Targets, Casualties, and Weapons of Conflict

How Non-State Actors Instrumentalize Water Resources and Infrastructures as Part of Military Tactics and Strategies

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1. Introduction

1.1 The Instrumentalization of Water Resources and Infrastructures

From 2013 when the terrorist organization known as the Islamic State (IS, ISIS, or ISIL) started conquering large parts of Syrian territory to the peak of its expansion in late 2014, IS confiscated major dams along the Euphrates and Tigris rivers.[1] By conquering these dams, the group gained control over substantial amounts of crucial water resources in both Syria and Iraq, conferring the group with the power to manipulate the region's water supplies. In both Iraq and Syria, IS used this power – among other tactics – to disrupt downstream water flows, either by withholding or diverting water or by releasing a wall of floodwater, to swamp adjacent towns and farmland or preclude them from critical water supplies. These tactics produced substantial destructive and lethal consequences.[2] In April 2014, IS used its control of Nuaimiyah Dam near Fallujah, Iraq, to flood almost 200 square kilometres of inhabited and fertile agricultural land, displacing more than 60,000 people from the area. Moreover, IS' control over this major dam on the Euphrates River caused that millions of people were left without (secure) water supplies in the cities of Karbala, Najaf and Babil.[3] Capturing Iraq's large dams at Fallujah, Mosul, Samarra, and Ramadi as well as the Tishrin, Euphrates, and Baath Dams in Syria – in addition to many other smaller dams – formed part of IS's greater strategy to instrumentalize water as a means to achieve its objective of military expansionism and regional statehood.[4]

[1] Islamic State is an extremist Islamic organisation that developed out of a violent Islamic insurgent group that altered its name several times in line with its geographical objectives. Previously, the group has operated under the names 'Islamic State in Iraq' (ISI); 'Islamic State in Iraq and al-Sham' (or 'Islamic State in Iraq and Syria' – ISIS); 'Islamic State in Iraq and the Levant' (ISIL); and, more recently, 'Daesh' from the Arabic phrase al-Dawlah al-Islamiyah fi al-Iraq wa al-Sham (the Islamic State in Iraq and al-Sham). In this thesis, the group will be referred to as Islamic State (henceforth IS). Shelly Culbertson and Linda Robinson, "Making Victory Count After Defeating ISIS: Stabilization Challenges in Mosul and Beyond" (Santa Monica: RAND Corporation, 2017), 6; Francis Gaffney, "Islamic State," in *Routledge Handbook of Terrorism and Counterterrorism*, ed. Andrew Silke (London: Routledge, 2018), 315; Seth G. Jones et al., "Rolling Back the Islamic State" (Santa Monica: RAND Corporation, 2017), ix–xi, 98–99; Tobias von Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," *The International Spectator* 51, no. 3 (2016): 82; Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East" (Mumbai: Strategi Foresight Group, 2014), 17–20.

[2] Fred Pearce, "Mideast Water Wars: In Iraq, A Battle for Control of Water," Yale Environment 360, August 25, 2014, https://e360.yale.edu/features/mideast_water_wars_in_iraq_a_battle_for_control_of_water; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 87–89.

[3] Financial Action Task Force, "Financing of the Terrorist Organisation Islamic State in Iraq and the Levant (ISIL)" (Paris: Financial Action Task Force, 2015), 16; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 88; Tobias von Lossow, "Water as Weapon: IS on the Euphrates and Tigris. The Systematic Instrumentalisation of Water Entails Conflicting IS Objectives" (Berlin: Stiftung Wissenschaft und Politik, 2016), 2.

[4] Financial Action Task Force, "Financing of the Terrorist Organisation Islamic State in Iraq and the Levant (ISIL)," 16, 30; Aysegül Kibaroglu and Tugba Evrim Maden, "An Analysis of the Causes of Water Crisis in the Euphrates-Tigris River Basin," *Journal of Environmental Studies and Sciences* 4 (2014): 352–53; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 87–89, 94; Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 17–20; Neda A. Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa," in *Routledge Handbook on Middle East Security*, ed. Anders Jägerskog, Michael Schulz, and Ashok Swain (London: Routledge, 2019), 177.

The relation between water resources or water-related infrastructure and war-making has also become painfully evident during the recent internationalized civil war in Yemen.[5] In Yemen, where water is a scarce commodity, control over its limited water resources developed into a strategic tactic that was employed by multiple parties to the conflict. Critical water supplies and sanitation facilities have been targeted directly by warring factions or destroyed as an indirect outcome of armed conflict. After seizing the country's southern city of Ta'izz in April 2015, the Houthis deliberately restricted the residents of Ta'izz from access to medical supplies, food and water.[6] In February 2016, a Saudi-led airstrike bombed and destroyed a water reservoir in al-Nahdin district of the capital Sana'a that supplied over thirty thousand people with fresh drinking water.[7] There is also repeated reporting of both Houthi and Saudi-led forces blockading humanitarian aid deliveries consisting of crucial food and water supplies.[8] The intentional and unintentional destruction of critical water resources or related infrastructure has led to death and disease for millions of people in Yemen and plunged the conflict into a severe humanitarian crisis.[9]

The water-related dynamics of the conflicts in Iraq, Syria, and Yemen demonstrate how water resources and water supply systems can be purposely targeted or manipulated as instruments of war-making. This deliberate and systemic destruction or weaponization of water is in direct violation of international humanitarian law, or international laws of war.[10] The

[5] Margaret Suter, "An Update on Yemen's Water Crisis and the Weaponization of Water," Atlantic Council, November 29, 2018, https://www.atlanticcouncil.org/blogs/menasource/an-update-on-yemen-s-water-crisis-and-the-weaponization-of-water/.

[6] The Houthi movement, formally known as Ansar Allan ('Partisans of God'), was essentially founded as a revivalist movement for the Zaydi form of Shi'a Islam that is mainly unique to the northern part of Yemen. The socio-political movement was established in 2004 under the leadership of members of the Houthi family native to the northern province of Yemen, Sa'da. The original objective of the Houthi movement was to end the marginalization of Zaydi Islamic communities and doctrines in Yemen. However, the movement is not merely a religious party and also embraces wider social and political goals including increased social and political rights and the overthrow of the current Yemeni government. Hadil Mohamed, Moosa Elayah, and Lau Schulpen, "Yemen between the Impact of the Climate Change and the Ongoing Saudi-Yemen War: A Real Tragedy" (Sana'a: Centre For Governance and Peace-building-Yemen, Centre for International Development Issues Nijmegen, 2017), 6; Barak Salmoni, Bryce Loidolt, and Madeleine Wells, "Regime and Periphery in Northern Yemen: The Houthi Phenomenon" (Santa Monica: RAND Corporation, 2010), 1–7.

[7] Al-Masdar News, "Saudi Jets Target's Yemen Reservoir, Dam," AMN - Al-Masdar News | المصدر نيوز, February 8, 2016, https://www.almasdarnews.com/article/saudi-jets-targets-yemen-reservoir-dam/; Collin Douglas, "A Storm Without Rain: Yemen, Water, Climate Change, and Conflict" (Washington D.C.: The Center for Climate and Security, 2016), 3; Margaret Suter, "Running out of Water: Conflict and Water Scarcity in Yemen and Syria," Atlantic Council, September 12, 2017, https://www.atlanticcouncil.org/blogs/menasource/running-out-of-water-conflict-and-water-scarcity-in-yemen-and-syria/.

[8] Douglas, "A Storm Without Rain: Yemen, Water, Climate Change, and Conflict," 3; Reuters, "Saudi Coalition, Houthi Rebels Restricting Yemen Aid Access: U.N.," *Reuters*, February 16, 2016, https://www.reuters.com/article/us-yemen-war-saudi-un-idUSKCN0VP2Q6.

[9] Milena Caye, "The Weaponization of Water Amidst Yemen's Humanitarian Crisis," Crossfire KM, August 18, 2020, https://www.crossfirekm.org/articles/the-weaponization-of-water-amidst-yemens-humanitarian-crisis; Douglas, "A Storm Without Rain: Yemen, Water, Climate Change, and Conflict," 3–6; Suter, "An Update on Yemen's Water Crisis and the Weaponization of Water."

[10] Several international humanitarian laws address and aim to protect critical civilian infrastructure, such as water resources and water infrastructure. The 1899 and 1907 The Hague Conventions as well as the 1949 and 1977 Geneva Conventions explicitly prohibit the intentional or indiscriminate destruction of civilian or public infrastructure, including water infrastructure, disproportionate relative to military necessity. The protection of water-related infrastructure is specifically

manipulation of water as a target or weapon by IS in Iraq and Syria and the Houthis in Yemen directly harmed civilians instead of military targets.[11] Moreover, these tactics produce severe collateral damage that spreads over to other domains, generating long term health, environmental, and economic consequences.[12] The weakened or even shattered conditions of water resources and infrastructures can cause severe water and soil degradation, alter local water availability, affect biodiversity, disrupt livelihoods, generate food insecurity, produce unemployment and mass migration, and give rise to enhanced insecurity.[13] The extensive indiscriminate destruction generated by targeted attacks on as well as the employment and manipulation of water resources and infrastructures represents an indiscriminate military tool or instrument that critically undermines and violates humanitarian considerations.[14] Still, as the recent and systemic use of water as instruments of warfare by non-state actors reveals, international laws of war are generally ineffective in preventing attacks on civilian water infrastructure and critical resources.[15] The international agreements and legal frameworks addressing international armed conflict often lack effective instruments of enforcement as they do not impose legal responsibility or accountability mechanisms.[16] A complicating factor is that international humanitarian law only addresses state-actors, while non-state actors are regularly the most critical players targeting critical infrastructure and resources in contemporary armed conflicts.[17] Moreover, international laws of war formulate the destruction of water resources

regulated under the 1977 Protocols to the Geneva Convention. Article 55 and Article 15 of these protocols address attacks on infrastructures that may produce dangerous forces and severe losses among civilians, including the destruction of dams and dykes. Military necessity refers to the attainment of a distinct military advantage over the enemy. In other words, acts and operations for war-making purposes should only be implemented to generate or gain some military advantage. While the assessment of what acts and operations of war are acceptable rests on considerations of military necessity, humanitarian considerations play a significant role as well. Yoram Dinstein, *The Conduct of Hostilities under the Law of International Armed Conflict* (Cambridge: Cambridge University Press, 2016), 8–9; Peter H. Gleick, "Water as a Weapon and Casualty of Conflict: Freshwater and International Humanitarian Law," *Water Resources Management* 33 (2019): 1741–42; Jeannie L. Sowers, Erika Weinthal, and Neda Zawahri, "Targeting Environmental Infrastructures, International Law, and Civilians in the New Middle Eastern Wars," *Security Dialogue* 48, no. 5 (2017): 413–14.

[11] Suter, "An Update on Yemen's Water Crisis and the Weaponization of Water."

[12] International Committee of the Red Cross, "Bled Dry: How War in the Middle East Is Bringing the Region's Water Supplies to Breaking Point" (Geneve: International Committee of the Red Cross, 2015), 7–9; Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 9.

[13] Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 6, 19.

[14] Dinstein, *The Conduct of Hostilities under the Law of International Armed Conflict*, 9; Group of Eminent International and Regional Experts, "Situation of Human Rights in Yemen, Including Violations and Abuses since September 2014: Report of the Group of Eminent International and Regional Experts on Yemen" (Genève: United Nations Human Rights Council, September 28, 2020); United Nations High Commissioner, "Report of the Office of the United Nations High Commissioner for Human Rights on the Human Rights Situation in Iraq in the Light of Abuses Committed by the So-Called Islamic State in Iraq and the Levant and Associated Groups" (New York: United Nations High Commissioner for Human Rights and the Office of the High Commissioner and the Secretary-General, 2015), 7; United Nations Security Council, "Final Report of the Panel of Experts on Yemen" (New York: United Nations Security Council, January 25, 2019).

[15] Jay E. Austin and Carl E. Bruch, *The Environmental Consequences of War: Legal, Economic, and Scientific Perspectives* (Cambridge: Cambridge University Press, 2000), 137–55; Mara Tignino, *Water During and After Armed Conflicts: What Protection in International Law?*, Brill Research Perspectives (Leiden: Brill, 2016).

[16] Gleick, "Water as a Weapon and Casualty of Conflict: Freshwater and International Humanitarian Law," 1738.

[17] M. Cherif Bassiouni, "The New Wars and the Crisis of Compliance with the Law of Armed Conflict by Non-State Actors," *Journal of Criminal Law & Criminology* 98, no. 3 (2008): 711–810; Jean d'Aspremont, *Participants in the International Legal System: Multiple Perspectives on Non-State Actors in International Law* (London: Routledge, 2011), 1–7.

and infrastructure largely as a side-effect or undesirable outcome of war-making instead of an intentional target or tactic.[18] Considering the intentional and devastating impacts generated by water-related military tactics and strategies, it is critically important to generate better understanding and awareness of the varied and systemic ways in which non-state actors are able to target and weaponize water resources and infrastructures during episodes of conflict.

1.2 Problem Definition and Research Question

Water resources and conflict are irrefutably interrelated. Only *how* they are interrelated is still an issue of discussion, both within academic literature as well as in international political debate. In the last two decades, scholars have increasingly analysed the role of water in the context of both interstate and intra-state conflict or cooperation as well as the instrumentalization of water as a military or political leverage tool in international relations.[19] However, academic research on the water-conflict nexus has resulted in mixed evidence and contradicting outcomes, without arriving at definite conclusions. Often, the relationship between water and conflict does not fit neatly in fixed categories of 'conflict' or 'cooperation'. Moreover, as the examples in the introduction validate, most armed conflict takes the shape of sub-national violence induced by or involving non-state actors.[20] The specific ways in which non-state actors in more localized contexts of conflict can purposely employ and manipulate water resources, water-related infrastructure, or water issues as instruments or strategies of sub-national violence are still examined to a lesser extent.

This thesis aims to contribute to the body of academic literature on the water-conflict nexus by enhancing both the conceptual and practical understanding of the instrumentalization of critical water resources and related infrastructure by violent non-state actors. To this end, this thesis will critically analyse how non-state actors in the civil wars of Iraq, Syria, and Yemen have targeted, employed, and manipulated water resources and infrastructures. The presence of violent non-state actors seeking military expansion, combined with prevailing dire water situations, underline the importance of examining and clarifying the intersection between water

[18] Bart Klem, "Dealing with Scarcity and Violent Conflict" (The Hague: Clingendael, 2003), 12; A. H. Westing, *Warfare in a Fragile World: Military Impact on the Human Environment* (London: Taylor & Francis, 1980).
[19] Tobias Böhmelt et al., "Demand, Supply, and Restraint: Determinants of Domestic Water Conflict and Cooperation," *Global Environmental Change* 29 (2014): 337–48; Vally Koubi et al., "Do Natural Resources Matter or Interstate and Intrastate Armed Conflict?," *Journal of Peace Research* 51, no. 2 (2014): 227–43; Sowers, Weinthal, and Zawahri, "Targeting Environmental Infrastructures, International Law, and Civilians in the New Middle Eastern Wars"; Ole Magnus Theisen, Helge Holtermann, and Halvard Buhaug, "Climate Wars?: Assessing the Claim That Drought Breeds Conflict," *International Security* 36, no. 3 (2011): 79–106; Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa."
[20] Bassiouni, "The New Wars and the Crisis of Compliance with the Law of Armed Conflict by Non-State Actors."

and conflict in these countries. To critically examine how violent non-state actors can actively instrumentalize water-related resources and infrastructures to form part of warfare tactics and strategies, this thesis will focus on two specific non-state actors operating in episodes of conflict and analyse the following research question: *How have the Islamic State and the Houthis instrumentalized water resources and infrastructures as a part of military tactics and strategies in Iraq, Syria, and Yemen?*.

To fulfil the objective of this research project and provide an answer to the research question, this study poses and analyses three sub-questions. First, how can water resources and infrastructures be instrumentalized as part of military tactics and strategies? Secondly, for what purposes become water resources and infrastructures part of the target selection of non-state actors? And thirdly, what shapes and motivates the weaponization of water resources and infrastructures for war-making purposes by the non-state actors? As explained in more detail in chapter 2, the analysis of two non-state actors is primarily based on the conceptions and hypothesis by Gleick. Gleick distinguishes between water – both resources or infrastructures – as targets, casualties, or weapons of conflict.[21] Another category identified by his research on violence and conflict induced by water-related resources hypothesizes water as a trigger of conflict. However, this conception does not hold analytical relevance for the current research project whose objective is to analyse the active instrumentalization of water by non-state actors *during* episodes of conflict. Conflict, in this research, refers to an armed dispute between two or more organized actors or groups, or against civilians, resulting in conflict-related casualties.[22]

1.3 Academic and Social Relevance

Analysing the targeting, employment, and manipulation of water by non-state actors is academically relevant, as the ongoing academic debate on the water-conflict nexus has not arrived at definite conclusions. Clarifying the active instrumentalization of water-related resources and infrastructure *during* episodes of conflict can serve to enhance understanding of the relationship and dynamics between the two phenomena.[23] Though scholars have linked

[21] Peter Gleick, "Water, Conflict, and Peace," *Open Rivers: Rethinking Water, Place & Comunity*, no. 11 (2018): 36.
[22] Dinstein, *The Conduct of Hostilities under the Law of International Armed Conflict*, 1–3; Stina Högbladh, "UCDP Candidate Events Dataset Codebook Version 1.0" (Uppsala: Department of Peace and Conflict Research, Uppsala University, 2019); Kendra Sakaguchi, Anil Varughese, and Graeme Auld, "Climate Wars? A Systemic Review of Empirical Analyses on the Links between Climate Change and Violent Conflict," *International Studies Review* 19 (2017): 624.
[23] Michele Abbott et al., "Examining the Food–Energy–Water and Conflict Nexus," *Current Opinion in Chemical Engineering* 18 (2017): 55–60; Jean Cahan, *Water Security in the Middle East Essays in Scientific and Social Cooperation* (London: Anthem Press, 2017); P. Michael Link, Jürgen Scheffran, and Tobias Ide, "Conflict and Cooperation in the Water-Security Nexus: A Global Comparative Analysis of River Basins under Climate Change: Conflict and Cooperation in the Water-Security Nexus," *Wiley Interdisciplinary Reviews. Water* 3, no. 4 (2016): 495–515.

water resources to instances of intra- or interstate conflict, there exist limited generalizable results on this relationship.[24] Authors often evaluate the context-specific ways in which the availability of water resources either fosters instability and conflict or contributes to peacebuilding between states or state-actors. However, intra- or interstate wars are highly complex social phenomena influenced by various (geo)political, economic, ideological, religious, and cultural factors and dynamics.[25] Moreover, most of the violence and conflict over water resources will not transpire in the form of traditional, full-out wars. Water-related conflict more often advances as low-intensity violence involving non-state actors who employ non-traditional tactics of warfare.[26] By examining how non-state actors can actively instrumentalize water *during* conflict, as opposed to how water issues *induce* conflict, this study seeks to enhance the generalizability of its results to other countries or conflict settings. Analysing the active and deliberate ways in which actors manipulate the water-conflict nexus as part of strategies and instruments of warfare provides evidence-based insights into the direct relationships between water and conflict.

This research project is also academically relevant from a methodological perspective. The analysis of the water-related military tactics and strategies by two non-state actors in their specific context serves to test the theory formulated by Gleick. Through a descriptive comparative case study model, this research aims to assess the real-life manifestations of his conceptual propositions as well as the conditions under which they hold valid.[27] Moreover, this study's focus on the explicit role and agency of two non-state actors in transforming and instrumentalizing water as a target or weapon of conflict hopes to limit ambiguousness and discussion on the issue of causality in the relationship between water and conflict, including the role of external factors and dynamics.[28]

Alongside the academic relevance of conducting a comparative study on the targeting and weaponization of water by non-state actors, this research paper holds critical social

[24] See the review of the relevant academic literature in chapter 2.2.1 and 2.2.2. Sakaguchi, Varughese, and Auld, "Climate Wars? A Systemic Review of Empirical Analyses on the Links between Climate Change and Violent Conflict," 633, 640–41; United Nations Department of Political and Peacebuilding Affairs, "Addressing the Impact of Climate Change on Peace and Security," Political and Peacebuilding Affairs, 2020, https://dppa.un.org/en/addressing-impact-of-climate-change-peace-and-security.
[25] Munther J. Haddadin, "Water Scarcity Impacts and Potential Conflicts in the MENA Region," *Water International* 26, no. 4 (2001): 466–69; Sakaguchi, Varughese, and Auld, "Climate Wars? A Systemic Review of Empirical Analyses on the Links between Climate Change and Violent Conflict," 628.
[26] Gleick, "Water, Conflict, and Peace," 34–35; Sakaguchi, Varughese, and Auld, "Climate Wars? A Systemic Review of Empirical Analyses on the Links between Climate Change and Violent Conflict," 628.
[27] Gleick, "Water, Conflict, and Peace," 36.
[28] Agency refers to the condition of acting, making things happen, exerting power, controlling developments or contexts, or being the subject of events. Martin Hewson, "Agency," in *Encyclopedia of Case Study Research*, ed. Albert J. Mills, Gabrielle Durepos, and Elden Wiebe (Los Angeles: SAGE, 2010), 12.

relevance. Above all, a critical and in-depth understanding of the various mechanisms through which violent non-state actors can instrumentalize water as part of military tactics and strategies informs existing international laws of war seeking to protect vital water resources and infrastructures.[29] The findings of this research project could potentially indicate limitations to contemporary legal frameworks and enforcement mechanisms. Moreover, the extreme vulnerability of countries in the Middle East to water-related challenges – both in terms of quantity, quality, and accessibility – and the region's recent history with violent conflict renders examining the instrumentalization of water during conflict as highly significant.[30] The findings of this research can inform decision-makers, security institutions, and non-governmental organisations (NGOs) in addressing fundamental drivers of violence and conflict in the region, from counterinsurgency strategies to the significance of effective water management. Furthermore, clarifying the connections between water and conflict is increasingly pertinent considering the growing pressures climate change is placing on critical and life-supporting ecosystems and environmental resources, including fresh water supplies.[31] Environments with climate change-induced insecurity present strategic openings for insurgent or terrorist groups who can operate more freely in such fragile contexts.[32] These security dynamics are especially important to consider in relation to the Middle East as one of the most adversely affected regions by the impacts of climate change combined with its recent history of numerous active and organized insurgent organizations.[33]

1.4 Research Structure

[29] Hussein A. Amery, "Water Wars in the Middle East: A Looming Threat," *The Geographical Journal* 168, no. 4 (2002): 313–23; Cahan, *Water Security in the Middle East Essays in Scientific and Social Cooperation*; Peter H. Gleick, "Water and Conflict: Fresh Water Resources and International Security," *International Security* 18, no. 1 (1993): 79–112.
[30] Water quality refers to salinity, nutrients, oxygen, metals, and bacteria levels measured in a water resource. Nett, *Insurgency, Terrorism and Organised Crime*, iv; Gen. (ret.) Tom Middendorp and Reinier Bergema, "Where Macro Meets Micro: How Climate Change Fuels Violent Extremism," *IPI Global Observatory*, September 11, 2019, https://theglobalobservatory.org/2019/09/where-macro-meets-micro-how-climate-change-fuels-violent-extremism/; and, United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia" (New York: United Nations, 2013), 42–43.
[31] Mohamed Abdallah Youness, "How Climate Change Contributed to the Conflicts in the Middle East and North Africa," *World Bank Blogs*, published December 10, 2015, https://blogs.worldbank.org/arabvoices/climate-change-conflict-mena; Gen. (ret.) Tom Middendorp and Reinier Bergema, *The Warning Signs are Flashing Red: The Interplay Between Climate Change and Violent Extremism in the Western Sahel* (The Hague: Planetary Security Initiative & ICCT, 2019), 4; and, Notre Dame Global Adaptation Initiative, "ND-GAIN Country Vulnerability Index," *University of Notre Dame*, accessed December 10, 2019, https://gain.nd.edu/ our-work/country-index/.
[32] Freedom C. Onuoha, "Environmental Degradation, Livelihood and Conflicts: A Focus on the Implications of the Diminishing Water Resources of Lake Chad for North-Eastern Nigeria," *African Journal on Conflict Resolution* 8, no.2 (2008): 35-62; Jasparro, *Environmental Threats*, 4-9; Parsons, "Climate Change,"101; and, Nett, *Insurgency, Terrorism and Organised Crime*, iv.
[33] Mohamed Abdallah Youness, "How Climate Change Contributed to the Conflicts in the Middle East and North Africa," *World Bank Blogs*, published December 10, 2015, https://blogs.worldbank.org/arabvoices/climate-change-conflict-mena; Gen. (ret.) Tom Middendorp and Reinier Bergema, *The Warning Signs are Flashing Red: The Interplay Between Climate Change and Violent Extremism in the Western Sahel* (The Hague: Planetary Security Initiative & ICCT, 2019), 4; and, Notre Dame Global Adaptation Initiative, "ND-GAIN Country Vulnerability Index," *University of Notre Dame*, accessed December 10, 2019, https://gain.nd.edu/ our-work/country-index/.

This research is organized into several chapters to provide a structured answer to the sub-questions and, ultimately, the research question. First, chapter 2 provides a critical discussion of the existing academic body of knowledge on the connections between water and conflict before focusing on the literature theorizing the instrumentalization of water during episodes of conflict more particularly. The review of existing relevant literature leads to the theoretical approach employed for the current research project. Next, chapter 3 specifies the research design, including a justification of the adoption of a descriptive comparative case study model, as well as its operationalization. Chapter 4 and 5 apply the theoretical framework on the instrumentalization of water during conflict to the case studies of IS in Iraq and Syria between 2013-2020 and the Houthis in Yemen between 2014-2020. Based on the comparative analysis of the water-related military tactics and strategies of these two non-state actors, chapter 6 provides an answer to the research question and discusses the limitations to these findings. Chapter 7 discusses the conclusions of this study in relation to its academic and practical relevance.

2. Body of Knowledge and Theoretical Framework: Reviewing the Water-Conflict Literature

This chapter reviews the academic literature on the connections between water and conflict. Conflict in this research project is defined as an armed dispute between two or more organized actors or groups, or against civilians, resulting in conflict-related casualties and is used interchangeably with armed conflict.[34] Academic analysis of the water-conflict nexus generally adopts two related yet distinct perspectives: on the *nature of* conflict, focussing on the water-related *causes* of conflicts, and on the *weaponization* of water resources or infrastructure *during* conflict. The principal focus of this research project is on the instrumentalization of water resources and infrastructures by non-state actors *during* episodes of conflict. Still, hypotheses on the water-related tactics and strategies for war-making purposes are situated in the wider academic debate on the water-conflict nexus. Therefore, this section will first review the body of knowledge discoursing the linkages between water and conflict, introduced by the literature exploring the mechanisms between renewable environmental resources, such as water, and armed conflict. The second section of the review will discuss the academic literature

[34] Dinstein, *The Conduct of Hostilities under the Law of International Armed Conflict*, 1–3; Högbladh, "UCDP Candidate Events Dataset Codebook Version 1.0," 3; Sakaguchi, Varughese, and Auld, "Climate Wars? A Systemic Review of Empirical Analyses on the Links between Climate Change and Violent Conflict," 624.

researching the connections between water resources and episodes of inter- and intra-state conflicts in the Middle East. Finally, the more recent literature focussing on the instrumentalization of water resources and related infrastructures as targets or weapons during conflict will be assessed. Based on this review, the third section provides a justification for the theoretical framework employed in the current research project.

2.1 Linking Renewable Environmental Resources and Conflict

The literature on the water-conflict nexus is situated in and considered through the broader relationship between renewable environmental resources and conflict. Renewable environmental resources include croplands, fish, forests, fresh air, and fresh water resources.[35] The central argument of scholars analysing this relationship is that scarcities of renewable environmental resources, in particular, can produce dispute or facilitate cooperation between (non-)state actors. As climate change is inducing and/or accelerating scarcities of critical resources in environments around the world, these linkages are increasingly and critically examined by academic research.

2.1.1 Renewable Environmental Resource Scarcities as a Source for Violence

In the 1990s, scholarship progressively analysed whether and how renewable environmental resources, like water, are able to induce civil violence or international conflict.[36] Until then, the academic debate on environmental resources and conflict primarily discussed environmental devastation and degradation as a side-effect or product of war-making.[37] Authors including Bächler et al., Hauge and Ellingsen, and Homer-Dixon argued that, particularly, scarcities in environmental resources contribute to conflict. The resource scarcity-conflict argument that was initially introduced by Malthus focused on the mechanisms between the availability of food and social tension.[38] According to the *neo-malthusian* line of reasoning, growing scarcities of and decreasing access to vital human resources causes frustration among civilian populations. Widespread frustration commonly generates criticism and objection to the state, thereby

[35] An important distinction is to be made with non-renewable environmental resources, including oil and minerals. The link between non-renewable environmental resources and intra-state or interstate resource wars has largely been established within academic literature. See:

[36] Günther Bächler et al., *Environmental Degradation as a Cause of War: Ecological Conflicts in the Third World and Peaceful Ways of Resolving Them* (Zurich: Rüegger, 1996); Wenche Hauge and Tanja Ellingsen, "Beyond Environmental Scarcity: Causal Pathways to Conflict:," *Journal of Peace Research* 35, no. 3 (1998): 299–317; Thomas F. Homer-Dixon, "Environmental Scarcities and Violent Conflict: Evidence from Cases," *International Security* 19, no. 1 (1994): 5–40.

[37] Klem, "Dealing with Scarcity and Violent Conflict," 12; Westing, *Warfare in a Fragile World: Military Impact on the Human Environment*.

[38] Thomas Malthus, *An Essay on the Principle of Population* (Oxford: Oxford University Press, 1993).

increasing the risk to protests, revolt, and violence.[39] Two groups were especially prominent in this field: the Toronto School and the Swiss 'Environment and Conflicts Project' (ENCOP) led by Bächler and Spillman.[40] Homer-Dixon – key figure of the Toronto Group – argued that the depletion, degradation, and scarcity of renewable resources can give rise to two social processes, namely: *resource capture* and *ecological marginalization*.[41] According to Homer-Dixon, resource capture and ecological marginalization can develop as critical sources of inter-group violence or civil insurgency through three causal dynamics: 1) by inducing or aggravating resource wars; 2) by generating large population movements that intensify ethnic clashes; and, 3) by causing economic deprivation and institutional disruption which weaken the capacity of states and can lead to opportunities for civil strife or insurgency.[42] Based on these mechanisms, his research differentiates three forms of internal armed violence induced by environmental resource scarcity: simple-scarcity conflicts or resource wars, group-identity conflict, and deprivation conflicts including civil strife and insurgency.[43] He finds more limited support for the link between environmental scarcities and interstate violence and conflict.[44] Still, since water resources like rivers and major lakes are commonly shared across national borders, some of the early research also focused on the relationship between water and interstate conflict, including studies by Gleick and Lonergan.[45]

A major criticism on this early research discussing the environmental resources-conflict relationship is that most analysis failed to consider additional contextual and conflict-generating factors. As demonstrated by Hauge & Ellingsen, Kahl, and Theisen, economic and political variables – including economic development, political regime type, and institutional stability – often have more explanatory power in relation to civil violence and conflict.[46] Another criticism identified by Gleditsch is that authors often analyse and base their findings on case studies in

[39] Koubi et al., "Do Natural Resources Matter or Interstate and Intrastate Armed Conflict?," 228.
[40] Kurt R. Spillmann and Günther Bächler, eds., *Environmental Crisis: Regional Conflicts and Ways of Cooperation* (Zürich: Center for Security Studies and Conflict Research, Swiss Federal Institute of Technology, and Swiss Peace Foundation, 1995).
[41] Resource capture is defined by Homer-Dixon as the seizing of resources by elites who employ their power to secure resources anticipated to become scarce in the future, for example by manipulating state policies. Ecological marginalization refers to the process by which groups of the population who experience critical resource scarcity migrate to areas with fragile eco-systems. This process leads to increased scarcity of natural resources in the destination area, generating resource competition with settled communities that could develop as a source of intra-group rivalries and subnational conflict. Homer-Dixon, "Environmental Scarcities and Violent Conflict: Evidence from Cases," 10–16.
[42] Homer-Dixon, 17–32.
[43] Homer-Dixon, 6–7.
[44] Homer-Dixon, 18–31.
[45] Peter H. Gleick, "Water and Conflict: Fresh Water Resources and International Security," *International Security* 18, no. 1 (1993): 79–112; Peter H. Gleick, "Water, War & Peace in the Middle East," *Environment*, 1994, 6–43; Steve Lonergan, "Water Resources and Conflict: Examples from the Middle East," in *Conflict and the Environment*, ed. Nils Petter Gleditsch (Dordrecht: Springer Netherlands, 1997), 375–84.
[46] Hauge and Ellingsen, "Beyond Environmental Scarcity," 308, 314; Colin H. Kahl, *States, Scarcity, and Civil Strife in the Developing World* (Princeton: University Press, 2008); Ole Magnus Theisen, "Blood and Soil? Resource Scarcity and Internal Armed Conflict Revisited," *Journal of Peace Research* 45, no. 6 (2008): 801–18.

which both environmental stressors and armed conflict are present.[47] This approach – which has been adopted by, among others, Homer-Dixon as well as Schwartz and Singh – precludes variation in the dependent and independent variables.[48] Still, the adoption of a biased case selection method enhances the analysis and understanding of the complex causal mechanisms between two social phenomena, because it maximizes the possibilities to identify and characterize interactions as well as to specify contextual conditions and dynamics. Early case study research on the link between renewable environmental resources and conflict provides some important insights for the current research project.[49] For instance, research revealed the increasing linkages between deteriorating environmental conditions, scarcity of resources, and episodes of intra- and interstate conflict. Bächler et al. and Hauge and Ellingson found that renewable environmental resource scarcities are most likely to induce diffuse and sub-national violence or civil conflicts.[50] Schwartz and Singh contend that tension over water resources is the most likely source for direct international and subnational conflict.[51] Homer-Dixion's conceptualization of 'resource capture' and 'ecological marginalization' are critical dynamics to keep in mind as these causal mechanisms can also be purposely harnessed by non-state actors. In addition, these studies highlight how the analysis of environmental resource-induced conflict requires a critical examination and description of specific social, political, economic, and environmental contextual variables.[52]

2.1.2 Climate Change, Environmental Degradation and Resource Scarcity

In more recent literature, the link between renewable environmental resources and conflict is increasingly examined from the perspective of climate change. Climate change, through changes in temperatures and precipitation patterns, a rise in the global mean sea level, and more frequent and extreme weather events, is projected – and already observed – to cause environmental degradation.[53] Environmental degradation affects the availability and quality of renewable environmental resources. A growing number of authors argue that environmental

[47] Nils Petter Gleditsch, "Armed Conflict and The Environment: A Critique of the Literature," *Journal of Peace Research* 35, no. 3 (1998): 381–400.
[48] Homer-Dixon, "Environmental Scarcities and Violent Conflict: Evidence from Cases"; Daniel Schwartz and Ashbindu Singh, *Environmental Conditions, Resources and Conflicts: An Introductory Overview and Data Collection* (Place of publication not identified: United National Environment Programme, Division of Early Warning and Assessment North America, 1999).
[49] Bächler et al., *Environmental Degradation as a Cause of War: Ecological Conflicts in the Third World and Peaceful Ways of Resolving Them*; Spillmann and Bächler, *Environmental Crisis*.
[50] Bächler et al., *Environmental Degradation as a Cause of War: Ecological Conflicts in the Third World and Peaceful Ways of Resolving Them*; Hauge and Ellingsen, "Beyond Environmental Scarcity"; Spillmann and Bächler, *Environmental Crisis*.
[51] Schwartz and Singh, *Environmental Conditions, Resources and Conflicts*, 34.
[52] Gleditsch, "Armed Conflict and The Environment," 94.
[53] Ole Magnus Theisen, Nils Petter Gleditsch, and Halvard Buhaug, "Is Climate Change a Driver of Armed Conflict?," *Climatic Change* 117 (2013): 615.

degradation, accelerated by climate change, aggravates the resource scarcity-conflict link. As argued by Theisen, water scarcity lies at the centre of the climate-conflict discourse as the world's most vulnerable societies often rely on rain-fed agriculture for food and livelihood security.[54] Reuveny explains how reduced access to or decreased qualities of environmental resources generates livelihood insecurity and induces or accelerates migration. Increased livelihood insecurity and migration, in turn, contribute to violence and conflict risk.[55] Barnett, Burke et al., Koubi et al., and Raleigh discuss how sudden climate change-induced renewable resource scarcities induce intra-state violence and civil conflict through livelihood insecurity, migration, and weakened state institutions.[56] Burke et al. and Raleigh find consistent evidence for this relationship in their empirical studies, though they emphasize the role of political and economic variables.[57] Koubi et al. find more limited empirical evidence.[58] Still, a correlational, and sometimes causal, link continues to motivate new research. The causal relationship between climate change and internal conflict in the Middle East and North Africa (MENA) has received particular attention. Sofuoğlu and Ay conducted empirical research on eighteen MENA countries and found that climate change in the region *indirectly* affects or deepens political instability, though in most countries they only find a weak causal relationship (or even none at all in the case of Algeria and Tunisia) from climate change to political instability. They argue that, above all, climate change acts as a *threat multiplier* – accelerating or intensifying existing socio-economic or political issues – rather than being the definite source for the emergence of political instability and conflict.[59] Research applying qualitative case study methods has also resulted in varied and contradicting findings and generally do not produce generalizable conclusions.[60] Scholars like Benjaminsen, Brown and Crawford, and Kelley et al. have studied the role of climate change as a driver of conflict in recent cases of political unrest and civil war

[54] Theisen, Holtermann, and Buhaug, "Climate Wars?: Assessing the Claim That Drought Breeds Conflict," 80.
[55] Rafael Reuveny, "Climate Change-Induced Migration and Violent Conflict," *Political Geography* 26, no. 6 (2007): 656–73.
[56] Jon Barnett and W. Neil Adger, "Climate Change, Human Security and Violent Conflict," *Political Geography* 26 (2007): 639–55; Marshall Burke and Solomon M. Hsiang, "Climate, Conflict, and Social Stability: What Does the Evidence Say?," *Climatic Change* 123, no. 1 (2013): 39–55; Vally Koubi et al., "Climate Variability, Economic Growth, and Civil Conflict," *Journal of Peace Research* 49, no. 1 (2012): 113–27; Clionadh Raleigh and Henrik Urdal, "Climate Change, Environmental Degradation and Armed Conflict," *Political Geography* 26 (2007): 674–94.
[57] Burke and Hsiang, "Climate, Conflict, and Social Stability"; Raleigh and Urdal, "Climate Change, Environmental Degradation and Armed Conflict."
[58] Koubi et al., "Climate Variability, Economic Growth, and Civil Conflict."
[59] Emrah Sofuoğlu and Ahmet Ay, "The Relationship between Climate Change and Political Instability: The Case of MENA Countries (1985:01–2016:12)," *Environmental Scienc and Pollution Research* 27 (2020): 14033–43.
[60] Francesca De Châtel, "The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution," *Middle Eastern Studies* 50, no. 4 (2014): 521–22; Eran Feitelson and Amit Tubi, "A Main Driver or an Intermediate Variable? Climate Change, Water and Security in the Middle East," *Global Environmental Change* 44, no. 2017 (2017): 46–47; Tobias Ide, "Climate War in the Middle East? Drought, the Syrian Civil War and the State of Climate-Conflict Research," *Current Climate Change Reports* 4 (2018): 347–54; Jan Selby and Clemens Hoffmann, "Beyond Scarcity: Rethinking Water, Climate Change and Conflict in the Sudans," *Global Environmental Change* 29 (2014): 367–68.

in various African countries as well as the 2011 Syrian uprising.[61] Comparable to the findings of quantitative research, case study analysis finds the relationship between climate change and violence or conflict to be largely indirect.[62]

Overall, the academic literature on the nexus between climate change, renewable environmental resources, and armed conflict has not reached a consensus. The analysis of the climate change-conflict link has resulted in mixed and varied arguments and evidence.[63] The environmental resource scarcity-conflict argument is also highly contested by 'resource optimists' – or cornucopians – like Deudney and Simon who contend that the neo-malthusian line of reasoning is too deterministic and generalizing.[64] Essentially, the cornucopian argument emphasizes the importance of various other causal dynamics and mediating factors in the relationship between environmental resources and conflict, including diplomatic interaction, market mechanisms, technological inventions, social and political institutions that regulate and advance resource allocation, or any combination of these.[65] Hence, the state of the research on the climate change-conflict nexus is still too inconsistent to generate universal conclusions or theoretical models.[66] Moreover, to simply assume such a link without understanding the specific mechanisms and connections of the climate-conflict nexus may risk leading conflict resolution efforts astray.[67] An important argument presented by De Châtel and Sakaguchi et al. against overemphasizing the role of climate change is that it distracts attention and responsibility away from other critical economic and political variables of deprivation and drivers of violence or conflict, such as critical institutional mismanagement.[68] This risks diverting responsibility away from government authorities and institutions to external climate variables.[69] The climate

[61] Tor A. Benjaminsen, "Does Supply-Induced Scarcity Drive Violent Conflicts in the African Sahel? The Case of the Tuareg Rebellion in Northern Mali," *Journal of Peace Research* 45, no. 6 (2008): 819–36; Ayalneh Bogale and Benedikt Korf, "To Share or Not To Share? (Non-)Violence, Scarcity and Resource Access in Somali Region, Ethiopia," *Journal of Development Studies* 43, no. 4 (2007): 743–65; Oli Brown and Alec Crawford, "Rising Temperatures, Rising Tensions: Climate Change and the Risk of Violent Conflict in the Middle East" (Winnipeg: International Institute for Sustainable Development, 2009); Colin P. Kelley et al., "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought," *PNAS* 112, no. 11 (2015): 3241–46; Selby and Hoffmann, "Beyond Scarcity: Rethinking Water, Climate Change and Conflict in the Sudans"; Theisen, Holtermann, and Buhaug, "Climate Wars?: Assessing the Claim That Drought Breeds Conflict."
[62] Sofuoğlu and Ay, "The Relationship between Climate Change and Political Instability: The Case of MENA Countries (1985:01–2016:12)," 14040–41.
[63] Jürgen Scheffran et al., "Disentangling the Climate-Conflict Nexus: Empirical and Theoretical Assessment of Vulnerabilities and Pathways," *Review of European Studies* 4, no. 5 (2012): 9–10.
[64] See page 11 for details on the neo-malthusian line of reasoning. Daniel Deudney, "The Case Against Linking Environmental Degradation and National Security," *Journal of International Studies* 19, no. 3 (1990): 461–76; Julian L. Simon, *The Ultimate Resource 2* (Princeton: Princeton University Press, 1996).
[65] Deudney, "The Case Against Linking Environmental Degradation and National Security," 461–76; Koubi et al., "Climate Variability, Economic Growth, and Civil Conflict," 228; Bjørn Lomborg, *The Skeptical Environmentalist: Measuring the Real State of the World* (Cambridge: Cambridge University Press, 2001).
[66] Theisen, Gleditsch, and Buhaug, "Is Climate Change a Driver of Armed Conflict?," 621.
[67] Theisen, Gleditsch, and Buhaug, 622.
[68] De Châtel, "The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution," 522.
[69] De Châtel, "The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution."

change-conflict argument can in that sense also be exploited by state actors seeking to evade accountability for inadequate governance or unlawful government action.[70] As concluded by the research of Feitelson and Tubi, Ide, and Smith and Krampe, climate change is primarily an intermediate variable rather than an major driver of conflict and should be analysed as such.[71]

2.2 Water Resources as Causes of Tension and Dispute

Building on the concepts and arguments from the wider literature linking renewable resources and conflict, scholarly research has adopted a particular focus on the connections between water and conflict in the Middle East. This focus is increasingly significant as climate change continues to progress and threaten the availability and quality of critical water resources in this already largely arid region.[72] Though the literature produces mixed findings, authors have established relevant hypotheses and accounts of how access to and control of water resources are developing as critical factors in intra-group tensions and dispute. As water resources, like rivers and large lakes, are often shared across national borders, studies analysing the linkages between water resources and armed conflict have focussed on both interstate as well as internal civil conflict. Both perspectives have resulted in relevant theoretical insights and conceptual models for the current research project.[73]

2.2.1 Water Wars

An important focus of the research discussing the linkages between water and conflict is the availability and quality of fresh water resources as a source of tension between two or more states, also termed *water wars*.[74] Water wars, according to Amery, Annin, and Gleick, range from disputes between riparian states over the allocation and management of critical water resources to intentional attacks executed by state actors on the water infrastructures of other

[70] Idean Salehyan, "From Climate Change to Conflict? No Consensus Yet," *Journal of Peace Research* 45, no. 3 (2008): 315–26.
[71] Feitelson and Tubi, "A Main Driver or an Intermediate Variable? Climate Change, Water and Security in the Middle East," 46–47; Ide, "Climate War in the Middle East? Drought, the Syrian Civil War and the State of Climate-Conflict Research"; Dan Smith and Florian Krampe, "Climate-Related Security Risks in the Middle East," in *Routledge Handbook on Middle East Security*, ed. Anders Jägerskog, Michael Schulz, and Ashok Swain (London: Routledge, 2019), 199–210.
[72] While dispute over the availability of water resources generally concerns the allocation of fresh water resources, water quality as the source of dispute could be caused by the (intentionally or unintentionally) contamination of water shared supplies with chemical or infections substances. Gleick, "Water and Conflict: Fresh Water Resources and International Security"; Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa," 174–76.
[73] Schwartz and Singh, *Environmental Conditions, Resources and Conflicts*, 7–9.
[74] Particularly, the decreasing quality of shared water resources, such as declining nutrient or increasing salination levels, or other forms of pollution have been a source of conflict between riparian states. Amery, "Water Wars in the Middle East," 313–14; Gleick, "Water, War & Peace in the Middle East," 15; United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 42–43, 48.

states during episodes of warfare.[75] The extent to which critical water supply systems like rivers and groundwater basins are distributed over two or more countries makes the apportionment of water supplies an increasingly complex and sensitive economic and political matter between upstream and downstream states.[76] Specifically when fresh water resources become scarce, water can be perceived as an issue of national security and develop into a critical strategic asset. As demonstrated by Sowers, Weinthal and Zawahri, inequities in water use have developed as the source of regional and international tensions, with states cutting off of access to shared water supplies for economic, political, and military reasons.[77] Gleick and Herberger argue that water resources can also develop into military and political goals, becoming the reason for military expansionism.[78] The strategic value of water and resulting national security tensions over water resources have become increasingly evident in the Middle East.[79] Gleick argues how disputes over water resources shaped the military hostilities between Syria and Israel in the mid-1960s that eventually led to the 1967 Arab-Israel War, the occupation of the West Bank, and control of Israel over much of the headwaters of the Jordan river.[80] Amery, Freeman, Kibaroglu and Maden, and Rahman have analysed how internationally shared water supply systems underly interstate disputes in the region in more detail, discussing tensions and dispute among the riparian states of the Jordan River, the Tigris and Euphrates River, and the Nile River basins.[81] Such analysis underscores the various connections between water and conflict, with water resources and water supply systems either being triggers of disputes and violence, targets of attacks, or instruments of politics.

An alternative perspective has been proposed by authors like Dolatyar and Gray, McMahon, and Wolf, who argue how water scarcity is more likely to reinforce peace than to

[75] Amery, "Water Wars in the Middle East," 313–14; Peter Annin, *The Great Lakes Water Wars* (Washington, DC: Island Press/Center for Resource Economics, 2018); Gleick, "Water and Conflict: Fresh Water Resources and International Security," 83–89; Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa," 174–76.
[76] Gleick, "Water, War & Peace in the Middle East," 8.
[77] Sowers, Weinthal, and Zawahri, "Targeting Environmental Infrastructures, International Law, and Civilians in the New Middle Eastern Wars."
[78] Peter H. Gleick and Matthew Heberger, "Water Conflict: Events, Trends, and Analysis," in *The World's Water, Vol. 8: The Biennial Report on Freshwater Sources*, ed. Peter H. Gleick (Washington D.C.: Island, 2013), 160, http://worldwater.org/wp-content/uploads/2013/07/www8-water-conflict-events-trends-analysis.pdf.
[79] For more detail the water-related dynamics of interstate dispute and potential conflicts in the Middle East, see the following research on international relations in the context of the Jordan-Yarmuk, the Tigris-Euphrates, and the Nile basins: Christine Drake, "Water Resource Conflicts in the Middle East," *Journal of Geography* 96, no. 1 (1997): 4–12; Kevin Freeman, "Water Wars? Inequalities in the Tigris-Euphrates River Basin," *Geopolitics* 6, no. 2 (2001): 127–40; Aysegül Kibaroglu and I. H. Olcay Ünver, "An Institutional Framework for Facilitating Cooperation in the Euphrates-Tigris River Basin," *International Negotiation* 5 (2000): 311–30.
[80] Gleick, "Water, War & Peace in the Middle East," 9–11.
[81] Amery, "Water Wars in the Middle East"; Freeman, "Water Wars?"; Kibaroglu and Maden, "An Analysis of the Causes of Water Crisis in the Euphrates-Tigris River Basin"; Majeed A Rahman, "Water Security: Ethiopia–Egypt Transboundary Challenges over the Nile River Basin," *Journal of Asian and African Studies* 48, no. 1 (2013): 35–46.

provoke war.[82] According to these authors, empirical evidence demonstrates how competition over scarce water resources more often results in cooperation and peaceful resolution between two states than in armed confrontation. Indeed, many international water management institutions and agreements facilitate the shared use of water as a channel for cooperation and peaceful negotiations, thereby reducing conflict risk even in water scarce contexts.[83] Despite such international agreements and frameworks on joint water-management, Brochmann and Gleditsch emphasize that the sometimes complex relationship and conflict-inducing dynamics between upstream and downstream states of shared rivers cannot be completely disregarded.[84] As both Kehl as well as Kibaroglu and Maden argue, the transboundary water governance structures of the Euphrates, Tigris, and Nile River systems have been characterized by power asymmetries between countries with weak or strong geographic or military leverages, which has often exacerbated international political instabilities and dispute.[85] Forsythe discusses how water continued to be manipulated for strategic purposes and, despite diplomatic agreements, Turkey, Syria and Iraq have engaged in various forms of conflict over the politics of water.[86] Coupled with increasing water insecurity and the presence of insurgency groups who seek to take control of critical water resources, the implementation of effective and equitable water management is often disabled.[87]

The central message that can be deduced from the literature discussing the linkages between water resources and interstate conflict or cooperation has been the importance of international water regimes and equitable and effective transboundary water management to prevent that water issues escalate into conflict.[88] As emphasized by Zawahri, it has generally been the disregard of states for the integrated management of the region's transboundary rivers that has produced or exacerbated interstate dispute and conflict.[89] By threatening with or directly inflicting water shortages to riparian neighbours, shared water supply systems can be

[82] Mostafa Dolatyar and Tim S. Gray, "The Politics of Water Scarcity in the Middle East," *Environmental Politics* 9, no. 3 (2000): 65–88; Patrice C. McMahon, "Cooperation Rules: Insights on Water and Conflict from International Relations," in *Water Security in the Middle East: Essays in Scientific and Social Cooperation*, ed. Jean Axelrad Cahan (London: Anthem Press, 2017), 19; Aaron T. Wolf, "Conflict and Cooperation along International Waterways," *Water Policy* 1 (1998): 251–65.
[83] Marit Brochmann and Nils Petter Gleditsch, "Shared Rivers and Conflict - A Reconsideration," *Political Geography* 31 (2012): 519–27; McMahon, "COOPERATION RULES," 20.
[84] Brochmann and Gleditsch, "Shared Rivers and Conflict - A Reconsideration," 519–20, 525–26.
[85] Jenny R. Kehl, "Water Security in Transboundary Systems: Cooperation in Intractable Conflicts and the Nile System," in *Water Security in the Middle East: Essays in Scientific and Social Cooperation*, ed. Jean Axelrad Cahan (Longon: Anthem Press, 2017), 39–42; Kibaroglu and Maden, "An Analysis of the Causes of Water Crisis in the Euphrates-Tigris River Basin," 351–52.
[86] David P. Forsythe, "The Water and Politics in the Tigris-Euphrates Basin: Hope for Negative Learning?," in *Water Security in the Middle East: Essays in Scientific and Social Cooperation*, ed. Jean Axelrad Cahan (London: Anthem Press, 2017), 167, 172–77.
[87] Kibaroglu and Maden, "An Analysis of the Causes of Water Crisis in the Euphrates-Tigris River Basin," 351–52.
[88] Gleick, "Water, War & Peace in the Middle East," 35–40; Kibaroglu and Ünver, "An Institutional Framework for Facilitating Cooperation in the Euphrates-Tigris River Basin."
[89] Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa," 170–71.

used by both upstream and downstream states as a leverage or instrument of manipulation in international politics.[90] The observations by Zawahri provide significant insights in relation to how certain water resources may become either a *cause*, but also a *tool* and a military *target* of conflict. Even though her focus is mainly on the agency of riparian actors in the context of state-to-state dispute and violence, these findings are important to keep in mind when analysing how non-state actors exploit and manipulate water resources in episodes of conflict. In addition, the value of equal and sustainable transboundary water allocation and management is important to note. Vulnerabilities in ineffective water management between upstream and downstream states could pose critical opportunities for non-state actors. As Kibaroglu and Maden emphasize, IS has exploited the conjunction of the dire water situation and weak water management in Iraq and Syria by impeding rural populations from access to essential water resources. By aggravating and purposely inducing water scarcity, violent groups like IS can generate or increase unrest and potentially trigger or aggravate conflict.[91] However, the authors do not further discuss this mechanism. The threats non-state actors like IS can produce to a country's water security adds another complex dimension to the Middle East's already complicated security climate.

2.2.2 The Relationship between Water and Intra-State Violence and Conflict

Other authors argue that conflicts over water resources more often transpire as intrastate conflict, arising at subnational levels as disputes, tensions, and competition between two or more groups that involve sub-state or non-state actors.[92] The argument of these authors is that all-out interstate wars are hardly ever the outcome of a single source of tension. Moreover, state-to-state violence is more likely to be constrained by international political and diplomatic norms and instruments as well as by state's interest in or advantage of economic and political relations. Such mechanisms do not necessarily apply to sub-national violence.[93] The extent to which states fail to provide its population with basic needs, such as water and food supplies, affects human security and internal political stability. Increasing water scarcity can produce political instability.[94] Böhmelt et al. define "domestic-level water conflict" as one-sided activities by individuals, companies, NGOs, or state actors, or interactions between these actors

[90] Zawahri, 176.
[91] Kibaroglu and Maden, "An Analysis of the Causes of Water Crisis in the Euphrates-Tigris River Basin," 352–53.
[92] Gleick, "Water, Conflict, and Peace"; Gleick and Heberger, "Water Conflict: Events, Trends, and Analysis," 162; Lonergan, "Water Resources and Conflict," 375; Theisen, Gleditsch, and Buhaug, "Is Climate Change a Driver of Armed Conflict?," 616.
[93] Gleick, "Water, Conflict, and Peace," 35; Gleick and Heberger, "Water Conflict: Events, Trends, and Analysis," 161; Koubi et al., "Do Natural Resources Matter or Interstate and Intrastate Armed Conflict?," 229.
[94] Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa," 171–75.

over water-related issues, which potentially exacerbate the domestic water quantity and/or quality situation.[95] In their study, Böhmelt et al. discuss the various mechanisms through which internal water conflict may be induced and distinguish between demand-side drivers of water resources, supply-side drivers of water resources, and the presence of mechanisms and factors conducive to restrain conflict between the parties involved.[96] Even though the authors warn that their proxy variables might be rather abstract and that additional analysis of local dynamics is required to better understand these causal relationships, their study provides useful theoretical insights.[97] Their research indicates that scarcities of water resources underlying water-conflict links can be the result of various direct and intermediate factors. Often, research discussing the relationship between water resources and intra-state conflict is based on qualitative methods that focus on specific cases of political violence or conflict at the subnational or local level in which the availability or quality of water resources constituted a causative factor. Case study research has examined the recent civil conflicts in Iraq, Israel, Libya, Syria, and Yemen in relation to the dynamics of water, climate, demographics, and other relevant factors.[98] However, the water resources-conflict nexus in such case-oriented analysis is commonly situated in and the result of specific historical, social, economic, and political conditions that contribute to or mediate this relationship, which vary significantly across contexts. Hence, the results of qualitative case study analysis are often not generalizable to other conflicts and cannot be effectively employed to deduct hypotheses concerning the relationships between water resources and conflict in other water scarce contexts.[99]

Even so, while "water wars" may be an overstatement or simplification of reality, the connection between water resources and political (in)stability is certainly not.[100] Water availability and quality are unmistakably playing an increasing role in the conflict dynamics of the Middle East.[101] As noted by Zeitoen and Mirumachi, the relationships between water and

[95] Böhmelt et al., "Demand, Supply, and Restraint: Determinants of Domestic Water Conflict and Cooperation," 338.
[96] Böhmelt et al. define demand-side drivers of water resources as water growing needs due to factors like population growth or economic development. Supply-side drivers of water resources are shaped by natural scarcity or climate variability. Mechanisms and factors conducive to restrain conflict between the parties involve institutional factors, e.g. democracy or political stability. Their empirical analysis demonstrates that demand-side induced water scarcity and institutional restraint are more likely to influence conflict over water resources than supply-side dynamics. Böhmelt et al., "Demand, Supply, and Restraint: Determinants of Domestic Water Conflict and Cooperation."
[97] Böhmelt et al., 346.
[98] Gleick, "Water, Conflict, and Peace"; Kelley et al., "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought"; Marcus DuBois King, "The Weaponization of Water in Syria and Iraq," *The Washington Quarterly* 38, no. 4 (2015): 153–69; Jan Selby et al., "Climate Change and the Syrian Civil War Revisited," *Political Geography* 60 (2017): 232–44; Sowers, Weinthal, and Zawahri, "Targeting Environmental Infrastructures, International Law, and Civilians in the New Middle Eastern Wars"; Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa," 175.
[99] Koubi et al., "Do Natural Resources Matter or Interstate and Intrastate Armed Conflict?," 228.
[100] Gleick and Heberger, "Water Conflict: Events, Trends, and Analysis," 34–35; Wolf, "Conflict and Cooperation along International Waterways," 261.
[101] Gleick, "Water, War & Peace in the Middle East," 7–9.

conflict are often too complex to disentangle and neatly categorize in the two fixed categories of 'conflict' and 'cooperation'.[102] Describing water as a source of *either* conflict *or* cooperation conceals the multiple and complex dynamics of water in the dynamics of conflict and fails to fully comprehend the instrumentalization of water *during* conflict.[103] Moreover, state-to-state warfare or civil conflict are not the only type of violence or conflict that may be induced by the availability or quality of natural resources. Other forms of violence include protests, uprisings, terrorism, or intra-group violence not involving state-actors.[104] Similar to the strategies and objectives of state actors, non-state actors also resort to water-related resources as tools and targets of warfare. Authors like Zawahri have hinted to the mechanisms through which vulnerabilities in or ineffective water management between upstream and downstream states provides critical openings for insurgency groups. However, the specific case study literature on the water issues underlying the recent conflicts of the Middle East has not discussed how violent non-state actors are able to exploit unrest, violence, or conflict induced or aggravated by water-related issues. The next section will discuss the academic literature that specifically focusses on the instrumentalization of water-related resources and the role of non-state actors in the water-conflict nexus.

2.3 Water as a Military Instrument and Strategy of Warfare

In addition to being potential variables or causes of international and internal armed conflict or civil strife, water-related resources have also long been instruments *during* warfare. In both state-to-state as well as civil conflicts, critical water resources or supply systems have been destroyed or cut off by actors to the conflict for military and political objectives.[105] As some case study research already indicated, water-related resources can become a political tool, a strategic source of power, or a means of violence during war-making.[106] The various specific ways in which water resources and related infrastructure have been used as a military tactic or instrument of warfare is a relatively recent topic in academic literature. In the earlier research the destruction and degradation of water resources was primarily discussed as a side-effect or

[102] Mark Zeitoun and Naho Mirumachi, "Transboundary Water Interaction I: Reconsidering Conflict and Cooperation," *International Environmental Agreements: Politics, Law and Economics* 8, no. 4 (2008): 305, 308.
[103] Marwa Daoudy, "Water Weaponization in the Syrian Conflict: Strategies of Domination and Cooperation," *International Affairs* 96, no. 5 (2020): 1348.
[104] Koubi et al., "Do Natural Resources Matter or Interstate and Intrastate Armed Conflict?," 238–39.
[105] Gleick, "Water and Conflict: Fresh Water Resources and International Security," 83; Sowers, Weinthal, and Zawahri, "Targeting Environmental Infrastructures, International Law, and Civilians in the New Middle Eastern Wars"; Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 7–13; Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa."
[106] Daoudy, "Water Weaponization in the Syrian Conflict," 1349; Sowers, Weinthal, and Zawahri, "Targeting Environmental Infrastructures, International Law, and Civilians in the New Middle Eastern Wars"; Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa."

outcome of war.[107] This sub-section focuses on the specific role and agency of actors in the water-conflict relationship. Specifically, the literature analysing how both state and violent non-state actors are able to intentionally employ and manipulate water resources in episodes of conflict will be reviewed.

2.3.1 The Weaponization of Water

Critical deficiencies in the availability and quality of fresh water resources can increase political instability which generates conflict. However, violent actors can also manipulate and intentionally trigger this causal mechanism or weaponize water during episodes of conflict. This is the central argument of the academic literature focusing on the ways in which the supply of water, in terms of both quantity and quality, can be turned it into a weapon. Authors like Zawahri and Sowers et al. discuss how water resources can be transformed into both defensive and offensive weapons of warfare through various tactics and mechanisms. In her analysis of water security in the Middle East, Zawahri describes how fresh water supplies and related infrastructure have been weaponized by states for both defensive and offensive war-making purposes. The dual weaponization of water to advance one's objectives and/or to obstruct those of opposing parties has also been adopted by non-state actors and violent armed groups.[108] She emphasizes how, given the MENA region's aridity, insurgency groups and warring factions seeking to expand their territorial control in recent conflict settings have recognized the importance of controlling water and hydrological infrastructure. For instance, in its attempt to form a state in Syria and Iraq, IS seized substantial amounts of two critical natural resources – water and oil – to generate significant wealth to finance its operations.[109] Sowers et al. argue that the targeting of environmental infrastructures, such as water and energy infrastructure, is an increasingly more common practice of war-making in the MENA region.[110] In their analysis, they focus on the intentional link between environmental infrastructure and conflict shaped by actors to a conflict, rather than as an unintended consequence of warfare.[111] Violent actors in the MENA region have employed the targeting of environmental infrastructures as both defensive and offensive methods of warfare. By capturing oil depots, gas lines and oil refineries, flooding towns or poisoning critical water resources, and destroying or sabotaging water supply

[107] Klem, "Dealing with Scarcity and Violent Conflict," 12; Westing, *Warfare in a Fragile World: Military Impact on the Human Environment*.
[108] Neda Zawahri, "Capturing the Nature of Cooperation, Unstable Cooperation, and Conflict over International Rivers," *International Journal of Global Environmental Issues* 8 (2008): 286–310.
[109] Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa," 177.
[110] Sowers, Weinthal, and Zawahri, "Targeting Environmental Infrastructures, International Law, and Civilians in the New Middle Eastern Wars," 410.
[111] Sowers, Weinthal, and Zawahri, 411.

systems, non-state actors seek to displace local and urban populations, to terrorize and reprimand citizens sympathetic to their "enemy" by hurting livelihoods and security, to expand territorial control, or to gain access to valuable assets for income and profit.[112]

King has defined the "weaponization of water" as the means – either an item, action, offensive capability, or mechanism exploited or intended to kill, injure, or coerce – to gain advantage or to defend oneself in the context of conflict or competition.[113] In his research, King differentiates between five purposes the weaponization of water resources as an instrument of warfare might serve, namely: strategic weaponization, tactical weaponization, psychological terrorism, extortion or incentivization, and unintentional weaponization. Strategic weaponization is defined as the use of water to effectively or actually control large or vital geographical areas or infrastructures to create the perception of sovereignty or the use and exploitation of water resources and infrastructures to fund activities and operations. Tactical weaponization refers to the manipulation of water as a weapon in warfare, for example through the poisoning of water, in direct support of other military campaigns or strictly to hurt assets of military value. Psychological terrorism involves the use of water resources, for example through depriving access or contaminating key water resources, to induce fear. The water flowing from water supply systems and networks can be systematically reduced or diverted, thereby excluding/secluding communities from sufficient water supply. Extortion or incentivization refers to the use of water resources to establish legitimacy and credibility under occupied civilians and to establish governing authority. Lastly, unintentional weaponization is defined as the unintended yet severe collateral destruction of the environment and its ecosystems as well as damages to populations as a result of the targeting or weaponization of water resources.[114] Although these categories provide useful conceptions and hypotheses for analysis the use of water resources as an instrument of warfare, identifying the specific intent actors have for weaponizing water can also be a challenging endeavour. More recently, King and Burnell introduced the concept of coercive weaponization to comprise both psychological terrorism and extortion or incentivization.[115] In addition, they emphasize how existing water stress, further aggravated by climate change, across the MENA region provides strategic opportunities for violent non-state actors to wield water as a weapon. Increased water stress heightens the risk to

[112] Gleick and Heberger, "Water Conflict: Events, Trends, and Analysis," 163–67; Sowers, Weinthal, and Zawahri, "Targeting Environmental Infrastructures, International Law, and Civilians in the New Middle Eastern Wars," 411.
[113] King, "The Weaponization of Water in Syria and Iraq," 155.
[114] King, 155–58.
[115] Marcus D King and Julia Burnell, "The Weaponization of Water in a Changing Climate," in *Epicenters of Climate and Security: The New Geostrategic Landscape of the Anthropocene*, ed. Caitlin E. Werrell and Francesca Femia (Washington D.C.: The Center for Climate and Security, 2017), 69–70.

international ripple effects by the weaponization of water, producing wider geopolitical, economic and security impacts and potentially leading to conflict that exceeds national borders.[116]

2.3.2 A Weapon, a Target, a Casualty: The Water-Related Tactics of Non-State Actors

Gleick has become a key author in the academic debate on the instrumentalization of water in conflict settings. In his recent article, he argues that water-related violence generally assumes three forms: water resources and water systems as a trigger of violence, as weapons of conflict, and as targets or casualties of conflicts.[117] Water as a trigger concerns the ways in which water can develop as the cause of conflict and is most directly linked to the availability – particularly a scarcity thereof – and competition over fresh water resources. Water as a weapon comprises how water and water resources can be employed as weapons of warfare.[118] Water as a target or casualty of conflict include cases in which water resources and water infrastructure have been directly targeted and/or destroyed during episodes of conflict. Whereas the use of water as a weapon of conflict and war is definitely intentional, water resources and infrastructure as a target of war may be both intentional and unintentional. Water resources or infrastructure might be mistaken for military targets and destroyed or damaged unintentionally during military operations, in which case water is considered a casualty of conflict. The intention of actors cannot always be easily determined.[119] Still, Von Lossow argues that generally three motives can be distinguished for the employment of what he terms 'the water weapon'. He differentiates between strategic political motives, tactical military motives, and "overarching" psychological motives.[120] Strategic political motives refer to political objectives, including crushing or driving out resistance, weakening the legitimacy of the opponent, forcefully gaining support, and establishing one's own authority. Tactical military motives include purposes in the battlefield, including using water as an offensive and defensive weapon against the opponent or to expand territorial control. The psychological effect of the water weapon refers to the enormous (destructive) power that the control of critical water resources exerts, merely through the existential threat of its potential use.[121]

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[116] King and Burnell, 67.
[117] Gleick, "Water, Conflict, and Peace," 38–40; Peter H. Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," *WIREs Water* 6 (2019): 5.
[118] Gleick, "Water, Conflict, and Peace," 38–39; Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 5.
[119] Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 6.
[120] Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 85.
[121] Lossow, 85.

Based on the concepts proposed by Gleick and King, Daoudy proposes a new typology for water weaponization in her recent case study analysis of the 2011 Syrian civil war. Daoudy analyses how different actors in Syria's internationalized civil conflict, including IS, the Kurdish Democratic Party (PYD), and the al-Assad regime, adopted strategies of war targeting or using water resources. Based on this analysis, she constructs four categories of water-related strategies, namely: water resources and infrastructures as 1) means of domination and legitimacy; 2) military tools; 3) military targets; and 4) weapons during cooperation.[122] Her study is innovative and significant in three ways: her analysis accounts for the ways in which state policies on water governance during peacetimes can constitute a form of water weaponization and influence how water is exploited during future conflicts, she refines existing discourses on the dual offensive-defensive unconventional capacities of water weaponization, and her analysis considers the "weapon-like effects" of shared water agreements.[123] The findings from this analysis provide several important insights, namely how – external to traditional conflict – water can be weaponized in state-society relations, how historical processes – including state policies of water management and violent state-society water relations – drive and shape the instrumentalization of water, and the need to fully consider how opposing actors in conflict strategically instrumentalize water cooperation.[124]

Different than previous authors analyzing the connection between water resources and conflict, King, Gleick, Von Lossow, and Daoudy demonstrate definite casual pathways underlying the water-conflict nexus. The purposeful exploitation of water as a strategy or instrument of war employed by sub-state or non-state actors is an indisputable dynamic and less contingent on contextual factors and dynamics. By focusing on the role of *agency* in the link between water and conflict, their research identifies and explains the different mechanisms through which water resources can actively become instruments and integrated into strategies of warfare. Especially the theory by Gleick is relevant for the current research project as his conceptions of water as a *target* and water as a *weapon* describe and clarify the instrumentalization of water *during* episodes of conflict. Moreover, his theory – in contrast to King and Von Lossow – establishes water as a target or as a weapon as two clearly distinct categories, differentiated by the argument that the water weapon is explicitly intended to

[122] Daoudy, "Water Weaponization in the Syrian Conflict," 1351–62.
[123] Daoudy, 1349.
[124] Daoudy, 1363–64.

directly attack the opponent or to defend one's own positions.[125] This categorization is useful as water can also be targeted for other purposes than for attack or defend strategies.

The analysis of the instrumentalization of water during the civil wars in Iraq, Syria, and Yemen adopts Gleick's conceptions of water as a target and weapon of conflict, including the distinction between intentional and unintentional targeting – in the latter case water is deemed a casualty of conflict.[126] 'Water as a trigger of conflict' is considered as a distinct category, as it hypothesizes how water *induces conflict* rather then how water is instrumentalized when *conflict has already erupted*. This conception does not hold analytical relevance for the research objective of the current study. The analysis also applies the specific strategies and motives of weaponizing water proposed by King and Von Lossow – including strategic political, tactical military, and coercive weaponization – as these allow a more detailed and in-depth evaluation of the water weapon. The relevance of considering state-society relations, historical processes, and the dual capacities of water weaponization emphasized by Daoudy will serve to inform a critical and comprehensive assessment of how opposing actors during conflict strategically instrumentalize water. This study will also keep in mind the findings and insights generated by the review of relevant academic literature on the interactions between water and inter- and intra-state conflicts, including the processes of 'resource capture' and 'ecological marginalization', the importance of demand- and supply-side drivers of water resources and the presence of conflict restraining factors and dynamics, the importance of transboundary water management, and the exploitation and manipulation of water resources by (non-)state actors as described by Zawahri and Sowers et al. as these dynamics and strategies can also be actively triggered, employed or manipulated by violent non-state actors. Moreover, this research project seeks to establish water-related resources as factors of conflict without distracting attention from critical and more fundamental economic and political drivers of violent uprisings or conflicts.

3. Research Design and Methodology

The following chapter discusses the research design of this thesis. The first section outlines the research approach by justifying the adoption of a comparative case study model of two non-state actors instrumentalizing water during episodes of conflict. The second section elaborates on the process of the case selection and justify the focus on the water-related tactics and

[125] Gleick, "Water, Conflict, and Peace," 38–39; Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 5.
[126] Gleick, "Water, Conflict, and Peace," 38–40; Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 5.

strategies by IS in Iraq and Syria between 2013-2020 and the Houthis in Yemen between 2014-2020. Next follows a discussion of what sources and types of evidence will be used to conduct the analysis of the two cases and how the data is processed and evaluated. Finally, the operationalization of the research model explains how this data is used to arrive at an evidence-based, legitimate, and critical answer to the research question, including a discussion of the limitations of the findings.

3.1 Case Study Design

This thesis examines the specific mechanisms through which non-state actors involved in the civil wars in Iraq, Syria, and Yemen have purposely targeted, employed, or manipulated water resources and infrastructures as instruments and tools during conflict. To study this phenomenon, this research applies the categories proposed by the conceptual model from Gleick and consider how specific non-state actors have instrumentalized water as a target or weapon of conflict. The analysis of these non-state actors does not adopt Gleick's third category that hypothesizes water as a *trigger* of conflict, because conflict has already erupted in the demarcated case studies of Iraq, Syria, and Yemen. The assessment of the water-related military tactics and strategies of non-state actors also keeps in mind the theoretical insights generated Daoudy, King, and Von Lossow who specifically hypothesize the varieties and motives of the implementation of the water weapon. This theoretical approach aims to increase understanding of the instrumentalization of water in settings of conflict. The research focuses on the agency of non-state actors in this social phenomenon, as non-state actors represent increasingly important players in the arena of international armed conflict. However, international humanitarian law remains ill-equipped to condemn the acts of war-making of these relatively new actors in international law.[127]

To critically analyse how non-state actors can transform or instrumentalize water resources or infrastructures as targets, casualties, or weapons of conflict, this thesis adopts a comparative case study approach. A case study model, in general, is useful for examining and providing meaningful insights in complex social phenomena.[128] As stated by Robson, case study research allows for an empirical examination of a contemporary phenomenon within its

[127] Bassiouni, "The New Wars and the Crisis of Compliance with the Law of Armed Conflict by Non-State Actors"; d'Aspremont, *Participants in the International Legal System: Multiple Perspectives on Non-State Actors in International Law*, 1–7.
[128] Robert Kuo-Zuir Yin, *Case Study Research: Design and Methods* (Los Angeles: SAGE, 2009), 7; and, Harder, "Explanatory Case Study," 370.

complex real-life context by exploiting multiple sources of evidence.[129] Hence, adopting a case study model of two non-state actors identified to have either targeted, employed, or manipulated water resources or infrastructures in their specific conflict setting will provide in-depth and critical insights concerning the instrumentalization of water. The case study design is the most appropriate research method for the descriptive objective of this research, namely to describe and define the instrumentalization of water resources during episodes of conflict.[130] Using descriptive accounts, the case study analysis aims to enhance understanding of the employment of water resources as a target or weapon of conflict, including the conditions, factors, and dynamics that influence this phenomenon.[131] Other research methods, such as a survey design or a quantitative approach, involve a more confined evidence base and would not offer the same depth and detail of understanding of the mechanisms of this complex social phenomenon.

A comparative case study design is particularly useful for revealing multiple dynamics of social phenomena. As the previous chapter indicates, there exists more than one mechanism through which violent non-state actors can transform and employ water-related resources as instruments and tools of warfare. Moreover, the linkages between water and conflict, even from the perspective of specific non-state actors, are the outcome of various contextual variables that drive or shape the strategic targeting or instrumentalization of water. Hence, to maximise the amount of insight and evidence concerning the water-related tactics and strategies of non-state actors, this research adopts a comparative case study approach. A context analysis of the environment in which the two non-state actors operate will be conducted to identify and rule out context-specific dynamics. Based on an in-depth descriptive analysis of the instrumentalization of water as a target or weapon of conflict by IS and the Houthis, a critical evaluation of similarities and differences between the water-related tactics and strategies of these non-state actors allows for the identification of parallel as well as distinctive patterns of behaviour.[132] This approach will contribute to identifying and specifying the characteristics and conditions of the instrumentalization of water as part of military tactics and strategies, which is often still characterised in largely general terms.[133] Through a descriptive comparative case

[129] Colin Robson, *Real World Research: A Resource for Social Scientists and Practitioner-Researchers* (Hoboken: Blackwell Publishing, 1993), 146.
[130] Ruthanne Tobin, "Descriptive Case Study," in *Encyclopedia of Case Study Research*, ed. Albert J. Mills, Gabrielle Durepos, and Elden Wiebe (Los Angeles: SAGE, 2010), 288.
[131] Juliet Kaarbo and Ryan K. Beasley, "A Practical Guide to the Comparative Case Study Method in Political Psychology," *Political Psychology* 20, no. 2 (1999): 373–74.
[132] Tobin, "Descriptive Case Study," 288–89.
[133] Inge Bleijenbergh, "Case Selection," in *Encyclopedia of Case Study Research*, ed. Albert J. Mills, Gabrielle Durepos, and Elden Wiebe (Los Angeles: SAGE, 2010), 61.

study model, this paper aims to assess and add detail to the existing conceptions and hypothesis by Gleick.

3.2 Case Selection

This research project selects two extreme cases in which the instrumentalization of water during episodes of violent conflict is evidently visible. The selection of cases is thus based on the presence of the actual phenomenon this research seeks to investigate – water as a target or weapon of conflict. Even though this implies that cases are selected in relation to the presence of the dependent variable, this case selection method allows a detailed and critical assessment of Gleick's theory on actual cases.[134] Moreover, to provide a critical and comprehensive answer to the research question and attain the descriptive objective of this research project, this study adopts the method of agreement in selecting the two case studies used for the comparative analysis. The method of agreement initiated by John Stuart Mill implies that two instances are selected in which the same social phenomenon occurs, yet under different contextual circumstances.[135] To clarify the instrumentalization of water by non-state actors during episodes of conflict, the case selection aimed to minimize the variability in external dynamics that may not be relevant for this relationship.[136] By comparing two similar cases, contextual variables that shape or, alternatively, are not necessary for the phenomenon to occur can be identified or eliminated.[137] Therefore, this thesis analyses two non-state actors operating in different conflict settings in the Middle East and known to have – either intentionally or unintentionally – employed water resources as instruments or integrated them into strategies of warfare during episodes of conflict. These two non-state actors do not necessarily have to be comparable in their ideology, organisation type, size, or goals and ambitions. This case selection allows the critical and elaborate description and analysis how water is used or manipulated as a target or weapon during episodes of conflict.[138]

Specifically, this research will analyse the water-related tactics and strategies by the Islamic State (IS) in Iraq and Syria between 2013-2020 and the Houthis in Yemen between 2014-2020. In addition to the presence of the dependent variable and prospects of comparability, these two cases are useful for assessing Gleick's theory due to various reasons.

[134] Iiris Aaltio and Pia Heilmann, "Case Study as a Methodological Approach," in *Encyclopedia of Case Study Research*, ed. Albert J. Mills, Gabrielle Durepos, and Elden Wiebe (Los Angeles: SAGE, 2010), 69; Bleijenbergh, "Case Selection," 61.
[135] Bleijenbergh, "Case Selection," 62.
[136] Kaarbo and Beasley, "A Practical Guide to the Comparative Case Study Method in Political Psychology," 379.
[137] Bleijenbergh, "Case Selection," 62.
[138] Bleijenbergh, 61.

First, the terrorist organization IS has been active – under various names and constellations – for almost a decade and has battered the Middle East through a wide variety of military strategies and tactics.[139] The Houthi movement's first violent confrontations with Yemen's state forces also date back to 2014. These extended time frames increase the scope of analysis in relation to the dependent variable. Second, the activities and operations of IS in Iraq and Syria as well as the Houthis in Yemen have been extensively reported and researched, both by international organizations, media outlets, research institutes, and academics. By selecting IS and the Houthis as case studies, the analysis is able to exploit the rich and extended academic literature and research evidence base on these non-state actors in their particular context, which contributes to the depth of data used for the analysis.[140] Third, both Iraq, Syria, and Yemen represent contexts where the water situation produces a suitable environment for the implementation and operation of water resources as an instrument of warfare.[141] Yet, the hydrological context in the case studies remains sufficiently different to be able to distinguish context-specific dynamics. Moreover, water management and security are generally the responsibility of the state within a state's delineated territory. Hence, delimiting the analysis to the contexts of Iraq, Syria, and Yemen allows for detailed and context-specific analysis of hydrological factors and dynamics in the water-conflict relationship. Finally, the time frames of 2013-2020 and 2014-2020 represent the periods during which the groups were (most) active in these countries. Specifically, in the case of IS: from April 2013 when the group was officially formed from Islamic State in Iraq (ISI) and Jabhat al-Nusra operating in Syria and renamed into Islamic State in Iraq and al-Sham (ISIS) until September 2020 by which IS had lost most of its territory – including its desert pockets and insurgent cells.[142] And in the case of the Houthis: from September 2014 when the group engaged in its first violent confrontations with the state's military forces until present day.

[139] Patrick Cockburn, "On the Rise and Fall of ISIS," Literary Hub, April 24, 2020, https://lithub.com/on-the-rise-and-fall-of-isis/.
[140] Michelle K. McGinn, "Depth of Data," in *Encyclopedia of Case Study Research*, ed. Albert J. Mills, Gabrielle Durepos, and Elden Wiebe (Los Angeles: SAGE, 2010), 286.
[141] Cockburn, "On the Rise and Fall of ISIS"; Kelley et al., "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought"; King, "The Weaponization of Water in Syria and Iraq"; Dorith Kool, Laura Birkman, and Bianca Torossian, "Interprovincial Water Challenges in Iraq" (The Hague: Water, Peace and Security, 2020).
[142] ISI changed its name to *ad-Dawlah al-Islāmiyah fī 'l-ʿIrāq wa-sh-Shām* (Islamic State of Iraq and al-Sham, ISIS), also translated as Islamic State of Iraq and the Levant or Islamic State of Iraq and Syria, because of its decision to participate in the Syrian civil war against the regime of Bashar al-Assad. Cockburn, "On the Rise and Fall of ISIS"; Ahmed S Hashim, "The Islamic State's Way of War in Iraq and Syria: From Its Origins to the Post Caliphate Era," *Perspectives on Terrorism* 13, no. 1 (2019): 28; Abdul Basir Yosufi, "The Rise and Consolidation of Islamic State: External Intervention and Sectarian Conflict," *Connections* 15, no. 4 (2016): 91–110.

3.3 Data and Sources

The case studies of IS in Iraq and Syria between 2013-2020 and the Houthis in Yemen between 2014-2020 are based on various sources and types of evidence. The analysis employs the extensive peer-reviewed academic literature on the tactics and strategies of IS in Iraq and Syria and the Houthis in Yemen as well as analytic and strategic reports by international research institutes. Analysing this case also requires sources of evidence that provide on the ground observation and reporting. Hence, data is derived from national security documents, situational reports from international governmental and nongovernmental institutions (NGOs) as well as media sources from both within and outside the region. The qualitative case study analysis is substantiated by quantitative evidence from conflict and terrorism databases, including the Armed Conflict Location and Event Data (ACLED) Project, the START Global Terrorism Database, and the Water Conflict Chronology database of the Pacific Institute.[143] Especially, information from national security documents is hard to obtain. Another challenge pertains to the validity and reliability of sources of evidence that report on the ground observations, like news reports from media outlets. Here, the issue of bias – both reporting and selection bias – arises.[144] Reporting bias refers to the bias of the author, for instance the media outlet, who applies a certain perspective and perception of the case at hand. Selection bias reflects the process in which certain media outlets are selected as sources of evidence for this analysis and others are not. However, the integration of multiple and different data sources allows for a thorough and thick description of these cases as well as an assessment of the validity of the used data sources, which increase the reliability of the analysis and its findings.[145]

3.4 Operationalization

The analysis of IS in Iraq and Syria and the Houthis in Yemen represents a holistic case study design.[146] IS and the Houthis embody the unit of analysis in the assessment of the instrumentalization of water resources and infrastructures. Moreover, the approach is inductive, starting from the conceptual model composed by Gleick to the specific practical targeting,

[143] Pacific Institute, "Water Conflict Chronology," Water Conflict Chronology, 2020, http://www.worldwater.org/conflict/map/; The National Consortium for the Study of Terrorism and Responses to Terrorism (START), "Global Terrorism Database," Global Terrorism Database, 2020, https://project-iris.app-staging.cloud/.
[144] Albert J. Mills, Gabrielle Durepos, and Elden Wiebe, *Encyclopedia of Case Study Research* (Los Angeles: SAGE, 2010), 159; Christopher J. Pannucci and Edwin G. Wilkins, "Identifying and Avoiding Bias in Research," *Plastic and Reconstructive Surgery* 126, no. 2 (August 2010): 619–25.
[145] McGinn, "Depth of Data," 286–87.
[146] Mills, Durepos, and Wiebe, *Encyclopedia of Case Study Research*, 441–42.

employment, and manipulation of water by the two non-state actors.[147] The selection of these cases is crucial for the outcomes of this research project. The analysis of IS in Iraq and Syria between 2013-2020 and the Houthis in Yemen between 2014-2020 are, above all, based on the consideration to provide useful and evidence-based results that will support an answer to the research question. IS and (to a lesser extent) the Houthis represent two high profile cases that received substantial attention and assessment in the political, security, and academic domains. The attributes of these case studies are not necessarily representative for all violent non-state actors or all conflicts. Still, these non-state actors have implemented a very diverse array of water-related tactics and strategies that can be also be adopted in other contexts. Moreover, these cases are very well suited to provide comprehensive insights into the conditions, factors, and dynamics that characterize and influence the targeting and weaponization of water. Providing a critical, thorough, and evidence-based answer to the research question is important to fulfil the principal objective of this research project, which is to provide practical and policy-oriented understanding of the instrumentalization of critical water resources and infrastructures.

Even though these cases do not represent typical cases, the outcomes of the analysis are to some extent applicable and generalizable to other contexts and violent non-state actors. The findings illustrate how water resources can be exploited as targets and instruments of warfare in susceptible contexts. This is not a tactic that is confined to the strategies and arsenal of IS in Iraq and Syria in the period 2013-2020 and the Houthis in Yemen between 2014-2020. The instrumentalization of water can be adopted by other non-state actors in other contexts of conflict as well. Even beyond conflict settings, non-state actors can potentially deploy the instrumental power of the water weapon. Though the specifics, outcomes, and impacts of the water-related military tactics and strategies might differ across contexts, the instrumentalization of water can assume the same form as in the case studies of this research project – as either targets, casualties, or weapons of conflict. Above all, the analysis of two violent non-state actor in their specific context allows for a critical assessment of Gleick's theoretical explanation as well as the conditions under which – and to what degree – it holds valid. Moreover, the analysis will enhance understanding of how non-state actors can employ water-related resources as an instrument of conflict and, thereby, explicate some direct causal dynamics underlying the water-conflict nexus. The findings on the connections between water and conflict can be extended to other contexts of conflict including violent non-state actors.

[147] Aaltio and Heilmann, "Case Study as a Methodological Approach," 69.

4. Islamic State in Iraq and Syria 2013-2020

The manipulation and impact of water as an instrument or as part of strategies of conflict depends on the hydrological, socio-economic, and political context.[148] The greater impact the instrumentalization of water can yield on the environment, the more effective and powerful water-related tactics and strategies can be in specific contexts of conflict.[149] Therefore, the first section of this chapter performs a context analysis of the water situation in Iraq and Syria prior to the instrumentalization of water resources by IS and considers relevant contextual socio-economic and political variables. The second section analyses how IS actively employed water and related infrastructure as either a target or weapon of conflict.

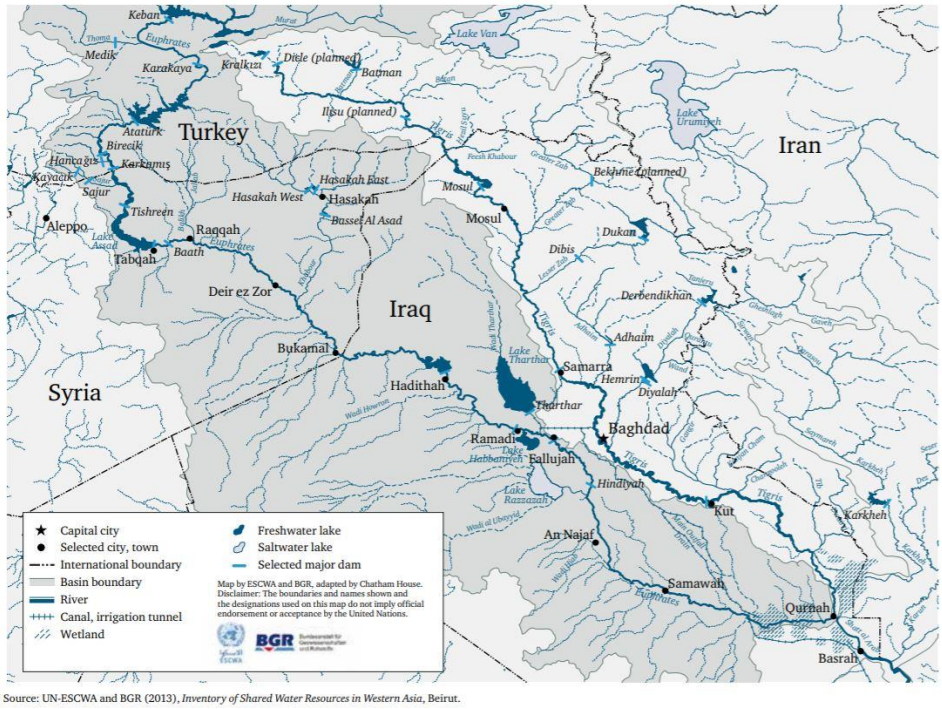
4.1 Introduction to the Context

The Euphrates and Tigris basins – Iraq and Syria are part of two shared surface water basins, the Euphrates and Tigris River basins.[150] The additional major riparian state of these two river basins is Turkey.[151] There does not exist a basin-wide agreement or a common approach or consensus on how to arrange the division of water quantities between Turkey, Syria, and Iraq of the Euphrates and Tigris Rivers. Each country embarks on individual and un-coordinated water sector programs, including large agricultural and hydro-engineering projects. This has resulted in decreasing mean annual flows and seriously deteriorating water quality of these rivers that are exacerbated along their course.[152] Since the 1970s, 32 dams and barrages have

[148] David K. Kreamer, "The Past, Present, and Future of Water Conflict and International Security," *Journal of Contemporary Water Research and Education* 149, no. 1 (2012): 89–91; Zawahri, "The Multidimensional Aspect of Water Security in the Middle East and North Africa," 176–77.
[149] Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 86.
[150] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 28, 36–37.
[151] Some inventories also include Iran as a riparian state of the Tigris River basin, because various tributaries flowing into the Tigris originate in Iran. However, the Tigris itself does not run through Iranian territory. United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, 37.
[152] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, 49.

been constructed on the Euphrates alone. The construction of the dams, reservoirs and water plants, together with the increase in water-intensive agriculture and industry, significantly altered the regime flow of the Euphrates River as to reduce downstream water flow by 40-45 percent.[153] Population growth, overuse, and mismanagement due to fast and uncoordinated development in riparian states have further stretched the water supplies of the Euphrates as well as the Tigris River.[154] Contamination from agricultural and domestic sources – such as the dumping of untreated sewage water – seriously affects water quality. The water flows of the Tigris River are likewise affected by large water development projects in Turkey and Iraq.[155] Water supplies from the Tigris are mainly used for agriculture by all riparian countries. Intensive irrigation projects and high evaporation rates threaten the water quality in the basin, with increasing salinity rates for downstream riparians.[156] Rising pollution from industrial uses are further exacerbating water quality issues.[157] The impacts of climate change on the world's environment are expected to contribute to the existing pressures on the Euphrates and Tigris Rivers. Temperatures in the river basins are projected to rise with 3-4 °C by the end of this century.[158] The resulting rise in evaporation rates could potentially cause a 30-40 % drop in rainfall and drop river flows in these basins.[159] In addition, the effects of climate change are projected to raise the frequency and intensity of severe weather events in the region, including droughts and heavy storms.[160] Under the current water management regime, especially droughts form a dangerous hazard that critically influences water availability and causes desertification.[161]

[153] Tobias von Lossow, "More than Infrastructures: Policy Brief Water Challenges in Iraq" (The Hague: Planetary Security Initiative, Clingedael, 2018), 3–4; M. Nouar Shamout and Glada Lahn, "The Euphrates in Crisis: Channels of Cooperation for a Threatened River" (London: Chatham House, the Royal Institute of International Affairs, 2015), 2, https://www.chathamhouse.org/sites/default/files/field/field_document/20150413Euphrates_0.pdf; United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 59–63.
[154] Shamout and Lahn, "The Euphrates in Crisis: Channels of Cooperation for a Threatened River," 2; United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 59–63.
[155] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 100–101, 113–17.
[156] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, 62–69.
[157] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, 100–101.
[158] Nasrat Adamo et al., "Climate Change: The Uncertain Future of Tigris River Tributaries' Basins," *Journal of Earth Sciences and Geotechnical Engineering* 8, no. 3 (2018): 86–89.
[159] Adamo et al., 90; Shamout and Lahn, "The Euphrates in Crisis: Channels of Cooperation for a Threatened River," 21.
[160] Lossow, "More than Infrastructures: Policy Brief Water Challenges in Iraq," 1; Shamout and Lahn, "The Euphrates in Crisis: Channels of Cooperation for a Threatened River," 22.
[161] Adamo et al., "Climate Change," 82–91; United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 48–49.



Source: UN-ESCWA and BGR (2013), *Inventory of Shared Water Resources in Western Asia*, Beirut.

Figure 1. Map of the major rivers, lakes and dams in Syria and Iraq[162]

Iraq – Water insecurity was already a critical issue in Iraq before the advance of IS. Iraq has a largely arid climate and receives minimum amounts of rainfall beyond its Kurdish mountains. It is almost entirely dependent on the Euphrates and Tigris rivers, the two major rivers flowing through the country, for its domestic water supply.[163] Today, Iraq receives an approximate share of 60 percent of the renewable water resources flowing from the Euphrates.[164] This share is expected to drop to 50 percent before 2030.[165] In Iraq, the Euphrates suffers from severe salinity that increases along the course of the river.[166] The country is economically highly reliant upon these water resources.[167] Iraq's oil industry, which is responsible for 95 percent of the country's revenues, requires roughly 1.8 billion cubic meters of water per year for extraction purposes.[168] Reducing water supplies also impacts Iraq's hydro-energy production, which accounts for over 75 percent of the country's electricity supplies. Moreover, both rivers are highly crucial for livestock and agricultural farming on which a large share of the Iraqi population depends. Over 95 percent of Iraq's domestic and industrial water resources derives from the Tigris and

[162] Shamout and Lahn, "The Euphrates in Crisis: Channels of Cooperation for a Threatened River," 6.
[163] Lossow, "More than Infrastructures: Policy Brief Water Challenges in Iraq," 2.
[164] Shamout and Lahn, "The Euphrates in Crisis: Channels of Cooperation for a Threatened River," 4.
[165] Lossow, "More than Infrastructures: Policy Brief Water Challenges in Iraq," 2.
[166] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 68.
[167] Adamo et al., "Climate Change," 76–77.
[168] Peter Schwartzstein, "Amid Terror Attacks, Iraq Faces Water Crisis," National Geographic, November 5, 2014, https://www.nationalgeographic.com/news/2014/11/141104-iraq-water-crisis-turkey-iran-isis/.

Euphrates rivers. Groundwater only provides for 2-9 percent of all supply.[169] In the Northern Iraq, agricultural production also enjoys rainfall. However, Iraq's highly fertile Marshes – one of the country's key agricultural centres – depend completely on the water of the Euphrates and Tigris for irrigation. Reduced waterflows of these rivers cause seawater intrusion and the massive dumping of drainage water has led to high salinity levels. The reduced water discharge and declining quality of the water are contributing to water and soil degradation, threatening agricultural production in Iraq's southern marshlands.[170] Iraq's water situation increases the strategic importance (or vulnerability) of the Euphrates and Tigris' waterflows for the country's water supply. These conditions make it easier for any actor controlling important dams on these rivers to dominate Iraq's water allocation.[171] The water situation in Iraq facilitated the instrumentalization of water resources for IS whose territorial conquest focused on capturing the country's key water infrastructures.[172]

Syria – Syria contains a humid Mediterranean coastal climate and an arid desert in the east. The country experiences high natural hydrological variability, with various episodes of prolonged drought in the past century.[173] Before the outbreak of political instability resulting from the 2011 Syrian revolution and the upsurge of IS in the country in 2012, Syria was also gripped by a five-year drought that had started in 2007 and generated a severe agricultural crisis.[174] Water is not naturally scarce in Syria. Besides the Euphrates and Tigris Rivers, the Jordan, Orontes, Nahr el Kabir, and Qweik Rivers flow through the country.[175] The prolonged drought was rather the result of rapid population growth and years of water overuse and mismanagement by the government, predominantly in agricultural production.[176] The Syrian agricultural industry, which accounts for 90 percent of water use in the country, depended for many years on highly subsidized water-intensive wheat and cotton farming as well as critically inefficient flood irrigation practices. The systemic pumping of groundwater at rates exceeding recharge caused that in 2012 up to 78 percent of Syria's groundwater withdrawals was

[169] Lossow, "More than Infrastructures: Policy Brief Water Challenges in Iraq," 2.
[170] Lossow, 6.
[171] Rebecca Collard, "Iraq's Battleground Dams Are the Key to Saving the Country from ISIS," *Time*, August 9, 2014, https://time.com/3303403/strikes-against-isis-in-iraq-dams/.
[172] Lossow, "More than Infrastructures: Policy Brief Water Challenges in Iraq," 4–5.
[173] Peter H. Gleick, "Water, Drought, Climate Change, and Conflict in Syria," *Water, Climate, and Society* 6 (2014): 332.
[174] De Châtel, "The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution," 524–25; Kelley et al., "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought"; Selby et al., "Climate Change and the Syrian Civil War Revisited," 261–64.
[175] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 37.
[176] Gleick, "Water, Drought, Climate Change, and Conflict in Syria," 332–33.

considered to be unsustainable.[177] The country's major renewable water resources – the Euphrates, Tigris, Orontes and Yarmuk or Jordan Rivers – are shared with other riparian states. Water supplies from these surface water resources are subject to overuse and contamination caused by the uncoordinated exploitation of these river's waterflows. These conditions cause that Syria enjoys relatively constrained overall freshwater availability in relation to its high domestic and industrial demands.[178] Thus, when a climatological drought struck the country in 2007, Syria's water supplies were highly vulnerable to this natural hazard.[179] Adding to the lack of rainfall, the inefficient exploitation of groundwater, and the many dams and irrigation projects of upstream riparians was the water mismanagement of the Syrian regime. While UN estimates stated that around two to three million Syrians were affected by the 2007-2012 drought, the Syrian regime of Bashar al-Assad downplayed the resulting water crisis and did not launch economic measures to mitigate its impacts.[180] The water crisis generated a mounting agricultural crisis in the country, especially in the mostly rain-fed agricultural regions in Syria's northeast where over a million people suffered critical livelihood and food insecurity.[181] The conditions of Syria's hydrological context in 2013, including the widespread water and agricultural crisis, facilitated IS' instrumentalization and weaponization of the country's water resources and infrastructures into various strategies of warfare.

4.2 Analysis

The analysis of conflict events involving IS in Iraq and Syria over the period 2013-2020 observes numerous instances during which water was transformed into or instrumentalized as a (deliberate or unintentional) target or weapon of conflict (see Figure 2). The following sections discuss the tactics, strategies and other mechanisms through which IS established water as a target or weapon of conflict.

[177] Gleick, 334; Katharina Nett and Lukas Rüttinger, "Insurgency, Terrorism and Organised Crime in a Warming Climate: Analysing the Links Between Climate Change and Non-State Armed Groups" (Berlin: Adelphi, 2016), 22.
[178] Gleick, "Water, Drought, Climate Change, and Conflict in Syria," 332.
[179] Arab Center for the Studies of Arid Zones and Dry Lands, United Nations Secretariat of the International Strategy for Disaster Risk Reduction, "Drought Vulnerability in the Arab Region: Case Study - Drought in Syria: Ten Years of Scarce Water (2000-2010)" (Damascus: Arab Center for the Studies of Arid Zones and Dry Lands, United Nations Secretariat of the International Strategy for Disaster Risk Reduction, 2011), 15–29, https://reliefweb.int/sites/reliefweb.int/files/resources/Full_Report_3074.pdf; Selby et al., "Climate Change and the Syrian Civil War Revisited," 234–39.
[180] Gleick, "Water, Drought, Climate Change, and Conflict in Syria," 334; Nett and Rüttinger, "Insurgency, Terrorism and Organised Crime in a Warming Climate: Analysing the Links Between Climate Change and Non-State Armed Groups," 22.
[181] Gleick, "Water, Drought, Climate Change, and Conflict in Syria," 334.

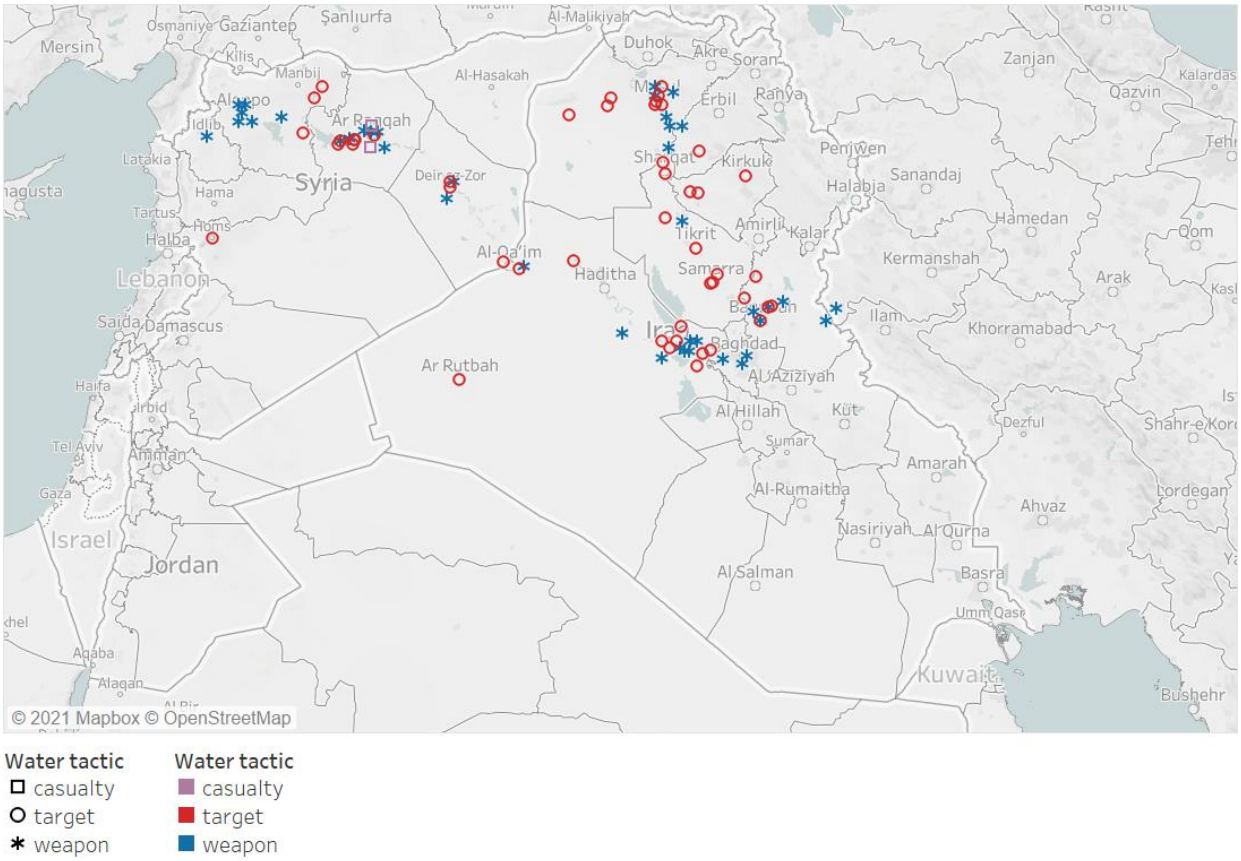


Figure 2. Map produced by the author showing water-related conflict events by IS in Iraq and Syria

4.2.1 Water as a Target of Conflict

During the period 2013-2020, water resources and water infrastructures were regularly a target of the armed fighting between IS and its opponents in both Iraq and Syria. Because of both countries' arid climates and great dependence on the Euphrates and Tigris Rivers for domestic water supplies, controlling these rivers' waterflows often meant gaining the capacity to dominate large swats of territory through manipulating downstream water availability. Realizing the instrumental power of controlling these rivers, IS targeted many important positions along the Euphrates and Tigris during its territorial expansion, including key towns and major water infrastructures. IS' *intentional* targeting of water resources and water infrastructures was motivated by three purposes. First, seizing control of key water resources and infrastructures held strategic relevance as it provided IS with the ability to exert influence over (downstream) enemy territory and advance its territorial expansion. Second, water was a vital and necessary resource to sustain IS's own troops and occupied populations. Third, IS purposely destroyed water-related infrastructure to deny its enemy from this humanitarian resource when its opponent threatened to recapture seized territory. In addition to the *intentional* targeting of water, water resources and related infrastructures also became *unintentional* targets

of conflict when these were destroyed as a consequence of the armed fighting between IS and its opponents, in which case water is considered a casualty of conflict. The remaining of this section will explicate the four motives of IS to target water during conflict in more detail.

First, IS targeted water resources and infrastructures to seize strategic positions and assets to dominate its opponent and further its own territorial expansion. By controlling key water infrastructures, IS was able to exert significant influence over the water flows of the Euphrates and – to a lesser extent – Tigris Rivers, thereby effectively dominating downstream populations. When captured water resources or infrastructures are used as instruments of domination, water is manipulated to become a weapon. These tactics will be discussed in the next section. Since 2013, when IS started securing control over large shares of Syrian territory, water infrastructure has often been a target of the group's conquest.[182] In February 2013, IS targeted and captured the Baath Dam and the Tabqah Dam – also known as the Euphrates or Al-Thawrah Dam – in Syria. The Tabqah Dam is responsible for 20 percent of Syria's electricity supply as well as water supplies to almost 5 million people.[183] By seizing these two major northern Syrian dams on the Euphrates River, IS was able to control the water flows of the river through Syria and into Iraq. This control gave IS the power to effectively dominate – and consequently seize – key cities positioned downstream, including Al-Bukamal, Deir-ez-Zor, Maskana, and Raqqa (see Figure 1).[184] IS emerged in Iraq in early 2014 where it prioritized the targeting of dams, pump stations, and other crucial water-related infrastructure to an even higher level.[185] During its territorial expansion in Iraqi territory, the group applied a more systemic and coordinated approach to capture key towns along the Euphrates Rivers, including Qaim, Rawah, and Fallujah. IS made its first advance on Haditha Dam, Iraq's second largest reservoir dam which regulates the flows of the Euphrates River for the whole country, in June 2014. The following months witnessed multiple, sometimes heavy assaults on the facility.[186] Though IS never succeeded in occupying Haditha Dam, the group actively and powerfully

[182] Ambika Vishwanath, "The Water Wars Waged by the Islamic State," Stratfor, November 25, 2015, https://worldview.stratfor.com/article/water-wars-waged-islamic-state.
[183] Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 7; Nett and Rüttinger, "Insurgency, Terrorism and Organised Crime in a Warming Climate: Analysing the Links Between Climate Change and Non-State Armed Groups," 24; United Nations Environment Programme, "Environmental Issues in Areas Retaken from ISIL: Mosul, Iraq" (Nairobi: United Nations Environment Programme, 2017), 21.
[184] Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 7.
[185] Amnesty International, "Dead Land: Islamic State's Deliberate Destruction of Iraq's Farmland" (London: Amnesty International, 2018), 8, https://reliefweb.int/sites/reliefweb.int/files/resources/MDE1495102018ENGLISH.PDF.
[186] Sinan Adnan, "Control of Terrain in Iraq: February 2, 2015," Institute for the Study of War, February 2, 2015, http://www.iswresearch.org/2015/02/control-of-terrain-in-iraq-february-2.html; Collard, "Iraq's Battleground Dams Are the Key to Saving the Country from ISIS"; Schwartzstein, "Amid Terror Attacks, Iraq Faces Water Crisis"; Wayne White, "Islamic State on the Move With Baghdad Still Gridlocked," Middle East Institute, August 8, 2014, https://mei.edu/publications/islamic-state-move-baghdad-still-gridlocked.

targeted and besieged the dam for over a year and half from 2015-2016, attacking the infrastructure repeatedly. As a consequence, the Iraqi government was only able to maintain its control over the dam through airlifts.[187] The seizure of Ramadi Dam in May 2015 provided IS with direct access to two major lakes in Iraq, Haditha Dam Lake and Lake Tharthar.[188] IS also targeted key positions and infrastructures along the Tigris River throughout 2014. In July 2014, IS seized Samarra Barrage, occupying it until the end of 2016.[189] Samarra Barrage controls the volume of water in Lake Tharthar, the largest lake in Iraq.[190] In the period January-April 2014, IS also conducted multiple assaults on Mosul Dam, Iraq's largest dam located on the Tigris River supplying most of Iraq's Kurdish regions with water and electricity.[191] Iraqi state forces managed to retain the facility for months until IS eventually confiscated the dam on August 7, 2014.[192] In November 2015, IS troops targeted Homs, which would give them strategic dominance over Qattinah Lake – or Lake Homs – and the water flows of the Orontes River. Though IS captures various towns in Homs province, the city of Homs was retained by Syrian government forces.[193]

Second, IS targeted water supplies because these were critical to sustain the group's own troops and operations as well as to supply occupied territories with water resources. For instance, IS continued the operation of major dams in Syria, like the Baath Dam and the Tabqah Dam, to provide its troops and local populations with water and electricity. Water infrastructure served as a valuable asset for income and profit for the organization. IS frequently financed its operations with enhanced electricity generation. For instance, IS combatants increased electricity production from the Baath and Tabqah dams to expand supply to surrounding areas, including the city of Raqqa where IS established its Syrian headquarters.[194] Moreover, IS' control over several dams in Syria – and later during the conflict also in Iraq – gave the group

[187] United Nations Environment Programme, "Environmental Issues in Areas Retaken from ISIL: Mosul, Iraq," 21.
[188] Adam Chandler, "ISIS Expands Its Reach in Iraq, Captures Fourth Town in Two Days," *The Atlantic*, June 21, 2014, sec. Global, https://www.theatlantic.com/international/archive/2014/06/isis-captures-control-of-key-town-on-syriairaq-border/373187/; Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 7; Vishwanath, "The Water Wars Waged by the Islamic State."
[189] Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," v; John Vidal, "Water Supply Key to Outcome of Conflicts in Iraq and Syria, Experts Warn," *The Guardian*, July 2, 2014, sec. Environment, https://www.theguardian.com/environment/2014/jul/02/water-key-conflict-iraq-syria-isis.
[190] Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 23; United Nations Environment Programme, "Environmental Issues in Areas Retaken from ISIL: Mosul, Iraq," 21.
[191] Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 82.
[192] BBC Monitoring, "Analysis: ISIS Control of Water, Oil Resources in Syria and Iraq," BBC Monitoring, July 22, 2014, https://monitoring.bbc.co.uk/product/m1bztiff.
[193] L'Osservatorio, "Syrian Conflict Update: Islamic State Captures Town in Homs Province," L'Osservatorio, February 11, 2015, https://www.losservatorio.org/en/publications/in-focus/item/143-syrian-conflict-update-islamic-state-captures-town-in-homs-province; Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," v.
[194] Colin Clarke et al., *Financial Futures of the Islamic State of Iraq and the Levant* (Santa Monica: RAND Corporation, 2017), 8–9; Agnès Levallois, Jean-Claude Cousseran, and Lionel Kerrello, "The Financing of the 'Islamic State' in Iraq and Syria (ISIS)" (Brussels: European Union, 2017), 9–10.

access to large quantities of water needed for extracting and processing crude oil, which constituted the group's main source of revenue.[195] To continue the functioning of confiscated dams, IS retained the employment of the original technical staff – who were still paid by the Syrian government – at the water plants. IS provided water to local citizens in seized territory in return for which it collected taxes. In this way, IS essentially transformed a state-run service into its own source of revenue.[196]

Third, when IS risked loosing territory, it resorted to scorched-earth tactics and extensively targeted essential water resources and infrastructures by blowing up bridges, blocking water canals, and planting mines in the ruins of water facilities and pumping stations. For instance, when in late August 2014 the Kurdish forces were able to regain control over Mosul Dam, IS had looted and demolished all operating equipment. The devastation left by IS impeded grouting operations that ensure ground stability below Mosul Dam, increasing the risk to disastrous collapse in the days after the recapture of the facility.[197] Although it is unclear whether this was an intentional outcome, IS' obstructing and damaging of Mosul Dam establish water infrastructure as a target of conflict. The strategy of purposefully destroying water resources and infrastructure became more prominent when Iraqi, Kurdish and Syrian military forces and the international anti-IS coalition started to recapture significant territory held by IS by late 2015 and 2016.[198] The targeting of water resources and related infrastructure shifted from strategic or collateral to deliberately sabotaging or destructing. IS emptied water tanks, contaminated or destroyed irrigation wells, and demolished or even boobytrapped water pumping stations and irrigation systems throughout Iraq and Syria.[199] These practices have particularly been reported for numerous irrigation wells and systems in the Sinjar district in Nineveh governorate and Kirkuk governorate, Iraq, but also beyond Sinjar area.[200] Iraqi troops

[195] Patrick Blannin, "Islamic State's Financing: Sources, Methods and Utilisation," *Counter Terrorist Trends and Analyses* 9, no. 5 (2017): 15–16; Stefan Heißner et al., "Caliphate in Decline: An Estimate of Islamic State's Financial Fortunes" (London: The International Centre for the Study of Radicalisation, 2017), 5–9.
[196] Blannin, "Islamic State's Financing," 17; House Homeland Security Committee, "Cash to Chaos: Dismantling ISIS' Financial Infrastructure" (Washington D.C.: House Homeland Security Committee, 2016), 10–11; Lina Khatib, "The Islamic State's Strategy: Lasting and Expanding," Carnegie Middle East Center, accessed January 6, 2021, https://carnegie-mec.org/2015/06/29/islamic-state-s-strategy-lasting-and-expanding-pub-60511; Levallois, Cousseran, and Kerrello, "The Financing of the 'Islamic State' in Iraq and Syria (ISIS)," 15; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 94.
[197] United Nations Environment Programme, "Environmental Issues in Areas Retaken from ISIL: Mosul, Iraq," 21.
[198] Tamer El-Ghobashy and Ghassan Adnan, "Iraqi Forces Take Full Control of Fallujah From Islamic State," *Wall Street Journal*, June 26, 2016, https://www.wsj.com/articles/iraqi-city-of-fallujah-fully-liberated-from-islamic-state-iraqicommander-says-1466934423; Hamuda Hassan and Maher Chmaytelli, "Iraqi Forces Storm Islamic State-Held Old City of Mosul," *Reuters*, June 19, 2017, https://www.reuters.com/article/us-mideast-crisis-iraq-mosul-idUSKBN19906N; Hassan Hassan, "The Battle for Raqqa and the Challenges after Liberation" (New York: Combating Terrorism Center, 2017); World Bank Group, "Iraq Reconstruction and Investment - Part 2: Damage and Needs Assessment of Affected Governorates" (Washington D.C.: The World Bank, 2018), 51–56.
[199] Amnesty International, "Dead Land: Islamic State's Deliberate Destruction of Iraq's Farmland," 9, 13–18.
[200] Amnesty International, 14; Peter Schwartzstein, "The Islamic State's Scorched-Earth Strategy," *Foreign Policy*, April 6, 2016, https://foreignpolicy.com/2016/04/06/the-islamic-states-scorched-earth-strategy/; Wim Zwijnenburg, "Iraq's

increasingly encountered the devastation and boobytraps left behind by IS' retreating fighters during the recapturing of occupied territories throughout 2016 and 2017.[201] Further examples of IS' targeting and destroying of water resources and infrastructures as part of its scorched-earth tactics were observed when the group faced losing control over Tishrin Dam (Syria), Fallujah Dam (Iraq), Al-Guba water purification plant (Iraq), the Water Department of Tabqa (Syria) and many other water plants, stations, wells, and tanks throughout Iraq and Syria.[202]

Fourth, IS also damaged or destroyed water resources and infrastructures as an *unintended* consequence of armed clashes with its opponents. During IS' initial territorial expansion in Syria and Iraq and its advance on many cities and towns, water resources and infrastructures at times became collateral damage from the fighting between IS and its opponents. For example, in August and September 2014, armed confrontations between IS combatants and Syrian government forces in Raqqa resulted in the destruction of the city's water plant and the cutting of local drinking water supplies. In September 2014, clashes between IS and Syrian state forces demolished pipelines that supplied drinking water to the Yarmouk refugee camp in southwestern Syria.[203] However, water resources and infrastructures became an significantly widespread casualty of conflict when IS was increasingly pushed back from its occupied territories by Iraqi, Kurdish and Syrian military forces backed by the international anti-IS coalition's air campaign.[204] The retreat of IS in Iraq and Syria often took the shape of pro-longed, intense, and highly destructive sieges of cities. For instance, the battle for Fallujah, Mosul, and Raqqa caused the nearly total desolation of these cities, including key water installations, water pipes and sewage systems, water tanks and other water supply systems.[205]

4.2.2 Water as a Weapon of Conflict

Continuing Struggle with Conflict Pollution," Peace Insight, December 3, 2015, https://www.peaceinsight.org/blog/2015/03/iraqs-continuing-struggle-conflict-pollution/.

[201] Schwartzstein, "The Islamic State's Scorched-Earth Strategy"; Peter Schwartzstein, "The Dangerous State of Iraq's Rivers," *Foreign Affairs*, July 4, 2017, https://www.foreignaffairs.com/articles/iraq/2017-04-07/dangerous-state-iraqs-rivers.

[202] For more examples and details, see conflict events nr. 67, 69, 71, 78, 80, 82-85, 87-93 in Table 1 in Appendix 1. Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 89–90; Clionadh Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project," Armed Conflict Location and Event Data (ACLED) Project, December 2020, https://acleddata.com/?post_type=popup&p=16628.

[203] Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 8.

[204] International Bank for Reconstruction and Development, The World Bank, "Syria Damage Assessment: Of Selected Cities Aleppo, Hama, Idlib" (Washington D.C.: International Bank for Reconstruction and Development, The World Bank, 2017), 39–41; Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 9; World Bank Group, "Iraq Reconstruction and Investment - Part 2: Damage and Needs Assessment of Affected Governorates," 51–56.

[205] El-Ghobashy and Adnan, "Iraqi Forces Take Full Control of Fallujah From Islamic State"; Hassan and Chmaytelli, "Iraqi Forces Storm Islamic State-Held Old City of Mosul"; Hassan, "The Battle for Raqqa and the Challenges after Liberation"; World Bank Group, "Iraq Reconstruction and Investment - Part 2: Damage and Needs Assessment of Affected Governorates," 51–56.

From the beginning of 2013, IS actively instrumentalized captured water resources and infrastructures to become weapons of conflict for both offensive and defensive purposes. Water is transformed into an offensive weapon when water resources or infrastructures are employed as a means to attack the enemy or enemy-held territory.[206] One apparent strategy through which IS manipulated water to directly attack its opponent was through flooding. By releasing a wall of water or retaining water behind a dam, IS submerged enemy positions. Through this use of the water weapon, IS instrumentalized its control over major water resources or infrastructures for tactical military motives as it served direct purposes in the battlefield. A distinct example is the way in which IS instrumentalized its control over Nuaimiyah Dam near Fallujah. In April 2014, IS managed to capture Nuaimiyah Dam and immediately closed its floodgates. By retaining water behind the dam, IS purposely flooded large areas of government-held land upstream, thereby inundating Iraqi government facilities situated on the river's banks, including military compounds.[207] Through this strategy, IS directly attacked its enemy's positions and manipulated water resources as an offensive weapon.

Flooding local populations also served to intentionally harm and weaken resisting populations and to displace them from their lands so that IS combatants were able to easily capture the deserted area, thereby serving both strategic political as well as tactical military purposes. Later in April 2014, IS diverted the water behind Nuaimiyah Dam through an irrigation channel to a side valley. This act resulted in the flooding of a stretch of more than 100 kilometres of nearby land in the valley and inundated the city of Abu Ghraib with water up to four meters high. Between Falluja and Abu Ghraib, over 10,000 homes and 200 square kilometres of fertile agricultural land, including its harvest and livestock, were destroyed. As a consequence, almost 60,000 people lost their livelihoods and were displaced from the area. Moreover, although it is not entirely certain whether this was an intended consequence by IS, the flooding hindered the Iraqi parliamentary elections as two thirds of the polling stations in the Anbar province could not be used.[208] There have been numerous instances during which IS combatants flooded populations sympathetic to the Iraqi government throughout 2014 and

[206] King, "The Weaponization of Water in Syria and Iraq," 155; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 84.
[207] Mohanad Hage Ali, "ISIS' Path of Destruction Drains Iraq and Syria's Water Supplies," Al Arabiya English, June 21, 2014, https://english.alarabiya.net/en/perspective/analysis/2014/06/21/ISIS-path-of-destruction-drains-Iraq-and-Syria-s-water-supplies.html; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 88.
[208] Jessica D. Lewis, "Warning Intelligence Update: ISIS Besieged Areas near Baghdad on Eve of Elections," Institute for the Study of War, April 24, 2014, http://www.iswresearch.org/2014/04/; Lossow, "More than Infrastructures: Policy Brief Water Challenges in Iraq," 5; Birgit Svensson, "Flutkatastrophe im Irak: Der Krieg mit dem Wasser - Qantara.de," Qantara.de, June 2, 2014, https://de.qantara.de/inhalt/flutkatastrophe-im-irak-der-krieg-mit-dem-wasser; The New Humanitarian, "Threat of Disease in Iraq Villages Flooded by Militants - Iraq," The New Humanitarian, May 27, 2014, https://reliefweb.int/report/iraq/threat-disease-iraq-villages-flooded-militants.

2015, for example in Miqdadiya, Saadiya, and Shirwain area in Diyala province.[209] In addition to strategic and tactical weaponization, IS's strategy of flooding can also be perceived as coercive weaponization, serving psychological functions including inducing fear to force its legitimacy and authority under occupied civilians. A clear instance of the psychological power of the water weapon is IS' capture of Samarra Barrage. Samarra Barrage controls the volume of water in Lake Tharthar, the largest lake in Iraq. Controlling this dam provided IS with the power to flood surrounding areas of the lake, including the city of Baghdad.[210] Although IS never wielded this power, it still controlled and exerted the enormous destructive capacity of this water resource through the existential threat of its potential weaponization. Another distinguished example during which IS manipulated water resources for psychological motives involves Mosul Dam which IS confiscated on August 7, 2014.[211] At its worst intentions, IS could have released a 20 metre high flood wave with the speed of 3.5 m/s from behind the dam that would have completely eradicated Mosul – then a city of 1.7 million residents – and swamped the city of Baghdad 350 km downstream with four to five meters of water. Such a flood wave would have produced approximately 500,000 to 1.5 million casualties, effectively giving IS access to a weapon of mass destruction.[212] However, after several days of disrupted water supplies, IS resumed a reliable supply of water and energy to the city of Mosul.[213]

IS employed the strategy of flooding for *defensive* purposes during its military campaigns when it submerged lands to obstruct the advance of enemy troops. For instance, two days after capturing Nuaimiyah Dam, IS released the dammed water behind it to prevent the rapid advance of units from the Iraqi army into IS' recently conquered territory.[214] This is an example of the tactical weaponization of water for defensive purposes to preserve one's own positions in the battlefield. The defensive strategy of cutting water to obstruct the advance of Iraqi state troops has also been reported in the Diyala province where IS controlled the Sudur

[209] For more details and other examples, see event nr. 13, 37 and 79 in Table 1 in Appendix 1. Erin Cunningham, "In Their Latest Outrage, Islamic State Fighters Are Using Water as a Weapon in Iraq.," *Washington Post*, October 7, 2014, https://www.washingtonpost.com/world/middle_east/islamic-state-jihadists-are-using-water-as-a-weapon-in-iraq/2014/10/06/aead6792-79ec-4c7c-8f2f-fd7b95765d09_story.html; Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 8; Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 20–21.
[210] Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 23; United Nations Environment Programme, "Environmental Issues in Areas Retaken from ISIL: Mosul, Iraq," 21.
[211] Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 82.
[212] Cunningham, "In Their Latest Outrage, Islamic State Fighters Are Using Water as a Weapon in Iraq."; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 92.
[213] Financial Action Task Force, "Financing of the Terrorist Organisation Islamic State in Iraq and the Levant (ISIL)," 30; Mahmoud Habboush and Aziz Alwan, "Islamic State Funds Caliphate with Mosul Dam as Terror Spreads," *Bloomberg*, November 8, 2014; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 93–94.
[214] Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 88.

mini-dam.[215] In December 2015, IS combatants flooded 200 acres of farmland in the Shirwain area of Diyala province by diverting water from adjacent rivers to obstruct the advance of Iraqi government troops.[216] On February 17, 2017, IS combatants diverted water behind Al-Tabqa Dam by pumping water supplies from Lake Assad into the Al-Jar to flood all the villages under their occupation in the Deir Hafer Plain of east Aleppo, near Kwaires Airfield, in response to advance of the Syrian Arab Army.[217]

Another strategy through which IS weaponized water for offensive purposes is through the contamination of crucial water resources. Water contamination is primarily intended to harm and weaken populations sympathetic to IS' opponent by purposefully distressing key drinking water supplies, thereby triggering disease and livelihood insecurity. An absence in fresh drinking water supplies and critical insecurity functioned to displace local populations sympathetic to IS' enemy, to crush their resistance, and to facilitate IS's territorial expansion.[218] In line with the categorization by Von Lossow, these tactics serve strategic political motives. Throughout the period 2013-2015, IS purposefully contaminated water resources in Aleppo, Baghdad, Deir-ez-Zor, Idlib, Mosul, and Raqqa by destructing sewage systems or poisoning water supplies with chemicals, toxic waste, or crude oil.[219] For instance, on April 17, 2014, IS combatants demolished an oil pipeline near Bayji. According to the Iraqi Ministry of Water Resources, the resulting oil spill critically contaminated the water supply to Baghdad and threatened the city with a severe water crisis.[220] In December 2014, IS purposefully poisoned water resources used for drinking purposes with crude oil in the Balad district of the Salahaddin Governorate.[221] IS has also manipulated the contamination of water resources to directly attack enemy troops. Near Baghdad, IS combatants reportedly used chlorine abstracted from water treatment plants across the country as a weapon against Iraqi state troops and Shia militia forces

[215] Cunningham, "In Their Latest Outrage, Islamic State Fighters Are Using Water as a Weapon in Iraq."; United Nations Environment Programme, "Environmental Issues in Areas Retaken from ISIL: Mosul, Iraq," 21–22.
[216] Cunningham, "In Their Latest Outrage, Islamic State Fighters Are Using Water as a Weapon in Iraq."; Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 8; Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 20–21.
[217] Leith Aboufadel, "ISIS Attempts to Halt Syrian Army Advance by Flooding East Aleppo Villages," *Al-Masdar News*, February 17, 2017, https://www.almasdarnews.com/article/isis-attempts-halt-syrian-army-advance-flooding-east-aleppo-villages/; Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 9.
[218] Leah Farrall, "The Fall of the ISIS 'Caliphate,'" Parliament of Australia, 2019, Australia, https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BriefingBook46p/ISISCaliphate; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 88–89.
[219] BBC News, "Mosul Diaries: Poisoned by Water," *BBC News*, December 19, 2014, https://www.bbc.com/news/world-middle-east-29600573; Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 8; Zwijnenburg, "Iraq's Continuing Struggle with Conflict Pollution."
[220] Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 7; Lewis, "Warning Intelligence Update: ISIS Besieged Areas near Baghdad on Eve of Elections."
[221] Abdelhak Mamoun, "ISIS Poisons Drinking Water with Crude Oil in Balad District," Iraqi News, December 3, 2014, https://www.iraqinews.com/iraq-war/isis-poisons-drinking-water-crude-oil-balad-district/.

in September 2014.[222] When using water contamination to directly attack enemy troops, water is transformed into a weapon for offensive strategies, serving tactical military purposes.

IS also offensively weaponized water by both *withholding* crucial water supplies from some and *providing* crucial water supplies to other populations. IS actively withheld water from populations sympathetic to its enemies. Withholding critical water supplies essentially serves the same strategic political motives as contaminating water resources, namely to trigger livelihood insecurity to weaken and crush local resistance and to facilitate the advance of IS troops. In August 2014, IS employed its control of the water and power networks in Mosul to cut off water and energy supplies to surrounding areas that were not yet confiscated and submerged under its rule. Through this strategy, IS forced the displacement of people who resisted their expansion after which they could easily seize the deserted territory.[223] However, withholding water also served an psychological purpose. Withholding crucial drinking water supplies to people resisting IS' rule served to weaken the legitimacy of the central state in Syria and Iraq who became increasingly unable to provide its citizens with basic resources. In this way, IS sought to potentially generate opposition and hostility towards the Syrian and Iraqi governments and undermine state authority. For instance, in May-June 2014, IS repeatedly cut off water supplies to the city of Aleppo by destroying water pipes, sewage pipes, and electric cables of water stations. As a result, around two million residents in Aleppo were compelled to drink from untreated wells and pools of water.[224] IS intended to weaken its opponent in the highly segregated city and to undermine the legitimacy of the Syrian government who failed to provide and protect basic human resources for its population.[225] Also in June 2014, IS isolated the Christian populated town of Qaraqosh in northern Iraq completely of water by blocking water pipes and interrupting all external trade connections from the town. IS has also frequently employed this strategy of cutting water supplies to weaken minority populations in the Shiite areas of the Diyala province and al-Anbar province – areas under the control of the Iraqi government.[226] IS also weaponized its control over Nuaimiyah Dam to cut water supplies to millions of people in South and Central Iraq where large shares of the Iraqi Shiite population resided who were sympathetic to the Iraqi government and resisted IS' rule. By depriving these

[222] Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 19.
[223] Cunningham, "In Their Latest Outrage, Islamic State Fighters Are Using Water as a Weapon in Iraq."
[224] Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," v.
[225] Nett and Rüttinger, "Insurgency, Terrorism and Organised Crime in a Warming Climate: Analysing the Links Between Climate Change and Non-State Armed Groups," 24; Vidal, "Water Supply Key to Outcome of Conflicts in Iraq and Syria, Experts Warn."
[226] Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 7; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 87.

populations from essential water supplies, IS sought to harm people supportive of their enemy and weaken their resistance.[227]

In contrast, IS also manipulated its control over water resources and infrastructures to *provide* certain populations with water supplies. IS provided water supplies to Iraq and Syria's Sunni population who suffered from critical water and livelihood insecurity due to years of the deprivation and negligence by their central government.[228] By supplying water to these Sunni Muslims, IS sought to benefit from the increasing disengagement and detachment from the Iraqi and Syrian regime and enforce its own legitimacy.[229] In this way, IS strategically manipulated the severe water and agricultural crisis and resulting livelihood insecurity in both Iraq and Syria to gain support and recruit among severely deprived rural populations. This strategy, considered as strategic political weaponization or incentivization, became particularly evident in northeast Syria, a region that was most harshly hit by the 2007-2012 drought and where public support for the Syrian government was already depleted.[230] By providing clean drinking water, implementing adequate irrigation projects, and offering social services, IS enhanced its legitimacy among the local population and further weakened the authority of the state. Though other drivers of political instability and conflict were also important factors, livelihood insecurity and water scarcity produced a fertile ground for IS to recruit numerous combatants in Syria.[231] According to a report by Nett and Rüttinger for Adelphi, the livelihood insecurity and water deprivation were important facilitators for IS to recruit at least 60 to 70 percent of its fighters in the region.[232] If people refused to join or support the group, IS just cut off water and electricity supplies to resisting areas.[233] Another important instance of this strategy is IS' control over Mosul Dam mentioned earlier. IS resumed a reliable supply of water and energy to the city of Mosul after several days of disrupted water supplies.[234] Parts of the population – particularly Sunni Muslims – who had fled the city returned to Mosul and actually perceived IS' occupation

[227] Ali, "ISIS' Path of Destruction Drains Iraq and Syria's Water Supplies"; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 88.
[228] In Iraq, the Sunni population had suffered from systematic political and economic exclusion under former prime minister Nouri al-Maliki. In Syria, the population was critically deprived due to years of civil conflict and in desperate need of basic human resources. Khatib, "The Islamic State's Strategy."
[229] Khatib; Vidal, "Water Supply Key to Outcome of Conflicts in Iraq and Syria, Experts Warn."
[230] De Châtel, "The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution," 524–25; Kelley et al., "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought"; Selby et al., "Climate Change and the Syrian Civil War Revisited," 261–64.
[231] Nett and Rüttinger, "Insurgency, Terrorism and Organised Crime in a Warming Climate: Analysing the Links Between Climate Change and Non-State Armed Groups," 23–24.
[232] Nett and Rüttinger, 24.
[233] Gen. (ret.) Tom Middendorp and Reinier Bergema, "The Warning Signs Are Flashing Red The Interplay between Climate Change and Violent Extremism in the Western Sahel" (The Hague: Planetary Security Initiative, International Centre for Counter-Terrorism, 2019), 6–7, https://icct.nl/app/uploads/2019/10/PB-The-Warning-Signs-are-flashing-red_2e-proef.pdf.
[234] Financial Action Task Force, "Financing of the Terrorist Organisation Islamic State in Iraq and the Levant (ISIL)," 30; Habboush and Alwan, "Islamic State Funds Caliphate with Mosul Dam as Terror Spreads"; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 93–94.

as a liberation, because IS provided them with basic resources and services that were previously neglected by the ruling elite.[235] In this way, IS employed water to neutralise opposition, to gain legitimacy, and to recruit new combatants among the local population.[236] This strategy serves strategic political motives. By capturing and providing a service that traditionally falls under the authority of the state, this strategy also served to enhance IS' ideological credibility of building an Islamic State among its followers.[237]

By withholding water from some and providing water to other populations, IS suppressed and controlled local populations throughout Iraq and Syria. The organization also subjugated populations sympathetic to its enemy by offering a continuation of water and electricity in return for payment. IS applied this strategy to governorates and towns throughout Iraq and Syria to exert power over areas that were not under its territorial control. For instance, in October 2014, IS combatants cut off electricity to the water wells of the village of Talkhaneim, near Gwer in northern Iraq, to pressurize and financially exploit the local population. They demanded a ransom of IQD 4 million (USD 3500) of the village to continue water supplies.[238] In January 2015, IS used its control of the Baath Dam to cut off water and energy to the Deir Ez-Zour area south of Raqqa, thereby affecting over 300,000 people.[239] Again, this is an instance of IS instrumentalizing its control over water resources as an offensive weapon. The control of critical water infrastructure sometimes provided the group with the capacity to effectively or actually dominate and rule large geographical areas that were not necessarily under their occupation. This is an instance of strategic weaponization.

4.3 Conclusions

IS has instrumentalized water resources and infrastructures as a deliberate and integral part of its military tactics and strategies throughout Iraq and Syria between 2013-2020. This research project has documented over 90 conflict events during which IS executed large or smaller attacks targeted against or instrumentalized Syrian and Iraqi water resources and water-related infrastructure. Particularly during the period 2013-2015, the employment of water resources

[235] Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 93; Vidal, "Water Supply Key to Outcome of Conflicts in Iraq and Syria, Experts Warn."
[236] Financial Action Task Force, "Financing of the Terrorist Organisation Islamic State in Iraq and the Levant (ISIL)," 30; Habboush and Alwan, "Islamic State Funds Caliphate with Mosul Dam as Terror Spreads"; Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 93–94.
[237] Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 94; Lossow, "Water as Weapon: IS on the Euphrates and Tigris. The Systematic Instrumentalisation of Water Entails Conflicting IS Objectives," 6; King, "The Weaponization of Water in Syria and Iraq," 159–62; Vishwanath, "The Water Wars Waged by the Islamic State."
[238] Cunningham, "In Their Latest Outrage, Islamic State Fighters Are Using Water as a Weapon in Iraq."; Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 19.
[239] Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 8.

and related infrastructure has been identified as constituting a key component of IS' territorial expansionist strategy in Iraq and Syria.[240] The motive underlying IS's *intentional* targeting of water resources and water infrastructures was initially two-fold. First, by targeting water resources and water infrastructures IS sought to gain strategic assets and positions to sustain its own troops and operations. IS' control over large quantities of water and critical water-related infrastructure presented significant sources of revenue for the group that funded and facilitated its considerable organizational and military capacities. Secondly, IS targeted water to facilitate its territorial expansion in both Syria and Iraq. Capturing water meant gaining strategic advantage over its opponent because of the substantial power controlling water availability yielded in the context of Syria and Iraq's water conditions. The presence of two large rivers in a largely arid climate increases dependency on these rivers for domestic water supply. As emphasized by Zawahri, rivers can be transformed into instruments of coercion vis-à-vis downstream users. IS realized the strategic relevance of key cities and water infrastructures to dominate the Euphrates and Tigris' river flows and wield this coercive tool.[241] In any context with these water conditions, non-state actors might appreciate and try to capture the compelling instrumental power of controlling a country's principal water supply. In arid climates, seizing or having access to sufficient water supply is also a necessary condition to be able to sustain and expand one's own troops and operations as well as to keep occupied populations in check. Moreover, denying the enemy from this strategic and vital human resource is an straightforward tactic to weaken your opponent. Thus, when IS risked losing territory to its enemy, combatants deployed scorched-earth tactics. The deliberate targeting of water resources and infrastructures to destroy and deny these from falling into the hands of its opponents became increasingly evident throughout 2016-2017. Hence, this research observes a transformation of IS' water-related military approach over the course of the conflict: from an emphasis on expansionist operations to retreat strategies.

The hydrological context in Iraq and Syria allowed IS to instrumentalize water as both an offensive and defensive weapon in highly varied and effective ways. IS weaponised water by flooding, contaminating, retaining, or providing water in order to facilitate its own or disrupt enemy troop movement or to weaken and displace local populations who resisted their rule. IS was certainly not the only actor during the conflicts in Syria and Iraq who employed water cuts as a weapon to weaken its opponent. However, the mixed, systemic, and coordinated way in which IS deployed water as an instrument or strategy of warfare placed IS at the forefront of

[240] Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 82.
[241] Habboush and Alwan, "Islamic State Funds Caliphate with Mosul Dam as Terror Spreads."

such tactics. IS has purposefully employed and manipulated water in conventional as well as unconventional manners: as a tool of expansion, a tool of extortion and subjugation, and an instrument of its arsenal.[242] IS' control of water infrastructure enabled it to advance its territorial expansion and to weaken its opponent militarily with a relatively small attacking force.[243] The group managed to pressurize local populations and exert power through the water weapon over large shares of Iraqi and Syrian territory, including over cities, towns, and rural areas not under its direct territorial control.[244] IS deployed the water weapon for tactical military or strategic political motives, but also as a coercive tool and ideological instrument through which IS enhanced local recruitment, forced support, and advocated the legitimacy of its envisioned Islamic state in occupied territory. The water-related tactics of IS are in this way closely related to its ambition of state-building.[245] Confiscating major dams in Iraq and Syria provided IS the power to take over critical state functions by delivering basic resources to local populations. Through these tactics, IS sought to assert its legitimacy and present itself as a state rather than a militia, bolstering their claim of establishing an Islamic caliphate.

5. The Houthis in Yemen 2014-2020

As in the case of IS, the manipulation and impact of water as an instrument or as part of strategies of warfare by the Houthis depends on Yemen's hydrological, socio-economic, and

[242] Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 16.
[243] King, "The Weaponization of Water in Syria and Iraq"; United Nations Environment Programme, "Environmental Issues in Areas Retaken from ISIL: Mosul, Iraq," 3.
[244] Strategic Foresight Group, "Water and Violence: Crisis of Survival in the Middle East," 16; Vishwanath, "The Water Wars Waged by the Islamic State."
[245] Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 94; Lossow, "Water as Weapon: IS on the Euphrates and Tigris. The Systematic Instrumentalisation of Water Entails Conflicting IS Objectives," 6; King, "The Weaponization of Water in Syria and Iraq," 159–62; Vishwanath, "The Water Wars Waged by the Islamic State."

political context.[246] Therefore, the first section of this chapter performs a context analysis of the water situation in Yemen before the onset of the civil war and considers relevant socio-economic and political variables for the instrumentalization of water resources by the Houthis. The second section analyses how the Houthis actively employed water and related infrastructure as either a target or weapon of conflict.

5.1 Introduction to the Context

Yemen – Yemen contains an extremely arid climate in which water scarcity has commonly been a critical issues. The country does not posses any permanent rivers and precipitation rates are naturally low.[247] Yemen's southern coastal zones experience heavy rainfall during the summer months, generated by seasonal (monsoon) winds from the Indian Ocean.[248] Its main water resources are subsurface water systems, including the Wajid Aquifer System, the Wasia-Biyadh-Aruma Aquifer System, and the Umm er Radhuma-Dammam Aquifer System. Yemen shares these aquifer systems primarily with Saudi Arabia and in the case of the Umm er Radhuma-Dammam Aquifer System also with Oman and United Arab Emirates.[249] There exist no water agreements between these countries on the allocation and management of their shared groundwater resources. Other natural sources of water supply in Yemen include springs, spate flows, and base flows in wadis.[250] Groundwater and wadis are critically important sources of the country's domestic and agricultural water supplies.[251] However, heavy abstraction of groundwater reserves are depleting these water resources and increasing salinity levels, and pollution is threatening groundwater quality.[252] Yemen has seen among the highest population growth rates in the recent decade, with a population growth of 25 percent between 2006 and 2014. Population growth has been accompanied by the expansion of agricultural production. Around 75 percent of Yemen's workforce is employed in agriculture.[253] These developments have pressurized the country's already scarce domestic water supply. Groundwater resources

[246] Lossow, "The Rebirth of Water as a Weapon: IS in Syria and Iraq," 86.
[247] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 18.
[248] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, 22.
[249] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, 29.
[250] Wadis are seasonal streams of water with varying lengths from several tens to hundreds of kilometres.
[251] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 20; Matthew. I. Weiss, "A Perfect Storm: The Causes and Consequences of Severe Water Scarcity, Institutional Breakdown and Conflict in Yemen," *Water International* 40, no. 2 (2015): 252.
[252] United Nations Economic and Social Commission for Western Asia and Federal Institute for Geosciences and Natural Resources, "Inventory of Shared Water Resources in Western Asia," 328.
[253] Weiss, "A Perfect Storm: The Causes and Consequences of Severe Water Scarcity, Institutional Breakdown and Conflict in Yemen," 255.

are depleted at much higher rates than the natural recharge rate (four times higher in Sana'a in 2014), causing groundwater levels in aquifers to decline with an average of 1-7 meters annually.[254] The last two decades also saw the development of a cash economy and modern technological innovation. This caused that farmers increasingly shifted from relying on sustainable sustenance farming to uncoordinated surface or spate irrigation of cash crops that are extremely water-intensive, like Qat.[255] The drivers of water scarcity in Yemen are further exacerbated by years of government mismanagement. Government policies subsidized these water-intensive crops and generally disregarded the construction and management of adequate water and sanitation infrastructure for its citizens. Adding to these pressures on Yemen's natural water resources is climate change. Higher temperatures are increasing evaporation rates.[256] The conjunction of a naturally dry climate, poor water resource management, and a climatological drought in 2007-2009, caused that Yemen was already considered one of the most severe water-stressed countries of the world before the outbreak of conflict in 2014. Public water was only accessible to approximately 50 and 40 percent of, respectively, the country's urban and rural population. The prolonged civil war has worsened Yemen's already critical water situation and plunged the country into a severe humanitarian crisis.[257] The scarcity of water supplies has transformed access to and control over water resources as a strategic objective for the Houthis and its opposing parties during Yemen's internationalized civil conflict.[258]

5.2 Analysis

The analysis of conflict events involving the Houthis in Yemen over the period 2014-2020 observes various instances during which water was transformed into or instrumentalized as a (deliberate or unintentional) target or weapon of conflict (see Figure 3). The following sections discuss the tactics, strategies and other mechanisms through which the Houthi movement established water into a target or weapon of conflict.

[254] Mohammad Al-Saidi, "Contribution of Water Scarcity and Sustainability Failures to Disintegration and Conflict in the Arab Region - The Case of Syria and Yemen," in *The Regional Order in the Gulf Region and the Middle East: Regional Rivalries and Security Alliances*, by Philipp O. Amour (Cham: Palgrave Macmillan, 2020), 391; Douglas, "A Storm Without Rain: Yemen, Water, Climate Change, and Conflict," 2; Mohamed, Elayah, and Schulpen, "Yemen between the Impact of the Climate Change and the Ongoing Saudi-Yemen War: A Real Tragedy," 1.
[255] Al-Saidi, "Contribution of Water Scarcity and Sustainability Failures to Disintegration and Conflict in the Arab Region - The Case of Syria and Yemen," 392; Douglas, "A Storm Without Rain: Yemen, Water, Climate Change, and Conflict," 2; Adam Heffez, "How Yemen Chewed Itself Dry" (Washington D.C.: Foreign Affairs, 2013), 228–29.
[256] Douglas, "A Storm Without Rain: Yemen, Water, Climate Change, and Conflict," 1–2; Weiss, "A Perfect Storm: The Causes and Consequences of Severe Water Scarcity, Institutional Breakdown and Conflict in Yemen," 255.
[257] Suter, "An Update on Yemen's Water Crisis and the Weaponization of Water."
[258] Douglas, "A Storm Without Rain: Yemen, Water, Climate Change, and Conflict," 1, 6; Weiss, "A Perfect Storm: The Causes and Consequences of Severe Water Scarcity, Institutional Breakdown and Conflict in Yemen," 251.

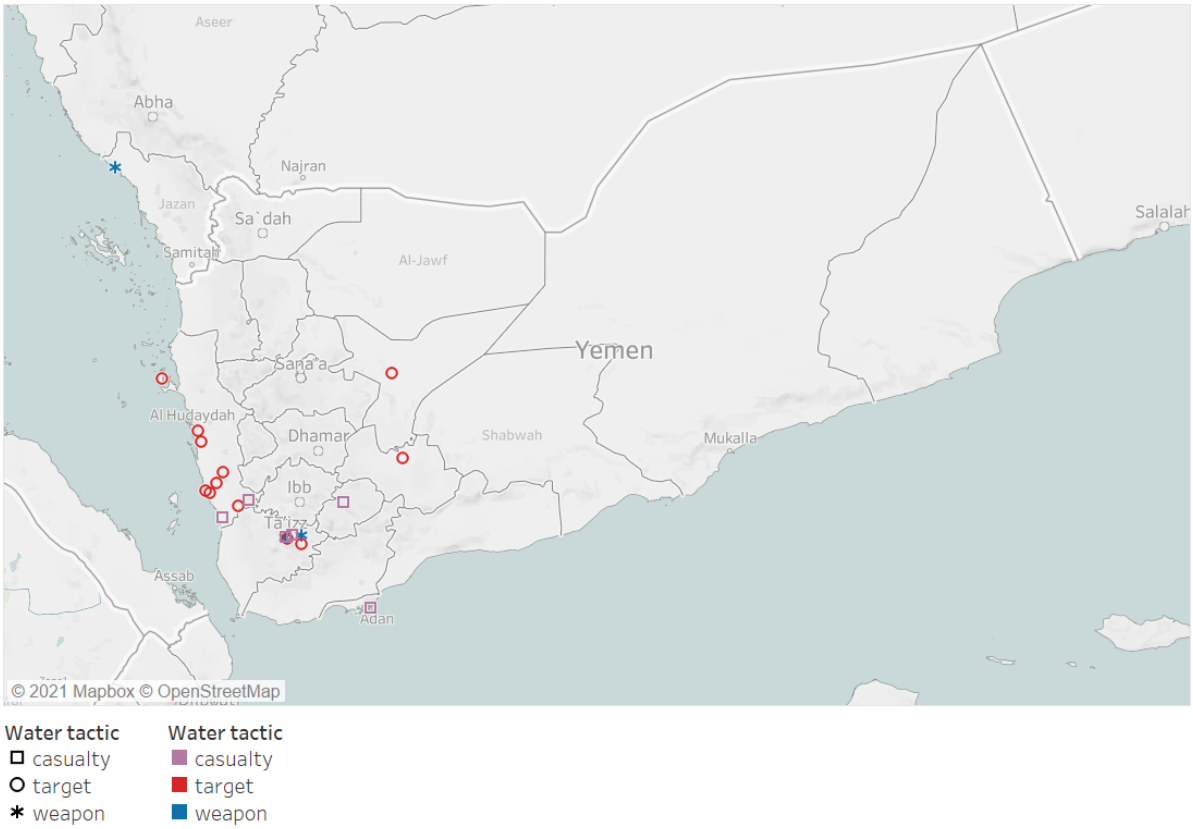


Figure 3. Map produced by the author showing water-related conflict events by the Houthis in Yemen

5.2.1 Water as a Target of Conflict

The internationalized civil war in Yemen has witnessed the extensive and destructive targeting of water supplies and water-related infrastructure, including water treatment plants and sanitation systems. A significant degree of the devastation has been caused by airstrikes of the international pro-government coalition led by Saudi Arabia and the United Arab Emirates (UAE). According to the Yemen Data Project, the coalition's aerial bombing campaign has targeted water infrastructure – including water projects, plants, dams, drills, wells, tanks, trucks, and storage – over a hundred times between 26 March 2015 and 31 October 2020.[259] Although to a significantly lesser degree than the coalition, the Houthi forces have also purposefully targeted water resources and infrastructures in Yemen. As the principal objective of this thesis is to examine the water-related tactics and strategies of non-state actors, the remaining part of this section will only focus on the instrumentalization and incorporation of water and related infrastructures into strategies of war by the Houthi forces.

[259] Gleick, "Water as a Weapon and Casualty of Armed Conflict: A Review of Recent Water-Related Violence in Iraq, Syria, and Yemen," 10; Ben Watson, "The War in Yemen and the Making of a Chaos State: What Future Is There for the Devastated Country?," *The Atlantic*, March 2, 2018, https://www.theatlantic.com/international/archive/2018/02/the-war-in-yemen-and-the-making-of-a-chaos-state/551987/; Yemen Data Project, "Data: Airwar," Yemen Data Project, October 2020, https://yemendataproject.org/data.html.

In the period 2014-2020, water resources and infrastructures have regularly become a target for the Houthi movement. The intentional targeting of water and related infrastructures is, above all, driven by the scarcity of this vital human resource in Yemen. Both for the Houthis and the government of Hadi, water is an essential resource necessary to sustain its troops and military campaigns. Due to the country's arid climate and critical water shortage, the seizing of water resources has increasingly developed into a strategic target during the civil war.[260] Securing access to water supplies has motivated targeted attacks on water resources and infrastructures by the Houthis on water wells, water tanks, and other water resources. For the Houthis, confiscating water supplies also involved a tactical military motive. That is, a typical strategy the Houthis have adopted to conceal from air assaults by the Saudi-led coalition is the minimization of troop movement. Houthi combatants are known for their capacity to remain immobile under the cover of hide sites for lengthy periods. To be able to limit their movement, Houthi troops require abundant supplies of resources like food, water, and ammunition.[261] Hence, these strategies increase the strategic relevance of occupying and seizing fresh water resources for the Houthis. In addition to capturing water for its own use, the Houthis have used water to finance its operations. Houthi combatants have been accused of seizing food and water deliveries by international aid agencies in the areas of Qallo'ah, Safi, and Zaytoon to divert them for profit.[262] The group reportedly disrupted and diverted water supplies from the World Food Programme (WFP) in Houthi-controlled areas to sell to the highest bidder.[263]

The importance of securing access to water resources and water-related infrastructures has played a major role during the offensive in and surrounding Hudaydah city between 2015-2018. The city – which the Houthis had captured in October 2014 – is of strategic significance due to its proximity to the fertile lands of the Tihama plain – an important agricultural area – as well as its access to international shipping lanes, including the Suez Canal. Around 70 percent of Yemen's humanitarian supplies, including key water, food, and medicine supplies for war-stricken areas, are imported through Hudaydah Port.[264] Hence, the battle for control over the Port of Hudaydah was decisive for the balance of power in Yemen's internationalized civil

[260] Douglas, "A Storm Without Rain: Yemen, Water, Climate Change, and Conflict," 6.
[261] Michael Knights, "The Houthi War Machine: From Guerrilla War to State Capture," *Combatting Terrorism Cener Sentinal* 11, no. 8 (2018): 19.
[262] Group of Eminent International and Regional Experts, "Situation of Human Rights in Yemen, Including Violations and Abuses since September 2014: Report of the Group of Eminent International and Regional Experts on Yemen," 10.
[263] Michelle Nichols, "U.N. Food Chief Warns Aid Suspension in Yemen Likely to Start This Week," *Reuters*, June 17, 2019, https://www.reuters.com/article/us-yemen-security-un/u-n-food-chief-warns-aid-suspension-in-yemen-likely-to-start-this-week-idUSKCN1TI1X7.
[264] BBC News, "Yemen War: Why the Battle for Hudaydah Matters," BBC News, March 6, 2018, https://www.bbc.com/news/world-middle-east-44471977; Suter, "An Update on Yemen's Water Crisis and the Weaponization of Water."

conflict.[265] In relation to the Houthi movement's advance on Hudaydah, water infrastructure – the Port of Hudaydah – is considered a target of conflict. The siege of Hudaydah intensified during the period June-December 2018 when the Saudi-led coalition launched Operation Golden Victory. The air strikes and ground fighting between the Houthis and the Saudi and UAE-led coalition particularly reached a climax in June 2018**,** during which Hudaydah Port was significantly damaged. The destruction of Hudaydah Port is not only the result of targeted attacks by Houthi forces, but also a casualty of the Saudi and UAE-led coalition's aerial bombing campaigns.[266]

In addition to securing one's own access to water resources, denying its opponent from fresh drinking water has also motivated numerous targeted attacks by the Houthis at water wells, water tanks, water silo's, treatment plants, and other water supply systems.[267] Pro-Houthi forces allegedly devastated water collection tanks in Bani Zuhayr village west of Hays on 22 May 2018 in the face of losing the area. The tanks were the only source of water for the population of Hays district.[268] The Houthis are reported to have used the same strategy when they were losing control over areas surrounding Tuhayta city. As anti-Houthi forces were advancing on the city of Tuhayta on 7 June 2018, the Houthis destroyed the main water tank of the city.[269] The targeted destruction of water resources to prevent them from falling into the enemy's hands is a common tactic by all parties to the internationalized civil war in Yemen.[270]

Besides denying enemy forces from water resources, the Houthis have targeted civilian water resources to deprive local populations sympathetic to the Hadi government from water supplies. These attacks could have been motivated to hurt people's livelihoods in government-held territory and weaken local resistance to the Houthi movement's territorial expansion. For instance, on 24 February 2017, forces from the Houthi-Saleh alliance claimed the launch of a Zilzal-2 ballistic missile from the Nihm district in Sana'a governorate towards Hadi government forces stationed near Ma'rib Dam. Ma'rib Dam provides water for Ma'rib city and surrounding agricultural production.[271] Other examples are the Houthi attacks on 5 August 2018, 5 January 2019, and 26 March 2020 listed in Table 2 in Appendix 2.[272] In addition to damaging water supplies, the ferocious shelling of water projects and supply tanks provided by international aid

[265] Knights, "The Houthi War Machine: From Guerrilla War to State Capture."
[266] BBC News, "Yemen War: Why the Battle for Hudaydah Matters."
[267] Suter, "Running out of Water"; Suter, "An Update on Yemen's Water Crisis and the Weaponization of Water."
[268] Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project."
[269] Ibid.
[270] Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project"; United Nations Security Council, "Final Report of the Panel of Experts on Yemen" (New York: United Nations Security Council, January 31, 2017), 46; United Nations Security Council, "Final Report of the Panel of Experts on Yemen," January 25, 2019, 47, 176, 183.
[271] Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project."
[272] See Appendix 2 for a more detailed description.

agency could be intended as acts of terror to induce fear among local populations. On the first of December, 2015, shelling by forces of the Houthi-Saleh alliance struck near a charity water tank in Al-Kwait neighbourhood in Salah district of Ta'izz.[273] On 13 December 2016, pro-Houthi forces allegedly shelled a civilian's house in the Water Project neighbourhood in the city of Ta'izz.[274] In line with Von Lossow, such instances could be considered acts of psychological terrorism. However, during the period 2014-2020, there are actually only sporadic reports of the Houthi targeting water infrastructure of local populations. These sporadic incidents do not reflect an apparent and systematic implementation of the strategy to crush local resistance to further territorial expansion. Hence, this research project lists these conflict events of the Houthis as targeting civilian water resources and infrastructure and water being a *target* of conflict – not a weapon.

Despite the already dire water situation in Yemen, water has also regularly become an *unintended* target, or casualty, of conflict between the Houthi movement and pro-Hadi forces. As mentioned earlier, the extensive air campaign by the international coalition has led to the widespread targeted or collateral destruction of water resources and related infrastructures in Yemen. Though to a lesser extent, water supplies and water infrastructures have also become a casualty of on the ground fighting between Houthi and warring parties in the internationalized civil conflict. These instances have been primarily reported by the ACLED data project. When it is not confirmed by sources that the destruction of water supplies or water-related infrastructure was an intentional target, water and related infrastructure are perceived and categorized as a casualty of conflict. For instance, on April 8, 2015, armed clashes took place between the Houthis and pro-government forces in Mu'alla and Crayter, with Houthi combatants reportedly taking sniper positions on the hills and piercing through blocked roads with armoured vehicles. The battle, during which airstrikes and mortar fire struck the area, led to the devastation of various key water and electricity institutions.[275] On 18 September 2016, a rocket fired by the Houthis targeted and struck a hospital in Ta'izz, thereby damaging solar panels and water storage.[276] Ten days later, on 28 September, a mortar fired by Houthi combatants targeted and hit al-Thawra hospital. The assault damaged the hospital's solar panels and water tanks and pipes, causing the temporary suspension of surgical operations.[277] On 25

[273] Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project."
[274] Ibid.
[275] Ibid.
[276] Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project"; United Nations Security Council, "Final Report of the Panel of Experts on Yemen," January 31, 2017, 53–54.
[277] Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project"; United Nations Security Council, "Final Report of the Panel of Experts on Yemen," January 31, 2017, 227.

October 2020, Houthi forces targeted and destroyed solar energy infrastructure in At-Tuhayat district, leading to the suspension of a key water project and deprivation of drinking water to 30.000 civilians.[278] Also during the battle for Hudaydah, the city's key northern exit was destroyed, thereby blocking the only feasible transporting route for large-scale humanitarian and commercial goods from Hudaydah Port to the rest of Yemen. This resulted in significant rises in the price of water, food, medicine, and fuel supplies and critically compounded the country's water crisis.[279] During these as well as other instances listed in Table 2 of Appendix 2, it is not clear whether the destruction of water infrastructure was an intended target or a unintentional consequence of the fighting and, hence, is considered a casualty of conflict.[280] Intentional or not, the Houthis' devastating operations depriving access to clean drinking water further increased the number of people in dire need of humanitarian aid.[281]

5.2.2 Water as a Weapon of Conflict

During the period 2013-2020, the Houthis have adopted several tactics and strategies through which they instrumentalized water as a weapon. In contrast to the sporadic attacks targeted at civilian water resources and infrastructure mentioned above, the Houthi forces have also actively used siege and blockade tactics to systematically deny civilians of access to water resources. For instance, during the battle for the city of Aden from March-July 2015, the Houthis forces blocked the importation of food and water supplies into the city to weaken and ultimately crush local resistance.[282] Aden has been a strategically important city in Yemen's internationalized civil war because of its location as a key maritime chokepoint in the Gulf of Aden. Control over the Port of Aden essentially implies control over all of Yemen's ports and waterways as well as the country's oil resources.[283] Likewise during the battle for control of the governorate of Ta'izz (April 2015-present) the Houthi forces used siege and blockade tactics to restrict their opponent and citizens resisting their rule from access to water resources since April

[278] Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project."
[279] Kayla Ritter, "HotSpots H2O, June 18: Yemen's Water Supply Jeopardized Again in Battle for Hodeidah," *Circle of Blue* (blog), June 18, 2018, https://www.circleofblue.org/2018/hotspots/hotspots-h2o-june-18-yemens-water-supply-jeopardized-again-in-battle-for-hodeidah/; Suter, "An Update on Yemen's Water Crisis and the Weaponization of Water."
[280] Other instances during which water became a casualty of the fighting between the Houthis and its opponents include the conflict events Nr. 16, 19, 20, and 21 in Table 2. See the Appendix 2 for more details. Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project."
[281] Ibid.
[282] Angad Singh, "Photos from a City under Siege," CNN, July 31, 2015, https://www.cnn.com/2015/07/30/world/cnnphotos-aden-yemen-besieged/index.html; United Nations Security Council, "Final Report of the Panel of Experts on Yemen Established Pursuant to Security Council Resolution 2140 (2014)" (New York: United Nations Security Council, January 26, 2016), 38.
[283] Fatima Abo Alasrar, "The Houthis Are Consolidating Power," Middle East Institute, October 30, 2020, https://www.mei.edu/publications/houthis-are-consolidating-power.

2015.[284] The northern and eastern Houthi-controlled areas of Ta'izz governorate included around forty key water wells, leaving only small artesian aquifers for government-controlled parts.[285] Moreover, Houthi forces blocked the main entry routes into the city of Ta'izz to impede any food and water supplies transport.[286] Such tactics also critically constrained the capacity of international aid agencies to provide vulnerable and afflicted populations with humanitarian resources.[287] In this way, Houthi combatants sought to deprive local populations sympathetic to their enemy from water supplies to hurt and weaken their opponent and rupture local resistance to their territorial expansion. During the sieges of these cities, water is instrumentalized as a strategic political weapon serving offensive purposes as the systemic retention of access to water is used to directly harm, discourage, and defeat the opponent. The Saudi-led coalition employed the same blockade tactics of humanitarian supplies such as water, food, and medicine, allegedly to prevent weapons imports smuggled from Iran to Houthi-held territory.[288]

In addition to instrumentalizing water for offensive purposes, the Houthis instrumentalized water as a defensive weapon serving tactical military motives. During the length of the Saudi and UAE-led coalition's aerial campaign, Houthi combatants evolved their defensive and fortification strategies. To conceal from and complicate air surveillance and targeting, the Houthi forces commonly build their bunkers on vegetated wadis where they can use the camouflage of the trees. Moreover, in both rural and urban areas, the Houthis established their command centres and arms supplies on critical infrastructures, including bridges, dams, hospitals, and schools, as these are officially on the restricted target list or "no target" list.[289] With these tactics, water resources and infrastructures are instrumentalized as defensive weapons. The concealment tactics of Houthi combatants may have resulted in the increased targeting and destruction of critical water supplies and water-related infrastructures by the coalition's indiscriminate air assaults. Indeed, the period 2015-2020 saw many instances of

[284] المصدر أونلاين, "Taiz Relief Coalition Issues a New Report on the Humanitarian Situation in Taiz during July 2016," *المصدر أونلاين*, July 8, 2016, https://almasdaronline.com/article/83575; Michelle Barone, "March 8-14: Civilian Death Toll Rises in Hajjah, Senate Passes War Powers Bill," Yemen Peace Project, March 15, 2019, https://www.yemenpeaceproject.org/blog-x?category=Press%20Review; Mohamed, Elayah, and Schulpen, "Yemen between the Impact of the Climate Change and the Ongoing Saudi-Yemen War: A Real Tragedy," 6; United Nations Security Council, "Final Report of the Panel of Experts on Yemen Established Pursuant to Security Council Resolution 2140 (2014)," 147.

[285] *المصدر أونلاين*, "بسبب القات والحوثيين.. أزمة مياه حادة في تعز," المصدر أونلاين, November 3, 2019, https://almasdaronline.com/articles/165203.

[286] United Nations Security Council, "Final Report of the Panel of Experts on Yemen Established Pursuant to Security Council Resolution 2140 (2014)," 38, 143–44.

[287] Iona Craig, "'Before I Had Everything to Eat. Now It's One Bite': Yemenis' Struggle for Survival," *The Guardian*, November 26, 2017, https://www.theguardian.com/world/2017/nov/26/yemen-daily-struggle-for-survival-behind-divided-lines; Suter, "An Update on Yemen's Water Crisis and the Weaponization of Water"; United Nations Security Council, "Final Report of the Panel of Experts on Yemen Established Pursuant to Security Council Resolution 2140 (2014)," 47.

[288] Craig, "'Before I Had Everything to Eat. Now It's One Bite': Yemenis' Struggle for Survival."

[289] Knights, "The Houthi War Machine: From Guerrilla War to State Capture," 18.

Saudi and UAE-led coalition airstrikes and air raids (allegedly) targeting, hitting, and destroying numerous water wells, tanks, reservoirs, desalination plants, transport, and water projects to assault and weaken Houthi forces.[290] For instance, on 30 March, 2020, four Saudi-led coalition air raids targeted three water wells on Kamaran Red Sea Island, western Yemen, allegedly to target locations utilized by the Houthis to store and assemble drones and ballistic missiles. There is no hard evidence that the Houthis used these water wells as weapons storage.[291] Riyadh has also claimed to have bombed several water facilities in Yemen because these were used as firing positions by Houthi militants. If these allegations are correct, these water-related infrastructures would have been used by Houthi combatants for offensive military purposes, in which case they would become legitimate military targets. Still, such allegations could also have been used by the Saudi government to assault and destroy water supplies of Houthi-held territory to force the movement of Houthi troops. If bombed water infrastructures were not utilized by Houthi combatants to fire from at Yemeni government or Saudi forces, then these sites are in fact illegitimate targets under Protocol I of the Geneva Convention to which Saudi Arabia has been a signatory since 1987.[292] There is generally an absence in hard evidence to support Riyadh's claims that the Houthis have employed water-related infrastructures as offensive military instruments or positions, in any case not to the same extent as the coalition has targeted and destroyed these.

The Houthis have also instrumentalized the destruction of water resources and infrastructures to challenge the Saudi and UAE-led coalition and discourage the international aerial bombing campaign. On 10 September 2016, a Scud missile launched from Houthi-controlled territory targeted and struck Al Shuqaiq Water Desalination Plant in Saudi Arabia.[293] During the period 2015-2018, the Houthis fought an extensive and deadly "cat-and-mouse" game of rocket launches along the Saudi border, with coalition aerial retaliations.[294] The attack on Al Shuqaiq Water Desalination Plant represents an instance during which the Houthi

[290] Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project"; United Nations Security Council, "Final Report of the Panel of Experts on Yemen," January 31, 2017, 46; United Nations Security Council, "Final Report of the Panel of Experts on Yemen," January 25, 2019, 47, 176, 183.
[291] Ibid.
[292] Brendan Clifford and Christiaan Triebert, "Yemen's Bombed Water Infrastructure: An OSINT Investigation," Bellingcat, May 2, 2016, https://www.bellingcat.com/news/mena/2016/02/05/yemens-bombed-water-infrastructure/.
[293] Raleigh et al., "Armed Conflict Location and Event Data (ACLED) Project"; United Nations Security Council, "Final Report of the Panel of Experts on Yemen," January 31, 2017, 149.
[294] The origin of these weapons is a matter of heated discussion among regional actors. Saudi Arabia accuses Iran and affiliated groups, like Hezbollah, to have supplied the Houthis with such armament. Tehran refutes these accusations and United States' security agencies have stated that there does not exist hard evidence to support the direct material weapon support by Iran. What has been proven is that the Houthis have manufactured significant shares of their arsenal themselves, using foreign (Iranian) military expertise or weapon parts. The Houthi movement also captured a large amount of the Yemeni armed forces' weapons, including Scud missiles, when it captured Sana'a in 2014. المصدر أونلاين, "Yemen Houthi Drones, Missiles Defy Years of Saudi Air Strikes," *المصدر أونلاين*, September 18, 2019, https://almasdaronline.com/articles/171723; Knights, "The Houthi War Machine: From Guerrilla War to State Capture," 17–18.

movement intentionally targeted a key water infrastructure of its opponent for offensive purposes, serving tactical military motives.

5.3 Conclusions

After years of conflict between the Houthis and its warring parties, Yemen is now experiencing one of the worst water crises in the world.[295] The insecurity of access to fresh drinking water has transformed the control over water resources as a priority for all sides to the conflict. The Houthis recognize the strategic significance of controlling water and related infrastructures in the face of its opponent. Houthi combatants have purposely targeted and destroyed the water supplies of their opponent to weaken and crush their enemy's military campaign, thereby using water as an offensive weapon for tactical military motives. Houthi combatants have also systematically withheld populations sympathetic to its enemy from access to water resources for strategic political motives through siege and blockade tactics. In addition to targeting water to ensure water supplies to its own troops and to sustain its military campaigns, there are also instances during which the Houthis targeted – confiscating or destroying – civilian water supplies and infrastructures. Such tactics could also be intended to increase livelihood insecurity and induce fear among local populations to weaken potential resistance. However, it is difficult to distinguish these occasional attacks at civilian water resources and infrastructures as being part of a wider strategy that seeks to instrumentalize water as a weapon to further the Houthi movement's military and/or ideological objectives. Hence, these sporadic incidents do not reflect an apparent and systematic implementation of the strategic weaponization of water. The active withholding of enemy-held territory from access to water resources through siege and blockade tactics are more reflective of the coordinated and systemic instrumentalization of water as an offensive weapon and serves strategic political motives.[296] Water is manipulated for defensive purposes, serving tactical military motives, when the Houthis hide out in or position themselves on water infrastructure.

It is crucial to interpret the development of water as either a target or weapon of conflict in Yemen's internationalized civil war in the context of the country's dire water situation. The Houthis would not have been able to effectively instrumentalize restrained access to water resources as an offensive weapon through siege and blockade tactics if water resources would have been abundant in Yemen or if the besieged cities would have had competent water

[295] Suter, "An Update on Yemen's Water Crisis and the Weaponization of Water."
[296] Mohamed, Elayah, and Schulpen, "Yemen between the Impact of the Climate Change and the Ongoing Saudi-Yemen War: A Real Tragedy," 6.

infrastructure to supply its citizens with fresh drinking water. Without Yemen's arid climate, the strategic relevance of targeting water resources to secure one's own access or to deny the opponent from water supplies would also be significantly different. Still, in contrast to the consistent, systematic, and effective manner in which IS purposefully deployed water and related infrastructure as instruments of warfare and integrated water-related tactics into its strategies of conflict, it seems water is more of a casualty in Yemen then part of the Houthis' military fighting strategy. Though Houthis combatants have resorted to retaining water from its opponent or enemy-held territory, they did not enjoy the same capacity as IS to instrumentalize water as a weapon through flooding or contamination.[297] Above all, water and related infrastructures have increasingly become an ill-fated casualty of Yemen's internationalized civil war during the period 2014-2020. Years of aerial bombing campaigns and ground fighting between the Houthis and the Yemeni government supported by the Saudi-UAE led coalition have led to the widespread and ongoing destruction of the country's already fragile water infrastructure. Although there have been reports of the Houthis instrumentalizing water-related infrastructures as defensive positions, the targeting of water and water infrastructure in Yemen by the international coalition's air strikes have regularly been disproportionate relative to military necessity.[298] Yemen's exacerbating water crisis further increases the strategic importance of controlling the minimum water supplies left in the country and shapes the warfare strategies of all parties to the conflict.[299]

6. Conclusion

Based on the analysis of parallel and common patterns of behaviour of IS and the Houthis as well as divergences in the instrumentalization of water by these two non-state actors, this chapter will provide an answer to the research questions and deduce several hypotheses. After these concluding observations follows a discussion of the limitations of this study's findings.

[297] For flooding, the environment has to enable the manipulation of great supplies of water. Contaminating water is mainly effective for military purposes when it can be instrumentalized to affect large numbers of people without spoiling one's own water supplies. As Yemen does not posses any rivers and only has limited groundwater supplies, these options were not feasible to the Houthis.

[298] Clifford and Triebert, "Yemen's Bombed Water Infrastructure: An OSINT Investigation"; Dinstein, *The Conduct of Hostilities under the Law of International Armed Conflict*, 8–9; United Nations Security Council, "Final Report of the Panel of Experts on Yemen," January 25, 2019, 47–50; Yemen Data Project, "Data: Airwar."

[299] Mohamed, Elayah, and Schulpen, "Yemen between the Impact of the Climate Change and the Ongoing Saudi-Yemen War: A Real Tragedy," 5–6; Suter, "An Update on Yemen's Water Crisis and the Weaponization of Water."

6.1 Conclusion

The tactics and strategies through which IS and the Houthis have instrumentalized water as a target or weapon of conflict in the analysed time-frames in Iraq, Syria, and Yemen bear various striking similarities. Both IS and the Houthis have targeted water resources and infrastructures to sustain its own troops and military campaigns and engaged in what Homer-Dixon terms *resource capture*. Although the hydrological contexts in which IS and the Houthis differed, the strategic relevance underlying the capturing and controlling of major water infrastructures was some aspects comparable, namely to manipulate water supplies and withhold them from surrounding areas that were not yet confiscated and submerged under their rule. Both IS and the Houthis – although not to same extent and systemic method –instrumentalized water as offensive and defensive weapons for strategic political, tactical military, and coercive motives. Both groups also diverted seized water supplies for profit. Another similar pattern in the behaviour of IS and the Houthis involves the scorched-earth tactics the groups applied when their opponents threatened to recapture seized territory. In both case studies, water resources and related infrastructures became widespread *unintentional* targets – or casualties – of conflict when these were destroyed due to or the object of armed fighting between the non-state actor and its opponents.

Despite several parallels and common patterns of behaviour in the observed water-related tactics and strategies of the two groups, this research project also observes dissimilarities in the instrumentalization of water as a target or weapon of conflict by IS in Iraq and Syria and the Houthis in Yemen. Although both IS and the Houthis targeted water infrastructures because of its strategic relevance, the specific strategic purpose of capturing these infrastructures differed for the two groups. For IS, seizing key water infrastructures often implied gaining the capacity to manipulate large volumes of water from the Euphrates and Tigris Rivers. The significant instrumental power of controlling major dams in Iraq and Syria gave IS the ability to exert considerable influence over its enemy or populations sympathetic to their enemy in downstream (or surrounding) territory by withholding or releasing retained water behind a dam. The Houthis did not enjoy the same opportunity as IS to target and confiscate the major instrumental power resulting from the control over the waterflows of large rivers, simply because Yemen does not posses any rivers and water infrastructures retaining large volumes of water behind it. Another major difference concerns the way IS instrumentalized water to establish its legitimacy among local populations. This strategy reflects IS' ideology of building a legitimate Islamic state. Providing water to citizens to enhance its local legitimacy is not a tactic that is observed for the Houthis. This could be because practices of the group in Houthi

territory are not necessarily documented or because the Houthis do not prioritize seeking legitimacy among occupied populations. Although the conditions of Yemen's water situation would have allowed the implementation of this strategy, considering that water availability is a critical problem in the country, it could also be that the Houthis themselves do not posses sufficient water to engage in this strategy. In contrast to the consistent, systematic, and effective manner in which IS purposefully deployed water and related infrastructure as instruments of warfare and integrated water-related tactics into its strategies of conflict, it seems water is more of a casualty in Yemen then part of offensive or defensive combat strategies.

To conclude, this research project finds that non-state actors can instrumentalize water as part of military tactics and strategies by targeting or weaponizing water resources and infrastructures to serve both offensive and defensive purposes and attain strategic political, tactical military, and coercive motives. The analysis of the water-related conflict events of IS and the Houthis and discussion of common patterns and differences in the behaviour of these two non-state actors in their specific context leads to various observations. First, attributes of the non-state actor – like ideology, organization size, and military power – influence the modus operandi and purposes of the water weapon. In line with its state-building ideology, IS weaponized water to enhance its local legitimacy while this specific strategy is not observed for the Houthis. Secondly, the objective underlying military operations significantly shapes the targeting and weaponization of water by non-state actors. This research project observed an important shift in the water-related tactics and strategies between the expansionist and retreat operations of IS. Thirdly, the environment in which non-state actors operate, including its hydrological, economic and political conditions, has a considerable impact on the instrumental power of controlling water resources and infrastructures and shapes the targeting of water during episodes of conflict.

This research hypothesizes that the hydrological context shapes the instrumentalization of water as instruments of coercion and tools of a non-state actor's arsenal through various dynamics. First, water scarcity and depleted water resources increase the vulnerability and effectiveness of water as military a target and instrument during conflict. An important similarity of the water situation in Iraq & Syria and Yemen is that these countries' strained domestic water supplies contributed to and enhanced the strategic importance of targeting and seizing water resources and infrastructures for non-state actors. Moreover, scarcities of fresh water resources increase the dependency on this vital human resources, facilitating the manipulation of the quality, quantity, and allocation of water to dominate large swats of territory, populations, and economies. However, sufficient quantities of water still have to be

present to allow certain specific forms of the water weapon, such as flooding. Secondly, poor maintenance and other qualitative vulnerabilities of water infrastructures render them more susceptible to attacks. The ease with which IS confiscated and weaponized Iraq and Syria's water infrastructure has demonstrated the critical vulnerability of these countries' vital infrastructures and water management. Weak infrastructures also make it easier for smaller scale attacks to generate great impacts. Moreover, as seen in the case of Mosul Dam, inadequate expertise or technical resources to operate and manage and operate large water facilities can increase the risk emanating from water resources. Thirdly, water supplies are interlinked with and detrimental to many economic sectors, including agriculture, energy production, transportation, and tourism. These dependencies increase the long-term social and economic consequences non-state actors generate by targeting or weaponizing water. Fourth, the extent to which water resources are shared across national borders facilitates the extent to which the water weapon can be internationalized. The control of major dams in Syria gave IS the power to even control the waterflows of the Euphrates River into Iraq. This international ripple effect is aggravated when there exists no or little coordination between riparian countries on the allocation and management of shared water resources.

6.2 Limitations

In relation to the findings of this research, some limitations are noteworthy. First, as both IS and, though to a somewhat lesser extent, the Houthis represent high profile non-state actors with relatively strong organizational capacities and military capabilities, the generalizability of the results is in some regards limited. Not all non-state actors enjoy the same military and organizational power as these two non-state actors. The specific findings on IS and the Houthis might not be entirely reflective of the water-related military tactics and strategies used by groups that are militarily less capable or powerful. Smaller organized groups of violent non-state actors operating in lower-intensity conflicts would not necessarily target or weaponize water in similar ways and extents as IS and the Houthi movement have done in the analysed time-frames. Still, IS and the Houthis have used a highly diverse array of methods and tactics that can be also be adopted in other contexts. Even though non-state actors might have different capabilities or motivations or operate in smaller low-intensity conflicts, this does lead to think that violent non-state actors would not deploy the power of the water weapon if they would enjoy the ability or opportunity to do so. For instance, the Houthis' organizational capacity and capabilities can be considered as relatively modest in contrast to IS (particularly during the peak of its territorial expansion). However, Houthi combatants were still implementing similar

water-related tactics and strategies. The findings of this study can to a considerable degree also be extended to other cases and enhance understanding of less organized non-state actors operating in low-intensity conflicts. An interesting objective for future studies would be to conduct case study research or a large-N study on the targeting or weaponization of water resources and infrastructures by smaller organized violent actors in as well as beyond contexts of conflict.

Another limitation of this research project pertains to the issue of intent. In the analysis of the water-related conflict events by IS and the Houthis, determining the extent of deliberate purpose and specific motives of non-state actors in their acts can be incredibly difficult. For instance, in the case of the scorched-earth tactics by IS and the Houthis during which combatants of these groups deliberately destroyed or sabotaged water resources and infrastructures to deny their enemy from recapturing this vital human resource, water can clearly be considered a target of armed conflict. These tactics do not directly attack the opponent itself. However, when a boobytrap in a water pumping station kills enemy soldiers, these scorched-earth tactics transform water infrastructure in an offensive weapon. In this specific example as well as in other cases, non-state actors can in hindsight claim responsibility for such an offensive attack while the actor's initial intent of targeting water resources or infrastructures might have been different or even unintentional.

Finally, this research project experienced some limitations in relation to gathering data. Both IS and the Houthis represent non-state actors operating in critically volatile, disrupted, and almost forsaken environments. It could be the case that not all water-related acts by IS and the Houthis have been documented or are not necessarily documented by valid sources. This was especially the case for the analysis of the Houthis in Yemen. In addition to questions of validity in relation to some secondary sources, sources discussing the tactics and strategies of these non-state actors might also be subject to reporting bias. The highly cruel and devastating acts and operations of IS in Iraq and Syria and the Houthis in Yemen could invoke subjective disclosure. Even though the Houthis have clearly targeted, destroyed, and manipulated water resources and infrastructures, they are certainly not the only actor to Yemen's internationalized civil war who adopted these tactics. Focusing solely on the actions of this group could produce a distorted image of the brutal war-making realities on the ground. To examine the role of actions and operations by warring parties of IS and the Houthis on the water-related military tactics and strategies of these two non-state actors requires further research.

7. Discussion

This research project has found that non-state actors can instrumentalize water as part of military tactics and strategies by targeting or weaponizing water resources and infrastructures to serve both offensive and defensive purposes and attain strategic political, tactical military, and coercive motives. This section will discuss the academic and practical implications of these findings and provide some suggestions for further research.

7.1 Academic Implications

This study and its findings are academically relevant as they assessed Gleick's theory in relation to actual contexts of conflict involving the instrumentalization of water. The comparative case study analysis demonstrates that Gleick's hypotheses relating to the targeting or weaponization of water resources and infrastructures indeed represent how non-state actors can purposely instrumentalize water as part of military tactics and strategies. This study finds, however, that his hypothesis of water as a trigger of conflict does not hold analytical relevance for the study of the instrumentalization of water *during* episodes of conflict. If the causal relation between water and conflict as is the object of study – or particularly, water as the source for violence – Gleick's three categories would all serve applicable. Hence, this study illustrates the importance of clearly distinguishing and defining the specific role water plays for *the onset of* or *during* armed conflict.

As the theoretical approach for the instrumentalization of water *during* conflict, Gleick's model maintains analytical relevance. Still, the theoretical framework can be strengthened by combining Gleick's categories of 'water as a target' and 'water as a weapon' during conflict with the specific strategies and motives of the water weapon proposed by King and Von Lossow. Their conceptions of strategic political, tactical military, and coercive weaponization add relevant detail to Gleick's still relatively general categories. Together with Daoudy's insights relating to the importance of state-society relations, historical processes, and the dual capacities of water weaponization, this theoretical framework is able to generate profound understanding of how actors to a conflict can strategically instrumentalize water as part of military tactics and strategies. Applying the theories of these scholars individually would not enable the same extensive and thorough assessment of the water-related tactics and strategies of non-state actors. A challenge with applying King and Von Lossow's theory is that it is not always clear or straightforward what specific *intent* actors might have for weaponizing water. Moreover, actors might target water resources to sustain its own troops and fund its operations,

instead of weaponizing it for offensive or defensive purposes. These observations are relevant for future academic research on the instrumentalization of water resources and infrastructures during episodes of conflict.

In addition to the implications of this study for Gleick's theoretical model and the analysis of the instrumentalization of water during conflict, the findings of this study are relevant for the wider academic debate on the water-conflict nexus. The analysis has demonstrated that definite links exist between water resources or infrastructures and instances of armed conflict. The analysis of the water-related tactics and strategies of IS and the Houthis demonstrates the substantial role of agency on the dynamics between water and conflict. The links between water and conflict can be actively and intentionally produced, employed, and manipulated by violent non-state actors pursuing military goals. This definite and deliberate connection can be extended to other contexts of conflict, regardless of specific social, political, economic, and environmental contextual variables that shape the onset, development, and type of conflict.

7.2 Practical Implications

The findings of this research project also hold practical relevance. The comparative analysis has indicated how IS and the Houthis have instrumentalized water as a deliberate and integral part of military tactics and strategies. The targeting, employing, and manipulating of water resources and infrastructure seriously and extensively undermines and violates humanitarian considerations. In addition to the long-term collateral damages of these tactics that extent the domain of water, the water weapon directly attacks and harms citizens. The instrumentalization of water exceeds military necessity and should be condemned as such. The case studies of this research project describe the instrumentalization of water by two non-state actors. This study is aware of the challenges concerning the status of these new actors in international law. However, such water-related tactics and strategies can also be adopted by states and state-actors operating in conflict settings, rendering the findings of this study informative to international laws of war. Above all, this research project stresses the importance of adding more explicit detail to current laws addressing attacks on water resources and infrastructures as water-related military tactics and strategies involve a highly diverse array of methods as well as the necessity to strengthen existing legal enforcement mechanisms.

Alongside this study's relevance to international law, the in-depth descriptive analysis of the instrumentalization of water as a target or weapon of conflict by IS and the Houthis holds relevance for the security community. The thorough examination of the targeting, employing,

and manipulating of water resources, water-related infrastructure, and water issues as part of military tactics and strategies by IS and the Houthis could inform decision-makers, security institutions, and NGOs seeking to mitigate or prevent violence and conflict in the region. The comparative case study analysis could provide perspectives and focus points for counterinsurgency strategies. For example, this research project has demonstrated the strategic openings that environments with critical water scarcity present for terrorist groups. In both case studies, the drivers of water scarcity in Iraq, Syria, and Yemen, were further exacerbated by years of ineffective and unsustainable water management by the central government. Therefore, this study highlights the significance of structural military approaches to defend and strengthen civilian water resources and infrastructures as part of counterinsurgency policies. Moreover, effective water allocation and management are key to post-conflict peace-building efforts.

Another critical observation for the security community is the security risks emanating from climate change. The dire water conditions in Iraq, Syria, and Yemen have enabled and influenced the varied and often powerful tactics and strategies through which non-state actors have both deliberately and unintentionally instrumentalized water into targets or weapons of conflict. In Iraq, Syria, and Yemen, climate change – through rising temperatures, increasing evaporation rates, and climate-related hazards – adds and accelerates pressures on these countries' already severely strained domestic water supplies. Based on the observations that reduced water availability and access enable the instrumentalization of water resources and infrastructures and incites non-state actors to transform water into targets or weapons of conflict, this research hypothesizes that climate change facilitates the tactics and strategies through which non-state actors can instrumentalize water during future conflicts. Climate change is expected to increase strains on water availability in already water scarce environments and pressurize water resources in countries around the world. Therefore, climate change could expand strategic opportunities for violent non-state actors to wield water as a weapon. Moreover, increased water stress heightens the risk to international ripple effects by the weaponization of water. The growing adverse impact of climate change on environments globally renders research into the potential water-related tactics and strategies available to the arsenal of non-state actors as well as the development of water resources and infrastructures as potential targets of insurgency violence or sub-national conflict critically relevant and imperative. In this regard, further research could examine whether terror groups have changed their water-related attack behaviour and strategies when and where water resources have become more scarce and/or valuable.

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Appendix 1: Water as a Target or Weapon of Conflict for IS in Iraq & Syria

Table 1. Water-related conflict events by IS in Iraq and Syria

Islamic State							Water tactic	
Year	Month	Day	Event nr.	Country	Location	Event	Target/ Casualty	Weapon
2013	February		1	Syria	Al-Baath Dam	IS captures the Baath Dam and the Tabqah Dam, also known as the Euphrates or Al-Thawrah Dam. By taking these major northern Syrian dams on the Euphrates River, IS sought (and succeeded?) to take control of key towns along the river, including al-Bukamat, Deir-ez-Zor, Maskana, and Raqqa.	X	
			2	Syria	Al-Tabqa Dam	IS captures the Baath Dam and the Tabqah Dam, also known as the Euphrates or Al-Thawrah Dam. By taking these major northern Syrian dams on the Euphrates River, IS sought (and succeeded?) to take control of key towns along the river, including al-Bukamat, Deir-ez-Zor, Maskana, and Raqqa.	X	
			3	Syria	Al-Bukamal	IS seizes the key cities of al-Bukamal, Deir-ez-Zor, Maskana, and Raqqa positioned along the Euphrates River.	X	
			4	Syria	Deir-ez-Zor	IS seizes the key cities of al-Bukamal, Deir-ez-Zor, Maskana, and Raqqa positioned along the Euphrates River.	X	
			5	Syria	Maskana	IS seizes the key cities of al-Bukamal, Deir-ez-Zor, Maskana, and Raqqa positioned along the Euphrates River.	X	
			6	Syria	Raqqa	IS seizes the key cities of al-Bukamal, Deir-ez-Zor, Maskana, and Raqqa positioned along the Euphrates River.	X	
			7	Syria	Aleppo	IS reportedly contaminates water in Aleppo, Deir-ez-Zor, Idlib, and Raqqa through the destruction of sewage systems or poisoning of water resources with chemicals, toxic waste, or crude oil.		X
			8	Syria	Deir-ez-Zor	IS reportedly contaminates water in Aleppo, Deir-ez-Zor, Idlib, and Raqqa through the destruction of sewage systems or poisoning of water resources with chemicals, toxic waste, or crude oil.		X
			9	Syria	Idlib	IS reportedly contaminates water in Aleppo, Deir-ez-Zor, Idlib, and Raqqa through the destruction of sewage systems or poisoning of water resources with chemicals, toxic waste, or crude oil.		X
			10	Syria	Raqqa	IS reportedly contaminates water in Aleppo, Deir-ez-Zor, Idlib, and Raqqa through the destruction of sewage systems or poisoning of water resources with chemicals, toxic waste, or crude oil.		X
2014	January	4	11	Iraq	Fallujah	IS captures the city of Fallujah, a strategic position along the Euphrates River.	X	
	January-April		12	Iraq	Mosul	IS targets Mosul Dam, but Iraqi state forces manage to retain the facility.	X	
	January-June		13	Iraq	al-Muqdadiya	IS combatants flood a total of 22 villages in Miqdadiya and Saadiya in Diyala province.		X
			14	Iraq	Saadiya	IS combatants flood a total of 22 villages in Miqdadiya and Saadiya in Diyala province.		X
	January-June		15	Iraq	Mosul	IS targets water supplies for refugee camps in Iraq holding refugees from Mosul due to water and energy shortages there.	X	
	April		16	Iraq	Fallujah	IS captures Nuaimiyah Dam near Fallujah, retaining water behind the dam at first and later flooding land over 100 kilometres afar, including Abu Ghraib as well as 200 square kilometres of fertile farmland, resulting in the displacement of almost 60,000 people. The release of a flood wave was also intended to prevent advancing Iraqi forces from retaking seized territory.	X	
	April		17	Iraq	Abu Ghraib	IS captures Nuaimiyah Dam near Fallujah, retaining water behind the dam at first and later flooding land over 100 kilometres afar, including Abu Ghraib as well as 200 square kilometres of fertile farmland, resulting in the displacement of almost 60,000 people. The release of a flood wave was also intended to prevent advancing Iraqi forces from retaking seized territory.		X
	April	17	18	Iraq	Bayji	IS combatants demolish an oil pipeline near Bayji. According to the Iraqi Ministry of Water Resources, the resulting oil spill critically contaminates the water supply to Baghdad and threatened the city with a critical water crisis.		X
	May-June		19	Syria	Aleppo	IS repeatedly cuts off water and electricity supplies to the city of Aleppo to weaken its opponent in the highly segregated city and to undermine the legitimacy of the Syrian government.		X
	June		20	Iraq	Qaim	IS captures the cities of Qaim and Rawah which are strategically located along the Euphrates River, together with the occupation of Fallujah, this essentially endowed IS with the power to control the water supplies behind Haditha and Tharthar Dam.	X	
	June		21	Iraq	Rawah	IS captures the cities of Qaim and Rawah which are strategically located along the Euphrates River, together with the occupation of Fallujah, this essentially endowed IS with the power to control the water supplies behind Haditha and Tharthar Dam.	X	
	June		22	Iraq	Haditha Dam	IS made its first advance on the Haditha Dam, Iraq's second largest reservoir dam which regulates the Euphrates River for the whole country, in June 2014. The following months witnessed multiple, sometimes heavy assaults on the facility, though IS never succeeded in occupying Haditha Dam.	X	

2014	June		23	Iraq	Qaraqosh	IS isolates the Christian populated town of Qaraqosh in northern Iraq completely of water by blocking water pipes and interrupting all external trade connections from the town.		X
	June		24	Iraq	Khalidiyah	IS troops deprive Khalidiyah and Habbaniyah in the al-Anbar province – areas under the control of the Iraqi government – of water supplies.		X
	June		25	Iraq	Habbaniyah	IS troops deprive Khalidiyah and Habbaniyah in the al-Anbar province – areas under the control of the Iraqi government – of water supplies.		X
	June	12	26	Iraq	Tikrit	IS combatants kill over a thousand Iraqi army cadets at Camp Speicher, near Tikrit, and dump their bodies into the Tigris, thereby dangerously contaminating the water of the river for downstream users.		X
	June		27	Syria	Aleppo	IS cuts off water supplies to the city of Aleppo for ten continuous days.		X
	July		28	Iraq	Samarra Barrage	IS seizes the Samarra Barrage west of Baghdad on the Tigris River, providing IS with the power to flood surrounding areas of the lake, including the city of Baghdad.	X	
	August	7	29	Iraq	Mosul	IS confiscates the Mosul Dam and employs water supply to the city of Mosul to neutralise opposition, to gain legitimacy, and to recruit new followers or combatants among the local population. IS also employed its control of the water and power networks in Mosul to cut off water and energy supplies to surrounding areas that were not yet confiscated or retaken from their rule.	X	
	August	7	30	Iraq	Mosul	IS confiscates the Mosul Dam and employs water supply to the city of Mosul to neutralise opposition, to gain legitimacy, and to recruit new followers or combatants among the local population. IS also employed its control of the water and power networks in Mosul to cut off water and energy supplies to surrounding areas that were not yet confiscated or retaken from their rule.		X
	August		31	Iraq	Mosul	IS loots and demolishes all operating equipment of the Mosul Dam when Kurdish forces are seeming to regain the facility, thereby impeding grouting operations that ensure ground stability below the dam.	X	
	August-September		32	Syria	Raqqa	Armed confrontations between IS combatants and Syrian government forces in Raqqa result in the destruction of the city's water plant and the cutting of local drinking water supplies.	X	
	September		33	Syria	Yarmuk	Clashes between IS and Syrian state forces demolish pipelines that supply drinking water to the Yarmouk refugee camp in southwestern Syria.	X	
	September		34	Syria	Tishrin Dam	IS combatants in Syria seize control of the Tishrin Dam on the Euphrates River, thereby controlling government water supplies and hydroelectricity power generated by the facility. IS uses its control of the dam to cut water supplies to Raqqa and Aleppo.	X	
	September		35	Syria	Aleppo	IS uses its control of the Tishrin Dam to cut water supplies to Raqqa and Aleppo.		X
	September		36	Syria	Raqqa	IS uses its control of the Tishrin Dam to cut water supplies to Raqqa and Aleppo.		X
	September		37	Iraq	Shirwain	IS combatants flood nine villages and 200 acres of farmland in the Shirwain area of the Diyala province by diverting water from adjacent rivers to obstruct the advance of Iraqi government troops.		X
	September		38	Iraq	Baghdad	Near Baghdad, IS combatants reportedly use chlorine abstracted from water treatment plants across the country as a weapon against Iraqi state troops and Shia militia forces.		X
	September-October		39	Iraq	Sudur mini-dam	IS cuts water flows from the Sudur mini-dam in Iraq to Balad Ruz to obstruct the advance of Iraqi state troops.		X
	September-October		40	Iraq	Balad Ruz	IS cuts water flows from the Sudur mini-dam in Iraq to Balad Ruz, a predominantly Shiite-populated area in Diyala province.		X
	October		41	Iraq	Samarra Barrage	IS targets Samarra barrage near Baghdad, planning to open the gates of the facility and flood the underlying lands, but the Iraqi army impedes the assault.	X	
	October		42	Iraq	Talkhaneim, Gwer	IS combatants cut off electricity to the water wells of the village of Talkhaneim, near Gwer in northern Iraq, to pressurize and financially exploit the local population.		X
	December		43	Iraq	Balad district	IS contaminates drinking water with crude oil in the Balad district of the Salahaddin Governorate.		X
2014-2015			44	Syria	Aleppo	IS contaminates drinking water in Aleppo, Baghdad, Deir-ez-Zor, Mosul and Raqqa.		X
			45	Syria	Deir-ez-Zor	IS contaminates drinking water in Aleppo, Baghdad, Deir-ez-Zor, Mosul and Raqqa.		X
			46	Iraq	Mosul	IS contaminates drinking water in Aleppo, Baghdad, Deir-ez-Zor, Mosul and Raqqa.		X
			47	Syria	Raqqa	IS contaminates drinking water in Aleppo, Baghdad, Deir-ez-Zor, Mosul and Raqqa.		X
			48	Syria	Al-Tabqa Dam	IS continues the operation of the major dams in Syria, like the Euphrates Dam in Tabqa, to provide its combatants as well as local populations with water and electricity.		X

	January	11	49	Iraq	Samarra	An explosive-laden boat, reportedly positioned there by IS combatants, is discovered and dismantled by Iraqi security forces near a weir on the Tigris River in Samarra city.	X	
	January	28	50	Iraq	Adhaim	IS combatants allegedly attack the dam in Adhaim area, Diyala governorate.	X	
	January		51	Syria	Al-Baath Dam	IS uses its control of the Baath Dam to cut off water and energy to the Deir-ez-Zor area south of Raqqa, thereby affecting over 300,000 people.		X
	Early 2015		52	Iraq	Ramadi	IS combatants reportedly target the Ramadi Dam and the main Tharthar regulator which links the Euphrates and Tigris rivers with vehicles and boats loaded with explosives, suicide car bombs, and armed attacks to Iraqi troops.	X	
	May		53	Iraq	Ramadi	IS succeedes in capturing the Ramadi dam.	X	
2015	May		54	Iraq	Ramadi	IS partially closes the gates of Ramadi Dam, causing an increased flow of water from the Euphrates into Habaniyah Lake and reducing the water flow of the Euphreates River temporarily with 50 percent. This critically limits the supply of water to irrigation systems and treatments plants in the provinces of Babil, Karbala, Najaf, and Qadisiya and causes severe food insecurity for the whole country. In addition, IS uses its control of the dam to lower water levels of the Euphrates River beneath the dam, allowing its IS troops to cross the river and attack Iraqi troops at the opposite bank before continuing its advance towards the city of Ramadi.		X
	March to October		55	Syria	Tabaqa Dam	From March to October 2015, IS employed its occupation of the Tabaqa Dam in Syria to cut practically all water flow from the Euphrates River to Iraq.		X
	November		56	Syria	Homs	IS troops attack Homs, which would give them strategic dominance over Qattinah Lake - or Lake Homs - and the water flows of the Orontes river. Though IS captures various towns in Homs province, the city of Homs is held off by Syrian government forces.	X	
	December		57	Syria	Tishrin Dam	IS combatants reportedly plant explosive devices within the Tishrin Dam to destroy it when DSF forces are likely to recapture the facility.	X	
			58	Iraq	Habbaniya	The tactic of manipulating water levels to facilitate the movement of IS troops has also been applied during attacks on Habboniya, Husaybah, and Khalidiyah to facilitate the movement and advance of IS troops.		X
			59	Iraq	Husaybah	The tactic of manipulating water levels to facilitate the movement of IS troops has also been applied during attacks on Habboniya, Husaybah, and Khalidiyah to facilitate the movement and advance of IS troops.		X
			60	Iraq	Khalidiyah	The tactic of manipulating water levels to facilitate the movement of IS troops has also been applied during attacks on Habboniya, Husaybah, and Khalidiyah to facilitate the movement and advance of IS troops.		X
	January	3	61	Iraq	Tharthar	IS combatants executed a coordinated attack on the Ath Tharthar Water Dam area in Tharthar, Al Anbar.	X	
	January	16	62	Syria	Deir ez-Zor	IS suicide bombers detonate explosives-laden vehicles towards and combatants attack the Basel al-Assad Water-Pumping Station in Deir ez-Zor city.	X	
	March	9	63	Iraq	Muqdadiyah	Four suspected IS mortar shells fall near a water purification plant in Abi Saida, resulting in material damages.	X	
	March	26	64	Iraq	Mosul	An airstrike from the international anti-Islamic State coalition killed four IS snipers who were hiding inside a water tank in As Salahiyah village, south of Mosul.		X
	March	27	65	Iraq	Hit	Islamic State combatants reportedly cut off water supplies for citizens of Kabisa.		X
	June		66	Iraq	Fallujah	IS blows up the floodgates of the Fallujah Dam when it faced loosing control of the dam to Iraqi state forces.	X	
2016	August	2	67	Iraq	Mosul	Near Qayara, IS combatants open an oil pipe into the Tigris River, letting the oil flowing into it to make the water undrinkable.		X
	September	3	68	Iraq	Ar Rutba	IS militants reportedly devastate a water station that supplies all residents of Ar Rutba district with drinking water.	X	
	October	17	69	Iraq	Khalis	IS combatants destroy five water pumps employed for the irrigation of the farmlands in the villages of Hawsh al-Hawi north of Baquba.	X	
	October	25	70	Iraq	Baquba	IS combatants bomb an agricultural pump near Al-Khulafa village with explosive devices, completely devastating the pump that provides irrigation water to large areas of farmland in the region.	X	
	November	25	71	Iraq	Ramadi	IS combatants capture a water station in Ramadi city.	X	
	December	11	72	Iraq	Mosul	Iraqi security forces discover fifteen decomposed bodies of civilians, reportedly executed by IS, thrown into a water well and contaminating the water of the well south of Mosul in Saf al-Tout.		X

2016			73	Iraq	Ninewa province	IS deliberately empties water tanks, contaminates or destroyes irrigation wells, and demolishes or even boobytraps water pumping stations and irrigation systems in the Sinjar district in Nineveh governorate and Kirkuk governorate, but also beyond Sinjar area.	X	
			74	Iraq	Kirkuk province	IS deliberately empties water tanks, contaminates or destroyes irrigation wells, and demolishes or even boobytraps water pumping stations and irrigation systems in the Sinjar district in Nineveh governorate and Kirkuk governorate, but also beyond Sinjar area.		X
2016-2017			75	Iraq	Northern Iraq	When IS faces the risk of loosing territory, it resorts to scorched-earth tactics, blowing up bridges, blocking water canals, and planting mines in the ruins of water pumping stations. Iraqi troops encountered the devastation and boobytraps left behind by IS' retreating fighters during the recapturing of occupied territories throughout 2016 and 2017.	X	
			76	Iraq	Northern Iraq	When IS faces the risk of loosing territory, it resorts to scorched-earth tactics, blowing up bridges, blocking water canals, and planting mines in the ruins of water pumping stations. Iraqi troops encountered the devastation and boobytraps left behind by IS' retreating fighters during the recapturing of occupied territories throughout 2016 and 2017.		X
2017	January	19	77	Iraq	Mosul	IS burns down Al-Guba water purification plant in Rashidiyah north of Mosul.	X	
	February	17	78	Syria	Dayr Hafir Plain	IS combatants flood villages under their occupation in the Deir Hafer Plain of east Aleppo by pumping water supplies from Lake Assad into the Al-Jar channel in response to advance of the Syrian Arab Army.		X
	March	6	79	Syria	Ar-Raqqa	IS militants bomb and almost completely destroy the high water tank in Al-Ahwas village in eastern Ar-Raqqa with explosive devices.	X	
	April	11	80	Iraq	Unknown	IS combatants launch rockets at water wells in western Nineveh governorate.	X	
	May	15	81	Syria	Al-Thawrah	An IS-planted landmine explodes in the Water Department of Tabqa city in Ar-Raqqa.	X	
	May	23	82	Syria	Jurneyyeh	IS combatants bomb the main water tank tower in Al-Hamam village in Ar-Raqqa governorate.	X	
	May	29	83	Syria	Mansura	IS bombs and devastates the water tank in Mansura area in the western countryside of Raqqa.	X	
	October	27	84	Iraq	Al Qaim	Amidst the launch of the second phase to liberate al-Qaim and Rawa from the Islamic State, The Popular mobilization (PMF) recaptured several strategic locations including an Islamic State communications center, the 70 Rest area and the 70 Water station. While advancing into IS-held al-Qaim, PMF units continuesly encounter booby-trapped vehicles, IEDs, and an SVBIED.		X
	November	15	85	Iraq	Abu Karmah	IS troops cut off the water flow to the village of Abu Karma by diverting the river that passes through the orchards of Mukhisa.		X
	November	15	86	Iraq	Qaryat al Mukhaysah	Iraqi security forces come across several IEDs installed around the blockade of the river in the area of Mukhisa that supplies Abu Karma with water and was cut off by IS combatants.	X	
2018	October	4	87	Iraq	Gharib	IS combatants allegedly plant and detonate a number of explosive devices targeting a water project site in Gharib, Kirkuk.	X	
	October	6	88	Iraq	Abbasi	IS troops reportedly blow up two water stations at a water plant in al-Abbasi, Kirkuk.	X	
	October	9	89	Iraq	Albu Jawari	IS detonate an explosive device near a water plant in Albu Jawari.	X	
	October	17	90	Iraq	Hakanah	IS detonate an explosive device targeting the vehicle of the Al Hadar Water Department director in Hakanah, south of Mosul.	X	
2019	July	9	91	Iraq	Shirqat	Two IEDs reportedly planted by IS explode near the water project in Shati al-Jidr village in the district of Sharqat.	X	

Appendix 2: Water as a Target or Weapon of Conflict for the Houthis in Yemen

Table 2. Water-related conflict events by the Houthis in Yemen

Houthi movement							Water tactic	
Year	Month	Day	Event nr.	Country	Location	Event	Target/ Casualty	Weapon
2015	April	8	1	Yemen	Aden-Al Maalla	Battles rage in Mu'alla and Crayter, with Houthi snipers reportedly taking positions on the hills and opening blocked roads with armored vehicles. Airstrikes and mortar fire pound the area. Several key water and electricity institutions are hit in the fighting.	X	
	April		2	Yemen	Taizz	In the battle for control of Taiz, Houthi combatants use siege and blockade tactics to restrict their opponent's access to water resources since April 2015.		X
	December	1	3	Yemen	Taizz-Salah	Shelling by the Houthi-Saleh alliance falls near a charity tank in Al-Kwait neighborhood in Salah district of Taiz.	X	
2016	September	10	4	Saudi Arabia	Al Shuqaiq	A Scud missile launched from Houthi-controlled territory strikes Al Shuqaiq Water Desalination Plant in Saudi Arabia.		X
	September	18	5	Yemen	Taizz	A rocket launched by the Houthis hits a hospital in Taizz, damaging solar panels and water storage.	X	
	September	28	6	Yemen	Taizz-Ath Thawrah	A mortar fired by Huthi forces strikes al-Thawra hospital, damaging its solar panels, water tanks and pipes, which causes all surgical operations to be temporarily suspended.	X	
	December	13	7	Yemen	Taizz	Pro-Houthi forces reportedly shell a civilian's house in the Water project neighborhood in Taiz city.	X	
2017	February	24	8	Yemen	Marib Dam	Al Houthi-Saleh forces claim to have launched a Zilzal-2 ballistic missile from Nihm district, Sana'a governorate towards Hadi government forces near Ma'rib Dam. Ma'rib Dam provides water for Ma'rib city and surrounding agricultural production in central Ma'rib governorate.	X	
			9	Yemen	Taizz	To conceal from and complicate air surveillance and targeting, the Houthi forces commonly build their bunkers on vegetated wadis where they can use the camouflage of the trees. Moreover, in both rural and urban areas, the Houthis established their command centres and arms supplies on critical infrastructures, including bridges, dams, hospitals, and schools, as these are officially on the restricted target list or "no target" list.		X
2018	May	22	10	Yemen	Hays	Pro-Houthi forces destroy water collection tanks in Bani Zuhayr village west of Hays city when they risk losing control over Hays city. The tanks are reportedly the only source of water for the citizens of Hays district.	X	
	June	7	11	Yemen	At Tuhayta	Pro-Houthi forces blow up the main water tank of Tuhayta as anti-Houthi forces were closing in on the city.	X	
	August	5	12	Yemen	Ad Durayhimi	The principal water tank of Durayhimi district, which supplies most of the district in drinking water, is reportedly targeted by bombing. Conflicting reports from local sources attribute the bombing to either pro-Houthi forces or Saudi-led coalition Apache helicopters that were targeting Houthi snipers near the tank.	X	
	November	20	13	Yemen	Al Wahabiyah	The Saudi-led coalition launches two airstrikes at Houthi forces in the Al Wahabiyah area in Al Sawadiyah district, Al Bayda governorate, hitting a water dam and killing a number of Houthi fighters.	X	
2019	January	1	14	Yemen	Al Hudaydah-Al Masna	A Houthi-planted landmine goes off in Al-Masna area south of Hodeidah, thereby killing two children who were collecting food and water.	X	
	January	5	15	Yemen	Al Jabaliyah	Pro-Houthi forces fire mortal shells near Hays city, thereby devastating a water tanker.	X	
	January	30	16	Yemen	Hays	Pro-Houthi forces reportedly fire mortar shells near the city of Hays in the south of Hodeidah governorate, western Yemen. Several houses and a water tanker however were severely damaged by shrapnel in the area.	X	
	June	17	17	Yemen	Hays	During the shelling of Hays city by pro-Houthi forces, a mortar fell near a water tank on June 17.	X	
	July	4	18	Yemen	Jabal Murays	Pro-Houthi forces reportedly fire heavy and medium weapons at residential villages east of Murays mountain in Qaatabah district, north of Ad Dali governorate, damaging houses and destroying a well and a water pump.	X	
2020	March	26	19	Yemen	At Tuhayta	Pro-Houthi forces reportedly target the main water silo of At Tuhayta district (Al Hudaydah) with caliber 23mm artillery, damaging it.	X	
	March	30	20	Yemen	Kamaran	Four Saudi-led coalition air raids target three water wells on Kamaran Red Sea island, western Yemen. Riyadh declares that it has targeted and hit several Houthi targets in Sana'a and Hodeidah governorates, including locations utilized to store and assemble drones and ballistic missiles. There is no hard evidence that the Houthis used these water wells as weapons storage.	X	
	October	25	21	Yemen	At Tuhayta	Houthi forces target and destroy solar energy infrastructure in At-Tuhayat district, leading to the suspension of a key water project and deprivation of drinking water to 30.000 civilians.	X	