



Unflushables

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Unflushables:

Designing new intervention pathways for sewer blockages and environmental pollution in the Anglian Water region, UK

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Executive summary

What are unflushables? This report addresses the topic of unflushables, products commonly found to be causing problems in sewerage and water systems having been disposed of via the toilet. The most problematic unflushables include a variety of wet wipes (also known as wet towels, moist towelettes, baby wipes and used for a range of bodily and household purposes) and menstrual absorbents (e.g. sanitary pads, tampons and applicators). Other products include incontinence pads, cotton buds, condoms, bandages, disposable nappies, syringes, razors, and dental floss. These products cause damage to wastewater treatment systems and contribute to sewer blockages.

What is the problem? In the UK, the cost of fixing sewer blockages reaches £88 million per year and around half of these blockages are caused by unflushables. Aside from the expense, blockages can contribute to flooding of wastewater systems, resulting in damage to properties and the environment. Often unflushables are not contained by wastewater retention systems and end up on our shores and in our water streams, contributing to aquatic ecosystem pollution. Flushing toilets are a substantial component of UK water demand, and disposal of unflushables via the toilet increases demand for toilet flushing. In each flush, water that has been treated to drinking water standard is used to remove products that could be disposed of in other ways (e.g., via solid waste streams). At the same time, water efficiency activities – particularly low flow toilets – reduce the input of water into sewer systems, impacting on the ‘self-cleansing’ of blockages within the sewer systems under conditions on reduced water flow. As the UK moves towards lower levels of domestic water use as standard, a projected increase in water efficiency activities to reduce use in periods of drought, and increased impact of climate change on watercourse flooding through storm events, there is a need to reduce the inappropriate disposal of unflushables.

How and why have unflushables become a challenge in our sewers? Unflushables present a distributed problem, one that is not the direct consequence of individual behaviour, product design or infrastructural decline, but the outcome of myriad social, cultural and material developments in society (Box 1). The formation of blockages in sewers is a complex process in which unflushable products combine with fats, oils and greases (FOG) and other solids in the sewer. There are infrastructural factors, such as the size of pipes and velocity of wastewater flows; and material dimensions including the design of unflushable products, how readily they breakdown, and the design of the spaces in which they are used. There are also social aspects to the unflushables challenge. These include cultural and gendered diversity in cleanliness practices; the historical evolution of conventions around cleanliness and hygiene; infrastructural imaginaries and expectations; and political dimensions of infrastructural development and maintenance.

Box 1: Why are unflushables flushed?

Today's disposal practices have evolved over many decades and emerge from complex social, cultural and material developments

Hygiene consumerism and conventions of cleanliness: Today's hygiene conventions have evolved with developments in water and sewerage systems, as well as the commodification of hygiene. The impacts of these changes are visible on both long and short timescales; from the gradual movement of the toilet from the outhouse to the home in the 19th century, to the relative decline in tampons appearing in sewers since the introduction of 'reusable' menstrual hygiene products. Infrastructures and materials are designed to provide for modern lifestyles and be cheap and easy to use, in turn effecting the qualities that consumers expect.

Sensory experience of 'dirt': Even when health professionals assure the risks are negligible, for many people disposing of products "contaminated" with blood or faeces is perceived as a potential threat to human health. The sensory experience produced by scent and sight of bodily fluids effects how we dispose of products, and deters the use of bins.

Gendered dimensions: People have different bodily needs and cultural etiquette dictates many bodily functions are kept private. Often unflushables are associated with women. The stigma associated with menstruation, for example, means that practices that would avoid unflushables reaching sewers (e.g. the disposal of single use products in bins or the use of reusable products) are a source of embarrassment, as menstruation becomes more visible. Men also use unflushable products, particularly wipes and incontinence pads, yet research shows these gendered and other care related dimensions of the unflushables challenge to be a gap in our understanding. We ought to be cautious to avoid disproportionately associating unflushables with particular groups.

Product design: Though companies have begun to label products, there are more behavioural cues surrounding a product that just its packaging conveys. The material properties of many products contribute to misunderstanding about their flushability. For example, many people assume tampons are flushable, given their shape, material, and the fact that they do flush away. The action of removing a tampon also makes flushing simple and hygienic. These design characteristics convey an understanding of flushability to users that is contrary to eradicating unflushables.

Cultural imaginaries: Bathroom practices vary greatly between countries and cultures. Disposing of unflushables via the toilet is more common in the UK than most European countries. This is explained by the UK's infrastructural imaginaries, where sanitation infrastructure has been designed to 'sweep away' human waste and we expect sewers to accommodate many kinds of waste. In other countries, sewer systems were designed for human waste only and people are unlikely to dispose of unflushables via the toilet. There is also diversity within countries that isn't well understood.

What is being done to address the unflushables challenge? There are different approaches to addressing the challenges that unflushables present. Even when used in combination these existing strategies are unlikely to solve the problems associated with unflushables as they overemphasise the responsibility and agency of consumers (as people who can change behaviour) and water companies (as organisations who can manage problems), and tend to encourage overinvestment in technological and behavioural interventions (Box 2). For example, many manufacturers have started to label their products based on their flushability characteristics, and there are now guidelines for the labelling of 'fine to flush' products. Though these labels are useful in outlining aspirational industry standards, from a consumption perspective labelling assumes that people dispose of unflushable objects due to a lack of awareness or concern about the impacts of their practice for infrastructures and the environment. It is not quite so simple as decisions 'not to flush'.

Box 2: Four existing models for managing unflushables and associated problems

Adapted from Hoolohan & Browne (2016) and Foden et al. (2018).

Service provision

In this model, water companies are service providers, responsible for managing unflushables, with consumers paying the price. Interventions focus on reducing the damage caused by unflushables. Though effective in many cases, maintenance is expensive and unsustainable. There is also risk that undesirable practices are sustained as cultural conventions and infrastructural imaginaries remain unchallenged. In reality responsibility is distributed across many actors, and holistic intervention action is needed.

Individual action

This model positions disposal as the result of individuals' decisions. Interventions seek to change behaviour by offering information and behavioural cues (nudges). While awareness is increasing of the challenges presented by certain unflushable products, this approach requires a substantial proportion of the population to alter their behaviour in order to be effective and overestimates the capacity people have to act in different ways. Additionally, this model risks blaming individuals for a systemic problem.

Social norms and networks

A relatively recent model revolves around the use of social norms and networks to influence people's decisions. Interventions are designed to normalise desirable practices, for example by using champions and community groups. Interventions assume that people's decisions are influenced by what others think is normal and acceptable, and seek to change these perceptions. Though valuably creating conversation around a taboo subject, this approach shares many of the challenges of Individual Action.

Socio-technical practices: This approach understands flushing practices as part of a wider complex socio-technical context. Instead of focusing on a particular behaviour this strategy intends to effect change in the collective conventions, routines and infrastructures of consumption. Not many interventions have been initiated within this area and further research and policy understanding is needed to develop interventions that address this problem.

In reality unflushable products enter the sewer system as a result of the accumulation of changing conventions around cleanliness and hygiene, contemporary lifestyles and routines, cultural habits, material cultures and infrastructural histories. This combination of elements results in domestic practices that are surprisingly difficult to change, a result of 'lock-in'. Lock-in means that though people may understand the implications of their actions and even have the desire to change; their capacity to act in different ways is limited. For most people, most of the time, their present actions produce satisfactory outcomes, and the challenges that unflushables present remain invisible.

What next?

Recognising the multiple developments that have contributed to the emergence of today's unflushables challenge calls for a distributed approach to governance, management and intervention that is not yet well understood. However existing research offers guidance for what a new approach could look like:

- (1) **Interventions must address the multiple cultural, political and material factors that shape how people routinely use and dispose of unflushable products.** It is insufficient to only consider how to design products and infrastructures capable of coping with unflushables. Though this can help, as long as existing sewage system remains in place we must also consider how to change the multiple cultural, political and material factors that shape how people routinely use and dispose of unflushable products.
- (2) **Interventions must recognise the continuously shifting nature of hygiene practices.** Flushing practices should be understood as constantly changing, and the appearance of stability as the result of repetition and normalisation. In order to solve the problems associated with unflushables questions should be asked regarding how disposal via the toilet has become normal, how this practice could be unsettled, and what could be done to normalise, and make convenient, alternative disposal practices.
- (3) **Distributed problems require distributed solutions.** Action to reduce unflushables should recognise the many actors that share responsibility for unflushables entering the sewer system, and who have agency to affect change. Reducing unflushables will require not only that water companies and consumers work together, but that their efforts are supported by the many organisations and businesses that contribute to the social organisation of practice, and appropriate governance structures guiding integrated action.
- (4) **What people do in their day-to-day lives varies substantially.** Acknowledging diversity helps identify different opportunities for intervention, and avoid designing interventions that are at best ineffective, or at worst exposes vulnerable people to unintended consequences, or cast judgement on the actions of particular groups of people (e.g., women, parents, caregivers).

Unflushables: A Research Agenda

Throughout this report there are recommendations for further research identified, based on a review of existing literature. In summary new areas for research include:

- (1) Understanding the demand for disposable hygiene products and how it relates to contemporary life styles and changing cleanliness and hygiene conventions. This area of

research may help to identify how products and practices can be substituted for more sustainable options.

- (2) Understanding the role of imaginaries and expectations about infrastructures and the provision of urban services in the prevalent flushing culture in the UK.
- (3) Understanding how flushing practices are shaped by sensory reactions to and cultural variations in attitudes towards everyday bathroom waste and what interconnections to other waste disposal infrastructures are needed to effect positive change.
- (4) Understanding and planning for the gender dynamics shaping the use and discard of hygiene products.
- (5) Understanding the governance landscape for unflushables and how regulations and standards can be further developed incorporating all actors involved.

This research agenda would benefit from the contribution from the wide range of organisations and individuals involved in the challenge of unflushables, reflecting the fact that this is a distributed problem. This includes consumers and water utilities but also those who manufacture, market and retail unflushable products, those involved in normalising certain products and behaviours or those involved in the design and construction of bathroom spaces.

Unflushables: Change Points for Interventions for Sewer Blockages

The research underpinning this work calls for recognition of the distributed institutions, people, objects and actions that shape everyday resource use, and heightened sensitivity to people's different situations and vulnerabilities. Associated 'Change Points' workshop outputs from a multi-stakeholder event held in January 2020 demonstrated the feasibility and variety of interventions that are possible to address the Unflushables challenge by 2030. The discussions underline the importance of a distributed approach to agency and responsibility; one that reflects the wide array of actors that need be involved in shaping changes in flushing practices (Browne et al., 2020).

The most immediate steps identified in this process are:

- Identify funding to research, co-ordinate and implement initiatives and cover the costs of resources and materials for interventions.
- Establish clarity on the regulatory steer needed to support coherent cross-sectoral action.
- Assign leaders and teams; several of the new ideas merely need teams assembling in order to get underway.
- Continue these challenging discussions to ensure pathways for action are identified and followed effectively to eradicate unflushables by 2030.

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1. Background and objectives

This report reflects the outcomes of a consultancy project between Anglian Water, The Anglian Centre for Water Studies, and the University of Manchester. The intention of the project was for the team to analyse existing research literature and previous programmes and interventions on unflushables within the Anglian Water region, and for the team to work together to support the identification of new pathways for intervention for tackling this issue with a distributed set of actors in the Anglian Water region and beyond.

This project builds upon a methodology and analytical process called 'Change Points' which is designed to enhance innovation in organisational responses to sustainability challenges by supporting organisations to think through how they can develop interventions that influence everyday practices within the home, and other spaces of everyday practices (Hoolohan & Browne, 2020; Hoolohan, Browne, Foden, Sharp, & Watson, 2018; Watson, Browne, Evans, Hoolohan, & Sharp, under review). The Change Points toolkit is the culmination of several ESRC (Economic and Social Research Council) research projects on the social sciences of water, food, waste, and energy across collaborators at the University of Manchester and University of Sheffield (now also Bristol, Keele) and with project partners including: Northumbrian Water Group, Defra, Food Standards Agency, Waterwise, WWF-UK, Artesia Consulting and Actant Consulting.

The intention of the Anglian Water sponsored 'Unflushables' project was to re-examine existing materials from Anglian Water through the frameworks developed within this previous work, and then facilitate a Change Points workshop where Anglian Water and their key stakeholders could use insights from this analysis to generate new pathways for sustainability intervention within the business, and with interconnected stakeholders.

The project set out to address important questions around the issue of reducing the inappropriate disposal of hygiene products including: How have practices of hygiene product use and disposal emerged and how do they intersect with people's everyday lives and routines?; How do these routines vary, between different individuals and over time?; and How do these routines intersect with wider sanitation and waste disposal provision inside homes and in other spaces of work, leisure and education where people spend a lot of time? Analysis also enabled project partners to 'map the system', enabling the identification of cultural, political, technological and material developments that lead to the disposal of unflushable hygiene products, and the distributed actors with responsibility and agency for change to positively influence this set of problems. These insights will determine a number of possible pathways for intervention to be taken forward by Anglian Water, and consider how to put these interventions into action to reduce the disposal of unflushables across the Anglian Water region.

There were several stages of this consultancy research including several specific methods:

- Rapid Evidence Assessment (REA) of related literature to the topic (overview of search terms, and process of evidence gathering of literature), identification of research and

policy gaps. Rapid assessment or reviews (see Tricco et al. (2015)) are a streamlined version of systematic reviews that allow information and evidence to be gathered promptly in response to demands from stakeholder communities;

- Case study methodology – analysis of case studies provided by Anglian Water (documentary, archival and textual analysis, joint meetings to co-define problem scope and discuss previous work, any interviews if conducted). Application of previous analytical strategies for working through ‘typologies’ of intervention programs (Hoolohan & Browne, 2016);
- Change Points Methodology (www.changepoints.net) and co-designing intervention pathways – Change Points is a multi-staged, ESRC funded project aiming at developing new ways of understanding how householders’ routine activities end up demanding resources, including of energy, food and water and at making academic understandings of household sustainability useful for informing actual policy processes with a diverse policy and non-academic project partners (Watson et al., under review). The Change Points Toolkit (Hoolohan et al., 2018) was developed as part of this project and has been used to facilitate a workshop with different stakeholders in the Anglian region and beyond involved identified in collaboration with Anglian Water. The workshop is a co-productive methodology with a diverse range of stakeholders, and leads to the identification of diverse intervention options and pathways that reflect the complexity of this challenge for Anglian Water and related stakeholder networks. Browne et al. (2020) summarises the main findings from the Unflushables 2030? Mapping Change Points for Intervention for Sewer Blockages Workshop.

2. Infrastructural and sustainability challenges of unflushables

The inadequate disposal of unflushables¹ via the toilet is producing important infrastructures and environmental challenges. Once in sewers these products can damage wastewater treatment systems or accumulate contributing the formation of blockages and fatbergs. The formation of blockages and fatbergs in sewer lines is a complex process that usually starts with the accumulation of FOGs and metallic soaps (saponification) on which other solids found in sewers build up (Ashley et al., 2005; Foden et al., 2018; Mattsson et al., 2015). According to the UK water industry, the cost of fixing sewer blockages reaches £88 million per year and half of the blockages are caused by disposal of hygiene products via the toilet (WaterUK, 2016). Blockages can produce flooding of wastewater that can damage properties and pollute the environment.

¹ Throughout this report we use the term ‘unflushables’ as a short hand to describe a variety of consumer and household products, and connected waste disposal practices, that result in hygiene and sanitation wastes being disposed of via the toilet. UK Water Industry Fine to Flush WIS defines flushability with nine criteria (i) intended use (ii) safety in the environment (iii) WC bowl clearance (iv) drainline clearance (v) disintegration in the drainline (vi) snagging in the drainline (vii) continued disintegration in the sewer (viii) settlement in treatment process) and (ix) Determination of synthetic and non-synthetic organic components. (WIS 4-02-06 November 2019: Issue 1.2).

Sewer blockages are often dependent on infrastructural factors such as the design and dimensioning of the sewer e.g. size of pipes, velocities, sags (Mattsson et al., 2015). A recent study in the UK showed that an important number of blockages “were due to a combination of inappropriate disposal and features that are common in sewer system design” (Drinkwater & Moy, 2017, p. 10). Furthermore, the aging of sewers, and the lack of investment in maintenance, also plays an important role (Mattsson et al., 2015). Many of the sewer systems that are in use today in many metropolitan areas were constructed at the end of the 19th century and require major investments in infrastructural rehabilitation. More recently constructed systems were designed to be operational for 25-50 years and have not been adapted to new practices of use or changes in the supply of water (Mattsson et al., 2015).

A different challenge produced by hygiene products discarded through the toilet and sewerage systems is the pollution of aquatic ecosystems (Peberdy et al., 2019). Often these products are not contained by retention systems or screening facilities and end up in water courses and marine environments. They may also be mixed with the raw sewage that is discharged by combined sewer systems in events of system overflow (i.e. rainstorms and flooding) (Spence et al., 2016). In 2017, the Marine Conservation Society (MCS) reported that 8.5% of the litter found in UK beaches were sewage related debris, of which wet wipes and cotton bud sticks were among the most common items collected during their beach clean campaign (MCS, 2017, 2018). The intersection of these dynamics has put the performance of water and sewerage companies on the spot for environmental complaints (Blanksby, 2002; Spence et al., 2016).

The problem of solids discharge that initially was characterised as of mainly aesthetic dimension (Ashley et al., 2005; Friedler et al., 1996; Spence et al., 2016) has more recently been associated with the alarming presence of microplastics in the environment (Pantoja Munoz et al., 2018; Peberdy et al., 2019). Products such as nonwoven wipes, menstrual absorbents, or condoms are made of plastic and synthetic fibres such as Polyesters, Polyethylene and Polypropylenes (Drinkwater & Moy, 2017; Pachauri et al., 2019; Pantoja Munoz et al., 2018). Even when these are effectively retained and broken down during wastewater treatment, the microscopic fibres that they contain can be released together with the wastewater effluent (Pantoja Munoz et al., 2018). Microplastics can also be transferred from sewage sludge into the soil matrix when recycled for use in agriculture (Pantoja Munoz et al., 2018). Once in the environment microplastics can enter in the food chain, including through drinking water, and while the health risks have not yet been thoroughly studied it is increasingly viewed as a crisis for public health (Revel et al., 2018; The Lancet: Planetary Health, 2017)

Finally, flushing products down the toilet increases household water use which is problematic for water demand in the context of climate change and water scarcity. In each flush, water that has been expensively treated to drinking standards is used as transport medium for products that could be disposed following the regular household waste stream (Ashley, 2004) at a lower environmental and economic cost (Ashley et al., 2005). At the same time, some studies have evaluated the impact of water saving practices and devices in the formation of deposits of solids (Mattsson et al., 2015). Devices such as low flush toilets, widely spread in

response to concerns with sustainability, reduce the input of water into the sewerage and impact on the self-cleansing velocities required for the system to function properly (Marleni et al., 2012; Mattsson et al., 2015) as a result solids are more likely to form within pipes along the sewerage system.

3. Understanding unflushables: academic literature & research gaps

The disposal of hygiene products through sanitation systems has been documented as a common practice in many countries across the world (Ashley et al., 2005) and the challenges they produce in the infrastructures have been a longstanding matter of concern for engineers (Mattsson et al., 2015). Yet academic research around unflushables has been very limited (Mitchell et al., 2017; Pantoja Munoz et al., 2018). This contrasts with an increased media attention to the topic largely spurred by the increased visibility of ‘fatbergs’ within the UK (e.g. ‘Flushable wipes put to the test as fatbergs clog the nation’s sewers’, 2019; ‘London sewers blocked by record-breaking “concreteberg”’, 2019; ‘Monster fatberg found blocking Sidmouth sewer’, 2019). The rapid evidence assessment shows that existing studies are in their majority quantitative and done from an engineering perspective. Research tends to be focused on the composition of material flows, interactions of these with wastewater systems, and end-of-pipe control and maintenance.

Content of solids in sewage is usually identified through the collection of samples from sewers and blockages (Drinkwater & Moy, 2017; Mitchell et al., 2017; Spence et al., 2016) or conducting surveys on reported practices of disposal (Friedler et al., 1996; Spence et al., 2016). Estimations on flushed products have also been produced based on collection of waste from beaches and rivers (MCS, 2017; Williams & Simmons, 1999). Quantifying solids discharged in sewers is challenging because the compositions of samples varies greatly depending on time and location of sample collection (Mitchell et al., 2017), and the difficulties to identify the materials when they are partially degraded and mixed with sewage (Drinkwater & Moy, 2017). Yet, this research has yielded important information about what products are most commonly found in sewer systems. These have been named by the water industry as the Dirty Dozen² (See Figure 1). Recent studies show that among those in the list, a variety of wet wipes and menstrual absorbents (e.g. sanitary pads, liners, tampons and applicators) cause the majority of blockages. Other hygiene products not included in

Figure 1. The Dirty Dozen of Unflushables
(Source: www.thinkbeforeyouflush.org)



² The top-12 list of items found in blockages. See Naismith (2017)

the list but often reported in the literature are razors, adult incontinency absorbents, condoms and femidoms, waste wrappers, syringes, or dental floss (Ashley, 2004; Ashley et al., 2005; Friedler et al., 1996).

A few of the studies reviewed incorporate recommendations on how to reduce disposal of unflushables. In general, these tend to frame the problem as one of individual choice and behaviour (Ashley et al., 2005; Drinkwater & Moy, 2017; Pachauri et al., 2019). Studies assume that people flush objects down the toilet because of lack of knowledge of the functioning of sewers; lack of awareness about the impact of the practice on infrastructures and the environment; or lack of care about the consequences (Ashley et al., 2005; Drinkwater & Moy, 2017). As a result recommendations tend to focus on raising awareness and educating individuals with the hope that they will take responsibility for their actions and change their damaging behaviour (Hawkins et al., 2018). This is similar to the way that the problem of flushing fats, oils, and greases (FOG) down the kitchen sink is approached (Foden et al., 2018).

An interesting exception to this framing is provided by Hawkins et al. (2018) in their exploration of women's practices of menstrual absorbents toilet disposal in the UK. The study shows that even when women clearly expressed desire to be more environmentally responsible in relation to their choices of absorbents and disposal practices, "the wider societal requirements for discretion and the design, accessibility and availability of bins and bathroom facilities" (Hawkins et al., 2018, p. 11) limited their actual possibilities. In line with broader critiques of behaviour change, this type of approach calls for consideration of the wider opportunities and responsibilities for intervention beyond the individual.

What the majority of research within this field misses is a deeper understanding of the logics, routines and practices through which unflushables find their way into wastewater systems. Research within other spaces of sustainable consumption have increasingly prioritised the importance of understanding how 'unsustainable' practices emerge, and how they are sustained, through routine and mundane everyday practices (Shove et al., 2012). Identifying how patterns of unsustainable practice emerge as a co-evolution of infrastructures, everyday practices and social meaning for example, it is argued, facilitates a deeper understanding of how systems may be reconfigured and a more diverse set of intervention options that intervene in *socio-technical systems* (Geels et al., 2015). These questions are not yet applied to the dynamics of unflushable hygiene practices identified within this report. As such guiding this report are a number of questions including:

- How have practices of hygiene product use and disposal emerged and how do they intersect with people's everyday lives and routines?
- How do these routines vary, between different individuals and over time?
- How do these routines intersect with wider sanitation and waste disposal provision inside homes and in other spaces of work, leisure and education where people spend a lot of time?

We argue that engagement with broader contributions from a diversity of social sciences literatures could be fruitful to develop a fuller understanding of the etymology of this problem across society, and to identify a wider set of opportunities for the water and sanitation sectors (and interconnected stakeholders) to intervene in these dynamics. In the next section we present some of the discussions and contributions made by these literatures.

3.1. Hygiene waste on sewers: Socio-material practices of disposal at the bathroom

In this section we review different strands of social sciences literature including historical, sociological, and anthropological theorisations of cleanliness and hygiene as well as socio-technical approaches to the study of practices and infrastructures. We suggest how the contributions they offer can be applied to the study of unflushables and outline empirical questions for further research.

3.1.1. Hygiene consumerism and conventions of cleanliness

Social sciences literatures define cleanliness as both a biological and social concept (Campkin & Cox, 2007; Douglas, 1984; Smith, 2007). Historical approaches have shown how hygiene norms, conventions, and standards change over time with developments in water supply and sewerage systems (Shove, 2003; Smith, 2007). In general cleanliness is becoming more resource consuming, not only in terms of water and energy but also through the commodification of hygiene (Jack, 2018; Shove, 2003). The number of products 'required' to comply with hygiene norms, conventions and standards is on the rise. Also hygiene products, and the ways they are used, change to adapt to new lifestyles and rhythms such as an increased focus on 'convenience' often delivered through single use products.

Some changes in patterns of hygiene products use and disposal are reflected in the historical data collected about the content of solids in sewers. Data from the late-1990s showed a great number of people disposed menstrual products in the toilet (Friedler et al., 1996), with tampons the most frequently flushed (Ashley et al., 2005; Friedler et al., 1996). However, the content of wastewater composition has changed since the '90s (Mitchell et al., 2017). While menstrual hygiene products, and particularly tampons and applicators, continue to be frequently flushed their volume has decreased in relation to other products (Drinkwater & Moy, 2017; Hawkins et al., 2018; Spence et al., 2016). This could be interpreted in relation to prevailing countertrends in the increased availability of, and interest in, 'reusable' menstrual hygiene products in recent years (Jones, 2018). This trend may have potentially reduced the impact of disposable hygiene products on the system also comes with increasing water demand from washing these reusable products which has its own impacts and problems during times of water scarcity or disruption (Alda-Vidal & Browne, under review).

A recent study conducted in UK sewers showed that wipes are at present the most common element in blockages (Drinkwater & Moy, 2017). Wet wipes made of nonwoven fabrics have gained popularity for an endless variety of uses in and outside the bathroom. This includes among others, baby wipes, wet toilet paper, hand sanitising wipes, cosmetic and facial wipes,

toddler wipes, incontinence wipes, surface cleaning wipes, gardening wipes, lens wipes, pet wipes etc. (Drinkwater & Moy, 2017; INDA/EDANA, 2017; Mitchell et al., 2017). According to an analysis conducted by Anglian Water (Anglian Water, 2011b), in 2008 wipes made up over half of the retail sales of the cleansing market (estimated in £232 million). In 2010 one in every two adults in the UK had purchased some form of wipe (Anglian Water, 2011b). In the last years, the nonwoven industry has grown substantially, and production and sales in this sector are estimated to continue increasing at a very fast rate (Atasağun & Bhat, 2018).

From the consumers point of view these types of products fit in “modern lifestyles” and are “cheap and easy to use” (Atasağun & Bhat, 2018, p. 2) . Easy disposability is considered as the key feature (Anglian Water, 2011b). In many cases these products have penetrated so much on daily routines that even environmentally conscious consumers find difficult to substitute them for more sustainable options.

Further research: Understanding the Demand for Disposable Hygiene

Further research is needed to understand how demand for (and practices of use and disposal of) different products such as menstrual hygiene products and wipes changes in relation to i) new expectations, conventions, and trends in personal and household cleanliness and ii) contemporary life styles and rhythms would be important from a policy and intervention perspective to identify how products (and inappropriate disposal practices) can be reduced or substituted for more sustainable options. In particular the analysis of factors driving the reduction of menstrual waste disposal through sewerage systems could help to identify strategies that could also work for wipes.

3.1.2. Cultures of flushing and infrastructural imaginaries

A survey undertaken in 2004 in 44 countries points the practice of flushing solids down the toilet which “appears to be most prevalent in the UK” (Ashley, 2004, p. 37). More recent studies concur that this practice is more common in the UK than neighbouring European countries (MCS, 2013). Ashley suggests that the prevalence of inappropriate flushing practices is underpinned by different infrastructural expectations, which are linked to the historical development and material characteristics of sewers systems. In the UK, much like other countries in the Global North, a culture of flushing waste into waterways (Benidickson, 2007) has developed since the first water and sewerage system were designed to ‘sweep away’ difficult, visceral materials related to our bodies (Kaika, 2005; Kaika & Swyngedouw, 2000; Sofoulis, 2005). Over decades these systems have been buried beneath cities, disappearing from the users’ sight (Kaika & Swyngedouw, 2000) and rendering the services they provided taken-for-granted (Star, 1999). This has contributed to the emergence of a specific infrastructural imaginary and set of consumer expectations which, as Ashley puts it, creates a perceived “right to put all kinds of solids in sewers” (Ashley, 2004, p. 214).

Yet these infrastructural expectations are not universal and inappropriate flushing practices seem to be less common where infrastructures, or infrastructural failures, are more visible for users. For example, users connected to off-grid solutions such as septic tanks that require more level of responsibility and engagement in maintenance are more aware of the challenge

produced by unflushables and less likely to dispose these products via the toilet (Hawkins et al., 2018). A similar dynamic has been observed in other locations where users could not rely on the capacity of toilets and sewers to cope with unflushables. In large parts of Greece and most of South America, sewers were not designed to handle toilet paper and normal practice is to dispose of used toilet paper in a bin. As a result, people in these countries are much more prone to use the bin for other sanitary and hygiene products (Ashley, 2004).

In the UK infrastructural expectations of flushability are further compounded by privatisation. Introduced as a means to establish a higher level of service for water and sanitation systems, privatisation has further entrenched a sense of the 'financial water consumer' with certain demands on the system for a specific level of service (Bakker, 2003; Loftus et al., 2019; Trentmann & Taylor, 2005) and delivery of environmental health (cf. Environment Agency, 2018; Ofwat, 2019). While some sources of pollution are sewer misconnections (Ellis & Butler, 2015), the water sector is recently mired by reports, legal action and fines due to inappropriate water pollution through sewage overflows resulting in calls for new legislation to protect and restore waterways (cf. Wainwright & Bradshaw, 2019; WWF UK, 2017).

This issue shows the deep socio-political nature of the problem of unflushables. For water companies operating in this space of trying to reduce the disposal of unflushable products in the sewerage system, there is a need to also address how interventions and engagement also connect with issues of trust in water companies (cf. Ofwat, n.d., n.d.), and wider discussions about private companies delivering environmental goods in a regulated water market (cf. Bakker, 2010). This provides a unique set of political challenges in which cultural practices and infrastructural imaginaries are enmeshed.

Further research: Understanding infrastructural imaginaries and service expectations

Further research is needed to understand the role of imaginaries and expectations about infrastructures and the provision of urban services in the prevalent flushing cultures in the UK. Action in this space should also consider developing a deeper understanding of the connections between individual, household and cultural practices in context of water privatisation including issues of trust in privatised water sectors, and support stronger voluntary, regulatory and legislative frameworks to reduce sewage pollution in order to build consumer trust.

3.1.3. Sensory experience of dirt and cultural differences in attitudes towards waste

According to Ashley et al, the practice of flushing hygiene products down the toilet "stems from the historical link associating health risks with human waste" (Ashley et al., 2005, p. 206). As they report, for many people the idea of disposing products "contaminated" with blood or faeces in the waste bin is perceived as a threat to human health, even when health professionals assure the health risks that these products actually pose among healthy populations are negligible (Ashley et al., 2005).

As many authors have noted our perceptions of cleanliness and hygiene have more subconscious motivations than disease prevention. Anthropological approaches to the social

construction of cleanliness, mainly working in majority world contexts, have documented the role of conventions, ideas of morality, sensorial engagements, or visceral reactions as powerful motivations for sanitation and hygiene practices (Akpabio & Takara, 2014; Bloomfield, 2003; Jewitt, 2011). The sensory experience produced by the smell, touch or sight of bodily fluids or dirty things is an influential element shaping how we deal with them.

In a related area of sustainable consumption, research on food waste has explored how modern embodied meanings around 'dirt' and 'contamination' in homes shape decisions about when food becomes waste and how this is discarded (Martin et al., 2006; Metcalfe et al., 2012; Waitt & Phillips, 2016; Welch et al., 2018). This includes research revealing how the aversion to smells and appearances of particular food waste (fats, rotten food) marks the preference for getting rid of these as quickly and with as little contact as possible (Foden et al., 2018; Martin et al., 2006); or the association of organic food waste bins with dirt and anxieties about their potential risk for cross-contamination in the kitchen as important elements shaping hesitation to use them (Metcalfe et al., 2012).

There is evidence that bathroom disposal practices are driven by sensory reactions to used products associated with bodily wastes, particularly blood and faeces. Hygiene, disgust or embarrassment are usually presented as important reasons for not using bathroom bins and preferring a quick out of sight disposal solution (Anglian Water, 2011a; Ashley et al., 2005; Hawkins et al., 2018). Furthermore, evidence from Anglian Water primary research shows that people tend to recycle less in the bathroom than they do in other spaces as waste generated in the bathroom is perceived to be contaminated.

Attitudes and disgust towards human waste vary greatly among cultures and societies (Jewitt, 2011; van der Geest, 2007), what is considered a clean or acceptable practice in one place is not in other (Jewitt, 2011). Yet there has been very little investigation into the implications of cultural differences in relation to flushing practices. From the studies reviewed as part of the REA, only two papers discussed geographical and socio-cultural diversity in flushing practices (Ashley, 2004; Spence et al., 2016). This gap signals an important topic for future research.

Spence et al. (2016) comparison of the solids contained in wastewater samples from three different areas in Sheffield (i.e. high income white population, low income ageing population, and low-income 30% Pakistani ethnicity) showed that hygiene products (except for tampons) were more numerous in samples from the area characterised by low income and ageing population. Primary research conducted by Anglian Water also points to cultural differences in relation to flushing practices in the catchment areas. These include different habits and use of menstrual products. For example, they have noted women from Asian background are less likely to flush tampons down the toilet as many prefer other absorbents over tampons. For many Eastern Europeans the toilet is seen as largest orifice in the house to get rid of food waste without it smelling.

As per Anglian Water experience, faith seems also an important element driving differences in flushing practices. In Islam, polluting water is prohibited as it is considered sacred. Local Imams

have supported Anglian Water efforts by reminding people at Friday prayers not to flush anything that can pollute or cause blockages to the water cycle. Another cultural difference was ascertained in Jewish communities. In Jewish faith tearing things is forbidden during the Sabbath which results in wipes being used as a substitute for toilet paper.

Evidence from Anglian Water also demonstrates that problems caused by flushing practices are exacerbated in areas where sewer pipes are thinner and older (24mm pipes pre 1960s). These types of pipes tend to correspond to social housing areas. Equally it has been known that in affluent areas there is a reliance on moist toilet paper and wipes. In general there are more people using wipes for personal hygiene as marketing plays on the need to be clean.

Considering the socio-cultural and socio-spatial dynamics of disposal practices also connects with research that has identified the importance of thinking about the multiple and interconnected dynamics that may influence sewer blockages and their socio-spatial distributions across a city (cf. Marvin & Medd, 2006).

Further research: Understanding Different Sensory Reactions to Everyday Waste and Cultural Interconnections to Bathroom Infrastructures

Further research is needed to explore how sensorial and visceral reactions play in decisions around different ways of discarding products that have been in contact with bodily fluids or faeces. In particular research is needed to understand problematic practices, and how these relate to different cultural habits within the UK. Care should be taken not to assume that practices are determined by socio/cultural demographics, but to explore diversity in cultural context and routines. An additional question to consider is how these dynamics connect different infrastructures of waste disposal within bathrooms including what other possibilities there are for discarding products that are perceived as risky or gross without creating problems elsewhere in the waste system.

3.1.4. Gender dimensions of flushing practices

Feminist scholars have shown that personal and household cleanliness is gendered. The burden of home and family cleanliness has traditionally disproportionately fallen on women (Berner, 1998). Still today women in the UK perform the majority of housework (Barr, 2019). Cleanliness is central to the performance of femininity (Jack, 2018). As such women are subjected to stricter (internal and external) standards and expectations in relation to their own personal cleanliness and that of the household and its members. These gender conventions are often institutionalised by the cleanliness industry that targets women with an always growing number of products and technologies.

Important gender dynamics also play a role in shaping the disposal of menstrual products, which are considered one of the main causes of problems in sewer systems. Around the world there are pervasive menstrual stigmas including shame, beliefs, taboos, which require menstruating people to deal with their periods in privacy and secrecy. These dynamics, intersecting with infrastructural limitations due to a failure of sanitation governance to plan for menstrual hygiene needs, has importantly restricted the possibilities for menstruating people

to deal with their periods in a safe and hygienic way across home, public, and work/educational spaces (Alda-Vidal & Browne, under review; Bobel, 2019). In the UK and other western countries due to menstrual etiquette “the management of menstruation has remained a highly personal, private act which needs to be concealed at all costs” (Moffat & Pickering, 2019, p. 768) impacting on the everyday experiences of discarding menstrual waste.

A study about the UK’s Bag-It-Bin-It campaign, aiming at reducing inappropriate flushing of menstrual products, pointed to embarrassment as one of the elements for women not wanting to introduce a bathroom bin for disposal in the home (Ashley et al., 2005; Brown et al., 2006). More recent research shows that the situations become more complicated for menstruating people when out of home or using public facilities: women report to feel stressed with the possibility of not finding (functional) disposal facilities (Moffat & Pickering, 2019) or having to use bins located in communal areas where used absorbents are exposed to others (Hawkins et al., 2018). In those situations many women opt for wrapping the used menstrual products and carry them on their person in search of an appropriate facility for disposal (Hawkins et al., 2018; Moffat & Pickering, 2019).

The problem of inappropriate flushing practices has often been framed as a gendered issue in the literature and policy contexts, with studies indicating women in the main are responsible for inappropriate disposal practices (Friedler et al., 1996). Men too have perceived “the problem to be entirely related to female behaviour and of little relevance to them, ignoring their own toilet disposal of condoms, razors, and cotton buds” (Ashley et al., 2005, p. 209). Awareness raising campaigns and other interventions have thus mostly been directed to women (examples in Ashley et al., 2005; Harvey, 2018). For example, Sydney Water identified in 2019 that: “We had made an assumption that it would be young mums, with young families, with babies, who would be the primary user. We did quite an extensive survey and it was quite interesting, the major user group of flushable wipes were young males, 15-29.” (Zhou, 2019). Similarly Anglian Water’s primary research have found men flush baby wipes more than women as they use them as cheap alternatives to moist toilet tissue.

Emerging research shows how hygiene standards and conventions are changing in relation to new ways of understanding masculinity (Jack, 2018). This change meaning in practice an increasing pattern of use and inappropriate disposal of hygiene products by men (Grant, 2013; Harvey, 2018; *Keeping it Clear Together. Brochure*, 2018; Silmalis, 2014; Sofoulis, 2017).

Discussions around gender and flushing hygiene products have two implications. The first is that further research is needed to understand the gendered dynamics of cleanliness expectations, as well as how bodily, family, and domestic labour shapes the use of disposable products. The second implication is the need to approach the assumptions around the gendered notion of ‘wet wipe’ or disposable product use as a ‘women’s problem’ either associated with their own self-care, or care of other for whom they have responsibility such as young children. Care needs to be taken not to moralise, or responsabilise, the practices of women without understanding the wider gendered dynamics underpinning disposal practices across society.

Consumer cultures and everyday practices of cleanliness and hygiene are also changing for men, so programs and interventions will need to be careful not to adopt a culture of blame of women. Rather developments in this space need to design interventions, governance and new infrastructures with the needs of gendered users in mind (Alda-Vidal & Browne, under review).

FURTHER RESEARCH: Understanding, and Planning For, Gendered Practices

Further research is required to understand the gender dynamics shaping the use and discard of hygiene products and how these connect with gendered patterns of home, childcare and personal bodily labours. Changing dynamics of use and disposal of hygiene products associated to new ways of understanding masculinity are also an important area for further exploration. In regards to menstrual products, more research on how menstrual stigma and etiquette influences flushing practices across different spaces (e.g. the home versus schools, workplaces, public toilets) could help to inform policy and interventions on the specific needs of menstruating peoples in relation to disposal of these products. There is also a need for more research to understand how menstrual etiquette and stigma can be eliminated.

3.1.5. Product design and flushability regulations

Literature on unflushables connects inappropriate flushing practices to perceptions about their flushability. As we elaborate in this section, these perceptions are result of both the material properties of unflushables and the way they are used, and the lack of clear labelling and standards. Current policy and governance conversations are trying to address this challenge.

Hawkins et al (2018, p. 7) note that “the mechanics of removing used tampons make flushing the ‘easiest’ and most ‘hygienic’ option” for many of the participants in the study (Hawkins et al., 2018, p. 7). Women perceived tampons to be flushable based on “the compact shape and material composition” and the fact that “the product flushed away easily” in practice. Applicators made of cardboard were also perceived as easily disintegrating (Hawkins et al., 2018). The use of particular products also influences practices of disposal. As Anglian Water research notes, consumers assume wipes that are used to clean the toilet must be suitable for flushing (“if I’ve cleaned the loo with it – it is fine to flush it”) (Anglian Water, 2011b). The design characteristics of products as these may be contrary to product labels, but convey a different understanding of flushability to users. In Anglian Water’s primary research consumers also mentioned that as tampons have been ‘inside bodies’ it is then seen as a bodily waste to be flushed like menstrual blood, pee and poo.

The lack of clarity in the vocabulary used for the commercialisation of these products has also contributed to misperceptions. A wipe or a tampon may be made of bio-degradable materials but those may not be easily and quickly disintegrated and dispersed in wastewater systems and thus the products should not be treated as flushable. This has been complicated by the history of commercialisation of these products. Many hygiene products were for a long time marketed as flushable (Atasağun & Bhat, 2018; Finley, 1998b, 1998a, 1998d, 1998c; Vostral, 2008). Later, producers started including ‘do-not-flush’ symbols in packages (Naismith, 2017). Yet symbols and instructions were not consistent or clear (Naismith, 2017).

In the last years, there have been attempts to standardize the labelling of flushable products through different guidelines and codes of practices (INDA/EDANA, 2017, 2018; WaterUK, 2019). However, these are not as ambitious as some actors would like as they are voluntary; they do not include any obligation for manufacturers to disclose the type of fibres used in production; and they only look at the performance of products in relation to wastewater system but do not address wider environmental challenges such as environmental pollution (Naismith, 2017; Pantoja Munoz et al., 2018).

At the national level, the UK water industry focus has been on defining flushability through a UK only water industry flushability specification – *Fine to Flush*. The *Fine to Flush* specification was created following an impasse to reach an agreement on an ISO joint standard on flushability and a UK-only joint flushability specification with water companies and wipes industry stakeholders. A number of retailers and manufacturers are now testing to the Fine to Flush specification in the UK. As of March 2020 eight products have been awarded the Fine to Flush logo/certification and many more are likely to be awarded the same. Determining the flushability of products and agreeing on a common standard regarding flushability is an important step to ensuring sustainable manufacturing.

However research suggests that a *Fine to Flush* label is unlikely to be sufficient to prevent inappropriate disposal practices. Research on labelling carried out in 2017 by the water industry showed labelling of products as ‘Do Not Flush’ did not prevent the items being flushed. Even with a sophisticated marketing and communication campaign, without underlying primary research to first ascertain people’s attitudes and behaviours around the current different labelling and a behavioural change programme approach, a campaign will not be effective in preventing flushing behaviour.

Wet wipes are only one category of products and there are other products when flushed cause problems for the sewer system. Relatedly, the promotion of *Fine to Flush* products to consumers sends a confusing normative signal regarding appropriate disposal practices that risks a rebound effect. In the worst-case scenario this rebound could result in higher volumes of unflushables entering the sewer system. Even if these initiatives were collectively successful in changing behaviours of consumers, this may only push the problems elsewhere, increasing the challenge of municipal solid waste management.

FURTHER RESEARCH: Governance, Regulations and Standards

Further research is required to understand how inappropriate flushing practices are underpinned by customers’ misperceptions in relation to the flushability properties of different products and how those can be changed. Research is also needed to understand the landscape for governance and policy development, including the scope of options for new and more ambitious regulations.

4. Case study: Anglian Water's response to the challenge of unflushables

This section provides a review and analysis of Anglian Water's response to the challenge of unflushables. The section starts by presenting a background of Anglian Water's program to reduce avoidable blockages. Next, Anglian Water's actions are classified following the typology proposed by Hoolohan and Browne (2016) in *service provision, decision making, social norms and networks and socio-technical practices*. In the last part of the section we reflect about the main findings from this analysis and suggest potential actions.

4.1. Background of Anglian Water's interventions in unflushables

Anglian Water's pioneer approach to reduce avoidable blockages produced by FOGs and hygiene waste has combined transformational interventions implemented at local level to shift practices of disposal with collaboration across company boundaries to push for sectorial governance changes. Their actions in these two areas of work have situated Anglian Water in a leading position in tackling the challenge of unflushables and are particularly commendable given the limited research on the topic.

4.1.1. Across company boundaries: research, regulation, and governance

Through the chairing of Water UK Sewerage Network Abuse Prevention group (SNAP) and 21st Century Drainage Programme Anglian Water has contributed to:

- Developing a robust program of research including studies on the composition of blockages (Drinkwater & Moy, 2017) or the labelling and content of plastic of hygiene products (Naismith, 2017);
- Driving advancements on the regulation and governance of flushable products. This has included producing policy positions and signing national and international statements (*International water industry position statement on non-flushable and 'flushable' labelled products*, 2016; WaterUK, 2010, 2016). As part of this engagement Anglian Water has participated in the development of flushability protocols and standards (Drinkwater & Galletti, 2008; WaterUK, 2019). An example of this is the recent WaterUK developed standard: "Fine to flush" (WaterUK, 2019).

4.1.2. Reducing avoidable blockages: Keep it clear

Anglian Water has developed a comprehensive programme to reduce avoidable blockages produced by FOGs and hygiene waste: Keep it Clear (KIC). The KIC programme was originally based on Nancy Kotler and Philip Lee's social marketing theory (Cf. Kotler & Lee, 2008) and was designed for Anglian Water by Corporate Culture. The transformational approach of Keep it Clear works on the principle that "it is possible to influence and change people's behaviour" (*Keeping it Clear Together. Brochure*, 2018, p. 6). There are 2 main overarching audiences for the programme: domestic customers (FOG/food waste and Unflushables) and food premises (FOG – food premises are not consented trade effluent businesses and do not come under the company's trade effluent inspector teams). The program includes 10 main strategies to

achieve social change (Figure 2). Whenever a new activity is introduced to the program a 6 step process is followed (Figure 3).

1. Social Issue analysis
2. Listening
3. Communicating
4. Public policy
5. Infrastructure & systems
6. Products, services & choices
7. Collaborative actions
8. Community & grassroots action
9. Participation & engagement
10. Organisational change / upstream marketing

Figure 2: 10 main strategies to achieve social change



Figure 3: KIC 6 step Social Marketing Planning Process

KIC 'formula' approach when targeting a hot spot (blockage/flooding/pollution) area is described in figure 4. Once a 'campaign' is started in an area there is always a constant drip feed of reminders and interventions.

Our social marketing approach

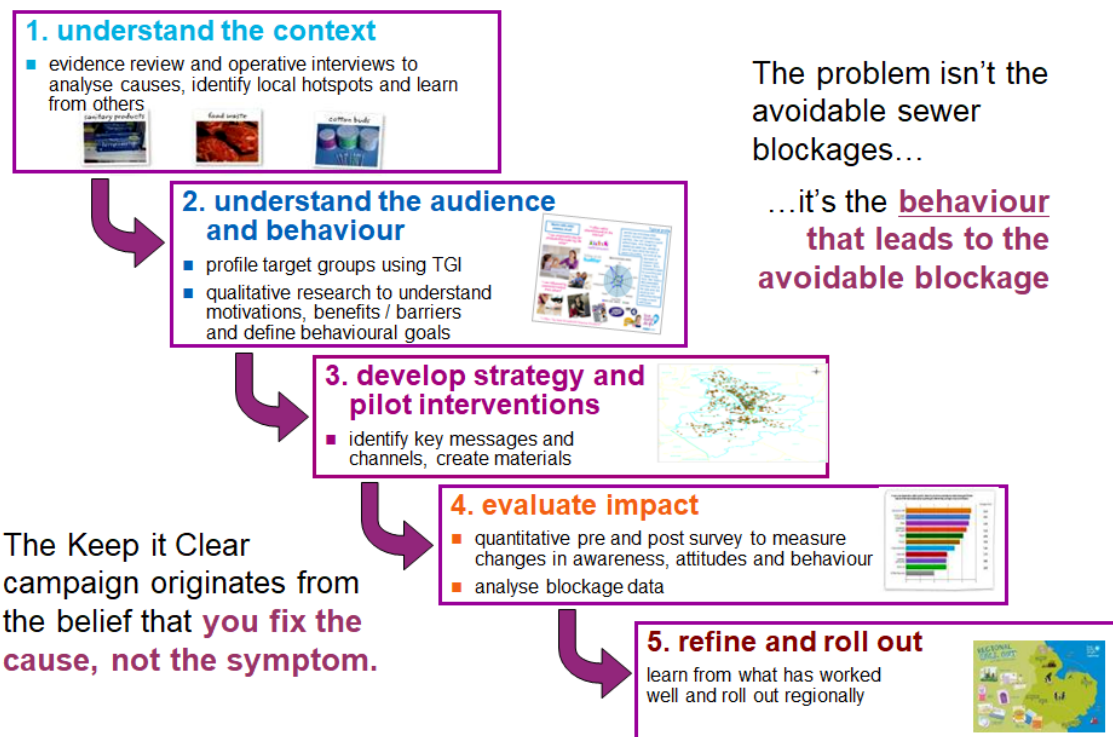


Figure 4: KIC Social Marketing Approach

The program has included a diverse collection of actions from communication and awareness to the provision of tailored information, gamification, learning by doing, community-based engagements and technological innovation aiming at shifting inappropriate practices of disposal of unflushables. All these elements are not seen as independent but as contributing to the whole programme.

The approach has been informed by the latest findings and best practices as reflected by academic research on behaviour change and social marketing including engagement with social norms and networks. This includes the following (*Keeping it Clear Together. Brochure, 2018*):

- Positive messaging and direct, clear and simple communication, making it easy to act;
- Segmentation of audience by experiences, behaviour and attitudes with the purpose to adapt the message to the diverse needs and motivations different audiences have. (e.g. segmentation of households in younger, older and families and analysis of their differentiated interests and attitudes in relation of the disposal of unflushables);
- Use of trusted voices in the community to spread the message (e.g. community and voluntary groups working on day care centres, community allotments, religious centres);

- Targeted campaigns after moments of interruption in the service to grab attention and make visible the infrastructures and the problem to users (e.g. an internal flooding in a Mosque in Wellingborough was the starting point of a campaign with worshippers and nearby community members);
- Use of local facts and specific information for each of the communities to make visible how the problem impacts them locally (e.g. campaigns refer to particular locations naming them and providing information on the amount of blockages suffered in the area);
- Open and flexible approach reflected on the ability to incorporate feedback from customers and programme learnt experiences in new actions.

According to an evaluation of the programme conducted by Anglian Water there has been a successful reduction in overall blockages in 30 per cent and 52 per cent in those areas where the campaign has been active for more than a year (*Keeping it Clear Together. Brochure, 2018*).

4.2. Anglian Water's typology of actions

A selected group of Anglian Water's actions in unflushables (*Keeping it Clear Together. Brochure, 2018*) have been classified following the typology developed by Hoolohan & Browne (2016) (see Table 1). This classification was developed to analyse water efficiency approaches in the UK but can be applied to work with other resource challenges and in other country contexts (Foden et al., 2017, 2018). In the following sections we introduce the main characteristics of each of the four relevant categories and discuss examples of Anglian Water's actions for each.³

³ The programmes that were selected and analysed as part of this consultancy project were largely actions that encompassed focus on customer and community engagement. Anglian Water also invests substantially in activities that would fall under the scope of 'Service Provision' i.e., programmes that focus largely on clearing sewer blockages or finding technological solutions to this issue. However, analysing these programmes was outside of the scope of this consultancy, and therefore, service provision is part of the review but not the case studies analysed in Table 1.

Table 1 – Summary of typology of Anglian Water actions on unflushable. Adapted from Hoolohan & Browne (2016) and Foden et al. (2018)

| Activity Name | Individual Decision making Intended to change consumer understandings of desirable and effective disposal practices | Social Norms and Networks Intended to change understandings of what is normal and acceptable | Socio-technical Intended to effect change in the collective conventions, routines and infrastructures of consumption |
|---|---|--|--|
| The Unmentionables | ** | * | |
| Period pilot | | | * |
| FablittleBag | ** | | * |
| Lottie’s Vlog | * | ** | |
| Stop the unflushables (MCS) | * | | |
| Engaging with communities: Targeted intervention | * | ** | |
| Engaging with communities: via a network of organisations | * | ** | |
| Student pipeline | * | ** | |
| Young citizens | * | ** | |
| Go with the flow | * | ** | |
| University ambassadors | * | ** | |
| Northampton General Hospital | * | ** | |
| Advertisement for baby TV (hospitals) | * | ** | |
| Wetwash | | | * |
| Hidden plastics | * | | |
| CXTP Email campaign | * | | |
| Fine to Flush - creation of flushability specification (led by KIC) | | | * |

(*) main approach (**) secondary/ additional approach

4.2.1. *Service Provision*

Service provision approaches encompass a range of preventive maintenance (PPM) measures implemented by the water industry to ensure the continuation of the service. Interventions include upgrading and redesigning the infrastructure to accommodate increasing volumes of solid material (Foden et al., 2017); fitting new equipment in wastewater treatment plants to accommodate unflushables; assuming the recurrent costs of repairs and maintenance (Ashley et al., 2005) or incorporating retention and screening systems to avoid discharge of these elements into the environment (Ashley, 2004; Ashley et al., 2002). Removal of blockages and cleaning of affected areas is also an important part of action within this approach. Water companies can also implement infrastructural measures that force behaviour change, for example retrofitting outlet flow constrictors (Ashley et al., 2002).

As Foden et. al (2017) argue PPM approaches are problematic for different reasons. These strategies imply accepting that the practice of flushing down the toilet will continue. As such they sustain and reaffirm present practices, expectations and hydro-social contracts. Maintenance, technical adaptation, and upgrading of the system are expensive and push the cost onto the companies, and ultimately their water customers. The elevated costs make some of these interventions unsustainable or not feasible, and perhaps even futile, as without change in practices of disposal the outflow of these products may become too much to maintain.

This approach also transmits the message that the water and sewerage sector is responsible for addressing the challenge, whereas responsibility for its creation is distributed across supply chains, other producer responsibilities, the sewerage/water companies and citizens. Such a framing that focuses solely on service provision, and the infrastructural possibilities for dealing with flushed products when in the water and sewerage system, misses the possibility of involving and collaborating with other actors who may be able to influence other 'Change Points' within the whole system of production-use-disposal of such products.

The overall costs reported by Anglian Water for service provision focused activities for unflushables challenges in 2016/17 were £19.7 million (Anglian Water data: cost of FOG/unflushables blockages 2018). These costs include insurance, customer service, reputation damage etc. and were comparatively higher than the budget dedicated to KIC per activity in a similar period (£550,000).

4.2.2. *Individual Decision Making*

'Individual Decision Making' positions disposal practices as the result of conscious decisions of individuals and appeal to changes in attitudes, behaviours and choices in order to change behaviour. Behaviour change approaches are very popular in the water sector. Examples of this are the *Bag-It-and-Bin-it* campaign implemented by a coalition of actors at UK national level since 1995 or the *Think Before You Flush* led by the Scottish Water Authorities (Ashley et al., 2005). The overall objective of these campaigns was to create public awareness around the

problems that unflushables cause in sewers and the environment and to educate individuals on the right way of disposing these products.

Anglian Water’s program on unflushables has followed a similar line of work, with a majority of actions including Individual Decision Making as the main or secondary approach to campaigns and intervention (see Table 1). As Table 2 shows, these activities are focused on the provision of information around the negative effects of inappropriate flushing practices and education on right methods of disposal. This has been done through the production of formal educational resources (e.g. Period Pilot aimed at producing a lesson plan for schools to educate on disposal of sanitary products), educational games (e.g. the Unmentionables, Go With the Flow), community-based approaches to cascade out information (e.g. Student Pipeline, Young Citizens, Engaging with communities, use respected community organisations or groups of volunteers to pass-on the information about the challenge and right ways of disposal) or the use of social marketing channels (e.g. Lottie’s Vlog was a YouTube influencer style clip to raise awareness about the challenge of unflushables). The use of tailored information has been incorporated in some activities to adapt the message to specific communities or events (for example using local toponyms or referring to real incidents) as a way to catch the attention of customers and create a sense of proximity to the challenge.

The majority of these activities have targeted the customers of the company and users of the infrastructures in general with little differentiation among them. Some activities have focused on women as users of menstrual absorbents (e.g. the Unmentionables, Period Pilot, FabliddleBag) or young people (e.g. Period pilot, Lottie’s Vlog, Student pipeline, University ambassadors).

Table 2- Anglian Water’s Actions: Individual Decision Making

| Activity | Description | Individual Decision Making Intended to change consumer understandings of desirable and effective disposal practices |
|-----------------------|---|--|
| The Unmentionables | A fun hen-party style game to educate women on sanitary waste disposal | Information & awareness raising; Gamification |
| FabliddleBag | Keep It Clear teamed up with Mumsnet and FabLittleBag™, a hygienic, easy-to-use disposal bag that biodegrades. Mumsnetters were surveyed and given the chance to trial the product | Information & awareness raising |
| Lottie’s Vlog | YouTube influencer style clip to engage with young people in senior schools | Information & awareness raising; Social Marketing |
| Targeted intervention | Collaboration with local partners to cascade out information and advice after particular incidents. At the time of something going wrong, i.e. overflowing manhole/blocked toilet is the time to grab attention, engage with the customer and change behaviours | Information & awareness raising Tailored information Community based approaches to cascade-out information |
| Engaging with | Long term funded partnerships with local | Information & awareness |

| | | |
|--|--|--|
| communities via a network of organisations | organisations and community groups that help sustain interaction by using their staff and volunteers to cascade out information and awareness. | raising; Community based approaches to cascade-out information |
| Student pipeline | Student ambassadors were recruited to spread the word about how to avoid blockages at different universities. | Information & awareness raising; Community based approaches to cascade-out information |
| Young citizens | Young volunteers engaged in promoting Keep it Clear | Information & awareness raising; Community based approaches to cascade-out information |
| Go with the flow | Board game for teenagers and adults | Information & awareness raising; Gamification |
| University ambassadors | Educational and awareness rising activities for university students | Information & awareness raising; Community based approaches to cascade-out information |
| Northampton General Hospital | Raise awareness activity directed to hospital staff including the production of posters | Information & awareness raising |
| Advertisement for baby TV (hospitals) | Advertisement on correct disposal of wipes was displayed on TV in maternity waiting rooms | Information & awareness raising |
| Hidden plastics | Research to find out if people were aware that plastics were in sanitary products and wipes and if they did would that change their flushing behaviour | Information & awareness raising |
| CXTP Email campaign | Email targeting customers with chance to win prize for pledging to Keep it Clear | Information & awareness raising; Financial incentives/dis-incentives/penalties |

There is a strong body of evidence that highlights the limitations of individual decision making approaches (Brown et al., 2006; Foden et al., 2018; Hawkins et al., 2018; Hoolohan & Browne, 2016). This approach often assumes that disposal practices are the result of a rational and conscious choice and overestimate the power of the individual to change their own practices and ignore difficulties to translate intentions into actions and wider structural barriers. People's behaviours are difficult to change and while interventions may be effective in the short term they are difficult to sustain in the long term as often practices re-emerge, and are linked to unknown rebounds. This type of unintended rebound effect has been observed for example in cases where the adoption of a water saving device has prompted more water-intensive consumption behaviours. Furthermore the approach usually locates the intervention in the bathroom and focuses on the moment in which the decision about disposal is made missing possibilities to intervene at other sites and moments that might more substantially create change throughout the whole system (Foden et al., 2018). Finally if individual approaches were successful, stopping these products going down the toilet only shifts the problem of disposal/degradation to somewhere else (e.g. landfill). This highlights the need to

engage with a broader range of actors including those involved in products’ marketing, manufacture, and retail among others.

4.2.3. Social Norms and Networks

More recently some behaviour change approaches have adapted to engage social norms and networks. These interventions are based on the idea that people’s decisions are more influenced by what they think is normal and acceptable by others than they are by direct instructions (Foden et al., 2018; Hoolohan & Browne, 2016)(Foden et al., 2018; Hoolohan & Browne, 2016). Thus they seek to open alternative pathways for practice evolution by changing perceptions of normality. Social networks are used to disseminate and normalise desirable practices, for example, identifying and using key actors and groups with influencing power. This approach shares some of the challenges of individual decision making interventions such as providing an instrumental vision of social norms.

Anglian Water has rapidly incorporated the use of Social Norms and Networks to their activities (Table 3). Despite only one of the actions having been designed with Social Norms and Networks as the main approach (for more details see Case Study 1) many other activities include features that belong to this category. These actions seek to end with the perception of flushing being a “normal” practice. This is done, for example, through actions that confront those who flush products down the toilet with the “abnormality” of their own practice (e.g. in Lottie’s Vlog flushing is presented as an anomalous practice) or by opening the conversation between people with adequate and inadequate habits (e.g. The Unmentionables aimed at sparking debate among women who flush menstrual products and women who do not). Other actions target specific moments of change in people’s life where routines are unsettled such as pregnancy/new parenthood, moving home, migration. These moments of change are used to familiarise customers with new norms around disposal of unflushables (e.g. Advertisement for TV targeting families with new-born babies). The use of influential messengers (‘influencers’) has been used to normalise disposal in the bin and effect change in flushing habits. For example many actions have used respected organisations and community groups, for this purpose and the Unmentionables used influential women in the region to act as hosts of the game.

Table 3- Anglian Water’s Actions: Social Norms and Networks

| Name | Description | Social Norms and Networks Intended to change understandings of what is normal and acceptable |
|--------------------|--|---|
| The Unmentionables | A fun hen-party style game to educate women on sanitary waste disposal | Comparative communications / normative marketing Trusted messengers |
| Lottie’s Vlog | YouTube influencer style clip to engage with young people in senior schools. | Comparative communications / normative marketing |
| Engaging with | Collaboration with local partners to | Trusted messengers |

| | | |
|---|--|--------------------|
| communities: Targeted intervention | cascade out information and advice after particular incidents. At the time of something going wrong, i.e. overflowing manhole/blocked toilet is the time to grab attention, engage with the customer and change behaviours | |
| Engaging with communities: via a network of organisations | Long term funded partnerships with local organisations and community groups that help sustain interaction by using their staff and volunteers to cascade out information and awareness. | Trusted messengers |
| Student pipeline | Student ambassadors were recruited to spread the word about how to avoid blockages at different universities. | Trusted messengers |
| Young citizens | Young volunteers engaged in promoting Keep it Clear | Trusted messengers |
| Advertisement for Baby TV (hospitals) | Advertisement on correct disposal of wipes was displayed on TV in maternity waiting rooms | Moments of change |

Case Study 1. Social Norms and Networks

Name: The Unmentionables

Type of Activity/Intervention:

- Social Norms and Networks (Comparative communications / normative marketing)
- Individual decision making (Gamification / Information and Awareness raising)

Population target: Women in Anglian Water Region

Description: The Unmentionables is a fun hen-party style game designed by word-of-mouth marketing agency Grapeviners (<https://www.grapeviners.com/2017/10/18/anglian-water/>) with the Keep It Clear team to educate women on sanitary waste disposal in an innovative, entertaining, effective way. Apart from providing information on correct disposal the objective was to change understandings of what is normal and acceptable through conversations between women with different flushing habits. Influential women in the region were identified and offered the opportunity to host the parties. Influencers were asked to recruit a group of 5-10 friends and invite them to play a mystery game. After the party participants were asked to provide feedback and share the experience in social media (e.g. Facebook)

Tracking impact:

- Over 100,000 conversations reported
- More than 750 women in the Anglian Water region played the Unmentionables
- 89% of flushers were converted to binners
- 15,792 minutes discussing disposal of unflushables
- 61% participants thought that the game was better than advertising or leaflets



Source of images: <https://www.grapeviners.com/2017/10/18/anglian-water/>

4.2.4. Socio-Technical Practices

Strategies under this approach are based on social and home practices literature. This literature defines practices in relation to their socio-technical context. In this work practices are not the result of rational choice or shared beliefs and values (Hoolohan & Browne, 2016) but “consequence of deeply intertwined patterns of activity, cultural conventions and expectations, and the broader technological and infrastructural context” (Foden et al., 2017, p. 9). Instead of focusing on a particular behaviour this approach intends to effect change in the collective conventions, routines and infrastructures of consumption (Shove et al., 2012). This includes actions that seek changing routines, diversifying infrastructures, promoting alternative products and services or changing habitus/context (Hoolohan & Browne, 2016).

Anglian Water’s actions that fall under the Socio-Technical Practices category, despite them perhaps not having been designed with such a conceptual perspective in mind, are presented in Table 4. These include actions that promote alternative products and services by providing information on existing alternatives to unflushables or encouraging customers to experiment with products meant to help in changing routines. Examples of this have been the Period Pilot Lesson Plan that includes information about different types of reusable menstrual products, or the provision of Fab Little Bag sample trials for women to test alternative ways for disposal of menstrual products (See Case Study 2). Anglian Water has also supported local entrepreneurs in the development of new products that help in shifting to more sustainable practices (See Case Study 3).

Overall not many interventions have been designed following the Socio-Technical approach and further research and policy understanding is needed in this area. This connects to wider debates occurring in the literature about the importance of practice-oriented design (cf. Kuijer & De Jong, 2011). This also connects to debates occurring in the UK Government regarding increasing producer responsibility regulations, and Anglian Water and allied stakeholders, could maintain leadership and momentum to influence stricter regulation around ‘flushability’ standards and increase the profile of discussions around the circularity and circular economy debates and how they relate to minimising waste from single use products and re-use as related to the hygiene, sanitation and water sector. This links to existing EU regulation (Reduction of the impact of certain plastic products on the environment, 2019) as well as ongoing debates about the 25 Year Environment Plan and related environmental regulation, and governance.

Table 4- Anglian Water’s Actions: Socio-Technical Practices

| Activity | Description | Socio-technical Practices Intended to effect change in the collective conventions, routines and infrastructures of consumption |
|--------------|--|---|
| Period pilot | Lesson plan for schools to spark debate about the methods of disposal of sanitary products, the social and environmental impacts of menstruation and the alternatives to disposal sanitary | Alternative products and services |

| | | |
|--|--|---|
| | products. This will be part of the PSHE National school curriculum | |
| Fab Little Bag | Keep It Clear teamed up with Mumsnet and FabLittleBag™, a hygienic, easy-to-use disposal bag that biodegrades meant to facilitate disposal in the bin of menstrual products. Mumsnetters were surveyed and given the chance to trial the product (see Case Study 2) | Alternative products and services Experiential |
| Wetwash prototype | Supported the development of a prototype of the Wetwash, a hand pumped, warm water bidet intended to reduce toilet paper consumption and removes the need for wet wipes. While the device was developed into a prototype further development failed due to challenges at implementation level (see Case Study 3) | Alternative products and services |
| Fine to Flush - creation of UK water industry flushability specification - led by KIC team | Creation of flushability specification - tests for flushability of products | Alternative products and services |

Case Study 2. Socio-Technical Practices

Name: Fab Little Bag

Type of Activity/Intervention:

- Socio-Technical Practices (Alternative products and services / Experiential)
- Individual decision making (Information and Awareness raising)

Population target: Women in Anglian Water Region

Description: Keep It Clear teamed up with Mumsnet and FabLittleBag™

(<https://www.fablittlebag.com>). FabLittleBag is a hygienic, easy-to-use disposal bag that biodegrades invented by Martha Silcott. The bag makes easier the disposal of used menstrual products in bins as it keeps these hidden and sealed so women do not have to worry about menstrual etiquette (see section 3.1.4). In this way the product aims at shifting inappropriate flushing habits.

Selected women were provided information on appropriate menstrual products disposal and given the opportunity to test the bags. Surveys were conducted before and after the provision of information and trial sample.

Tracking impact:

- After testing Fab Little Bag; almost all who always previously flushed said they now bin.

- 9/10 testers said Fab Little Bag made them feel less embarrassed about tampon disposal and 9/10 testers said Fab Little Bag made them feel more confident about tampon disposal.
- 7/10 say the Fab Little Bag product test make them think about blockages caused by tampons and 9/10 said the test made them think about tampon disposal.



Case Study 3. Socio-Technical Practices

Name: Support to development of Wetwash prototype

Type of Activity/Intervention:

- Socio-Technical Practices (Alternative products and services)

Population target: The action did not target consumers/users but the development of alternative products and services

Description:

Andy Speechley, a local inventor, was supported to develop a working model of the Wetwash. The Wetwash is an affordable and effective hand pumped, warm water bidet. This action seeks to opening alternative pathways for practice evolution by giving people a hygienic alternative for keeping themselves clean while reducing toilet paper consumption and removing the need for wet wipes. <https://www.kickstarter.com/projects/1782654901/wetwash-better-hygiene-for-everyone?lang=fr>

Tracking impact:

The device was developed to a prototype however problems with 3D printing reproduction and costs prevented devices being made into sufficient quality to test in people's homes.



4.3. Case study findings and suggested opportunities for action

An assessment of the interventions undertaken by Anglian Water in relation to the wider academic literatures shows the following dynamics about the approaches adopted.

4.3.1 *Insights about the dominant intervention approach: Awareness and information*

The majority of interventions (13 out of 17) include awareness raising and information components and thus operate on the logic that practices are the result of conscious decisions that will be changed if the right information is provided (i.e. use an individual/social decision making approach). However a few of these (10/17) have also incorporated insights from social norms and network approaches based on creating spaces for exposure to, and conversation around different understandings of what are considered to be normal and acceptable practices (e.g. the Unmentionables Game) or drawing on social networks to influence change (e.g. activities that engage well known and trusted local community groups to cascade out information).

Suggested Action: Our literature review shows that these types of approaches are unlikely to solve the problems associated with unflushables as they overemphasise the responsibility and agency of consumers (as people who can change behaviour). Even when individuals have the desire to make responsible decisions around the disposal of unflushables the wider cultural and infrastructural context and systems of provision-disposal of products limit their possibilities. Interventions could be extended to engage with more comprehensive socio-technical approaches addressing the complexities of the entire system from changing norms and conventions, to diversifying infrastructures, promoting alternative products and services or changing habitus/context.

4.3.2 *Moment and site of interventions: Changing Decisions on Disposal*

The majority of interventions (16/17) are focused on changing decisions over disposal of products at the bathroom, and not considering other moments and sites for intervention. An

exception to this approach was the Period Pilot Lesson plan which included information about alternative menstrual products (washable) that would eliminate the need for disposal. This action shifted the focus of attention from the moment of disposal to the moment of buying disposable products.

Suggested Action: Our literature review shows that unflushable products enter the sewer system as a result of the accumulation of changing conventions around cleanliness and hygiene, contemporary lifestyles and routines, cultural habits, material cultures and infrastructural histories. Interventions could thus incorporate actions to change the multiple cultural, political and material factors that shape how people routinely use and dispose of unflushable products taking into account decisions made at different moments and sites of the wider system of provision-disposal (from design to manufacturing, to shopping, to reuse etc.). An example of this could be to engage with initiatives aiming at changing people's habits of consumption such as zero plastic waste campaigns or those aiming at eliminating non-biodegradable wipes or cotton buds from stores (e.g. (Harvey, 2019; Smithers, 2019)(Harvey, 2019; Smithers, 2019) as a way to reduce the amount of unflushables that enter our sewers.

4.3.3. Targeted actors and partners: Thinking about Diversity and Distributed Responsibilities

All interventions have been designed to target customers of the water company as users of the infrastructures. There is also very little attention and recognition to diversity of practices between households and within households. In thinking about different patterns of use and disposal of products women have been identified as one of the main target groups with specific interventions directed to them (e.g. Unmentionables Game, Period Pilot, Mumsnet and FabLittleBag).

Suggested Action: Our literature review shows that there are many actors who share responsibility for unflushables entering the sewer system, and who have agency to affect change. Reducing unflushables will require not only that water companies and consumers work together, but that their efforts are supported by the many organisations and businesses that contribute to the social organisation of practice. Furthermore, acknowledging diversity in practices helps identify different opportunities for intervention, and avoid designing interventions that blame and expose particular groups of people.

5. Summary: Reflecting on opportunities from the review and analysis of Anglian Water programmes

As this report identifies, unflushables present a distributed problem, one that is not the direct consequence of individual behaviour, product design or infrastructural decline, but the outcome of myriad social, cultural and material developments in society. For this reason it is insufficient to only consider how to design products and infrastructures capable of coping with unflushables. Though this can help, as long as the existing sewage systems remain in place we must also consider how to change the multiple cultural, political and material factors that shape how people routinely use and dispose of unflushable products. Indeed what is regarded

as 'unflushable' now just a decade or so ago were products that people were encouraged to flush. Recognising the multiple developments that have contributed to the emergence of today's unflushables challenge calls for a distributed approach to governance, management and intervention. Some opportunities for these new pathways to action were identified in the Unflushables 2030 Change Points workshops held in January 2030 (Browne et al., 2020). This new perspective on the challenge of unflushables offers a number of opportunities for Anglian Water to continue leading positive change in the topic:

- advocacy for policy change with government stakeholders – there is cross sectoral appetite for stronger regulatory steers related to Unflushable. Anglian Water can be a key stakeholder to drive positive policy change;
- advocacy of the distributed responsibilities associated with creating, and solving, the unflushables problem, and continue to be a leader in mobilising multi-stakeholder conversations and action in this space;
- continuing investing in primary research with cross sectoral stakeholders, including the research community, to build deeper understandings of what contributes to the 'unflushables' challenge;
- building a socio-technical systems approach to understanding into business plans, interventions and actions related to the Unflushables challenge.

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