# "Embracing the Rain: Overcoming Barriers to Sustainable Drainage Systems in Greater Manchester through Socio-Technical Transition Theory"

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Thesis submitted in partial fulfilment for the degree of Master of Science in Environmental Management and Policy (MESPOM)

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Monika SOMOGYI

#### **CENTRAL EUROPEAN UNIVERSITY**

ABSTRACT OF THESIS submitted by: Monika SOMOGYI

for the degree of Master of Science and entitled: *Embracing the Rain: Overcoming Barriers to* Sustainable Drainage Systems in Greater Manchester through Socio-Technical Transition Theory

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This study explores Sustainable Drainage Systems (SuDS) in Greater Manchester (GM), focusing on overcoming existing barriers to their implementation through the lens of Socio-Technical Transition Theory (STTT). This theory allows for the analysis of the regulatory, institutional, socio-cultural, and economic challenges involved in the broader adoption of SuDS. Through qualitative research involving case studies across three boroughs of GM, policy document analyses at different governmental levels and interviews with key stakeholders, this dissertation identifies the need for clearer regulatory frameworks, enhanced stakeholder and public engagement, better feedback mechanisms and financial incentives to promote SuDS adoption. The study concludes with strategic recommendations for policymakers to create a more supportive environment for SuDS in GM's boroughs, which can be generalised beyond GM.

**Keywords**: Greater Manchester, Sustainable Drainage Systems (SuDS), Socio-Technical Transition Theory (STTT), Urban Flooding, Climate Change, Flood Resilience.

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# List of Abbreviations

- AEP Annual Exceedance Probability
- **CBA –** Cost Benefit Analysis
- CDA Critical Drainage Area
- DEFRA- Department for Environment, Food & Rural Affairs
- **EA** Environment Agency
- FWMA Flood and Water Management Act
- ${\bf GM}$  Greater Manchester
- GM SFRMF Greater Manchester Strategic Flood Risk Management Framework
- LA Local Authorities
- LLFA Lead Local Flood Authority
- LPA Local Planning Authority
- NPPF National Planning Policy Framework
- RoFSW Risk of Flooding from Surface Water
- ${\bf SAB}$  SuDS Approval Body
- SPD Supplementary Planning Document
- STTT Socio-Technical Transition Theory
- SuDS Sustainable Drainage Systems
- $\boldsymbol{SWF}$  Surface Water Flooding
- UDP Unitary Development Plan
- UK United Kingdom
- UU United Utilities

# Chapter 1 – Urban Flooding and SuDS

# The growing challenge of Urban Flooding

Urban areas across the globe are facing complex challenges due to increased urbanisation, climate variability and growing vulnerability to impacts from natural disasters (McBean & Ajibade, 2009; Satterthwaite, 2008; Satterthwaite et al., 2012). Among these threats, flooding stands out as a particularly disruptive force, affecting millions worldwide (Miller & Hutchins, 2017; Muis et al. 2015; Potter and Vilcan, 2020). According to the Environment Agency (EA), there are seven main types of flooding affecting residents in the United Kingdom (UK). These are a) fluvial, b) groundwater, c) surface water, d) coastal, e) sewer, f) reservoir, and g) canal flooding (Newground, 2022). Today, 1 in 6, or around 5.2 million properties in England are at risk of any of these types of flooding (Environment Agency, 2009; Rentschler, Salhab & Jafino, 2022).

Surface Water Flooding in the UK: Surface Water Flooding (SWF) is a severe threat to urban areas, with 325,000 properties across England found to be in high-risk areas (Mallows, 2024). SWF presents devastating costs of damages, ranging between  $\pounds$ 1.3bn and  $\pounds$ 2.2bn annually, as estimated by the National Risk Register (Jenkins et al., 2018).

#### Figure 1

Flooding in Wigan after Storm Christoph



Note. From Manchester Evening News, by S. Coyle, 2021

In Greater Manchester (GM), much of the urban area is at risk from SWF, except the more elevated northern and eastern parts of the city region. Figure 2 from the Greater Manchester Strategic Flood Risk Management Framework (GM SFRMF) illustrates a medium risk 1% Annual Exceedance Probability (AEP) event from the Risk of Flooding from Surface Water (RoFSW) (Manchester City Council, 2018). The framework attributes GM's high vulnerability to SWF to the combined effects of extensive urbanisation, overwhelmed drainage systems, runoff from the Rivers Irwell and Mersey and climate change. Moreover, many parts of GM have been identified as Critical Drainage Areas (CDAs) due to their greater risk of flooding. In these areas, drainage systems are particularly prone to overloading during heavy rainfall, leading to increased RoFSW (Manchester City Council, 2018).

#### Figure 2

Surface Water Flood Risk Across GM



Note. From GM SFRMF, by Manchester City Council, 2018

The 2007 floods in the UK, resulting from the highest May-July rainfall in over 240 years (Met Office, 2013), marked a critical turning point in flood management strategies. These floods differentiated themselves from the commonly expected fluvial or coastal sources of flooding, as

they were characterised by an unusually high incidence of SWF (Environment Agency, 2007). The floods happened because of the combination of saturated soils and extreme rainfall events in the summer months (Marsh & Hannaford, 2007). Unlike the historically referenced devastating winter floods of 1947, the summer 2007 floods were notable for their timing and the extent of floodplain inundations. Indeed, the floods affected over 55,000 homes and 6,000 businesses, with damages nearing  $\pounds$ 3 billion (Environment Agency, 2007). Furthermore, they prompted the greatest number of search-and-rescue missions since World War II (Marsh & Hannaford, 2007). Thus, this event underscored the UK's vulnerability to SWF and challenged contemporary flood risk management strategies (Ochoa-Rodríguez et al., 2018).

Perhaps most critically, the event highlighted the need for improving resilience, considering future climate variability (Environment Agency, 2007). Responding to the 2007 floods, Sir Michael Pitt wrote a review highlighting major gaps in the understanding and management of SWF in the UK, as opposed to the better understood fluvial and coastal flooding (Pitt, 2008, as cited in Jenkins et al., 2018). This review, coined the *Pitt Review*, recommended, among other strategies, Sustainable Drainage Systems (SuDS) as an effective solution to reduce the risk of SWF and alleviate the pressure on the piped sewerage system (Pitt, 2008). SuDS are defined as drainage solutions designed to replicate the natural drainage process whereby rainfall infiltrates through permeable surfaces into the ground (British Geological Survey, 2023). These systems include swales, ponds, green roofs ad rain gardens amongst others (Green, 2019; Monberg et al., 2018). Today, our urban areas are overwhelmingly characterised by impermeable, concrete-heavy surfaces, leading to increased runoff (Poleto & Tassi, 2012). In addition to high runoff, these concrete-heavy environments threaten the functionality and resilience of our urban infrastructure, directly affecting citizens (Kaźmierczak & Cavan, 2011).

**The Multifaceted Benefits of SuDS:** Traditionally, surface water drainage in the UK followed the conventional, first-generation, "all-to-the sewer" practice (Ellis, 2013, p.24). The main

goal of this approach was to move away the water as quickly as possible from urban surfaces. Moreover, since this rainwater was thought to be clean, it was judged appropriate to let it flow untreated into rivers or seas (Ellis, 2013). Contrastingly, SuDS have the potential to provide urban areas with a buffer ability during a flood event, in the first stage, by infiltrating and storing water away and in the second stage, by desynchronising peak flows (Potter and Vilcan, 2020). First introduced into the English planning system following the severe floods at the end of the 1990s, SuDS are now crucial components of the UK's strategy for managing urban flooding. Their benefits span from the management of heavy rains and water pollution to the creation of natural habitats and recreational spaces (Jose, Wade & Jefferies, 2015; Potter and Vilcan, 2020; White, 2005).

Following the Pitt Review, the Flood and Water Management Act (FWMA) 2010 was introduced as the principal statutory document for taking forward many of Sir Pitt's recommendations (Landmark Chambers, 2023). Schedule 3 of the Act was drafted, providing a framework for the approval and adoption of SuDS, making them a mandatory requirement for developments of more than a single house, or where the construction area is over 100m2 (United Kingdom Parliament, 2010). Although Schedule 3 has been in force in Wales since 2019, the programme has not yet commenced in England. Currently, the Government relies on the planning system to oversee the implementation of SuDS in new developments (DEFRA, 2023; Landmark Chambers, 2023).

Throughout the years, the Government's approach has been heavily criticised, notably with the Department for Environment, Food and Rural Affairs (DEFRA) committee coining their current flood management structures as being fragmented, inefficient and ineffective (DEFRA, 2023). Similarly, the 2020 *Jenkins Review of the Arrangements for Determining Responsibility for Surface Water and Drainage Assets*, found that the current-state planning-led approach alone is not effective (DEFRA, 2020). The *Review for the Implementation of Schedule 3 to the FWMA 2010* by DEFRA was ultimately the turning point for the adoption of Schedule 3 in England. The framework is now expected to commence in 2024. Schedule 3 is predicted to revolutionise the way in which SuDS are being implemented in England, by eliminating developers' long-standing automatic right to connect to conventional sewer systems (DEFRA, 2023; UK Parliament, 2017).

# Overcoming Barriers to SuDS Implementation

The adoption of Schedule 3 in 2024 exemplifies England's aspirations to tighten their control on SuDS implementation (Barques, 2024). In practice, however, the broader incorporation of SuDS is obstructed by a range of intricate barriers (Li et al., 2020; Melville-Shreeve et al., 2017; Ossa Moreno, Smith & Mijic, 2017; Potter and Vilcan, 2020; White, 2008). These barriers can be analysed through the lens of Socio-Technological Transitions Theory (STIT). This theoretical perspective provides a tool for understanding the relationship between technological innovations, such as SuDS, and the broader societal, policy, and cultural contexts that shape their adoption (Nóblega Carriquiry, 2022). The primary aim of this research is to explore *how the application of STTT can address and overcome the barriers to the implementation of SuDS in GM*. This aim is articulated through the following guiding research questions:

- 1. What are the key barriers at different governance levels that impede upon the effective implementation of SuDS in GM?
- 2. How do socio-technical dynamics, including legislative and regulatory frameworks and societal factors, influence the implementation of SuDS in this region?
- 3. What strategic policy recommendations can be developed to align SuDS with the necessary legislative, regulatory, and social reforms in GM?

# Significance and Contribution of the Study

This study is novel in its kind to the field of urban flooding management. The analysis of SuDS through the lens of STTT provides a new approach to understanding the intricacies of the interplay between regulatory frameworks, technological systems, and societal issues that influence the adoption of sustainable infrastructure such as SuDS. Moreover, this thesis presents novel empirical data on the problems and successes of implementing SuDS at various levels of governance in England, providing a nuanced, multi-level perspective that is lacking in previous research. This information is particularly useful to policymakers, urban planners and sustainability experts working to promote more robust and adaptable urban flood risk strategies in the face of increased RoFSW. The recommendations that this study presents not only address the specific issues of GM, but also provide generalisable strategies that can be applied to other metropolitan environments facing similar issues in England.

This study is structured as follows: Chapter 2 presents a review of literature, looking into the emergence of resilience thinking in flood management, and exploring the different barriers to the adoption of SuDS in the UK and GM. Chapter 3 details the methodology used in the research, explaining the rationale for the framework and case study selection, alongside the data collection techniques. Chapter 4 presents the analytical framework, and how it can be applied to the study of SuDS implementation. Chapter 5 analyses SuDS implementation at various governmental levels through the application of the STTT framework. Chapter 6 discusses the findings from the analysis, organising them by four transformation failures and provides policy recommendations. Finally, Chapter 7 reviews and concludes the thesis.

# Chapter 2 – Review of Literature

A systematic search of key literature was carried out to address the key focus of this study. The search engine Google Scholar was used to extract research publications representing the contemporary body of knowledge surrounding SuDS implementation in the UK. The search terms were informed by the research question that the study seeks to address, these were: *SuDS, urban flood resilience, barriers to SuDS implementation*. Additionally, the term UK was added to refine the search, selecting geographically relevant studies.

# Resilience Thinking and SuDS in the UK: An Evolving Framework

Due to the ever-increasing urbanisation and the uncertain climatic challenges that cities are facing globally, *resilience thinking* has been gaining significant traction in the academic and policy discourse (Brandt et al., 2021; Potter & Vilcan, 2020; Rözer, Mehryar & Surminski, 2022; Sörensen et al., 2016). According to Ellis (2013), this emergence of resilience thinking can be attributed to Green Infrastructure being at the core of national philosophy in recent years in the UK. This particularly applies in the areas of sustainable development and urban regeneration. According to Potter and Vilcan (2020), resilience thinking acknowledges the increasingly dynamic nature of social and natural processes as a response to a complex and unpredictable world. The United Nations Human Settlements Programme (UN-Habitat) defines a resilient city as "...the ability of any urban system to maintain continuity through all shocks and stresses while positively adapting and transforming towards sustainability. Therefore, a resilient city is one that assesses, plans and acts to prepare for and respond to all hazards, either sudden or slow onset, expected or unexpected" (UN-Habitat, 2019, as cited in Potter & Vilcan, 2020, p.2).

As stated by Restemeyer, van den Brink and Woltjer (2018), resilience thinking is becoming the central framework to examine the interplay between planning and flood risk management in the UK. The country is now increasingly moving away from established engineering-centric mechanisms towards more sustainable flood defence strategies (Fournier et al., 2016; Potter and Vilcan, 2020). White (2008) posits that this new approach puts particular emphasis on the creation of urban fabric that can absorb water, thereby emulating natural hydrological processes. Subsequently, in this emerging context, SuDS takes a central role in the creation of flood resilient urban environments (Davis & Naumann, 2017). This transition to sustainable approaches not only addresses flood management in a more holistic manner but also contributes to enhancing urban biodiversity, improving water quality, and promoting public well-being by creating greener, more liveable cities (Sharma, Gardner & Begbie, 2018). Overall, existing literature views SuDS as a positive mechanism towards urban flood resilience (McClymont et al., 2020; O'Donnell et al., 2020; Potter & Vilcan, 2020).

# Barriers to SuDS Implementation

The literature identifies several barriers to the implementation of SuDS that impede their broader adoption within development projects. These challenges arise from a multitude of sources, including legislative, economic, and socio-cultural realms (Li et al., 2020; Ossa-Moreno, Smith & Mijic, 2017; Melville-Shreeve et al., 2018).

# **Regulatory and Legislative Barriers**

*Complex regulatory environment:* According to Melville-Shreeve et al. (2018), the lack of comprehensive legislation hinders the widespread adoption of SuDS in the UK. Indeed, the country's current regulations do not strictly mandate the use of SuDS, which leads to inconsistencies in their application (Vilcan & Potter, 2020). The National Planning Policy Framework (NPPF) only provides a recommendation in favour of SuDS rather than making their implementation mandatory (CIWEM, 2024; Department for Levelling Up, Housing and Communities, 2023). Indeed, it suggests that SuDS should meet minimum operational standards

and have clear maintenance arrangements but emphasises that these requirements must remain economically proportionate (Ellis & Lundy, 2016). The reliance on non-statutory technical standards such as DEFRA's standards contributes to this ambiguity. Although these provide important suggestions, their non-mandatory nature implies that they are not routinely followed (Melville-Shreeve et al., 2018). This regulatory fragmentation creates uncertainties for developers and planners, who often lack clear guidance on standards, maintenance responsibilities and longterm management of SuDS (Ellis & Lundy, 2016; Potter & Vilcan, 2020). Consequently, SuDS are not uniformly integrated into new developments, leading to different adoption rates across regions (Li et al., 2020).

Moreover, the scale of proposed developments also influences SuDS policies. Indeed, for major applications of 10 dwellings or more and commercial developments of over 1,000m2, SuDS are a planning requirement (Newground, 2022). However, on smaller development sites, housebuilders and LPAs are ill-prepared to implement SuDS (Lambeth Council, 2024; Ellis & Lundy, 2016). For these types of developments, drainage is addressed through Section 106 planning conditions rather than being integrated into the initial planning consent process, which makes SuDS a reserved matter, leaving their approval up to the discretion of the planning officer (Ellis & Lundy, 2016). This, in turn, diminishes the rate and effectiveness of their implementation (Vilcan & Potter, 2020).

*Division of responsibility:* Another regulatory challenge is the division of responsibilities among different bodies. Schedule 3 of the FWMA 2010 was abandoned by the Government, in favour of a strengthened planning system (Vilcan & Potter, 2020). This strengthening of the planning system was announced by DEFRA (2014) and was justified as an attempt to avoid the increase in bureaucracy that would result from the implementation of Schedule 3 (Vilcan & Potter, 2019). On the one hand, Schedule 3 would establish a regulatory framework that mandates comprehensive roles and duties for the implementation of SuDS. On the other hand, the enhanced planning

system serves as a more adaptive and flexible governance approach. This system is however supported by minimal regulation and depends on existing practices and extensive stakeholder participation (Vilcan & Potter, 2019).

The strengthening of the planning system has been criticised and coined as a form of nondesign space where the Government is unwilling to design policy but at the same time does not have the power to change the status quo (Vilcan & Potter, 2019). This arrangement results in ambiguous and non-committal legislation, where SuDS delivery heavily relies on the goodwill of stakeholders. Indeed, developers have the option to opt out of SuDS on viability grounds when these would increase the overall cost of development. SuDS therefore become a matter of negotiations and power relations between LAs and developers (Vilcan & Potter, 2020). Moreover, LAs lack the necessary legislative backing to provide incentives to developers, or to impose a consistently rigid approach. In turn, this leads to persisting suboptimal implementation of SuDS (Vilcan & Potter, 2019). Vilcan and Potter (2020) argue that this strengthened planning system creates an *institutional void*. This denotes "a lack of policy clarity that occurs when the role of the state is scaled back and other actors take up governance roles" (Vilcan & Potter, 2020, p.11). This argument is corroborated by the findings of *The Big SuDS Survey*, in which 75% of participants indicated that the planning system does not encourage SuDS sufficiently (Grant, Chisholm & Benwell, 2017).

The current strengthened, planning-led approach gives responsibility to the planners to decide on SuDS implementation (Melville-Shreeve et al., 2018). Before approving a scheme, planners consult the Lead Local Flood Authority (LLFA) (who are in essence flood risk consultees) to ensure the proper design and implementation of SuDS (Green, 2019). The creation of SuDS Approval Bodies (SABs) as part of Schedule 3 of the FWMA 2010 requires developers to first submit their SuDS plans to the SAB, and in a second instance, their application to the LPA. This dual licensing requirement previously raised concerns with Local Authorities (LAs) and housebuilders, resulting in Schedule 3 being completely abandoned. Instead, a modified local

planning policy framework was established, requiring many LAs to develop their own SuDS implementation guidance (Ellis & Lundy, 2016). This decentralised approach has produced a patchwork of regulations and practices. LAs therefore present substantial differences in how they implement SuDS. Moreover, the evolving legislative framework with the adoption of Schedule 3 in 2024 will see the implementation of the dual licensing process. This could result in confusions over responsibilities and delays in application processing timelines (Ellis & Lundy, 2016; Green, 2019; Melville-Shreeve et al., 2018; Potter & Vilcan, 2020).

Furthermore, LPAs' ability to promote SuDS adoption is often hindered by the availability of resources. LPAs frequently lack in-house drainage expertise and heavily rely on LLFA consultees for technical advice (Potter & Vilcan, 2020). This reliance can result in delays in processing applications and increased expenses for developers according to Melville Shreeve et al. (2018). Moreover, many LPAs struggle with resources to effectively enforce planning policies leading to gaps in implementation and potential oversights (Potter & Vilcan, 2020). The mandatory provision for developments to connect to existing drainage systems, under the Water Industry Act 1991 further exacerbates these challenges. This condition allows developers to link their drainage systems to water company owned infrastructure without including SuDS, which can lead to environmental consequences. Hence, water companies, professional groups and NGOs have been pushing for changes to this law, and for SuDS to become mandatory (Ellis & Lundy 2016).

# CEU eTD Collection

### **Economic and Social Barriers**

The integration and widespread use of SuDS in urban planning and development projects face further challenges due to economic and social factors. These include the high upfront expenses, costs of maintenance and resistance to step away from the established norm of connecting to the sewer.

High Upfront Costs and Perceived Economic Burdens: Among the main obstacles that impede upon the widespread acceptance of SuDS is the belief held by developers that they are associated with high initial costs (Johnson & Geisendorf, 2019). Many professionals in the development field view environmentally friendly drainage solutions like SuDS as more expensive than traditional systems. This perception persists despite studies showing that the long-term advantages and cost savings of SuDS often outweigh their upfront expenses (Ossa Moreno, Smith & Mijic, 2017). The substantial upfront investment required for designing, installing, and incorporating SuDS into new or existing projects might discourage developers who prioritise immediate financial returns over sustainable practices in the long run. Furthermore, the lack of financial incentives or procedures for measuring the economic worth of SuDS and provided ecosystem services contributes to hesitancy in their adoption (Vincent et al., 2017). As Li et al. (2020) point out, without clear economic incentives or backing from financial institutions and government authorities, developers may choose conventional drainage systems that appear more financially appealing in the short term.

Maintenance and Long-term Financial Commitments: Another economic challenge lies in the ongoing maintenance and management of SuDS. Indeed, to ensure adequate functionality and effectiveness of SuDS over time, regular maintenance is required (Dierkes, Lucke & Helmreich, 2015; Oladunjoye, Proverbs & Xiao, 2022). This in turn can be resource-intensive and costly, discouraging developers to take on this added financial burden. Moreover, there is currently no single entity in charge of the maintenance and operation of SuDS facilities. This adds to the complexity of cooperation and funding (Kennedy et al., 2007). Melville-Shreeve et al. (2018) have noted that many LAs, already constrained by limited budgets and resources, struggle to allocate the necessary funds and personnel to maintain these systems adequately. This financial strain is exacerbated by the lack of clear legislative mandates that define maintenance responsibilities among stakeholders, leading to uncertainty and potential neglect. Furthermore, developers and

property owners may be reluctant to take on the long-term financial commitments required to keep SuDS operational, resulting in systems that fall into disrepair and fail to deliver their intended benefits (Ossa-Moreno, Smith & Mijic, 2017).

Despite these economic concerns, Vilcan and Potter (2020) argue that through the current planning-led approach, developers can opt-out of their SuDS obligations on viability grounds. Indeed, they state that "Developers do not need to provide evidence to support their viability claims or submit information regarding the cost of the conventional drainage used for purposes of comparison with SuDS. This suggests that the language used in planning policy is non-committal and presents a series of caveats, which act as loopholes in practice, allowing room for negotiation for the parties that lack the incentive to implement SuDS" (Vilcan & Potter, 2020, p.7).

*Socio-Cultural Resistance to SuDS:* Alongside economic barriers, socio-cultural factors also play a significant role in inhibiting the adoption of SuDS. Many stakeholders have traditional mindsets and prefer conventional drainage solutions (Gimenez-Maranges, Breuste & Hof, 2020; Li et al., 2020). Regrettably, this resistance to change can make it difficult to promote innovative and sustainable practices such as SuDS (Li et al., 2020). Lack of awareness and understanding of the benefits of SuDS further add to this resistance. Many stakeholders, including developers, planners, and the public, may not fully appreciate the multifaceted benefits of SuDS, such as better flood management, improved urban biodiversity and increased public welfare (Oladunjoye et al., 2020). Indeed, a study by Williams et al. (2019) on residents' perceptions of SuDS found that issues of waste, pests and costs were of most concern to residents. Certainly, without adequate knowledge and positive perceptions, there is little motivation to move away from established conventional methods (Oladunjoye, Proverbs & Collins, 2017).

# Research on SuDS Implementation in Greater Manchester

To date, a single study has been conducted on the specific topic of SuDS implementation in GM. In their 2009 study, White and Alarcon discussed challenges and strategies surrounding SuDS implementation in GM. They explored the relationship between SuDS site numbers and the comparative strength of local planning policies. Their study found that the three LAs with the strongest policies, namely Salford, Stockport, and Tameside, had the lowest number of SuDS sites in comparison to the other boroughs (White & Alarcon, 2009). This study revealed a strong variance in GM's LAs, shedding light on barriers including costs, adoption, and maintenance problems, alongside a lack of legislative clarity. Moreover, the study critiqued the translation of national SuDS policies into local action, urging improvements in regulatory coordination (White & Alarcon, 2009).

# Research Gaps

What emerges from the literature is a complex issue of governance, legislation, and responsibility. The decentralised management of SuDS is coupled with an evolving network of stakeholders with different responsibilities, exacerbated by the impeding implementation of Schedule 3. Thus far, research on the topic of SuDS in the UK has been limited. Existing research is primarily centred around the technical aspects of SuDS and their ecological impacts, with few studies covering the barriers to SuDS implementation. Moreover, existing case-study research focuses on small-scale applications, such as neighbourhood or single-building projects, without adequately addressing the broader, systemic implications of SuDS. Due to the fragmentation of responsibility across governance levels, there is a critical need for research that analyses the pitfalls of the current system to provide actionable policy recommendations.

# Chapter 3 – Methodology

# Rationale for the Framework Selection

Applying STTT to the implementation of SuDS offers a thorough method for managing urban flood risks. This theory explores how social systems change under various pressures to achieve sustainable advancements. The theory uses a multi-level perspective that looks at changes at three levels: the *niche*, where new innovations emerge; the *regime*, which includes established norms and practices; and the *landscape*, which covers the broader social context that is not directly influenced by niches or regimes (Raven, Schot & Berkhout, 2012). This model highlights the connection between technological changes and social systems, both of which are essential for tackling sustainability challenges.

Recent updates to the theory have included the aspects of politics, cultural histories, grassroots innovations, and corporate resistance. These additions provide a deeper understanding of how various societal actors affect transitions. Indeed, for SuDS to be successfully integrated into urban planning, technological changes must be supported by changes in social, cultural, and institutional frameworks. This requires engaging a wide range of stakeholders, including policymakers, urban planners, developers, and community members, to build a shared commitment to sustainable urban development. This theoretical approach not only highlights the relationship between technology, society and governance, but also helps identify challenges and opportunities for implementing SuDS.

To assess the current state of SuDS policies in GM, the *Integrated Framework for System Transformations* by Edler et al. (2021) will be used. This framework helps analyse transformation processes and find policy entry points that can support system changes (Edler et al., 2021). Edler et al. (2021) incorporate transformation failures as proposed by Weber and Rohracher (2012) into their framework to increase analytical depth. Transformation failures provide a structured approach to dissect complex socio-technical interactions, allowing for the dissemination of solutions. According to Weber and Rohracher (2012), four types of system failures can occur in transformation processes, these are the following:

1. Directionality Failures: Stemming from a lack of common goals and coordination among different parties, resulting in ineffective alignment of policies.

2. Demand Articulation Failures: Inadequate consideration of the needs of users or consumers when designing systems.

3. Policy Coordination Failures: Poorly aligned activities across various levels including the national, regional, and local, and between technological and institutional players.

4. Reflexivity Failures: Weak adaptive management processes, vital for predicting problems and adjusting strategies effectively.

By examining the socio-technical aspects of SuDS using the framework of Edler et al. (2021) and through considering the four types of transformation failures as proposed by Weber and Rohracher (2012), we can identify and address potential issues. This approach will help enhance the implementation and effectiveness of SuDS.

# Justification of the Case Study Selection

Considering identified research gaps, this study selects three boroughs of GM as case studies to examine the effectiveness of local SuDS policies compared to the broader national and regional policy framework. A case study is defined as "an intensive analysis of an individual unit...stressing developmental factors in relation to environment" (Flyvbjerg, 2011, p.301). Case studies are intensive in nature; therefore, they can provide deeper understanding into the system they belong to (Eckstein, 2000). The objective of choosing the three boroughs as case studies is to get a more detailed understanding of issues at the local level, which can inform broader issues with SuDS implementation in GM and England.

The three boroughs, namely Salford, Stockport and Tameside (Figure 3) are selected from the 2009 analysis by White and Alarcon, which revealed that Salford, Stockport, and Tameside had robust SuDS policies but a low implementation rate of actual sites (White and Alarcon, 2009). These varied implementations of SuDS provide a robust basis for exploring socio-technical transitions in SuDS implementation across different regulatory environments. By focusing on these three boroughs, the research seeks to understand dynamics between the macro, or national level, the meso, or regional level and the micro, or local level. In this study, the macro refers to the country of England within the UK. While some of the documents that will be analysed also cover other constituent countries of the UK, England is chosen as it is home to the metropolitan county of GM, constituting the meso level of this research. The three designated boroughs are, consequently, the micro levels of the analysis.

The application of STTT allows for a deeper examination of the interplay between technology, policy, and societal factors influencing SuDS adoption at the three levels. By focusing on these three LAs, the study seeks to uncover the systemic barriers and facilitators within the socio-technical landscape, providing insights into the progress and ongoing challenges in translating SuDS policy into effective practice. This methodological approach is particularly suited to this study's objectives, as it seeks to not only understand current barriers but also propose actionable recommendations based on real-world experiences. By seeking to link these various elements together, this research ensures that the findings are grounded in empirical evidence and are relevant to both academic and practical considerations in environmental policy and urban planning.

#### Figure 3

Greater Manchester: Focus Areas for Study



Note. Map of the Focus Areas for Study. Own Work.

# Data Collection Techniques and Sources

This research utilises mixed methods, combining primary and secondary data. The core data is collected through document analysis, examining macro, meso and micro-level policies and supporting documents pertaining to SuDS. To support the findings from the primary data and to neutralise biases emerging from a single research method (Creswell et al., 2003), primary research is conducted through interviews with planners and/or flood risk managers from each LA. Interviews were held online and were semi-structured to allow for a deeper exploration of participants' insights (Valentine & McKendrck, 1997). The choice to include interviews aims to cross-validate and enrich the insights derived from the document analysis, as well as to explore how issues are framed by asking participants specific questions based on the policies.

#### **Document Analysis**

Documents were selected to provide an understanding of national, regional, and local policies and non-statutory regulations around SuDS. Although document review cannot provide clear and concise understanding of the everyday workings of organizations (Atkinson & Coffey, 2004), it provides an excellent overview of the context of the topic and of subsequent primary data collection. Stake (1995) posits that document analysis can be of advantage in complementing other qualitative research methods.

This document analysis involves the selection, appraisal and synthesis of information contained in the documents to understand the SuDS related policies and how these apply to the three different organisational levels (Bowen, 2009). Each document was selected based on its direct relevance to existing SuDS regulations. The document analysis not only involves the selection and synthesis of the policies but also an appraisal of their significance in shaping SuDS management practices across various governmental layers. The full list of the analysed documents and description of their type is attached in Appendix 1.

## Interviews

Interview participants were selected and approached through purposive sampling, a sampling method where participants are the best informed on a given phenomenon and would therefore provide the most accurate answers to the phenomenon under study, "the purposive sampling technique is the deliberate choice of a participant due to the qualities the participants possess" (Etikan, Musa & Alkassim, 2016, p.2; Tongco, 2007). A disadvantage of this sampling technique is that it can lead to research bias. Indeed, the representativeness of the sample can be questionable (Rai & Thapa, 2015). Individuals with positions in direct connection to SuDS were approached from each LA. 16 individuals were approached, of which three individuals agreed to participate. The participants' occupations and their organisations are presented in Table 1.

#### Table 1

Participants' Occupations and Organisations

Occupation	Organisation
Senior Planning Officer	Stockport City Council
Flood Risk Manager/LLFA	Salford City Council
Planning Officer	Tameside City Council
Planning Officer	Tameside City Council

Note. Table of Participants' Occupations and Organisations. Own work.

Participants were approached wherever possible through email, however, few organisational email addresses or contact details were publicly accessible. The main method used to find participants was therefore LinkedIn where individuals' job title and organization is easily identifiable. Prior to the interview, participants were asked to fill out a consent form, to comply with Central European University and the University of the Aegean's ethics requirements. Interviews lasted on average half an hour, took place in April and May 2024, and were held on either of the video communication platforms Zoom and Teams. Interviewees decided to remain anonymous and wished only to share their job title. Interviews were all audio-recorded and excerpts from them were taken out for the analysis. Guiding questions were asked to all participants, who were then allowed to elaborate as widely or restrictedly as they desired, these guiding questions are available in Appendix 3.

# Chapter 4 - Analytical Framework: Socio-Technical Perspectives

# Framework Components

In this study, the framework is applied to analyse the transformation dimensions, along with its corresponding meta-categories and dimensions. The focus of the analysis will be on identifying barriers to the transformation of SuDS according to STTT, as such, the systems dimensions will not be examined. The framework components are represented in Table 2.

#### Table 2

SYSTEM DIMENSIONS		TRANSFORMATION DIMENSIONS	
Meta- Category	Dimension	Meta- Category	Dimension
General	Function	Drivers and barriers	Societal preferences (culture)
Characteristics	Relevant sectors		Technological change/innovation
	Interactions with other systems	-	External shocks
	Characteristics of relevant technologies and practices	-	Policy and regulations
	Geographical scope		Emergent vs intentional dynamics (market driven or politically/societally driven)
			Demand articulation
Context factors	Infrastructures; Physical, knowledge, financial	Politics	Nature of contestation
	Regulation and its importance		Degree of (national) autonomy

System and Transformation Dimensions for Analysing Sustainability Transitions

	Socio-cultural factors		Governance structures
SYSTEM DIM	ENSIONS	TRANSFOR	Degree of coordination
STOTEM DIM			
Meta-category	Dimension	Meta- category	Dimension
Agency	Actor constellations and their capacities	Dynamics	Development over time
	Power structures	]	Learning process

Note. From Dimensions of systems and transformations: Towards an integrated framework for system transformations, by Edler et al., 2021, p 6-7.

# Applying the Framework to SuDS Analysis

The study will employ a 2-step approach to analysing the secondary and primary data sources.

- 1) In a first instance, the national and regional documents, pertaining to England and GM will be analysed. Information from the documents will be categorised in the meta-categories of the transformation dimensions. This information will be presented in a table, attached in Appendix 2. Based on this analysis, the four basic transformation system failures, outlined by Weber and Rohracher (2012) will be applied to understand these failures.
- 2) In a second instance, the SuDS policy frameworks of all three boroughs will be individually analysed. These analyses will also be conducted by utilising the meta-categories of the transformation dimensions of the STTT framework. Key findings will be presented in a table and transformation failures will be identified. The four basic transformation system failures will be applied, complemented by input from the interviews.

# Chapter 5 - Data Analysis & Results

# Macro and Meso-Level Policy Analysis

A table summarising the key findings from the national and regional document analysis can be found in Appendix 2. The different reviewed documents reveal different aspects and challenges in the current climate around SuDS implementation in England and GM. They highlight emerging issues linked to evolving legislation. Indeed, the 2023 DEFRA review found the previously established planning-led approach to SuDS to be inefficient and lacking specific checking regimes to ensure that SuDS are constructed to agreed standards. In response, Schedule 3 of the FWMA 2010 is due to be adopted in 2024, after years of negotiations between DEFRA and the Government. Schedule 3 includes the establishment of a robust regulatory framework for SuDS, which provides approval rules for the design, construction, operation, and maintenance of SuDS in addition to national standards. Additionally, the presently non-statutory technical standards will become statutory, fees will become chargeable, and non-performance bonds will be introduced.

Moreover, Schedule 3 will shift the approval process from planning authorities to SABs. The approval of SuDS schemes will therefore be required before granting planning permission for a given development. Schedule 3 also removes developers' automatic right to connect surface water runoff to water and sewerage company sewers (Landmark Chambers, 2023). Funding for Schedule 3 is under review to analyse costs and benefits, which will inform decisions on funding, including SAB running costs and SuDS operation and maintenance.

Current planning policy requires SuDS to be included in all major new developments of more than 10 houses unless they are considered inadequate. Schedule 3 extends this requirement to the SuDS for all new developments except those under 100m2, which are automatically permitted. The Government intends to work with the Green Jobs Delivery Group and other stakeholders to ensure that the skills and capacity to implement and sustain SuDS are available. Based on the framework by Weber and Rohracher (2012), the national and regional document analysis of SuDS reveals several transformation failures.

- a) Directionality failures result from a lack of a unified long-term vision and discrepancies in policy implementation across levels of government. This is seen by the adoption of Schedule 3, 13 years after it was first introduced.
- b) Demand articulation failures are apparent from the weak stakeholder participation and the need for increased public knowledge and demand for SuDS, despite a general cultural trend towards sustainability.
- c) Policy coordination failures arise from the complexity of aligning regulations and standards at national, regional, and local levels. Schedule 3 could present a solution to this issue, although its recent adoption raises questions about the quality of its implementation and could lead to further confusion and a lack of coordination.
- Reflexivity failures are apparent from the absence of specific control regimes and limited support for ongoing adaptive learning processes.

# Micro-Level Policy Analysis: Salford, Stockport, and Tameside

# Analysis of Salford's SuDS Policies and Supporting Documents

#### Table 3

Dimension	Meta-Category	Key Findings		
Transformation	Drivers and Barriers	<ul> <li>SuDS are a solution to urban flood risks and part of the climate adaptation strategy.</li> <li>They are supported by the policy framework.</li> <li>Implemented through the Local Plan's policies WA4 and WA5.</li> </ul>		
	Politics	<ul> <li>SuDS policies are seen as necessary planning obligations, ensuring developments are acceptable in planning terms.</li> <li>Local strategies emphasise the integration of SuDS into green infrastructure and flood management strategies.</li> </ul>		
	Dynamics	<ul> <li>Structured approach to SuDS integration into urban planning through clear policy guidelines on priorities for managing surface water.</li> <li>The Local Plan outlines measurable indicators for monitoring the success of SuDS implementation over time.</li> </ul>		

Transformation Dimensions of the Analysis of Salford's SuDS Policies

Note. Adapted from *Dimensions of systems and transformations: Towards an integrated framework for system transformations*, by Edler et al., 2021, p. 6-7.

#### Insights from the Interview: Unpacking Transformation Failures

The flood risk manager from Salford, also part of the LLFA, is an expert in the field of SuDS. Due to their extensive experience working on SuDS approvals in the borough, their input to the study was deemed crucial. This section integrates insights from the interview with transformation failures identified from the policy analysis.

Salford's policies reveal clear directionality with their prioritisation of flood risk management in urban development. The Salford Local Plan, adopted in 2023, presents comprehensive SuDS policies, namely policies WA4 and WA5. When asked about the plan, the LLFA claimed that they "deal with everything from SuDS and surface water drainage to flood defence, and even with things like the standing advice from the environmental agency on how you would implement flood defences for development" (Flood Risk Manager, personal communication, April 24, 2024). The interview also revealed that the LPA embeds all of their planning responses into these policies, resulting in a uniform approach to their application. This method helps developers to understand and realise their SuDS obligations. This strengthened approach to SuDS delivery was created as a response to previously poor SuDS submissions at the application stage (Flood Risk Manager, personal communication, April 24, 2024). This reaction reflects positive reflexivity strategies in the council.

The participant noted that "Throughout the years there has been more focus at Salford on really implementing these policies and requiring developers to stick to them." Moreover, the participant stated that "What we have tried to do is to make it clear to developers that if they come and develop in Salford, this is one of the most important things that we want to see how they have addressed, and it has got to be done thoroughly and properly." The participant also emphasised that the mayor, Paul Bennett's commitment to delivering sustainable development cannot be understated in the support for this improved strategy (Flood Risk Manager, personal communication, April 24, 2024). This observation insinuates the importance of political support for achieving a shared vision for SuDS.

Although the policy analysis revealed some demand articulation measures, through stakeholder engagement in the planning and implementation of SuDS, it did not find evidence of public engagement. This gap may explain the participant's observation that residents have concerns about SuDS schemes, as noted "They do not really understand what SuDS are for or how this is an improvement for them...They do not grasp that it is against climate change and to improve water quality" (Flood Risk Manager, personal communication, April 24, 2024). This indicates a disconnect between the project's intentions and public perception. In response to similar challenges in the past, public education projects were implemented by a previous colleague who set up scheme boards and put informative markings on pavements. These educational programmes were deemed crucial by the officer, as they "change the culture and how these things are perceived" (Flood Risk Manager, personal communication, April 24, 2024). Despite the colleague's departure from the council, the participant highlighted that the council has continued to benefit from these educational efforts, demonstrating a reflexive approach within the borough

On the one hand, the borough's devotion to the integration of SuDS across various strategic documents indicates a drive towards effective policy coordination. On the other hand, the participant displayed some uncertainty about the forthcoming implementation of Schedule 3 of the FWMA 2010, suggesting potential emerging policy coordination issues in the LA. At the time of the interview, five months after the intended implementation of Schedule 3, the participant revealed that SABs had not yet been established. "We are waiting for the implementation of Schedule 3 which was announced last year. The only information that they gave us is that it was going to happen in 2024", they explained (Flood Risk Manager, personal communication, April 24, 2024). Until recently, the LA's primary insights into Schedule 3 came from a meeting attended by all GM councils. This meeting focused on learning from the pitfalls of the Welsh implementation.

The interviewee, who will be part of the SAB along with a colleague from the LLFA in Salford, expressed concerns about the lack of substantial guidance: "We are on the basis that we are not going to get given any good advice, we are just going to be told to do it and work out the problems ourselves." They added, "The benefits are that we will get more power if we do not think that the developers have addressed the SuDS properly. We can just say sorry we are not approving that, you are going to have to go away and come back with a better proposal if you want to build this in Salford" (Flood Risk Manager, personal communication, April 24, 2024). Although the participant stressed their concerns about receiving limited guidance, they remain optimistic about the setup and funding of the SAB, which they believe will largely depend on political backing. They expressed confidence in aligning with local government priorities, particularly regarding climate change, which is seen as the most significant threat to the borough. "I think we will be on the same page as climate change is the biggest risk to the borough", they stated (Flood Risk Manager, personal communication, April 24, 2024).

# Analysis of Stockport's SuDS Policies and Supporting Documents

# Table 4

Dimension	Meta-Category	Key Findings	
Transformation	Drivers and Barriers	<ul> <li>Policies reflect a recognition of the need for SuDS in urban development.</li> <li>Lack of detailed guidelines for the actual implementation of SuDS in the sustainable design and construction document.</li> </ul>	
	Politics	<ul> <li>Responsibilities of the authority are outlined.</li> <li>Gap in the specification of stakeholder roles and specifics of collaboration.</li> </ul>	
	Dynamics	<ul> <li>Some documents, like the local development scheme do not mention SuDS, suggesting their inconsistent integration.</li> <li>The environmental protection and improvement policy is outdated, referring to the PPG 25 (replaced in 2006 by PPS 25 and the NPPF in 2012), indicating a need for updating local guidelines to reflect current SuDS practices</li> </ul>	

Transformation Dimensions of the Analysis of Stockport's SuDS Policies

Note. Adapted from Dimensions of systems and transformations: Towards an integrated framework for system transformations, by Edler et al., 2021, p. 6-7.

Insights from the Interview: Unpacking Transformation Failures

The senior planning officer from Stockport, member of the LPA, is an expert in development management and has extensive experience working on major project approvals in the borough. Consequently, their input to the study was deemed crucial. This section integrates insights from the interview with transformation failures identified from the policy analysis.

The directionality of SuDS policies in Stockport is impeded upon by the outdatedness of the policies. Policy EP1.7 of the Stockport Core Strategy DPD from 2011 mandates SuDS but references the now-superseded Planning Policy Statement 25 (PPS 25). This underscores the urgency for updating guidelines to align with current standards of the NPPF. The planning officer noted a legitimacy challenge from developers, pointing out that the policy is over a decade old: "There is a legitimate pushback from developers to say, well you wrote this policy more than ten years ago" (Senior Planning Officer, personal communication, April 24, 2024). The planning officer further discussed the need for balancing the pros and cons of development proposals, indicating that while SuDS may not always be possible, other priorities of the council may balance the development proposal out, they noted "I have yet to see the perfect development".

When prompted about stakeholder cooperation, the participant also noted that "We are doing our best to work with the lead local flood authority staff who are basically drainage engineers and who are very familiar with SuDS and are quite robust in their implementation" (Senior Planning Officer, personal communication, April 24, 2024). However, the interview highlighted potential coordination problems between the LPA and the LLFA. Indeed, when asked about metrics for evaluating SuDS projects, the officer suggested consulting with the LLFA: "Because I work in development management, it is probably better to talk about it with the LLFA, to be honest". The interviewee further noted that while the LLFA and EA are statutory advisers, United Utilities (UU), although not statutory, is also involved in the discussions. The planning officer pointed to the challenges of multi-agency coordination: "Then we have to try to reconcile it all". This statement suggests that there are frequent difficulties in harmonizing input from different stakeholders. Additionally, the creation of SABs has been problematic according to the participant. The officer expressed their frustration, stating: "It has been talked about for years and it is all over the place and it is too fragmented and that is where the problems are". Moreover, CDAs of the borough remain undefined despite the adoption of the Core Strategy DPD in 2011, which calls for their definition and strategic management (Senior Planning Officer, personal communication, April 24, 2024).

A demand articulation failure is also apparent in the lack of detailed guidelines for SuDS implementation. The officer emphasised, "The sustainable design and construction Supplementary Planning Document (SPD) lacks detailed guidelines for actual SuDS implementation". This absence of clear directives complicates the LPA's role in enforcing these measures and leaves developers uncertain about compliance requirements. The continued reference to PPS 25, which was superseded by the NPPF in 2012, underscores this misalignment with current standards, potentially compromising the effectiveness of SuDS.

The interview also touched on reflexivity failures, particularly the diminished role of the EA due to significant budget cuts. The planning officer noted, "The EA had much more direct involvement in planning applications... obviously they have been the subject of massive cuts and are a shadow of their former selves, only from a planning perspective". This reduced involvement has had noticeable impacts: "It is shining through, but we get our advice primarily from the LLFA, so we will always push for the most sustainable option". Despite these efforts, achieving optimal solutions is often challenging due to various constraints, such as land availability, which forces reliance on traditional sewerage solutions. The officer acknowledged, "The problem with a lot of nature-based solutions and SuDS is the land take associated with them; that land may not always be available, particularly if you are dealing with an urban site".

In terms of future policy development, the planning officer noted that Stockport's exit from the Places for Everyone (PfE) long-term plan for GM was driven by greenbelt considerations. This withdrawal has left the borough reliant on the outdated 2011 policy. The officer mentioned, "There is all the other stuff in PfE that Stockport fully supported, and I am sure will be in our local plan as money comes forward, in identical or a similar form, but in the meantime, we are left with our 2011 policy. But it does the job, as policies cannot be too prescriptive, as every site has its own challenge. Nature-based solutions are not always possible" (Senior Planning Officer, personal communication, April 24, 2024).

# Analysis of Tameside's SuDS Policies and Supporting Documents

#### Table 5

Dimension	Meta-Category	Key Findings		
Transformation	Drivers and Barriers	<ul> <li>Policies driven by environmental concerns.</li> <li>Clear mandate for incorporating SuDS in residential developments.</li> </ul>		
	Politics	<ul> <li>High degree of collaboration with various stakeholders.</li> <li>Policy framework provides council with the authority and resources needed to implement SuDS effectively.</li> </ul>		
	Dynamics	<ul> <li>Despite an outdated Unitary Development Plan (UDP), Tameside continues to enforce policies actively.</li> <li>The development scheme's lack of mention of SuDS suggests potential gaps in policy coverage.</li> </ul>		

Transformation Dimensions of the Analysis of Tameside's SuDS Policies

Note. Adapted from *Dimensions of systems and transformations: Towards an integrated framework for system transformations*, by Edler et al., 2021, p. 6-7.

#### Insights from the Interview: Unpacking Transformation Failures

The planning officer from Tameside, member of the LPA, is knowledgeable in development management, and has substantial experience in working on project approvals across

the borough. Consequently, their input to the study was deemed crucial. This section integrates insights from the interview with transformation failures identified from the policy analysis.

Directionality and policy coordination failures are apparent in Tameside's approach to SuDS in that the LPA does not deal with them in-house, but rather employs an external consultee. Policy U3 specifically encourages the incorporation of SuDS in new developments and is complemented by Policy RD25 of the Tameside SPD, which mandates the inclusion of SuDS in all residential developments. The participant however noted the outdatedness of these documents: "These documents date back to 2004 and 2005 respectively" (Planning Officer, personal communication, May 7, 2024). Although there are plans to update the UDP, with a new development plan in preparation, the process is slow. The planning officer noted that it is expected "not to be adopted for at least five years."

The interview also highlighted significant problems in coordination between the LPA and the LLFA. The officer admitted: "I have not personally come across SuDS... I have only seen them in conditions" and "I personally have never included SuDS in my applications" (Planning Officer, personal communication, May 7, 2024), this could hint at low SuDS adoption rates in the borough. The officer also mentioned the introduction of the PfE plan, suggesting that it could guide the implementation of SuDS, although its impact in the LA remains uncertain. Outdated policies and unclear implementation processes show that Tameside's strategies lack the flexibility to adapt to current needs and feedback, highlighting reflexivity failures. This could hinder the smooth integration and success of SuDS projects. Moreover, the lack of public engagement hints at a lack of demand articulation in the borough.

# Relevance of Transformation Failures Across Governance Levels

A summary has been created to explain the importance of each transformation failure across various levels of governance and the specific LAs. The table categorises and assesses the significance of each failure using a qualitative scale.

#### Table 6

Failure Level/LA	Directionality	Demand articulation	Political coordination	Reflexivity
National/	Rather relevant	Little relevance	Strongly relevant	Rather
Regional				relevant
Salford	Strongly	Little relevance	Strongly relevant	Rather
Sanoru	relevant			relevant
Stockport	Rather relevant	Little relevance	Rather relevant	Little
				relevance
Tameside	Rather relevant	Little relevance	Little relevance	Not relevant

Relevance of Transformation Failures in SuDS Implementation Across Governance Levels

*Note.* Relevance of Transformation Failures in SuDS Implementation Across Governance Levels. Own Work.

The analysis presented in Table 6 underscores the varying degrees of relevance of transformation failures across the boroughs and the national and regional levels. This analysis reveals that while demand articulation is consistent across all levels of governance and boroughs, other failures exhibit less consistency. This suggests a targeted approach to policy development across all levels of governance and boroughs.

# Chapter 6 - Discussion

# Evaluating Local Alignment with Broader Policy Frameworks

The analysis of the three boroughs' SuDS policies allows the contrasting of each borough's alignment to national and regional policies. When contrasted, the different boroughs show varying degrees of alignment and effectiveness in addressing transformation failures through their respective SuDS policies. From our analysis, Salford denotes itself from the other boroughs. Indeed, the LA demonstrates a comparatively better integrated and adaptive approach, linking SuDS with their broader environmental agenda, advocated by clear political support and stakeholder engagement.

This integration positions Salford, based on the comparative approach of White and Alarcon (2009), as the LA with the strongest SuDS policies. In contrast, Stockport, and Tameside, while seemingly supportive of SuDS implementation, offer less comprehensive and more outdated policy frameworks, which directly impact developers' incentive to comply with SuDS regulations. The disparities between LAs of the same metropolitan county highlight the critical need for updated, statutory policies and improved stakeholder engagement. These changes would help to align local implementations of SuDS with national and regional goals, thereby improving urban resilience and environmental sustainability.

# Addressing Transformation Failures

The integrated analysis of transformation failures at national, regional, and local levels offers strategic opportunities for policy improvement. These failures, framed within the framework of transition failures of Weber and Rohracher (2012), provide a clear perspective on the systemic challenges that hinder the adoption of SuDS. By assessing these issues through this established framework, we gain a deeper understanding of the systemic barriers that must be overcome to facilitate effective SuDS implementation.

# **Directionality Failures**

Directionality failures are evident in the lack of a shared vision and coherent strategy for SuDS implementation across the three LAs. Out of the three boroughs, Salford's policies were found to be comparatively the strongest. Indeed, Salford's local plan includes policies that not only advocate for SuDS but also integrate them into the broader green infrastructure network. This integrated approach enhances Salford's resilience to flooding while supporting biodiversity. In contrast, Stockport, and Tameside comparatively lag behind Salford, with outdated and fragmented policies. Stockport's planning framework comprises the UDP from 2006 and a Core Strategy DPD from 2011. The UDP still refers to the PPS25, which was superseded by the NPPF in 2012. Moreover, the borough has not defined its CDAs despite guidance from the Government stating that SuDS should be used in all developments in areas at risk of flooding (DEFRA, 2023). What is more, the GM SFRMF, which Stockport is part of, puts emphasis on managing flood risk and developing a consistent approach to surface water flood risk management, including CDA management. Therefore, Stockport's lack of definition of its CDAs indicates poor commitment to both national and regional guidance and strategies.

Tameside's policies are similarly outdated, with the borough relying on policies from 2004. Although it is currently being worked on, as stated by the planning officer, the new development plan is not expected for at least another five years. The borough's approach to SuDS implementation therefore reflects a lack of urgency and low commitment to modernising SuDS practices. As indicated during the interview, SuDS are dealt with by an external consultant. This reliance on external expertise could possibly hint at a lack of coordination between the flood risk consultant and the LPA, which may contribute to the LA's slower progress in updating their SuDS policies. These findings align with the study of Melville-Shreeve et al. (2018), which highlighted insufficient expertise in SuDS implementation among LPAs. This is further corroborated by their findings that LPAs lack in-house drainage expertise and depend heavily on LLFAs for technical guidance. In turn, this dependence can cause delays in application processing and increase costs for developers, potentially encouraging developers to opt out of their SuDS obligations on viability grounds (Melville-Shreeve et al., 2018; Potter & Vilcan, 2020; Vilcan & Potter, 2020).

Despite the dependency on their advice, the weak policies make it difficult for the LLFA to push for better design standards from developers. Indeed, even when LLFAs offer suggestions, developers frequently disregard them, and projects get approval if they satisfy the minimum operational standards (Ellis & Lundy, 2016). Developers usually expect to negotiate any restriction unless they are legally binding, which adds to the barriers impeding on SuDS adoption (Vilcan & Potter, 2020). This directionality failure in SuDS adoption in England is corroborated by the study of Ashley et al. (2015) who found that the role of SuDS within the planning process in England is to avoid excessive burdens on businesses. Indeed, a written statement by the Secretary of State for Communities and Local Government, Mr. Pickles (2014, para. 3-4), specifies that "The sustainable drainage system should be designed to ensure that the maintenance and operation requirements are economically proportionate. To protect the public whilst avoiding excessive burdens on business, this policy will apply to all developments of 10 homes or more and to major commercial development." This indicates that the regulatory framework in England aims to facilitate business operations by not imposing excessive requirements, potentially undermining, and discouraging the implementation of SuDS, where not deemed absolutely necessary (Ellis & Lundy, 2016).

The recent implementation of Schedule 3 adds even more complexity to stakeholder coordination, a view supported by officers from Salford and Stockport. The current focus of boroughs while waiting for the implementation of Schedule 3 seems to be on learning from the Welsh implementation. In fact, the review for the implementation of Schedule 3 to the FWMA 2010 clearly states "we will learn from the Welsh implementation" (DEFRA, 2023, p. 18). It is to be noted that the Welsh implementation was not a smooth process, with the SAB initially running

at a loss due to poor skills and capabilities. This happened despite the fact that the SAB should have been running in a net-zero cost for the LA through an established application and inspection fee system that the developer should pay as part of the application system. Although the review recommends that the successful implementation of Schedule 3 will rely on skills and capabilities of professionals to design, construct, assess and maintain SuDS, it later mentioned that there is a skills and capabilities gap in the SuDS industry (DEFRA, 2023). The Government however plans to confront this lack of skills by working together with the Green Jobs Delivery Group and other stakeholders to ensure that the skills and capacity to implement and sustain SuDS are delivered (DEFRA, 2023).

Moreover, the review also posits that much of the existing guidance around SuDS needs to be reviewed and updated as part of the implementation. The document analyses and interviews did not uncover any pressing agenda for updating SuDS policies and guidelines in any borough, raising concerns about the smooth implementation of Schedule 3 across England. The evident lack of alignment across governance levels, particularly in light of the impending changes that the implementation of Schedule 3 will bring, underscores strong directionality failures with the implementation of SuDS.

# **Demand Articulation Failures**

The analysis has revealed significant gaps in addressing the needs of the community, especially concerning interactions with residents and stakeholders. When planned and executed properly, SuDS can operate as multi-functional entities, offering benefits such as reduced SWF risk, improved aesthetic value, recreational opportunities, increased biodiversity and community welfare, and even increased property value (Ashley et al., 2018; Jose, Wade & Jefferies, 2015; Ossa-Moreno, Smith & Mijic, 2017). Despite these potential advantages of SuDS schemes, there seems to be a noticeable oversight in considering those directly impacted, as evidenced by the limited reference to locals in official documents. Indeed, outreach and educational initiatives aimed at

raising awareness about SuDS within the community are not mentioned. In Salford, the interview revealed public engagement efforts such as marking sidewalks to highlight water infiltration points. While this effort has gained positive feedback, challenges arose with the implementation of the Walkden Neighbourhood SuDS plan. The interview with the flood risk manager revealed an early leak of project drawings which led to community distrust, as residents misunderstood the project's purpose, seeing it merely as a street improvement rather than a climate change and water quality initiative.

In Stockport, the involvement of the public in SuDS initiatives is limited to traditional planning procedures, such as neighbour consultation for proposed developments, as opposed to specialised outreach programmes. This method may fail to meet the special educational needs associated with SuDS, resulting in a lack of community support and understanding. Due to a lack of targeted teaching programmes, locals may not fully understand the benefits of SuDS, which might lead to resistance and obstacles during implementation. Indeed, the potential for litter and pests appearing from SuDS schemes can worry residents according to Williams et al. (2019). Moreover, residents may also fear children drowning in ponds, constructed as SuDS (HR Wallingford, 2003). This illustrates the need for not only informing residents but also working together with the community to identify their specific needs and deliver schemes that are safe and appropriate for the local demographic. In Tameside, the approach to public engagement is equally lacking. The interview suggested that SuDS are primarily considered in planning conditions rather than through proactive community engagement.

The SuDS scheme at Manor Fields District Park in Sheffield serves as a commendable model for community engagement and illustrates the benefits of SuDS (Kennedy et al., 2007). It has provided several benefits to the community, including enhancing recreational facilities and increasing the property values in the area due to its improved attractiveness. Additionally, the scheme features a storage area designed to manage a 1 in 100-year storm event, which is utilised during community events and by local children for football games. The scheme has also introduced

educational initiatives aimed at reducing vandalism and maintaining the integrity of the site (Kennedy et al., 2007). On a related note, Henry (2012, p.183) states that "communication is vital in order to maximise the integration of Suds within a development scheme and community, to gain local buy-in and engender a spirit of ownership". At the Hampton development in Peterborough, community education on SuDS and information sharing was achieved through environmental forums, the implementation of signages and community events. Henry (2012, p.183) particularly recommends the use of signages as they not only convey information about SuDS but also "highlight walking routes and health benefits, provide contact details for any queries and identify the wildlife to be observed in and around the SuDS features."

#### Figure 4

Information Board Presenting the Benefits of a SuDS Scheme



Note. From Lessons Learned from SuDS Implementation at Peterborough, UK. By R. Henry, 2012, p. 183

Overall, effective demand articulation for SuDS necessitates a collaborative effort to educate and engage communities. While Salford's measures are a positive advancement, more comprehensive and extensive policies must be implemented across all local governments to ensure that communities are well-informed and supportive of SuDS. LAs can develop an environment of support for SuDS by adopting focused educational campaigns.

# **Policy Coordination Failures**

The policy analysis reveals that effective SuDS implementation mandates inter-stakeholder coordination at all governmental levels, necessitating seamless collaboration between LPAs, SABs, the LLFA, the EA, developers, UU, and the community. Stockport's policies, however, are outdated and insufficient to address drainage challenges, potentially leading to weak implementation. Despite Stockport's fragmented planning framework, an updated development plan will take years to be issued, raising concerns about the LA's capacity to meet national and regional flood prevention and SuDS implementation goals. Stockport's withdrawal from the PfE plan further highlights poor regional integration. According to a news article by Manchester Evening News, which coins Stockport's withdrawal *Stexit*, the decision was made due to the confluence of political dynamics, local concerns, and the pursuit of planning autonomy (Statham, 2022).

Concerns over the green belt were pivotal in Stockport's decision to withdraw from the regional plan. Indeed, there was a widespread apprehension among residents and planners that adhering to the PfE strategy would escalate development pressures on precious green spaces. Moreover, Stockport aims to gain greater control over its local development and planning processes by stepping away from the PfE. Indeed, this autonomy could allow the borough more flexibility in addressing specific local needs, particularly in housing and employment (Statham, 2022). There is also a prevailing belief among Stockport's leadership that independent planning could secure better developmental outcomes. This withdrawal however raises the issue that it could potentially isolate Stockport from regional efforts to standardise SuDS. Nonetheless, the PfE's strategy of releasing greenbelt land raises concerns about its alignment with broader environmental goals, making Stockport's decision not to participate appear as a commitment to preserving green

infrastructure, aligning with SuDS objectives. Specifically, the plan proposes a net reduction of 2,213 hectares of greenbelt area, equating to a 4.1% decrease across the involved districts (GMCA, 2023). Although this reduction is intended to be balanced out by biodiversity net gain initiatives (GMCA, 2024), which aim to maintain ecological balance and enhance natural habitats, this strategy is somewhat contradictory to the principles of SuDS. Indeed, SuDS are designed to increase infiltration and are integral parts of green infrastructure strategies (Ellis, 2013). Stockport's decision not to participate in the PfE, although presenting policy coordination issues due to misalignment with regional goals, can nonetheless be interpreted as a commitment to preserving green infrastructure, which aligns with the objectives of SuDS.

Tameside also faces significant coordination challenges stemming from a fragmented governance structure. The borough's reliance on outdated policies and external consultants leads to delays and inconsistencies in SuDS implementation. The outdated policy framework impedes upon effective coordination and adaptation to current best practices in sustainable drainage. In contrast, Salford has demonstrated more effective inter-agency coordination, serving as a potential model for other LAs. Salford's proactive approach in securing funding and support from UU underscores the importance of strong collaborative relationships. Comprehensive policies in Salford integrate SuDS into broader environmental and infrastructure planning, enhancing stakeholder coordination.

Our research indicates that the introduction of Schedule 3 in 2024 will bring up various issues related to policy coordination. Indeed, Schedule 3 requires the formation of SABs who will approve of SuDS, however, there are uncertainties surrounding how SABs will be established, how they will operate, and how they will be funded, as apparent from the interview with the flood risk manager. Currently, boroughs are waiting for more detailed information on the implementation process, despite its predicted commencement in 2024. On the one hand, the lack of clear guidelines regarding Schedule 3's implementation poses challenges in policy coordination. On the other hand, this change could also present opportunities for innovative approaches to SuDS implementation.

Schedule 3, reliant on SABs, who are skilled in flood risk management, could create space for stricter SuDS implementation that aligns with regional and national flood management strategies.

# **Reflexivity Failures**

Reflexivity issues are clear in the lack of systems to capture and incorporate the lessons learned from previous SuDS projects into future practices within all three LAs. This failure raises particular concern, as it is essential to continuously update and adjust policies based on new research, technological advancements, and feedback from past projects to enhance the effectiveness of SuDS (Henry, 2012). Unfortunately, our research reveals that there is no formal feedback mechanism to incorporate lessons from past SuDS projects, resulting in missed opportunities for advancement.

In the boroughs of Stockport and Tameside, reflexivity failures are particularly noticeable due to the outdated nature of their policy framework. Moreover, Tameside's reliance on an external flood risk consultee exacerbates reflexivity issues due to poor collaboration between stakeholders, leading to a potential lack of dialogue and knowledge-sharing of past projects. This aligns with the findings of Melville-Shreeve et al. (2018), who found that LPAs often lack the expertise and capacity to properly manage and monitor SuDS projects, ultimately leading to their suboptimal implementation. The timeline in Figure 5 shows that both Tameside's and Stockport's policies have not been updated for over a decade. Moreover, they were adopted before the establishment of the NPPF. This exacerbating the difficulties in maintaining effective SuDS systems. The lack of timely updates, as discussed by Vilcan and Potter (2020), results in missed opportunities to incorporate advancements and feedback into policy frameworks.

#### Figure 5





Note. Timeline of Key SuDS Documents. Own Work.

Overall, these findings align with the findings of Vilcan and Potter (2020), that the Government is unwilling to design policy and does not have the power to change the status quo. This leads to fragmented and inconsistent approaches to SuDS implementation, impeding upon the ability to adapt to new challenges and incorporate innovative solutions. To address these reflexivity failures, it is crucial to establish structured feedback mechanisms which allow for continuous learning and adaptation.

# Strategic Policy Recommendations for Enhancing SuDS Implementation

Based on the findings and analysis of the transformation failures for the transition of SuDS as a socio-technological system in the three boroughs and in the wider policy framework in England, a series of recommendations can be proposed. Table 7 presents policy recommendations by order of importance, from highest priority (red) to lowest priority (green).

# Table 7

Recommendation	Description	Target Level
Develop Strategies for Schedule 3	Develop plans to smoothly transition to the novel approach led by the SAB as outlined in Schedule 3.	Local/Regional
Update Local Planning Documents	Ensure that the local planning documents align with the latest recommended methods and the SuDS guidelines at the national and regional levels.	Local
Strengthen Enforcement of SuDS Policies	Ensure that developers adhere to the required guidelines by performing detailed compliance assessments and imposing sanctions, as necessary.	Local/National
Learn from the Welsh Implementation	Apply lessons learned from the implementation of Schedule 3 in Wales to avoid similar issues.	National/Regional/L ocal
Foster Collaborative Governance	Engage all key stakeholders in the planning and implementation of SuDS projects.	Local
Enhance Public Awareness	Establish awareness campaigns to educate residents on the advantages of SuDS.	Local
Establish Feedback Mechanisms	Develop formal mechanisms to capture and integrate lessons learned from SuDS projects into future practices.	Local/Regional
Introduce Financial Incentives	Offer financial support such as grants, tax incentives or subsidies to mitigate any perceived cost burdens associated with SuDS	National/Local

Policy Recommendations for Improved SuDS Implementation

Note. Policy Recommendations for Improved SuDS Implementation. Own Work.

# **Research Limitations**

This research has some limitations that should be considered for a thorough understanding of the results. First, the study is geographically limited to three specific GM LAs, which may not fully reflect the state of SuDS implementation in England. This is because, currently, the delivery of SuDS depends on individual boroughs (Potter & Vilcan, 2020), therefore, the state of delivery in one borough may not be reflective of another borough. Consequently, this geographical limitation may limit the generalizability of this study's results to other areas of England. Moreover, the study relies heavily on qualitative data obtained through interviews with LA officials. Relying on such subjective perspectives can bias the research, as these perspectives may not fully reflect all stakeholders involved in SuDS projects. Moreover, interpretation bias could arise from the analysis, where the researcher's perspective influences the conclusions drawn, with a different researcher perhaps interpreting the same data differently.

These limitations underscore the need for further research which encompasses a broader geographic scope, includes a more diverse range of stakeholder perspectives, and incorporates quantitative data to complement the qualitative findings.

# Chapter 7 – Conclusive Review & Future Directions

This study has critically examined the barriers to the implementation of SuDS in GM. It applied the lens of STTT to highlight how socio-technical dynamics influence SuDS adoption and suggest policy recommendations to enhance their adoption. This study has uncovered a complex landscape of regulatory, institutional, socio-cultural, and economic barriers, impeding the adoption of SuDS in GM. Although this study was geographically limited, its findings can be applied to a broader scale for two reasons. Firstly, seeing that SuDS implementation is currently largely delt with under the discretion of LPAs, there is no uniform standard for dealing with SuDS schemes. Secondly, the study sheds light on stakeholder coordination issues that could potentially arise from the implementation of Schedule 3 in England. These combined factors allow for the generalisation of this study's findings to other LPAs in England.

Through the application of STTT, the study has provided a multi-dimensional analysis of barriers to SuDS implementation, offering an understanding of the challenges faced at different levels of governance in the UK. Namely, at the micro (local), meso (regional), and macro (national) levels of governance. Specific transformation failures were identified. Directionality failures stemmed from the lack of a unified vision for SuDS across distinct levels of governance and among stakeholders. Demand articulation failures resulted from a gap in public awareness about the benefits of SuDS. Policy coordination failures arose from the improper alignment of policies across the macro, meso and micro levels. Finally, reflexivity failures originated from the lack of feedback mechanisms which inhibit the ability to learn from past implementation.

The use of STIT framework was successful in providing precise understanding into these failures and allowed for the provision of policy recommendations. These recommendations can inform policymakers, SABs, LPAs, and other SuDS stakeholders in addressing existing and emerging barriers to SuDS implementation. With the impeding adoption of Schedule 3 in England, there is a pressing need for further research on lessons from the Welsh implementation and their applicability in England. This information could help streamline the shift and avoid stakeholder confusion and, most critically, inefficient SuDS implementation. Additionally, a comprehensive economic analysis of SuDS in the UK is an essential area for future research. Indeed, our study highlights that economic barriers often deter developers who fail to see the long-term benefits of such schemes. Therefore, understanding the economic implications of SuDS is critical.

A thorough cost-benefit analysis (CBA) could provide useful data on their financial viability and broader benefits. This analysis could evaluate both the direct and indirect costs and benefits associated with SuDS implementation. This would include the comparison of upfront costs, ongoing maintenance expenses, and operational costs, with traditional drainage systems. The research would aim to quantify tangible benefits such as reduced flood damage and increased property values, along with savings from mitigated sewer overflow incidents. Additionally, it would incorporate harder-to-quantify environmental and social advantages such as improved water quality and enhanced community spaces, using ecosystem services valuation techniques to give an informed view of the economic impacts of SuDS. This comprehensive economic assessment could significantly influence policy decisions and lead to more informed, sustainable urban planning practices that align with both economic and environmental goals, fostering wider adoption and success of SuDS initiatives across the UK.

Lastly, given the significant lack of reflexivity in the implementation of SuDS in the UK, future studies should investigate international best-practice cases of feedback mechanisms that retain past data and inform future SuDS projects. This could in turn advise the establishment of imperative feedback mechanisms in the UK.

# Chapter 8 – Appendix

# Appendix 1

Table of Analysed Documents at Macro, Meso and Mico-Mevels

National Policy Documents (UK)			
Document Name	Type of Document	Year	
The National Planning	Policy Document	Most recent version:	
Policy Framework		December 2023	
(NPPF)			
The NPPF prescribes that S	SuDS should be incorporat	ted in any planning application	
to avoid increasing flood ris	sk elsewhere. It says that Su	uDS should be incorporated	
unless there is clear evide	ence that they would be i	nappropriate.	
Moreover, projects should t	take account of advice from	n the LLFA, have proposed	
minimum operational stand	ards, have maintenance arr	rangements in place and where	
possible, provide multifunc	tional benefits (Departmen	nt for Levelling Up, Housing	
and Communities, 2023).			
<i>The FWMA 2010-</i>	Legislative Act	April 8, 2010	
Schedule 3		-Schedule 3 is implemented	
		in England from 2024	
Schedule 3 of the Act, due	to be implemented in 2024	requires the LLFAs to become	
SABs, responsible for appro	oving and adopting SuDS o	on new developments. This	
would be separate from the	planning process and the	SAB approval would be	
required prior to developme	ent commencing on site. U	Inder schedule 3, SuDS are the	
default option for surface w	vater drainage on new deve	elopments, removing the	
automatic right to connect	to the public sewerage syst	em (United Kingdom	
Parliament, 2010).			
The Review for	Government Review	January 2023	
Implementation of	by DEFRA		
Schedule 3 to The			
FWMA 2010			
The review suggests phased	implementation, clear gui	delines, and exemptions for	
minor developments to avo	id burdening developers. I	hese measures aim to improve	
infrastructure resilience, water quality, and flood risk management (DEFRA, 2023).			
The Non-Statutory	Guidance document	March 2015	
<i>Lechnical Standards for</i>			
SuDS			
Emphasis on controlling pe	ak runoff and volume to n	natch greenfield conditions,	
ensuring SuDS prevent floc	ding during significant rain	nfall events, and maintaining	
structural integrity. The standards also address the use of high-quality materials,			
minimal reliance on pumping, and proper construction practices to avoid damage.			
(DEFRA, 2015).			
Regional Policy Documents (Greater Manchester)			
Greater Manchester	Strategic framework	September 2018	
Strategic Flood Risk			
Management			
Framework			
Calls for the integration of SuDS in new developments to manage surface water flood			
risk effectively. The framework highlights the need for collaboration among LAs, the			
EA, and other stakeholders, as well as updating policies and guidance to ensure the			

successful application of SuDS across Greater Manchester (Manchester City Council, 2018).		
Places for Everyone (PfE)	Joint Development Plan	Adopted March 2024
Long-term plan from 2022 to 2039 of GM districts (except Stockport) for jobs, new		
surface water reduce flood	risks and improve water of	mality. The plan integrates
SuDS with groop infrastruct	tisks, and improve water e	agoment. Maintenance plans are
subs will green inflastice	n sustainability and offecting	sonoss of SuDS contributing to
flood resilience and ecologi	col benefits across Greater	Manchester (CMCA 2023)
Schodulo 3 presentation	Information brief	2024
GMCA		2024
Challenges to SuDS implem	nentation include funding	maintenance and adoption
issues. The introduction of	SABs will ensure that SuD	S meet national standards
before construction. The de	cument emphasises the in	portance of a consistent
collaborative approach and	includes guidance for integ	prating SuDS into new
developments and retrofitti	na existing infrastructure (	Holden 2023)
	<b>Policy midance</b>	<b>2015</b>
interaction of SuDS	document	2015
	document	
The desument on phasiase	the improvement of intervent	and superinternet and existing
developments within Creat	an Manah astan ta managa a	ing SuDS into new and existing
developments within Great	er Manchester to manage s	surface water nooding and
improve water quality. It red	cognises the predominance	e of private land ownership and
the challenge of retrofitting	SuDS into already develop	bed areas with impermeable
surfaces. It stresses the need	d for a coherent and integr	ated approach to SuDS
implementation, supported	by appropriate design stan	idards and collaborative efforts
among stakeholders (CIRIA, 2015).		
Local Policy Documents		
Salford		
Salford SPD	Supplementary planning document	Latest version December 2019
Mandates the integration of	SuDS in new developmen	its to manage surface water and
reduce flood risk. SuDS mu	st meet national standards	and be part of broader
infrastructure planning for s	sustainability. Effective imp	plementation requires
collaboration between deve	lopers, LAs, and stakehold	lers, with maintenance plans in
place. The SPD also empha	sises the need for funding	mechanisms to support SuDS
while considering the financial viability of developments (Salford City Council, 2019).		
Salford Local Flood	Strategic planning	2015
Risk Management	document	
Strategy		
Emphasises the importance of incorporating SuDS in new developments and		
promoting their retrofitting in existing areas. SuDS are crucial for managing flood		
risks sustainably, mitigating climate change impacts, and enhancing water quality and		
biodiversity. The strategy calls for adherence to national standards and collaborative		
efforts with stakeholders to ensure effective implementation and integration of SuDS		
in the planning system (Salford City Council 2015)		
Salford Local Plan Statutory planning 2013		
	document	
The document outlines Salf	ord's commitment to impl	ementing SuDS to manage
surface water in a coordinated and sustainable manner. It highlights the importance of		
surface water in a coordinated and sustainable manner. It highlights the importance of		

minimizing surface water runoff from development sites to reduce flood risk and water pollution, promote biodiversity, and enhance water quality. SuDS should be integrated into the site layout early on to maximise benefits, and their use is encouraged across new developments, with a focus on creating multi-functional green infrastructure. The policy aims to reduce the rate of surface water discharge, particularly from previously developed sites, and encourages the removal of impermeable surfaces and the storage of rainwater for later use (Salford City Council, 2023).

Salford Green Space	Strategic planning	2019
Strategy	document	

The document emphasises the importance of SuDS to address flood risks and improve water quality in Salford. It highlights that SuDS can provide construction and maintenance cost savings, enhance biodiversity, and create more attractive developments. The policy mandates that new developments must manage surface water sustainably, prioritizing infiltration and minimizing discharge to combined sewers. SuDS should be integrated early in the site layout to maximise benefits and support the city's green infrastructure network (Salford City Council, 2019).

Drainage Strategy –	Regulatory guidance	2024
Salford City Council	framework	
Same for the Samper all and the	·	

Specifies that SuDS should improve water quality, reduce discharge rates, and provide amenity opportunities. Developers must include detailed drainage strategies for various application types, such as major developments and those in high flood risk zones. These strategies should cover design calculations, maintenance plans, integration with green infrastructure, and ensure compliance with national standards. The goal is to mitigate flood risks and promote sustainable water management practices (Salford City Council, 2024).

# Stockport

otoenpoit		
Stockport SPD	Supplementary planning document	2012

The document discusses SuDS as a key strategy for managing water runoff in urban areas. SUDS aim to mimic natural water systems to reduce surface water runoff and minimise flooding risks. These systems can include green roofs, permeable pavements, swales, and basins. SUDS also help protect rivers by reducing the rapid runoff caused by traditional drainage systems, which can contribute to flooding. The integration of SUDS into urban planning is seen as a sustainable approach to water and flood management (Stockport M.B.C., 2012).

and nood management (bio	export m.D.C., 2012).	
Stockport Local Flood	Strategic planning	2016
Risk Management	document	
Strategy		
The document highlights th	e importance of SuDS in 1	managing surface water drainage
and mitigating flood risks in	i urban areas. SuDS are cru	ucial for reducing surface water
runoff, protecting watercourses from pollution, and enhancing local amenities and		
environmental quality. Stockport's strategy emphasises implementing and maintaining		
SuDS in new developments, supported by national legislation and local policies. SuDS		
techniques like green roofs and permeable paving offer multiple benefits, including		
biodiversity enhancement, urban cooling, and resilience against severe weather events		
(Stockport M.B.C., 2016).		
Stockport Green	Strategic planning	2015

 Infrastructure Strategies
 document

 Key recommendations include the local council's leadership in strategy delivery, integrating green infrastructure into planning processes, and fostering community

involvement through initiatives like the GreenStreets project. SuDS play a crucial role in managing water at the source, reducing runoff, and providing cost-effective, sustainable solutions (Stockport M.B.C., 2015).

Stockport Sustainable	Guidance document	2015
drainage pre-		
application advice		

The document emphasises the need for early consideration of SuDS in site design to maximise benefits and cost-effectiveness. It also provides a hierarchical approach for runoff management and highlights the importance of integrating SuDS with the site's overall design and green infrastructure. The goal is to manage surface water as close to its source as possible, promoting natural infiltration and reducing downstream flood risk (Stockport M.B.C., 2015).

## Tameside

Tameside Unitary	Statutory land use	2004
Development Plan	planning document	
(UDP)	- 0	

Policy U3 "Water Services for Developments"; The document encourages and promotes the incorporation of sustainable drainage systems into developments where appropriate. This is aimed at controlling run-off, managing water resources, minimizing diffuse pollution, reducing environmental damage, and providing opportunities for landscaping. It emphasises the need for satisfactory arrangements for the ongoing maintenance of the SUDS structures involved (Tameside M.B.C., 2004).

Tameside SPD	Supplementary	2010
	planning document	

Policy RD25: SuDS, recommends that all residential development incorporate SuDS (Tameside M.B.C., 2010).

Tameside Local Flood	Strategic planning	2016
Risk Management	document	
Strategy		

Emphasises the importance of SuDS for managing surface water runoff sustainably, reducing flood risk, and enhancing water quality. SuDS are now a mandatory consideration in new developments, with the LLFA responsible for their adoption and maintenance (statutory consultee since April 6, 2015). The strategy promotes the use of SuDS through data collection, policy development, and stakeholder engagement. Collaboration with neighbouring authorities and stakeholders is crucial to ensure effective implementation and maintenance of SuDS (Tameside M.B.C., 2016).

<i>Tameside Local</i> <i>Development Scheme</i>	Planning policy document	2023
Programmatic framework for	or the preparation of local	planning documents. The
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document provided does not contain a specific section or detailed discussion about SuDS (Tameside M.B.C., 2023).

Climate change and	Strategic document	February 2020
environmental Strategy		
2021-2026		
T1. 1. 1	·1	· · · · · · · · · · · · · · · · · · ·

The document emphasises the importance of integrating green infrastructure and SUDS in urban planning to manage extreme rainfall, prevent flash floods, and mitigate the urban heat island effect (Tameside M.B.C., 2020).

Tameside Sustainable	Guidance document	2005		
Design and				
Construction Guide				
The document underscores the importance of SUDS in achieving sustainable				
development by managing water runoff, enhancing water quality, and contributing to				
biodiversity (Tameside M.B.C., 2005).				
Stockport: Welcome to the Stexit: The big questions for Stockport after				
leaving Greater Manchester's masterplan (Manchester Evening News)				
Stockport has chosen to diverge from the PfE plan, a regional housing and growth				
strategy developed for Greater Manchester, by pursuing its own unique				
developmental trajectory, often referred to as "Stexit." This decision was influenced				
by a confluence of political dynamics, local concerns, and the pursuit of planning				
autonomy. Central to Stockport's withdrawal was the emphasis on protecting green				
belt lands. There was a widespread apprehension among local residents and planners				
that adhering to the PfE strategy would escalate development pressures on these				
precious green spaces. The decision to exit the regional framework was thus driven by				
a desire to shield these areas from potential overdevelopment (Statham, 2022).				
Note. Table of Analysed Documents at Macro, Meso and Mico-Mevels. Own Work.				

# Appendix 2

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Transtormalion Timensi	ions of the Analy	KIS OF INALIONAL ANA	Regional Multin Policies
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Dimension	Meta-Category	Key Findings
Transformation	Drivers and Barriers	<ul> <li>Shift towards embracing sustainability.</li> <li>Efforts to modernise infrastructure using technology.</li> <li>Steps are being taken to address the rising risk of flooding.</li> <li>The adoption of Schedule 3 is reinforcing SuDS implementation process.</li> <li>Demand for sustainable drainage solutions from both the public and policymakers</li> </ul>
	Politics	<ul> <li>Disagreement arising from technical and economic challenges.</li> <li>Emphasis on national policies with localised adjustments.</li> <li>Multiple stakeholders, with different concerns.</li> <li>The importance of coordination is clear, in how policies are designed to engage a range of stakeholders.</li> </ul>
	Dynamics	<ul> <li>Evolving policy responses, especially with the enactment of Schedule 3 in England.</li> <li>Ongoing updates to standards reflect adaptative learning-process.</li> </ul>

Note. Adapted from Dimensions of systems and transformations: Towards an integrated framework for system transformations, by Edler et al., 2021, p. 6-7.

# Appendix 3

List of interview questions

- 1. Policy Framework: Could you explain how the current policy framework supports SuDS in your council? How are SuDS policies connected with planning and environmental policies, in the council? Who is responsible for overseeing these policies? Can you talk about any efforts between departments to simplify the implementation of SuDS? How have these policies developed over time to enhance support for SuDS? What significant changes have been. Why?
- 2. Implementation Challenges and Achievements: What are the obstacles faced when implementing SuDS policies in your region? Could you share examples of SuDS projects. What contributed to their success?
- 3. Public Involvement: How does the council involve the public and local communities in planning and executing SuDS projects? Can you provide instances of community driven SuDS initiatives within your area?
- 4. Adoption Barriers: What are the primary obstacles hindering adoption of SuDS practices? How is the council working to tackle these hurdles? Is there assistance provided to developers or property owners to incorporate SuDS into existing and new developments?
- Stakeholder Collaboration: How do you manage coordination for SuDS implementation among stakeholders such, as planners, the environmental agency and community organizations? What effective strategies have been used to handle conflicts or disagreements, among groups involved?
- 6. Regulation and Adherence: How do the rules and enforcement methods function for SuDS in Stockport? Have there been any situations where following the rules was particularly difficult and how were these challenges addressed?
- 7. Financial Support and Economic Factors: How does your council secure and manage funding for SuDS projects? What financial impacts have SuDS initiatives had on your area in terms of expenses and advantages?
- 8. Adaptation and Knowledge Enhancement: How does your council integrate knowledge or flexible management approaches into the execution of SuDS? Have there been insights gained from areas/countries regarding SuDS? Can you share instances of how feedback from SuDS initiatives has influenced practices or policy adjustments?
- 9. Assessment and Review: What criteria or signs does your council utilise to evaluate the effectiveness of SuDS? How is performance information gathered and utilised for creating policies?
- 10. Future Plans and Objectives: What are the strategies, for expanding or enhancing SuDS in your region? How do SuDS align with the sustainability and environmental objectives of the council?

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