or chronic illnesses are being met.		
	equalwat_children	The water needs of children are being met.		
	equalsan_children	The sanitation needs of children are being met.		

Table A1.3: Institutions dimension = (Accountability indicator + Transparency indicator + Enabling Environment indicator + Trust indicator)/4

Indicator	Variable	Question	Threshold	ToC link?
Accountability (Average of 3 variables x 100)	*holdacc_idea*	What do you think you can you do to hold the government and service providers accountable for water and sanitation services?	At least one idea = 1 Don't know/Not sure = 0	Direct
	holdacc_conf	How confident do you feel about your ability to hold the government and service providers accountable for water and sanitation services?	Very/somewhat confident = 1 Not confident = 0	
	holdacc_yn	Have you done anything in the past year to try to hold the government and service providers accountable for water and sanitation services?	Yes = 1 No = 0	
Transparency (Average of 8 variables x 100)	*info_yn*	Do you get any information about the management of your water and/or sanitation systems?	Yes = 1 No = 0	Direct
	concern_yn	Do you know who you can go to if you have questions or concerns about your water and/or sanitation systems?		
	watdecision_who	Do you know who makes the decisions about your water services/systems?		
	watdecision_how	Do you understand how decisions are made for your water services/systems?		
	sandecision_who	Do you know who makes the decisions about your sanitation services/systems?		
	sandecision_how	Do you understand how decisions are made for your sanitation services/systems?		
	decision_satisfaction	Overall, how satisfied are you with how decisions are made for your water and sanitation services/systems?	Very/Somewhat satisfied = 1 Very/Somewhat dissatisfied = 0	
	decision_yourneeds	How much do you think that your needs and opinions are accounted for in decisions about your water and sanitation systems?	A lot/Somewhat = 1 Not at all/Just a little = 0	
Enabling Environment (Average of 3 variables x 100)	*businessowner*	Household reported that they earned income from their own business during the past 12 months (1 year).	Yes = 1 No = 0	Direct
	businessstarter	Household reported that they earned income from their own business during the past 12 months (1 year), but they did not report earning any income from this source in 2012.		
	investment	Have you or any member of your household made any big investments of more than 2,000 kwacha in the past year (for example, to build a latrine or buy a booth)?		
Trust (Average of 9 variables x 100)	*trust1*	How much would you say you trust: Local Government/Lusaka City Council (LCC)?	A lot/Somewhat = 1 Not at all/Just a little/No opinion = 0	Direct
	trust2	How much would you say you trust: Ward Development Committee (WDC).		
	trust3	How much would you say you trust: Central Government (national).		
	trust4	How much would you say you trust: Water and sanitation service providers.		
	trust5	How much would you say you trust: Property owner (landlord/landlady).		
	trust6	How much would you say you trust: Non-governmental organizations (NGOs)		
	trust7	How much would you say you trust: Community-based organizations (CBOs)		
	trust8	How much would you say you trust: Community-based enterprises (CBEs).		
	trust9	How much would you say you trust: Area Councillor.		

Table A1.4: Operations dimension = (Asset Management indicator + Financial Viability indicator + Accessibility indicator)/3

Indicator	Variable	Question	Threshold	ToC link?
Asset Management (Average of 12 variables x 100)	*committeestructure*	How are water and sanitation committees structured in your community?	Structure known = 1 Don't know/N/A = 0	Direct
	confident1	How confident are you in the capacity of this committee or group to manage routine operation and maintenance of water systems within your community?	Very/somewhat confident = 1 Not confident or No opinion = 0	
	confident2	How confident are you in the capacity of this committee or group to manage routine operation and maintenance of sanitation/sewerage systems within your community?		
	confident3	How confident are you in the capacity of this committee or group to manage major repairs to water systems when broken down within your community?		
	confident4	How confident are you in the capacity of this committee or group to manage major repairs to sanitation/sewerage systems when broken down within your community?		
	confident5	How confident are you in the capacity of this committee or group to manage a full replacement of water systems if the current systems cannot be repaired within your community?		
	confident6	How confident are you in the capacity of this committee or group to manage a full replacement of sanitation/sewerage systems if the current systems cannot be repaired within your community?		
	confident7	How confident are you in the capacity of this committee or group to manage management of water systems through a crisis, shock or disaster within your community?		
	confident8	How confident are you in the capacity of this committee or group to manage management of sanitation/sewerage systems through a crisis, shock or disaster within your community?		
	waterbd_alt	What water source does your household use most often for drinking water when your primary drinking water source is not functioning or is inaccessible?	Piped/improved = 1 Unimproved = 0	
	sanbd	How often does it happen that you cannot use your main toilet/facility/place because it does not function properly?	Never/Almost never = 1 Annually to Daily = 0	
	sanbd_alt	What type of sanitation facilities do members of your household use most often when your main toilet/facility/place is not functioning or is inaccessible?	Closed pit/flush toilet = 1 Open pit/none = 0	
Financial Viability (Average of 13 variables x 100)	*watfeestruct*	What is the fee structure for your primary drinking water source?	Fixed or variable = 1 Irregular or free = 0	Indirect
	sanfeestruct	What is the fee structure for your primary sanitation services (such as pit emptying costs)?		
	watfeeopt_yn	Do you know of any options for those who are not able to pay (for water)?	Yes = 1 No = 0	
	sanfeeopt_yn	Do you know of any options for those who are not able to pay (for sanitation)?		
	watpayment	How difficult is process of paying for water?	Not difficult at all = 1 Very/somewhat difficult = 0	
	sanpayment	How difficult is the process of paying for your sanitation facility/toilet/service?		
	expense_wat	Calculation of how much the household spends on water (fees, bottled water, chlorine, etc.), as a percentage, based on an accounting of monthly expenses.	<=5% of total = 1 >5% of total = 0	
	expense_san	Calculation of how much the household spends on sanitation and personal hygiene (toilet, soap, etc.), as a percentage, based on an accounting of monthly expenses.		

	watafford	In the past month, how difficult has it been for your household to come up with the money to pay for water?	Not difficult at all = 1 Very/somewhat difficult = 0	
	sanafford	In the past month, how difficult has it been for your household to come up with the money to pay for sanitation?		
	watpricing	Do you think your water service is fairly priced?	Completely/Somewhat fair = 1 Completely/Somewhat unfair = 0	
	sanpricing	Do you think your primary sanitation facility/toilet/service is fairly priced?		
	sanplans	Are you planning and/or saving up now to upgrade/improve your sanitation facility/toilet/service in the next 6 months?	Yes = 1 No = 0	
Accessibility (Average of 20 variables x 100)	*watsources*	Can you please list all the water sources that your household uses for all purposes during the DRY season?	2 or more improved sources = 1 1 or 0 improved sources = 0	Indirect
	waterdry	How do you primarily access water for drinking now during the dry season?	Piped/Improved = 1 Unimproved = 0	
	waterwet	How do you primarily access water for drinking now during the wet season?		
	waterdom	How do you primarily access water for other domestic purposes during the dry season?		
	sanfac	What type of sanitation facilities do members of your household use most often now?	Closed pit/flush toilet = 1 Open pit/none = 0	
	watsourceofficial	Is your primary drinking water source during the dry season an official/government service?	Yes = 1 No = 0	
	sanofficial	Do you use any official/government sanitation facilities or services?		
	watsource_sp	Is your primary drinking water source during the dry season private, only for your household, or is it shared?	Private = 1 Shared = 0	
	san_sp	Is the main toilet/facility/place you use private, only for your household, or is it shared?		
	watsourceloc	During the dry season, where is your primary drinking water source located?	In house/On plot = 1 Off plot = 0	
	sanloc	Where is your main toilet/facility/place located?		
	watsourcetime	How long does it take to collect water from this source, including walking and any time spent waiting?	<=10 minutes = 1 >10 minutes = 0	
	santime_walk	How long does it take to walk (to your main sanitation facility)?	<=5 minutes = 1 > 5 minutes = 0	
	watsourceterrain	During the dry season, what is the terrain like on the way to and from your primary drinking water source?	Easy/N/A = 1 Very/Somewhat difficult = 0	
	wateraccess	During the dry season, when everything with the water system is functioning properly, how many hours per day are members of your household able to access your main drinking water source?	24 hours = 1 <24 hours = 0	
	sanaccess	When everything with the toilet/facility is functioning properly, how many hours per day are members of your household able to access it?		
	watsourcesafegoing	Do you feel safe and secure when you are going to and from this water source?	Yes/ N/A = 1 No = 0	
	watsourcesafeusing	Do you feel safe and secure while you are at this water source (while you are using it)?		
	sansafegoing_day	Do you feel safe when you are going to and from your main toilet/facility/place during the day?		
	sansafegoing_night	Do you feel safe when you are going to and from your main toilet/facility/place at night?		

Table A1.5: Well-being dimension = (Life Satisfaction indicator + Health indicator + Education indicator)/3

Indicator	Variable	Question	Threshold	ToC link?
Life Satisfaction (lifesatisfaction x 100)	*lifesatisfaction*	Overall, how satisfied are you with life these days?	Very/Somewhat satisfied = 1 Very/Somewhat dissatisfied = 0	Indirect
Health (Average of 7 variables x 100)	*health*	Overall, how would you describe your state of health now?	Very good/Good = 1 Very poor/Poor = 0	Direct
	stomachpain	In the last 30 days (1 month), have you had any stomach pain (excluding menstrual pain, for women)?	No = 1 Yes = 0	
	fever	In the last 30 days (1 month), have you had a fever?		
	diarrhoea	I'm sorry to have to ask this, but in the last 30 days (1 month), have you had any diarrhoea?		
	unwell	In the last 30 days (1 month), have you felt so unwell that you had to interrupt your normal daily activities (excluding menstrual pain, for women)?		
	cholera	Thinking back to the most recent cholera outbreak earlier this year, were any members of your household directly affected?		
	choleracompare	How much did this cholera outbreak affect your household compared to other outbreaks in the past?	Less/The same = 1 More = 0	
Education (Average of 2 variables x 100)	*schoolnow*	Are all school-aged children in the household attending school? (calculation)	Yes = 1 No = 0	Direct
	absencewatsan	Have any school-aged children in the household missed school in the past 1 month due to water and sanitation related issues? (calculation)	No = 1 Yes = 0	

Table A1.6: The Environment dimension = (Water Safety indicator + Waste Management indicator + Water Conservation indicator)/3

Indicator	Variable	Question	Threshold	ToC link?
Water Safety (Average of 2 variables x 100)	*environment1*	The government or another committee monitors water systems in my community to ensure water is safe to drink.	True = 1 False/Don't know = 0	Direct
	environment2	The government or another committee has water safety plans to protect drinking water sources in my community from contamination.		
Waste Management (Average of 3 variables x 100)	*environment3*	The government or another committee has drainage plans to protect my community from flooding.	True = 1 False/Don't know = 0	Direct
	environment4	The government or another committee monitors sanitation systems in my community to ensure wastewater/sewage is safely managed.		
	environment5	The government or another committee has solid waste management plans to keep my community clean from refuse.		
Water Conservation (Average of 3 variables x 100)	*environment6*	The government or another committee has plans that account for the various uses of water, including domestic uses (within the household) and productive uses (agriculture, businesses, factories).	True = 1 False/Don't know = 0	Indirect
	waterconserve	What techniques does your household use to reduce the amount of water you use?	Any technique = 1 N/A = 0	
	waterprotect	What techniques does your household use to protect your primary water source from contamination?	Any technique = 1 N/A = 0	

APPENDIX 2: SUMMARY STATISTICS BEFORE MATCHING

For reference, Table A2.1 and Table A2.2 below show various summary statistics for George and Chawama, respectively. These data represent the sample before propensity score matching (PSM), but after filtering (data from households that had moved to the community less than two years before the survey were excluded, i.e., toward the end of the project or after it was over). In each table, the difference column indicates several significant differences between the intervention and comparison group before matching. The purpose of PSM is to balance these differences during analysis (see Appendix 3).

Table A2.1: Summary statistics before propensity score matching for George Compound (Intervention) and Kanyama Compound (Comparison)

Variable	Intervention group mean (George)	Comparison group mean (Kanyama)	Difference	Standard error
Interviewee is a woman (%)	50.64	53.21	-2.57	4.53
Interviewee age (years)	34.69	33.98	0.71	1.13
Interviewee completed secondary school (%)	38.46	48.57	-10.11*	4.51
Interviewee is married (%)	59.62	53.57	6.04	4.51
Interviewee participated in a group in 2012 (%)	35.90	56.07	-20.17***	4.47
HH head is a woman (%)	20.51	23.93	-3.42	3.82
HH head age (years)	42.26	40.29	1.97	1.17
HH head completed secondary school (%)	44.23	58.39	-14.16**	4.48
HH head is literate (%)	82.69	91.61	-8.91**	2.74
Number of HH members in 2012	4.18	3.64	0.54**	0.20
80%+ HH members over 5 years old fit to work (%)	81.16	74.99	6.17*	2.55
HH lived in the community in 2012	91.67	95.54	-3.87	2.03
HH owned their home in 2012 (%)	45.51	31.43	14.08**	4.28
HH earned income from salaried employment in govt in 2012	7.05	14.11	-7.06*	2.99
HH earned income from salaried employment in private sector and/or NGOs in 2012 (%)	20.51	28.04	-7.52	3.99
HH earned income from casual labour in 2012 (%)	33.97	35.18	-1.20	4.32
HH earned income from their own business in 2012 (%)	32.69	43.57	-10.88*	4.44
HH earned income from farming, agriculture, husbandry in 2012 (%)	11.54	9.82	1.72	2.74
HH earned income from remittances in 2012 (%)	10.90	16.79	-5.89	3.27
HH earned income from cross-border trading in 2012(%)	3.21	3.57	-0.37	1.66
HH was in the lowest 20% of wealth distribution in 2012 (%)	28.29	18.10	10.19**	3.66
HH was in the second lowest 20% of wealth distribution in 2012 (%)	19.08	21.15	-2.07	3.71
HH was in the second highest 20% of wealth distribution in 2012 (%)	18.42	20.43	-2.01	3.66
HH was in the highest 20% of wealth distribution in 2012 (%)	16.45	18.10	-1.65	3.50
Improved+ water source (dry season) in 2012 (%)	83.97	95.54	-11.56***	2.27
Improved+ water source (wet season) in 2012 (%)	83.33	95.18	-11.85***	2.33
Piped on premises (dry season) in 2012 (%)	19.23	33.04	-13.80***	4.12
Piped on premises (wet season) in 2012 (%)	19.23	33.21	-13.98***	4.13
Improved sanitation facility in 2012 (%)	38.71	71.43	-32.72***	4.18
Affected more by 2018 cholera outbreak than previous outbreaks (%)	92.95	61.96	30.98***	4.04
Observations	**716**			

+Improved water includes piped water on premises. * p < 0.1, ** p < 0.05, *** p < 0.01. Variables dated 2012 are estimates, based on recall data. Construction of the wealth index is described in Section 4.4.

Table A2.2: Summary statistics before propensity score matching for Chawama Compound (Intervention) and Kanyama Compound (Comparison)

Variable	Intervention group mean (Chawama)	Comparison group mean (Kanyama)	Difference	Standard error
Interviewee is a woman (%)	50.00	53.21	-3.21	4.46
Interviewee age (years)	36.53	33.98	2.55*	1.16
Interviewee completed secondary school (%)	43.83	48.57	-4.74	4.46
Interviewee is married (%)	50.00	53.57	-3.57	4.46
Interviewee participated in a group in 2012 (%)	61.73	56.07	5.66	4.41
HH head is a woman (%)	26.54	23.93	2.61	3.84
HH head age (years)	43.21	40.29	2.92*	1.16
HH head completed secondary school (%)	48.77	58.39	-9.63*	4.42
HH head is literate (%)	83.95	91.61	-7.66**	2.68
Number of HH members in 2012	3.94	3.64	0.30	0.20
80%+ HH members over 5 years old fit to work (%)	65.63	74.99	-9.36**	2.86
HH lived in the community in 2012	90.06	95.54	-5.47**	2.06
HH owned their home in 2012 (%)	51.85	31.43	20.42***	4.22
HH earned income from salaried employment in govt in 2012	12.35	14.11	-1.76	3.07
HH earned income from salaried employment in private sector and/or NGOs in 2012 (%)	38.89	28.04	10.85**	4.09
HH earned income from casual labour in 2012 (%)	43.21	35.18	8.03	4.30
HH earned income from their own business in 2012 (%)	45.68	43.57	2.11	4.43
HH earned income from farming, agriculture, husbandry in 2012 (%)	12.96	9.82	3.14	2.74
HH earned income from remittances in 2012 (%)	34.57	16.79	17.78***	3.56
HH earned income from cross-border trading in 2012(%)	4.32	3.57	0.75	1.69
HH was in the lowest 20% of wealth distribution in 2012 (%)	14.29	18.10	-3.81	3.38
HH was in the second lowest 20% of wealth distribution in 2012 (%)	15.53	21.15	-5.62	3.57
HH was in the second highest 20% of wealth distribution in 2012 (%)	20.50	20.43	0.07	3.61
HH was in the highest 20% of wealth distribution in 2012 (%)	31.06	18.10	12.96***	3.62
Improved+ water source (dry season) in 2012 (%)	100.00	95.54	4.46**	1.62
Improved+ water source (wet season) in 2012 (%)	98.77	95.18	3.59*	1.75
Piped on premises (dry season) in 2012 (%)	53.09	33.04	20.05***	4.26
Piped on premises (wet season) in 2012 (%)	54.32	33.21	21.11***	4.26
Improved sanitation facility in 2012 (%)	73.46	71.43	2.03	4.02
Affected more by 2018 cholera outbreak than previous outbreaks (%)	29.01	61.96	-32.95***	4.28
Observations	**722**			

+Improved water includes piped water on premises. * p < 0.1, ** p < 0.05, *** p < 0.01. Variables dated 2012 are estimates, based on recall data. Construction of the wealth index is described in Section 4.4.

APPENDIX 3: PROPENSITY SCORE MATCHING METHODOLOGY

The results presented in Section 6 of this report have been estimated using propensity score matching (PSM). PSM is a statistical technique that allows the effect of an intervention to be estimated by accounting other factors that predict receiving the intervention, or 'treatment'. The idea behind PSM is to match households in the intervention group to similar households in the comparison group, based on baseline characteristics. After each participant is matched with a non-participant, the average treatment effect on the treated (those who benefited from the intervention) is equal to the difference in average outcomes of the intervention and the comparison groups after project completion. This appendix describes and tests the specific matching procedure employed in this evaluation. The approach follows the guidance provided by Caliendo and Kopeinig (2008).

Estimating propensity scores

Finding an exact match for treated households, based on various baseline characteristics, is very hard to implement in practice. Rosenbaum and Rubin (1983) demonstrate that a 'propensity score' can summarize all this information in one single variable. The propensity score is defined as the conditional probability of receiving the intervention given background variables. Specifically, propensity scores are calculated using a statistical probability model (e.g., probit or logit) to estimate the probability of participating in the project based on a set of characteristics.

Table A3.1 shows the variables used to estimate the propensity score in this report, alongside marginal effects at the mean, standard errors and p-values by compound. Note that the propensity score could not be calculated because of one or more missing values for 14 households (six comparison, eight intervention – four each from George and Chawama). Following Caliendo and Kopeinig (2008), only variables that influence the participation decision, but which are not affected by participation in the project, have been included in the matching model. In the table, the dependent variable corresponds to whether the household received the intervention (i.e., it is equal to 1 if the household participated in the project, and 0 otherwise). The coefficients in the table correspond to the marginal effects, which are the change in the probability of receiving the intervention if the independent variable is increased by one.

Defining the region of common support

After estimating the propensity scores, it is necessary to verify that potential matches exist for the observations in the intervention group with those from the comparison group – checking that there is *common support*. The area of common support is the region where the propensity score distributions of the intervention and comparison groups overlap. The common support assumption ensures that each 'treatment [intervention] observation has a comparison observation "nearby" in the propensity score distribution' (Heckman, LaLonde & Smith, 1999). Figure A3.1 shows the propensity score density plots for both groups. It can be observed that, although the distributions of propensity scores are clearly different between the intervention and comparison groups in each case, there is a reasonably good area of overlap between the groups. However, in constructing the model for household-level outcomes for George, two intervention and 119 comparison observations were dropped for lacking suitable matches. Similarly, in the matching process for Chawama, seven intervention and 43 comparison observations were dropped.

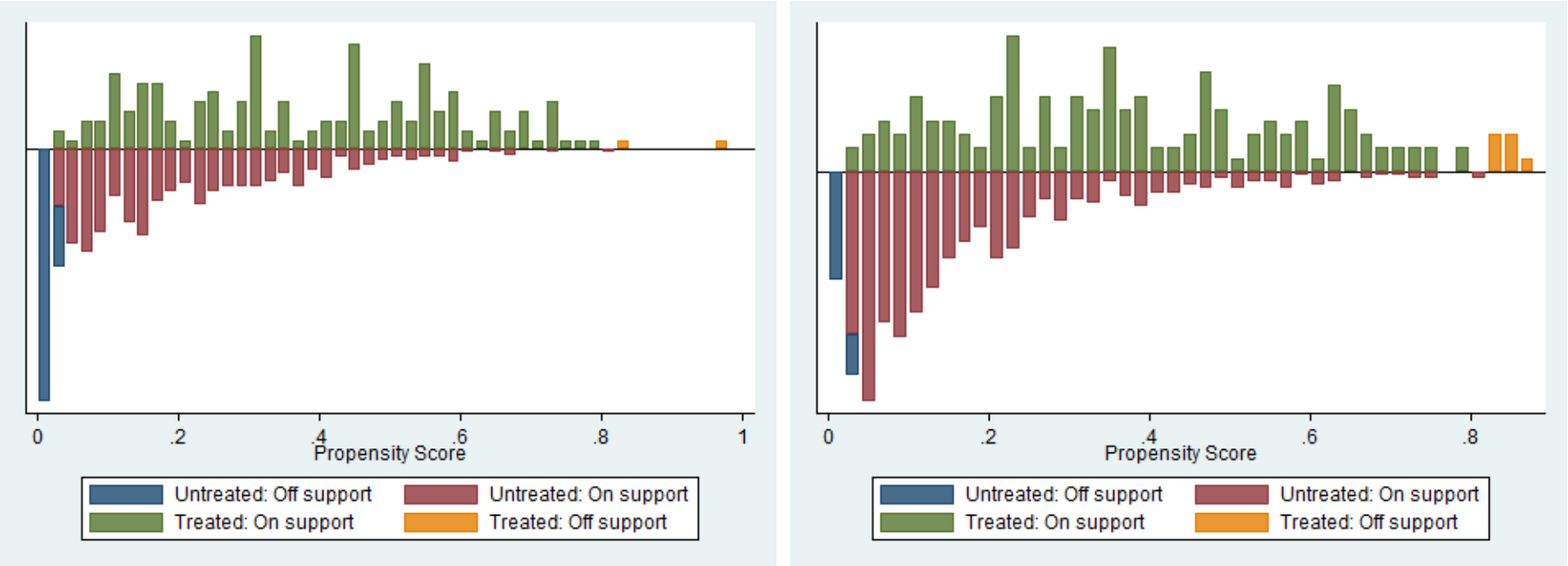
Table A3.1: Variables used for propensity score matching with marginal effects, standard errors, and p-values, by intervention compound

Variable	Intervention Group: George Compound			Intervention Group: Chawama Compound		
	Marginal effect	Standard error	p-value	Marginal effect	Standard error	p-value
Interviewee is a woman	0.00	0.03	0.98	-0.01	0.03	0.77
Interviewee age (years)	-0.00	0.00	0.44	-0.00	0.00	0.89
Interviewee completed secondary school	0.02	0.04	0.59	-0.02	0.04	0.61
Interviewee is married	0.03	0.04	0.40	0.06	0.04	0.11
HH head is a woman	-0.02	0.04	0.71	-0.01	0.04	0.78
HH head age (years)	0.00	0.00	0.95	0.00	0.00	0.72
HH head completed secondary school	-0.03	0.04	0.44	-0.05	0.04	0.28
HH head is literate	-0.08	0.06	0.17	-0.10	0.06	0.12
Number of HH members in 2012	0.02*	0.01	0.02	0.01	0.01	0.29
HH lived in the community in 2012	-0.28**	0.10	0.01	-0.24**	0.09	0.01
HH owned their home in 2012	0.09*	0.04	0.02	0.11**	0.04	0.01
80%+ HH members over 5 years old fit to work (%)	-0.00	0.03	0.92	0.04	0.03	0.17
HH earned income from salaried employment in govt in 2012	-0.02	0.05	0.64	-0.10**	0.03	0.01
HH earned income from salaried employment in private sector and/or NGOs in 2012	-0.02	0.03	0.61	0.11**	0.04	0.01
HH earned income from casual labour in 2012	-0.03	0.03	0.41	0.03	0.03	0.39
HH earned income from their own business in 2012	-0.04	0.03	0.22	-0.00	0.03	0.96
HH earned income from farming, agriculture, husbandry in 2012	-0.00	0.05	0.96	0.01	0.05	0.90
HH earned income from remittances in 2012	0.01	0.05	0.77	0.14**	0.05	0.00
HH earned income from cross-border trading in 2012	0.10	0.11	0.37	-0.01	0.07	0.89
HH was in the lowest 20% of wealth distribution in 2012	0.05	0.05	0.38	0.07	0.06	0.29
HH was in the second lowest 20% of wealth distribution in 2012	-0.03	0.04	0.56	-0.02	0.05	0.72
HH was in the second highest 20% of wealth distribution in 2012	0.03	0.05	0.48	0.00	0.05	0.92
HH was in the highest 20% of wealth distribution in 2012	0.09	0.06	0.17	-0.02	0.05	0.72
Interviewee participated in a group in 2012	-0.08*	0.03	0.01	0.00	0.03	0.99
Main drinking water source (dry season) in 2012 (ordinal 0 - 2)	0.06	0.11	0.56	-0.04	0.10	0.70
Main drinking water source (wet season) in 2012 (ordinal 0 - 2)	-0.13	0.11	0.22	0.17	0.09	0.08
Improved sanitation facility in 2012	-0.20***	0.04	0.00	-0.00	0.04	0.98

2018 cholera outbreak effect vs. previous ones (ordinal 0 – 2)	-0.13***	0.02	0.00	0.13***	0.02	0.00
Observations	**706**			**712**		

* p < 0.1, ** p < 0.05, *** p < 0.01. Variables dated 2012 are estimates, based on recall data. Construction of the wealth index is described in Section 4.4. The dependent variable is binary, taking 1 for project participants, and 0 otherwise.

Figure A3.1: Common support histograms of propensity scores for intervention (Treated) and comparison (Untreated) households, by intervention compound with George and Kanyama on the left and Chawama and Kanyama on the right



Matching intervention households to comparison households

Following Rosenbaum and Rubin (1983), households are matched based on propensity scores using a kernel matching algorithm. Kernel matching assigns more weight to the closest comparison group observations that are found within a selected 'bandwidth'. Thus 'good' matches are given greater weight than 'poor' matches. The *psmatch2* module in Stata (Leuven & Sianesi, 2003) was used with a bandwidth of 0.06 and analysis was restricted to the area of common support. When using PSM, standard errors of the estimates were bootstrapped using 1,000 repetitions to account for additional variation caused by the estimation of the propensity scores.

Checking balance

For PSM to be valid, the intervention group and the matched comparison group need to be balanced. In other words, the intervention and comparison groups need to be similar in terms of their observed characteristics. The most straightforward method of doing this is to test whether there are any statistically significant differences in baseline covariates between both groups in the matched sample. The balance of each of the matching variables after kernel matching is shown by intervention compound in Table A3.2. There are no statistically significant differences between intervention and comparison in the matched sample for any of the matching variables (for either intervention compound). For all of these variables, the *p*-values for the difference in means tests are large, with the lowest value being 0.25 and most being more than 0.70. It can therefore be concluded in each case that a satisfactory match has been found for the intervention group in the sample, according to this set of matching variables.

Table A3.2: Variable balance check after propensity score matching

Variable	Intervention Group: George Compound			Intervention Group: Chawama Compound		
	Intervention group mean	Comparison group mean	p-value	Intervention group mean	Comparison group mean	p-value
Interviewee is a woman	0.51	0.55	0.41	0.51	0.53	0.73
Interviewee age (years)	34.58	34.53	0.97	35.91	34.5	0.37
Interviewee completed secondary school	0.38	0.34	0.5	0.44	0.44	1
Interviewee is married	0.59	0.65	0.25	0.50	0.46	0.42
HH head is a woman	0.21	0.17	0.33	0.28	0.29	0.84
HH head age (years)	42.15	41.3	0.57	42.87	41.83	0.51
HH head completed secondary school	0.44	0.42	0.67	0.50	0.51	0.83
HH head is literate	0.83	0.77	0.31	0.85	0.85	0.98
Number of HH members in 2012	4.19	4.1	0.70	3.95	3.87	0.75
HH lived in the community in 2012	0.93	0.95	0.25	0.91	0.91	0.91
HH owned their home in 2012	0.47	0.42	0.42	0.50	0.44	0.26

HH has at least 80% members over 5 years old fit to work	0.62	0.65	0.53	0.56	0.55	0.82
HH earned income from salaried employment in govt. in 2012	0.07	0.07	0.95	0.13	0.13	0.97
HH earned income from salaried employment in private sector and/or NGOs in 2012	0.21	0.18	0.45	0.38	0.39	0.76
HH earned income from casual labour in 2012	0.35	0.34	0.86	0.42	0.43	0.84
HH earned income from their own business in 2012	0.33	0.3	0.56	0.46	0.5	0.43
HH earned income from farming, agriculture, husbandry in 2012	0.11	0.08	0.48	0.13	0.14	0.79
HH earned income from remittances in 2012	0.11	0.09	0.52	0.33	0.37	0.49
HH earned income from cross-border trading in 2012	0.03	0.02	0.54	0.05	0.05	0.77
HH was in the lowest 20% of wealth distribution in 2012	0.28	0.31	0.60	0.15	0.14	0.83
HH was in the second lowest 20% of wealth distribution in 2012	0.19	0.19	0.99	0.17	0.18	0.79
HH was in the second highest 20% of wealth distribution in 2012	0.19	0.21	0.62	0.21	0.21	0.96
HH was in the highest 20% of wealth distribution in 2012	0.16	0.13	0.37	0.30	0.32	0.79
Interviewee participated in a group in 2012	0.37	0.35	0.72	0.60	0.59	0.79
Primary drinking water source (dry season) in 2012 (ordinal 0–2)	2.05	2.05	0.96	2.52	2.53	0.82
Primary drinking water source (wet season) in 2012 (ordinal 0–2)	2.04	2.04	0.95	2.52	2.54	0.71
HH had an improved sanitation facility (e.g., toilet) in 2012	0.39	0.38	0.88	0.75	0.78	0.61
2018 cholera outbreak effect vs. previous ones (ordinal 0–2)	1.13	1.14	0.82	2.25	2.25	0.98
Observations	**585**			**662**		

* p < 0.1, ** p < 0.05, *** p < 0.01. Variables dated 2012 are estimates, based on recall data. Construction of the wealth index is described in Section 4.4. The dependent variable is binary, taking 1 for project participants, and 0 otherwise.

Propensity score weighting

We use propensity score (PS) weighting for difference-in-difference estimates and subgroup analysis. The PS-weighted models used in this report are described below.

PS-weighted OLS regression to estimate project impact using difference-in-difference for improved water, piped water and improved sanitation

Where data for both recall and now are available, we used PS-weighted OLS regression to estimate project impact on the difference in each outcome – improved water, piped water, improved sanitation. We calculated this difference by subtracting the 2012 (recall) value from the 2018 (now) value. All three of these outcomes are binary, meaning the difference variables can take the following three values: -1 (the situation got worse), 0 (the situation stayed the same), 1 (the situation got better). The results of the regression tell us the difference in this difference, controlling for the PSM matching variables and with PS-weighting.

PS-weighted OLS regression with interaction term to estimate differential impacts for subgroups

The average overall effect was estimated using PSM. To test for differential impacts, we used PS-weighted OLS regression together with an interaction term (all matching variables used for PSM are also included as control variables). Based on how each subgroup variable is defined, those equal to 1 can be considered as the 'group of focus' and those equal to 0 as the 'reference group'. In this report we considered three subgroups with interaction terms as follows:

1. **Gender:** the interaction term multiplies a variable for interviewee gender (equal to 1 if a woman, 0 if a man) by the intervention variable (equal to 1 if in the intervention group, 0 if in the comparison group). Therefore, we define women as the group of focus and men as the reference group.
2. **Disability of household members:** the interaction term multiplies a variable indicating household members' disabilities (equal to 1 if 80% of members over five years old are 'fit to work', 0 otherwise) by the intervention variable (equal to 1 if in the intervention group, 0 if in the comparison group). Therefore, we define households with fewer members with disabilities as the group of focus and households with more with disabilities as the reference group.
3. **Home ownership status:** the interaction term multiplies a variable indicating home ownerships status (equal to 1 if the household owns their own home, 0 otherwise – i.e., tenants) by the intervention variable (equal to 1 if in the intervention group, 0 if in the comparison group). Therefore, we define homeowners as the group of focus and tenants as the reference group.

The tables in Section 6.6 provide the results of PS-weighted regressions, each with the relevant interaction term. Table A.3.3 provides tips for interpreting these results.

Table A3.3: Example results and interpretation of PS-weighted regression with interaction term

Sustainable Water and Sanitation index	Example results	Interpretation
Effect among the group of focus in the comparison group, relative to the reference group	2.50** (2.10)	The first row shows the coefficient, standard error and significance for *the subgroup variable* (i.e., gender, disability, home ownership status). It indicates the difference between the group of focus and reference group, irrespective of the intervention. The sign of the coefficient tells us whether the average is higher (if positive) or lower (if negative) for the group of focus, relative to the reference group, while the size of the coefficient tells us how large this difference is (e.g., between women and men). The standard error and significance indicate to what extent this difference is statistically meaningful. The example results would mean that the average value for the group of focus is 2.50 higher than it is for the reference group for the Sustainable Water and Sanitation Index, and this difference is statistically significant ($p<0.05$).
Project impact for the reference group	5.09*** (4.02)	The second row shows the coefficient, standard error and significance for *the intervention* (i.e., project impact) for the 'reference' group (i.e., men, households with fewer members with disabilities and tenants). The sign of the coefficient tells us whether the project impact is positive or negative, while the size of the coefficient tells us how large this impact is for the 'reference' group. The standard error and significance indicate to what extent this difference is statistically meaningful. The example results would mean that the project had a statistically significant ($p<0.01$) positive impact of 5.09 for the reference group for the Sustainable Water and Sanitation Index.
Differential project impact for the group of focus and the reference group	1.08 (1.02)	The third row shows the coefficient, standard error and significance for the *interaction term*. The sign and size of the coefficient can be interpreted together with the two other coefficients for the subgroup and intervention variables to calculate the project impact for the group of focus. The standard error and significance indicate to what extent the difference in impact between the group of focus and reference group is statistically meaningful. The example results would mean that the project also had a positive impact for the group of focus for the specified outcome, and that impact is slightly larger (e.g., 1.08 + 5.09 = 6.17). However, this difference in impact between the group of focus and the reference group is not statistically significant (i.e., there is no differential impact by gender for the Sustainable Water and Sanitation Index).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates are bootstrapped with 1,000 repetitions. Standard errors are in parentheses.

APPENDIX 4: RISK OF BIAS

Not all quasi-experimental impact evaluations are the same. Choices made during sampling, selection of the comparison group, and at the analysis stage are crucial in assessing overall confidence in the results. Table A4.1 uses our standard framework to assess the risk of bias against ten predetermined parameters for this evaluation. This framework is specifically for ex-post quasi-experimental impact evaluations. Lower overall risk provides higher confidence in the results.

Table A4.1: Risk of Bias table

No.	Title	Description	Assessment	Description
Sampling				
1	Random sampling	**Score LOW risk if:** Sampling is conducted using probability random sampling methods on a clearly established sample frame. **Score MEDIUM risk if:** Sampling is conducted using probability random sampling methods at geographical level (e.g., village level), and use random sampling to select interviewees within the geographical area. **Score HIGH otherwise.**	MEDIUM	Interviewees were randomly sampled within each of the three compounds (2 intervention compounds and 1 comparison compound) using a random walk protocol (see Section 4.2 Household Surveys for details).
2	Representativeness of project participants	**Score LOW risk if:** Project participants have been involved for the entire duration of the project and have been involved in the project with the same level of exposure. Project participants have been exposed to a variety of different activities, some may have dropped out from some activities, but sampling is conducted on the entire list of project participants. **Score MEDIUM risk if:** Project participants have been exposed to a variety of different activities. Sampling is conducted only among those project participants that have been enrolled for the entire duration of the project or that have been enrolled in all the activities. These are not less than 80% of the entire list of project participants OR it is clear the results apply only to a particular group of project participants. **Score HIGH otherwise.**	LOW	Project activities were largely conducted at the community level and there were no participant lists at the household level. It is expected that different households were exposed to different activities directly (e.g., attending a roadshow, seeing a poster), but that all community members were affected indirectly (e.g., through infrastructure and governance improvements).

3	Selection survey interviewees	**Score LOW risk if:** Identification of survey interviewees is not determined by project participation (the same protocol to identifying the interviewee(s) within the household is applied in intervention and comparison groups). The resulting selection of survey interviewees is not affected by project participation (based on observables). **Score MEDIUM risk if:** Identification of survey interviewees is not determined by project participation (the same protocol to identifying the interviewee(s) within the household is applied in intervention and comparison group). The resulting selection of survey interviewees is affected by project participation (based on observables). **Score HIGH otherwise.**	LOW	All community members were included in the sampling frame and equally likely to be selected for an interview.
Selecting comparison group				
4	Potential for contamination (spillovers)	**Score LOW risk if:** The units for comparison group are selected in geographical areas where it is not reasonable to expect for the project to have had spillover effects. The project also implemented some activities (which are not considered the most relevant under analysis) which are expected to have had an impact also in the comparison group (e.g., the project implemented campaigns using radio and other digital media, but these are only a minor component of the activities implemented). The report makes clear which impact is assessed (added-value of other components, taking into account exposure to those minor components). **Score HIGH risk if:** Units for the comparison group are selected within the same geographical area as the intervention group, and it is reasonable to expect that project activities had spillover effects (e.g., comparison observations within the same village, for awareness-raising projects).	LOW	The comparison group is a compound with the same community characteristics and household compositions as the intervention group compounds. All three compounds are located approximately the same distance from the city centre, with the two project compounds being to the west and the south and the comparison compound being to the south-west. However, these compounds do not border each other and are separated by industrial/commercial areas. The project did implement some minor activities, including support to the Lusaka District Health Office and radio programming, that may have also had an impact in the comparison group.
5	Self-selection of project participants	**Score LOW risk if:** The comparison group is exploiting an experiment or natural experiment. Units are randomly selected at community level both in the intervention and comparison group. The selection process for the comparison group is mimicking the same selection process used by the project.	LOW	Project activities were largely conducted at the community level and there were no participant lists at the household level. The comparison group is the only other compound in Lusaka, in addition to the two intervention compounds, that was part of Oxfam's humanitarian response to the 2018 cholera outbreak. To isolate the impact of the project, the comparison group selected was the only possibility.

		Score MEDIUM risk if: If the self-selection is corrected during the matching procedure (e.g., controlling for group participation at baseline). **Score HIGH risk if:** Project participants were selected or self-selected based on idiosyncratic or unobservable characteristics, and the selection of comparison interviewees is done randomly from neighbouring geographical sites.		
6	Other interventions in the comparison group	**Score LOW risk if:** There are no other actors in the area (e.g., INGOs, NGOs, governmental programmes). Other actors are conducting activities which are not linked to the project's theory of change. **Score MEDIUM risk if:** Other actors are conducting similar activities linked to the project's theory of change in both the intervention and the comparison group. **Score MEDIUM-HIGH risk if:** Other actors are conducting similar activities linked to the project's theory of change in the comparison group only, but the evaluation purposefully chooses to compare these activities to the intervention making it clear that the impact is compared with these other activities (e.g., as a natural experiment). **Score HIGH risk if:** Other actors are conducting similar activities in comparison communities only. Other actors are conducting activities in the comparison communities, which are not the same, but are partially related to the project's theory of change.	MEDIUM	The institutions the project worked with, both governmental and non-governmental, are involved in various ongoing efforts to improve water and sanitation facilities and services in the peri-urban areas of Lusaka, including in the intervention and comparison compounds. The project provided system-level support in line with these ongoing activities for the intervention group only.
Analysis				
7	Representativeness	**Score LOW risk if:** During analysis or matching procedure less than 10% of the sample in the intervention group is excluded. **Score HIGH risk if:** During analysis or matching procedure more than 10% of the sample in the intervention group is excluded.	LOW	During analysis for George Compound, 4% of the sample in the intervention group was excluded; for Chawama Compound, 7% of the intervention group was excluded.

8	Robustness checks	**Score LOW risk if:** Magnitude and statistical significance of the results are approximately consistent with different econometric models. **Score HIGH risk if:** Results are not consistent with different econometric models.	LOW	Different econometric model specifications – PSM and PS-weighted OLS regression – produced approximately consistent results.
9	Triangulation	**Score LOW risk if:** Results are triangulated and consistent with other evaluation methods within the same evaluation. Results are triangulated and consistent with other data on the same project but from different evaluations. **Score HIGH risk if:** Results are not consistent or triangulated with other evaluation methods.	LOW	Challenges described in KIIs are reflective of the results seen from quantitative analysis.
10	Multiple hypothesis testing	**Score LOW risk if:** Multiple hypothesis tests apply Benjamini or Bonferroni tests. The evaluation drafted a pre-analysis plan before analysis and followed the plan. **Score MEDIUM risk if:** The evaluation drafted a pre-analysis plan prior data analysis and significantly altered the plan, but changes that are clearly justified. **Score HIGH otherwise.**	LOW	This evaluation drafted a pre-analysis plan prior to data analysis and followed the plan.
11	Clustering	**Score LOW risk if:** Clustering is applied. Clustering was tested but rejected as providing higher standard errors than non-clustering estimates. **Score HIGH otherwise.**	HIGH	Clustering was not possible with only two project areas and one comparison area.
Other				
12	Other	Any other issue reported by the evaluator.	LOW	Data gathered in the comparison area on or after 23 November may have been biased due to flooding. During analysis, indicator variables were checked but there were no systematic differences between data gathered before versus after the flooding.

REFERENCES

Abadie, A. and Imbens, G.W. (2008). On the Failure of the Bootstrap for Matching Estimators. *Econometrica*, 76(6), 1537–57.

Alkire, S. and Foster, J. (2011). Counting and Multidimensional Poverty Measurement. *Journal of Public Economics*, 95(7–8), 476–87.

Banerjee, S. G. & Morella, E. (2011). *Africa's water and sanitation infrastructure: access, affordability, and alternatives*. The World Bank.

Bartram, J., Brocklehurst, C., Fisher, M. B., Luyendijk, R., Hossain, R., Wardlaw, T., & Gordon, B. (2014). Global monitoring of water supply and sanitation: history, methods and future challenges. *International journal of environmental research and public health*, 11(8), 8137–8165.

Bishop, D., & Bowman, K. (2014). Still learning: a critical reflection on three years of measuring women's empowerment in Oxfam. *Gender & Development*, 22(2), 253–269.

Bland, M. & Altman, D.G. (1997). Statistics Notes: Cronbach's Alpha. *British Medical* Journal, 314(7080), 572.

Bratton, M., & Gyimah-Boadi, E. (2016). *Do Trustworthy Institutions Matter for Development? Corruption, Trust and Government Performance in Africa*.

Caliendo, M. & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys*, 21, 31–72.

CDC (2018). Morbidity and Mortality Weekly Report (MMWR): Cholera Epidemic – Lusaka, Zambia, October 2017–May 2018. https://www.cdc.gov/mmwr/volumes/67/wr/mm6719a5.htm

Eubank, N. (2014). Zambian 2006 to 2010 Constituency and Ward Boundaries. Available at: http://purl.stanford.edu/yc436vm9005

Filmer, D. & Pritchett, L.H. (2001). Estimating Wealth Effects without Expenditure Data – Or Tears: An Application to Educational Enrollments in States of India. *Demography*, 38(1), 115–32.

Fuller, R. & Lain, J. (2015). Measuring resilience: Lessons learned from measuring resilience in Oxfam's large-N Effectiveness Reviews. https://policy-practice.oxfam.org.uk/publications/measuring-resilience-lessons-learned-from-measuring-resilience-in-oxfams-large-583601

Giné-Garriga, R., & Pérez-Foguet, A. (2018). *Measuring sanitation poverty: A multidimensional measure to assess delivery of sanitation and hygiene services at the household level*.

Godlonton, S., Hernandez, M., & Murphy M. (2018). Anchoring Bias in Recall Data: Evidence from Central America. *American Journal of Agricultural Economics*, 100(2), 479–501.

Heckman, J., LaLonde, R., & Smith, J. (1999). The economics and econometrics of active labor market programs, *Handbook of Labor Economics*, 3(A), 1865–2097.

Hughes K. & Bushell, H. (2013). A multidimensional approach to measuring resilience. https://policy-practice.oxfam.org.uk/publications/a-multidimensional-approach-to-measuring-resilience-302641

Hopkins A., Brady, C., & Brownlie, A. (2014). *The Right to be Heard Framework: A learning companion.* Oxfam GB: Oxford. https://policy-practice.oxfam.org.uk/publications/the-right-to-be-heard-framework-a-learning-companion-254793

HWISE (2019). *Household Water Insecurity Experiences (HWISE) Scale*. https://sites.northwestern.edu/hwise/

Kayser, G. L., Moriarty, P., Fonseca, C., & Bartram, J. (2013). Domestic water service delivery indicators and frameworks for monitoring, evaluation, policy and planning: a review. *International journal of environmental research and public health*, 10(10), 4812–4835.

Leuven, E. & Sianesi, B. (2018). PSMATCH2: *Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing*.

Lombardini, S., Bowman, K., & Garwood, R. (2017) *A 'How To' Guide To Measuring Women's Empowerment: Sharing experience from Oxfam's impact evaluations*. https://policy-practice.oxfam.org.uk/publications/a-how-to-guide-to-measuring-womens-empowerment-sharing-experience-from-oxfams-i-620271

Medland, L. (2018). *Outcomes-Based Programming for Water and Sanitation: Oxfam's vision and monitoring framework*. https://policy-practice.oxfam.org.uk/publications/outcomes-based-programming-for-water-and-sanitation-oxfams-vision-and-monitorin-620573

Mizniak, J., Wildman, T., & Medland, L. (2017). *A Global Water and Sanitation System That Works for All: Oxfam GB's Sustainable Water and Sanitation Strategy*. https://policy-practice.oxfam.org.uk/publications/a-global-water-and-sanitation-system-that-works-for-all-oxfam-gbs-sustainable-w-620333

Nicola, F. & Giné, X. (2012). *How Accurate Are Recall Data? Evidence from Coastal India.* The World Bank. Policy Research Working Paper 6009.

Porteous, D. (2006). The enabling environment for mobile banking in Africa.

Rosenbaum, P. & Rubin, D. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70:41–55.

Shilling, F., Khan, A., Juricich, R., & Fong, V. (2013). Using indicators to measure water resources sustainability in California. In *World Environmental and Water Resources Congress 2013: Showcasing the Future* (2708–2715).

Thomas, E., Andrés, L. A., Borja-Vega, C., & Sturzenegger, G. (Eds.). (2018). *Innovations in WASH Impact Measures: Water and Sanitation Measurement Technologies and Practices to Inform the Sustainable Development Goals*. The World Bank.

UN (2018). Sustainable Development Goal (SDG) 6: Ensure availability and sustainable management of water and sanitation for all. https://sustainabledevelopment.un.org/sdg6

Vonk, J. (2019). Going Digital: Privacy and data security under GDPR for quantitative impact evaluation. https://policy-practice.oxfam.org.uk/publications/going-digital-privacy-and-data-security-under-gdpr-for-quantitative-impact-eval-620884

WHO Africa (2018). *Zambia cholera outbreak situation reports*. https://www.afro.who.int/countries/zambia/situation-reports/cholera

WHO/UNICEF (2017). *JMP Methodology: 2017 Update & SDG Baselines*. https://washdata.org/sites/default/files/documents/reports/2018-04/JMP-2017-update-methodology.pdf

Wilbur, J., & Danquah, L. (2015). Undoing inequity: water, sanitation and hygiene programmes that deliver for all in Uganda and Zambia – an early indication of trends. In *38th WEDC International Conference, Loughborough University, UK*.

Young, S. L., Collins, S. M., Boateng, G. O., Neilands, T. B., Jamaluddine, Z., Miller, J. D., Schuster, R. C. et al. (2019). Development and validation protocol for an instrument to measure household Water Insecurity across cultures and ecologies: the Household Water InSecurity Experiences (HWISE) Scale. *BMJ open*, 9(1), bmjopen-2018.

Oxfam Effectiveness Reviews

For more information, or to comment on this report, email policyandpractice@oxfam.org.uk

The information in this publication is correct at the time of going to press.

ISBN: 978-1-78748-728-4
DOI: 10.21201/2021.7284

Oxfam GB, Oxfam House, John Smith Drive, Cowley, Oxford, OX4 2JY, UK.

OXFAM

Oxfam is an international confederation of 20 organizations networked together in 67 countries, as part of a global movement for change, to build a future free from the injustice of poverty. Please write to any of the agencies for further information, or visit www.oxfam.org.

Oxfam America (www.oxfamamerica.org)
Oxfam Australia (www.oxfam.org.au)
Oxfam-in-Belgium (www.oxfamsol.be)
Oxfam Brasil (www.oxfam.org.br)
Oxfam Canada (www.oxfam.ca)
Oxfam France (www.oxfamfrance.org)
Oxfam Germany (www.oxfam.de)
Oxfam GB (www.oxfam.org.uk)
Oxfam Hong Kong (www.oxfam.org.hk)
Oxfam IBIS (Denmark) (http://oxfamibis.dk/)
Oxfam India (www.oxfamindia.org)
Oxfam Intermón (Spain) (www.oxfamintermon.org)
Oxfam Ireland (www.oxfamireland.org)
Oxfam Italy (www.oxfamitalia.org)
Oxfam Mexico (www.oxfammexico.org)
Oxfam New Zealand (www.oxfam.org.nz)
Oxfam Novib (Netherlands) (www.oxfamnovib.nl)
Oxfam Québec (www.oxfam.qc.ca)
Oxfam South Africa (http://www.oxfam.org.za/)
KEDV (www.kedv.org.tr)

OXFAM