ENGINEERING THE NILE:
IRRIGATION AND THE BRITISH EMPIRE IN EGYPT, 1882-1914

by

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Abstract

This thesis examines technological and social mechanisms of British imperial water control as created and managed by British irrigation engineers in Egypt between 1882 and 1914. In the aftermath of the British military conquest of the Ottoman colony, irrigation engineering was lauded as a way to make Egypt prosperous and financially solvent through the growth and sale of cash-crop cotton on the global market. The irrigation engineers who transferred into Egypt in the wake of the British occupation to enact this revivification of irrigation were Indian-experienced military engineers; these Royal Engineers officers and their British superiors in Egypt and the Foreign Office enacted the principles of late nineteenth century liberal economy, including the construction of large-scale public works.

The British engineers imported their Indian experiences when they transferred to the Egyptian Irrigation Department. Their engineering epistemologies included economic frugality, an emphasis and reliance on hydraulic science, and skepticism of the viability of local irrigation practices. Permanent dams were built or reconstructed across the Nile at Cairo (Delta Barrage, 1887-1890) and at Aswan (Aswan Dam, 1898-1902). With these structures, among other major projects, the engineers created a system of water control that extended their abilities to manage the Nile and local irrigation practices. Always chaotic, contingent, and geographically and temporally specific, the engineers forced Egyptian peasants, cash crop cotton, and the Nile into the interconnected web of politics, economics, and science that was transnational British imperialism.
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Chapter 1

Introduction: Egypt-Making

The Nile is Egypt’s all in all – to be trained and cockered, filled up now, emptied out then, coaxed into giving the greatest possible life and leaving behind the least possible death. Egypt is… the land of the engineer… The British engineers in this country are making it – quite literally and visibly and palpably making Egypt. The Barrage is one of the greatest pieces of Egypt-making in the country.”¹


This encomium to British hydraulic engineering highlights not only the centrality of British irrigation engineers to redirecting and controlling the Nile but also their crucial place in colonizing modern Egypt. If the Nile was Egypt’s “all in all” then those British irrigation engineers were involved in an inherently risky project of making, re-making, or even un-making the British-occupied territory.

These words were written after a visit to the Delta Barrage impressed upon the author the importance of a small group of British engineers to the occupation of Egypt. The individual engineers were given an enormous amount of political power and the way that they made Egypt was reflective of British imperial priorities. At its simplest level, for

the irrigation engineers, Egypt-making meant the social, economic, and political structures of power, as well as the physical technologies and the system of irrigated agriculture that it represented. My purpose in this thesis is to illuminate the technological and social mechanisms of British imperial water control as created and managed by British irrigation engineers between 1870 and 1914.

1.1 The Project

Egypt-making was calculated to manufacture, maintain, and expand technical control over water in the *de facto* British colony through physical irrigation projects – dams, barrages, canals, basins, and smaller works. These projects will therefore be the focus of this dissertation – their genesis, execution, and economic, environmental and social repercussions. Water control was understood by the British bureaucrats and engineers alike to be the best and most expedient way to make Egypt a lucrative protectorate. British irrigation engineering caused comprehensive and long-term effects. Between 1882 and 1914, the engineers created a system of agricultural supervision through irrigation dominance, which this thesis will detail. These technological irrigation projects were also calculated to increase colonial control over the agricultural populations through harnessing and managing water control. The specific developmental doctrines

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2 “Projects” is conceived broadly here, to represent both the physical infrastructure as well as the more broadly dispersed system of associated water management that accompanied the British enactment of irrigation systems in Egypt. Clearly, this is a form of development, but one with only shades of the implied morality of twentieth century development projects, Egyptian irrigation projects winked at helping the lower classes of rural Egyptians.
hinged on dedicated expert supervision of scientific irrigation regimes, and operated through increasingly sophisticated mechanisms of water control. Always messy, contingent, and geographically and temporally specific, the engineers brought Egyptian peasants, cash crop cotton, and the Nile into the interconnected web of politics, economics and science that was transnational British imperialism.

The engineers and the technologies they designed cannot be discussed in separate frames of reference; to do so risks decontextualizing either or both. A large part of this thesis has been to develop an understanding of how the engineers determined which technologies were implemented, how these were distributed into an existing irrigation network, and reasons behind altering the systems of irrigated agriculture. The engineers’ own understandings of irrigation were mediated through their educational, institutional, and individual histories. This thesis, therefore, explains in some detail those engineering educations, and specifically how they approached irrigation and hydraulic engineering. In the case of the Egyptian irrigation system, its British engineers were almost exclusively trained and experienced in South Asian colonial irrigation projects, and they carried with them *military* engineering doctrines.

Although historians of imperial South Asia recognize that the early irrigation projects, among the first large-scale British imperial public works, were constructed and designed by military engineers of the East India Company’s armies and later the Corps of

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3 This is Ken Alder’s argument in his exemplary study of engineers *Engineering the Revolution* (1997). His work will be discussed in more detail throughout this thesis and with special emphasis in the historiography section in this chapter. *Ken Alder, Engineering the Revolution: Arms and Enlightenment in France, 1763-1815* (Princeton: Princeton University Press, 1997).
Royal Engineers, the full impact of this military engineering has been all but ignored in favour of discussing the more theoretically-minded civil engineers of the later nineteenth century.\footnote{Daniel Headrick goes so far as to say that modern hydraulic engineering started in British India with the military engineers of the East India Company’s Armies. Daniel Headrick, Tentacles of Progress: technology transfer in the age of imperialism, 1850-1940 (Oxford: Oxford University Press, 1988), 175.} In the historiography, therefore, it is usually assumed that once the military engineers stopped being placed to low-level irrigation department positions in the mid-1870s, they stopped being important.\footnote{More recently, Thomas R. Metcalf has argued that the appointment of British Indian-experienced engineers in Egypt marked “the first stage in the empire-wide diffusion of Indian practices of water management.” Thomas R. Metcalf, Imperial Connections: India in the Indian Ocean Arena, 1860-1920 (Berkeley: University of California Press, 2007), 45.} Nothing could be farther from the truth. The most important point in military irrigation engineering was between the 1870s and the early 1900s, when military engineers were high level bureaucrats and educators. Military engineers were also responsible for starting a handful of Indian and British civil engineering colleges, which trained a large proportion of the imperial engineers.\footnote{See: David Gilmartin, “Imperial Rivers: Irrigation and British visions of Empire,” in Decentring Empire: Britain, India, and the Transcolonial World, ed. Durba Ghosh and Dane Kennedy (London: Orient Longman, 2006), 81-82. This statement is in puzzling contrast to the rest of Gilmartin’s otherwise excellent article, which will be referred to throughout this thesis for its discussion of water duty, river systems, and civil engineers. Ibid., 76-101.} Acting as college principles, teachers, supervisory engineers, and politicians, the army engineers and their civil engineer pupils took uniquely military epistemologies and applied them to the large-scale projects undertaken by the British Empire in India and afterwards in Egypt. Whether a rehabilitation of existing systems or entirely new canals these projects were designed to make the British Empire more agriculturally productive through capital outlay towards public works.

\footnote{K.V. Mital, History of the Thomason College of Engineering (1847-1949) on which is founded the University of Roorkee (Roorkee: University of Roorkee, 1996), 15.}
Imperial science is described in this thesis through the technological and social projects of the engineers. They were attempting to understand and control Egyptian irrigation systems utilizing technologies and practices developed in Southeast Asia – and importing them messily into Egypt. This transnational application of hydraulic science not only governed the construction of technologies, but also the ways that the engineers thought about and managed Egypt’s water. Water control mediated and furthered Egyptian social control. Everything the engineers designed and constructed was meant to increase control over water supply – specifically the Nile’s floods – and decrease the amount of water that was not utilized at some point in its journey through Egypt. The technical projects of Egypt-making did what they set out to do: improve the amount of cash-crop cotton grown and increase the number of crops grown in Egypt every year. Because these projects failed to take into account certain unique social, geological, and hydraulic factors, in the longer term the projects have locked Egypt into a fundamentally unsustainable system of water delivery.

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7 As will be discussed at length in the methodology section below, this thesis follows Kapil Raj’s distinction between “two aspects of science: its material and social practices on the one hand, and the knowledge to which they gave rise on the other.” Kapil Raj, “Colonial Encounters and the Forging of New Knowledge and National Identities: Great Britain and India, 1760-1850,” Osiris, 2nd Series 15 (2000): 133. However, my own work states that the social practices and the local technologies from which the imperial science was derived were not treated equally by imperial scientists. In this thesis, therefore, irrigation practice, although my own term, can be defined as “the social organization of water supply and use.” Janusz Gudowski, “Water Management Systems in Egypt and their Organizational and Technical Modernisation in the Years 1905-1960,” Africana Bulletin 32 (984): 96.

8 Technological lock-in is one of this dissertation’s main theoretical underpinnings and will be discussed in some detail in Chapter 6. According to Chinese environmental historian Mark Elvin, lock-in has two predominant social components: 1) its abandonment would cause production losses, social stability and/or physical security; and 2) a “substantial proportion of the economy’s... available resources were required for the maintenance of the system.” Mark Elvin, The retreat of the elephants: an environmental history of China (New Haven: Yale University Press, 2004), 123-124.
Imperial and transnational people, places, and structures were of the highest importance in British-controlled Egypt between 1882 and 1914. The imperial sensibilities of the engineers, their transnational education, professional connections, and the international monetary system meant that the story of British irrigation engineering as a whole was inseparable from a number of human actions and social systems, and non-human forces that had their genesis outside of Egypt. The engineers’ science was simply one aspect of these networks. Towards the end of the nineteenth century, the engineers increasingly saw themselves as belonging to an international “brigade of hydraulic engineers” – which defined its leaders and principles globally. Rather than looking just to Britain, the Anglo-Egyptian government also looked to the Indian Ocean basin as an “interregional arena.” However, the most important international factor of all was the river itself. During this time period, the success or failure of all Egyptian agriculture rested on the annual rise and fall of the Nile; none of its waters originated within the boundaries of Egypt itself.

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9 This thesis alternatively uses the terms British-controlled, British-occupied and Anglo-Egyptian to describe the governmental structures that were in place between 1882 when Egypt was militarily occupied and subjugated, and 1914 when it became a formal protectorate of the British Empire. All three of these terms describe the importance of the British military, political, economic, and social policies on the de jure Ottoman colony.


1.2 A very short history of irrigation in British Egypt, 1882-1914

The Ottoman colony that the British army invaded in 1882 was very different politically and agriculturally from the state that Napoleon Bonaparte had conquered between 1798 and 1801. In 1798, Egypt had been ruled by Mamluks, the Turkic warrior castes who ruled for the Ottoman Sultan, and had since 1517.12 Napoleon destroyed Mamluk rule and after his armies retreated, the ambitious Mehmet ‘Ali took power in the name of the Ottoman state. In the 1830s and 1840s, Mehmet ‘Ali fought a war against the Porte, and although militarily defeated, he won the rights to a semi-independent Egyptian state with the Sudan as a colonial possession and inheritance for his hereditary heirs.13

Critically for this thesis, Mehmet Ali’s attempts to create wealth for Egypt had included the promotion and monopolization of long-staple cotton for cash-crop farming and export.14 As will be discussed at greater length in Chapter 4, although the Ottoman Sultanate ostensibly ruled Egypt Mehmet Ali’s dynasty had political authority over the internal policies between the 1840s and 1882. That these rulers chose to continue to promote cash crop cotton made the state rich in the 1860s during the American Civil War – when demand for Egyptian long-staple cotton boomed – and allowed them to construct the Suez Canal. However, debt incurred at the construction of the Suez Canal, high-

12 The best recent work that has come out situating the Egyptian environment and the Nile within the purview of Ottoman governance is written by Alan Mikhail. See: Alan Mikhail, Nature and Empire in Ottoman Egypt: an environmental history (Cambridge: Cambridge University Press, 2011).
interest loans, and sharply declining cotton profits after the American Civil War meant that the Egyptian government went bankrupt in 1876, and its European creditors imposed severe economic and political restrictions to ensure repayment.

The most important of these restrictions was the creation of the Council of the Public Debt (Caisse de la Dette Publique, or Caisse). All financial decisions made by the Egyptian government had to pass through the Caisse, and the government could not borrow money without the express consent of the Turkish Sultan, the Caisse, and the Egyptian General Assembly. The European governments also took the opportunity to create more financial opportunities for their national subjects within Egypt through the extant Capitulations.\(^\text{15}\) The Capitulations were a series of originally legal concessions that Europeans living in the Ottoman Empire were not subject to Ottoman laws—a either criminal or civil.\(^\text{16}\) By the late nineteenth century, however, the Capitulations had been extended to include taxation rights—the Egyptian government could not tax European and American subjects, except on direct land tax, and new taxes were dependent on approval by the subjects’ national governments as represented by their diplomatic Consuls. Between 1876 and 1882, the British government was represented by a Consul-General on the Caisse in Egypt, and during this time, the Consul-General was the political equal of the other European representatives (Consuls-General). For Europeans,

\(^\text{16}\) Owen, Cotton and the Egyptian Economy, 86-87.
Egypt between 1876 and 1882 was a business opportunity, tax haven, and protected market.

Since the American Civil War, the main source of Egyptian wealth had been long-staple cotton. Long-staple cotton was in high demand from Britain especially because manufacturing plants in Manchester and Lancashire used Egyptian cotton to make delicates. Long-staple cotton is more flexible and can be woven in higher thread counts to create a softer fabric than short-staple cotton. Short-staple cotton is a much hardier plant and can be grown in a greater variety of climates and conditions, so it was never as valuable a crop. As mentioned above, in the 1820s, the Egyptian government learned that long-staple cotton could be grown in summer throughout the Egyptian Nile delta, if it was given enough water. However, the Nile flooded during the winter when the delta was too cold to grow cotton, so the Egyptian Khedives modified the irrigation systems to promote cotton growth. Between the 1840s and 1880s, the irrigation system utilized a combination of deep canals and pumping machines to encourage water to reach the gently sloping delta farms, and to pull the water from the canals to the cotton fields. In order to prevent the canals from silting up, the Egyptian government utilized an extensive system of corvée labour, although by the late 1870s, this labour system had reached its

17 Unless specified otherwise, for the purposes of this thesis Egyptian cotton means “long-staple cotton.” A number of varieties were introduced and grown by Egyptian farmers during the nineteenth century. The best book about Egyptian cotton in the nineteenth century remains Owen’s *Cotton and the Egyptian Economy* (1969).

largest extent and was starting to decline. During this time, the system of perennial irrigation, and the Khedival government encouraged the formation and consolidation of tenant-farmed large estates at the expense of small landowning hereditary farms. These large estates were increasingly held not only by Egyptian and Turkish Deltaic elites, but also European business interests.

Why the British invaded and conquered Egypt in 1882 has been the subject of much excellent scholarship. Protecting business interests or protecting strategic

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19 Corvée labour is unpaid labour which has traditionally been a form of taxation. As well as taxing in money or kind, governments which use corvée take the taxes in labour; a certain number of people in every affected community would be “borrowed” for a certain number of days for a series of given public works projects. Most famously, the Egyptian government used corvée extensively in the construction of the Suez Canal. The best explanation for the abolition of canal clearance corvée has been provided by Nathan J. Brown, “Who abolished Corvée Labour in Egypt and Why?” *Past and Present* 144 (August 1994): 116-137.


21 First proposed in 1953, Ronald Robinson and John Gallagher theorized that the expansion of empire was driven by the needs of industry, and operated along lines of informal influence. Territories which refused imperialist economic penetration were subjected to formal colonization. Indeed, in their book *Africa and the Victorians* (1963), Robinson and Gallagher applied this theory to the invasion of Egypt in which they suggested that British invasion was specifically a reaction related to the overthrow of a supplicant ruler, the threat of the French acting first to seize control of Egypt, and the potential loss of the Suez Canal and thereby the most economical route to India. John Gallagher and Ronald Robinson with Alice Denny, *Africa and the Victorians: the Official Mind of Imperialism* (London: MacMillan, 1963), 94-95. As an alternative economic theory, P.J. Cain and A.G. Hopkins argued in 1988 that industrial classes did not shape imperial political action, but rather a class of heretofore ignored capitalist interests governed the Empire from Britain. These capitalists, who in the period from 1850 to 1945 were represented by the financier classes in “The City,” were at the intellectual and financial center of the operations of London, Britain, and the Empire. A self-perpetuating, self-inculcating group of aristocratic politicians, the “gentlemanly capitalists” had absorbed the ideas of primacy of land and the primacy of the market economy. In the case of Egyptian-British relations, Cain and Hopkins stress the importance of debt-repayment rather than the strategic Suez Canal. P.J. Cain and A.G. Hopkins, “Gentlemanly Capitalism and British Expansion overseas II: New
interests, as well as opportunism have been favoured explanations. Most persuasive is Afaf Lufti Al-Sayyid-Marsot’s account which argues strongly that the British conquest was an attempt to secure the increasingly unstable political circumstances in Egypt between 1879 and 1882 for intertwined strategic and financial investments. The new British Consul-General Sir Evelyn Baring (1841-1917) took a series of steps to repair agricultural stability and increase cotton yields. Baring (Lord Cromer after 1892) secured the services of a series of Indian-experienced British irrigation engineers to run the Public Works Ministry in general and the Irrigation Department specifically. The engineers were “guided” by Indian systems.

Imperialism, 1850-1945,” Economic History Review, New Series 40:1 (1987), 13. Recent critiques have emerged of both of these classic economic theories of expansion of empire. Although they argued from different perspectives, both theories agree that London was the center of the empire, and that London’s dictats were grounded in the economic interests of a singular powerful elite, to which some historians of transnationalism have taken exception. More importantly for the purposes of this thesis, neither Cain and Hopkins nor Gallagher and Robinson can entirely account for the reasons that Britain occupied and all-but colonized Egypt. For a critique based on the geographical nature of the economic theories see David Lambert and Alan Lester, “Introduction: imperial spaces, imperial subjects,” in Colonial Lives across the British Empire: Imperial Careering in the Long Nineteenth Century, edited by David Lambert and Allan Lester (Cambridge: Cambridge University, 2006), 3-5.

According to Gregory Claeys, many liberal Britons felt that Gladstone’s occupation of Egypt (where he held a third of his personal investments), especially after his anti-imperialist rhetoric in the 1880 election campaign, looked more like intervention by financiers than protecting the route to India. Gregory Claeys, Imperial Sceptics: British critics of Empire, 1850-1920 (Cambridge: Cambridge University Press, 2010), 80-81.


However, the Egyptian government was still bankrupt and had to operate under the international politico-economic regulations of the *Caisse* between 1882 and 1906. Although much more influential and better-funded than any other department of the Egyptian government, Public Works was often a political pawn between Baring’s government (and his successors to the British Consul-Generalship) and the *Caisse de la Dette Publique*. Within these constraints the engineers focused their attention in the 1880s on two aspects of irrigation: the so-called uneconomical practices in the Egyptian delta surrounding unpaid labour, and working to provide more scientific technologies for management of the system itself. The abolition of Egyptian canal clearance *corvée* in 1889 was a complex political outcome, but was widely publicized as a victory for irrigation works officials and a defeat for the international debt commissioners. The other important step towards overhauling the extant perennial irrigation system was to repair of the Delta Barrage at Cairo, first patched in 1885, and then permanently repaired in 1889. Mehmet ‘Ali had ordered the barrage’s construction, but it was completed and subsequently abandoned under Khedive Sa’id (r.1854-1863) when the French engineers in his employ declared it an unsafe construction project. However, the training and

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26 If this statement seems unnecessarily adversarial, it is how the Irrigation Department engineers and the British-occupied government conceived of their relationship to the *Caisse* after 1882. For the best example of British triumphalism see: Lord Cromer, *Modern Egypt* (London: Macmillan and Co., 1908), 406-419.
experience of the Indian-experienced engineers suggested that if repair was possible, it could be used as a substitute for the expensive system of pumping water into the Delta canals for cotton cultivation. By repairing the Delta Barrage, the Irrigation Department engineers created a new form of perennial irrigation, one that was dependent on large-scale technologies and highly specialized maintenance by expert engineers.

In Middle and Upper Egypt, by contrast, the irrigation engineers were at first sceptical about the ability to grow cotton, or the need to modify the “basin” irrigation system. This system of water delivery was based on capturing the Nile’s floods in large shallow basins which then drained off and left replenishing silt behind; basin irrigation guaranteed one crop per year but little of it cotton. Upper Egypt especially was perceived as a backwater with its basin irrigation and hand-pumped water. However,

27 Only two monographs deal exclusively with the Delta Barrage’s construction and repair, both of them written by Robert Hanbury Brown, a nineteenth century military engineer. See: R.H. Brown, History of the Barrage at the head of the Delta of Egypt (Cairo: F. Diemer, 1896); R.H. Brown, The Delta Barrage of Lower Egypt (Cairo: National Printing Department, 1902).


29 Basin irrigation will be discussed in more detail in Chapter 4. Robert L. Tignor has a good (and short) description and assessment of basin irrigation in his article, Tignor, “Agricultural and hydraulic policy,” 63.
the ever-growing demand for more water, and the associated desire for more control over
the management of the Nile, triggered a search for a permanent dam across the river. This
dam – the original Aswan Dam – was planned and designed in the early 1890s, and
constructed between 1898 and 1902 by Egyptian workers, European stonemasons, and
British engineers. In the immediate aftermath of construction, the irrigation department
engineers worked to expand the system of canal-based irrigation technologies into
Middle Egypt, thereby increasing the land values, and prompting more cotton cultivation.
In order to increase the size of the reservoir, the Aswan Dam was heightened between
1907 and 1912, and again from 1929-1933. The second heightening meant that the dam
held back 5 billion cubic meters of water, and effectively provided water to much of
Lower, Middle and even Upper Egypt. However, total canalization of the country was
only completed with the opening of the Aswan High Dam in 1970.

In 1898, with the conquest of the Sudan, and the creation of the Anglo-Egyptian
Condominium of governing the double-colony, the land immediately south of Egypt
became a new territory for the Egyptian Irrigation Department to prove their expertise.30

30 Egypt’s historiography, like the state itself, is at a crossroads between African, Middle Eastern, Ottoman
imperial and British imperial and Mediterranean histories. This footnote is not meant to be comprehensive
but representative of the different historiographical traditions in which Egypt is situated. For the nineteenth
and twentieth centuries’ relationship between Egypt and other Nile countries see for instance: John
Waterbury, HydroPolitics of the Nile Valley (Syracuse, NY: Syracuse University Press, 1979); Haggai
Erlich, The Cross and the River: Ethiopia, Egypt and the Nile (Boulder, CO: Lynne Rienner Publishers,
2002); Eve M. Trout Powell, A Different Shade of Colonialism: Egypt, Great Britain, and the Mastery of
the Sudan (Berkley: University of California Press, 2003). Many, perhaps even most, Egyptian historians
situate themselves within a Middle Eastern and Ottoman Imperial tradition. P.J. Vatikiotis, History of
Daly, ed. Cambridge History of Egypt, Vol. II: Modern Egypt, From 1517 to the End of the Twentieth
Century (Cambridge: Cambridge University Press, 2000); Joel Beinin, Workers and Peasants in the
Modern Middle East (Cambridge: Cambridge University Press, 2001); Afaf Luftp Sayyid-Marsot, History
Terje Tvedt has argued convincingly that the Irrigation Department had a vision of controlling the entire Nile river and its tributaries from the great African lakes northward, that they were unable to put into practice until the conquest of the Sudan. After 1898, irrigation engineers in the Egyptian government worked to ensure that Egypt would have enough water by damming the Blue Nile at Sennar in 1926 and the White Nile at Jebel Aulia in 1937. The Sudanese Irrigation Department, although nominally independent, was staffed by former Egyptian Irrigation Department engineers, and actually a sub-department of Egyptian irrigation until after the First World War, and therefore acted in Egypt’s interests first, at least in the time period under discussion. The Sudanese Irrigation Department was responsible for the set-up and construction of the Gezira scheme of cotton growth in the early 1900s, although at that time it was a small experimental farm; by 1914 the Gezira scheme had been approved both by Britain and Egypt. Although the war delayed and ultimately made much more expensive, the Gezira

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project was constructed along with the Sennar dam on the Blue Nile, and remains the biggest Sudanese development project and source of income.  

The irrigation engineers who accomplished these works were, until the early 1910s, men who had transferred from India to Egypt. They were also very influential in high governmental circles. For the entire period under discussion, the Minister of Public Works was a series of Egyptian bureaucrats, but the Under-Secretary of Public Works, was an irrigation engineer (first Colin Campbell Scott-Moncrieff, and then William Garstin). At many points during the British occupation, but especially under the first British Consul General Lord Cromer, the Under-Secretary of Public Works was one of the three most powerful individuals in Egypt – including the Egyptian hereditary ruler, the Khedive. Although there was some significant turn-over between 1883 and 1914, the Egyptian government recruited most of its top engineers from one of two sources: the Indian public works departments directly or straight out of Indian engineering training college. Once in the Irrigation Department, the government tended to recruit from within,


34 Tignor, Modernization and British Colonial Rule, 89.
creating a self-perpetuating corporate structure in which “company men” were rewarded with higher and higher positions. For the most part these men seem to have created a community for themselves in Egypt based on similar professional values, backgrounds, and training. Egyptian rural officials, large land-owners and fellahin were generally excluded from regional and national level decision-making processes of the irrigation engineers. High office in the Irrigation Department was practically closed to Egyptian engineers until after the period under examination, although they made up the majority of staff. The British and Indian-experienced engineers set up a remarkably self-perpetuating system of promotion and scientific expertise within a very prominent and highly-respected department.

1.3 Literature Review

As it connects Indian, British imperial, Egyptian, scientific, environmental, and developmental historiographies, this thesis must situate itself within a series of overlapping and often disconnected histories. A confluence of British, military, environmental, imperial, engineering, diplomatic, and Egyptian historiographies make for choppy waters. Each of these broad categories have generated vast libraries of historical

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35 As will be discussed below, the British engineers in the Irrigation Department gathered colonial knowledge from a wide variety of Egyptian, Turkish, and European sources, but interpreted and retained final control over strategic-level or operational decisions. By national and regional decisions, I mean the planned development of technologies or policies affecting, for instance, Egypt or Upper Egypt rather than Aswan province or the town of Elephantine.
texts, and therefore the following literature review represents an overview of the most important works to this thesis, rather than a comprehensive historiography.

Much of the framework for this thesis draws on the work of James C. Scott, a highly critical developmental scholar. In *Seeing like a State* (1998) he argued that in many instances of large-scale development, state-appointed officials “took exceptionally complex, illegible, and local social practices... and created a standard grid whereby it could be centrally recorded and monitored.” The officials privileged transnational scientific expertise, instead of local/colonial knowledge. In some instances, (those that could be associated with an ideological framework called “high modernity”) these processes of technocratic state-sight led to “tragic episodes [in] social engineering.”

Scott’s work on development argues that the first state-wide attempts at creating “abridged maps” were in its dealings with the environment. Nature itself was put through a selection and categorization process into useful and not-useful. As a means of making the nature (whether that was forests, crops, or water) more understandable to the state, the modern, developmentally-focused state began a series of regimentations designed to separate the good from the bad, useful from useless, and that this process of

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37 Scott, *Seeing like a State*, 2-4. In this thesis, I use Scott’s definition of “high modernity,” which he defines as “a strong (one might even say muscle-bound) version of the beliefs in scientific and technical progress that were associated with industrialization in Western Europe... from roughly 1830 until WWI.”
38 Scott, *Seeing like a state*, 3. For an upcoming use of high modernism in relation to water-based projects, see: Daniel MacFarlane, *To the Heart of the Continent: the creation of the St. Lawrence Seaway and Power Project* (Draft Manuscript, 2013).
controlling nature was used as a way to control human populations too.\textsuperscript{39} In British-controlled Egypt, the distinction between state water and non-state water meant that from the very beginning of their tenure in the Anglo-Egyptian government, the British engineers worked to corral as much of the Nile’s water as they possibly could, in the way that they deemed most modern and best: perennial irrigation.

Other developmental scholars and historians of development have been instrumental to this dissertation. Michael Cowen and Robert Shenton in \textit{Doctrines of Development}, for instance, historicize nineteenth century theories of development, situating these theories in their historical context; their work provides a contrast to Scott’s ahistorical “high modernity.”\textsuperscript{40} Marshall Berman’s \textit{All that is Solid Melts into Air} (1988), discusses development projects in the context of their role that these development projects have on the developers themselves; Berman’s developer is Johann Goethe’s \textit{Faustus}, who forces the old world to move aside for the new, but these processes themselves make the “developer” obsolete.\textsuperscript{41} More recently, Joseph Hodge places \textit{fin de siècle} and late imperial developers in their historical context as ambitious imperial scientists, and their expanding roles in twentieth century British imperial state-controlled projects.\textsuperscript{42} His work documents the twentieth century transition between “the fabled

\textsuperscript{39} Ibid., 11.
\textsuperscript{41} Berman interprets the Faustian bargain. In Goethe’s \textit{Faustus}, the developer dies when he stops the process of building. Similarly, those who were designated “in the way” had to be removed – killed, moved, or forcibly modernized. Marshall Berman, \textit{All that is Solid Melts into Air: The Experience of Modernity} (New York: Viking Penguin, 1988), 62-78.
district administrator who ‘knew his natives’ to the specialist who ‘knew his science’;” and the repercussions that these changes held for colonial knowledge and imperial governance. In this context, the irrigation engineers, working as both administrators and scientists carved a liminal bureaucratic space in a moment before either was totally professionalized. My work utilizes the theoretical perspectives of Scott and Berman and welds them to the historical intercessions of Shenton and Cowen, Hodge, and others. This thesis historicizes Egyptian technological engineering projects within the context of nineteenth century development.

The engineering aspects of large technological systems themselves have been theorized by historians of technology. As Ken Alder has argued, engineers deny history — engineering “operates on a simple, but radical assumption: that the present is nothing more than the raw material from which to construct a better future.” However, engineers seek to shape an entire socio-technical world. Therefore, Alder asks, “what

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43 Ibid., 12. Hodge is careful to trace the waxing and waning influences of local (as opposed to universalized) knowledge in British imperialism, as well as the gap between the rhetoric of colonial knowledge and “the reality of science as practiced.” Ibid., 4-5, 15. Hodge has also published recently about colonial knowledge and the end of the British empire. See: Joseph Hodge, “Hybridity of Colonial Knowledge: British Tropical Agricultural Science and African Farming Practices at the End of Empire,” in Science and Empire: Knowledge and Networks of Science across the British Empire, 1800-1970, Brett Bennett and Joseph Hodge, eds. (Basingstoke, UK: Palgrave MacMillan, 2011), 209-231; Joseph Hodge, “Colonial Foresters versus Agriculturalists: The Debate over Climate Change and Cocoa Production in the Gold Coast,” Agricultural History 83:2 (Spring 2009): 201-220.


45 Alder, Engineering the Revolution, 15.
kind of politics do artifacts have?” In response to Alder, this thesis develops from the basic assumption that technology is political, but political in ways that are not straightforward. Timothy Mitchell and environmental historian Mark Fiege have argued for the impossibility of predicting all the consequences of environmental interactions. In *Rule of Experts* (2002), Mitchell argues that in the history of irrigation projects, “human agency appears less as a calculating and reorganizing intelligence... and more as the product of a series of alliances, in which the human element is never wholly in control.” Despite the fact that British engineers believed they could predict and compensate for all outcomes of their projects, Mitchell discusses “a variety of agencies that are not exclusively human,” including mosquitoes as historical “agents.” The role of technical experts was critical to the construction of the Egyptian irrigation projects, but not always decisive. In effect, this thesis demonstrates the political and environmental limitations of technical expertise.

In British-occupied Egypt, the irrigation engineers acted like imperial technocrats, and the political limitations were imposed, in large measure, by the Foreign Office,

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47 In his work, *Irrigated Eden*, Fiege remarks that large-scale development was not always entirely environmentally predictable by its engineers. In his words: “These massive hydraulic structures indeed disrupted the flow of the river but not in ways that irrigators could fully predict or control.” Mark Fiege, *Irrigated Eden: the making of an agricultural landscape in the American West* (Seattle: University of Washington Press, 1999), 7.

British bureaucrats in the Anglo-Egyptian government, and to a certain extent by the
Caisse de la Dette Publique, rather than local (or even national Egyptian) political,
economic or social input. This thesis, therefore, argues strongly Egypt itself was more
than part of the “informal empire,” to use Ronald Robinson and John Gallagher’s
venerable terminology. Because of the high political priorities placed on Egyptian water
control, agricultural management, and large-scale irrigation technologies, the Egyptian
Irrigation Department was thoroughly colonized, and was effectively an arm of the
British imperial state.

Explanations for why the Irrigation Department was so thoroughly colonized, in
this thesis, build from the works of area specialists, which have been discussed
extensively in the citations in the previous section. Roger Owen’s theoretical work is
especially important in this context. Owen, analyzing Sir Evelyn Baring’s liberal beliefs
on good financial governance, included what he termed “remunerative public works” in
the Consul-General’s perceptions of late nineteenth century economics, which were
drawn from India rather than Britain. The irrigation engineers whom Baring hired

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50 This thesis, therefore offers an implicit intervention on the tendency towards totalizing statements of imperial penetration into colonial governmental systems. For the classic work on the subject, see Christopher Bayly, Empire and Information intelligence gathering and social communication in India, 1780-1870 (Cambridge: Cambridge University Press, 1996). For a more look at a specifically British-controlled Egyptian department, see Tollefson, Policing Islam (1999).
shared his belief in the importance of liberal economics and especially public works. Samera Esmeir has argued that the claims for good governance of the Egyptian peasants put forward by the British technocrats rested on the legal separation of labour management from everyday life.\textsuperscript{52} In Esmeir’s work, large-scale technologies, specifically, irrigation projects were the “substance of... [the colonial state’s] power.”\textsuperscript{53} Taking the above as a given, the ideas of the irrigation engineers becomes critical, and the development of these ideas over time. Although I take issue with the exact moment at which the Nile was “conceptually conquered,” this thesis argues that, in accordance with water historian Terje Tvedt, by the early twentieth century the Nile was seen as a tool for the engineers to create a more prosperous Egypt according to liberal governance.\textsuperscript{54} With Tvedt and James C. Scott, I argue that the overall tendency for the irrigation engineers and their system of water management was to centralize water control and increase political and legal oversight.

Because the irrigation engineers were also imperial agents, this thesis draws from the wealth of scholarship surrounding imperial science, its relationship to power, and the manufacture and operation of colonial knowledge across the empire.\textsuperscript{55} One of the first formulations of science as part of colonial knowledge/power was Michael Adas’

\textsuperscript{53} Esmeir, \textit{Work of Law}, 197.
\textsuperscript{54} Tvedt, \textit{River Nile in the Age of the British}, 2.
Machines as the Measure of Men (1989), in which he argued “machines and equations, or their absence, were themselves indicators of the level of development a given society had attained.”\(^{56}\) Adas discussed the ways in which British and European elites adopted a “civilizing mission” dominated by the application of science and technology to showcase Western superiority. I utilize Adas’ idea that British scientific and mechanical expertise would bring the Egyptian people a sort of technological “salvation,” because of their perceived technological antiquity. In a more focused thesis, Gyan Prakash’s Another Reason (1999) has argued that the processes of applying science and technology to the Indian subcontinent changed these European ideologies, often undermining the very justifications of British power. Like Adas, Prakash stressed the authority of science as “the legitimating sign of rationality and progress.”\(^{57}\) This thesis develops takes Prakash’s concept as a fundamental principle of the British colonising project in Egypt – the engineers felt strongly that their science would legitimize Anglo-Egyptian governance and convinced administrators in Cairo and the Foreign Office. However, Prakash also stressed the inseparability of South Asian knowledge from the construction of imperial science; this part of his pioneering work has become historiographically highly influential. Bernard Cohn, Kapil Raj, Ronald Inden, and others have studied the intertwined and contested relationship between colonial knowledge, imperial science and


imperial governance. These scholars help explicate the motives of the irrigation engineers and remind historians that imperial science was inseparable from the same methodological framework of the physical violence inherent in the work of re-structuring the Egyptian landscape – displacing earth, stone, water, and people.

Because most of the projects discussed in the following chapters were completed by those with military epistemologies, this thesis also draws from the scholarship on the imperial army. The historiography of the military engineers is, however, problematic because of the academic gap between imperial and military history and the general disregard for the Royal Engineers in broader historical scholarship. In the case of the Royal Engineers, imperial and military historians have been content to leave their civilian


60 Only three books discuss the irrigation works of the Royal Engineers: two from the 1930s and another written in 1991. However, the one written in 1991 by A.J. Smithers is devoted to an uncritical, narrative history. A.J. Smithers, Honourable Conquests: an account of the enduring work of the Royal Engineers throughout the Empire (London: Leo Cooper, 1991). E.W.C. Sandes, The Military Engineer in India, V. II (Chatham: Institution of Royal Engineers, 1935); E.W.C. Sandes, Royal Engineers in Egypt and the Sudan (Chatham: Institution of Royal Engineers, 1937).
projects to historians of technology and science. However, more recent scholarship offers excellent examples of the relevance of military education; this thesis builds especially from John Black’s article on the military engineers and their influence on nineteenth century British imperial engineering education.

Finally, because I deal with the imposition of imperial science, technologies, and social engineering, this thesis must also confront Karl Wittfogel’s idea of “hydraulic societies” and the relationship of a society to water. The idea of the “hydraulic society” – that certain ancient Asian societies had based their political power on water control – has had a long and fractious career in the historiography. In his 1985 classic *Rivers of Empire* Donald Worster rehabilitated Karl Wittfogel’s idea of “hydraulic societies” by ignoring the success or failure of colonial irrigation projects, and distancing the theory from Wittfogel’s personal racism and anti-communism. Instead, Worster asked how the American West became the center of a vast empire. By borrowing Wittfogel’s theory, he answered this question in terms of a large governmental project increasingly involved in the management of the western rivers. Worster called the American West the center of an American “empire,” built on large-scale water-control schemes. Worster’s imperial

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hydraulic societies provides a good starting point from which to unpack not only how the British empire in Egypt was manufactured and controlled, but how the engineers understood their roles in this process.64

1.4 Methodology

This thesis studies imperial irrigation engineers and their projects in Egypt between 1882 and 1914. I have chosen to study the individual British-Indian and British engineers of the Egyptian Irrigation Department and through them the irrigation systems in the Empire. As Terje Tvedt has argued, “there is no way to understand these phenomena other than through an understanding of individual actions.”65 In pursuit of this understanding, I focus on the complex interwoven history between engineer training, the ideologies of empire-building, colonial knowledge, and the technologies of imperial control. The forms and power distribution of colonial knowledge of irrigation, rivers, and dam/canal construction, and irrigation practices were put into place by these imperial technocrats.

As was highlighted above, one of the problems of the military historiography has been an extreme separation between the military and civil projects undertaken by the Royal Engineers in a professional context. The current historiographical trends separating

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64 The engineers, as Jennifer Derr has recently argued however, saw themselves, as “as distinct from political colonialism and administration.” Jennifer Derr, “Drafting a Map of Colonial Egypt: the 1902 Aswan Dam, Historical Imagination, and the Production of Agricultural Geography,” in Environmental imaginaries of the Middle East and North Africa, ed. Diana K. Davis and Edmund Burke III (Athens: Ohio University Press, 2011), 140. Derr’s article about the engineers’ epistemologies and colonial knowledge will be consulted in some depth. Ibid., 136-158.

65 Tvedt, River Nile in the Age of the British, 8.
military from civil engineers are based on a rigid conception of the military and civilian structures, and do not reflect the complexities of either. The military, civil, personal, and political lives of the British and British-Indian engineers working in the Egyptian Irrigation Department were integrated and inseparable in ways that have not been explored by the historiography. This thesis has utilized letters, diaries, autobiographies, contemporary biographies, official correspondence, obituaries, census records and secondary sources to attempt to trace the private as well as public lives of a few well-established, articulate, literate, and often prolific male British and British-Indian engineers. However, these sources have produced only fragmented images of their lives, and my conclusions about the private motivations of engineers for their actions in Egypt are suitably cautious. Where possible, I have drawn on the works of other imperial historians to provide context and framework for their personal and public lives. The history of imperial and transnational networks has been especially useful in this endeavor.

The engineer training regimes are reconstructed in Chapters 2 and 3, and deserve some specific methodological explanation. Other historians have focused on the training of engineers, but few have focused on the training for irrigation engineering. I examined the curricula for the civil engineering colleges for Indian-experienced engineers (specifically Thomason Civil Engineering College and the Royal Indian Engineering
College) to see the pedagogies of these colleges. I cross-referenced these curricula with contemporary references and assessments of the colleges, and with historical scholarship. For the military engineers, I accessed the Field Engineering training manuals because the genesis of their irrigation engineering principles was derived from the methods utilized for battlefield engineering instruction. The field engineering manuals were supplemented with the specific irrigation engineering training materials that were available for military engineers, memoirs of irrigation military irrigation engineers, and histories of the School of Military Engineering.

Individual engineers feature prominently in this dissertation, and a few words might usefully be spent to explain how and why these specific people were singled out. I focus on those engineers whose thoughts and opinions about irrigation in the British-occupied Egyptian government thought merited record, and whose actions with regard to engineering or irrigation practice therefore can be traced. Although the archival records vary in their detail and amount of private information, the lives of these men can all be reconstructed with a greater or lesser degree of specificity. These engineers were consulted by the Egyptian government for their irrigation expertise and their professional opinions and policy decisions have been archived. I, therefore, concentrate on the engineers such as Lieutenant-Colonel Colin Campbell Scott-Moncrieff, RE. As head of the Egyptian Irrigation Department and later Under-Secretary of State for Public Works

66 “Indian-experienced” is my term for those engineers who had been employed by the Indian Public Works Departments as irrigation engineers and transferred to the Egyptian Ministry of Public Works to work in the Irrigation Department there. It is meant to denote formal employment rather than identity, and as such includes both the military and civil engineers. “Indian-experience” is also a way to reference the importance of Indian epistemologies that these engineers carried with them to Egypt.
Scott-Moncrieff wrote a series of irrigation reports that have been preserved in the British archives; he was instrumental in forming irrigation policy in British-occupied Egypt.

Scott-Moncrieff also published journal and newspaper articles to internationally promote those policies, wrote a memoir and extant letters, was counted in the census and military records; his niece wrote a biography of him using that now-lost memoir and other private family sources. Similarly, Sir William Willcocks, Colonel Justin Ross, RE, Sir William Garstin, Major Hanbury Brown, RE, and Sir Murdoch MacDonald are other engineers whose policy decisions will be discussed at length. All of the above mentioned were of British or British-Indian descent and all rose to be Inspectors-General of the Egyptian Irrigation Department, and except for MacDonald all had been military trained or trained in institutions run by military engineers. Other engineers employed by the Egyptian

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67 Scott-Moncrieff will be highlighted at some length in Chapter 2. See Mary A. Hollings, ed. *The Life of Sir Colin Scott-Moncrieff* (1917, reprinted Ithica: Cornell University Library). Personal letters are in the British Library, and some of his letters to Lord Cromer have been recorded in the British National Archives.

68 Willcocks, Ross, Garstin, Brown, and MacDonald, along with a series of other less senior engineers, will be discussed in Chapter 2. William Willcocks (1852-1932) has become the most famous engineer who worked in the Egyptian Irrigation Department. After his training at the Thomason Civil Engineering College, he worked on the Ganges Canal and the Betwa Dam in India between 1872 and 1883. Willcocks arrived in Egypt in 1884; he designed the repairs to the Barrage, the original plans of the Aswan Dam, as well as other barrages and irrigation structures in Egypt. In 1897, Willcocks left the Irrigation Department to work for private Egyptian companies until 1901, when he went to South Africa to advise the Egyptian government on irrigation works there. He surveyed Mesopotamia between 1908 and 1910. After the Egyptian government accepted the modifications to the Aswan Dam discussed below, Willcocks became an implacable enemy of the Irrigation Department, and critiqued them for a series of what he considered mistakes in the development of Egypt and the Sudan. Anita McConnell, “Willcocks, Sir William (1852–1932),” in *Oxford Dictionary of National Biography*, ed. H. C. G. Matthew and Brian Harrison (Oxford: OUP, 2004); online ed., ed. Lawrence Goldman, May 2006, http://www.oxforddnb.com.proxy.queensu.ca/view/article/40872 (accessed January 5, 2010). For a series of recent historiographical discussions of Willcocks, see also William Beinart and Lotte Hughes, *Environment and Empire* (Oxford: Oxford University Press, 2007), 133-144; Gilmartin, “Imperial rivers,” 90-101; Metcalf, *Imperial Connections*, 4-5, 92-93; Derr, “Drafting a map of Egypt,” 139-140.

69 At both the Royal Indian Engineering College (REIC, also called Coopers Hill) and the Thomason Civil Engineering College (now the University of Roorkee) military engineers with an Indian Public Works
Irrigation Department left archival records in the annually published Irrigation Department Reports, and I have utilized their contributions to diversify the engineering voices. Although the subordinate engineers and Egyptian staff were more engaged in the day-to-day negotiations of British power, the high-level engineers were responsible for developing overarching policy.

Methodologically, my research into the irrigation technologies is grounded in English archival and published primary sources. The published primary sources include the scholarly articles, newspaper editorials, books, project reports, and governmental publications written by the individual engineers, and about their technical projects. The engineers tended to publish engineering or hydraulic texts in scholarly journals, but sometimes they also published editorials in newspapers. These sources portrayed the engineers as they wanted to be seen by communities of their scientific peers and the British press, as well as their thoughts about Egyptian irrigation in lay terms. These publications were always published to either bring individual credit to the engineer, the background were employed as principals and instructors between 1882 and 1914. The principals especially were responsible for creating curricula and setting institutional culture.

One of the most notable silences is the lack of Egyptian engineers in this thesis. Almost without exception, the Egyptian engineers were shut out of Inspector-Generalships, and therefore did not contribute to the annual irrigation department reports or were consulted for their opinion on large scale public works projects. Where possible, I have included their words and perspectives about the projects and systems implemented by their superior (British and British-Indian) irrigation engineers. There is an even more complete erasure in the British archives of go-betweens in the primary sources; although Egyptian engineers’ names are sometimes mentioned, those of the translators, clerks, surveyors, mechanics, and other staff are rarely acknowledged. At the time of writing their voices must remain silent although I am aware of their importance in mediating Egyptian irrigation technologies and practices.

Specifically, the archives were: the British National Archives (Kew), the British Library (London), the Institute of Civil Engineers (London) the Science Museum Archives (Swindon), the Royal Engineers Museum and Archives (Gillingham) and the Sudan Archive (University of Durham).
British-Egyptian government, or both, and are therefore analyzed for the underlying ideologies which demanded these technological “development” projects.

Working from the position that both technologies and technological systems are inherently political and specifically reflect the assumptions of their creators, this thesis also focuses on the technologies themselves – in this case the dams, barrages, canals, and drainage channels that were constructed along the Egyptian Nile. A few major projects have been selected for special study: the Nile Barrage and the Aswan Dam are the two most important to this thesis. These choices are partially motivated by archival material: in each case there was a clear archival and published primary record of the projects themselves, and the bureaucratic decision-making processes associated with their construction. More importantly for this dissertation, these projects were the cornerstones of revolutions to Egyptian irrigation practice and irrigation systems. The physical infrastructure was part of an expanding and inseparable system of water control and social control represents an official response to water supply perceived crises. In order to access the physical projects, I analyzed archival and published governmental reports for their changing assumptions about Egyptians, water control, cash-crop, the Empire, and even the different technologies themselves.

This dissertation is grounded on a series of critical analyses of archival and published government documents. These official and semi-official documents were written by and about the Egyptian Irrigation Department engineers and their policy decisions and were either sent directly or copied to the Foreign Office (FO) and other
British archives. The Foreign Office was the guiding institution of the British-occupied Egyptian government; it functioned as a mediator between the Egyptian government and the British public, the organizing institution for Egypt’s international relations, and the final authority for Egyptian governmental decisions. Within the framework of the “veiled protectorate,” more than almost any other single branch of the Egyptian government, the Ministry of Public Works was especially top-heavy with senior British officials – in the foundational years these consisted of British civil and military engineers with Indian expertise.\textsuperscript{72} The documents that were archived by the Foreign Office represent a small cross-section of the total written correspondence of the Irrigation Department, but ones that most illuminate the imperial dimension of Egyptian governance. These documents, for instance, heavily emphasize remunerative, technological public works completed with Egyptian funds, the monetary value of these projects, and the worth that would be derived from these projects.

This thesis also discusses the importance of Egyptian irrigation practices and how these irrigation practices were – sometimes forcibly – altered under British political dominance. Initially, I decided to include this discussion because of the sheer volume of Foreign Office correspondence about the abolition of forced labour and the dearth of secondary sources discussing the government’s actions to ban a seemingly well-established Egyptian practice. However, I have come to argue that irrigation practices,

\textsuperscript{72} In the 1890s, the British-occupied Egyptian government would hire British engineers, but ones who had been trained by the Royal Indian Engineering College for imperial service in India. Therefore, the government privileged formal engineering education rather than informal British apprenticeship programs.
although methodologically difficult to access through British archives, are critical to nineteenth century perspectives of irrigated agriculture. That is, in order to assess irrigation systems, it is not enough to discuss the technologies, but also the practices, especially within a state undergoing significant agricultural change.\textsuperscript{73} The importance and inclusion of irrigation practice is also an attempt to gauge rural Egyptian reaction to the local efforts of the British irrigation engineers.\textsuperscript{74} Without the benefit of Egyptian archives,\textsuperscript{75} these sections rely on the published Irrigation, Public Works Department and the Consul-Generals’ Annual Reports written by British administrators. I flesh out the British official record with the works of area specialists.

This thesis argues that the technological projects, local practices, \textit{and} engineers are necessary to holistically understand the actions of the Irrigation Department in Egypt. The engineers defined themselves professionally and were in turn defined socio-politically by their careers, of which the large-scale projects were all-important. These technologies were meant to increase the cotton crop in Egypt, and their overwhelming

\textsuperscript{73} This thesis focuses on the impact of the engineering decisions on the \textit{fellahin}, rather than the landowning and urban elites. As indicated in the foregoing literature review, distinct Egyptian groups/individuals were affected by irrigation policy and practice in different ways and similarly shaped those practices to some degree. Water control was the first priority of the Irrigation Department, but that water control gave the Irrigation Department engineers managerial control over the Egyptian cultivators’ waterings and their agricultural efforts.

\textsuperscript{74} Egyptian reactions varied wildly depending on class, gender, and location, as well as community status. The specific proposals of the Irrigation Department, the actions of the engineers, the size of the landholding, landownership, and a geographical north/south divide seemed to be the most important factors governing opinion. For convenience’s sake, this thesis often refers to the overly-general category of the \textit{“fellahin”} as a catchall term synonymous with peasant. See: Mitchell, “Invention and Reinvention of the Egyptian peasant,” (1990).

\textsuperscript{75} Egypt’s “Arab Spring” erupted into politically-motivated violence in the fourth year of my PhD. I had originally planned to go to Egypt in that year, once my two years of Arabic training in preparation for this research trip had been completed. However, according to Queen’s University guidelines for Field Safety measures, Egypt was not safe.
success in this regard only served to reinforce and tighten Britain’s control over the irrigation system and Egyptian agriculture. The local practices provided a series of rationale about why the technologies should be modified and why Egypt “needed” continued British occupation. At the same time, studying these intersecting “sociotechnical” systems allows the historian to reinforce the role of chance, natural “intelligences,” and the “unrealized expectations and unintended consequences” of history.76 Taking up Timothy Mitchell’s challenge in *Rule of Experts*, this dissertation has stressed that the irrigation system that the engineers constructed was neither quite what they wanted nor what they expected, because it was a product of a piecemeal set of re/actions to an imperial project that was dependent on unpredictable funding, European political meddling, British popular support, and Egyptian political acceptance.77

1.5 Thesis Outline

Chapter 2 “Military Irrigation Engineering” emphasizes the training of military irrigation engineers and the resultant scientific practices and methods in India. In this context, military colonial knowledge, irrigation science, irrigation practice, and a short review of the Ganges Canal controversy are discussed. I trace the military’s declining

77 Official Egyptian political acceptance was rooted in the Egyptian and Turkish landowning elites that had political representation in the Egyptian parliamentary system, and the bureaucracy. British administrators took specific steps to prevent small-landowners and *fellahin* from gaining political representation while protesting that their military occupation created greater freedoms for those rural Egyptians. According to Samera Esmeir, this hypocrisy was at the heart of the British-imposed legal codes. See; Esmeir, *Work of Law*, 169-197.
interest in educating Royal Engineers in irrigation engineering, and the subsequent identity dislocations of the individuals being grandfathered out of the civil Public Works Department. The military engineers, although a small number of the British engineers in the Egyptian Irrigation Department, were over-represented in their personal influence and have been under-represented in the historiography and this chapter addresses that gap. Collectively, the military engineers emphasized adapting Indian technologies but remained sceptical of the associated irrigation practices. This chapter also focuses in rather more tightly on the “men on the ground” than later chapters, because this was where the engineers acquired their experience in technologies and practical management, which stayed with them after transfer to and promotion in Egypt.\footnote{These engineers seem to have gone from being fairly low-ranking engineers in the Irrigation Circles in India to essentially administering their own sub-departments in Egypt. They therefore stood to gain prestige and reputation by transferring to Egypt.} In this regard, the influence of the military irrigation engineers long outlasted their physical presence in the canal districts of Northern India.

The creation of an “Indian” Irrigation Department in Egypt is the topic of Chapter 3. The engineers strove for continuity of both procedure and personnel between India and Egypt. It opens with an analysis of the first Advisor to the Public Works Department, Colin Scott-Moncrieff, his personality, and his policies. Scott-Moncrieff and his hand-picked assistants continued to perpetuate bureaucratic assumptions and practices of the Indian irrigation departments. These policies included the correct personnel, and specifically a concerted effort to hire engineers trained by military irrigation engineers;
many Coopers Hill engineers were hired for Egypt. This chapter then provides an overview of the type of irrigation engineering education that the younger engineers acquired. Finally, I gauge the social implications of these bureaucratic policies by examining some aspects of the Anglo-Egyptian community of Indian-experienced engineers.

Chapter 4 examines Egyptian irrigation practices and the British reactions to these irrigation practices. As in India, the engineers reacted with skepticism about the Egyptian irrigation practices, tried to modify them through technological manipulation of the irrigation systems. Relying on the scholarship of area specialists and archival material, I focus on both the practices that the British Indian engineers created and those that they tried to suppress. Because of their technological and historical assumptions about Egypt and its people, the British engineers and the British administrators were intent on abolishing certain Egyptian practices, such as the *kurbaj* and *corvée* labour. They tried to replace these local practices with imperial practices, such as wage labour and specific forms of crop rotation. The overall effect of the imperial practices was to decrease peasant autonomy, increase the number and size of large farms, and increase the control that irrigation officials had over farmers.

Chapter 5 is an extension of Chapter 4, as they each describe two sides of the same process: increasing British political control through water management in the late nineteenth century. Here too, the British engineers demonstrated their reliance on Indian irrigation preconceptions: they demonstrated a willingness to work within the extant
system of perennial irrigation as long as it was financially inexpensive. This chapter, therefore, focuses on technological aspects of water control through the Wadi Rayan reservoir scheme, the repair of the Delta Barrages at Cairo, and the drainage system in Egypt. The British government and interested outsiders proposed a series of projects to better manage water control in Egypt, specifically through the mechanism of perennial irrigation in Lower Egypt and in decreasing fallow land in Upper Egypt – however, only those projects that fit into the engineers’ pre-determined epistemologies of what an irrigation system should look like were actually constructed.

Chapter 6 examines the British decision to permanently dam the Nile at Aswan. The construction of the Aswan Dam (1898-1901) poses something of a challenge to this thesis, as it represents the first major break from the existing engineering systems. However, this chapter argues that by the 1890s, the engineers felt that the economic and water supply needs of the de facto colony could only be addressed with a new dam. First, it analyzes the internal Irrigation Department politics involved in choosing a dam site then the controversial decision to build a dam at Aswan. The Aswan site was vociferously protested by the international archaeological community because the proposed dam would swamp the famously beautiful temples of Philae. The chapter ends with a brief analysis of the construction of the Aswan dam and its environmental repercussions. Throughout the chapter, I highlight the heterogeneity of opinion and the political, economic, and social complexities that were responsible for determining where and how the dam was constructed.
Chapter 7, the final body chapter, addresses “total Nile control” which I argue became official policy of the Irrigation Department after 1902. Between 1902 and 1914, the Irrigation Department put much effort, time, and money into a conception of water management that included the drainage basin of the Nile rather than merely the river in Egypt. This process has been called by later scholars as the attempt at “total Nile control.” In the words of Terje Tvedt the water engineers “conceptually conquered” the entire river at the beginning of the twentieth century, although physical conquest was always partial and secondary to international diplomatic concerns. Within Egypt, total Nile control meant a concerted Irrigation Department effort to manage all of the water; this policy included raising the Aswan Dam (1907-1912). Finally, the repercussions of these policies meant that the Irrigation Department ceded social control of irrigation practices to a more generalized agricultural science that could, and soon did, dominate many aspects of rural Egyptian life. In Egypt’s case, the agricultural policies of the early twentieth century state grew out of the Irrigation Department’s inability to handle all the complexities of an expanding cotton economy.

Twentieth century Egyptian perennially irrigated agricultural systems were locked-into physical structures of imperial power that had been constructed in India in the early and mid-nineteenth century. That is, Egyptian projects germinated in the training and actions of mid-nineteenth century Indian army engineers and the Indian Public

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Tvedt, River Nile in the Age of the British, 2.
Works Department. It is to these men, their “corporate identity,” and their educational experiences, that this dissertation will now turn.\textsuperscript{80}

\textsuperscript{80} Peers, “Colonial Knowledge and the Military,” 160-161.
Chapter 2
Military Irrigation Engineering in India, 1840-1882

2.1 Introduction

Writing to his sister in October 1843, Lieutenant Richard Baird Smith (1818-1861), of the Bengal Engineers candidly discussed his life and work along the Jumna Doab Canal in the Northwest Provinces. His annual “allowances” had recently been set at £800 a year, a sum that he referred to as “a large income for one so young in the service as I am.” His letters complained about European mismanagement of a privately owned canal nearby, and the necessity of his management of it. The wealthy Indian financier was “a most liberal old gentleman” who had allowed Baird Smith to have flowering trees planted around the canal and the reservoir; “in time it will be a very pretty place, I flatter myself.” His tent was described as a “despicable habitation” because it was small and crowded to bursting with his possessions. Baird Smith’s personal staff received special mention: four mounted orderlies, four foot orderlies, and five Guards, “and besides them there is a whole tribe of ... writers, private servants, canal men, [and] cash drivers.” In the main office, Baird Smith referred to one of his staff, an insubordinate but competent man who “waddle[d] like an apoplectic duck” but understood the accounts and revenues “as
perfectly as you do ABC.”

Baird Smith’s self-caricature in the letters portrays a manager of irrigation revenues, of canals and tanks, of multitudinous workers, and even of tree planting. Though he possessed some respect for the Indians with whom he worked, Baird Smith felt the need to demonstrate his superiority, either through explicitly stating his management of a canal or characterizing his subordinates in demeaning ways. His salary and expenses of £800 attest to his competence or at least his superiors’ confidence in his abilities because at the time of writing he was still twenty-four years old. Within a single letter, Baird Smith created a persona for himself as an upwardly mobile young engineer officer with some pretentions to a better life – his “despicable” tent, where he would have spent most of his time, was simply too small to contain him and his personal belongings.

Like many other East India Company Army officers, Richard Baird Smith wrote home, in his case, to Scotland. His family was from Lasswade, near Edinburgh, and his father was a retired Royal Navy officer. Baird Smith had been educated in the local school, then at Duns Academy, and the Indian Army College at Addiscombe. After a short mandatory course at the School of Military Engineering (SME) at Chatham in early 1837, he took six months leave to study civil engineering and geology before departing England for India. Baird Smith was commissioned to the Madras Engineers arriving in


2 For an excellent discussion of how Britons felt about the South Asians who functioned as their go-betweens, see: Simon Schaffer, “Asiatic Enlightenments of British Astronomy,” in Brokered World: Go-Betweens and Global Intelligence, 1770-1820, ed. Simon Schaffer, et al. (Sagamore Beach, MA: Science History Publications, 2009), 49-104.
1839, and was appointed acting adjunct that year, but his training in formal irrigation engineering was minimal. By 1843, he had transferred to the Bengal Engineers as assistant to the Doab Canal under then-Captain Proby Cautley (1802-1871). Baird Smith was, like other Assistant Engineers, involved in the practical administration of irrigation canals and tax collection.

At the time, a growing number of his fellow Indian Army officers were also engaged in the modification and redesign of India’s myriad irrigation networks, and were increasingly involved in creating new projects. By 1882, British-Indian irrigation engineering represented a significant commitment of military personnel, time, and resources, and the military engineers had created their own unique, if no less exploitative, perspectives on colonial knowledge. British military engineers took their Indian irrigation practices with them to Egypt, and therefore this contextual chapter is an attempt to explain an important precursor to British imperial irrigation in Egypt.

This chapter lays the foundation for understanding the irrigation engineers’ later efforts at irrigating the empire by first exploring their foremost, formative undertaking: the creation of irrigation networks in British India. My purpose here is to build an understanding of the education of the Royal Engineer officers, and to argue that military education profoundly contributed to British-Indian irrigation science and practice. By

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4 By “irrigation science,” I am primarily referring to theoretical hydraulic knowledge, such as theories of flow, slope, and dam construction.
highlighting the role of military irrigation engineers in creating colonial knowledge and nineteenth century science, between roughly 1835 and 1885, I hope to remedy the historiographical oversight about an important and coherent group of nineteenth century engineers. Perhaps most importantly, this chapter establishes a series of continuities in irrigation practice and knowledge between the ambitious technological projects undertaken in both India and Egypt. Many of the theoretical assumptions, technological perceptions, and governmental scaffolding discussed in this chapter were set up in Egypt after the 1882 conquest as conscious extensions of British-Indian irrigation practices.

I draw from a range of South Asian imperial and colonial histories as I trace the engineers’ attempts at knowledge creation. Colonial knowledge creation for irrigation projects started in South Asia, but did not stay there as it became blended with elements of European hydraulic theory, Mediterranean irrigation technologies, British military education, and local technological adaptations. As Edward Said asserted, British colonial knowledge of “the Orient, the Oriental and his world” was intertwined to the point of inseparability. Said’s comment points to an important factor in this chapter: the engineers’ imbricated understandings of environment, nature, technology, and imperial science. As detailed by Bernard Cohn, the British military engineers created systematic “types” of knowledge about the colonized Indian peoples:

\[\text{5} \text{ Current historiographical conceptions of the military irrigation engineers are not wrong, but do not recognize that these engineers are the primary creators of a mindset of irrigation engineering that dominated engineering conversations. Later engineers found themselves either rejecting or accommodating themselves to the mindsets that were inherent in the training and epistemologies of military irrigation engineers.}\]

\[\text{6} \text{ Edward Said, Orientalism (London: Vintage, 1976), 40.}\]
This knowledge was to enable the British to classify, categorize, and bound the vast social world that was India so that it could be controlled. These imperatives... shaped the ‘investigative modalities’ devised by the British to collect the facts. An investigative modality includes the definition of a body of information that is needed, the procedures by which it is gathered, its ordering and classification, and then how it is transformed into useable forms.7

Cohn’s conception of the modalities used by the British administrators to understand a colony is fundamental to this chapter. This chapter, however, seeks to break down the monolithic “Britishness” of the colonial project, and explore ways in which some specifically military engineers created colonial power through irrigated agriculture. Since these men were engaged in training and supervising civil engineers, their epistemologies were disseminated to younger generations.8 This work stands in agreement with historian Douglas Peers’ statement that the East India Company Armies’ officers brought “their corporate identity and some level of professional training” to colonial knowledge.9

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8 In the 1870-71, 1871-72 school years, the engineering students at Roorkee were taught and administered by Royal Engineer officers. Thomason Civil Engineering College Calendar, 1870-1871 (Roorkee: Thomason Civil Engineering College Press, 1870), 15; Thomason Civil Engineering College Calendar, 1871-1872 (Roorkee: Thomason Civil Engineering College Press, 1871), 16. As late as 1885, the engineering textbook still used was the Roorkee Civil Engineering Treatise written by RE officer Lt.-Col. J.G. Medley. See: Thomason Civil Engineering College Calendar, 1884-1885 (Roorkee: Thomason Civil Engineering College Press, 1885), xlvii; Lt. Col. Medley, Roorkee Treatise on Civil Engineering in India, Vol. II, 3rd Ed., ed. Major A.M. Lang, (Roorkee: Thomason Civil Engineering College Press, 1877).
Indeed, military engineers employed unique investigative modalities to understand their contemplated irrigation projects.\(^{10}\)

The first section examines the army irrigation engineers as military men, fashioned from the shifting demands of nineteenth century military education, British professional society, army necessity and unique Indian requirements. Their education helped establish professional identities shaped by, among other things, army tactical doctrine. Far from instilling the engineers with a rigid sense of discipline, their training stressed taking into account practical necessities of men and material at hand, and considerations shaped primarily by fluid, unpredictable events. These parts of their education created a deep scepticism of theory, and a willingness to adapt solutions by example and trial and error. However, by the 1880s, military irrigation engineers found themselves being grandfathered out of the irrigation department jobs. Like other servants of the empire, as David Lambert and Allan Lester have argued, irrigation engineers had a limited degree of personal control over their “imperial careering.”\(^{11}\)

The second section discusses the ways in which military engineers were responsible for fashioning the norms of irrigation science and practice in India until the early 1880s. The military educations and identities of the Royal Engineers can be directly

\(^{10}\) At times this scholarship tends to treat British imperialists as a unified Other which lessens the potency of the individualized violence that was enacted upon the colonial space and environment. This chapter concentrates on the military engineers as a self-consciously distinct group of British imperialists in South Asia; part of the colonial project but pursuing it in a series of circumscribed ways. See: Gyan Prakash, *Another Reason: Science and the Imagination of Modern India* (Princeton: Princeton University Press, 1999), 4.

linked to early irrigation science and elements of irrigation practice. Like David Arnold has described for the Indian Civil Service, military irrigation engineers “valued first-hand experience in the districts above the cosmopolitanism and intellectualism of [professional] science.”

Irrigation science was driven by instrumentalist concerns, and adapted available technology and materials to the immediate needs of individual projects. Much of the rationale for irrigation practice can also be traced back to a set of military assumptions about education, money, and power. The chapter concludes with a targeted overview of governing policy and controversial modifications to the Ganges Canal in the 1860s. In this instance, the Ganges Canal debate forced the Indian government to reaffirm its commitment to its military engineers, their irrigation science, and large-scale public works projects in general. Although the Indian government eventually withdrew its support for Royal Engineers’ irrigation projects, the engineers’ reputation allowed some individuals to transfer to Egypt and build the Irrigation Department in that colony.

2.1.1 South Asian Irrigation Historiography

Before moving on, a brief overview will help to place the nineteenth century South Asian irrigation projects in historiographical and historical perspective. The effects of irrigated agriculture, damming and canalization practices were and continue to be controversial. Even nineteenth century British governments were worried about the effectiveness of irrigation; contemporary engineers firmly believed that the best way to

prevent famine was to increase the number of “protective works.” The 1901 Indian Famine Commission, presided over by Sir Colin C. Scott-Moncrieff, reported that “in many parts of India, the only possible source of supply is an uncertain and often insufficient rainfall[,] it will not be possible to provide, at any practicable cost, the amount of storage required to counteract the effects of severe and prolonged drought.”  

Scott-Moncrieff’s Commission however was not critical of the British project; it recommended construction of further irrigation works. Although later British projects became more concerned with agricultural productivity through education, the Public Works Department and its supporters continued to promote their nineteenth century irrigation projects. Writing in 1935, E.W.C. Sandes stated unequivocally that “the irrigation of Northern India is one of the greatest humanitarian works ever performed.”

His views were echoed by many British and European historians who celebrated the achievements of the Raj, by concentrating on profits of the Indian Government and using almost exclusively official government reports as their source of assessment.

After the British Indian Empire fell, however, historians of irrigation have been increasingly critical of the utility of large-scale irrigation schemes, especially in northern India where irrigated agriculture was most intensively practiced. Writing in what I.D.

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Derbyshire has uncharitably called a “Nationalist orthodoxy,” historians such as Elizabeth Whitcombe and B.M. Bhatia were intensely critical of the British irrigation projects, and stressed the detrimental effects of irrigation.17 Bhatia’s *Famines in India* (1963) argued that Indian famines were caused by the decreasing supply of food, increasing population, rising food prices, and exporting of large amounts of foodstuffs; Bhatia also stressed that the Famine Codes and protective irrigation works were not able to prevent famine, and that only greater mobility amongst the peasantry allowed them to escape agricultural poverty in drought conditions.18 By contrast, Whitcombe in *Agrarian Conditions in Northern India* (1971) focused on the harmful results of canalization. Her work enumerates many failings of the Public Works Department (PWD), but the most serious effects of canal irrigation were: “the health of the people as well as the condition of the soil on which they depended for their livelihood deteriorated badly... compensation was not and could not be given... The canals proved a costly experiment.”19 Other historians such as Imran Ali and A.K. Bagchi shared Whitcombe’s scepticism of the British projects, if not her detailed condemnation of the entire system.20

In this context, it is unsurprising that there has been much debate about the precise consequences of the irrigation projects in British India. In 1984, for instance, Ian

Stone argued in *Canal Irrigation in British India* that “the refurbishment of old irrigation works and the construction of major new systems must rank among the most positive actions taken by the British.”

Stone’s work took direct exception to Whitcombe’s, and he stated that her work underestimated “the fact that for most of the period... the heavily irrigated northern districts enjoyed a degree of broadly based material prosperity matched by few areas in India.” Aside from a rebuttal by Whitcombe, the book was well-received by reviewers.

Reviewer I.B. Derbyshire sets this book and its reviewers within the aforementioned revisionist economic historical trend, which stressed that “the period 1860-1920 was thus one of mild expansion [in India] and almost ‘automatic development’ based upon the improving technologies of bullock carts, railways, and canals.” In this context, as in the earlier historiography, emphasis was placed upon the economic, technological, and fiscal aspects of irrigation schemes.

Since the popular growth of the environmentalist movement scholars have been increasingly critical of the effects of large-scale irrigation projects – whether they were

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22 Ian Stone, *Canal Irrigation in British India: perspectives on technological change in a peasant economy* (Cambridge: Cambridge University Press, 1984), 6. Stone’s work is used with some care throughout this chapter. His discussion of the Ganges Canal controversy is one of the most detailed I have found, but his conclusions are at odds with my own scholarship.
25 Although not in agreement with the historiographies above, Daniel Headrick’s *Tentacles of Progress* should be mentioned in this context, as he developed a history of the determinist technological “transfer” between Britain, India and finally Egypt. Headrick calls British colonialism a “benevolent tyranny,” arguing that “in the long run irrigation works have proved to have been a better investment of government funds than railways,” and lamenting that “irrigation has had few poets and publicists to sing its praises.” Daniel Headrick, *Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940* (New York: Oxford University Press, 1988), 171, 194-195.
high dams or large-scale canalization projects. By 1984, the Sierra Club was warning about the social and environmental effects of large dams. They charged that dam building brought “massive ecological destruction, social misery, and increasing ill-health and impoverishment for those very people who are expected to benefit most... the real beneficiaries... [are] large multinational companies, the urban elites of the Third World, and the politicians who commissioned the projects.”26 Their objections have found resonance with environmental historians increasingly critical of British irrigation projects across the Empire. In South Asian historiography, these works were also part of a backlash against the large-scale development projects of the 1970s and 1980s inaugurated by Prime Minister Jawaharlal Nehru and successive Indian governments – specifically large hydroelectric dams.27 Donald Worster added a very different assessment of contemporary irrigation projects in his 1985 *Rivers of Empire*; he argued that large-scale irrigation was another way in which nineteenth century empires controlled their populations. Worster’s theory therefore combined a critique of empire and a sharp criticism of the methods of large scale-irrigation: “the modern canal, unlike a river, is not an ecosystem.”28 Writing in the mid-1990s, South Asian environmental historians

acknowledged their theoretical debt to American environmental historians like Worster and William Cronon.  

When post-colonial historians in the 1990s and 2000s, such as Thomas Metcalfe and David Hardiman, focused on the social history of British India, they recovered the voices of local opposition and protest against the social and environmental consequences of irrigation. Their articles and monographs, often published within the Subaltern Studies literature, found purchase with Whitcombe. Stone’s thesis has been increasingly marginalized in the historiographical literature. Indeed, the focus of South Asian environmental historians has shifted from the fiscal benefits to the social and cultural ramifications, and attendant misery and protest, caused by large-scale irrigation projects receiving more and more attention. Again, Whitcombe was at the forefront of the current historiographical trends. Her article in Nature, Culture, Imperialism (1995), focused on the suffering caused by “the diseases of waterlogging and fevers, principally

30 See: David Hardiman, Histories for the Subordinated (London: Seagull Books, 2007); Thomas R. Metcalf, Land, Landlords, and the British Raj: Northern India in the Nineteenth Century (Berkley: University of California Press, 1979); Gyan Prakash, Another Reason, esp. 159-170; Arnold, Science, Technology and Medicine (2000). As will be seen above, these authors, although theoretically originally aligned with the Subaltern Studies group, have continued to write about the social and environmental effects of irrigation across South Asia.
malaria.” Other historians have also discussed disease in heavily irrigated landscapes. Of these scholars, the most radical is Mike Davis, whose arguments in *Late Victorian Holocausts* (2001) about causality and intentionality are still controversial. Post-millennial environmental historiography continues to examine how large-scale colonial irrigation projects, like other aspects of British imperialism, which resulted in almost uniformly negative consequences. The following paragraphs provide a brief history of the irrigation works of the British in India, and some of the detrimental effects.

### 2.1.2 A Short History of Indian Irrigation

In their efforts to irrigate the sub-continent, the British were the most systematic of sub-continental conquerors. By the time of the British victory at Plassey in 1757, the Indian landscape was a palimpsest for systems of irrigation – including wells, dams, and canals.

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34 Davis, *Late Victorian Holocausts* (2001). Davis argued that not only was the British colonial state responsible for poor irrigation technologies, and the resultant health concerns, but also that the colonial government was responsible for the famines of the late nineteenth century which the irrigation projects were designed to prevent.
canals, reservoirs, and temporary weirs. In contradiction to contemporary British wisdom that Muslim rulers built canals and Hindu kingdoms concentrated on tanks, David Hardiman has persuasively argued that many smaller irrigation works were probably maintained locally, if financed and constructed by higher levels of government. The irrigation systems laid down by pre-British imperial states on the subcontinent were exploitative, for as David Gilmartin explains they often were “localized inundation canal construction to expand state revenue and to control elites by tying them to the land. The British were not the first to link investment in irrigation with the structuring of political power.” Many of these systems were falling into disrepair by the early nineteenth century, when the East India Company shifted its focus away from conquest to territorial management through promotion of agricultural productivity.

In the 1820s and 1830s, the three branches of the Indian Army Corps of Engineers – Bengal, Madras and, to a lesser extent, Bombay – became responsible for rebuilding extant dams and canals, at first because of their low estimated cost. Bengal Army engineers Lieutenant Proby Cautley and Captain Robert Smith designed a completely rebuilt Doab Canal on the Jumna River, a tributary of the Ganges, with the assistance of

Richard Baird Smith. Simultaneously, General Arthur Cotton (1803-1899) was redesigning Indian irrigation works in Madras on tributaries of the Godavari River – first at Coleroon, then a canal on the Godavari itself. In 1836, Cautley convinced the Indian government of the utility of another major irrigation project, a singular Ganges Canal, and after that canal’s successful completion, reconstruction projects were superseded by a zeal for entirely new and large-scale, publically funded irrigation works. In the 1850s and 1860s, a series of major famines devastated large swathes of India and correspondingly, famine control became highly prioritized by the government. The Indian Government proposed that extension of such works would allow famine relief aid to flow to those regions more swiftly. Certainly, the vocal commitment by prominent British Indian engineers and the praise of impressed outsiders did not hinder governmental dedication to large-scale irrigation projects. Aside from their apparent utility as relatively inexpensive famine prevention mechanisms, irrigation canals gained a reputation among governmental agents as being revenue generating in terms of both

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40 Some of these irrigation works were being constructed at the private expense of the Madras Irrigation Company, founded by Lt. (later Col.) Arthur Cotton. Private irrigation companies attempted to operate on a share-selling basis, but foundered in the 1860s when building and repair costs skyrocketed, and shareholders got nervous. Without exception, the Raj had to take over Cotton’s companies in order to prevent bankruptcy. See: D’Souza, “Canal Irrigation and the Conundrum of Flood Protection,” 41-68.
41 Headrick, Tentacles of Progress, 175-176.
42 One of the above impressed outsiders was Australian politician and later prime minister Alfred Deakin (1856-1919). See: Alfred Deakin, Irrigated India, an Australian view of India and Ceylon: their irrigation and agriculture (London: W. Thacker and Co., 1893).
increased crop yields and in tax returns. There was also a ready supply of army engineers to help create and maintain this system of control. Later in the century, as Arnold has stressed, large-scale construction projects were hailed by propagandists as “monuments to [British] power and munificence... They embodied the idea of the British Raj as a technological empire, able... to master forces of nature that had defied and enslaved Indians for centuries.” Technological dominance associated with the ability to construct “feats of engineering” became a key to creating, maintaining and demonstrating political power.

A primary goal of the colonial state was to increase the productivity of agriculture and to increase taxation on the newly irrigated land, but large-scale irrigation projects never became the agricultural panacea that British canal officers expected. Increasing the amount of water flow to a region meant that local British officials, like Baird Smith, could reassess tax revenues in the area based on higher land values. Juxtaposed to higher taxes, however, were the environmental challenges that accompanied canal irrigation: “without control over the flow of water or proper drainage of the irrigated land, irrigation caused waterlogging, salt deposits, and a rise in the incidence of malaria.” With a rise in malaria and a newly enforced system of water control, the agricultural productivity and

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46 Headrick, *Tentacles of Progress*, 175.
cultural vibrancy of many rural regions were jeopardized.\textsuperscript{47} Local populations living around these large-scale irrigation projects were alarmed and tried to prevent their implementation. In the Oudh, local landlords, the \textit{taluqdars}, successfully opposed the construction of a Sarda canal for over 40 years between 1870 and 1913. The \textit{taluqdars} argued that the region already had abundant water, canal water would be mixed with gravel and decrease agricultural productivity, and the canal would increase the humidity and promote diseases.\textsuperscript{48} In other areas, most notably Orissa, irrigation schemes were financially unsuccessful because farmers refused to buy water.\textsuperscript{49} Furthermore, the “botched” Orissa scheme provides evidence for the most revisionist of historical arguments against the British governance: that irrigation projects \textit{caused} famines. The British government wanted to commodify the water supplied by canal irrigation, so that it could be, in the words of Rohan D’Souza, “regulated through a market imperative” – on a free-trade economy based on supply and demand.\textsuperscript{50} Market imperatives, when combined with drought, according to Mike Davis’s \textit{Late Victorian Holocausets}, caused a series of devastating famines across the Indian subcontinent in which millions died in the course of the nineteenth century.\textsuperscript{51} The government’s support of large-scale irrigation projects continued until the early twentieth century, when a commitment to scientific “improvement” of Indian agriculture replaced an interest in the “technical issue of water

\textsuperscript{48} Thomas R. Metcalf, \textit{Land, Landlords and the British}, 316.
\textsuperscript{49} D’Souza, “Canal Irrigation and the Conundrum of Flood Protection,” 42.
\textsuperscript{50} Ibid., 48.
\textsuperscript{51} Davis, \textit{Late Victorian Holocausets}, 9-11.
As Elizabeth Whitcombe has stressed, the full environmental effects of irrigation canals were not scientifically understood until many years after the last major perennial canal was opened in 1928. Having sketched in rough outline the larger parameters of irrigation in South Asia, this chapter now turns to the military engineers, their training and irrigation projects.

2.2 Irrigation Engineers as Military Men

The British military apparatus provided irrigation engineers in both India and Egypt, and as the first irrigation officials in both of these colonies, engineer officers set the bureaucratic standard for their civil counterparts who would later supersede them. Originally part of the East India Company’s Bengal, Bombay and Madras Engineering corps, those engineer officers were reassigned to the British Corps of Royal Engineers in 1862 when the East India Company was disbanded. However, this section focuses on the issues of the British Army’s School of Military Engineering because after 1815, the East India Company’s engineers received engineer training at the School of Military Engineering. Because of their involvement in the Indian irrigation works, military engineers wrote many of the foundational English-language texts on practical irrigation engineering, connecting themselves – very self-consciously – to, in the words of historian

52 Arnold, Science, Technology and Medicine, 121.
Donald Worster, “an international fraternity of experts.” By the time of the dissolution of the East India Company Army in 1862, military engineer officers were respected as irrigation engineers, and the Indian Public Works Department (PWD) civil engineers trained at the Roorkee Engineering College were usually instructed by military engineer officers; the engineering textbook used for the first twenty years of classes was written by one Lt-Col J.G. Medley. This section will explore their education to understand how their positions as the empire’s irrigation engineers were conceptualized by themselves and others.

2.2.1 The Training of Royal Engineer Officers

British military training programs in the mid-19th century were haphazard at best, and reflected the variety of historical circumstances that had prevented an earlier systematization of the army. The Royal Engineers and Royal Artillery had completely different training than the infantry or cavalry because they had originally been formed under the authority of the Board of Ordnance in 1717 to reflect the intimate connections that existed between engineers, artillerymen, and the heavy ordnance they employed in their martial works. The Board of Ordnance was only abolished in 1855 to make way for a single unified War Office, and the Royal Engineering Corps was unified with its

56 The Horse Guards survived as a distinct administration until the Cardwell Reforms in 1870. E.M. Spiers, *Late Victorian Army, 1868-1902* (Manchester: Manchester University Press, 1992), 6. The East India Company’s army had its own officer training programs at Addiscombe, its military college; from 1809-1862 Addiscombe trained all the infantry, artillery and engineering officers for their basic military duties, and then engineering cadets were sent to the School of Military Engineering for some specifically engineer training. See: Vibart, *Addiscombe* (1894).
enlisted Sappers and Miners in 1856. The Royal Engineers, because of the specialized nature of their work and their historical connections to the Artillery, continued to be educated first at the artillery’s school, the Royal Military Academy (Woolwich) and then at their own School of Military Engineering. Formal military education instilled a battlefield understanding of how to design and construct.

The British army reforms of the 1850s were a direct response to the crises brought about by the Crimean War. The Crimean War (1853-56) was a pyrrhic victory insofar as the war exposed the outdated tactics, poor quality of battlefield medical care, and the army’s inability to properly coordinate and distribute supplies. In the disgusted words of one Crimean War historian, the British generals epitomized “gross mismanagement and incompetent leadership.” 57 Afterwards, a group of ambitious and relatively young military officers emerged who were firmly committed to promoting military education “both as a science and an art” as a corrective to many of these perceived military shortcomings. 58 However, until 1857, there was only a single infantry officer training college: the Royal Military College at Sandhurst. 59 In that year, the Camberley Staff College opened to train Staff officers as a two year training program, the curriculum of which was gradually expanded to include “military history, administration and law,

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57 Denis Judd, Someone has blundered: calamities of the British Army in the Victorian Age (London: Phoenix, 2007), 29, 36.
59 It is worth mentioning that until the mid-1850s enlisted infantry were expected to learn drill by only one mandatory textbook. Infantry officers had to train their men rigidly to the standards dictated in that text, because of the necessity of many regiments to act in concert during battle. Hew Strachan, From Waterloo to Balaklava: tactics, technology and the British Army, 1815-1854 (Cambridge: Cambridge University Press, 1985), 18.
strategy, artillery, fortifications, surveying, reconnaissance, science, and riding.”

Historian Martin van Creveld is skeptical of this mid-nineteenth century lack of didactic focus, and argues that the staff college went into a lamentable decline until the early twentieth century.60 Royal Engineers’ training similarly suffered from the necessity of educating the corps for a wide variety of tasks. Like the Staff College, the School of Military Engineering responded by focusing the available training time on battle preparation, although after 1826 there were some courses of instruction in architecture.61 For the Royal Engineers, an increasingly martial identity went hand in hand with professionalization. Irrigation and other civil projects were a part of their curricula only so long as they did not interfere with the militarized aspects of engineer training.

In the 1840s, Chaplain-General of the armed forces G.R. Gleig suggested introducing commissioning exams, so that “young gentlemen will be brought to regard the Army as a great profession.”62 As the first Commandant of the Staff College, from 1857-1861, Major-General Sir Patrick MacDougall pursued the professionalization of military education by encouraging a good grounding in military history.63 As historian Gillian Sutherland has recently pointed out, formal examinations became one of the hallmarks of professionalization – along with a set of specialized knowledge and

60 Of the mid-Victorian army, van Creveld states dismissively, “war [was seen as] neither a science nor an art, but as some exhilarating if slightly dangerous open-air game.” Martin van Creveld, *Training of Officers: from Military Professionalism to Irrelevance* (New York: The Free Press, 1990), 43, 47-49.
63 Luvaas, *Education of an Army*, 105-106.
expertise, such as the historical knowledge developed by MacDougall. By the later nineteenth century, qualifying exams became associated with three themes:

First, formal examinations were seen as the antithesis of corruption and self-interest. Second, examinations... [tested] more than attainments or skills, they were perceived as instruments to get at basic abilities. Third, ability was equated with merit, talent with virtue.

The introduction of examinations, and the pursuit of dedicated sets of knowledge, were ways for the officers in the British army and East India Company’s armies to shed their collective image as a crooked, inefficient institution self-perpetuated by the purchasing of officer commissions (until such purchasing was abolished in 1871). Public perceptions suggested that the “purchase system” – especially after the military embarrassments of the Crimean War and the Indian Rebellion – encouraged patronage, and left an institution ripe for dissolute gentlemen’s sons rather than educated middle-class men.

Commissions to the Royal Engineers and Royal Artillery were never available for purchase; those positions were offered to officer cadets who had scored top marks on a set of mandatory qualification exams upon finishing their courses at the Royal Military Academy (Woolwich). The then-anomaly of promotion by seniority and ability left the engineering corps with a reputation for attracting the “mad, married or Methodist.” In fact, given that gentlemen’s sons in the cavalry and infantry purchased their commissions

65 Sutherland, “Examinations and the Construction of a professional identity,” 55.
and promotions, whereas the Royal Engineering Corps did not have to (or at least did not have the funds or connections to do so), RE cadets probably were not recruited from the upper-classes per se.\(^{66}\) In an 1857 letter to his sister, engineer cadet Colin Scott-Moncrieff (1836-1916) wrote that “we rather pride ourselves in not being fine gentlemen like the cavalry.”\(^{67}\) Therefore, with the compulsory set of entrance and exit examinations the British army tried to send the best, most meritorious students into its engineering and artillery.\(^{68}\) According to the regulations, cadets had to provide a birth certificate and a “certificate of good moral character, signed by a clergyman of the parish to which he belongs, and by the tutor or head of the school or college at which he has received his education for at least the two preceding years.”\(^{69}\) These requirements, along with a medical examination, disqualified most men of lower class standing, those of illegitimate birth, atheists, the iterant, and the uneducated, and women.\(^{70}\) As Sutherland stresses, the

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\(^{67}\) Quoted in Hollings, *Life of Scott-Moncrieff*, 35.
\(^{68}\) When the governing Board of Ordnance was abolished in 1855, these qualities were explicitly sought out and the rest of the army began a transformation to become more like the Royal Engineers in terms of promotion structure.
\(^{69}\) Quoted in Francis B. Head, *Royal Engineer* (London: J. Murray, 1869), 4-5. Sutherland suggests that middle-class professionals tried (and succeeded) in connecting their occupations with the landed gentleman as on a similar level of society. Douglas Peers, however, states specifically that prestige was generally awarded to the infantry and cavalry at the expense of the Royal Artillery and Engineering Corps, despite the technical proficiency of the latter officers. Peers implies that technical education could be confused with that of a lower-class trades-knowledge. See: Peers, *Colonial Knowledge*, 168-169.
\(^{70}\) Women were not allowed to serve in the Royal Engineering Corps in all roles until 1998 because the RE are considered frontline combat soldiers. Katie Neighbour, “Should women serve on the frontline?” (2002) www.fitting-in.com/c/neighbour.pdf (accessed 16 September 2012).
processes of professionalization were as much about prohibiting some groups as they were about admitting others.\(^{71}\)

However, examinations and a more professional reputation did not prevent the Royal Engineers from being heavily criticized by internal official commissions, frequently because of the inability of their soldiers to design properly with the materials at hand. Army Commissions in 1857 and 1862 concluded that the practical education of Royal Engineer officers was lacking, even if their theoretical grounding was solid. Since mathematical theories were primarily taught at the Royal Military Academy (and Addiscombe), before officer cadets entered to the School of Military Engineering, the critique was levelled entirely at the efforts of the RE to educate their own.\(^{72}\) Major-General E. Renouard James opined that, “the average man left Chatham incapable of designing or superintending the erection of the simplest work.”\(^{73}\) However, the commissions’ recommendations seem to have been followed, and by 1868 officer training at School of Military Engineering gave its students a more practical learning process – one that stressed the importance of local conditions and inhibiting factors. In the School of Construction, this meant six months of instruction, including classroom learning of the physical applications of construction theory, lectures on building materials

\(^{71}\) Sutherland, “Examinations and the Construction of a Professional Identity,” 52. These criteria also imply that the Royal Engineers wanted boys from public schools in Britain. See: Captain Walter H. James, late RE, “Military education and training,” Royal United Services Institution Journal 26 (1882), 370.

\(^{72}\) Addiscombe throughout its history increasingly emphasized the importance of mathematics above all other subjects. By the 1850s these included: mathematics, fortification, military drawing, military surveying, civil drawing, Hindustani, French, Latin. Vibart, Addiscombe, 154-155.

\(^{73}\) Quoted in Bernard R. Ward, School of Military Engineering, 1812-1909 (Chatham: Royal Engineers Institute, 1909), 19.
by both Royal Engineers and civilian scientists, courses in designing and estimating and touring local and national construction sites. However, aside from geography, military history, and Hindi studied at the Royal Military Academy, Royal Engineer Cadets did not receive instruction targeted to prepare them for the cultural encounters in the Empire. Formal instruction at the School of Military Engineering was entirely focused on the technical aspects of their profession, such as photography, electricity, telegraphy, signalling, construction and chemistry. As Elizabeth Vincent has argued, military engineering education also encouraged engineers to keep up-to-date on developments in civil construction and practical techniques.

The type and manner of irrigation engineering that would develop under the Royal Engineers gestated in their military training. By the 1860s, army engineers were taught first to make models and then practise their constructions in the field, which was meant to give officers and men a clear and distinct idea about how to construct field engineering. However, after these two educational tests had been passed, officers were challenged to take their education and apply a set of given resources to a battlefield scenario. In effect, officers were tested on their ability to adapt their constructive knowledge to the situation at hand. Rather than military training instilling a rigid sense of

74 Head, Royal Engineer, 197-200.
75 Ibid., 12-13, xi-xii.
76 As Elizabeth Vincent has argued, military engineering education also encouraged engineers to keep up-to-date on developments in civil construction and practical techniques. Vincent, Substance and Practice, 16.
78 Head, Royal Engineer, 167-169.
discipline and institutional dogma, the British army prepared its engineers to apply their knowledge laterally in a variety of fluid situations. In the engineering textbook, *Instruction in Military Engineering* (1870) students were taught to understand field engineering. The manual began every section by discussing what a given useful devise was ("Gabions are cylinders open at both ends... [and] filled with earth..."), why it was useful ("[gabions] are musket proof, and form a good revetment for field works"), their construction ("[gabions] are generally 2 feet in exterior diameter and 2 foot 9 inches high in the web but averaging 3 feet in height when used as a revetment in consequence of the projecting ends of the upright rods or pickets...") and the variables in construction ("they may be made of almost any material, capable of being bent or woven into a cylindrical form."). By discussing, for instance, variability of gabion construction, or how to construct trenches in different battlefield situations and terrains, *Instruction in Military Engineering* attempted to provide the officer cadets with a highly flexible form of practical construction techniques. These paradigms were repeated as late as 1912, when the War Office’s 1912 *Engineering Training* stated explicitly that in battle, “the ever varying phases of the modern fight [make] it ... impossible to issue orders on all occasions, and every [Engineer] officer is responsible for carrying on his own initiative any work which the situation demands.” This method of training explains much about the epistemological tendencies of military engineers in India and Egypt.

81 *Engineer Training 1912* (London: War Office, 1912), 121.
Further “on the job” training in India solidified these principles. After completing a course at Chatham, East India Company officers posted to India between 1840 and 1861 took courses in Indian languages at the barracks in Roorkee, and after 1847 at the Thomason Civil Engineering College. The Royal Military Academy at least partially took over this type of training, but limited its curriculum to studying Hindi. Subaltern officers were then sent into the field under close supervision of a superior officer, presumably to learn about cultural mores as well as technical education. “An engineer officer,” states architectural historian John Weiler, “served an apprenticeship as a necessary supplement to formal classroom learning.” This apprenticeship period was supposed to last until the recruit officer earned his captaincy, and the junior officer was to “make designs for small works, to draw up estimates, and to keep accounts.” 82 While these activities would have been supervised by his superior officer, and certainly corrected to ensure their accuracy, an apprenticeship model of learning supports making use of local resources and knowledge as a supplement to classroom learned techniques. As John Weiler states, even after the Indian Army Engineering Corps was disbanded, “the [Royal Engineering] Corps held on tenaciously to the idea that learning by doing was best.” 83 When posted to engineering depots around the world, the Royal Engineers demonstrated a general acceptance of local materials and practice. As Vincent has demonstrated in her detailed study of the Royal Engineers’ Canadian construction projects, engineer officers became

82 Weiler, Army Architects, 18.
83 Ibid., 26.
increasingly aware of the reasons why local builders utilized specific materials and methods, and copied these examples.  

Before the dissolution of the East India Company’s armies, there seems to have been no specific instruction in hydraulics or irrigation engineering. In terms of irrigation theory, after 1872 hydraulic engineering was consistently a minor part of the “Construction” program at the School of Military Engineering, and specific instruction on reservoirs was introduced as a part of the curriculum under G.K. Scott-Moncrieff (1855-1924) as Commandant from 1893 to 1898. Lectures on irrigation were presented to the students at Chatham in 1874 and again in 1875. These lectures were delivered by two eminent Indian Army Engineers – Arthur Cotton and F.H. Rundall – but the content seems to have been at the discretion of the lecturer. Cotton’s lectures, for instance, consisted primarily of calculations about water’s value, and exhortations of how to combine India’s navigation and irrigation canals for the profit of all, and were not published by the School of Military Engineering (SME). By comparison, the SME did publish Col. Rundall’s Lectures on Irrigation Works in India, which were apparently

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84 Vincent, Substance and Practice, 29. Vincent is careful to state that not all local construction practices were taken up by the Royal Engineers. They resisted using locks, glass, and nails. Ibid., 155, 162, 180.
85 Ward, School of Military Engineering, 18-19, 21.
86 Arthur Cotton, Lectures on Irrigation Works in India (Delivered at the School of Military Engineering) Autumn Session, 1874 (Hyderabad: Jyothi Press, 1968); Col. F.H. Rundall, Lectures on the Irrigation works in India (Chatham: School of Military Engineering, 1876).
87 See for instance, Cotton, Lectures on Irrigation Works in India, 42, 56. Cotton’s lectures seem to have been printed for private circulation in 1875, and summarized in the British Quarterly Review 65 (April 1877), 189-204.
distributed to engineer officer cadets at the SME, and were assigned by the Thomason
Civil Engineering College (at Roorkee) as required reading until at least 1885. 88

Given their publication, and subsequent use, Rundall’s Lectures can be taken as a
successful didactic model for irrigation in the SME, and the Thomason Civil Engineering
College. The lectures clarified terminology, eschewed hydraulic theory, and provided
guidelines about how and where irrigation works should be built. For instance, in his
Lecture IV (“Masonry Works – River Weirs”) Rundall began by defining his terms:

“Those [masonry structures] of primary importance are what are called the Head works,
consisting of the weir across the river, its sluices, the regulator over the canal, and Lock.”

He then warned students against ignoring local conditions, for these should determine the
type of weir constructed, and that

The engineer in India must remember that he has not an
unlimited command of money, that he is expected to devise
schemes on principles which will ensure those schemes
proving remunerative. His ability will be gauged by this
test. 89

Rundall implied not only that the engineer had to produce profitable works, but that these
works needed to follow other projects which had proven cost-effective. Rundall then
provided generalities for the proper location of a weir: “the best site will be found in a

88 Thomason Civil Engineering College Calendar, 1884-1885 (Roorkee: Thomason Civil Engineering
Delivered at the School of Military Engineering, Chatham. Autumn Session 1871 (Chatham: School of
Military Engineering, 1872); Alexander R. Binnie, Lectures. Water supply, rainfall, reservoirs, conduits,
and distribution. Delivered at the School of Military Engineering Session 1877 (Chatham: School of
Military Engineering, 1878). The lectures may have been assigned reading after 1885, but my own research
into the Thomason Calendars ended in 1885.

89 Rundall, Lectures. Irrigation Works in India, 23.
straight reach where there is a tolerably even section, and the river maintains about an average width. The stability of the river bed is the first and most important point to be examined.” After he had provided the student with general principles with which to work from, Rundall then examined specific weirs, such as the Godavery delta weir.

The Lectures emphasized the “correct” ways of thinking about hydraulic problems (and provided some examples of how other engineers had solved these problems) rather than the mathematical solutions for calculating discharges, volumes, and taxes. This attempt to teach irrigation also drew on the long history of the importance of finances to the Indian government. Critically, when the military engineers wrote textbooks for their civil engineering students at Roorkee, the pecuniary nature of imperial governance was highlighted – stressing the tax collection and collating duties of engineer grades, the precise taxes to be levied, and the amount each canal should cost per mile irrigated. These tasks were all to be accomplished, according to the military engineers, without need for significant recourse to hydraulic theory, but with the judicious application of governmental funding for public works.

At the end of his final lecture, Rundall explained why he had refrained from utilizing hydraulic theory to teach his students about irrigation works. “There are so many

90 Ibid., 24.
91 In his work, Business of Empire (2006), H.V. Bowen highlights the importance of a detailed and accurate financial picture for the British Empire. He traces this emphasis back to the 1780s when the East India Company’s Court of Directors needed not only “full and accurate record keeping” but also comparative statistics between estimates and outcomes for parliamentary oversight. H.V. Bowen, The Business of Empire: The East India Company and Imperial Britain, 1756-1833, (Cambridge: Cambridge University Press, 2006), 160-161.
92 Medley, Roorkee Treatise, 483-484.
disturbing elements occurring in actual practice, especially where Nature works on such a gigantic scale, obliging the Engineer to follow in her wake, that the formulae which are based on the most careful experiments carried out on a small scale in which the distributing elements are altogether wanting, are often quite inapplicable." Like other facets of their education, at the School of Construction cadets learnt about the application of principles and practices and the need to refine these principles to local circumstances – including governments with a primary emphasis on parsimony.

During the 1850s-1880s, however, military engineering education (not to say army education generally) underwent a pedagogic shift away from a broadly-based civil engineering education towards an explicitly martial knowledge. In *Military Identities* (2005), David French argues that the regimental system in Britain, introduced in the 1870s, was singularly responsible for creating military identities: the inculcation of a shared set of “historical memories” which emphasized the distinctiveness of the regiment, its heroes, its practises, and above all its institutional values. In the 1885 edition of his *Soldier's Pocketbook*, General G. Wolseley argued that regimental traditions allowed the soldier to perform at his best. “The soldier is a peculiar animal that can alone be brought to the highest efficiency by inducing him to believe that he belongs to a regiment which

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93 Rundall, *Lectures. Irrigation works in India*, 42. Rundall also states that the lecture hall is an inappropriate venue to discuss hydraulic theory and, tantalisingly, that the students may already have studied hydraulic theory. Ibid.

is infinitely superior to the others around him."\textsuperscript{95} However, the Royal Engineering Corps was not as easily pigeon-holed into a regimental scheme. Between 1869 and 1914 the military engineers were, at various times, responsible for the Ordnance Survey, submarine mining, signalling, ballooning, battlefield engineering, and fortification works – as well as preparing its engineers for building roads, railways, hospitals, and barracks in Britain and throughout the empire. All of these added duties placed stress upon curricula at the School of Military Engineering, and took priority away from irrigation and hydraulic engineering education. Although the SME continued to publish lectures delivered at the School of Construction, they do not seem to have returned to the topic of irrigation engineering.

A series of War Office Committees in 1886, 1891, 1902, 1906 and 1912 officially determined the proper organization, duties, training and strength of the Royal Engineer establishment, and they conveyed a strong sense of the values, attitudes, and skills that the corps wanted to instil in its officers. The 1886 Committee was still fairly divided: it listed a set of seven duties, including: “to take the field with the Army; [...] to form part of the garrisons of fortresses” as well as administering War Department Works, defending harbours; constructing and defending railways in wartime, and military ballooning.\textsuperscript{96} Like contemporaneous military colleges, the curriculum had expanded “until it lost its focus; it turned into a smorgasbord of different subjects,” none taught for

\textsuperscript{95} General Viscount Wolseley, \textit{The Soldier’s Pocketbook for Field Service}, 5\textsuperscript{th} ed. (London: MacMillan and Co., 1885), 4.

\textsuperscript{96} “Report of the Committee appointed to enquire into the Duties and Strength of the Corps of the Royal Engineers,” 1886, WO 33/46 A. 50, War Office, British National Archives, Kew.
long enough, or in enough detail.97 By 1912, these seven duties had been trimmed down to one: “The Committee have taken as a premise that the organization of the Royal Engineers should be based on their duties in war... In the field, the duties [are] ... to apply engineering science to the exigencies of modern warfare.”98 Unsurprisingly, the Commandant of the SME, and many of his staff, complained that portions of the engineering education were being neglected because there was simply not enough course time available for instruction in all the fields that military engineers needed to know.99

Military commitment to wartime engineering had hardened at the expense of “civil” engineering duties. Engineer Training 1912 clearly shows that these principles had been applied; officer training was to consist of “general military training [and] special technical training.” The manual continues: “the recruit officer must be taught from the first that engineers exist only for the assistance of the principal fighting arms.”100 This decision was not delivered by career staff officers; one of the 1912 Committee members was G.K. Scott-Moncrieff, a former Indian Public Works Department engineer who had spent the first few years of his career on irrigation works in India. His personal experience did not stop him from agreeing that military engineering needed to foreground battlefield considerations and eschew civilian applications. Imperial wars, and particularly the South African War from 1899 to 1901, punctuated those arguments. The 1912 War Office Committee debated how far the emphasis on training

97 van Creveld, Training of Officers, 48.
99 See for instance, WO 30/5 A.204 (1891); “Report of the Kitchener Committee,” WO 32/11378.
100 Engineer Training, 5.
had to shift towards martial discipline and military technologies, but after 1912, military engineers were discouraged from pursuing the increasingly professionalized aspects of civil engineering, because their governing institution (the War Office) was attempting to provide a practical response to military necessity.

In India, because of almost continual wars of conquest between 1762 and 1880, the colonial state saw a need for military engineers: as combat troops they constructed bridges, trenches, roads, railways, telegraphs as well as demolishing enemy structures and supply lines. However, during periods of peacetime, the engineers made themselves useful to the East India Company, and later the Indian Government, by utilizing their engineering skills for Public Works projects. The education of Royal Engineers reflected a blend of these different skill sets, in which the SME tried to impart to their students a practically-based ideology of the utility of local materials and local knowledge. This relationship only began to break down in the later nineteenth century as the details of training military engineers outstripped the time available to educate them.

2.3 Military Men as Irrigation Engineers

2.3.1 Military irrigation engineers and their forms of knowledge

This section discusses the ways in which military education and the cultivation of an identity which Douglas Peers has termed the “gentleman-officer-scholar”101 contributed to irrigation science and practice by RE officers in the PWD during the

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1870s. Peers argues that Indian Army officers engaged in many aspects of collecting, parsing, and distributing colonial knowledge. In the 1820s, after years of successful military conquest, Anglo-Indian militarism dominated political circles, and elided the distinctions between civil servant and military personnel.\textsuperscript{102} Officers pursued scholarship – often extra-curricular – because of “a combination of plentiful opportunities, boredom and professional incentives.”\textsuperscript{103} Not all officers were interested in scholarly pursuits, but when they did study, “much of what they wrote… was embedded within a particularly romanticist reading of Indian society, one that was redolent with medieval images and associations...”\textsuperscript{104} Among military engineers, this romanticist tradition manifested itself as a type of “technocratic paternalism, which brought India the ‘improving’ benefits of railways, bridges, canals, without the need for a more extensive engagement with Indian society.”\textsuperscript{105} The irrigation engineers seem to have concentrated their literary efforts on non-fiction, including military history, geography, palaeontology, agriculture, or the mint.

Even a brief survey of military engineers reveals a split between a Georgian generation of “amateur” scientists, and Victorian “professional” military officers. Until at least the 1840s sciences like botany, in the words of Richard Drayton, “remained both socially and intellectually a ‘gentlemanly’ science with the threshold of expertise which

\textsuperscript{103} Peers, “Colonial Knowledge and the Military,” 159.
\textsuperscript{104} Ibid., 160-161. In Britain, there is some evidence to suggest that the army was anti-intellectual – at least as far as promoting study in its officers is concerned. Until 1860, graduating from Camberley Staff College was not required for staff officers, and as van Creveld has amply stated, the College itself languished under indifferent leadership and poor funding. van Creveld, \textit{Training of Officers}, 47-48.
\textsuperscript{105} Arnold, \textit{Science, Medicine, and Technology}, 119.
allowed participation remaining low enough to admit a sizeable proportion of the educated public.” 106 These officers seem to fit Peers’ schema of “gentleman-officer-scholar” much more closely than later generations. Although the Indian Army engineers had relatively generous pensions, the first generation engaged in “amateur” scientific pursuits. Those irrigation engineers born between 1800 and 1820, including Richard Baird Smith, Proby Cautley, Arthur Cotton, John Thomas Smith (1805-1882), and Henry Yule (1820-1889), were often polymaths. 107 Aside from his business interests in entrepreneurial success, which will be discussed below, Arthur Cotton published work on irrigation, agriculture, and the study of Indian languages. Sir Henry Yule, by comparison, aside from his lengthy irrigation career, was a scholar of medieval literature, and translated many important works, not the least of which was Marco Polo. 108

As Drayton has argued, those engineers born in and after the 1830s were probably the products of a more professionalized military identity; “part of a generation more aware than its predecessors of the constraints within which it operated, but also more ambitious.” 109 As the highest testing individuals out of Addiscombe and Woolwich, they had been educated with professional pride in their virtue, and aspirations to a gentlemanly

107 As Richard Mikulski has demonstrated, this 1800-1820 generation also produced the very first generation of recognizably “professional” academics, and they were instrumental at overhauling university teaching in the mid-nineteenth century. See Richard Mikulski, “Professionalization of British Academic Life 1825-1860: An Anglo-American Perspective,” unpublished paper Mid-West Conference on British Studies (12-14 October 2012), 2-3.
ideal. This generation was not as interested in pursuing “amateur” science, but rather professionalizing science through formal education and learned societies as a “necessary preliminary to demanding the help from the state and respect from the public.” It may be more correct to conceptualize them as “gentlemen-officers-military scientists” – simply because of their steadfast commitment to the military. Although C.C. Scott-Moncrieff (1836-1916) and Percy G.L. Smith (1838-1893), published many works, these were an outgrowth of their occupations. Smith, who created a military career for himself as head of the School of Construction at the SME between 1874 and 1879, published a series of practical manuals on building construction and materials; Scott-Moncrieff published works that grew out of his professional interest in irrigation engineering in Italy, India and Egypt. By contrast, his nephew, G.K. Scott-Moncrieff (1855-1924) wrote his own memoir, a biography of Lord Nicholson, and texts on principles of structural design and field entrenchments. After the 1830s, the military establishment itself also encouraged professionalization – the Papers on Subjects

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110 Ibid., 179.
111 The difference in publications between, for instance, Cautley and C.C. Scott-Moncrieff may also be attributable to the increasing attention of the Raj to the scientific works of its colonial servants. Arnold describes the benevolent neglect of the East India company towards those scientists in early nineteenth-century India. In the aftermath of the Indian Rebellion, “science and technology... provided an identity, they were the evidence of the progressive and altruistic virtues of the conquerors.” Drayton, Nature’s Government, 230; Arnold, Science, Medicine, and Technology, 24.
112 By contrast, the civil engineers of the same generation were proud to be men of limited formal education, who had “won their fortune, fame... [through] the trials of fieldwork in remote areas.” Casper Andersen, British Engineers and Africa, 1875-1914 (London: Pickering and Chatto, 2011), 70.
*Connected with the Duties of the Corps of Royal Engineers* were published regularly with articles from military engineers around the British Empire, including those of the East India Company’s armies.\(^{114}\)

Colonial knowledge can also be drawn along military lines, at least in the memoir of one army engineer. Definite, if careful, parallels can be made about treatment of enlisted men and Indian labourers by these military officers. Of the officers, David Arnold has stated, “managing the land and managing labour went hand in hand,” but managing labour also went hand in hand with conceptually framing colonial knowledge.\(^{115}\) Superficially, G.K. Scott-Moncrieff described the work of constructing the Bari Doab Canal in narrative conventions used by other military officers and military historians to describe battle: That is, very few people were named, much confused action was omitted from the description, and the mass of soldiers/labourers were constantly described as moving together. All of these are elements of what preeminent military historian John Keegan termed the “rhetoric of battle history,” which Keegan locates in the military historiographical tradition since the Middle Ages.\(^ {116}\) If he did not treat the workers themselves like enlisted men, Scott-Moncrieff’s *narrative* treatment understood all subordinates to be like enlisted men marshalled for a battle. G.K. Scott-Moncrieff’s memoirs are rife with names – most of them with military rank and none South Asian. In the summer of 1878, his superior went on furlough and “left [Lt.] Cahter and me to work

\(^ {114}\) Vincent, *Substance and Practice*, 37.


the canal by ourselves.”117 His statement implies only isolation from European company, therefore reinforcing the importance of South Asian assistants as “invisible” go-betweens.118 Indians often formed an integral part in the transmission of many types of colonial knowledge production; Scott-Moncrieff’s single reference to a specific person from India was a Pushtan teacher. Instead of portraying individuals, the South Asians in Scott-Moncrieff’s narrative were all doing something together. Stone was “quarried by native labourers,” and “contracts were taken for the supply of [wood] by native contractors who brought in loads.” He described the materials, both physical and human, as “indifferent” and “poor,” and his tribulations included hiring donkeys, bullocks, and camels to move both the stone and wood and sinking wells for kilns.119 Throughout his memoirs, Scott-Moncrieff discussed the logistical difficulties that he had to overcome with a distinctly long-suffering, paternalist-in-isolation tone. Although the direct equation of English sappers and Indian hired labour is clearly facile and eliminates issues of race, it represents a certain modality of conceiving of and dealing with subordinates.120 Certainly not unique to Scott-Moncrieff’s memoirs, his perspective is indicative of larger

118 For an excellent interpretation of a life of one of these go-betweens who were critical to the British project of knowledge collection and interpretation, see Schaffer’s discussion of the life of Tafazzul Husain Khan, an eminent astronomer, court tutor, translator, and go-between. See Schaffer, “Asiatic Enlightenments of British Astronomy,” esp. 53-62.
120 Although there is little evidence in Scott-Moncrieff’s narrative about the mistreatment of Indian subordinates, as Linda Colley has stressed, until the mid-19th century the most common forms of discipline of enlisted British soldiers was corporal punishment. Colley has called British soldiers of the East India Company’s army “white captives in uniform.” Linda Colley, Captives: Britain, Empire and the World, 1600-1850 (New York: Anchor, 2004), 334.
narrative patterns in the British Empire: to erase the subaltern voice from a narrative is to deny agency and dehumanize.\textsuperscript{121}

In some conventional ways, the military irrigation engineers contributed to imperial scholarship and directly to colonial knowledge. How they did so was partially dependent on their generation and how they understood the limitations and opportunities available to themselves as “gentlemen-officers-scholars.” The next segment fleshes out the military conceptions of science and practice created by the gentlemen-officers-military scientists.

\textbf{2.3.2 Military Irrigation Science}

Between the 1840s and 1880s, military irrigation engineers created an identity for themselves out of their professional (military) identities and distinct from other (civil) engineers. Gilmartin has argued convincingly that civil engineers became increasingly dedicated to “the prestige of mathematical science,” as a way of promoting educational discipline, moral training, and the subduing of nature.\textsuperscript{122} By the early 1870s, civil engineering was shedding its educational roots in practical apprenticeships and, like other professions, becoming more closely associated with universities and the Institute of Civil Engineers.


\textsuperscript{122} Gilmartin, “Imperial Rivers,” 82.
Engineers (ICE). In Britain, water engineering by civilian engineers was highly derivative of French hydraulic theory, which in turn was based on conceptions of water movement and water pressure. French hydraulic theory exhibited a universalist perspective in that the theories of water movement were regarded as universal; the most efficient engineer was one equipped with abstract theoretical knowledge of flow and pressure. Royal Engineering education, by contrast, necessitated a set of widely applicable skills, and these skills in turn made a certain empirical kind of engineering knowledge and practise preferable to a theoretically-based knowledge. Military engineering education also committed its trainees to the commitment of science to imperial service, not *visa versa* or as authoritative in its own right. As outlined above, the School of Military Engineering provided its officers with a rudimentary set of engineering principles, but not those specific to irrigation engineering. Because of their educational backgrounds, military irrigation engineering was developed through trial, error, and adaptation but with a willingness to learn from hydraulic science.

At least in the Irrigation Branch in India, military engineering could be distinguished from civil engineering in a few clear-cut manners, which in turn affected the creation and collection of colonial knowledge. Whether deliberate or not, the East India Company Army’s engineers were critical of the direct application of broad

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123 Sutherland, “Examinations and the Construction of a professional identity,” 54. King’s College, London established a chair of engineering in 1838, and the University of Glasgow in 1840. However, acceptance of engineering as a field of scholarship was not widespread until later still: the University of Edinburgh only established a chair in 1868, Cambridge in 1875, and Oxford in 1907. See: John Rae and Rudy Volti, *Engineer in History*, rev. ed. (New York: Peter Lang, 2001), 179.

hydraulic theory and seemed to favour locally-produced solutions to specific hydraulic problems. This de-centralized application of hydraulic science perfectly fit the education of military engineers: their schooling emphasized fitting the technology to the environment, not visa versa. As mentioned above, in his Lectures, Rundall was sceptical of the general applicability of hydraulic theory:

In actual practice, one never finds a river and rarely even a canal that has a perfectly straight course, or in which irregularities of bed or banks do not occur... [There are] so many disturbing elements for which it is impossible that any general co-efficient can provide.

Co-efficients were mathematical multipliers to determine the size of flow, amount of water by engineers, and at the time were frequently based on small-scale experiments. Rundall was suggesting that no mathematical constant had been developed that was detailed enough to provide a useful substitute for careful hours of current measuring, and detailed measurements of the canal. Partially as a consequence, until the 1870s, “the masonry dam... remained a structure built on the basis of empiricism and experience.”

Instead of applying hydraulic theory directly (the most scientifically accurate in the world), early- and mid-nineteenth century British military engineers utilized European and Indian techniques of dam construction, and adapted irrigation projects by a trial and

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125 As Kapil Raj has argued, this process, the process by which knowledge became “universalized” was one of “calibration” – that is, calibrating the evidence from one geographical region and modifying it to the specifications of another. Kapil Raj, “Colonial Encounters and the Forging of New Knowledge and National Identities: Great Britain and India, 1760-1850,” Osiris, 2nd Series 15 (2000): 133.
126 Rundall, Lectures. Irrigation Works in India, 42. Rundall used the term “disturbing elements” three times in the space of a paragraph to indicate the imperfections in canals and rivers. His use of the term might be unconsciously coded for the mental disturbance presumably caused by the inability of the engineers to use mathematics to predict riparian action.
error method to improve dam and canal construction. As Norman Smith has pointed out, even French engineering with its rationally constructed structures, resulted in dam failures into the 1890s; there is some evidence to suggest that the trial and error method of dam construction had produced results that were “not unsafe even though they were undoubtedly uneconomic.”

In order to adapt British dam-building to Indian purposes, the military engineers also studied and modified existing hydraulic structures in India. In 1836, for instance, Arthur Cotton designed and had a new dam built on the Coleroon River in Tanjore, following the style of a second century dam at that site: he even designed the foundations of the new structure on the soft alluvial riverbed like the ancient dam. Rundall’s Lectures also discussed the adaptation of Indian methods:

The works carried out in recent years by European Engineers have been mainly improvements on the systems which they found in operation... The features of the country in each locality have been turned to account with much ingenuity... [But] in old native works these [reservoirs]... had no control over the volume of water entering them. The result was that, on the occasion of an extraordinary fall of rain... the embankment was overtopped and breached. One of the first measures that the British Engineers had to carry out was the regulation of the volume of water.

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128 In at least three instances, the irrigation projects of the military engineers failed or partially failed – at Red Hill, the Coleroon, and the Ganges Canal. Invariably, the irrigation engineers with experience in India presented these mistakes as “learning experiences” and adapted their technologies accordingly.


130 Smith, History of Dams, 189.

131 Rundall, Lectures. Irrigation Works in India, 2-3.
Rundall praised the ingenuity of the Indian hydraulic systems, and stressed that they needed “improvements” because of lack of proper water control. Among the Indian-experienced engineers in Egypt, water control would become the overriding concern of irrigation engineering – specifically controlling the amount of water flowing into a canal or reservoir.

Making the production of colonial irrigation knowledge more complicated, Indian Army Engineers often travelled to Europe to observe irrigation works there. Baird Smith toured the irrigation works of southern Italy in 1852-53, and Colin Scott-Moncrieff reprised Baird Smith’s tour in 1867-68. When confronted with an engineering problem that had not been tackled in India by earlier engineers they adapted engineering technology from, according to Gilmartin, “what could be learned pragmatically from irrigation works in other parts of the world.” These excursions also reinforced the importance of personal observation among nineteenth century engineers – merely by seeing earlier works the engineers attempted to ascertain how they were constructed.

Colin Scott-Moncrieff’s tours resulted in his confident statement that “much can be done in irrigation without the help of any very scientific [ie. theoretical] engineering.” The ensuing texts became important tools for international irrigation engineers and brought

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132 Gilmartin, “Imperial Rivers,” 81-82.
133 The importance of personal observation will be discussed again in Chapter 7 with William Garstin’s travels southwards on the Nile. However, this modality seems to be akin to Mary Louise Pratt’s discursive trope the “monarch-of-all-I-survey.” As she states, “discovery in this context consisted of a gesture of converting local knowledges (discourses) into European national and continental knowledges associated with European forms and relations of power.” Mary Louise Pratt, Imperial Eyes: Travel Writing and Transculturation (London: Routledge, 1992), 201-202.
134 Quoted in Hollings, Life of Scott-Moncrieff, 78.
international attention to British-Indian irrigation projects. Baird’s and Colin Scott-Moncrieff’s experiences bridged the nineteenth century gap between construction as a trade, and mathematical hydraulic theory.

The military engineers demonstrated a willingness to adapt local technologies and learn practically from trial and error, and they passed along these didactic tools to their civil engineering pupils. 135 Rundall mentioned the failure of an embankment in the Red Hill Lakes district, of which he remarked, “It is as useful for Engineers to learn why or how failures occur as it is to be taught wherein success lies… The lessons to be learnt from this accident are…” 136 The revision of theory based on the failure of construction projects mimicked the development of French hydraulic theory in the late 18th and early 19th century. 137 However, because they worked from adaptation and trial and error, the Royal Engineers erred frequently – and drew criticism. 138 Royal Engineer Captain H.A. Yorke thought that Indian experience needed “a certain knowledge ... as to conditions depending on climate and as to material available, but a man of ordinary intelligence can

135 The integration of local technologies into imperial irrigation networks in Egypt as well as the epistemologies of the civil engineers such as William Willcocks will be discussed in greater detail in Chapter 5. The field of civil engineering was changing between the 1860s-80s, however, and more scientific emphasis and experiments were devoted to the development of hydraulic theory. By the mid-nineteenth century, according to civil engineering historian Mike Chrimes, Americans were undisputed leaders in a series of civil engineering pursuits, not least of them canal and dam engineering. Mike Chrimes, Civil Engineering, 1839-1889: a photographic history (London: Thomas Telford, 1991), 131-142.
136 Rundall, Lectures, Irrigation Works in India, 3.
137 Smith, History of Dams, 174-176.
138 Sir W. Denison, Governor of Madras wrote an early critique of military engineers: “The Public Works Department will decline to employ them [RE Field officers] ... in consequence of their being unacquainted with the language, and the special kind of engineering required. The vacancies will probably be filled up by civilians and the Officers left for military employ.” Quoted in J.L. Simmons, “Memorandum,” Correspondence relative to the Establishment of officers of the Royal Engineers to be retained in India, 1 January 1880, WO 33/41, War Office, British National Archives, London.
Yorke implied that the practical knowledge of Indian irrigation was necessarily being learned in India, on the job. As David Gilmartin has remarked, “Beautifully drawn and skilfully coloured plans” did not excuse the “shocking mistakes of design” of irrigation projects such as the Bari Doab and Sirhind canals.\footnote{Gilmartin, “Imperial Rivers,” 81-82.} In the early years of irrigation engineering in India the officers were, in effect, copying older structures without precise instruments or a foundational grasp of what caused dam failure and their projects often needed time-consuming, costly repairs or failed outright as a result. The Coleroon dam, for instance, partially failed in its first year because its foundations were not on bedrock.\footnote{Smith, History of Dams, 189.}

Military engineers were committed to the latest professional standards, increasingly codified as mathematical hydraulic theory, but their own teaching and learning institutions emphasized personal experience, local solutions, and apprenticeship. Given that the official War Office attention was increasingly taken up with preparing the Royal Engineers for martial pursuits, Royal Engineers who were posted to the Irrigation Branch in the 1870s attempted to compensate haphazardly at an individual level. Proby Cautley’s Ganges Canal designs from the 1840s indicated some familiarity with French hydraulic theory. Cautley, Bengal Artillery, designed the original canal to have a relatively steep slope (15 inches per mile in the upper sections, and 11 inches per mile at the tail) based on the slope of the Jumna Canals (which he had designed based on Indian

\footnote{Captain H.A. Yorke, “Minutes of Evidence,” Report of the Joint War Office and India Office Committee on the Establishment of Royal Engineers to be retained in India, WO 33/42, War Office, British National Archives, London.}
canals) and he calculated the water’s velocity from the works of French hydraulic theorist Dubuat. As historian Ian Stone has stated, “The problem was that little was known at the time about the flow of water in large earthen channels, and that what was an appropriate slope on the Jumna Canals was an excessive slope on a much larger one. Dubuat’s formula for open flow channels was proved to be quite unreliable, particularly for large works.”

Especially in sandy river beds, like the Ganges, excessive slope in large canals causes much of the canal flooring to be washed away in a process called “scouring.” Scouring results in what had been the river bed being deposited further downstream when the water subsequently slows down. As Stone says, the velocity was actually much higher than Cautley had anticipated, and other design features borrowed from his work on the Jumna Canals, also served to make the water faster than it should have been. In this instance, Dubat’s formula and Cautley’s experience did not work; it is unclear, however, if any contemporary hydraulic theory would have been more effective. As Rundall noted, the military engineers’ scepticism of hydraulic theory was based not only on their own educational predilections, but also on the practical acknowledgement that contemporary understandings of water flow in large canals was limited.

At least one other military irrigation engineer took a hybrid approach to the ongoing problems of water flow in irrigation engineering. Captain Allan Cunningham attempted to develop a new hydraulic theory for the movement of water in large canals –

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142 Stone, *Canal Irrigation in British India*, 43.
143 Ibid., 44.
144 Rundall, *Lectures. Irrigation Work in India*, 42.
partially to prevent the problems caused by scouring on the Ganges. His work represented an intriguing example of the directions that military irrigation engineering could have taken, had the experiments not been cancelled in 1879-80. Indeed, it demonstrated that military engineers were involved in attempts to develop a more “scientific” method of irrigation theory, while being committed to practical engineering considerations – which David Arnold has termed “instrumentalist” science.\textsuperscript{145} Cunningham spent the better part of four years attempting to discover a theory of fluid motion for large bodies of water. More practically, his experiments were trying to find the best method of measuring water flow through canals, and test current water-speed formulae. In his own words:

\begin{quote}
The General Result of this work may perhaps be considered in some ways disappointing, in that there are no brilliant Results, no simple laws of fluid motion discovered... Nevertheless the author submits that, on the whole, the practical objects proposed have been attained and that... the great outlay on this Work has been usefully incurred.\textsuperscript{146}
\end{quote}

It is unclear whether Cunningham himself was disappointed or whether he believed that critics would place the highest importance on theoretical hydraulic engineering to the detriment or derision of his results. Despite the lack of “brilliant results,” two important points can be drawn from his experiments. First, Cunningham probably saw this as an opportunity to showcase the advantages of testing hydraulic theory in Bengal, specifically on the Ganges Canal.\textsuperscript{147} Cunningham used scientific methods to test water currents and

\textsuperscript{145} Arnold, \textit{Science, Medicine and Technology}, 129.
\textsuperscript{147} Cunningham, \textit{Roorkee Hydraulic Experiments}, 29.
measure the volumes of water: he attempted to control for issues of measurement by using only specially-trained observers, recording multiple tests at each site, and personally managing the conditions of each experiment. He was also committed to the “instrumentalist” utility of his experiments. His published volume was not intended for hydraulic engineers, but a “general reader,” inexperienced in hydraulic theory.\textsuperscript{148} He defined terms such as “mean velocity,” clarified velocity measurement, and explained why and under which conditions the different measures of velocity would be useful.\textsuperscript{149}

Cunningham’s work, therefore, can be seen as a bridge between the didactic traditions of military engineers and the increasingly “universalist” hydraulic theory of continental European civil engineering.\textsuperscript{150} Although he protested that he was attempting to “afford the means of criticizing [his experiments],” Cunningham’s intended audience may have been other military engineers, or the civil engineering students at Thomason Civil Engineering College, since he was an instructor at the college. These experiments also reflect David Arnold’s contention that this type of experimental science represented a trend away from dependence upon local knowledge and towards a “British sense of being able to know India systematically and scientifically from the authority of printed texts.”\textsuperscript{151} If Arnold is correct and if Cunningham was attempting to divorce British-Indian science from the unreliability of “native testimony” this shows the lie in British

\textsuperscript{148} Ibid., iii.
\textsuperscript{149} Ibid., 43, 45-46.
\textsuperscript{150} By “universalist” science, I mean the attempt by hydraulic scientists and engineers to develop theories and principles existing in all times and places.
\textsuperscript{151} Arnold, \textit{Science, Medicine and Technology}, 131-132.
engineering texts: all of Cunningham’s work was derived from low-paid Indian labour using stopwatches to measure the speed of water in the Ganges Canal.  

In contrast to Cunningham’s experiments, the next section analyzes the work that low-ranking military irrigation engineers performed in rural areas of the Raj. This section is an attempt to understand irrigation fieldwork as the formative experience of the Indian-experienced irrigation engineers and the sorts of administrative structures that they believed were necessary for good irrigation practice.

2.3.3 Military Irrigation Fieldwork

As the official historian of the Royal Engineering Corps in India, E.W.C. Sandes listed forty-five Royal Engineer officers in the space of sixty-eight years who were instrumental to the Indian irrigation projects. Given that in 1862, the total Corps officer strength was 420 and spread across at least four continents, the contributions of military engineers to the Indian Irrigation Department represented a significant commitment of resources and manpower. More importantly, the RE officers represented a militarization of colonial knowledge: the acceptability of using military personnel and resources not only for the physical irrigation projects, but for the furthering of irrigation theory.

Administratively, each province was divided into three or four irrigation Circles, run by a Superintending Engineer. Colin Scott-Moncrieff, as Superintending Engineer on the Ganges Canal in the 1870s, was constantly travelling and simultaneously doing “office work,” as his nephew noted, “Uncle Colin and the executive engineer of the district were away all day discussing plans of drainage and land improvement.”\textsuperscript{154} The Circles were further subdivided into Divisions, run by Executive Engineers, who then were in charge of assistant engineers, subordinate engineers and craftsmen.\textsuperscript{155} According to Ian Stone, the executive engineers were constantly travelling: in camp 24 days a month and directly responsible if a crisis (like too much rain) threatened to wash away some part of the irrigation works.\textsuperscript{156} Like Baird Smith, however, subordinate engineers seemed to carry a specific dislike of the Indian officials that they interacted with on a daily basis. Colin Scott-Moncrieff, complained in 1859 that “it is often depressing enough to see how the native [ie. Government official] revels in bribery, and forgery, lying, and double lying... The poor \textit{ryots} and land-holders are not much wiser than their cattle, yet they are far the more honest set.”\textsuperscript{157} As recounted by G.K. Scott-Moncrieff, the lower-ranked engineer officers were in charge of small sections of a proposed canal, and their work primarily consisted of inspection and regular overseeing, rather than the design of major irrigation structures. The lower ranked officers were also in charge of contracting local

\textsuperscript{154} Scott-Moncrieff, Eight Years,” 29. Scott-Moncrieff makes specific reference to a “canal bungalow,” a house built for irrigation officers. Ibid.
\textsuperscript{156} Stone, \textit{Canal Irrigation in British India}, 63-64.
\textsuperscript{157} Quoted in Hollings, \textit{Life of Scott-Moncrieff}, 58.
labour; this was a long-established military practice.\textsuperscript{158} The lives of the engineer officers were therefore spent moving between construction sites to ensure against natural disasters, accidents and incompetence.

In his first PWD position as an Assistant Engineer in the Bari Doab Circle in the Punjab, G.K. Scott-Moncrieff was assigned to “take charge of all the construction of 9 miles of the canal and the forts adjacent.” In practice, this meant redesigning and revising estimates for the canal and arranging for the supply of material because construction on the engineering works had just begun.\textsuperscript{159} Scott-Moncrieff was careful to point out that “my work at Narrai was much more interesting than the compilation of the plans and estimates though I was equally inexperienced in both. I had some large engineering works to carry out…”\textsuperscript{160} The fact that Scott-Moncrieff, an inexperienced subaltern, was given 9 miles of canal and “large engineering works” probably reflected the gap between administrative theory and practise. John Weiler has described a system of apprenticeship for military engineers: they were supposed to be carefully, if not closely, supervised by their superiors. One of the reasons that the executive engineers were constantly travelling was probably an attempt to prevent environmental disasters and to control subordinates.

\textsuperscript{158} Scott-Moncrieff, “Eight Years,” 66. This practice seems to have been inaugurated in the regular British army in 1818 with a Treasury minute establishing the importance of competition for contracts by local labour and supplies. Vincent, \textit{Substance and Practice}, 22.

\textsuperscript{159} Like G.K. Scott-Moncrieff, Baird Smith learned irrigation engineering during a \textit{de facto} apprenticeship with his superior officers in India, as he spent over a year as assistant to Sir Proby Cautley, RA, and continued to work with Cautley on the Doab Canal for another three years after being commissioned to first lieutenant. Vetch, “Smith, Richard Baird.”

\textsuperscript{160} Scott-Moncrieff, “Eight Years.” 62, 65.
over a wide area. G.K. Scott-Moncrieff, as an assistant engineer, worked with his more experienced colleague Jacob on estimates one day a week, but did not record assistance or guidance with the construction projects themselves. Scott-Moncrieff, therefore, later stated: “I built at Narrai a concrete arch, semi circular 22 feet span, 127 feet long.”

The assistant engineers’ job was not an administrative posting: Scott-Moncrieff was primarily responsible for arranging transportation and payment of masonry stone, freshwater, lime, brick dust, and animal fodder, instead of the taxation or even much canal design. The 9 miles of canal that he was responsible for was a subdivision of an administrative unit. As H.A. Yorke was careful to distinguish to an 1884 War Office Committee, “I was employed on the construction of new canals [like Scott-Moncrieff]. I was never employed upon running a canal, where the duties of the officer would be almost entirely confined to the collection of revenues.”

The Roorkee Civil Engineering Textbook stated clearly the tasks of an assistant engineer: “his first duty is to carry out the execution of all works, whether original or repairs, within his Sub-Division. He is responsible for the measurements of earth-work, masonry, etc., done; he has special charge of all the stock of building material, plant, etc.” Later, (after service in the Second Afghan War), Scott-Moncrieff went back to the Bari Doab Circle, where he was reassigned to Abazai, and put in charge of “12 miles of the canal, and had two large canals.

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161 According to the Roorkee Civil Engineering Textbook, an executive engineer, “should not tie himself down by assuming direct charge of works or administration of any particular portion of canal, but reserve himself for general supervision…” Medley, Roorkee Treatise, 478-479.
162 Scott-Moncrieff, “Eight Years,” 64, 66.
163 Yorke, “Minutes of Evidence,” WO 33/42.
164 Medley, Roorkee Treatise, 477-478. My emphasis.
aqueducts, several large culverts, two super-passages, a number of road bridges and the head works to build, also a fort just overlooking the swift and clear Swat River.” He was also almost completely under his own prerogative, “[Jacob] left me pretty much to myself at that time... Occasionally he came to see how I was getting on and to give advice but he left me to make most of my arrangements for myself which was very pleasant and satisfactory…” From a bureaucratic perspective, this made logical sense, as Scott-Moncrieff had acceptably completed the previous set of works (and accounts) and could be trusted to take up more responsibility.

As an assistant engineer, at both Narrai and Abazai, Scott-Moncrieff was also responsible for “detailed accounts of all manner of expenditure, and keeps with his own hand a precise cash-book of all payments.” At Abazai especially, his duties changed to incorporate more financial work, he described “office work and accounts” in the mid-afternoon. As argued above, his training may have included the importance of constructing low-cost and remunerative works. The emphasis on the accounts demonstrated a fixation with accurate bookkeeping which started with the Executive Engineer and was supposed to be carried down to the sub-overseers and canal policemen. As Rohan D’Souza has described, the Indian government was attempting to make irrigation projects directly profitable – farmers using irrigation for watering their

166 Medley, Roorkee Treatise, 477-478.
168 Medley, Roorkee Treatise, 478.
crops were not only pressured into doing so, but also charged a series of “rates” which were meant to recoup the government’s expenses and return profit.\textsuperscript{169}

Managing the resources was accomplished like British military procedures. As mentioned above, these men had been trained to construct military fieldworks, barracks, and other habitations during their tenure at Chatham. Military training stressed an “aggregate in the theory and practice... [since members of the Corps] may be required to apply the principles taught in these courses.”\textsuperscript{170} Engineer Training (1912) spelled out the principles: “the tactical situation, and the work required in consequence of it, are the only guides... in the employment of the engineers” – in practise this meant adapting to local conditions.\textsuperscript{171} Scott-Moncrieff used local materials (lime, brick dust, stone) and Indian labourers, and utilized local knowledge about the properties and manufacture of binding agents for masonry.\textsuperscript{172} At the same time, he was dedicated to constructing his projects the “correct” way – aqueducts, culverts, arches etc. all had to be constructed according to standardized designs, although Scott-Moncrieff himself was allowed to design an aqueduct near Abazai.

Military engineers did not implement Indian irrigation practice along with local materials and Indian technologies. This critical distinction between local practices and local technologies will be revisited again in Chapters 4 and 5 –in Egypt as in India, the engineers were much more willing to work with existing physical structures than they

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\textsuperscript{169} D’Souza, “Canal Irrigation and the Conundrum of Flood Protection,” 66.
\textsuperscript{171} Engineer Training, 116.
\textsuperscript{172} Scott-Moncrieff, “Eight Years,” 65-66.
\end{flushright}
were with the pre-colonial labour practices that had been associated with such structures. In northern India, for instance, pre-colonial practices had included the annual clearing of silt by unpaid labour, but the irrigation engineers put in headworks to control the flow and maintained those works assiduously to prevent the canals from silting up. Water control along the Ganges developed from the perception that the maintenance of irrigation networks had been inefficient and exploitative. Similarly, as will be discussed in reference to Egypt, because drainage works were not directly profitable, their construction was neglected under the British – despite a growing awareness that that water-logging and salination resulted from poorly-drained canal lands. Both the denunciation of forced labour and the lack of adequate drainage followed Indian-experienced engineers from India to Egypt, and imply that these attitudes were deeply engrained in contemporary irrigation engineering.

The British engineers, keen to build “better” (more profitable) irrigation canals, according to Prakash, focused their efforts on constructing canals “between scouring and silting, based on a formula for slope and water velocity. This solution excluded the local society from the administration of canals.” Both the East India Company and the Raj were eager to keep costs low and remuneration high. They encouraged the use of

173 Hodge and Adas mention the two different sides of this “instrumentalist” scientific coin. Hodge mentions the “dismantling of local irrigation practices as part of a dedicated policy in British India under the East India Company. Hodge, *Triumph of the Expert*, 31. Although more of a historical stretch, the emphasis on Indian technology might be traced back to common seventeenth century descriptions of Asian material culture and technology. Michael Adas, *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance* (Ithaca: Cornell University Press, 1989), 47.
unskilled labour in the construction of these projects.\textsuperscript{177} The technologies (both dams and canals) furthered the extension of the existing taxation systems of India: irrigated agriculture was taxed by the amount of land irrigated, rather than the amount of water delivered.\textsuperscript{178} The canal colonies in Northern India, therefore, worked to maximize the amount of land irrigated.\textsuperscript{179} By privileging technology rather than procedure, and profitable works rather than protective ones, military irrigation engineers were able to effectively distance themselves and their work from the apparently despotic measures of former governments, while inserting their own practices, and preventing local elites from gaining power over irrigation systems.\textsuperscript{180}

2.3.4 The Ganges Canal: Policy and Controversy

The Ganges Canal scheme affords a look at some of the issues of irrigation technology, governmental policy, engineering authority, and provides an example of an early engineering debate. Authorized in 1841, construction started in 1842 and the canal was opened in 1854. British irrigation officers contracted 1.9 million jobs to migrant workers, or those without local ties and therefore less personal investment in alternative methods of water control, who were unlikely to protest the system of canalization.

\textsuperscript{177} Arnold, \textit{Science, technology and medicine}, 117-118.
\textsuperscript{178} Medley, \textit{Roorkee Treatise}, 484.
\textsuperscript{179} Arnold, \textit{Science, technology and medicine}, 116, 118.
\textsuperscript{180} These measures had the effect of distancing the engineers from the current government too. As Ken Alder has written, “engineering is a purposeful, future-oriented activity, one which takes cognizance of present circumstances only insofar as they can be shaped to achieve desired results,” therefore, engineers and engineering “denies history” - of itself and its technologies. Ken Alder, \textit{Engineering the Revolution: Arms and Enlightenment in France, 1763-1815} (Princeton: Princeton University Press, 1997) 13,15.
Cautley described contracting “tribes of a wandering class whose chief, if not entire occupation is digging and watercourses.”\textsuperscript{181} Death tolls were not recorded in Cautley’s official account of the building of the Ganges Canal, although he spent a considerable amount of a chapter attempting to debunk the myth that irrigated agriculture caused malaria.\textsuperscript{182} Unlike other canals systems in northern India, the Ganges Canal was an entirely new project – that is, it was not built on the site of older canal works. It was the first canal to be financed by loan capital, administered by public works engineers (instead of the zamindars whose maintenance had been much criticized by the irrigation engineers), and expected to be profitable in ten years.\textsuperscript{183} When it was opened in 1854, the canal was 274km long, had cost £4 million pounds and would irrigate 530,000 hectares.\textsuperscript{184}

Because of scouring, and the resultant waterlogging and salinity, farmers, engineers and the Indian Government quickly became aware of the canal’s design flaws.\textsuperscript{185} These were serious enough to require major reconstruction. In 1863, Arthur Cotton was sent by the Madras Irrigation Company, which he had started in an effort to

\textsuperscript{181} Proby Cautley, \textit{Report of the Ganges Canal Works, Vol. I} (London: Smith, Elder and Co., 1860), 67. Pre-British practices featured the recruitment of local labour for locally managed irrigation projects. The record here is ambiguous because while Cautley’s “tribes of a wandering class” might have been local, they might also not have been imported from outside the region.
\textsuperscript{182} Cautley’s assertions were incorrect - mosquitoes flourish in areas with stagnant water, and the connection between canal irrigation and increased levels of regional malaria has since been well-documented. Cautley can therefore be read in either a cynical light, or one of medical ignorance. William Beinart and Lotte Hughes, \textit{Environment and Empire} (Oxford: Oxford University Press, 2007), 144-146.
\textsuperscript{183} Whitcombe, “Environmental costs of irrigation,” 243.
\textsuperscript{184} Headrick, \textit{Tentacles of Progress}, 177-179.
\textsuperscript{185} Whitcombe, “Environmental costs of irrigation,” 248. Whitcombe describes that by 1866, 66 drainage cuts had been made, but in years where the rainfall was above average, waterlogging was rampant, and fevers attendant. Whitcombe, “Environmental costs of irrigation,” 253.
privatize and profit from irrigation, to “correct the Ganges Canal’s operational defects with a view to purchasing it from the government.”

Cotton’s report lays out 4 “fundamental” design flaws, and another 14 “minor” flaws. After outlining the first four mistakes, Cotton stated unambiguously, “[these mistakes] have caused the cost of the work to be probably three times what they need have been, consequently having increased the time of execution threefold; so that they might have been yielding 20 or 30 per cent., or much more for the last ten years, instead of being to this day an unpaying project, with interest accumulating.”

For Cotton, the value of a project was critical; he had started his Lectures at the SME: “The importance of any subject of investigation is measured by the difference between the cost of obtaining it and its value when obtained... let us enquire into the value and cost of water.”

It can be inferred that because the Ganges Canal was “unpaying”; for Cotton this meant that it was not as valuable as it could have been, and therefore not as important an achievement to British India.

More importantly, a well-publicized and acrimonious quarrel broke out between Cautley, as the designer of the Ganges Canal, and Cotton. Cautley responded to Cotton’s critiques, and was drawn into a series of increasingly acrimonious exchanges in published reports, books, articles, and pamphlets. A brief example of the progressively more caustic

186 Stone, *Canal Irrigation in British India*, 45.
tone involved by both parties makes it clear that more than just ego was at stake.\textsuperscript{189} In his \textit{Discussion}, Cotton stated that the head of the canal “has cost \( \frac{3}{4} \) of a million sterling, it is impossible that it could have been more expensive.” Cotton then proposed his own repositioning of the canal head downstream near where the Solani and Ganges flow into each other, although “in the reports... [he had] seen there has been no discussion at all on this point.”\textsuperscript{190} Cotton implies that Cautley had overlooked an elegant and cheap solution due to his inexperience. Cautley’s response was direct and sarcastic:

\begin{quote}
When one looks at a map, what appears more easy than to take a short cut from the Ganges below the Solani junction, and to maintain a headwater by damming the Ganges? Sir A. Cotton remarks, with apparent astonishment, that this has not even been discussed in the reports he has seen; and he will be still more astonished when he learns that all discussion which have taken place on the subject, and all experiments that have been brought to bear upon it, have resulted in the inevitable conclusion that interference with the river in this part of its course would end in utter failure and that the works would be breached and washed away on the occurrence of the first flood.\textsuperscript{191}
\end{quote}

Cautley challenged Cotton’s engineering skills by suggesting that Cotton had not conducted experiments, but merely looked at a map. As Ken Alder has argued,

“engineers work very hard to transform artifacts into black boxes... [when] reproaches are

\textsuperscript{189} Of the two, Cotton had more to lose, and his resultant pursuit of the Artilleryman was vitriolic and dogged. Cotton had staked his professional career on his proposed changes to the Ganges Canal; the more deeply embroiled he became in a “shouting match” about knowledge of irrigation theory, the more explicitly his name became connected with a series of controversial design modifications. Cautley, by contrast, was concerned with his legacy, his good reputation as an irrigation engineer, and the status of “his” construction project.
\textsuperscript{190} Cotton, \textit{Ganges Canal}, 6-7.
leveled by rival groups of engineers… the black box of technology is opened for the inspection of the historian.”

The debates about the aqueduct get to questions at the heart of irrigation epistemologies: What are the criteria for determining the placement of technologies? Who has the right to determine the placement of these technologies? What is the relative importance of personal and scientific examination of an irrigation site? How important should cost be to a public works technology? Finally, how long should the technology last? These are questions which engineers in both Egypt and India struggled to answer.

In response to Arthur Cotton’s claims, the Indian government convened “a committee of PWD engineers [in 1864]... to recommend remedial measures for remodelling the Ganges Canal.” These were considered by Bengal Engineer James Crofton, who officially disagreed with Cotton’s suggestions for foundations, navigation, and expense. Cotton, in turn, attacked the government of India and Crofton for their unwillingness to use his suggestions. He contrasted his long years of service with Crofton’s apparent inexperience and lack of engineering skill. In 1867, another committee – this one composed of “impartial” engineers” was appointed “to decide between the two proposals. Although the committee gave a nod to Cotton’s schemes, it made allowances for the current condition of the Ganges Canal, and officially recommended Crofton’s plans. Cotton’s response was typical of later engineering

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193 The President and two of the Committee’s members were RE officers, the other two were George Sibley and Hugh Leonard, both civil engineers. *Report of the Ganges Canal Committee* (Roorkee: Thomason Civil Engineering College Press, 1867), 1.
controversies: he called into question the objectivity of the committee, “the president was
altogether opposed, both professionally and personally, to myself, and only one of the six
[members] could be an unbiased person.” Cotton’s reaction forced the government’s
response: they supported Crofton, their employee, and ignored all further correspondence
from Cotton. Although Cotton had been an Indian government engineer, by the late
1860s the failure of his irrigation companies, his unpopular insistence on navigation
canals, his public defamation of Cautley, and his attack on the Indian Government meant
that Cotton was dismissed as a crank.

The way that their public dispute unfolded provides an early example of the types of
bureaucratic tactics resorted to by the Egyptian government later in the century.
Engineering controversies were particularly difficult for the colonial governments to deal
with because of the purportedly highly technical nature of the evidence and the resultant
lack of “unbiased,” qualified personnel to weigh the merits of competing designs. Both of
these issues left engineers open to criticisms of incompetence, nepotism, or both. As
Drayton has argued, although historians may be sceptical of a revolution in government,
“from the 1830s onward ... [there was] a vastly expanded number of Royal and other
public commissions, [and] regulatory agencies... [This betrays] a new confidence in the
efficiency of government.” However, although there was a “new confidence” in the
bureaucratic processes, the Ganges Canal committees served to reaffirm the

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194 Quoted in Stone, *Canal Irrigation in British India*, 51-52.
195 An outsider questioning the objectivity of governmental officials, and the government’s response of
supporting their technocrats will be described again in Chapter 5 with the Wadi Raian Reservoir scheme.
196 Stone, *Canal Irrigation in British India*, 52.
government’s commitment to large-scale publically funded irrigation works. As Nicholas Dirks has persuasively argued in his work on the Warren Hastings trial, governmental controversies were “ritual moments in which the sacrifice of the reputation of one or more individuals allows many more to continue their scandalous ways, if perhaps with minimal safeguards.” Colonial governments had a vested interest in supporting their scientists and could be the final arbiters of all disputes. The government chose when to stop taking an irritating and potentially embarrassing individual seriously, in this instance Arthur Cotton, regardless of his qualifications or past service.

2.4 Conclusion

From the perspective of imperial science and colonial knowledge, the military irrigation engineers in India created systems of knowledge that their civil engineering pupils followed into the twentieth century. Military engineers had been drilled in practical construction techniques, and where possible they followed these principles. However, they also were willing to use and study local materials and thereby advance “instrumentalist science,” while they disregarded traditional South Asian practises and perspectives about irrigation. Their use of local materials, the adaptation of engineering technologies, and emphasis on fiscal management reflected an education that stressed pragmatic reactions to situations “on the ground.” By the late 1860s, military irrigation engineers were even starting to investigate the principles of hydraulic theory directly.

198 Nicholas Dirks, Scandal of Empire: India and the Creation of Imperial Britain (Cambridge, Mass: Harvard University Press, 2006), 30.
although the experiments of Captain Cunningham were probably more important to his civil engineering students at Roorkee than they were to later generations of military engineers.

Engineers like G.K. Scott-Moncrieff designed the necessary structures for Indian irrigation across the subcontinent, although there is evidence to suggest that in their own conception, the military irrigation engineers were an overworked and little-respected group of competent individuals. These problems, of course, need to be put into perspective of the environmental, financial, and social devastations that went hand-in-glove with irrigation projects. Lack of drainage, waterlogging, malaria, fixation on profits and profit margins, and famine caused by free market penetration were all consequences of the irrigation systems that the engineers designed. Prakash has called these interlocking structures “a grid, a coherent strategy of power and identity underpinned by an ideology of modernity that is legitimated in the last instance by science.”199 If Scott-Moncrieff’s work on 21 miles of canal is inserted into Prakash’s “grid,” his position and the arch at Narrai becomes insignificant. The dehumanizing power of his narrative is turned on its head, and the spectacle of the irrigation works – as symbolized by his arch – is a facade.

Between roughly 1883 and 1891, the early efforts of the Egyptian Irrigation Department were directly informed by epistemologies of military irrigation engineers through the person of Col. Colin Campbell Scott-Moncrieff RE, and therefore after

199 Prakash, Another Reason, 3.
indirectly: the re-organization of Egyptian agriculture into Irrigation Circles, adaptation of Egyptian technologies, the necessities of “improvement” and frugality, the engineers themselves. This chapter has documented the methodologies behind nineteenth century British Indian irrigation practice and science. By contrast, social, educational, and professional aspects of the engineers’ lives have been almost entirely absent, and will be discussed in the next chapter. Chapter 3 examines the creation of a new Egyptian Irrigation Department by focusing on the men who chose to transfer their imperial careers from India or Britain to Egypt.
Chapter 3

British Professional Irrigation Engineers in Egypt, 1883-1914

3.1 Introduction

In early April 1916, amidst news of war, the London Times ran an article titled: “Death of Sir Colin Scott-Moncrieff: A Maker of Modern Egypt.” The title was wordplay on Aukland Colvin’s The Making of Modern Egypt (1906) a popular work familiar to many readers and, as promised, it announced the death of Colonel Sir Colin Campbell Scott-Moncrieff, KCMG, RE (1836-1916). The British imperial project of “Egypt-making” was again boldly attributed to engineers, and specifically to this single individual, although it acknowledged his “capable staff.” The sympathetic, if fairly brief, article praised his “persistence, his imperturbable temper, and his devotion to duty.” The crowning moment in his career, according to the article, was the restoration of the Nile Barrage at Cairo within seven years of his arrival in Egypt, despite unfamiliarity and “local difficulties.” The rest of his long career, including 29 years in India, and ten years as the Under-Secretary for Scotland, were glossed over in favor of the nine years as Under-Secretary of Public Works, Egypt.1

Why was this? What made Scott-Moncrieff a “Maker of Modern Egypt,” rather than a “Maker of Modern India,” to which he devoted much more of his life, or even a “Maker of Modern Scotland” where he had wielded more political power? More

critically, how did Scott-Moncrieff “make Egypt” when Egypt was already a fully-formed and functional state? Scott-Moncrieff was credited with, “introduc[ing] a better system of water regulation with the available means, to increase and assure the area of irrigation, to improve scoured and waterlogged land, and to keep the canals and Nile embankment in repair…”² Irrigation engineering was portrayed as the people’s salvation. Scott-Moncrieff was deemed a “maker of modern Egypt” because the obituary-author accepted the British-occupied Egyptian propaganda that through the development of better irrigated agriculture, the engineers had made Egypt modern.

This chapter situates the engineers in their administrative and political contexts during and after their transition from the Indian context to British-occupied Egypt. Scott-Moncrieff and his successors in the Egyptian Irrigation Department tried to recreate an Indian Department in Egypt by hiring Indian-experienced personnel and recreating Indian bureaucratic structures. Part of these policies include the deliberate hiring and promotion of Royal Indian Engineering College graduates, (REIC, or Coopers Hill), who were educated in a quasi-military engineering college. The engineers’ educations are also highlighted because of their relevance to the water control policies, the irrigation projects, and perceptions of Egyptian irrigation practices of the Indian-experienced engineers.³ By discussing some of the social and professional repercussions of this consciously-created

² Ibid.
³ In this chapter, Clive Dewey’s assertion that the elites of the Indian Civil Service were “prisoners of the values they absorbed in their youth,” seems to apply to the education and epistemologies of the military and civil engineers. The military irrigation engineers were taught to continue learning about and incorporating new irrigation science as well as including their personal experiences and observations into their technologies; they did so. Clive Dewey, Anglo-Indian Attitudes of the Indian Civil Service (London: The Hambledon Press, 1993), vii.
organizational framework for the engineers, this chapter then examines the professional and social repercussions of the creation of an ex-patriot community.  

Colin Scott-Moncrieff was introduced in Chapter 2 at the beginning of his career; the body of this chapter opens with a short analysis of his long life. I introduce the concept of “imperial careering” in some depth, and utilize it as a method of understanding how his personal and professional life developed through his travels between Scotland, India, and Egypt. This section also breaks the dichotomy between personal and professional, and demonstrates how individual imperialists dealt with the messiness of and inseparability of individual motivations and the imperial project.

Secondly, I examine the bureaucratic structures and hiring policies that Scott-Moncrieff inaugurated. This chapter first discusses the bureaucratic framework that was set up for the Irrigation Department. The same power structures, engineering duties, and even language were used as epistemological and bureaucratic bridges between India and Egypt. Another way that the Egyptian Irrigation Department reflected that of the Indian PWD was the exclusion of Egyptian engineers from higher positions in the bureaucracy. The hiring policies deliberately privileged civil and military Indian-experienced engineers as the “best” hydraulic engineers in the British Empire. Scott-Moncrieff and his successors hired men with a similar class background, outlook, and education. These policies continued even as the British government had to hire men directly from Britain.

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4 Casper Andersen has made the connection explicit; in his terminology, there were “growing communities of engineers in colonial diasporas.” Casper Andersen, British Engineers and Africa, 1875-1914 (London: Pickering and Chatto, 2011), 87.
Throughout this time period, the Egyptian government continued to be skeptical of abilities and education of Egyptian engineers.

Finally, this chapter also examines the social and professional repercussions of such deliberate hiring practices on the engineers themselves. I argue that the increasingly professionalized engineers created a fledgling community in Egypt, along with their British and European counterparts in other Egyptian governmental positions.\(^5\) This community in Egypt was insular, middle class, Protestant, and overwhelmingly of British-origin. This “modern” community centered on the engineers as Egypt-makers and as a corollary, self-proclaimed destroyers of corruption and ignorance. As the British community in Egypt grew, British and British-Indian engineers used their social and professional connections to support their careers both during and after Egyptian service.

Throughout this chapter, I highlight specific engineers as examples of the wider historical processes described. This practice serves a dual purpose: 1) I situate individual engineers within their educational and professional bureaucratic positions, and 2) I introduce some of those who will be discussed in the rest of the thesis. The irrigation engineers (re)acted to/in each of these conceptually and spatially linked instances to provide for themselves and frequently their families. The importance of good “character”

\(^5\) This part of the chapter is drawn from a variety of imperial sources, but I make specific use of Catherine Hall, *Civilising Subjects: Metropole and Colony in the English Imagination, 1830-1867* (Chicago: University of Chicago, 2002); Ann Laura Stoler, *Carnal Knowledge and Imperial Power: race and the intimate in colonial rule* (Berkley: University of California Press, 2002); and Elizabeth Buettner, *Empire Families: Britons and Late Imperial India* (Oxford: Oxford University Press, 2004).
cannot be underestimated – the engineers as a group were trying to portray themselves as incorruptible, hard-working, honest, and apolitical.⁶

### 3.2 Colin Campbell Scott-Moncrieff

Like many other imperial administrators, Scott-Moncrieff applied “lessons” from one colony to another. In 1965, Roger Owen applied this principle to Lord Cromer and analyzed Cromer’s governance of Egypt through his India-tinted lenses.⁷ However, coupling this idea with theories of space and networks is relatively recent. In her prologue to *Civilizing Subjects* (2002), Catherine Hall gives a detailed analysis of Governor John Eyre’s journeys around the empire and the influences that led to his brutal suppression of the Jamaican revolt in 1868.⁸ Although he considered England “home,” Governor Eyre’s “identity, his sense of self and his notions about the world were formed as much but his experiences abroad as by his time in England. She maps his “imperial identity” across these different colonies.⁹ More recently, David Lambert and Allan Lester’s *Colonial Lives across the British Empire*, have theorized an idea of “imperial careers” Their idea of imperial careering is tied to both the “sense of volition, agency, and self-advancement” while evoking a “less autonomous, more de-centered sense of subjectivity and movement.” In the following discussion I attempt to use the

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⁶ The (usually unstated) claim that the engineers were apolitical was contemporaneously the least controversial, but has become the most difficult to accept.


⁹ Ibid., 65.
historiography to discuss aspects of his personal and professional life. Scott-Moncrieff struggled to control intimate tragedies through his considerable administrative talents and his devotion to the ideals of imperial science; he grafted Indian administrative customs onto Egypt.

Figure 2: Colin Campbell Scott-Moncrieff, 1863. Source: Royal Engineers Museum and Archives, Gillingham.
Colin Scott-Moncrieff was born in Dalkeith just south of Edinburgh, and spent much of his childhood there. Details about his early life are sparse. For instance, in the 1841 census Scott-Moncrieff at four years old was the second youngest-child living with his 7 older brothers and sisters, and his younger brother. His father was the Chamberlain of Dalkeith Park (also known as Dalkeith Palace), and was 47 at the time of the census. The family prospered, as evidenced by an increase of in-home servants between 1841 and 1851.\(^{10}\) Scott-Moncrieff therefore came from a home where his father worked into his mid-sixties as a literate household manager.

Scott-Moncrieff’s adult life was spent in the service of different colonial governments, and he was born at the tail end of the first generation of professional careerists. As Zoë Laidlaw has argued, his generation embraced information collection for its own sake, and specifically quantitative data. She states, “numbers implied control over a subject, and the possibility, so important to utilitarian philosophy, of calculation.”\(^{11}\) Scott-Moncrieff, educated as a military officer at Addiscombe and the School of Military Engineering, had been taught adaptability to colonial conditions and the importance of parsimonious hydraulics – Scott-Moncrieff collected monetary facts and figures instead of hydraulic theories. In the 1860s, for instance, he travelled to Italy to learn about irrigation from personal observation of Italian irrigation technology. As he wrote, “seeing in Europe the thought and attention bestowed on canals of very small

\(^{10}\) “Colin Campbell Scott-Moncrieff – 1851 and 1861 Scotland Census Records” http://www.ancestry.ca (accessed 19 June 2012). The household had no servants in 1841, but by 1851 there were 5 servants in the household.

\(^{11}\) Zoë Laidlaw, Colonial Connections, 1815-1845: Patronage, the Information Revolution and Colonial Government (Manchester: Manchester University Press, 2005), 174-175.
discharge compared with out great Indian works... one cannot but be impressed with the value of every drop of water.”

Scott-Moncrieff both expressed the importance of collecting all of the water, and the fact that this fact had been impressed upon him by “seeing” European canal systems. Therefore, as Jonathan Hyslop has argued, Scottish imperialists developed a “pragmatic mentality which was heavily focused on personal advancement and relatively little invest[ment] in emotional identification with the empire and its ideologies.” Hyslop states that this pragmatism was a result of the empire being a career path which presented more and better opportunities than those in the British Isles. In both his military training and social background, Scott-Moncrieff viewed the empire as a professional career.

As Lambert and Lester stressed, however, imperial careering encompasses the individual’s motivation, as well as his or her administrative decisions. Scott-Moncrieff was more autonomous than most Royal Engineer officers, because he had a specialized skill set and political recognition by superior officers. His own compulsion towards hard work, his reputation as a political engineer, and his good fortune allowed Scott-Moncrieff to have a particularly lengthy and varied imperial career. Monetary incentives may have been the driving force – in 1876 Scott-Moncrieff was making 1530Rs a month,

12 Quoted in Mary A. Hollings, ed. The Life of Sir Colin Scott-Moncrieff (1917, reprinted Ithica: Cornell University Library), 79.
(18,360Rs/a), and in 1885, Scott-Moncrieff was paid £1500/a. However, Scott-Moncrieff was also a careerist workaholic, whatever that career happened to be. He retired twice, first from Indian service and the Royal Engineers in 1883 when he was 47, secondly from the Scottish office at 65. Even his second “retirement” included lectures about irrigation, touring, writing articles and books, joining organizations, and heading Commissions. Undoubtedly he engaged in these rigorous pursuits for a number of reasons, but seemingly not from a lack of pension.

After his first retirement (from the Public Works Department Burma) while travelling through the newly occupied Egypt in 1883, he was offered head of the Irrigation Department. Writing to his sister in April, Scott-Moncrieff expressed his ambivalence, “Lord Dufferin said… that the work would be tremendous, but that he thought a very great benefit would result… Although I have not accepted it yet I don’t think I can refuse, when my only reason is that I am tired of Exile and would fain spend the rest of my days in my own land [ie. Scotland].” Despite his self-proclaimed exhaustion of “exile,” he spent another nine years in Egypt, and as late as December 1891, had consented to stay another year. However, he seems to have changed his mind after the sudden death of the reigning Khedive, Ishmael, in January 1892. Trepidation

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15 For a good outline of the work that he did between 1901 and 1916, see Hollings, ed., The Life, 298-346.

16 Quoted in Hollings, Life of Scott-Moncrieff, 152.
about political intrigue probably drove him to resign: by August Scott-Moncrieff had
accepted an offer from Lord Lothian to be the Under Secretary for Scotland. 17

Scott-Moncrieff’s imperial career was also defined by his tragic personal life:
two wives and three of his five children died before him. Furthermore, eight of his ten
brothers and sisters predeceased him, including four before he was 25 years old. 18 His
first wife’s death de-centered his sense of career and caused him to re-think his choices.
In 1876, he sent a letter from Bengal to General Charles Gordon, RE in the Sudan, asking
for a position there. He explained, “I am tired of routine life of many years in one
province. Eighteen months ago I had the great misfortune to become a widower and I
should like a change.” 19 His application to Gordon was an attempt to regain control of his
personal life by initiating a new career in a different colony. Still, his new career choice
remained within the rubric of a colonial engineering service.

Indicatively, Scott-Moncrieff’s reaction at his second wife’s death was not much
different. Immediately after her death, in late March 1885, Scott-Moncrieff received to a
letter from a friend suggesting that he take a leave of absence from the Irrigation
Department. Scott-Moncrieff responded, “At present I feel stunned to the great fact: it
will only be by degrees I shall realize that the whole plan of my life has to be rebuilt from
the bottom without her who made it all that was worth having… God’s own solace, work,

17 Hollings, Life of Scott-Moncrieff, 268-269.
18 Hollings, Life of Scott-Moncrieff, 367.
19 Quoted Hollings, Life of Scott-Moncrieff, 102.
steady work must do the rest.” He was attempting to assert personal control over his life by fixating on another aspect that could be managed. However during the February 1887 corvée crisis in Egypt, which will be discussed in the next chapter, Scott-Moncrieff resigned. His act of “moral protest,” reflected his growing disheartenment with the work of the Irrigation Department. Although British Consul-General Sir Evelyn Baring was able to convince Scott-Moncrieff to rescind his resignation, the latter was clearly unhappy about it. Scott-Moncrieff’s response was atypically sulky; his words are worth quoting at length:

You have several times compared your situation to mine… You seem full of hope of this Egyptian policy; I have not a shade of hope. You have not buried the happiness of your life here in Egypt. Do you wonder that life is not very bright to me, and that I often wish I had never seen the country? … Unless something quite unlooked-for occurs, I will stop on here at least till my five years are finished in May 1888. I cannot say more.

This passage implies a sense of inner turmoil that is similar to his letter to Gordon. In both, Colin Scott-Moncrieff cited personal reasons underlying his professional unease. For all his brave words in the immediate aftermath of his wife’s death, the above letter to Baring suggests a deeply unhappy widower. His resignation may reflect an attempt to free himself of his personal tragedy and a difficult professional situation. His attempts to cope with the untimely deaths of his wives seemed to involve removing himself from the

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21 This complex crisis will be discussed in detail in the following chapter.
place/space of their death. His words implied that if he could leave Egypt, he could leave tragedy behind. In this way, Scott-Moncrieff attempted to reassert some autonomy by reasserting control over his professional career.

Professional threats did not affect Scott-Moncrieff in the same way as the above marital tragedies. Shortly after he tried to resign in Feb. 1887, Scott-Moncrieff became embroiled in a controversy with an American scholar Cope Whitehouse. Whitehouse claimed that Scott-Moncrieff had promised his personal project, the newly discovered Wadi Rayan depression in the desert west of Cairo, £200,000 of the Irrigation Department’s £1,000,000.00 extraordinary budget. The project never got past the planning stages, but as the months and then years dragged on, Whitehouse became increasingly impatient and angry. Whitehouse came close to personally slandering Scott-Moncrieff, in July 1888, he wrote to F. Sanderson, “there is not a person to be found in Egypt or in Europe who considers the notes of Sir C. Scott-Moncrieff as fair representations of fact…” Whitehouse’s project will be dealt with at length in Chapter 5, but Scott-Moncrieff’s reaction to the American’s claims was above reproach. Rather than engage directly with Whitehouse’s claims, Scott-Moncrieff allowed the Egyptian government to deal with Whitehouse; he confined himself to simply stating that he had not promised Whitehouse that money.

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25 “Cope Whitehouse to F. Sanderson,” 7 July 1888, FO 78/5261.
Scott-Moncrieff devoted himself to colonizing and “civilizing” projects across the British Empire, and accepted some form of the civilizing mission and contemporary racist perceptions of the colonized. After visiting Granada early in his career, Scott-Moncrieff thought, “I seem to feel why the Mussulmans must perforce have been expelled by the Christians – these Christians who, narrow and cruel and bigoted… still had hold of some portion of divine truth.”\footnote{Quoted in Hollings, \textit{Life of Scott-Moncrieff}, 82. Emphasis in original.} Scott-Moncrieff’s conflation of Christianity with progress meant that he was able to justify the actions of the British in India and Egypt against both Hindus and Muslims. Furthermore, as a military engineer during the 1858 Indian Rebellion, he saw active service. Although his part in attempting to destroy resistance to British rule was confined to a single minor engagement, he was still disinclined to be “forgiving to the mutineers,” and referred casually to two “Muhammadan devotees… [being] cut down.”\footnote{Quoted in Hollings, \textit{Life of Scott-Moncrieff}, 47.} He tended to categorize individuals according to highly essentialized categories of racial and religious difference.\footnote{Indeed, John Black has recently speculated that one of the reasons why Indian graduates were employed as subordinate engineers was because of perception among the British engineers of the threat of another rebellion. John Black, “The military influence on engineering education in Britain and India, 1848-1906,” \textit{Indian Economic and Social History Review} 46:2 (2009), 215.} Hyslop, discussing another Scotsman, has written, “the form that his racism seems to have taken was that of a total exclusion of black people from his field of emotional or intellectual interest.”\footnote{Hyslop, “Making Scotland in South Africa,” 319.} Scott-Moncrieff, of similar social origins and status, seems to have acted, felt
and written along similar lines, and his Presbyterian Christianity led to his mental and emotional exclusion of colonized peoples.\(^{30}\)

Scott-Moncrieff referred to the Egyptian peasantry as credulous, bullied, “down-trodden” children, creating a patriarchal image for him and the other Irrigation Department engineers.\(^{31}\) Individual Egyptians were referred to in specific, if demeaning forms. After the death of the Khedive, Scott-Moncrieff wrote: “we have lost the best Turk I have ever met; the best man in his dominions; not a bit clever or enlightened, with little education, and very conservative in his views, but a loyal truthful man, serving the Almighty faithfully…”\(^{32}\) Scott-Moncrieff praised the Khedive for his devotion to God and the English, but belittled his lack of formal education, his personal world-view and his intelligence. These beliefs contributed to his conviction that “a subject race should not impose its regulations upon a governing race,” and as Hollings describes, he refused to take his shoes off to enter mosques.\(^{33}\) In 1908 his only surviving son was killed in the Sudan for attempting to impose British law in a land dispute there. Scott-Moncrieff attributed the incident to “Mahdiist” fanaticism, and Scott-Moncrieff wrote to the *Times* that “we must expect occasional outbreaks [of “Mahdiism”] from time to time, and it

\(^{30}\) In an 1874 letter to his sister-in-law, Scott-Moncrieff characterized himself as having a “broad church” conception of religion. By this, he meant that he felt that individuals should find a church whose principles that they agreed with, and he felt that there were political reasons to belong to the official church (he preferred the Church of Scotland). However, he referred derogatorily to Catholics as “Romanists,” and Muslims as “Muhammadans,” so his broad church preferences had clear limits that did not extend generally to other peoples who believed in a singular God. Quoted in Hollings, *Life of Scott-Moncrieff*, 93-96.

\(^{31}\) Quoted in Hollings, *Life of Scott-Moncrieff*, 159, 168, 177.

\(^{32}\) Quoted in Hollings, *Life of Scott-Moncrieff*, 268.

The anger of this statement may be attributed to a grieving father, but his racism and intolerance must be linked to a life-long prejudice towards South Asian and Islamic cultures.

Scott-Moncrieff was responsible for orchestrating the original hiring practices and administrative biases of the Irrigation Department. These grew out of his personal and professional beliefs about how to run and manage an irrigation department. A firm believer in the religious and cultural superiority of Britons, he smothered not only Egyptian promotion into the top ranks of the Irrigation Department, but also hiring Egyptian engineers at all. Scott-Moncrieff kept a tight leash on his British subordinates, his was the authoritative voice on the Irrigation Department’s communications to the Foreign Office in London and, more broadly, to the press. This predilection must be seen as an attempt to protect the Anglo-Egyptian government from the machinations of the Caisse, protect the lower-ranked engineers from themselves, as well as effectively manage the information that was transmitted to the British press.

34 Colin Scott-Moncrieff, “The Murder of Mr. Scott-Moncrieff,” The Times, 27 May 1908, 6b.
35 For instance, under his administration more than any of his successors, there were a very limited number of publications about the Egyptian Irrigation Department and its works – Scott-Moncrieff instead wrote a series of articles to various journals.
36 This statement is based on Foreign Office Correspondence for these years, the reports contained therein, and the British press’ reports of the Egyptian Irrigation Department’s activities. All of these reports and articles were dominated by Scott-Moncrieff’s voice.
37 Wilcock states unequivocally that it was Baring not Scott-Moncrieff who was responsible for suppression of the British engineers speaking to the Egyptian press. However, this explanation does not explain the lack of scholarly articles in British periodicals and newspapers except by Scott-Moncrieff. See William Wilcock, Sixty Years in the East (Edinburgh: William Blackwood and Sons, 1935), 115-117, 144.
3.3 Making a new India in Egypt

3.3.1 Bureaucratic policies

Many departments within the Egyptian administration underwent what Robert Tignor has called “Indianization.” This term refers to the “grafting of Indian institutions and methods onto Egyptian institutions which in themselves reflected Ottoman, French and purely Egyptian influences” and the time period in which these processes occurred – roughly 1882 to the mid-1890s.\(^38\) However, because the British government was unwilling to formally annex Egypt to the British Empire, they accomplished this Indianization process by placing “advisers” in key governmental positions with more power than their nominal Egyptian superiors.\(^39\) Areas of reform included the departments of public health, irrigation, education, finance, and the judiciary, the police, the army, and political institutions. The British-occupied Egyptian government argued that Indian officials were accustomed to operating on tight budgets, and the first priority of British rule was to reduce Egypt’s debt.\(^40\) As Harold Tollefson has demonstrated with regards to the Ministry of the Interior, the “Indianization” process was sometimes a long, hard-fought battle between Egyptian and British administrators.\(^41\)

One of the most important areas of reform for the new Egyptian government was irrigated agriculture. India was specifically understood by British administrators as a


\(^{40}\) Tignor, “Indianization,” 638, 660.

good model for re-invigorating Egyptian agriculture, and as a result, the highest-ranking Egyptian engineers in the Public Works Department were quickly dismissed to make way for the British and British-Indian irrigation engineers. According to Roger Owen, Cromer, like other former Indian administrators, specifically had a “strong conviction as to the utility of public works as a means of increasing property, coupled with the realization that, in a country like [Egypt], such works would have to be undertaken by the government or not at all.”42 “Indianization” formed not just a major part of the British reorganization of Egyptian administrative structures, but public works took on a specific form and importance within these processes. The Indian-experienced engineers had a firm belief in their own competence, and did not feel the need to utilize the services of London consulting engineers unlike other British African colonies which often drew on the professional services of London based consulting civil engineering firms.43

British and British-Indian engineers and politicians alike understood the Nile as the source of Egyptian wealth and this fact explains the overweening importance of these development projects. More importantly, since the American Civil War had produced a boom in Egyptian cotton, British politicians had seen the importance and quality of Egyptian cotton as the source of Egypt’s current wealth.44 The industrializing world had been rocked by the American cotton crisis, and it had forced nationalist governments to

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42 Owen “Influence of Lord Cromer’s Indian Experience,” 110, 115.
43 Andersen, British Engineers and Africa, 74. Andersen connects this explicitly with the engineers’ military background or training, leaving the question of motives open for debate. It is possible that the military engineers held some long-standing antipathy towards consulting civil engineers.
re-examine the role of the state in the economy: “protecting national industries and securing reliable sources of raw materials became a central component of the new political economies of... the capitalist world economy.”45 The British administrators and the Foreign Office believed that Egypt needed to increase its agricultural productivity. According to received doctrine from the Indian context increased peasant access to water and increasingly rationalized distribution of water were the optimal methods of achieving heightened productivity; this need for irrigation brought the Irrigation Engineers to the forefront of governmental decision-making. As historian Robert Tignor has stressed, the emphasis placed on the hydraulic requirements of Egypt meant that Colin Scott-Moncrieff was, practically, secondary only to Cromer in the echelons of the colonial administration in the 1880s.46

As the first head of the Irrigation Department, Colin Scott-Moncrieff had the power to dictate irrigation policy, and primarily he adapted his knowledge of irrigation from India to Egypt. This meant transplanting the basic assumption that irrigated agriculture increased the monetary value of fields by making crops better. In his words, the primary “indirect advantage” of irrigation systems was “the increase in the general wealth and prosperity of the community resulting from the increase in the produce of cultivation due to irrigation.”47 He also believed unquestioningly in the utility of public

irrigation systems. As mentioned in the previous chapter, private irrigation companies in India had been thoroughly discredited, and according to Roger Owen, both Cromer and Scott-Moncrieff agreed that the principles of good financial management were “the importance of low taxation, efficient fiscal administration, careful expenditure on remunerative public works, [and] the minimum of interference in the internal and external traffic of goods.” In Egypt, the importance of remunerative public works for the bankrupt colony was married to a long-standing worry about the legal outcomes of a private company having water rights to the Nile.

These factors influenced his importation of bureaucratic systems from India as well. The Egyptian Irrigation Department was divided into “Circles,” and in each Circle an Inspector was appointed, with a subordinate staff. In India, Irrigation Circles encompassed the drainage area of a river; in Egypt the Nile was subdivided into three circles in the Delta (to the west of the Rosetta branch, between the Rosetta and Damietta branches, and to the east of the Damietta Nile), two circles in Middle Egypt (the Fayum and along the Nile) and two in Upper Egypt. The basic assumption that each of these areas was and should be its own administrative unit “in which [the Indian-experienced engineer] had full authority and which he was expected to bring to a state of

49 Owen “Influence of Lord Cromer’s Indian Experience,” 113, 115.
efficiency.” The duties of Egyptian Irrigation Inspectors were roughly equivalent to Indian Executive Engineers: they were overseers and administrators rather than engineers for the construction and modification of canals. They also each had their own staff, (as in India) with the sub-assistant engineers being British, and the lower ranked staff members Egyptian. The hierarchies of command were clear and restricted Egyptian access to the top levels of irrigation administration. Indian administrations had also allowed for special postings, such as the Chief Engineer of Ganges Canal works, and starting in the 1880s, the equivalent Egyptian Irrigation Department positions included the Director-General of Reservoirs.

Indian-experienced engineers (both military and civil) dominated irrigation staff and policy in the first years of the British occupation of Egypt, but the increasing demand for engineers meant that the Egyptian government started recruiting from Britain. After the retirement of the last of the original Indian-experienced engineers (Robert Hanbury Brown) in 1903 and 1923, except for the notable exceptions of Murdoch Macdonald and Ismail Sirry Bey (between 1904 and 1908), only engineers educated at the Royal Indian Engineering College were Inspectors General of Irrigation.

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52 Willcocks, *Sixty Years*, 34.
53 Although it took most of 30 years for these issues to come to the boil, the British and Indian-experienced engineers became increasingly jealous of the policies of the Egyptian government towards Egyptian engineers. In the 1920s an affirmative action policy was set in place for the ratio of British to Egyptian engineers. Tottenham, *Irrigation Service* (1927).
54 Tottenham, *Irrigation Service*, 82-85.
Scott-Moncrieff and his successors denied both Inspectorships and Inspector-Generalships to Egyptian engineers until the early 1920s. Egyptian engineers were later characterized by P.M. Tottenham as “useless wrecks… unfit for the open sea of profitable service, were towed into port and left there.” Tottenham’s metaphor represented a founding narrative of the Egyptian Irrigation Department; Tottenham himself did not arrive in Egypt until 1895. His emphasis on “profitable service” is probably a key to the disagreements that the Egyptian engineers had with their conquerors. Tottenham’s assessment of Egyptian engineers was indirectly supported by Scott-Moncrieff’s 1885 request for Indian engineers. He wrote: “these [specific] officers have all been trained to Hydraulic Engineering. I can vouch for their experience, ability, and industry and believe that they would consent to come to Egypt.” Egypt’s need for experienced, able, and industrious hydraulic engineers is implicit in this statement.

The role of Egyptian engineers exemplified the colonial state’s aims for Egypt. Scott-Moncrieff wrote in an 1885 article that the work of the [British] irrigation engineers had been, “hindered by the absence of trustworthy native engineers.” As in India, the British trained Egyptians and Sudanese for low and middle-ranked positions in the

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55 In 1905, for instance, Egyptian civil servants made up only 28% of high civil service positions. By comparison, Britons and British Indians made up 42%. Owen “Influence of Lord Cromer’s Indian Experience,” 129.
58 Colin Scott-Moncrieff to Nubar Pasha, “Terms of employment and incidence of Pension of Officers permitted to serve under Imperial, Colonial or Foreign Governments: Application for the services of Major Western, RE and 6 Civil Engineers for Irrigation Duty in Egypt,” April 1885, IOR/L/MIL/7/660 File 5/10, India Office, British Library, London.
Irrigation Department. Although Egyptians became Inspectors of Irrigation their standing in the Irrigation Department was decidedly inferior, because between 1883 and 1923, only one Egyptian engineer was promoted to Inspector-General. For Egyptian engineers, even inspectorships were in short supply. In 1883, five Circles of Irrigation were administratively created, and one Egyptian Inspector (Abu Saud Bey) employed; in 1899, for instance, there were two Egyptian Inspectors - Mahmoud Sidky, and Hassan Wassif, and four British engineers. During the first 40 years of British occupation, no Egyptian was an Inspector-General in the Irrigation Department. This is significant because only Inspectors General submitted annual reports for publication in the Public Works Department Report. In a very concrete way, therefore, Egyptian words were stripped from the British historical record about Egypt. This erasure reinforced the statements of the British engineers and administrators about irrigation science and its practical applications in the Nile’s valley.

British engineers did not feel that their Egyptian compatriots – viewed as a group – were worthy of high office. British and British Indian engineers had a vested interest in

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60 Ismail Pasha Sirry was Inspector General of Branch Canal Works in 1907 and 1908, when he was promoted to Minister of Public Works. Tottenham, *Irrigation Service*, 82-83.
61 P.M. Tottenham, “Irrigation Service, 2; W.E. Garstin. *Report upon the Administration of the Public Works Department for 1899, with reports by the officers in charge of the several branches of the administration* (Cairo: National Printing Department, 1900), 36. Garstin also mentioned the death of another Egyptian engineer: Mahmud Bey Sabri. Sabri’s death was felt as a “severe loss,” because he “was an excellent officer and did good and loyal service.” Sabri’s death, however, was a loss to the Irrigation Department, not a cause of “mourning” like that of Wilson a year later.
62 As will be discussed in Chapter 6, a small, but vocal, section British public had the political clout to protest and modify the height of the Aswan Dam. If the public had known or cared to understand about the consequences of the Egyptian irrigation department’s actions, they might have been able to force changes. This type of argument, however is specious because, of course, Britons were not usually ambivalent about their empire, and especially about the works of technological “advancement.”
denigrating the proficiency of Egyptian engineers “for the value of… [their services
demanded] the absence of native experts.”63 They re-wrote the history of Egyptian
irrigation engineering to place themselves at the pinnacle. Although French engineers had
advised successive Egyptian governments, “the French engineers were not responsible
for this [decrepitude of Egyptian irrigation]. They could only advise and their advice…
was promptly rejected…”64 Tottenham therefore compared “Arab” engineers to the
“Anglo-Indian” engineers directing Arabic engineers, and found the Egyptians wanting.
In his abbreviated “History of the Irrigation Service,” P.M. Tottenham (himself a former
Inspector-General between 1909-1920) wrote about what he saw as the incompetence of
Egyptian engineers. British advice and supervision was essential, Tottenham argued,
because “the native talent has sunk so low that without modern scientific aid the
Egyptians could not work their own canals.”65 Tottenham’s account reflected why he
believed Egyptians could not be employed as Inspectors-General: he deployed the
narrative that Egypt was a decaying civilization which required British engineering
management and direction.

The British-Indian processes of promotion, as described by G.K. Scott-Moncrieff
in his memoir, seem to have been followed in Egypt: subordinates were promoted based
on their proven ability to carry out the departmental task at hand. In his memoir, William
Willcocks (more about him below) mentioned that promotion was by selection instead of

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64 Tottenham, “Irrigation Service, 1.
seniority. In many instances, the criteria used to promote some engineers and not others have been buried in the archival record. Most mentions of promotions are described along the following lines: “Mahmoud Bey Sidky was in charge of the Girga Directorate till the end of the year, when he was appointed Inspector of the 5th Circle.” Why Mahmoud Bey Sidky was promoted to Inspector is unclear—it may be surmised that he had been a competent subordinate. By promoting from within, the Egyptian government was able to keep, in Willcocks’ words, “the official squad… easily drilled.” Another example from the Public Works official reports, however, points to a clearer picture of how engineers in Egypt were promoted. In 1904, C.E. Dupuis became the first Inspector General of Irrigation in the Sudan. His former supervisor, K.E. Verschoyle, wrote that Dupuis, “[had] done an enormous amount of valuable work since he took charge of the 2nd Circle in 1901”; Verschoyle praised Dupuis for his systematic “transformation” of “ragged and inefficient channels… into respectable irrigation canals with good banks, regulators, and outlets.” His former supervisor implied that Dupuis’s anthropomorphized work somehow represented a moral transformation. By mentioning the date, Verschoyle also drew attention to Dupuis’ long service in the 2nd Circle. The disconnect between the memoir and the public document are probably also typical. What both types of source

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68 Willcocks was an embittered ex-official at the time of writing his memoirs in 1935. He was especially vitriolic towards Cromer, saying “Lord Cromer was never so happy ordering officials to march to the right or the left as he was when ordering them to think to the right or the left.” Willcocks’ words must be taken with a grain of salt, but his memoir remains the only extant personal discussion of an irrigation official in Egypt, and is therefore an invaluable source, Willcocks, *Sixty Years*, 116.
69 Sir William Garstin, *Report upon the Administration of the Public Works Department in Egypt for 1904, with reports by the officers in charge of the several branches of the administration.* (Cairo: National Printing Department, 1905), 161.
agree on is the expectation of promotion from within the Irrigation Department – by the engineers, the Egyptian government and the Foreign Office.\footnote{In 1911 in Upper Egypt, for instance, A.B. Buckley transferred from 5th Circle to Lower Egypt. In order to fill Buckley’s position, Mr. Jacomb transferred from the Delta Barrage to the 5th Circle. “Mr. Mason, Chief Engineer, Delta Barrage, retired on pension, and was replaced by Mr. Marr, from Mex Pumping station.” C.E. Dupuis, \textit{Report of the Ministry of Public Works for the Year 1911} (Cairo: Government Press, 1913), 104-105, 192.}

Evidence of a policy for why irrigation engineers were fired is even more difficult to determine than the reasons behind promotion. The Egyptian PWD reports that I have surveyed only mention a single engineer who was dismissed. The dismissed engineer, unnamed in the 1900 Report, had not been present when a drainage escape had given way, having “disobeyed orders to remain on the spot and take frequent soundings below the Escape.”\footnote{Sir William Garstin, \textit{Report upon the Administration of the Public Works Department for 1900: With Reports by the Officers in Charge of the Several Branches of the Administration} (Cairo: National Printing Department, 1901), 87.} In this instance, the destruction of the drainage escape was too important a failure to overlook. In his exposé of the Kitchener administration, journalist Sydney Mosley implied a less direct but more effective tactic: sometimes the government forced engineers to resign. Mosley mentioned that C.E. Dupuis was forced to resign as Under-Secretary of Public Works because “he dared… to hold opinions of his own on the way public works should be managed.”\footnote{Dupuis officially resigned from Egyptian service in 1912 when he was only 37 or 38 and in apparent good heath since he lived to be 80 years old; a forced resignation seems like a plausible explanation for a rising engineer to have suddenly retired. A.R. Astbury, comp. “C.E. Dupuis,” \textit{Register of Students}, 289.} Dupuis, according to this admittedly critical source, was fired simply for his opinions rather than his abilities as an engineer.

Undoubtedly, the Egyptian government did all in its power to stop bad press. In his memoir, William Willcocks mentioned that “one day, Lord Cromer… told me that I
must there and then sit down and engage in writing never to write anything while I was
an official of the Egyptian government, and to accept instant dismissal if I
transgressed.”\(^73\) Indeed, the official papers of Lord Cromer imply that his government
censored any negative critique; Kitchener went so far as to shut critical newspapers
down.\(^74\)

In the irrigation department, more than almost any other department in the
Egyptian government, the British-occupiers tried to introduce Indian precedents. These
precedents took the precise format of introducing bureaucratic formats, naming
conventions, and hiring Indian-experienced personnel. They also reflected the biases of
the Indian government against the promotion of Egyptian engineers. The next section will
discuss in more detail the hiring policies of the Egyptian Irrigation Department, and fit
the experiences of the individual engineers into an overarching series of educational
experiences.

### 3.3.2 Sources of engineers for Egypt

Hiring practices for engineers in Egypt demonstrates two distinct organizing
epistemologies. Firstly, Scott-Moncrieff hired Indian-experienced British and British-

\(^73\) Willcocks, *Sixty Years*, 116.
\(^74\) For instance, in 1904, Garstin wrote to Cromer mentioning that in his new book, eminent archaeologist
implied that Egyptians did not want to work for the government because of the use of the whip. Within two
days, Cromer send a letter to Petrie demanding an explanation. William Garstin to Lord Cromer, 11 April
1904, FO 633/8, *Cromer Papers. Miscellaneous Letters and Telegrams chiefly concerning Egyptian
Administration*, Foreign Office, British National Archives, Kew; Lord Cromer to Professor Flinders Petrie,
13 April 1904, FO 633/8. For a discussion of the suppression of newspapers under Consul-General
Kitchener, see Sydney A. Moseley, *With Kitchener in Cairo* (London: Cassel and Company, 1917), 181-
212.
Indian engineers. In his words, quoted above, these men had been “trained in Hydraulic Engineering,” and their hiring continued until the early 1890s. William M. Welch Jr. has argued that the British-Indians in Egyptian Irrigation reinforced the idea that a few well-chosen and competent Britons could be more valuable to the occupation than many foreigners.\textsuperscript{75} However, in the 1890s, the Egyptian government was forced to modify its hiring practices. Indian-experienced engineers had been “leant” to the Egyptian government rather than hired directly by the latter. The expiry of these contracts could be inopportune; in an 1887 letter to the India Office, Sir Evelyn Baring (later Lord Cromer) wrote that the Egyptian government needed the continued service of a Mr. Reid, who was “the engineer who has superintended the work [of repairing the Nile Barrage] and knows most about it. It would never do to make a change just now when the work is only half completed.” Incredibly, given the desperate state of Egyptian finances, Baring even offered that the Egyptian government would contribute extra to Reid’s pension.\textsuperscript{76}

Appointing experienced irrigation engineers on the India pay-role became associated with a series of practical problems. Similarly, these hiring problems occurred with the military engineers. In 1899, Cromer wrote a piquant letter to then-War Office Secretary Lord Lansdowne complaining about the Royal Engineers. The RE establishment refused to send more officers so that the Egyptian government could hire two military engineers “to high civil employment. The WO refuses to give the officers and refers us to India…”

\textsuperscript{76} “Sir E. Baring to Mr. Sanderson,” 2 May 1887, FO 633/5, \textit{Cromer Papers. Letters written from Cairo}, Foreign Office, British National Archives, Kew.
[whereupon] I must, of course, fall back on civilians. This I would rather not do anyhow from the point of view of Egyptian administrative wants.” 77 Although it is not clear which Egyptian department was going to hire the military engineers, his complaint implies why the RE officers were not hired for irrigation work in Egypt: the military establishment was against hiring its engineers for civil purposes, even when requested.

Because of these administrative difficulties, it is not difficult to see why the Irrigation Department ended up hiring British-educated engineers. According to Welch, by the 1890s colonial service Egypt hired according to a distinctive trend: “a premium was placed on youth, adaptability, and an adventurous spirit. Experience was less important than one’s social status.” 78 The use of these principles was derived generally from the example of the Indian Civil Service. 79 However, for the Public Works and Justice Departments, technical expertise was needed. Within these categories, then, the practice of hiring university and college graduates made sense, even reluctantly: the British imperial state in Egypt was looking to hire young, qualified, well-bred engineers who would gain expertise in that country. 80 As will be discussed below, because the British-occupied Egyptian government was looking for the qualities of adaptability, youth, and adventurousness they eventually settled on the Royal Indian Engineering College (Coopers Hill) as the best source for engineers. In the sections and chapters that

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78 Welch, No Country for a gentleman, 3.
79 In the words of Clive Dewey, for those who would enter the Indian Civil Service, “prospective recruits were force-fed with classics and mathematics from early childhood. Their prepatory schools crammed them for entrance examinations to public schools... their public schools crammed them for entrance exams to Oxbridge colleges.” Dewey, Anglo-Indian Attitudes, 6.
80 Welch, No Country for a gentleman, 100-101.
follow, the reader should remember that until 1912, the Advisor and Under-Secretary of State for the Egyptian Ministry of Public Works were at all times Indian-experienced irrigation engineers.

Although Royal Engineer officers made up only a small portion of the Egyptian Irrigation Department, they wielded disproportional political power. Scott-Moncrieff was merely the most successful of a handful of military engineers. Justin Ross, for instance, was appointed the first Inspector-General of Irrigation between 1885 and 1892; his programs on how to reduce fallow land in Upper Egypt set the standard for the next 10 years.\(^81\) Similarly, Major R.H. Brown became head of the Inspector-generalship of Lower Egypt in 1895 and retained that position until 1904.\(^82\) Scott-Moncrieff’s selection of few (military) engineers for the highest irrigation offices can be explained by the importance of good character\(^83\) and a common education, and similar epistemologies – all of the early Inspectors-General of Irrigation were engineers committed to the governmental need for frugality and increasing revenue by expanding irrigated agriculture.

Major Robert Hanbury Brown was one of the engineer officers posted to Egypt in 1884; unlike Scott-Moncrieff he retained his military rank until 1893, when he retired with an army pension of £250 per annum.\(^84\) An Anglican, Robert Hanbury Brown was born 15 January 1849 in London, and was educated at Marlborough College as a public

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\(^81\) Tottenham, *Irrigation Service*, 80.  
\(^82\) Ibid., 81-82.  
school boy. Upon finishing his education at Chatham, Brown was posted to India in 1872, where he worked for over eleven years, making Captain in 1882; Brown saw active duty in Afghanistan in 1880. Brown was an English Anglican, had a public school education, and represented an ideal candidate for British army service. His specialized irrigation knowledge allowed him to take an administrative position, unlike many other Royal Engineer officers. Brown’s career epitomizes the sort of “incremental professionalization” that D.M. Schreuder has propounded as being common among British bureaucrats. His proven combat effectiveness and administrative skill were rewarded by successive posts and promotion across the empire.

By contrast to the long traditions of the military engineers, Thomason College which opened in 1847 at Roorkee on the Ganges Canal was originally conceptualized as a place to train Indian subordinates for skilled work on the nearby canal. In the early 1870s when the British-Indian engineers later employed by the Egyptian Irrigation Department were training there, the college was under the direction of military engineer officers. In 1870-1872, the Principals and assistant principals were all RE officers. The college

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86 At Dinapore in 1871, Brown married Marion Mayrick, and she seems to have followed him, for at least some of his career; their three children were baptized in Bengal, Sussex, and Cairo respectively. Brown, “Service Record.” WO 25/3914.
88 According to RE traditions, the first military engineer in Britain arrived in 1066 with William the Conqueror. For a good overview of the military engineers’ perceptions of their traditions, see: M.D. Cooper, compiler. A short history of the corps of Royal Engineers (Chatham: Institution of Royal Engineers, 2006), 7.
89 Thomason Civil Engineering College Calendar. 1870-1871 (Roorkee: Thomason Civil Engineering College Press, 1870), 15-16; John Black mentions too that Thomason Civil Engineering College was
expanded its program considerably between 1847 and 1871, so that by the 1870s, it was training civil engineers, (both Indian and European), military officers, as well as offering a variety of other programs designed for Indian Civil Servants. The engineering program was two years, and covered courses in mathematics, civil engineering, surveying, drawing, physical science, and technical Urdu. Although by 1870-71 the college did not guarantee employment in the Public Works Department its engineering graduates were typically placed as Second Grade Assistant Engineers.

The education of the Roorkee engineers inclined them to believe in the applicability of universal mathematical principles. As mentioned in the previous Chapter, the 1870s and early 1880s were the years in which Captain Allan Cunningham was conducting his experiments at the Ganges Canal to develop a unified hydraulic theory for large canals. The students’ education at the Thomason Civil Engineering College was rooted in mathematics as the “language of international science,” to borrow David Gilmartin’s phrasing. Indeed, when one goes through the training manuals, mathematical engineering seems to have been the crucial didactic point. As the officiating principal, Captain A.M. Lang, RE of the Thomason Civil Engineering College wrote in 1871, “for success in these days theoretical, should precede practical, training [among engineering students].” The “universal” mathematical engineering principles

originally set up by a military engineer, Robert Maglan was the first Principal at Roorkee. Black, “Military influence,” 217.
90 *Thomason Calendar. 1870-1871*, 32.
91 Ibid., 20.
became a way to keep adaptability at the forefront of irrigation engineering at Roorkee. Lang was a strong proponent of an engineering student learning “intellectual training and book-learning” at college, and “the practice of his profession” after graduating into the Public Works Department and the tutelage of more experienced government engineers. William Willcocks (1852-1932), E.W.P. Foster (1850-1932) and William Garstin (1849-1925) were all trained at Roorkee in the 1870s at the apogee of its popularity among would-be imperial public servants.

William Willcocks provides a good, if extremely able, example of an Indian engineer who was educated at Roorkee. Willcocks was born in “a tent in the Dehra Doon,” and his father decreed that he would be an Indian-trained engineer. Accordingly, he was educated first at Mussooree School, then at Roorkee. As Willcocks later wrote in his autobiography, at Roorkee “I worked very hard, was never ill for a day, and laid a sound foundation for my future work. We were taught on the sound lines of the École Polytechnique of Paris, and not on the ridiculous lines generally in vogue in England at that time.” Willcocks was especially decorated when he left the college; he passed out of Thomason at the top of his class of fourteen students, received the Higher Standard, the Council of India Prize of Rs.1000, the Thomason Gold Medal for best Design, the Cautley Gold Medal for Mathematics, Col. Medley’s Prize for Civil Engineering, Col.

93 Thomason Civil Engineering College Calendar. 1871-1872 (Roorkee: Thomason Civil Engineering College Press, 1871), 276.
94 Willcocks, Sixty Years, 13, 23.
95 Willcocks, Sixty Years, 33-34.
Maclagan’s Prize for Physical Science, and the Prize for Drawing.\textsuperscript{96} In his words, “the college gave good prizes.”\textsuperscript{97} The PWD employed Willcocks in India between 1872 and 1883, when he left for Egypt. According to Willcocks, he was nominated for Egyptian service because the engineer for the Nile Barrage needed French, and he had studied it before. Although Scott-Moncrieff was afraid of charges of nepotism, and wrote to ask his nephew-in-law not to take the position, Willcocks “thought it best not to waste time, so as soon as [he] could hand over [his] division to [his] successor, [Willcocks]… left for Egypt early in November 1883.”\textsuperscript{98} That is, Willcocks left for Egypt before Scott-Moncrieff could prevent his leaving.

William Garstin’s education, by contrast, represented the first formal attempt by the Indian government to recruit civil engineers for public works employment. Between 1859 and 1871, the Indian government set a series of examinations which, if passed with an average of at least 60\%, earned the recipient a guaranteed position in the Indian PWD. These successful candidates were then sent to India to finish training in either Roorkee or one of the other engineering colleges. Garstin was a British-Indian born in 1849, and educated in engineering at King’s College London.\textsuperscript{99} His father was a member of the Bengal Civil Service, and he must have passed the so-called Stanley engineering exams

\textsuperscript{96} Thomason Civil Engineering Calendar (Roorkee: Thomason College Press, 1885), 34.
\textsuperscript{97} Willcocks, \textit{Sixty Years}, 36.
\textsuperscript{98} Willcocks, \textit{Sixty Years}, 81-82.
in one of the last few years of their existence. In 1872, he was being educated at Roorkee alongside William Willcocks.  

However, the Stanley engineers were criticized on a number of levels, predominantly because this method did not produce sufficient numbers of civil engineers. In 1871, the Royal Indian Engineering College (RIEC, also known as Coopers Hill) opened west of London as an institution specifically devoted to training British engineers for the Indian Public Works Department. The Principals of Coopers Hill were all Royal Engineer officers. The first principal, Major G.T. Chesney was a PWD engineer, who specifically created “its curriculum, its methods, and its traditions” based on what he perceived to be the specific requirements of the Indian Public Works Department. According to the biographer of the second Principal General Sir Alexander Taylor, Chesney looked for “[the] soul which would be its true esprit de corps... energy and ability: ... disinterested service, for patriotism, and for pride of race, with its corollary, noblesse oblige.” These character traits, however, were probably deployed to reinforce racial and class distinctions between Britons and Indians in Southeast Asia. Historian John Black argues that the single most important point of

100 Willcocks, Sixty Years, 33.
103 Ibid., 248.
education for Indian engineers was the ability to “use the resources at hand.”\textsuperscript{105} The other two Coopers Hill principals were also former Indian PWD military engineers, and continued the institutional patterns and traditions set down by Chesney in his explicitly martial framework.

Coopers Hill College was established by the India Office “in view of the education of Civil Engineers for the service of Government in the Indian Public Works Department,” and was the sole British means of getting Public Works Department (PWD) positions. In 1873-74, it could guarantee its graduates a Public Works position, and a Second Grade Assistant Engineers with a salary of Rs. 4200.\textsuperscript{106} A rigorous set of mandatory entrance exams and an expanded three year curriculum made Coopers Hill seem more scholarly than Roorkee and without the unsavory whiff of an Indian education.\textsuperscript{107} Given the importance of English, contemporary European and classical languages in the entrance examinations (4250 marks out of a possible total of 8700), the college wanted graduates with an English public-school education.\textsuperscript{108} The relative importance of science requirements was meant to force schools to train their graduates in scientific education.\textsuperscript{109} In 1873-74, the required curriculum taught mathematics, construction, architectural design, surveying, chemistry, physics, geology, “Hindustani,”

\textsuperscript{105} Black, “Military Influence,” 231-232.
\textsuperscript{106} Indian Civil Engineering College, Coopers Hill, Calendar. 1873-1874 (London: William H. Allen &Co. 1873), 5, 15. The medical board always reserved the right to reject candidates on basis of health concerns. Several engineers in the Egyptian Irrigation Department were rejected by the Indian medical board.
\textsuperscript{107} As Elizabeth Buettner has argued, schooling in Britain was a way to reinforce “whiteness” as a race. Buettner, Empire Families, 73-74.
\textsuperscript{108} Coopers Hills Calendar, 1873-1874, 6. John Black comments that the public schools, in the 1880s and 1890s were concerned with educating their students for a liberal-arts curriculum, rather than a scientific or technical education. Black, “Military Influence,” 221.
\textsuperscript{109} Cuddy and Mansell, “Engineers for India,” 111-112.
Indian geography and history, accounts, and optional subjects included higher math, natural science, architecture, and free-hand drawing.\textsuperscript{110} When the college closed in 1906,\textsuperscript{111} over 1600 students had been admitted, 1100 granted government positions, 764 had been appointed to the Indian PWD, and 36 to the Egyptian Irrigation Department.\textsuperscript{112} 

Like the engineers trained at Roorkee these young men would have seen themselves as unbiased students of universalist science. According to contemporary commentator Sir Richard Temple, the aim of the college was not only to educate them but to provide “moral training... discipline... [and] thoughtful tuition, which so greatly conduce to forming the character of youths.”\textsuperscript{113} This process of character-formation was created and instilled as martial drill.\textsuperscript{114} These edifying qualities in the college, according to Gilmartin, were put towards “subduing nature” through engineering mathematics.\textsuperscript{115} 

The engineers were supposed to have been very well acquainted with the mathematics of engineering science during their training at Coopers Hill. In the 1880s and 1890s, their courses included pure and applied mathematics, physics, chemistry, estimating, etc. The Coopers Hill Annual Calendars discussed Indian irrigation at some

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\textsuperscript{110} Coopers Hill Calendar, 1873-1874, 9. \\
\textsuperscript{111} The closing of the RIEC was directly attributable to the fact that the college was never able to make money. Set up as a self-supporting institution, the college always practically cost the government money. A controversy about the dismissal of seven faculty members at a time when the college needed to replace its equipment and renovate its buildings meant that it was closed in 1906. See: Cuddy and Mansell, “Engineers for India,” 118-123. \\
\textsuperscript{112} Astbury, Register of Students, 4. Astbury is not clear about whether those students who transferred from India to Egypt were counted twice. \\
\textsuperscript{113} Richard Temple, Oriental Experience: A Selection of Essays and Addresses Delivered on Various Occasions (London: John Murray, 1883), 310. \\
\textsuperscript{114} Black, “Military Influence,” 214. \\
\textsuperscript{115} In India, part of this insistence on their commitment to mathematical science was to define themselves in opposition to the military engineers, which Gilmartin makes explicit. See: Gilmartin, “Imperial Rivers,” 82.
\end{flushright}
length but even in the early 1900s they ignored Egyptian irrigation as a specific problem. For most of the college’s career, second and third year students were specifically taught hydraulic engineering. In 1886, for instance, the Annual Calendar specified that students were supposed to be taught hydraulic engineering in five segments: water supply, river engineering, artificial canals, sanitary engineering, and works of irrigation in India. According to the Calendar, the first four concentrated on the mathematical theory of irrigation, “the estimation of mean and minimum discharge... proportions of puddle trench and wall... floats and current meters... cross-section of canal.” The section about works in India was vaguer, as it purported to teach concepts such as “dams, weirs... diversions, aqueducts... escapes.” This section probably concentrated on the historical conceptions of Indian irrigation; for instance it also mentioned the “alignment of canals” which had been one of the major trouble-spots in South Asian canal engineering.116 Nothing in this program mentioned Egyptian agriculture as specifically distinct despite the fact that a significant minority of engineers were taking positions in Egypt. Egyptian irrigation got mixed in with other types of inundation or perennial irrigation, and became one example among many. The curriculum implied that there were universal laws to engineering construction as there were scientific laws of hydraulic motion.117 Some of the engineers who were hydraulically educated in this manner included T.H. Clowes, C.E.

116 Royal Indian Engineering College, Coopers Hill Calendar for 1886-1887, Containing a syllabus for the courses of study (London: W.H. Allen, 1886), 55-56.
117 In response to complaints, the Coopers Hill College changed its program in the early 1900s. The Coopers Hill Calendar for 1900-1901 broke the hydraulic engineering up into a basic understanding of the theoretical mathematics in year 2, and some specific tutoring in irrigation in year 3. Royal Indian Engineering College Calendar for 1901-1902, Containing a syllabus of the courses of study (London: Harrison and Sons, 1902), 95, 104-106.
Dupuis, J.K.E. Verschoyle, A.L. Webb, W.J. Wilson, and W.R. Williams, as well as P.M. Tottenham, and other Inspectors General in Egypt.\textsuperscript{118}

Charles Edward Dupuis (1864-1944), can be seen as representative of the Coopers Hill engineers with Indian experience. His father was the vicar in Richmond, and Dupuis was the fourth of five children.\textsuperscript{119} He was educated (like R.H. Brown) at the public school Marlborough College, and attended Coopers Hill between 1885 and 1888.\textsuperscript{120} Like Willcocks, Dupuis received prizes for his work at the college: he graduated third overall, and received First Prize in Descriptive Engineering and Second Prize in Projects and Designs. He also accomplished Firsts in Engineering, Applied Mechanics and Mathematics, and Second Class in Natural Science. He was appointed to the Indian PWD in the United Provinces in 1888.\textsuperscript{121} By 1892, he was Assistant Engineer First Class in the Northwest Provinces and Oudh, working at the Ganges Canal.\textsuperscript{122} Although it is difficult to pinpoint why Dupuis went to Egypt, it is probable that he was originally lent to the Egyptian government on a temporary basis. In 1902, he was appointed to head an

\textsuperscript{118} This is not to say that most of the irrigation engineers in Egypt were trained at Coopers Hill. Egyptian Irrigation Department Reports turned up another 14 engineers who were not trained at Coopers Hill or Roorkee. Unfortunately because these men were not trained at governmental colleges they are very difficult to track down.
\textsuperscript{120} Astbury, “C.E. Dupuis,” Register of Students, 289.
\textsuperscript{121} By the 1880s, the PWD in India only required about 20 students per year. The fact that Dupuis was able to get one of these positions speaks to his engineering abilities. Taylor, General Sir Alex Taylor, 263.
expedition to Lake Tana on the Blue Nile, and in 1905, he was appointed Inspector General of the Sudan.\textsuperscript{123}

Coopers Hill, as an educational institution, branched out in the 1880s in an attempt to compete against engineering programs in British universities. Positions from Coopers Hill for the Indian PWD became more and more limited – in the 1880s the government of India abruptly stopped recruiting engineers for public railways. This meant that the number of Indian PWD positions dropped precipitously. In 1898-99, for instance, although the College was still taking in enrollments of 30 students a year, only 12 graduates were guaranteed Indian PWD positions.\textsuperscript{124} Unsurprisingly, many of those graduates who were unable to gain Indian positions were hired by the Egyptian government; Indian positions were preferred, but Egypt was a good alternative for those who were not top of their class. The majority of engineers in the Egyptian Irrigation Department were trained by Coopers Hill between 1890 and 1906.\textsuperscript{125} Some engineers who went to Egypt had been rejected by the Indian medical board – the archival Coopers Hill Register lists at least six. Although many of the engineers in the Egyptian Irrigation Department remained low to mid-level technocrats for their careers a few became Inspectors General of Egyptian Irrigation.

One of the most successful, certainly the longest lived, was Percy Marmaduke Tottenham (1873-1975). Tottenham was born in Country Fermanagh (in what is today

\textsuperscript{123} Astbury, “Dupuis,” Register of Students, 289; Tottenham, Irrigation Service, 82.
\textsuperscript{124} Royal Indian Engineering College, Coopers Hill Calendar for 1897-1898 (London: W.H. Allen & Co., 1897), 13 note.
\textsuperscript{125} Of the 24 engineers identified by the REIC Calendar 1901-02 as serving in Egypt, 18 graduated after 1890. Coopers Hill Calendar, 1901-1902, 302.
Northern Ireland) to an Irish Anglican family, the Loftus Tottenhams; his father was in the army, and they may have had connections to the military traditions of many old Anglican-Irish families. Tottenham was educated at Repton School, an old Anglican English public school. He graduated from Coopers Hill in 1894, and took service in Egypt in 1895. He did not receive high honors from the College and therefore was not offered a position in the Indian Civil Service. Tottenham was able to rise in the ranks of the Egyptian Irrigation Department – in 1899, he was temporarily in charge of the Second Irrigation Circle; by 1909 he was Inspector-General of the Sudan.

The Egyptian Irrigation Department also recruited engineers from other British institutions however British universities tended to specialize in local fields of industrial engineering, rather than broadly-based engineering programs. According to John Black, the university curriculums “reinforce[d] the status quo of practical technical instruction rather than upgrade the prevailing system to encompass theoretical and practical technical education.” Maurice Fitzmaurice was among the prominent Victorian university-educated engineers who worked and consulted in Egypt. Born in Co. Kerry, Fitzmaurice (1861-1924) was the son of a physician, and almost certainly Protestant; he was educated at Armagh Royal Academy and Trinity College, Dublin,

126 Astbury, “Tottenham,” Register of Students, 356.
129 Black, “Military Influence,” 223. The increasing number and quality of engineering programs in Britain was one of the reasons why Coopers Hill was finally closed in 1906. Cuddy and Mansell, “Engineers for India,” 122.
1878-1882, where he received a joint BA and BAI with honors. To complete his engineering education, however, he articled under Sir Benjamin Baker between 1883 and 1885. Afterwards he worked for Baker and Sir John Fowler, on the Forth Railway Bridge and Chignecto Ship Railway; in 1892, he left the firm to take projects on other English railways. Upon Baker’s recommendation, Fitzmaurice was recruited by Egyptian government in 1898 specifically to be Chief Resident Engineer on the Aswan Dam. Baker’s patronage of a former protégé represents an instance of the informal networks of professional engineers at a low level of political influence.

By most accounts, however, the profession of civil engineering in Britain remained hostile to college-trained graduates until the early 20th century. Apprenticeships continued to be seen as the most important part of an engineer’s training; some contemporaries insisted that apprenticeships were more useful than any technical education. In his opening address to the Edinburgh and Leith Engineers Society in 1875, C. Graham-Smith expressed a common derision toward engineering programs and colleges in Britain asserting, “it is a delusion to suppose that the requisite mechanical knowledge can be gained in the workshops attached to some colleges.” Graham-Smith believed that apprenticeships taught not only the requisite skill set, but also discipline,

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130 BAI is the abbreviated form of Baccalaureus in Arte Ingeniaria; a Bachelor of Engineering. Trinity College had one of the best engineering programs in Britain in the 1870s. Taylor, General Sir Alex Taylor, 243.
131 “Sir M. Fitzmaurice. A Noted Engineer (Obituaries),” The Times 43812 (18 November 1924), 20c.
133 Andersen, British Engineers and Africa, 59. Andersen is at pains to stress that patronage networks were still essential to the civil engineers in late nineteenth century Britain.
attention to detail, punctuality, leadership, and good character.\textsuperscript{134} Civil engineers made substantial sums from their apprentices, and had a vested interest in the apprenticeship system. An 1870 Institute of Civil Engineers (ICE) report on the state of engineering in Britain argued that: “it is not the custom in England to consider theoretical knowledge absolutely essential... whereas the practical education in England is perhaps the most perfect possible, if the opportunities obtained during the pupilage are ample and the pupil properly avails himself of them.”\textsuperscript{135} The ICE did not accept university examinations as qualifications for entry until 1897.\textsuperscript{136} The Institute of Civil Engineers’ refusal to regulate British civil engineering contributed to this didactic split in the professionalization of engineering between apprenticeships and formal education\textsuperscript{137}

Some British engineers continued to be apprenticed until the late 1800s, and one such was Murdoch MacDonald. MacDonald (1866-1957) was educated at Dr. Bell’s School, Inverness. He received no other formal engineering training, but articled as a clerk on the Highland Railway, then apprenticed to its chief engineer. From 1891-1898, MacDonald worked for the Black Isle Railway (Scotland), first as resident engineer, then

\textsuperscript{134} C. Graham-Smith “Address on the Education of a Civil Engineer, at the Opening Meeting of the Edinburgh and Leith Engineers Society, 3 Nov. 1875” (London: E&F.N. Spon, 1876), 13,16.
\textsuperscript{135} Quoted in Cuddy and Mansell, “Engineers for India,” 110. One of the REIC’s measures to overcome this stereotype was to offer apprenticeships to certain candidates. Originally built into the curriculum – two terms of the final year to be given over to apprenticeship – the apprenticeship seems to have been revised in 1897, and restricted to two students a year in 1898, thus implying that practical apprenticeships were being de-emphasized during the processes of increasing professionalization in civil engineering. \textit{Coopers Hill Calendar, 1873-1874}, 8; \textit{Coopers Hill Calendar, 1897-1898}, 14; \textit{Royal Indian Engineering College, Coopers Hill Calendar for 1898-1899} (London: W.H. Allen & Co., 1899), 15.
\textsuperscript{136} Buchanan, “Engineers and Government,” 57. For an excellent chapter about the reforms of the ICE in the 1890s and 1900s, see Andersen, “Empire in the Institution of Civil Engineers,” in \textit{British Engineers and Africa}, 112.
in the engineering office. In 1898 he was appointed to be assistant engineer on the Aswan Dam. As a former apprentice, Sir Benjamin Baker recommended that MacDonald work with Fitzmaurice as an assistant engineer on the Aswan Dam in 1898. At that time, according to his obituary, he had designed an earth dam and a spillway to protect against floods. However, his previous experience of irrigation engineering was minimal.

Egyptian engineers were predominantly hired as assistants and not highly-paid, published, or promoted irrigation engineers in their own right. Although almost totally erased from the British archival record, a few generalities can be arrived at. Egyptian engineers were usually of high class backgrounds, and educated at Gordon College (Khartoum), and the University of Cairo after 1908. A Polytechnic School for Engineering was preferred by the Irrigation Department recruiters, and A.L. Webb was a presiding examiner in 1903. A School of Agriculture opened in 1890 and quickly focused on educating high school graduates (in English) to “be trained in the scientific and practical aspects of agriculture” and therefore be prepared to be agricultural

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139 As Casper Andersen has argued, the rise of British professional society integrated patronage networks based on apprenticeships. In fact, these networks may have assumed new importance as they represented a bond of trust between older consulting engineers and the younger generation of former apprentices who were looking for work. Andersen, British Engineers and Africa, 58-59. “Sir Murdoch MacDonald: the irrigation of Egypt (Obituaries)” Times, 25 April 1957, 13d. Baker himself had previous Egyptian experience – he had been involved in surveying Egypt during the reign of Khedive Ismail (r.1863-1879). Andersen, British Engineers in Africa, 62.
140 Obit, “MacDonald.”
141 Astbury does list one apparently Egyptian engineer who attended Coopers Hill. Hassan Effendi El Arab attended school between 1897 and 1900, got a job in the Egyptian Irrigation Department. Astbury, “Hassan Effendi El Arab,” Register of Students, 297.
plantation managers.¹⁴³ Given the poor state of education in Egypt under the British occupation, only children of the upper classes (either landed notables or the urban middle and upper classes) were able to afford post-secondary education. In 1903, for instance, fifty-three students were admitted to the School of Agriculture of whom thirty-two were from the “Egyptian land-owning” class and twenty were “foreigners.”¹⁴⁴ State-run secondary schools had been free in Egypt until 1882, but after the British occupation was set at LE £15/a – a sum too high for most parents. Indeed, in his 1904 Report on the Egyptian Administration, Lord Cromer mentioned that there were not enough willing civil engineering students, because they would be “often exposed to heat and discomforts of remote districts, and are necessarily bound to lead an active outdoor life with little or no prospect of private practice.” According to Cromer, students would have been welcomed into the Public Works Department, but that “did not afford adequate prospects in the way of pay or promotion.”¹⁴⁵ In that year, only ten students had graduated from the Polytechnic School of Engineering. Cromer’s words were meant to explain a situation that his administration had created and, as usual, he found a way to place blame on the Egyptians themselves.

As Amy Johnson has summarized, “the primary aim of the Egyptian state-run schools at the beginning of the twentieth century was to train public officials, officials

¹⁴³ Samera Esmeir, Work of Law in the Age of Empire: Production of Humanity in Colonial Egypt, (PhD thesis, New York University, 2005), 199-200. Esmeir contrasts this priority with the school’s original mandate to also train primary school graduates with good agricultural practice. Ibid.

¹⁴⁴ The final student on Cromer’s list was Egyptian, but not from the land-owning classes; all the students paid for their education. Lord Cromer, “Report on the Administration of Egypt for 1903,” FO 407/163.

who would be ‘unintelligent and docile,’ and the ethos of the schools ensured this.”146
One contemporary Egyptian thought that, the best that could be said of the post-secondary Egyptian educational system was that “we possess judges and lawyers, physicians and engineers more or less capable of exercising their professions.”147
Because of the British-encouraged emphasis on training professional assistants, language education took precedence over geography, mathematics, and science.

The engineers that had been trained in Egypt for Egyptian civil engineering had been educated to be go-betweens for the British civil engineers. Those Britons reproduced the structures of power that they had been part of in India, and brought to Egypt an overriding sense of their own professionalism, scientific expertise, and confidence in the British imperial project. This next section will discuss how these engineers socially and professionally adapted to life in the “veiled protectorate.”

3.4 Community and Professional Engineering

Within the bureaucratic structures and hiring policies, the Irrigation Department engineers acted in their own personal best interests. Their careerist ambitions and romantic engagements were intertwined interests, which I have conceptualized under the umbrella of community and professional engineering. In this case, politics, romance, and

147 Quoted in Johnson, “Reconstructing Rural Egypt,” 5-6.
rivalries bonded the engineers together as part of the ex-patriot community in occupied Egypt.

British irrigation engineers in Egypt often brought their wives and/or children to stay with them, at least for part of the annual routine. The presence of their families is an implicit rather than explicit argument for community, but it does imply that there were generations of Britons in Egypt for at least part of the year. In his eulogy for Justin Ross, Scott-Moncrieff mentioned that Ross’ wife travelled everywhere with her husband.148 Undoubtedly this was made easier because they were childless, but other engineers seem to have moved their families to Egypt. Willcocks describes the fact that his children and wife moved back and forth between Britain and Egypt; in 1884-86, his family settled at the Nile Barrage.149 However, by 1896, Willcocks made reference to his family joining him in Egypt for the first time in six years. Even then, “the boys were left at school in England,” to be collected by their mother in April, when “[his] family went home while [he] stayed on in Egypt.”150 Robert Hanbury Brown’s youngest child (Austin Hanbury

149 The presence of women and children in Egypt was probably not perennial. According to Anthony Sattin, there were four British seasons in Egypt: duck hunting in December-February; “preparing for the summer leave” in March-June, June-September only husbands in Egypt; September-December “return of the wives.” Anthony Sattin, Lifting the Veil: British Society in Egypt 1768-1956 (London: J.M. Dent and Sons, Ltd., 1988), 194-195.
150 Willcocks, Sixty Years, 121, 164-166. Willcocks’ personal relationship with Britain as “home” was tenuous at best. See Metcalf, Imperial Connections, 5.
Brown) was baptized in Cairo, 1887. Brown and his wife may have chosen to have the child born in Cairo rather than Britain.

More concrete evidence for a British community can be seen through intermarriage. Brown’s daughter Dora married Hugh W. Molesworth in 1903. Molesworth had joined the Irrigation service in 1894, and became an Inspector-General of Irrigation in 1913. Willcocks himself, as mentioned above, married Scott-Moncrieff’s niece. However, these marriages were slightly unusual in the colonial administration; as Zoë Laidlaw has stressed, most colonial elites conducted “the business of marriage” in Britain because they were “unimpressed by the marital opportunities available to them in the colonial sphere.” Indeed, other examples of such intermarriage are rare.

This British engineering community was strengthened by generations of families entering into Egyptian service. Of course, Colin Scott-Moncrieff and William Willcocks both served in the Indian and then Egyptian Public Works Departments and Scott-Moncrieff’s son worked in the Sudan Civil Service between 1906-1908. The Anglo-Egyptian community was also strengthened by generations of civil engineers. In 1898, E.W.P. Foster’s son Guy Christopher Foster graduated from Coopers Hill and took service in Egypt. G.C. Foster had been born in India near Dinapore in 1877, and

152 This young man, Austin Hanbury Brown followed his father into the Royal Engineering Corps, but died at the Somme in March 1918. R.B.B. “Major Sir Robert Hanbury Brown,” Royal Engineers Journal 40 (1926). 303-305.
154 Laidlaw, Colonial Connections, 19.
155 Scott-Moncrieff, “Murder of Mr. Scott-Moncrieff.”
therefore would have been eligible for enrollment in the Indian Colleges (E.W.P. Foster had been educated at Roorkee). The fact that Guy Christopher Foster was not trained at Roorkee like his father, and educated at Coopers Hill instead, implies the increasing reputation of the latter college at the expense of the former. As Casper Andersen has also identified in a series of case-studies of consulting engineers, British civil engineers often recruited their sons for successful family businesses, but the younger generations had more formal educational experience often as well as apprenticeships.\footnote{Andersen, \textit{British Engineers and Africa}, 68-69.}

However, if the engineer resigned from Egyptian Public Works Department, they did not often stay in Egypt. Some engineers left Egypt after short time, such as E.W. West who was appointed to the Irrigation Department in 1899 and resigned in 1903.\footnote{Astbury, “E.W. West,” \textit{Register of Students}, 390.} In the case of young Coopers Hill men, these engineers needed to take other positions, sometimes in other British colonies.\footnote{George Townshend Brooke was appointed to the Irrigation Department in 1899, but resigned in 1914 due to “ill-health.” Henry E. Shakerly transferred from the Irrigation Department after 4 years to the Sudanese Slave Trade Repression Department. Frederick Arthur Hurley worked in Egypt between 1896 and 1904, and then worked in the Transvaal Irrigation Department. Astbury, “G.T. Brooke,” \textit{Register of Students}, 12; Astbury, “Henry E. Shakerly,” \textit{Register of Students}, 283; Astbury, “Frederick Arthur Hurley,” 420.} Maurice Fitzmaurice went to Egypt as Chief Resident Engineer on the Aswan Dam in 1898, and came back to Britain in 1901, for an appointment to be the London city council’s chief engineer. In this instance, Fitzmaurice’s Egyptian service supplied him with the reputation to gain him a prestigious posting and imperial honors; he received the order of the Mejdidie and a CMG for his
work at Aswan in 1901. Other engineers used Egypt as a stepping-stone to a career in the colonies; Coopers Hill graduate F.A. Hurley went from Egypt to the Transvaal Irrigation Department, and rose to be Assistant Director of the South African Irrigation Department. Like Arthur Cotton, some engineers went from colonial governments into private business, but these positions seem to have been opportunistic rather than directly related to irrigation engineering. F.F.P. Walsh joined his brother as an Export and Shipping Agent after resigning from Egyptian Service in 1915. William Willcocks left the Irrigation Department in 1897 to manage the Cairo Water Company before transferring to South Africa and ending his British imperial public works career in Mesopotamia. Finally, the impact of world events should not be discounted; Willcocks went to South Africa in the aftermath of the Boer War, and a number of engineers joined the army during the First World War. Edward Lambton, for instance, left his position as Director General of Egyptian Public Works, and joined the Pembroke Yeomanry in 1914. Whether he intended to return to his pre-war position became a moot point in 1916 when he died at Ypres. The British engineering community within Egypt was thoroughly centered on official work, and like the Egyptian engineers themselves there were limited options for private practice. If dissatisfied, most engineers had to leave the colony.

160 Carlyle, “Fitzmaurice, Sir Maurice.”
162 For an overview of the work that Willcocks performed while in South Africa, see: Kate B. Showers, Imperial Gullies: soil erosion and conservation in Lesotho (Athens, Ohio: Ohio University Press, 2005), 153-154.
Deaths may have created a unifying bond within the community of British engineers. The records of the Coopers Hill Society list more than a handful of young men who died in Egyptian service.\textsuperscript{163} The reactions to a death seem to have included the need to publically memorialize their works. For instance, Henry Shakerly had a memorial tablet erected in his honor in the All Saints Church in Cairo. Scott-Moncrieff mentioned one of the ways in which these memorials were arranged. In 1901, on one of his last visits to Egypt, Scott-Moncrieff asked his “good friend” the Pasha Mustafa Fahmi “to call one of the canals of Upper Egypt after dear old Justin Ross, and he promised to do it.”\textsuperscript{164} This request, presented as a personal favour, may have been how many engineers were officially remembered for their works – Scott-Moncrieff makes no mention that the request was unusual. Even William Willcocks, although the Irrigation Department’s relationship with him was more troubled, had a street in Cairo named after him (Avenue Willcocks).\textsuperscript{165}

Some of these memorials crossed colonial boundaries and were situated in prominent British as well as Egypt. Benjamin Baker died suddenly in London in 1907 also received special attention. The 1907 Irrigation Department Report mentioned, “the lamented death of this distinguished engineer [which] has deprived the Egyptian Government of a valued counselor and adviser. He was consulted by us upon all

\textsuperscript{163} Astbury lists five engineers who died while serving in Egypt; another 2 died during World War I after resigning their positions. See: Astbury, Register of Students.
\textsuperscript{164} Quoted in Hollings, Life of Scott-Moncrieff, 293.
\textsuperscript{165} Peter Mansfield mentions that there may have been other streets named after irrigation engineers, but Avenue Willcocks is the only one that survived Egyptian nationalism. Peter Mansfield, “The Water Engineers in Egypt,” History Today 21:5 (1971): 359.
questions connected with the construction works of the Nile reservoirs.” His friends and colleagues were not content with Cairene streets or Egyptian canals: Baker has a window in Westminster Abbey commemorating his work on the Firth Bridge and the Aswan Dam. By contrast, Lord Cromer’s Westminster headstone is a small space on a wall near the royal tombs.

A close-knit community with husbands, wives, and generations, led to an intensification of scandals and personal animosity. William Garstin, mentioned above, had worked in India between 1872 and 1883. Upon transfer to Egypt, Garstin married his fiancé Mary North in 1888, and they went to Egypt. In 1898, she met her lover there: the military writer Lt.-Col. Charles à Court Repington. Amazingly, Garstin and Repington signed a published contract forbidding contact between the ex-lovers, and Repington was formally ordered to end the affair. However, upon both Mary Garstin and Repington’s return to London, the affair was rekindled and William Garstin successfully sued for divorce in 1902. However public their love triangle became, although it was primarily embarrassing for the participants, it did not have a long term effect on Garstin’s career (although Repington was forced out of the army because of his broken oath).

Service in Egypt seems to have, for the British engineers at least, created a community which transcended the socio-economic and educational origins of the engineers. This community revolved around the workings of the official British

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166 Reports upon the Administration of the Irrigation Services in Egypt and the Sudan for the year 1907 (Cairo: National Printing Department, 1908), 18.
167 Baigent, “Garstin, Sir William Edmund.”
government in Egypt and probably set the British engineers at odds with their Egyptian subordinates and co-workers, let alone the *fellahin*. The British community, generally, were sure of their own ability to govern. As imperial historian P.J. Cain has recently argued, this certainty was born out of ideas of their moral superiority as Britons. In Cain’s words, “the men who ran the British Empire and guided the fortunes of those who fell under Britain’s informal sway were alarmingly sure they had the right and the duty to mould the societies they dominated precisely because they were ‘men of good character’ and the natives were not.”¹⁶⁸ As Cain describes it, “character” was a mix of national character which was the result of overcoming historical obstacles as a nation, but manifested in individuals through the personality traits of “industry, energy, self-help and self-discipline, thrift, honesty, integrity, devotion to duty, and manliness in the face of difficulty.” These national and individual traits were inseparable in the minds of the British, but as mentioned above, they allowed the British administrators to retain moral superiority because they had undergone the necessary moral training at public school.¹⁶⁹ Although this fledgling community was obsessed with appearances, good character and scandals, it did bring people together.¹⁷⁰

Because of the generations and the explicit connections with the Raj, Britain, and later the Sudan, these engineers were also embedded in transnational networks of professional engineers. Professional engineering can be discussed in terms of the

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¹⁶⁸ Cain, “Character and Imperialism,” 178.
¹⁶⁹ Ibid., 178-179.
networks that its members were able to create, access, and utilize. As historian Frederick Cooper has discussed, imperial networks are defined as “forms of affiliation and association that are less defined than a structure but more than just a collection of individuals engaging in transactions.”

Gary Magee and Andrew S. Thompson have added to this definition by stressing three factors of formal networks: their voluntary nature, ability to bind individuals, and capacity to transcend national boundaries.

Professional civil engineering provided opportunities of knowledge, prestige, and connection for its members. Undoubtedly the most successful civil engineering professional organization in Britain, the Institute of Civil Engineers (ICE) worked to manage the field of British and British imperial civil engineering. However, it was not the only professional engineering institution organizing membership and international connections. Especially after retirement from Egyptian service, organizations such as the Institution of Royal Engineers and the Coopers Hill Society, (with its publications like the *Coopers Hill Magazine*, c. 1897-1950) also reinforced links to a shared history, and strengthened military or school-based bonds. These societies tracked and traced the careers of their members. Therefore, the Coopers Hill Society could not only record where P.M. Tottenham lived in 1966 – sixty years after the Royal Indian Engineering

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172 Ibid., 27.

173 Andersen has made a series of connections between the importance of attaining high office in the ICE and those highly placed imperial consulting engineers in Africa. Andersen, *British Engineers and Africa*, 70.

College closed – but also his hobbies in retirement: “lawn tennis, golf, and gardening.”

Although Tottenham was long retired, his willing participation in the compilation of the
*Coopers Hill Register* indicates the continuing utility of these networks.

Professional societies played a variety of important roles in the lives of British
and Indian-experienced engineers in Egypt and during retirement. Although they may
allowed members to keep in contact with each other, engineering, military, and scientific
societies also provided publishing opportunities for the dissemination of professional
information, scientific discoveries, and technological achievements. The journals of the
Royal Geographical Society (*Geographical Journal*), the Institution of Royal Engineers
(*Royal Engineers Journal*) and the Institution of Civil Engineers (*Proceedings of the
Institution of Civil Engineers*), all provided vehicles for articles about Egyptian
engineering. At the ICE, medals and monetary prizes were available to professionally
judge the most meritorious papers (according to that society’s standards), such as the
Telford Medal that F.A. Hurley won for his paper about the Zifta Barrage in 1904.

Engineers gained professional credibility from affiliation with institutions. As
Magee and Thompson stress, “networks made the ‘imperial center’ more permeable…
people were more able move in and out of it with increasing ease and regularity.”
One of the beneficiaries of these networks was Captain Henry Lyons, RE, who served as the
Director General of Surveys in the Egyptian Public Works Department. Lyons epitomizes

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the Institution of Civil Engineers* CLVI (1904) 323-336.
the professional, as he was educated as a Royal Engineer, elected to the Geological Society (in 1882), and the Royal Society (1906). His journal between 1905 and 1909 records a man obsessed with honorariums, societies and publications. He received an honorary degree from Oxford in 1906 and another from Trinity College Dublin, 1908, and glued the text of his Trinity College degree into the journal itself. Lyons’ sponsors for election into the Royal Society included one Turner, who introduced him to the Astronomer Royal and ultimately advised Lyons giving up his position as Director-General of the Survey in favour of a lectureship at the University of Glasgow. In Lyons’ words, “Turner advises accepting Glasgow offer of lectureship if offered… Wrote accepting if University thought lack of educational experience no bar. And if they could wait until the summer.” The university agreed, but after two years of teaching at the University, he took a position at the Science Museum. There, Lyons rose to be the Director, where he continued to publish articles, accept honorariums, and collect voluntary positions until his death in 1944. In this instance, the networks of

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179 Although Turner is only referred to by his last name, it is probable that Lyons refers to Herbert Hall Turner (1861-1930), an astronomer and also active in transnational organizations such as the Royal Astronomical Society (1885), the Royal Society (1896), and the British Association for the Advancement of Science (1913-1922). Roger Hutchins, “Turner, Herbert Hall (1861–1930),” in *Oxford Dictionary of National Biography*, online ed., ed. Lawrence Goldman, Oxford: OUP, http://www.oxforddnb.com.proxy.queensu.ca/view/article/36587 (accessed October 24, 2010).
180 Lyons was typically laconic in these journal entries. Lyons, “Henry Lyons Journal,” 29 October 1908, 15 November 1908.
professional institutions not only aided Lyons in his career, but provided him with life-
long professional relationships.

Many engineers who rose to administrative positions in the Anglo-Egyptian bureaucracy also received accolades or honours from both Egypt and Britain. Inspectors-General could expect to receive military decorations from the Ottoman Empire – the orders of the Medjidie and Osmanieh. Lower ranked engineers also sometimes received such honours, but possibly of a lower order. In some cases, British honours – knighthoods and appointments to the Order of Bath, among others – were also awarded to these engineers, but with less consistency. J. Kynaston Verschoyle, Edward W.P. Foster, Major Sir Robert Hanbury Brown, RE and Sir Arthur L. Webb were contemporaries in the Egyptian Irrigation Service. All four men rose to be Inspectors General of Irrigation, and received roughly equivalent orders of the Osmanieh and Medjidie, and all created Commanders of the Order of Saint Michael and Saint George (CMG). However, only Webb and Brown were knighted, and subsequently were awarded KCMG. As David Cannadine has argued, honourifics (especially of the Orders of Saint Michael and Saint George) were distributed to order to make and solidify connections between Britain and the Empire. In his alliterative turn of phrase, “hierarchy... homogenized the heterogeneity of empire.” Honourifics also served to “rank and classify military and civilian service to the state, as well as to honour and reward it.” Garstín’s KCMG in 1897 seems to have

Chapter 1
182 One of the engineers who did not rise to become Inspector-General but did receive the Order of the Medjidie was G. Parker. A.R. Astbury, “G.P. Parker,” Register of Students, 185.
been a present from Lord Cromer as part of “birthday honours” because “he is a capital man, and the Irrigation people have, as you know, been the financial saviors of the country.” These reasons for Garstin’s KCMG seem to reinforce Cannadine’s point about the ease with which “competent administrators” made their titles another point of access into British hierarchies. In this time period, accolades (including knighthoods) were becoming increasingly available for civil engineers more widely, and specifically those involved in colonial public works projects. In life, as in death, the British engineers collected post-mortem accolades as a way to publically demonstrate their professional successes.

Evidence for the existence of these convivial bonds post-Egyptian careers can be drawn from the published works of former Egyptian engineers. For most of the 40 years between 1882 and 1922, British engineers published most of the books written about Egyptian irrigation; these monographs were the results of Nile expeditions, official commissions, and Egyptian careers. The introductions and prefaces were often written by Egyptian Irrigation Department colleagues or former colleagues, implying friendship or at least continued written contact. For instance, after Colin Scott-Moncrieff retired, he wrote the “Preface” to Major R. Hanbury Brown’s *The Fayum and Lake Moeris* (1892). After Brown himself had retired, he wrote a very positive introduction to the

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184 Lord Cromer to Mr. Barrington, 12 April 1897, FO 633/8; Baigent, “Garstin, Sir William Edmund.”
185 Andersen, *British Engineers and Africa*, 80.
186 Interestingly, not all prefaces were glowing reviews. While still working in the Irrigation Department, Brown had then-Advisor to the Secretary of State W.E. Garstin write the introductory note to his *History of the Barrage at the head of the Delta of Egypt* (1896). Garstin, however, gave faint praise, merely saying that “Major Brown possesses special qualifications for the task he has undertaken.” W.E. Garstin,
third edition of William Willcocks’ *Egyptian Irrigation* (1913). Brown compared Willcocks to “Joseph of old, [because he] went through the land of Egypt and gained a comprehensive knowledge of the country and the condition of its irrigation and agriculture.” The book itself was praised as “thorough, scientific and complete,” even if some of the complaints about the irrigation department were described as “too hot for me [Brown].” Brown’s positive discussion of the monograph and hagiographic portrayal of Willcocks was distinctly tempered by Willcocks’ proposed changes to the Irrigation Department.

However, the bonds of common interest and friendship could be broken. If those involved were not directly under Egyptian governmental services they were sometimes more free about expressing their views. Differences of professional opinion could turn into long-standing quarrels. In 1905, for instance, Henry Lyons published a critical review of William Willcocks’ *The Nile in 1904* (1904). Lyons ended by stating: “it cannot be said that this work furnishes a full account… of the Nile, nor are all the statements in it free from doubt; but it is much to be regretted that in such cases more proof is not given, and no references or authorities are quoted.” Lyons has therefore suggested that Willcocks’ work was fundamentally flawed, and that he needed to provide more evidence for his claims. Willcocks responded to the review and attempted to

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disprove Lyons’ critiques point for point.\textsuperscript{189} Regardless of Willcocks’ success or failure, he remained suspicious of Lyons’ animosity. In 1918, in response to Willcocks’ critiques of the Egyptian Irrigation Department, the Egyptian government convened a Committee of expert engineers. Willcocks refused to appear before the Committee due to their biases against him. In his words:

\begin{quote}
\end{quote}

Willcocks was both afraid that the members of the Committee (Garstin, Webb, Lyons, and Fitzmaurice) would be biased against him, and he had hoped for a more sympathetic audience, such as Hanbury Brown.

The problems with professional friendships, especially in very small engineering networks, demonstrate the difficulties inherent within a small community. According to popular historian Anthony Sattin, there was a strict hierarchy among British officials in Cairo. Sattin also points to the fact that the social circles were quite small, and rumours of

\textsuperscript{190} William Willcocks, \textit{The Nile Projects} (Printing Office of the French Institute of Oriental Archaeology, 1919), ix-x.
poor behavior travelled fast.\textsuperscript{191} According to Welch, in the memoirs of British-Egyptians, “little is said of Islamic Egypt frankly because it is too much a part of living British Egypt. Ubiquitous Islam was too menacing for Anglo-Egyptians to respond easily to Islamic culture.”\textsuperscript{192} This is too broad a generalization, and one that did not quite fit with the necessarily interactive relationship between British engineers and rural Egyptians. Simply put, the engineers were supposed to work with the farmers, tenants, and large landowners in the vernacular to ensure continued cotton crop production and proper irrigation practices.\textsuperscript{193} Although much of their bureaucratic work entailed working with Egyptians, the engineers and other British administrators created ex-patriot British communities for their personal and much of their social lives. Because of the small number of British officials, these communities were quite tightly knit, and involved successive generations.

A scandal surrounding the Gezira scheme in the late 1910s shocked the Egyptian Public Works Department. Some of the official reactions typified the official response to Britons who were embarrassed the politically delicate Anglo-Egyptian government. William Willcocks, long-time expert in Egyptian irrigation, set himself at odds with most of the PWD, but refused to leave Cairo. After he had been found guilty of libel against a former colleague, Murdoch Macdonald, tensions between the two of them meant awkward and embarrassing moments for Cairene society. For instance, in June 1921,

\textsuperscript{191} Sattin, \textit{Lifting the Veil}, 190-191.
\textsuperscript{192} Welch, \textit{No country for a gentleman}, 39-40.
\textsuperscript{193} Ibid., 58. In his obituary, for instance, Justin Ross was credited with a very good command of Egyptian Arabic. Colin Scott-Moncrieff, “Lieut.-Col. Justin Charles Ross,” \textit{Royal Engineers Journal} 26 (1 October 1896): 225.
Willcocks was mistakenly invited to a garden party for the King’s birthday hosted by Lord Allenby, the Consul-General of Egypt.\textsuperscript{194} According to a guest at the party, Macdonald had been in attendance, but left when he saw Willcocks. He subsequently left Egypt entirely because he believed that Willcocks’ invitation “practically wipes out the effect of his sentence in Court.” The guest went on to complain bitterly about both men’s behavior: “Macdonald and Willcocks are both to blame for the money wasted and the reputation lost for this damnable discussion.”\textsuperscript{195} However, whether the guest was complaining because of the political consequences or the awkward garden party is unclear – and probably represents a bit of both. Although Willcocks felt remorse for some of his wrecked friendships, he likened their inevitability to the weather: “unexpected rain clouds gathered over my friendship [with William Garstin] and quenched it…”\textsuperscript{196} Nonetheless, he “regret[ted] bitterly” the loss of a long-time friend.

This section has attempted to place in context the Indian-inspired policies of the Egyptian Irrigation Department, and then discuss how they helped contribute to a community of Britons in Egypt. This community was also created by British isolationism and high rates of intermarriage death. The cumulative administrative effects of transplanted Indian policy meant many engineers with some military engineering background were not only hired to work in the Egyptian irrigation department, but that

\textsuperscript{194} Mr. Furness to Mr. Dowson, “Advisability of Sir William Willcocks undertaking public speaking engagements,” 9 June 1921, No. 13391/2 in FO 141/816/33, Foreign Office and Foreign and Commonwealth Office: Embassy and Consulates, Egypt: General Correspondence Foreign Office, British National Archives, Kew.

\textsuperscript{195} Dowson to Furness, 5 June 1921, No 13391/1 in FO 141/816/33.

\textsuperscript{196} Willcocks, \textit{Sixty Years}, 37.
only those with a military-influenced education became Inspectors-General. The cumulative social effects meant for that for the engineers this community itself was reminiscent of other colonial outposts: complete with controversies, scandals, mourning and racial exclusions. Differences between Egypt and India occurred in the relative entrenchment of Ottoman and French culture, but these aspects of Egyptian culture seem not to have deterred the Britons from recreating the social stratification of imperial British-India.

3.5 Conclusion

As David Gilmartin has cogently argued, “the increasing prestige and professionalism of irrigation engineers in India in the late nineteenth century was thus rooted particularly in the conjoining of the prestige of mathematical science to the prestige of service to the state.” Gilmartin’s statement highlights the political actions of irrigation engineers in India. With their transfer to Egypt, the British and British-Indian engineers became more overtly political – if only because they gained political power and influence as the arbiters of Egypt’s salvation: bringing water to the all-important cotton crop. The engineers received the accolades of professional scientists from their pursuit of theoretical universalism and a self-proclaimed “ethos of

197 What appears remarkable, then, is the relative speed and ease with which a British community “set-up-shop” and flourished. Undoubtedly, the relatively high numbers of Europeans in Cairo and the Egyptian community’s geographical proximity to Britain meant that a British community
198 Gilmartin, “Imperial Rivers,” 82.
disinterested service to science.” Their reputations as impartial scientists was a large part of how they justified being the arbiters of water control in the Egyptian provinces.

The importance of the connections to engineers operating in India and the British army should not be minimized. One of the most clear and important points for this thesis is the continuing military connections of the civil engineers who were hired by the British government in Egypt. Military engineer principals in both Coopers Hill and Roorkee continued the established practices of imbuing engineering students with the basic tenets of military education: the importance of technological adaptability, skepticism of native subordinates, and ambivalence towards mathematical theory. These networks were not static, however, and as this chapter has demonstrated the importance of British civil engineers became more important after the involvement of Benjamin Baker with the construction of the Aswan Dam. As Casper Andersen has argued, “imperial connections and the engineering projects they generated were central to the businesses, societal aspirations and profession identities of the consulting engineers [in Britain].” Andersen’s statement also reinforces the continuing importance of formal and informal transnational networks both during and after the Egyptian careers of British and British-Indian engineers.

Military engineers had a direct influence on their former students and unofficial apprentices: Egyptian Irrigation Department engineers retained their skepticism of local practices and did everything in their power to subvert and change those that were

199 Ibid.
200 Andersen, British engineers and Africa, 80.
perceived as inefficient and anti-capitalist – the exact definitions of these terms will be discussed in the next chapter. At the same time, the engineers were comfortable (at least in the first decade of irrigation engineering in Egypt) using existing irrigation networks and structures to better manage agriculture. These two contrasting irrigation engineering epistemologies will be discussed at length in the next two chapters.
Chapter 4

Irrigation Practice in Egypt

4.1 Introduction

For engineers in the Irrigation Department, the *fellahin* and their work represented a conceptual predicament. The *fellahin* were seen predominantly as contemporary versions of ancient peasants, and their techniques and tools were similarly perceived ancient. However, the agricultural work that they completed was recognized as critical to the modernization of Egypt, as well as its financial solvency.¹ In the middle of the engineers’ quandaries, Egyptian irrigation practices were often portrayed as unchanging, uncivilized, and anti-capitalist.² Egyptian small-landlords, tenant farmers, and landless-labourers were portrayed in ways that homogenized and silenced.

The engineers celebrated ancient irrigation knowledge while promoting imperial engineering as a vehicle of civilization. William Willcocks, for instance, discussed Egyptian irrigation, which he considered to be ancient, with an unabashed respect, “basin irrigation has stood without a rival for 7000 years. It is the most efficacious methods of

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¹ P.J. Cain has connected an Egyptian “failure of moral discipline” and the bankruptcy, and how character was equated with “civilization.” P.J. Cain, “Character and Imperialism: The British Financial Administration of Egypt: 1878-1914,” *Journal of Imperial and Commonwealth History* 34:2 (June 2006), 180. This chapter also uses James C. Scott’s definition of “high modernism,” which he describes as “the aspiration to the administrative ordering of nature and society,” specifically by technocrats through a “rational engineering of all aspects of social life in order to improve the human condition.” James C. Scott, *Seeing like a State: How Certain Schemes to Improve the Human Condition have Failed* (New Haven: Yale University Press, 1998), 88.

² In this chapter, the term “irrigation practices” not only encompass the methods, times and quantities of waterings. It also includes canal dredging, corporal punishments for labourers, and the use of contracting canal dredging. At that time, the Irrigation Department was the only governmental agency responsible for agriculture.
utilizing existing means of irrigation... King Menes built his first dyke when the Egyptian nation was in its infancy.”

Both Robert Hanbury Brown and Colin Scott-Moncrieff also celebrated the irrigation system of the ancient Egyptians. Brown wrote, “in Egypt, this natural inundation was assisted and controlled by artificial banks and means of regulation with such success that in the time of Joseph ‘all countries’ came into Egypt to buy corn.”

Hanbury Brown’s statement, not only implied the technical competence of the ancient Egyptians, but invoked the Biblical narrative of Joseph so familiar to Victorian figures, reminding them that Egypt was for them in some ways a known country, inhabited by the figures of Bible stories. Throughout their expanding empire, British imperialists sought to demonstrate their continuity with legitimate political sovereignty in the past. In South Asia, they created comparisons to the Mughal Empire and in Egypt as the rightful heirs of the ancients. While political control in Egypt was based on military conquest and power, and the implicit backing of other European powers, the Indian-experienced technocrats comforted themselves with delusions of a contented Egyptian population presided over by Pharaoh Cromer.

5 In his article “Poetics of Postcolonialism” Hussein L. Kahdim argues that Arabic poets, even Turco-Circassion upper class officials, saw another way in which Lord Cromer was like the Pharaohs: his authority was derived from brute force, and was therefore illegitimate, and enslaved its people. Hussein Kahdim, “Poetics of Postcolonialism: Two Qasidahs by Ahmad Shawqi,” *Journal of Arabic Literature* 28:3 (Oct. 1997), 185-86. Samera Esmeir has tied the British portrayal of their “humane” legal system to the fact that they focused on protecting the peasants’ rights against Egyptian officials rather than the landowners for which they worked. Samera Esmeir, *Work of Law in the Age of Empire: Production of Humanity in Colonial Egypt*, (PhD thesis, New York University, 2005) 169-170.
As part of the connections with the ancient Egyptians, the British engineers in the Egyptian Public Works Ministry portrayed the mechanics of Egyptian agriculture as strictly ancient. They re-read Herodotus, the Bible, and nineteenth century scholarship and saw around them agricultural tools and practices that they believed had been used for thousands of years. The engineers therefore assured themselves that the introduction of new technologies and practices would not simply re-vivify irrigated agriculture but pull the fellahin directly into a new millennium. Hanbury Brown even gave British occupiers the approval of the Sphinx: the Sphinx... turns its back on the royal tombs and the lifeless desert to gaze across green fields and flowing river.”

Agricultural change was underwritten with a moral lineage from the ancient Egyptians to the British Empire.

Egypt on its own was seen as incapable of developing in ways that would have been acceptable to the British. That is, the financial bankruptcy of 1876 was equated with social and even moral bankruptcy, and served as the foundation for a series of widespread and sweeping reforms. Although this chapter, and dissertation focus on the irrigation program and its attendant works, British reforms in other sectors – such as the Egyptian army and education – were justified along similar lines of “progress,” “modernity”, and “development.” As Roger Owen has indicated, British governors saw Egypt as an “inefficient despotism,” and this caricature led them to “concentrate their attention on

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7 Major R.H. Brown, *The Delta Barrage of Lower Egypt* (Cairo: National Printing Department, 1902), ix.
8 See the Introduction of this thesis for an overview of Egyptian politics between 1882 and 1914.
projects of reform and reconstruction rather than on measures designed to assist the long- 
term development of the economy.”

British dominance in Egypt had a seismic and variegated impact on the Egyptian 
economy, in its local lineaments, as well as its place in a British imperial economy and a 
transnational or global economic network. British imperialism hindered long-term 
development of an Egyptian industrial economy while feeding British industries through 
the provision of raw materials for manufacture. As Timothy Mitchell and Donald Worster 
have noted, Egyptian irrigation systems quickly became bound up in this imperial 
political economic paradigm, not least as colonial administrations sought to re-shape 
diverse existing labour practices for a wage-labour economy. Worster has discussed the 
ways in which modern “hydraulic societies” have attempted to gather control over the 
supply of water – right from the river to the fields; “irrigation... is a type of water control 
that is constant, pervasive, and... socially demanding... It leads in all cases to communal 
reorganization, to new patterns of human interaction, to new forms of discipline and 
authority.” Some of these “reorganizations,” such as the partial abolition of corvée 
labour and the increasing insistence on cash crops, allow the historian to focus on not just 
the British prescriptions but also some of the varied Egyptian actions and responses.

10 Roger Owen, Cotton and the Egyptian Economy, 1820-1914: A Study in Trade and Development 
11 Donald Worster, Rivers of Empire: Water, Aridity, and the Growth of the American West (Oxford: 
Egyptian agricultural actions depended upon the class’ relative political power, their access to money and credit, and the size of their landholdings.\textsuperscript{12}

In Chapters 4 and 5, I examine roughly the first twenty years of British rule in Egypt (1882-1902) from the perspective of changing irrigation practice and technologies. The three basic corporeal parts of irrigation systems are water delivery, water drainage, and irrigation practice.\textsuperscript{13} This chapter will focus on the British occupiers’ ideological drive to change Egyptian irrigation practices. Chapter 5 discusses the contemporaneous acceptance of the technological systems of water delivery and drainage. In both chapters, however, the overarching result of the measures of the irrigation department was to centralize control over the water in the hands of the irrigation engineers. The circumstances surrounding the British occupation of Egypt framed their intellectual understanding of the country, which in turn affected how, where, and why the modifications to the irrigation systems were executed. The underlying principles of military irrigation engineers were dominant during these years: a discomfort with local practices and simultaneously a desire to adapt local technologies to their vision of irrigation systems. That is, the engineers maintained that irrigation technology could be

\textsuperscript{12} As mentioned in the introduction, \textit{Corvée} labour is a system of utilizing usually unpaid (sometimes low paid) coerced labour as a taxation system. The most famous instance of \textit{corvée} in Egypt was its utilization in the construction of the Suez Canal.

\textsuperscript{13} In her recent article, Jennifer L. Derr, “Drafting a map of Egypt,” referred to “practices of irrigation” as a contrast to “infrastructure.” Her use of these terms is imprecise, as she seems to discuss basin irrigation as an example of irrigation practice. In the works of many irrigation historians, drainage and drainage works are “technologies.” See: Jennifer L. Derr, “Drafting a Map of Colonial Egypt: The 1902 Aswan Dam, Historical Imagination, and the Production of Agricultural Geography,” in \textit{Environmental Imaginaries of the Middle East and North Africa}, ed. Diana K. Davis and Edmund Burke III (Athens: Ohio University Press, 2011), 143-144.
adapted to the colonizer’s worldview; irrigation practices were often perceived as immoral, corrupt, and abusive, and in desperate need of overhaul.

In this chapter, I will first discuss the irrigation systems in place in Egypt before the British occupation; before 1882 Egypt was a complex and dynamic state, hampered by increasing debt for its attempts to reform the irrigation system, among other government sponsored projects. After situating Egyptian irrigation systems in their historical context, the second part briefly inspects the conceptual framework that the British brought to Egypt, from the perspective of the engineers. The engineers had many conceptual problems with the practicalities of Egyptian irrigation, especially their inability to understand irrigation practice as part of the extant technological networks. Instead, the engineers thought of irrigation in a simplistic Manichean dichotomy: ancient benevolent basin irrigation as opposed to recent, pernicious perennial irrigation. Their task, however, was to modernize both types of irrigation by bringing basin irrigation practices under British guidance, and dismantle Khedival perennial irrigation practices. The rest of this chapter describes their attempts at modernizing.

The third section, therefore, examines the suppression of Egyptian irrigation practices after 1882. I concentrate on describing the irrigation practices which the British systematically targeted as being obsolete remnants of an archaic and tyrannical system, specifically focusing on the kurbaj and the corvée. In Lord Cromer’s iconic words: “[reforms] dealing with long-standing abuses or faulty habits of thought... the three C’s –
the Courbash, the Corvée, and Corruption.”

These British legal actions, however, were based in large measure on pre-1882 reforms ordered by various Egyptian governments. By co-opting a series of high profile and widely unpopular irrigation practices, the British-run government was able to claim success, and claim that they had made the lives of Egyptian fellahin better. Finally, as I discuss in the fourth section, these reforms were wedded to the modification of Egyptian irrigation practice because the government explicitly wanted to develop wage labour and cotton crop rotations. These capitalist innovations were supposed to make Egypt more profitable by bringing Egyptian peasants and agricultural labourers into the global economy.

Egyptian irrigation and agricultural practice was aggressively targeted as an outdated and exploitative system for the fellahin. Who these fellahin might be or what they might want out of an irrigation system were not overwhelming consideration of the Irrigation Department engineers. Instead, as will be discussed in the final section in this chapter, they acted to replace these Egyptian practices with imperial ones. This meant the implementation of strictly regimented water regimes, cotton rotations and wage-labour.

One of the primary objectives and results of these attempted changes was a more thorough system of imperial observation and interference in the working of certain

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14 Cromer, Modern Egypt, 397.
15 Although this thesis makes no pretence to speak of gender and the Egyptian fellahin, Judith Tucker’s classic Women in Nineteenth Century Egypt discusses the linaments of class, labour, gender, and legal history. See: Judith Tucker, Women in Nineteenth Century Egypt (Cambridge: Cambridge University Press, 1985), esp. 16-64.
16 The question of whose colony was a delicate subject with the Ottoman Porte, but historians generally agree that the Anglo-Indian officials were uninterested in the details of making Egypt an unofficial British colony until they could guarantee French acquiescence. Headrick argues this happened around 1890. See Daniel Headrick, Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940 (Oxford: Oxford University Press, 1988), 200.
aspects of agriculture, specifically those connected directly with use and distribution of
the Nile’s water. As will be described below, although the Egyptian state could observe
its cultivators, it could not always force them to act in accordance with governmental
requests. First, however, this chapter will examine Ottoman historical precedents of late
nineteenth century Egyptian irrigation practice.

4.2 Egyptian Irrigation Practices and Technologies before 1883

4.2.1 Basin Irrigation before 1820

Under the Ottoman Empire, Egypt’s role was a granary, and a trading hub
between the Mediterranean Sea, Europe, the Near East, and sub-Saharan Africa. Egypt
grew rice, lentils, beans, wheat, and other agricultural foodstuffs for export to regions
such as Anatolia and Syria. The trade networks were supported by Egypt’s unique
geographical location; they were also supported the Nile itself, which flowed northward,
while the winds blew south, allowing shipping to easily travel up and down the river. The “natural” fertility of the soil, replenished every year by the Nile flood which
deposited large quantities of Ethiopian topsoil onto the Nile’s floodplain, meant that
Egypt’s agriculture consistently produced for overseas markets. Although not a “cash
crop” economy as understood in terms of capitalist monocropping, neither can it be

\[17\text{ Alan Richards, } Egypt’s \text{ Agricultural Development, 1800-1980: Technical and Social Change (Boulder,}
\text{ Colorado: Westview Press, 1982), 7.}
\[18\text{ J.R. McNeill, Something New under the Sun: An Environmental History of the Twentieth Century (New}
\text{ York: W.W. Norton, 2000), 166.}
characterized as a “subsistence” or “peasant” economy.\textsuperscript{19} However, the wealth generated from these agricultural surpluses went mainly to the Ottoman State and its representatives in Egypt, the Mamluks; the \textit{fellahin} were often squeezed for tax money, so that the Mamluks could wage wars against each other.\textsuperscript{20} That said, the legal priorities of the Ottoman-Egyptian government were to ensure community welfare at the expense of individual water rights.\textsuperscript{21}

The “basin” system of irrigation deserves some explanation, as it provided the long-term method of delivering water to crops until the completion of the Aswan Dam in 1902. Egypt receives little annual precipitation; the average annual amount in Cairo is 25.0\textsuperscript{mm}.\textsuperscript{22} The Nile therefore is the primary source of fresh water, and the only source of water for agriculture. In his eloquent imagery, Alan Richards describes the Nile Valley like “the back of a leaf: the land slopes down gradually from the high land lying along the banks of the river and canals toward the desert.”\textsuperscript{23} The annual flood of the Nile was allowed to spill over the banks and into shallow basins, bounded by low walls, which held the water for approximately forty days. At that point, the water was allowed to drain off the fields and either back into the Nile or into basins farther removed from the Nile banks. Since the flood waters were full of silt, when the water was either drained or

\begin{flushright}
\begin{footnotesize}
\textsuperscript{20} Richards, \textit{Egypt’s Agricultural Development}, 11-12.
\textsuperscript{23} Richards, \textit{Egypt’s Agricultural Development}, 14.
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allowed to infiltrate the soil, the silt was left behind and provided a layer of nutrient-rich fertilizer.  

Egyptian agriculture as practiced under basin irrigation was indefinitely sustainable, but there are a few caveats that need to be amended to statements of sustainability. First and foremost a large amount of work was required if agriculturalists wanted to grow more than one crop per year. To accommodate, Egyptian farmers dug canals, and from Ptolemaic times water wheels and Archimedean screws were used to lift water from the canals and Nile’s banks to grow two crops a year – or had slaves do this for them. Historically, the Nile has also changed course or had its branch channels dry up; this has caused, at certain points, entire societies to collapse without water. Under the Ottoman Sultans, Egypt’s economy was predicated on growing two crops a year; the silt that was left behind on the fields was also deposited in canals, which needed to be annually cleared. Canal clearance was undertaken through the use of forced labour, usually characterized as corvée labour. Therefore, “basin” irrigation in Egypt incorporated both basins and canals, and must be regarded as hybridized system of

24 For a very detailed description of how basin irrigation was actually practiced in Egypt in the late 18th and early 19th centuries, see Richard, Egypt’s Agricultural Development, 14-19.
25 As Mikhail has articulated, this meant that a “highly silted-up canal could, for example, force water to flow with more force and in considerably different directions than it usually did. This could in turn erode canal embankments or completely overtake them. Alternatively, such a canal could stop flowing altogether.” Mikhail, “From the Bottom up,” 117.
28 Perennial canal clearances, therefore, were not remarkable for the use of the corvée. They seem to have been more intensive because of the depth of the canals, which was necessary to utilize the low summer supply of water in the Nile, and because of the extent of the network of perennial canals.
agriculture.\textsuperscript{29} Basin irrigation needed a system of drains to move the water off the first set of basins, and either back into the Nile or onto other basins. Even in this most ecologically sustainable system of irrigation, excess water had to be carefully dealt with. Because of this, statements such as J.R. McNeill’s: “Muhammad Ali, Lord Cromer, and Nasser traded the only large, ecologically sustainable irrigation system in world history – one which sustained the lives of millions for five millennia and made Egypt the richest land in the Mediterranean from the Pharaohs to the Industrial Revolution,” should be examined critically, if not dismissed for hyperbole.\textsuperscript{30}

Before moving on, the sustainability of basin irrigation should also be questioned from a demographic and destructive perspective. That is, the Egyptian population never exceeded 5 million people before the mid-nineteenth century. By 1897, the first British census, the population was 9.7 million people and by 1907, that had risen to 11.3 million.\textsuperscript{31} These extra people simply required more water, although the increased cotton cultivation probably accounted for much of the extra water utilized. Sustainability must also be questioned in terms of the property and environmental damage that occurred because of the Nile floods. Flood waters were caused by spring rain running into the Nile's tributaries, which were unpredictable at best and disastrous at worst. If the Nile flood was too high, it would swamp much of the Nile Valley and cause massive property damage. If the Nile flood was too low, it would not overflow its banks, or only fill the

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\textsuperscript{29} In this thesis, to accommodate the aforementioned fact, I will refer to Egyptian irrigation in the plural, either inundation irrigation or basin systems of irrigation.
\textsuperscript{30} McNeill, \textit{Something new under the sun}, 172.
\textsuperscript{31} Owen, \textit{Cotton and the Egyptian economy}, xxiii.
\end{flushright}
basins and canals nearest the river, causing much of the irrigable land to be left without water. A series of low floods could cause massive food supply problems, and possibly famine.

Arguments about the “sustainability” of basin irrigation or the “unsustainability” of perennial irrigation, then, are probably based on oversimplifications of the issues in play. This thesis takes the perspective that perennial irrigation was, on the whole, more ecologically damaging than basin irrigation, and led to epistemologies and engineering decisions that supported a more invasive bureaucracy, the enhancement of agricultural class divisions, and the pursuit of ever more water.

4.2.2 Mehmet ‘Ali and Perennial Irrigation

The Egyptian government, under Mehmet ‘Ali, introduced a new form of perennial irrigation to the Nile Delta in the early 1820s in order to grow long-staple cotton.\(^{32}\) Long-staple cotton became increasingly prominent in Egyptian agriculture after Mehmet ‘Ali sponsored a French textile engineer, L.A. Jumel to research and develop a cotton plant whose fibres Jumel noticed were longer and stronger than any cotton then being cultivated in the Middle East. Within two years of Jumel’s beginning cultivation, asserts cotton historian Roger Owen, Mehmet ‘Ali recognized that because it “could not be consumed locally... it [was] an ideal product for monopoly [and]... an article for which

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\(^{32}\) Long-staple cotton growth in Egypt requires hot summer temperatures, but also heavy watering. To economize water usage, fertilizer, and labour, cultivation is usually best on large plots. Cotton cultivation also favored large land-owners who could afford to allow a crop to grow for seven months without income from the land, and wait two years between cash crops. Joel Beinin, *Workers and Peasants in the Modern Middle East* (Cambridge: Cambridge University Press, 2001), 26, 54.
there was a ready demand in Europe." Mehmet ‘Ali created state-run agricultural monopolies, and he used corvée labour to further his projects, which included the Nile Barrage at Cairo, and built deep canals in the Delta to take advantage of the summer flow of the Nile. Cotton became Egypt’s primary export crop during the American Civil War (1861-1865), and probably marks the first time that rural Egyptians interacted directly with the world economy.

Even before cotton was a potential cash crop, agriculture had been carefully monitored from the beginning of Mehmet ‘Ali’s reign. In 1814 he abolished the tax farmers, and had his government and occasionally the army directly collect the taxes from the fellahin. As Joel Beinin has stated, the collection of taxes from the fellahin, was carried out by “salaried government employees, monopolization of domestic and foreign trade, and compulsory delivery of harvests to state-operated depots of prices below the market rate.” The Pasha was, in fact, modernizing to raise money for his conscript army which he then used to conquer, albeit temporarily, large parts of the adjacent Ottoman Empire and the Sudan. Because of the delicacy and skill required to ensure a good cotton harvest, cotton cultivation leant itself to state-run organizing and managing initiatives. Furthermore, after the abolition of the tax-farming, Mehmet ‘Ali used the

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33 Owen, Cotton and the Egyptian economy, 29.
34 Owen states that cotton provided the impetus for a massive programme of public works utilizing corvée labour. By 1833, 240 miles of new canals had been dug in the Delta. See Ibid., 47-48.
35 Beinin, Workers and Peasants in the Modern Middle East, 25. As Beinin is careful to state, the peasants did not react favourably or necessarily comply with these instructions. He gives seven examples of peasant rebellions between 1814 and 1826. Ibid., 26.
36 For more about Mehmet ‘Ali’s modernization, specifically with regard to the disciplining of his army, see Timothy Mitchell, Colonising Egypt (Berkley: University of California Press, 1991), 36-38.
distribution of captured lands to gain loyalty from officials and provincial notables, and rewarded himself, his family and their favourites. In 1822, just a year after widespread cultivation of cotton had started, Mehmet ‘Ali became convinced “of the need to instruct the fellaheen more comprehensively in the correct methods of cultivation, he brought experts from Syria and Asia Minor, each of whom was assigned a number of villages in which the peasants were placed completely under his control.” In 1830, these instructions were codified into law, which gave specific instruction on every aspect of production. Long staple cotton cultivation, therefore, had always been associated with state control over the Egyptian rural population.

Perennial irrigation, unlike basin irrigation, allows three crops in an agricultural year, and specifically the growing of cotton as a cash crop. The difference, strictly speaking, is that water for irrigation is available perennially, so that agriculturalists can draw the water up from the canal using mechanical pumps, water wheels, or the aforementioned Archimedean screws as often as the crops allow. Perennial irrigation requires one of two technologies: deep summer canals to encourage the water to flow, or pumping stations/barrages to divert the water into canals. Under Mehmet ‘Ali’s hereditary successors because of engineering problems with the Nile Barrage, perennial irrigation primarily utilized deep summer canals. Mehmet ‘Ali’s program of public works also built water wheels and small dams and diversions to raise water level in the canals.

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Therefore, perennial irrigation required more labour, because of the crops of choice, the extended system of government-initiated canals, and the clearances of these canals.

Mehmet ‘Ali’s system of state monopolies were forcibly dismantled in the early 1840s, and he died in 1849. The sale of the monopolies led to an increase in large landowners, who in the 1850s began to set up the *izba* system, which will be discussed in more detail below. Large landowners came to lead the Egyptian governmental apparatus and it was unsurprisingly biased towards them. Under Sa‘id, (r. 1854-1863) military conscription and taxes were both burdens on the *fellahin*, causing many peasants to temporarily abandon their land; Sa‘id’s government limited their right to return, and sold the land titles to officials or foreigners. This process continued in the 1850s through 1870s, and led to the concentration of more and more land under wealthy large landowners. With an increase in economic power, came social power, as the large landlords increasingly sought to protect and project their power, rights, and agricultural practices in government. Egyptian historian Ehud Toledano also emphasizes the increasingly social and status-based differences between the Ottoman-Egyptian elites and the rest of the Egyptian population, which included differences in dress, the reassertion of the Turkish language, and legal inequality between classes.

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41 One of these practices was the use of *corvée* labour on private property, and later the exemption from *corvée* on the large estates’ tenants. Nathan J. Brown, “Who abolished Corvée Labour in Egypt and Why?” *Past and Present* 144 (August 1994): 116-137.
In the nineteenth century, irrigation practice underwent what Ghilaine Alleaume has termed an “industrial revolution in agriculture.” Her work and the work of Kenneth Cuno stress the social changes that occurred in Egypt between the 1840s and 1870s – according to Cuno, the Egyptian state for political and military reasons became much more interested in the categorization of its rural subjects for taxation purposes. In 1868, after the collapse of the cotton boom (with the return of the cotton-producing USA to the world markets) taxes were raised 70% to help pay for public works projects and the rising long-term debt. The tax hike caused many of the fellahin to become so deeply into arrears that they were forced to sell their land, or have it foreclosed.43 Those fellahin who left their land to avoid conscription into the army or the corvée, had that land seized and the usufruct rights handed over to tax farmers, the state, or large land owners. What these changes meant for irrigation practice was two-fold: firstly that many rural Egyptians were not living entirely from agricultural produce because they did not retain enough agricultural land to feed themselves and their families.44 Secondly, that land was increasingly concentrated into large farms of at least 50 feddans, but sometimes many more.45 The owners of the large farms (izbas), sought to tie down a supply of

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44 Ibid., 305.
45 Alan Richards, following British colonial administrative practice, divides the land tenure into four parts: “small peasants” holding less than 5 feddans of land; peasants holding between 5 and 50 feddans, large land-holders with over 50 feddans, and finally the landless. Richards, *Egypt’s Agricultural Development*, 2.
agricultural labour to work the fields and dredge canals. By the mid-nineteenth century, *corvée* labour was being used on both government canals and privately-owned canals.  

Both Egyptian systems of irrigation were based on the availability of unfree labour to keep the canals clear and the basins level. As political scientist Nathan J. Brown, documents, this labour was used to clear canals, maintain dykes guard the canal banks, dig new canals, build new dykes, and sometimes for large-scale public works projects, including the Suez Canal and the Sweetwater canal linking Suez with Cairo. Practically, these applications of forced labour meant that Egyptian irrigation was based on the availability of people without needing to pay for food or labour. In the late eighteenth century, village officials had maintained regional canals that they benefitted from – a locally maintained system of labour, albeit directed by the state. After cash crop cotton’s dominance, the system of *corvée* labour was expanded, and men were compelled to travel at the government’s bequest anywhere where their work was needed. As Brown has articulated, “a peasantry that had become accustomed to view the *corvée* as a locally administered (though perhaps inequitable) necessity watched the central authorities organize and exploit such labour more directly. A village institution became a national imposition.”

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47 Ibid., 121-122.
48 There is actually some disagreement in this historiography about whether or not the Egyptian *corvée* was paid/unpaid. Historians agree, however that if they were paid it would not have been much. See Owen, *Cotton and the Egyptian economy*, 48; Brown, “Who Abolished the *Corvée*?”; Beinin, *Workers and Peasants in the Modern Middle East*, 65.
50 Brown, “Who Abolished the *Corvée*?” 120.
maintain canals and dykes. However, especially those villages in Upper Egypt were also expected to send a portion of their population to distant public works projects.\footnote{For an early twentieth century perspective on the practice of sending Upper Egyptians to Lower Egypt to work as contracted labour, see: K.G. Ghaleb, “Extension of perennial irrigation in Middle Egypt,” (1908) ICE Paper 3768, Institution of Civil Engineers Library, London, 13-15.} As Brown sums up, “The state and the landowning elite became more aware of the possible uses of corvée labour and better able to exploit it.”\footnote{Brown, “Who Abolished the Corvée?” 123.}

The exploitation of corvée after 1882 became a delicate political issue for the British, among other Egyptian practices. However, the British made no secret of their admiration of perennial irrigation, which allowed both close supervision of the fellahin and the cultivation of cotton.\footnote{See Mitchell, Colonizing Egypt, 40-43.} The imported Indian-experienced irrigation engineers were told by Lord Cromer and the bureaucrats in London that their role in Egypt was to revitalize the agricultural system of the countryside to make it more profitable. As will be discussed below, the engineers brought their own very specific conceptions about colonial knowledge and irrigation to Egypt.

4.3 Colonial knowledge and irrigation practice

British engineers did not directly think about irrigation practice as a part of the irrigation systems, or if they did, it was not widely perceived as a part of the administrative framework of Egypt.\footnote{Esmeir states that agriculture and penal practices became institutionally separated. “Penal policies came to be confined to criminals threatening the cultivation of cotton, not labourers engaged in its cultivation,} This meant that while basin irrigation was
acknowledged as useful for the colonial state, the practices that were associated with it were seen as somehow ancillary, or worse antiquated. Perennial irrigation practices were supposedly even more pernicious – the corvée far from being eradicated under the more “modern” perennial irrigation had reached its widest extent (at least, this was what the engineers believed). This section, will briefly explore the colonial knowledge that the British brought to bear on existing Egyptian practices.

British engineers’ epistemologies centered on irrigation technology, and that technology was perceived as either ancient or modern. In an 1885 article, Scott-Moncrieff set up a straw man: “[irrigation] at least is the one subject that the Egyptian understands... Why should England begin teaching Egypt irrigation?” His answer referred specifically to the “new” perennial irrigation introduced in the Delta which “the people did not understand. Ignorance of the most ordinary rules of engineering, indolence, and corruption were fast destroying the country.” According to Scott-Moncrieff, the applicability of utilizing the Egyptian system of perennial irrigation was highly questionable. Scott-Moncrieff distinguished between basin and perennial irrigation, and stated that the Egyptians understood basin irrigation: “in the long narrow valley of Upper Egypt, the old Pharaonic system of irrigation still prevails and there the Egyptian has

while agricultural policies were limited to nature, worms, and machinery.” Esmeir, Work of law in the Age of Empire, 192.
little to learn.” Scott-Moncrieff implied that the Egyptian peasants did not have to learn about basin irrigation precisely because it was, in his words, “Pharaonic.”

As discussed at the beginning of this chapter, the British engineers’ epistemologies centered on the antiquity of Egyptian technologies – either specifically biblical or “Pharaonic.” Justin Ross, for instance, argued that basin irrigation was ancient irrigation, and that King Menes “found the Nile in a very untrained state, liable to great floods and irregular movements. The first thing he would do would be to construct a series of banks...” Ross set up the British engineers as the obvious successors to Menes, because of his attempt (like theirs) to train and control the river. Similarly, William Willcocks in *Egyptian Irrigation* (1913) referred to basin irrigation in the past tense, and perennial irrigation in the present tense, although both were still utilized in Egypt – in this example, although subtle, his tenses implied how forcefully basin irrigation was associated with antiquity, or at least history. Such comparisons also served to convince the British that nineteenth century fellahin made poor farmers, since they and their

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55 Colin Scott-Moncrieff, “Irrigation in Egypt,” 343-344. Scott-Moncrieff distinguished between basin and perennial irrigation, and stated that the Egyptians understood basin irrigation, and there “the Egyptian has little to learn.” Ibid., 344.
56 Derr, “Drafting a map of Egypt,” 141-142.
58 William Willcocks had four chapters dedicated to the systems of irrigation, two each of both types of irrigation. However, his two chapters of basin irrigation precede the chapters of perennial irrigation and he implied that basin irrigation was a prior, and superseded, system of organizing water delivery. Willcocks saw some merits in basin irrigation, stating “no better system than basin irrigation... could possibly have been devised.” However, when discussing basin irrigation in general, he tended to see basin irrigation as superseded by more technically “superior forms”: Willcocks used past tense, signifying an event or action completed in the past. In contrast, even when defining perennial irrigation, he used the present tense: “[perennial irrigation] is irrigation from canals which run the whole year round.” These differences in tense and tone suggest that the way that at least one engineer thought about perennial irrigation was conceptually different than basin irrigation. Willcocks, *Egyptian Irrigation* (1913), 299, 366. My emphasis.
technologies had apparently changed little in the intervening centuries. The engineers saw the use of such technologies, as Michael Adas has argued, as proof of an innate conservatism. They believed, that “civilization was not a state; it was a process... [Change] was essential for the civilized. Stagnation and decadence were associated with barbarians.” Civilization, for the engineers, was tied to large-scale technologies, and science.

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59 As Timothy Mitchell has argued, the occupiers believed that the “lack of form and structure indicate[d] the absence of individuality because without straight lines one cannot have individual houses.” Timothy Mitchell, “Invention and Reinvention of the Egyptian Peasant,” International Journal of Middle East Studies 22:2 (May 1990), 135.

60 See: Michael Adas, Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance (Ithaca: Cornell University Press, 1989), 194. Both the animals used and the tools used in Egypt had been used there for a long time, reflecting “both a resistance to technological change and the efficiency of the ancient instruments in performing a set of agricultural tasks that did not change significantly.” Bowman and Rogan, “Agriculture in Egypt,” 5-6.

61 Adas, Machines as the Measure of Men, 196. Esmeir has argued that the Anglo-Egyptian administrators felt that Ottomans were also arbitrary in their rule and application of force and law — and this became a justification for a new and widely applicable legal system. Esmeir, Work of law in the age of empire, 189.
Figure 3: Irrigating with a shaduf (circa. 1908-1927). Source: Royal Engineers Museum and Archives, Gillingham.
As mentioned in the last chapter, although engineering science – as epitomized by mathematics – was being taught at the schools set up and run by military engineers, this theory focused on the importance of designing, building, and monitoring irrigation technologies. The Coopers Hill Calendar for 1893-1894 (the year that P.M. Tottenham graduated) detailed the following aspects of canal construction: “Lateral canal. Summit canal. Cross-section of canal. Feeder to canal. Waste weirs. Passage of streams. Aqueducts. Siphons. Losses of water in canals. Reservoirs for supplying canals. Cuttings and Embankments. Puddling canals. Construction of Canal Locks. Form and construction of Lock gates.”

All canals were assumed to operate under the same set of conditions and the only irrigation practices mentioned might have been included in the discussion of water losses.

Whether the engineers had experience in India, or had just finished their engineering training in Britain, the irrigation practices in Egypt were not what they were accustomed to; in the case of Coopers Hill engineers, having been taught predominantly in terms of principles and mathematics the losses of water and noncompliance of the peasants must have been discomfiting, to say the least. Instead of borrowing from the local practices in Egypt, the Indian-experienced engineers utilized their own experience, and transferred British-Indian engineering principles to Egypt. 63 These experienced engineers thought that the Egyptian fellahin practiced good basin irrigation because it

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62 Royal Indian Engineering College, Coopers Hill Calendar for 1893-94 (London: W.H. Allen & Co., 1893), 57. The Calendar did include a discussion of irrigation in India, but it focused on the sort of structures built in India.

63 Headrick, Tentacles of Progress, 198-199. Headrick’s work is now older, but in this case, his theory of technology transfer best fits the importing of British experts and their technologies from India.
was ancient. The supposed antiquity of basin irrigation also meant that it needed to be developed.\(^{64}\)

The practices associated with perennial irrigation were perceived as fundamentally flawed and needed specifically British assistance. Time and again in the primary sources, the British and British-Indian engineers reserved their most acidic tones for the Khedives, their government, and their engineers. Hanbury Brown, for instance, recounted a story about how the heirs of a Minister called “Sultan Pasha” had “filled up a poor man’s field channel and then cut off his water supply.” Brown recounted another instance in which Sultan Pasha had ordered a dam built in the middle of a canal to flood his own fields, and leave none for his poorer neighbours.\(^{65}\) These stories, as Samera Esmeir has argued, reinforced the idea that Egyptian officials had mistreated the peasants and therefore the importance of legislating interactions with officials. Esmeir convincingly argues that the British state legislated peasant-administrator interactions as a way to avoid legislating labour relations.\(^{66}\)

The fellahin and their irrigation practices – whether associated with basin or perennial irrigation – became, therefore, a collective justification for the British occupation. These practices were always discussed in contrasting ways rather than as a

\(^{64}\) In the Faustian legend, the continued existence of the previous system in the people of Baucis and Philemon and their land cannot be tolerated. “They are too old, too stubborn, and maybe even too stupid to adapt and to move: but they are beautiful people, the salt of the earth where they are… [Faust] comes to feel that it is terrifying to look back, to look the old world in the face.” Marshall Berman, All that is Solid Melts into Air: The Experience of Modernity (New York: Viking Penguin, 1988), 69.


\(^{66}\) Esmeir, Work of Law in the Age of Empire, 169-172.
continuum, as mentioned above by Bowman and Rogan, and served to naturalize the economic, political, and social differences between Upper and Lower Egypt. An interrelated aspect of the arguments of the timelessness of the fellahin surrounded their so-called political apathy. British-Indian official A. Colvin spoke of their “ceaseless misery,” and stated that they were “politically blind” but he excused himself from describing the peasantry by the fact that he was writing a political history of the first 24 years of the British occupation. Peasants were not seen as being politically aware, and were therefore unimportant in his eyes. They were not citizens but timeless toilers of the land. Aside from squashing nationalist arguments about enfranchisement, these descriptions of the fellahin served to naturalize their place in an existing agricultural system – it made the peasants, in Derr’s phrase, “mobile pieces of an agricultural landscape.”

The engineers believed that the Egyptian fellahin needed British guidance, and technological expertise. The engineers thought of the Egyptian problems in terms of an Indian solution: provide more water to Egypt through public works. The primary way that the engineers completed this task was by “building structures” and conceptually framing them these structures as the dominant parts of technological systems. The rivers, in this case, became less rivers, and more “systems whose interrelated parts needed to be

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67 Ibid., 207; Derr, “Drafting a map of Egypt,” 144.
68 A. Colvin, Making of Modern Egypt 20, 27.
69 Derr, “Drafting a map of Egypt,” 150. Marjorie Morgan writes that British tourists imagined a nation to have a unique landscape therefore, “landscape is an integral part of national identity.” Marjorie Morgan, National Identity and Travel in Victorian Britain (New York: Palgrave, 2001), 46.
70 The historiographical theory of technology associated with engineering solutions will be discussed in greater detail in the next chapter.
controlled.” All engineers in the Irrigation Department therefore transplanted South Asian concepts about a homogenizing engineering doctrine. Problems would no longer be solved by studying and then modifying local solutions; rather the Egyptian problems were “solved” through a specific and multi-layered solution that had been perfected in Indian irrigation. This importation of technocrats and their techniques is not exactly a “method of transforming Egyptian irrigation from the basin to the perennial system,” as Daniel Headrick has argued. Instead they brought the discourses of Indian irrigation, which had become more and more interested in the articulation of “big principles” and “scientific” theoretical coefficients to use on any river, with the assumption that if the engineer knew how to apply these coefficients, and some basic local geography he would be able to build anything on every river. Irrigation projects took direct primacy and, more generally, local practices were often more or less annoyances which got in the way of good water distribution.

British “improvement” went hand-in-hand with doctrines of trusteeship and development. In liberal theory, the colonized non-European peoples were often regarded as incapable of self-government because they needed British aid to become rational. This can be associated with, as Michael Cowen and Robert Shenton have argued, the theory of “trusteeship,” in which the “remedy for disorder lay with those who had the...

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72 Headrick, Tentacles of Progress, 199.
73 For a much more subtle and complete interrogation of the connections between liberalism and empire, see Uday Mehta Singh, Liberalism and Empire: A Study in Nineteenth Century British liberal thought (Chicago: University of Chicago Press, 1999), 46-76.
capacity to utilize land, labour and capital in the interests of society as a whole.”

“Trusteeship” was understood by officials to be especially necessary in countries where British strategic interest and capital was at stake – such as Egypt. Because the British administrators perceived Egypt as an agricultural country, trusteeship in an Egyptian context was intimately tied to the agricultural economy. Joseph Hodge argues that in 1895, a theory of development became official policy with the appointment of pro-imperialist politician Joseph Chamberlain as head of the Colonial Office. Chamberlain’s theory of development “imagined tropical and colonized lands to be vast undeveloped estates, full of untapped resources that eagerly awaited British capital and know-how to open them up.”

Although Hodge does not directly discuss Egypt, Cromer’s policies were in step with Chamberlain, “growth was essentially a question of the development of a country’s resources through the application of capital to productive works.” In bankrupted Egypt, the expertise of the Indian-experienced engineers stressed remunerative technologies which built on the existing irrigation systems and acted to transform the social landscape into those “vast undeveloped estates.”

The engineers seem not to have grasped the implicit difficulties of adapting Indian engineering to Egypt. Justin Ross, for example, in a lecture to the Scottish Geographical Society introduced himself by discussing his qualifications. “I have been from 1863 to 1883 employed in irrigation in the Gangetic plains... and in the end of 1883 went to

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76 Owen, Cotton and the Egyptian economy, 334-335.
Egypt to assist in rectifying the irrigation system there.” His transition between the two colonies was apparently seamless. However, a few pages later, he mentioned one of the greatest practical difficulties of adapting irrigation engineering from one colony to another: “the irrigation of rainless countries is not studied much in Europe, nor does our Indian experience throw much light on the subject...”

Ross mentioned that the works of American engineers were the basis of the science of decreasing soil salination in Egypt. His words speak to what Donald Worster has called an “international fraternity of experts.” The engineers of the Egyptian Irrigation Department, therefore, both recognized and failed to recognize the difficulties of adapting Indian irrigation engineering to Egypt, while at the same time reiterating the applicability of universalist principles. Undoubtedly, Ross’ particular military education with its focus on technological adaptability, gave him confidence that Indian irrigation could be adapted to Egypt.

By the late nineteenth century a set of theoretical mathematical principles among hydraulic engineers were widely accepted by “experts” around the world. Although texts by military engineers such as Hanbury Brown continued to warn readers of the dangers of using the wrong coefficients when calculating water pressures, Brown

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77 Ross, “Irrigation and Agriculture,” 170, 182.
78 For their part, the American engineers carried the works of Scott-Moncrieff with them. Worster, Rivers of Empire, 146.
79 Gilmartin, “Imperial Rivers,” 83-86.
preached caution with rather than distance from mathematical engineering. As dam historian Norman Smith has argued, many late nineteenth century irrigation engineers concerned themselves with designing and testing theories of “stress-analysis” and ways to apply these tests to new dams. In practice, this meant that fewer dams in Europe fell down, and European civil engineers congratulated themselves on discovering universal theories of hydraulic pressures on structures. More importantly for the purposes of this chapter, the successful application of theory to structure was also applied to promote the scientific rightness of European practice to colonial irrigation systems. In many cases, the application of European agricultural practices in poorly understood colonial environments lead to devastation for local economies and environments. In Lesotho, as Kate B. Showers has documented, irrigation technologies were implemented by British officials to prevent gullies and soil erosion from forming in the fields of the Bathoso. Instead the engineering solutions only caused more soil erosion, because they had not been developed in the region and showed no comprehension of the peculiarities of the environment. In the early twentieth century in Northern India British agricultural policies were based on the widespread applicability of a universalist agricultural

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80 For instance, “The calculations must therefore admit the inevitable coefficient that varies with the particular conditions of each case, and so introduce the element of individual judgement which is so liable to err. However, there is no help for it.” See Brown, *Irrigation: its principles and practice*, 35.
And in Egypt, as Jennifer Derr has argued, “the imagined simplicity of Egyptian peasants prevented colonial technocrats from grasping the significance of human components of that landscape.” The next two parts of this chapter will discuss those “human components”: irrigation practices.

4.4 Dismantling local irrigation practices

The irrigation engineers tried to end practices that had been supporting the technological irrigation systems in Egypt. Superficially, they succeeded in reforming the practices that they believed were unfair, exploitative, or outmoded. Under British auspices, the institutions of the corvée, the kurbaj, and some forms of corruption were legally abolished, and the engineers and administrators congratulated themselves on their reform efforts. However, the British ignored or minimized uncomfortable truths about these irrigation practices: the measures that they claimed to have pioneered (explicitly abolishing the kurbaj, and the corvée) had begun as Egyptian reforms of the 1870s and early 1880s. Instead, the British emphasis on wage labour, planting cash crops, and providing more water for those crops helped force the small class of Egyptian landowners into a particularly ecologically destructive type of crop rotation.

4.4.1 The kurbaj


Derr, “Drafting a map of Egypt,” 150.
Before giving more detailed outlines of the changes to the corvée and crop rotation, a fairly quick explanation of the abolition of the kurbaj can be given. It represents a practice that the British wanted to be rid of, without being rid of its usefulness, and therefore serves as a less complicated example for the other Egyptian irrigation practices. The kurbaj, or courbash (sometimes kourbash), was a hippopotamus-hide whip, which had been used to flog the fellahin into, for instance, working for the corvée, paying taxes, or obtaining legal confessions.\textsuperscript{86} For the British, the abolition of the kurbaj was a great accomplishment, one of the “three C’s,” and British administrators used its elimination as a major reason why they were good governors of Egypt. In his 1907 travelogue-commentary, Douglas Sladen stated “before the abolition of the courbash [sic]... [the fellahin] were little better than slaves, not only of the Khedive, or even the Pashas, but of every... head man of a village.”\textsuperscript{87} The way that use of the kurbaj was abolished was something of a dénouement. According to Cromer, “Lord Dufferin determined that... the country should not, if he could prevent it, be ruled by an indiscriminate use of the whip... A circular was issued forbidding the use of the

\textsuperscript{86} Cromer, Modern Egypt, 398, 406.
\textsuperscript{87} Douglas Sladen, Egypt and the English, Showing British Public Opinion in Egypt upon the Egyptian Question: with Chapters on the Success of the Sudan and the Delights of Travel in Egypt and the Sudan (London: Hurst and Blackett, 1907), 17. Sladen’s overwrought writing was self-contradictory because he went on to argue that the Egyptians did not mind when their women were made into slaves and “the Egyptian has no special aversion to slavery.” In effect, Sladen was arguing that the British administrators had not only freed the Egyptians from slavery, but also freed their minds by making them see the moral wrongness of slavery. Ibid., 17-18.
Courbash.”

Dufferin’s actions, as related by Cromer, would not have been enacted by somebody who was more familiar with the government of Egypt.

The story was more complicated than either Cromer or Sladen wished to admit, and provides an adequate example of both the British ideologies and practice. One of the reasons why Dufferin’s circular was accepted by the Egyptian officials and the Egyptian landowning class, despite being the instrument of “slavery,” was because the kurbaj had already been abolished. In 1880, Turko-Circassian Prime Minister Riyad abolished the kurbaj. By 1881, according to Alexander Schölch, use of the kurbaj had practically disappeared.

Therefore, the Dufferin’s abolition of the kurbaj re-formalized what had already become accepted and law.

It is tempting to view this abolition of British practice in terms of the “modernization” of Egypt, and its substitution by a more Foucauldian routinized form of punishment. Certainly, there were elements of both high modern and pre-modern forms of discipline in Egypt between 1882 and 1914, and the kurbaj seems to fit the image of “torture as public spectacle.” However, the Irrigation Department engineers sometimes wished that they were able to discipline agricultural labourers using the kurbaj; direct evidence of engineers actually using the kurbaj after 1882 is nonexistent. In 1888, courts

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88 Cromer, Modern Egypt, 399.
91 Quoted in Cromer, Modern Egypt, 407.
martial proceedings of the police force brought to light the use of the *kurbaj* to extort confessions by prisoners.\textsuperscript{92} In his monograph about the Egyptian police force, Harold Tollefson presents an empathetic portrayal of why the police continued to use the *kurbaj*:

> Certain police characteristics and circumstances made them willing and able to circumvent the apparent prohibition [:::] the police were accustomed to harsh military discipline... they also had not acquired the necessary skill to provide... [necessary] evidence... Frustrated, they were tempted to revert to the use of the *kurbaj* to extract confessions and simplify their task.\textsuperscript{93}

Tollefson concentrates on the 1880s; British administrators took over the police force in the 1890s and were anxious to downplay continued use of torture.\textsuperscript{94} However, public whippings were handed down as sentences in the Dinshawai Trials in 1907.\textsuperscript{95} According to Roger Owen, this incident caused both Egyptian nationalists and British Liberals to severely question Lord Cromer’s policies: “pointing out the obvious disparity between Cromer’s lauding the fact that he had rescued Egypt from the *kurbaj*... only to resort to...”


\textsuperscript{94} Ibid., 87-88.

\textsuperscript{95} In June 1906, a party of Egyptian officers went pigeon-shooting, but their expedition led to a riot in the Deltaic village of Dinshawai and both the officers and villagers were injured; one of the officers later died of his injuries. In response to this incident, in the words of Kimberly Luke, the Anglo-Egyptian government had the decision to pursue order or justice and chose justice.” In direct contravention of Egyptian law, four men were publically hung, and a total of eight villagers sentenced to 50 lashes each; some of these villagers also were sentenced to jail. Both at the time and in the eyes of many commentators and scholars since these actions were seen as repressive and harsh. For a good treatment of the nuances of the case, see Kimberley Luke, “Order or Justice: The Dinshawai Incident and British Imperialism,” *History Compass* 5:2 (2007): 278-287. For a good look at the impact of the Dinshawai incident on Egyptian nationalism, see: Zachary Lockman, “Imagining the Working Class: Culture, Nationalism, and Class Formation in Egypt, 1899-1914,” *Poetics Today* 15:2 (Summer 1994): 157-190.
the same type of public flogging when he felt that the need to uphold military prestige required it." 

This hypocritical method of punishment was a continuing embarrassment to the British government after the early 1890s and presents something of a problem for this chapter. More than anything it represents a disconnection between rhetoric and action. The British administrators wanted to have been the ones who abolished the kurbaj; they tried to elide the sticky issue by ignoring or downplaying its abolition in 1880. Abolishing the kurbaj, however, does not mean that it fell out of use; rather the kurbaj was still employed in certain unofficial places and situations yet became a source of public embarrassment among the British officials and their European audiences. In African colonies, imperial historian David Killingray contrasts the popular Victorian belief in the utility of corporal punishment and its gradual abolition for African soldiers and labourers. Killingray concludes that in colonies where the Colonial Office and African elites had control, “the authorities more rapidly regulated corporal punishment, steadily removing it from the workplace and confining its use to the native authority judicial codes, to schools, prisons, and the barracks.” Killingray’s insights about the place of corporal punishment in society seem to have ideological traction in Egypt. In this case, the British wanted to remove the kurbaj from their transactions with the fellahin and official oversight, and relegate it to an officially unaccepted but continued custom in

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97 See: Sladen, Egypt and the English, 18 for an example of downplaying the abolition in 1881.
the police force. The kurbaj thus fell into a liminal administrative space between official policy and continued practice – which other irrigation practices, like the corvée, soon fell into as well. This zone was contested by the various people with power, the British administrators, the large-landowning Pashas, and the village officials, but the site of contestation was the fellahin and their fields, or the fields of those who were to benefit from their labour.

4.4.2 Canal-Clearance Corvée

Like the kurbaj, abolition of corvée labour was lauded and made into one of the great stories about the benefits of British rule; the reality of its abolition was much more complex than the British administrators were willing to admit. Unlike the kurbaj, the corvée was an integral part of the workings of the irrigation system: Egyptian irrigated agriculture – specifically canal clearance and canal construction – was based on the widespread availability of un-enfranchised, inexpensive workers who could be compelled to work. Corvée labour therefore presented two problems for those who wished to get rid of it: how to supplant its use with machines, and how to pay for these machines. In the chilly financial climate of the early 1880s, these problems were volatile issues since Egyptian national budgets were tightly controlled by the Caisse.

Timothy Mitchell mentions that the corvée was heavily supervised by “continuous police control” and that a system of tickets was implemented before the workers left their

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100 Nathan J. Brown is careful to remind readers of Egyptian history that the fellahin were politically active regarding things that affected them, and therefore the above is a simplification of the issues at play. See Brown, *Peasant Politics in Modern Egypt*. 204
native villages. Mitchell concludes that “Rural Egypt was to become… a place wherever possible of continuous supervision and control, of tickets and registration papers, of policing and inspection.”\footnote{101} The policies of policing and inspection were critical to the control of Egyptian farmers and their crops. As R.B. Buckley wrote after a lengthy tour of Egyptian irrigation works in 1891, the “system of [perennial] irrigation by rotation ... is of great advantage, not only in checking the loss of water in the channels, but in teaching economical irrigation to the cultivators, and in ensuring an equitable division of the supply among the people.”\footnote{102} The British engineers felt that increasing the area of perennial irrigation would improve not only the irrigation practices, but also the mindset of the fellahin by teaching them to be “good” farmers.

By the 1870s, national canal clearance corvée was not supported by the large landowners of the Council of Notables. Because of the success of perennial irrigation, in summer large landowners wanted their workers to be available for cotton cultivation, and tending cotton crops. However, summer was also the time in which the corvée was usually levied for canal clearances and construction projects because of the low Nile. After many expansions to the Deltaic irrigation networks, there was not enough easily procured labour to fulfill both the drainage and silt clearance projects and allow the large landowners to tie workers to their cotton cultivation harvests. In Nathan J. Brown’s words, “the corvée, by accomplishing so much, had dug its own grave.”\footnote{103} Instead, in

\footnotetext[101]{Mitchell, Colonizing Egypt, 96-97.}
\footnotetext[102]{R.B. Buckley, Irrigation works in India and Egypt (London: E.&F.N. Spon, 1893), 237.}
\footnotetext[103]{Brown, “Who abolished the Corvée?” 124.}
1878, the new Minister of Public Works, a French engineer, led a proposed system that allowed all peasants to be susceptible to corvée labour, while instituting a policy which allowed them to be exempted from work by a payment of their landlord. In practice, the peasants were not released from their work, and the landlords did not pay the tax. However, in 1879, Isma’il was removed from Khedive-ship. His successors, both Nubar Pasha and Riyad were long-time opponents of the corvée. In fact, the reform program of Mahmud Sami’s government [Prime Minister of Egypt Feb-May 26 1882] included “abolition of the corvée and fairness in the distribution of water.” 104 By the time of the British military conquest, the Egyptian government had cut the use of corvée by as much as half what it had been in the mid-1870s. The Egyptian government had not abolished the corvée completely because they were unable to find an affordable substitute.

The British administration, therefore, inherited a delicate situation. Large “l” Liberal inclinations among the top British administrators, and a Liberal government in London until 1885 dictated that the Egyptian budget must be balanced before “modernization” efforts could be implemented. The Caisse’s demands for financial solvency were negotiated before the British-occupied Egyptian government could, according to their own consciences, abolish the use of unfree labour. 105

By contrast, the Foreign Office correspondence articulated the multifaceted frustration of the British-dominated Egyptian government. The correspondence demonstrates the importance of the monetary control of Caisse and the interference of

104 Schölch, Egypt for the Egyptians, 221.
other European consul-generals. The European, especially French, consul-generals were seen by the British, as mentioned above, to be meddling in Britain’s business, but their objections rested partly on legitimate financial grounds and partly on purely political grounds.\textsuperscript{106} The French financial opposition was initially based on an official policy that land tax reduction should be implemented before abolishing the corvée.\textsuperscript{107} However, by the late 1880s, this objection seems to have been supplanted by concern for the practical abilities of the Egyptian government to abolish the corvée and balance the national budget, while still maintaining a viable military. One of the ways that the British proposed to garner money to replace corvée labour with dredging machines and paid labour was by allowing soldiers to buy their way out of the Egyptian army. On this point in January-February 1887, the French consul-general working with the Russian consul-general, refused to budge, although they conceded the necessity of abolishing the Egyptian corvée.\textsuperscript{108} The British attempted to circumvent these objections by calling out the corvée; this action was meant to shame the European powers into withdrawing their objections. Cromer admitted that this bluff did not have exactly the desired effect however, because it took another two years before canal clearance corvée was formally

\textsuperscript{107} Cromer, \textit{Modern Egypt}, 410-411. French imperial policy was much more favourable to corvée labour than British. As Allen Isaacman has discussed, they utilized a system of forced labour in colonial Mozambique from the early 1900s until 1961. Allen Isaacman, \textit{Cotton is the Mother of Poverty: Peasants, work, and the rural struggle in colonial Mozambique, 1938-1961} (Portsmouth, NH: Heinemann, 1996).  
\textsuperscript{108} For a very good summary of the complicated international situation that included the French and Russian against the British and German consuls-general, see: Sir R. Morier to M. De Giers, 31 January 1887, Inclosure in No. 111, FO 407/55 \textit{Further Correspondence respecting the Finances of Egypt, January to March 1887}, Foreign Office, British National Archives, Kew.
suppressed in early 1889.\textsuperscript{109} The European powers did withdraw their objections, and therefore the British could claim that they had abolished the use of forced labour in Egypt. Furthermore, the Foreign Office itself was able to take credit for the formal abolition of the corvée, as the agreement eventually stated that “payment of the money due to the British Government on account of interest on the Suez Canal shares should be postponed in order to provide the funds necessary for dispensing with corvée labour.”\textsuperscript{110} This agreement was a victory for the British administrators in Egypt, a victory for the Foreign Office, and a defeat for the influence of European interest in Egypt, as it bypassed the authority of the Caisse. In this regard, the abolition of the corvée was more of a struggle over political power in Egypt than a heroic defeat of an unfair Egyptian practice. If the Egyptian land-owners had been in favour of the corvée, the British would have found it nigh-impossible to abolish the entire labour system behind perennial irrigation.

Although the British were not responsible for the abolition of the corvée as they claimed,\textsuperscript{111} individuals within the Anglo-Egyptian government, like Scott-Moncrieff were fervently opposed to its use. In February 1887, Scott-Moncrieff handed his resignation to Baring in protest of the “iniquity of calling out the “Corvée.” He called it a “cruelty” and

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\textsuperscript{109} The way that Cromer gets around lengthy timeline of his narrative in Modern Egypt was to avoid mentioning the dates involved. He juxtaposes the bluff of calling out the corvée with the eventual abolition, and states in passing “after some further communications had passed...” Cromer, Modern Egypt, 415.

\textsuperscript{110} Ibid.

decried the “60,000 men... called out for a hundred days’ toil, unfed and unpaid.”¹¹² Scott-Moncrieff’s action demonstrated the extent of his conviction that the *corvée* was an example of poor irrigation practice, although he was convinced by Baring to withdraw his resignation. In that letter, Baring argued that the fault of the re-imposition of the *corvée* was not the Foreign Office but the French who were attempting to take over the entire Egyptian government by placing the British in an “illegal position.”¹¹³ According to Cromer, after being persuaded to withdraw his resignation, Scott-Moncrieff started authorizing contracts for dredging and paid labour, and thereby reducing the *corvée*, without official permission to spend the money.¹¹⁴ In an interview with representative members of the *Caisse*, “Colonel S. Moncrieff [explained] that efficiency and economy were the results of the *ouvrages d’art...* for example a dam across a canal, by raising the level and volume of the water, obviated the necessity of a large amount of [cleaning out].”¹¹⁵ Instead, he proposed that technology, developed in India, should replace unpaid labour. The drainage practices were handed to contracted companies and dredging continued by machines and paid labour. Scott-Moncrieff’s ideals “efficiency and economy” were ultimately promoted by the government and minor construction works were *en masse* leased to private contractors. In addition to the above, in 1884 the Public

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¹¹⁵ “Mr. Money to Sir E. Baring,” 22 May 1887, Inclosure in No. 106, FO 633/5.
Works Department attempted to “buy out” the corvée-able labour at a price of 30 Piastres per person, and raise money in that fashion.116

Underlying the engineers’ universalist principles was a set of assumptions about the necessity of capitalist wage-labour. As Robert Hanbury Brown wrote, “the real value of the work done by the Corvéé was absurdly low when compared with the estimate of the proper value of the labour employed in doing it.”117 Brown objected to corvée because he saw it as economically unproductive.118 Nineteenth century Indian-experienced hydraulic imperialism engrained in its technocrats a revulsion and scepticism of unpaid labour. In this context, Ronald Inden’s insight becomes highly relevant: “the essence of the ancient was the division of societies into self-contained, inwardly turned communities consisting of cooperative communal agents. The essence of the modern was the unification of societies consisting of outwardly-turned competitive individuals.”119

The project of modernity itself could be fulfilled if the Egyptian were made into capitalist wage-labourers. In both India and Egypt, engineers assumed that the actual builders were

116 “Memorandum by Colonel Scott Moncrieff on the Corvéé in Egypt,” 16 Feb 1886, Inclosure in No. 81, FO 407/51, Further Correspondence of the Finances of Egypt, January to March 1886, Foreign Office, British National Archives, Kew.

117 Brown, “Irrigation in Egypt,” 419. Hanbury Brown even provided a monetary breakdown of corvée for his readers: “In 1884, the number of unpaid labourers impressed was, according to official reports, equivalent to 165,000 men working for 100 days. If we take three piastres as the daily wage, the money value of this labour would be about £500,000.”

118 In his excellent monograph, Robert J. Steinfeld contends that the differences between “free” labour and coerced labour in the nineteenth century were much less pronounced than has been historiographically assumed, as both labourers and employers of labour (both free and unfree) resorted to similar tactics to deal with problems. Robert J. Steinfeld, Coercion, Contract, and Free Labour in the Nineteenth Century (Cambridge: Cambridge University Press, 2001), 7.

going to be compensated for their labour. In this instance, the *corvée* was portrayed as an engineering aberration, which the engineers emotionally believed needed to go. William Willcocks provided two reasons for this in his autobiography: the *corvée* was only being conducted by the poorest *fellahin* who were not paid “except in blows,” secondly because of the conditions they worked in, the work actually done was inefficient and “seemed interminable.” In his first year, after only six weeks supervision, Willcocks “ordered” a stoppage of work on his particular canal.\textsuperscript{120}

In 1889, the government officially abolished canal clearance *corvée*. However, forced and unpaid labour continued to be used to prevent the Nile flood waters from going over the banks. This type of *corvée* labour was supposed to be utilized in emergencies, and was strictly for village and regional purposes. However, “emergencies” were defined broadly, and the *corvée* was called out annually well into the 20\textsuperscript{th} century. In this sense, *corvée* labour in Egypt therefore went back to its 18\textsuperscript{th} century roots and probably represents a governmental concession to the environmental problems of living on a flood plain and the expense of installing pumping stations. Any concession meant that British governance had limited ideological objections to forced labour, but many objections to the precise conditions of Egyptian *corvée*.\textsuperscript{121} In this regard, *corvée* labour can be understood, like the *kur baj* as something that had to be divorced from the national or regional workplace and isolated in villages, communities, and individuals.\textsuperscript{122}

\begin{footnotes}
\item[121] Brown, “Who abolished the *Corvée*,” 136-137.
\item[122] Interestingly, official discussions of the *corvée* in the 1890s and 1910s only presented *corvée* in terms of the national scale, and always in terms of trying to ensure that its necessity was slowly fading. See for
\end{footnotes}
However rational flood watch corvée retention was it represented an awkward position for the Egyptian government. Lord Cromer, writing in the early 1910s, justified this form of unpaid labour: “it is essential to the well-being and safety of the country that this work should be performed. It has not as yet been found possible to abolish [this] completely.”

Cromer offered a sop to his audience with the idea that the corvée was dying organically. In fact, the necessity of calling out more or less men for watching the Nile’s banks depended on the height of the flood. The actual numbers of corvée varied dramatically by year and region. The full transformation to perennial irrigation was the only means of abolishing the corvée, and provides another, if peripheral, explanation for the British push to implement total control of the Nile. Total Nile control did not happen until the construction of the Aswan High Dam and the availability of over-year storage of water, making corvée labour an ongoing and continual embarrassment to the British administrations, and the successor Egyptian government. Corvée labour, therefore, found itself in a liminal position legally after 1889. Because it was no longer a national institution, the British administrators felt that flood watch corvée was acceptable, but still needed to explain the high number of unpaid manpower work days used to prevent flooding.

instance: W.E. Garstin, *Report upon the Administration of the Public Works Department for 1899, with reports by the officers in charge of the several branches of the administration* (Cairo: National Printing Department, 1900), 27; C.E. Dupuis, *Report of the Ministry of Public Works for the Year 1911* (Cairo: Government Press, 1913), 23.

4.5 Replacing local with imperial practices

In the aftermath of abolishing the *kurbaj* (1883) and the *corvée*, (1889) the British government, and especially the Irrigation Department engineers, sought to remake the system of labour utilized for large scale construction projects, and the system of cotton crop rotations. In the 1880s and 1890s, both of these reformulations targeted *fellahin* in the Egyptian Delta because their focus was on the cash crops of perennially irrigated agriculture. As articulated in Scott-Moncrieff’s 1885 article, the engineers felt that they could instruct the agricultural population in the Delta on the proper practices of wage labour and cotton cultivation especially amongst the poorer landholders in the Delta.

What follows can be seen as a preliminary discussion of the intended and unintended consequences of the introduction of wage labour and the capitalist market economy. Egyptian small-landowning peasants in the Delta were more consistently managed and their irrigation practices increasingly constrained by imperial governing procedures, as embodied by the figure of the District Engineer. However, the increasing pressures of the market economy and a lack of easily affordable financing options forced the small and medium landowners into cotton crop rotations which were damaging to the environment and contributed to decreased cotton yields which in turn only increased peasant indebtedness. The British administrators created not only a stereotypical and “timeless” *fellah*, they also created the ways that that stereotype was fulfilled.

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124 Esmeir argues that “colonial reforms were meant to perfect the labor of peasants via fixed taxation, regulated force labor, and more efficient irrigation.” Esmeir, *Work of law in the age of empire*, 190.
4.5.1 Wage Labour

Work by contract instead of corvée meant that the Public Works department had much more economic and political control over the distribution of labour. This system of labour officially found corruption anathema, but the informal system that is discussed below seems to imply that political power to the engineers as agents of the imperial state was the primary goal.

The British attempts to abolish local practices and create wage labour specifically targeted the apparently chaotic nature of corvée labour. As mentioned above, Willcocks was horrified at the corvée’s lack of payment or apparent organization. Comparatively, G.K. Scott-Moncrieff’s contracts in India were presented as an orderly capitalist system for overcoming the obstacles: “contracts were taken by native contractors.”¹²⁵ One of the reasons for Willcocks’ displeasure may have been the agricultural differences between Indian scarcity and Egyptian abundance. As Roger Owen has outlined, for the Indian-experienced administrators’ agricultural success appeared more easily, quickly and cheaply in Egypt than it ever had in India.¹²⁶

Contractors replaced corvée labour with machines, dredged old canals and created new ones in the Delta.¹²⁷ This followed official British colonial policy – as early as 1818 the Treasury had issued a directive stating that during peacetime as many supplies as

¹²⁶ Owen, Cotton and the Egyptian economy, 340.
¹²⁷ According to Roger Owen, many contractors in Egypt were Greek. The prevalence of European contractors and money-lenders emphasizes the diversity of nineteenth century Egyptian society and the numbers of foreigners, especially Southern Europeans, who lived there. Ibid., 212.
possible should be purchased through competition.\textsuperscript{128} The contractors in Egypt were of “south European nationality” although Willcocks explicitly describes one as Greek.\textsuperscript{129} Willcocks’ interactions with the contractors include his unceasing attempts to “teach” the contractors and Egyptian engineers the value of capitalism while keeping his personal position as instructor. Willcocks states that he first put a contract for canal clearances up for bidding “with a dozen applicants, whose offers were opened in their presence.” This demonstration led to the most economical offer being given the contract, and then to Willcocks being offered a bribe which he dealt with by publically humiliating the contractor. After this “lesson,” Willcocks smugly remarked, “Mr. A turned out to be an excellent contractor.”\textsuperscript{130}

Willcocks portrayed himself as being a great crusader against corruption among Egyptian engineers, which Lord Cromer specifically mentioned as being one of the great deeds of the British in Egypt.\textsuperscript{131} In fact, Willcocks’ system of paying of the Egyptian engineers under his command only reinforced the arbitrary but authoritarian system of British administration. Willcocks “allowed them [the Egyptian engineers] to draw from the contractors a fixed percentage of the payments made to them... the engineers had explained to them that if they took the fixed sums they were simply drawing their salaries, but if they took more it would be considered bribery and corruption.”\textsuperscript{132}

\textsuperscript{128} Elizabeth Vincent, \textit{Substance and Practice: Building Technology and the Royal Engineers in Canada} (Ottawa: Environment Canada Parks Service, 1993), 22.
\textsuperscript{129} Willcocks, \textit{Sixty Years}, 93.
\textsuperscript{130} Ibid., 93-94. The system of contracting will be discussed again at some length in Chapter 7.
\textsuperscript{131} See: Cromer, \textit{Modern Egypt}, 422-424.
\textsuperscript{132} Willcocks, \textit{Sixty Years}, 95.
Willcocks presented this system of payment as a “fair” way to augment the salaries of his officials, but gave no indication that this was accepted practice in other irrigation circles. By making the engineers indebted to him alone, Willcocks was creating a mechanism for informal political control over his subordinates.

The social implications of the capitalist wage labour are one of increasing governmental control at the village level. British engineers dismantled the Egyptian practices through a rigorous attempt at supervision and direct control over Egyptian villages. Terje Tvedt’s perceptive statement equates the hydraulic engineers with British soldiers. In his words, “while the soldiers held Egypt by physical force, the water planners ‘conquered their minds’.”\textsuperscript{133} Scott-Moncrieff alleges that under the Khedives, Egyptian engineers had not lived in the provinces, but rather stayed in Alexandria and Cairo. One of the first practices that the engineers picked up from their Indian experience was “living in the provinces... not only giving orders but personally seeing that they were carried out.” Scott-Moncrieff was deliberately unclear about who opposed these engineers living in the provinces and exercising “executive authority... without referring every little question to the Public Works Ministry.”\textsuperscript{134} Scott-Moncrieff felt that listening to the engineers without reference to their superiors was the best policy. The engineers exercised the same kind of authority that they had been accustomed to wielding in India

\textsuperscript{134} Scott-Moncrieff, “Irrigation in Egypt,” 345.
where appeals by the populace to a higher authority were discouraged. Tvedt’s “conquest of [the fellahs’] minds” was accomplished by a rigid technocratic system where the engineers represented the absolute authority.

Like ideas of antiquity, ideas of indolence among the fellahin played into the British declamations for the necessity of making rural Egyptians into industrious wage-labourers. Their laziness caused their poverty. For tourists like Douglas Sladen the Egyptian peasants were: “…lazy. The fellahin work in their fields, they laze in their villages, and even in their fields, their work often consists of watching their animals.”

Another commentator, Hardwicke Rawnsley reasoned why the Egyptian agricultural system should be modernized: “let the shaduf-men…but cease their work for a week, and the plain that is so fertile… would return to the bareness of the desert.” Rawnsley implied that the fellahin could not be trusted to continue working for a week without supervision, another reason why they needed to be integrated into the capitalist market economy. “Modernization” became necessary, not just to free the fellahin from their “slavery,” but also to keep Egypt’s soil fertile, productive, and, especially profitable. Ideas of Egyptian indolence came from the British perceptions of time and the necessity of work discipline. Michael Adas, borrowing from E.P. Thompson, had argued that “the Europeans who explored [and] colonized... Africa and Asia were setting out from

135 In his commentary of the British in Egypt, Douglas Sladen mentioned that an old landowner in possession of 2000 acres of cotton lands, was made to wait for 2 hours while the Sub-Inspector of Irrigation chatted with a friend. The Sub-Inspector “was harder to see than the Khedive.” Sladen, Egypt and the English, 60.
136 Ibid., 421.
137 Hardwicke D. Rawnsley, Notes for the Nile (Leipzig: Heinemann and Balestier, 1892), 164.
societies dominated by clocks, railway schedules, and mechanical rhythms.”

Therefore, part of the British rationale for vigorously introducing wage labour and the capitalist world economy was to free the Egyptians from their indolence through the cultivation of cotton for a regulated and routinized capitalist global market.

### 4.5.2 Cotton Crop Rotations

More insidiously detrimental to Egyptian agriculture than the *corvée* or the *kurbaj*, and arguably more than wage labour, cotton rotations also came to inhabit what I have been referring to as the liminal space between official policy and continued irrigation practice. The British officially promoted three-year cotton crop rotations, but the market economy encouraged 2 year cotton crop rotations. Furthermore, the institutions that the British utilized to spread their environmental policies were weak, and did not have widespread audiences outside of the Cairene large landowners. The British engineers sought to control how and when the agriculturalists placed water on their crops, but when their efforts failed to produce ecologically sustainable results among the majority of small landowners, the engineers were unable, or unwilling, to work with the Egyptian people to create new practices. Instead, the engineers retreated

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139 Until the late 1890s, the only formal institution for spreading agricultural science in Egypt was the Khedival Agricultural Society. This dissertation will return to the Society in Chapter 7.
140 This is not to imply that the *fellahin* would, or even should have, listened to the British engineers, but merely to say that the engineers did not attempt to connect with the *fellahin*. The “*fellahin*” were also not a coherent group, and their reactions to the British engineers were similarly mixed—among other things, these reactions would have depended on the size of the land, whether or not the cultivators were landowners or tenants, their education, region in Egypt, their indebtedness, the size of their family, and personal predilections.
to their policy of technological improvement, by relegating themselves to providing more and more water.

In the 1880s and 1890s, British official policy promoted three-year cotton cultivation, which meant growing cotton once every three years, and introducing beans, wheat, maize, clover, and fallow fields in between. By the early 1900s, the engineers also calculated the “storage of the summer supply” based on the three-year rotation.141 The fallow fields, or sharaqi in Arabic, would crack in the sun and effectively aerate the soil.142 The environmental effect of this crop rotation was to rejuvenate the soil since clover and beans are legumes, which returned nitrogen to the already fertile Deltaic soil. The land under British-dominated perennial irrigation, produced different five crops in 3 years, but only one was a cash crop, as wheat was being produced more cheaply for world markets elsewhere. Because of their more secure financial position, their ability to invest capital without a quick return, and the educational efforts of agricultural societies, large landowners favoured a triennial rotation.

141 Because many smaller landowners did not conform to this recommended rotation, the calculations of the summer supply were probably wildly incorrect on that basis alone, as well as for a variety of reasons – this brings into question the “facts” of the engineers. It is possible, therefore, that the engineers were hiding behind their extremely precise facts as a way to “cover up” their inability to understand and dominate the Egyptian cultivators. Ghaleb, “Extension of perennial irrigation,” 7.
142 For more detail on this see: Richards, Egypt’s Agricultural Development, 75.
Figure 4: Triennial Crop Rotations (circa. 1908). Source: K.G. Ghaleb, "Extension of Perennial Irrigation," Institute of Civil Engineers Library, London

_Fellahin_ in possession of medium (5-50 feddans) and small (0-5 feddans) landholdings favoured a rotation of planting cotton once every two years, which decreased the fallow time, and did not allow beans to be included in most rotations. Although the use of perennial irrigation itself caused higher water tables and greater soil salinity, the quality
of the soil deteriorated under the shortened fallow season and lack of legumes returning nitrogen to the soil. As Alan Richards has documented both medium land owners and a small-land owners had a variety of pressures that caused them to switch to a more environmentally damaging rotation. As cotton yields fell, plentiful water availability and high cotton prices in the 1890s induced Egyptian farmers to plant more and more land in cotton crops more frequently.\textsuperscript{143} Richards makes a series of distinctions based on the size of the land in question. First of all, he argues that peasants with less land than that needed for subsistence had to plant cotton because they “had to rely on the market for food.” The two-year rotation was even chosen by landowners who could subsist on their own land, because of the short-term revenues. For a variety of reasons including inability to receive short term loans or mortgages, high cost loans and fear of the banks, such small landholders could not afford a three-year cotton crop rotation.\textsuperscript{144} Roger Owen, in general agreement with the above statements, adds that peasants also increased the intensity of cultivation in order to grow more \textit{birsim} for their animals’ fodder.\textsuperscript{145}

Regardless of the size of the land-holding, cotton was a crop that the Anglo-Indian engineers could argue needed supervision and precise amounts of water at the right time. Because it was a crop that could only be grown in summer, and needed a lot of water, the engineers were able to impose a discipline on the planting and irrigating. This

\begin{flushright}
\textsuperscript{143} Ibid., 72.
\textsuperscript{144} Ibid., 87-88. Richards, it must be stated does not consider that the peasants may have been engaged in other economic activity, like Kenneth Cuno does in his more recent article “A Tale of Two Villages” (1999). If the \textit{fellahin} were engaged in other economic activities in the 1840s, there is no logical reason that they could not have been doing so in the 1890s. See Cuno, “A Tale of Two Villages,” 310-317.
\textsuperscript{145} Roger Owen, \textit{Middle East in the world economy, 1800-1914} (London: Methuen, 1981), 231.
\end{flushright}
discipline was imposed legally – peasants were penalized for not maintaining the irrigation system, and threatening cotton cultivation.\textsuperscript{146} For instance, between 1903 and 1913, the government made illegal watering maize between May 15\textsuperscript{th} and July 31\textsuperscript{st} because it would jeopardize water supplies for the cotton crop.\textsuperscript{147} Evidence of water discipline is easily found in the Public Works Department reports, as is the attendant project of reforming the fellahin, their labour, and their crops into agents of a capitalist economic system. In 1899, the Nile flood was very low, and the canals in the eastern Gharbiya region of the Delta did not carry enough water and, “early dhurra sowing also caused a tightness of supply for the cotton and rice crops. So much so that… it was found necessary to prohibit [watering] them between the 13\textsuperscript{th} July and the 6\textsuperscript{th} of August.”\textsuperscript{148} These measures, by no means unusual, seem to have been a daily part of the control that British engineers had over the availability of water. Irrigation inspectors themselves were required to report their findings on the “state of irrigation” every 10 days to the Public Works Department.\textsuperscript{149} In this way, the Egyptian government was able to see and supervise the works of its “Egypt-making” agents.\textsuperscript{150} Because of the regulation of water inherent in perennial irrigation, the lands in the Delta seem to have been under stricter

\begin{footnotesize}
\begin{enumerate}
\item[146] Esmeir, \textit{Work of law in the age of empire}, 185, 192.
\item[147] Richards, \textit{Egypt’s agricultural development}, 83.
\item[150] I have only uncovered a couple instances of the results these 10 day reports in the British archives. These reports detail the low flood of 1902, and the measures (including rotations) to minimize the damage to the cotton crop. See: “Inclosure in No. 77 A.S. Webb, “Note on the Nile flood of 1902 – August week ending the 19\textsuperscript{th} by A.S. Webb,” 25 August 1902, Inclosure in No. 77, FO 407/159, Further Correspondence on the Affairs of Egypt 1902, Foreign Office, British National Archives, Kew; A.S. Webb, “Note on the Nile flood of September 1902 – week ending the 9\textsuperscript{th} by A.S. Webb,” 14 September 1902, Inclosure in No. 80, FO 07/159.
\end{enumerate}
\end{footnotesize}
water discipline than the basins of Upper and Middle Egypt. Although the 1899 Report does mention the exact dates when the basins were filled, the regulation of crops and waterings in Upper Egypt is not as omnipresent.\textsuperscript{151} Later, after the explosion of boll worm and other parasites in the 1890s, this discipline was extended to include the cotton seed, and harvesting under the Department of Agriculture.\textsuperscript{152}

The Indian-experienced irrigation engineers were not just trying to control the economic and agricultural aspects of crops and crop rotations; they were also trying to control the environment, specifically the water itself. As David Gilmartin has critically examined, one of the ways they measured the productivity of the crops and water was through water duty. Duty reflected both a “moral mission” and a “fundamental measure of the ultimate goal of irrigation science – the extraction of productive capacity from water.”\textsuperscript{153} In order to understand the productive capacity, Gilmartin emphasizes that measurement was the “defining feature” of scientific engineering and their projects.\textsuperscript{154} By 1908, water duty was conceived as “the number of watering x the duration of each x depth in m x 4200.83m.\textsuperscript{3}\textsuperscript{155} This precise figure demonstrates the stylized science in which irrigation routines were calculated, and the contemporary belief in the power of

\textsuperscript{151} For instance, the 1899 Report does specify the dates when the basins in Upper Egypt were flooded. However, for Lower Egypt, the report not only details the dates when waterings were allowed, it speculates about when and why the fellahin were planting their crops, what and how they should have planted, and finally mentions a Ministerial Stop placed on watering maize before a certain date. See: Garstin. \textit{Report of the Public Works Department for 1899} 5, 133,135,137.
\textsuperscript{152} William Beinart and Lotte Hughes, \textit{Environment and Empire} (Oxford: Oxford University Press, 2007), 143; Esmeir, \textit{Work of law in the age of empire}, 221.
\textsuperscript{153} Gilmartin, “Imperial Rivers,” 83.
\textsuperscript{154} Ibid., 84-85.
\textsuperscript{155} Ghaleb, “Extension of Perennial Irrigation,” pg. 4-5.
nineteenth century science to solve problems of state “legibility.”¹⁵⁶ In a different context of irrigation engineering, Mark Fiege argues that “this assumption of human control over a pliant and even willing nature, basic to the outlook of virtually all farmers and engineers, was consistent with another popular belief: that irrigators were master technicians whose work realized the inherent potential or purpose of the land.”¹⁵⁷ These historians, taken together provide a powerful reason for why the engineers needed to take control over the land and water: it was their moral duty to bring forth in Egyptian agriculture the system of perennial irrigation which was the “purpose of the land,” and representative of progress.

The question of the reception of these changes to irrigation practice must be approached with care, as the evidence is contradictory, scattered, and temporally and geographically dependent. Large land-owners seem to have been either unaffected or benefitted from the increased lands available for sale and higher rents – but they were not the targets of the governmental oversight. The fact that the system of crop rotations in Lower Egypt in the 1890s was modified may have represented a form of acceptance of the British occupation. As Allen Issaacman has argued, referring to the much more physically violent and overtly repressive colonial administration in Mozambique, “coping was aimed at muting the adverse effects of the cotton regime. But coping strategies often had the unintended consequence of sustaining the system.” Isaacman contrasted coping

¹⁵⁶ According to James C. Scott, “all state simplifications are always far more static and schematic than the actual social phenomenon they presume to typify. The farmer rarely experiences an average crop, an average rainfall, or an average price for his crops.” Scott, Seeing like a state, 46-47.
with strategies of resistance which aimed to “block or undercut the claims of the colonial regime.”

Given the increasing strain of producing for a market economy, the fellahin’s adoption of a two-crop rotation can be considered a peasant coping mechanism rather than a form of resistance. However, Nathan Brown, in his monograph *Peasant Politics in Modern Egypt* (1990) questions not only the dichotomy between coping and resistance, but also the assumption that peasants were ever *un*-resistant to colonial regimes. Brown argues that “[Egyptian] peasants became [politically] active because of a distinct political outlook; and... they acted when the order implied by this outlook was violated and when action was required to defend their structurally created interests.”

Brown traces four types of political activity, including individual resistances, but concludes that “all the forms of political activity examined in this study demonstrate the... strong antipathy of Egyptian peasantry towards agents of the state [between 1882 and 1952].”

Given the loss of autonomy in terms of their lands, crops, watering, and other irrigation practices, such antipathy can be predicted in this chapter.

### 4.6 Conclusion

The British occupation chose to continue practical, agricultural trends set by the Khedival government before 1882. This meant that they promoted cash crops and perennial agriculture at the expense of institutions like the *kurbaj* and the *corvée* which

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159 Brown, *Peasant Politics in Modern Egypt*, 8, 22.

160 Ibid., 215.
Egyptian historians have emphatically described as institutions under assault by the 1870s. According to Ghislaine Alleaume these changes brought new challenges to the *fellahin*, and new wealth to the British occupiers and the Egyptian elites. However, Egyptian and Middle Eastern historians have until recently been historiographically concerned with fitting Egypt into a modernizing paradigm, which Zachary Lockman has characterized as the “the struggle of the enlightened middle and upper classes to assimilate and transplant Western-inspired ideas and institutions.” Lockman argues that any intellectual history which limits its focus to the intellectual elites risks the exclusion of the non-literate majority, “or at best implicitly regard[s] them (as the elite themselves regarded them) as passive objects of a state-sponsored project of reform and moral uplift.”

Aside from their mutual perspectives about the *fellahin* and practicable irrigation among other projects of “uplift,” the British administrators and the Egyptian elites, however, were often at odds about who should rule the country, and the political institutions that were being implemented. At the very least, given the rhetoric deployed under which the British took political and military control over Egypt, some explanation needs to be given about why they continued to utilize a constellation of irrigation and agricultural practices that had been developed and promoted by Egyptian elites.

One part of the answer concerns the engineers themselves, and their high professional reputation. Perennial irrigation was implemented, and the *corvée* was

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abolished in a large part because the engineers, like hydraulic engineers working in other parts of the empire, threw their intellectual weight behind the scientific and moral aspects of this system instead of basin irrigation. Cromer, and other Anglo-Indian officials, supported the engineers because of their perceived successes in India. They characterized the engineers as men of high character, and able experts, whose proven expertise would bring prosperity to Egypt. The engineers stated that the engineering and social principles learned in Indian agriculture would be directly, universally applicable to Egypt. The British engineers were not anxious to highlight Mohammed Ali’s successes in introducing cotton as a cash crop, nor his successors’ efforts to introduce perennial irrigation. By 1882, Egypt’s agricultural system was dominated by large landowners who were exploiting the forced labour of the fellahin, and these landowners, especially in the Delta, successfully produced cotton perennially. Although in practice the Indian-experienced engineers were aware of the presence of the large land-owners and the changing irrigation systems, assumptions about the fellahin’s agricultural inability served as state justifications for continued British occupation and the specific irrigation programs that were introduced.

To bring these circumstances back to the engineers does not explain why the engineers themselves thought perennial irrigation was a “better” irrigation system. The engineers were following their own cultural assumptions about the practices that Indian

164 Broich, “Engineering the Empire,” 353.
and Egyptian civilizations, which were assumed to be morally inferior and historically prior to the intervention of cash crops, wage labour, capitalism, and non-physical punishment. Another important factor for the Indian-experienced engineers was the importance of the French engineers to earlier Egyptian governments. The fact that the Egyptian governments had employed French engineers at all was used to praise the beginnings of perennial irrigation, attribute it to European intellect, and lament the inability of direct control by the French engineers.\footnote{Cain, “Character and imperialism,” 188-189.} As will be seen in Chapter 5, these assumptions also extended to the physical structures of irrigation.

Another part of the explanation involved liberal and modernizing assumptions about how to make a colony productive. The Egyptian economy had not been a subsistence economy before the British occupation, but rather one that had been producing cash crops for the world economy since at least the cotton boom of the 1860s.\footnote{Kenneth Cuno, The Pasha’s Peasants: land, society, and economy in Lower Egypt, 1740-1858 (Cambridge: Cambridge University Press, 1992), 3.} However, the British assumed that the Egyptian financial bankruptcy was also a \textit{moral} bankruptcy of the economic system that had existed in Egypt before the occupation. To this end, British and British-Indian administrators concentrated on making Egypt a source of primary economic sectors at the explicit expense of industrialization. Cromer, although he believed that industrialization was going to develop “naturally” was a free-trade liberal, who believed strongly in the importance of the competition, cheap
imports and the evils of protective tariffs.\textsuperscript{167} He also believed personally that “[economic] growth was essentially a question of the development of a country’s [natural] resources through the application of capital to productive [public] works.”\textsuperscript{168} Cromer advocated necessity of developing the agricultural industry through the Indian-imported assumptions about the necessity of irrigation structures and practices.

The British administrators continued the established traditions of perennially irrigated Egyptian agriculture because they had helped to create them. This conclusion has therefore set up a conveniently false dichotomy between British involvement in Egypt before and after the occupation in 1882. To be sure, financial penetration of the Egypt and Ottoman markets, and the establishment of the \textit{Caisse} in 1876 is qualitatively different from militarily conquest another empire’s colony, but they were on the same spectrum of nineteenth century European capitalist behaviour.\textsuperscript{169} As Middle Eastern historian Joel Beinin has argued, the Ottoman Empire and its more autonomous provinces of Egypt and Tunisia were increasingly involved in the European capitalist system from the 1830s, and after 1852 the Ottoman Empire borrowed directly from European banks. As economic historian Paul Auchterlonie has argued, “it was axiomatic that ‘loans to foreign governments carried with them political control,’ and the associated penetration of the foreign economy by industrial and commercial companies and concessions merely

\begin{itemize}
\item[\textsuperscript{168}] Owen, \textit{Cotton and the Egyptian economy}, 334.
\item[\textsuperscript{169}] Joel Beinin is very critical of world systems theory because it is teleological and Eurocentric, but admits that economic history in Egypt has to wrestle with the “undeniable fact that western Europe did come to dominate the Middle East economically and then politically.” Beinin, \textit{Workers and Peasants}, 7-8.
\end{itemize}
enhanced the dominance of the European power.” The financial collapse, the Great Depression of 1873-1896, brought agricultural prices down in the Ottoman Empire and led to provincial bankruptcies. In Egypt, governmental bankruptcy in 1876 allowed the British, and the other European powers, to intervene in an agricultural system that they had promoted and helped stimulate in specific directions at the expense of others. It should not be a surprise that these directions included the establishment of large-scale estates dedicated to the growth of cotton, rice and other cash crops.

This dissertation is focused on the British engineers – their epistemologies, practices, and especially projects. The presence of large numbers of military and civil engineers in Egypt was a specific intervention by the British state into the conditions of Egyptian agriculture, and only occurred after 1882. The fact that these engineers were at first imported from India speaks to Thomas Metcalf’s assertion of the central role of India in the colonial framework. However, by the 1890s, when the British government in Egypt was hiring men with hydraulic instruction about a different set of riparian conditions on another continent, that engineering truly embraced what Omnia El Shakry has defined as “universal rationality[:] conceived of as ahistorical and independent from social and

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cultural particularity.”¹⁷¹ For the engineers, social, cultural, and especially environmental contexts were irrelevant to the science of engineering, if not to the practical application thereof. The British were predominantly interested in modifying existing conditions in irrigation and through irrigation the social conditions of the Egyptian fellahin. 

Increasingly, with the utilization of more “modern” construction materials and building models, the local, practical applications of engineering were also incorporated into mathematical discourses of dam construction, and will be discussed in Chapter 6. In the next chapter, however, this dissertation will explore how British irrigation engineering technologies were used to increase social and water control in late nineteenth century Egypt.

Chapter 5

Irrigation Technologies and Technological Systems, 1883-1894

5.1 Introduction

Late nineteenth century Britons in Egypt told themselves a story about the Egyptian economy in which Egyptian irrigated agriculture stagnated under the Ottoman Turkish regime, was resurrected by the Khedives and pulled into the modern age under the aegis of British engineering. In this story, Mehmet ‘Ali (referred to as Mohammed Ali) was the originator of the system of perennial irrigation and cotton farming in the Egyptian Delta: “the famous Mohamed Ali introduced perennial irrigation into Lower Egypt. He abandoned the old basin system, and introduced the present staple product, cotton.”1 However, Oriental incompetence and inefficiency meant that Mehmet ‘Ali’s innovations did not save his heirs from going into debt and eventually losing control of their state. The British, therefore, stepped in to save Egypt financially, and to develop a system of irrigated agriculture, especially perennial irrigation as a means to stimulate Egypt’s cotton production. The story ended happily with a statement of the increased productivity of the cotton crop or the increased revenues from the wildly successful British ventures.

1 Sidney A. Mosley, With Kitchener in Cairo (London: Cassell and Co., 1917), 238.
By making perennial irrigation a government priority, Mehmet ‘Ali and his government concentrated political power and control into the hands of “experts,” and relocated the site of irrigation expertise away from the Egyptian farmers.\(^2\) One of Mehmet ‘Ali’s schemes, the least successful from an engineering perspective, was to modify his new perennial irrigation system through raising the summer water level in the Nile by constructing a barrage, and thereby avoiding pumping contracts in the Delta.\(^3\) When the Delta Barrage failed, it was simply left as an unnecessary part of the new productive system of irrigation in Lower Egypt. Mehmet ‘Ali’s original system of perennial irrigation extended the existing web of Delta canals, and constructed pumping stations, and forced labour to secure the perennial flow of water. By contrast, the British irrigation engineers constructed barrages, dams, and extended canalization to ensure the requisite amount of water. Both of these irrigation “systems” utilized their strengths: Mehmet ‘Ali had an extant labour force and canals; the Anglo-Egyptian government acquired Indian-experienced engineers to construct the technologies that they knew best. In this way, the systems, technologies, and management changed but the resultant perennial flow of water for irrigated agriculture remained the same. The British engineers claimed direct intellectual descent from Mehmet ‘Ali and his French engineers – in their terms, they took the existing system of irrigation and made it more productive and


\(^3\) Perennial irrigation in Egypt requires raising the water level in canals or possibly pumping water through deep canals with coal-powered pumping machines. The Nile valley slopes gently down to the Mediterranean sea, so digging deep canals encouraged the water to flow from these canals to the sea, but the pumping machines were useful for making sure that the water got to the downstream end of the canals. The machines, of course, were expensive to build, repair, and maintain since most coal had to be imported.
remunerative. Public Works irrigation projects, and especially the reconstruction of the Nile Barrage, therefore, became a justification for the continued British political regime, as well as an *ex post facto* explanation for their interference in the first place.

This chapter examines the irrigation technologies of the first twenty years of British rule in Egypt. I look at perennial and basin irrigation as technological systems, and examine the changes that the irrigation engineers made to these systems. All of their institutional changes served to establish and expand the engineers’ control over the Nile, the crops, and the people. To historicize the idea of technological systems, this chapter argues that the technology itself reflected the assumptions and biases of its engineers. The ideologies of imperial liberalism were especially vividly reflected in the technological systems which the engineers created.  

For a variety of reasons including financial constraints and geographical factors the engineers were not always able to construct and design precisely as they wished, but with fits and starts, the tendency of Egyptian irrigation was towards greater hydraulic and social control.

Beginning with an examination of the types of water control in both Lower Egypt (canalization) and Upper Egypt (*sharaqi*), I compare and contrast different public works projects between roughly 1885 and 1895. For both the British government in Egypt (the administrative positions) and the engineers themselves, water management was based on

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4 In this chapter, I am using Roger Owen’s definition of “liberal ideology” of financial management, which encompassed, “attention to the laws of sound finance, and in particular to the importance of low taxation, efficient fiscal administration, careful expenditure on remunerative public works, the minimum of interference in the internal and external traffic of goods.” Roger Owen “The Influence of Lord Cromer’s Indian Experience on British policy in Egypt, 1883-1907” in *Middle Eastern Affairs, no. 4*, ed. Albert Hourani (Oxford:Oxford University Press, 1965), 113.
manipulating water supply however the Upper and Lower Egypt, with their specific crops and political power, were approached in separate manners by the irrigation engineers. Water supply schemes were grounded on the assumption that Egyptian *fellahin* should be circumscribed in the way they grew crops and used water. In both Upper and Lower Egypt the British engineers and their administrative superiors developed ways of supplying increasing amounts of water while increasing their control over the system – this process almost invariably revolved around deepening canals to increase the amount of water supply, and then installing masonry regulators on canals to manipulate and divide that supply. However, there were important differences in the relative importance of these projects: the canals in Lower Egypt were, from the beginning of British administrative dominance, well funded and well managed with either *corvée* or paid labour. In Upper Egypt, by contrast, perennial canals were first constructed in the late 1880s because of a series of low floods. This short section is meant to introduce the basics of technological irrigation systems under the British engineers in Egypt, before discussing specific projects, such as the Delta Barrage or the proposed Wadi Rayan reservoir.

As a way to understand the British engineers’ understanding of the possible irrigation technologies and technological systems, I then examine two specific proposed technologies: the Wadi Rayan reservoir scheme in the Western Desert, and the repair of the Nile Barrage at Cairo. These two schemes were proposed in the same year and both promised to control flooding and expand perennially irrigated agriculture through either
land reclamation or raising the branch channels’ water level to increase the amount of water to the Delta. Either project could have been the beginning point of a “new” perennial irrigation system. As will be discussed in detail below, the Nile Barrage better reflected what the Indian-experienced engineers believed they should build in Egypt.

Finally, this chapter will also discuss that which the British self-consciously did not construct with zeal. Drains and drainage works consistently lagged behind the construction of water-delivery systems. Drains, therefore, represent a point at which the historian can analyze the colony from a new angle; the engineers did not know how to reconcile the commitment to increasing the area of irrigated agriculture with the twinned need to remove that water. Intellectual discomfort with the state of drains, especially in the Nile Delta, was tied to an engineering knowledge of the negative ecological consequences of too much water. Drains were also costly to build and repair, both factors mitigating against their upkeep and extension. Drainage, therefore demonstrates the ideological preconceptions of the irrigation engineers from a different perspective.

This chapter grapples with the long-standing idea of “hydraulic societies” first articulated by Karl Wittfogel. Wittfogel himself defined hydraulic societies in terms of the “agromanagerial and agrobureaucratic characteristics of [Oriental] civilizations.” His work focused on understanding the “patterns of class” in the type of society created when the leaders were “holders of despotic state power and not private owners and
entrepreneurs.” Wittfogel’s criteria for determining a “hydraulic society” included intensified cultivation, large scale cooperation, and a specific type of division of labour. Wittfogel himself thought that nineteenth century Egypt was a hydraulic society, and he mentioned Egyptian corvée as an example of cooperative large-scale agriculture. As discussed in Chapter 1, Donald Worster has used Wittfogel’s theory of hydraulic societies to ask the question: “How, in the remaking of nature, do we remake ourselves?” Worster comes to the conclusion that the United States created a hydraulic society out of its need to reclaim its own Western deserts; importantly for this thesis, he characterizes the societal outcomes of this environmental reclamation “imperial.”

If the British occupation created a “hydraulic society” in 1880s and 1890s Egypt, it was much messier and more conflicted than either the British administrators or the Indian-experienced engineers would have liked. Neither the Egyptian small-landowners, nor the large land-holders, nor the tenants, nor the nationalists, and certainly not the Caisse always acted according to the plans of the engineers. The projects constructed were dependent on what the international political interests, such as the Caisse and capitulations, would allow. International influence meant that the British never had a

6 Ibid., 22, 25.
7 Donald Worster, Rivers of Empire: water, aridity, and the growth of the American West (New York: Oxford University Press, 1985), 15, 30. However innovative his work is in a British imperial context, Worster’s thesis has been disavowed by his Americanist colleagues. In his classic, Great Thirst (2001), Norris Hundley Jr. contends that bureaucrats, governments, and private interests only rarely worked together to achieve water control, in fact the systems created were often a reflection of contingency, available funding, and political compromises; his findings are borne out in this chapter. Norris Hundley Jr., The Great Thirst, Californians and Water: a history, revised edition (Berkley, University of California Press, 2001), xix-xx.
“blank cheque” in Egypt, yet the British government was unwilling to formally colonize Egypt. Likewise, the uses to which the water control was put were historically constructed, and reflective of the assumptions of the British occupation about what constituted good government. Therefore, when Baring and Scott-Moncrieff insisted that major public works projects could only be constructed by the Egyptian government, the outcome was that they kept water control concentrated in their own hands. However, their stated reasons were to avoid paying unnecessary rent and interest on projects. As will be discussed in the next chapter, once they became convinced that nothing else was possible, the Egyptian government turned to private wealth to pay for the Aswan Dam. This chapter therefore attempts to add a sense of contingency and immediate necessity to the study of Egyptian irrigation systems and their associated social management. Control of water has been an expedient short-cut to gaining political power in Egypt but during the British occupation that water control was always contested by landlords, fellahin, and the river itself.

More generally, historians of technology have sought to historicize the “stages” by which technological systems are assembled. In his groundbreaking work about late nineteenth century electrical systems, *Networks of Power* (1983), Thomas P. Hughes articulated five stages of large-scale technological system development: invention, technology transfer, growth, momentum, and management phases. In especially the

8 Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore: Johns Hopkins University Press, 1983), 14-17. The last, most amorphous, phase seems to be defined by the rise of consulting engineers and financiers as problem-solvers to the problems of the large regional systems and to clear the political and legislative grounds. Ibid., 17.

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“growth” stage, wherein the technological system “grows” or becomes dominant in an area or series of regions, and in which, in the 1880s, the British engineers would situate their perennial irrigation system, Hughes argued that engineers responded to what they defined as a series of “reverse salients,” or areas in a general advance that were not advancing. The act of defining these reverse salients made them into “critical problems” for the system engineers, and the “articulation of a problem often implies its solution.”\textsuperscript{9} Although the idea of distinct “phases” of systems for irrigation systems is suspect because the boundaries of these phases must be fuzzy, Hughes’ concepts of reverse salients and critical problems are useful framing devices for how the engineers understood problems within the irrigation systems they created and maintained.\textsuperscript{10}

As mentioned above, Hughes understands technological systems as “constituted [of] related parts or components. These components are connected by a network, or structure... often centrally controlled.”\textsuperscript{11} Although he sees these systems developing historically, the idea of technological systems themselves, according to Ken Alder in his work \textit{Engineering the Revolution} (1997), are historically constructed. Alder states that after the assumptions of the engineers of a technological system are “hard-wired” into the system they become part of the intellectual background and simply fade from view. The ideologies of many Indian-experienced irrigation engineers were similar to other late nineteenth century public servants of the Empire: classical nineteenth century liberalism

\textsuperscript{9} Ibid., 14-15.
\textsuperscript{10} These concepts will be discussed again the next two chapters.
\textsuperscript{11} Ibid., 5.
with its emphasis on racial hierarchy, economy, public works, development, control of natural resources, and the infallibility of science and its expert practitioners. More specifically, they also believed that the Nile’s floods were primarily responsible for crop failure or success in Egypt, and this assumption was inscribed into the fabric of the technological system. Although irrigation engineering in Egypt has modified its techniques and the technology itself, the intellectual underpinnings remain those of the late nineteenth century British engineers.

This chapter also draws upon James C. Scott’s work on development. He argues that the first state-wide attempts at creating “abridged maps” were in its dealings with the environment.\textsuperscript{12} Nature itself was put through a selection and categorization process into useful and not-useful. As a means of making the nature (whether that was forests, crops, or water) more understandable to the state, the modern, developmentally-focused state began a series of regimentations designed to separate the good from the bad, useful from useless; this process of controlling nature was used as a way to control human populations too.\textsuperscript{13} In British-occupied Egypt, the distinction was between state water and non-state water, and the British engineers worked to corral as much of the Nile’s water as they possibly could, in the way that they deemed most modern and best: perennial irrigation. For them, the easiest – not the most economical – way to do so was to, quite literally, dam, quantify, and then divide the calculated amount of water needed for each

\textsuperscript{13} Ibid., 11.
region, province, and farm. In order to accomplish these goals, the engineers’ first technological projects included reconstructing basins in Upper Egypt and building canals in Lower Egypt. This chapter will now turn to these aspects of Egyptian irrigation.

5.2 Control over land and water

5.2.1 Lower Egypt and canalization

In their most basic form, canals are man-made channels; they are usually used to conduct water towards or away from a larger body of water for either irrigation or navigation purposes. Present-day irrigation canals conduct regulated amounts of water, and are often lined with concrete to minimize water seepage into the surrounding soil. Nineteenth century Egyptian irrigation canals were not concrete-lined because of the expense, and engineers had only a rough estimate about the volume of water flowing through them as a result – water soaked into the soil, evaporated, and was drawn up from the roots of the canal-side plants. The Egyptian government engineers fought against these factors; they focused on increasing water supply to an idealized Egyptian farmer.¹⁴ In the minds of the engineers, they were part of an exchange with these fellahin: the government contributed water, and the farmers raised crops. For their part, the Egyptian

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¹⁴ British engineers seem to have been fascinated by increasing the water supply in the Egyptian Delta since at least the 1870s. In a report to the Khedive in 1873, eminent engineer John Fowler wrote, “I shall assume… that the supply of water at a sufficiently high level to irrigate the lands in Lower Egypt at all states of the Nile without the aid of mechanical appliances, must be the essential features for any new project of irrigation.” John Fowler, “Report on Egyptian Irrigation and on the Ship Canal between Alexandria and Cairo,” January 1875, J. Fowler Egyptian Reports, 1869-1877, Institution of Civil Engineers Library, London 4.
farmers were only supposed to use what was absolutely necessary for the growth of their crops, and watering was strictly regulated by Egyptian law, as discussed in the previous chapter. On both the supply and demand sides of this technological system water was always unaccountably “wasted.” Scott theorized “state spaces and nonstate spaces... [and] a major objective of would-be rulers was to create and then expand state spaces.” The analogy works for Egypt’s water management: state water was controlled water for either urban or irrigation purposes; non-state water was that which flowed unchecked into the Mediterranean Sea, seeped into desertified land, or evaporated into the air. One way to conceive of the engineers’ entire project in the valley of the Nile was increasing state-control of water.

The distribution of state water and the mechanisms of its distribution were almost as important to the British-Indian engineers in the 1880s as the supply. The Delta Barrage was supposed to take the deepened river water into three canals, but only two of them had been constructed by the Egyptian engineers. In their reports and articles, the engineers conceptualized “success” in terms of a single accomplishment: the number of engineering projects completed and how much they cost. In 1891, for instance, Scott-Moncrieff wrote that “the canal supplying the East Delta has been entirely made since 1886, at a cost of

15 Scott, *Seeing like a State*, 186.
£372,000.”

Typically, Scott-Moncrieff complained about the extant canals’

construction:

The centre known one [sic] as the Rayah Menufieh had
been made with the Barrage... but it was nearly useless for
navigation... The Western, or Behara Canal had been dug
along with the Barrage, but had been allowed almost to go
out of use. It passes through a strip of desert a few miles to
the north and drift sand used to come in in large
quantities.18

In this passage, the canals were portrayed as both poorly constructed and unable to
distribute water to the tail ends of the canals, and therefore unable to fulfil their purposes.

British engineers also criticized canal alignment, Scott-Moncrieff stating that “nothing
could be worse than the alignment.” By this, Scott-Moncrieff meant that canals were not
constructed in straight lines – British engineers knew straight canals were made
measuring water volumes easier – and were not placed at points which would prevent
silting of the canals.19 According to James Scott, “the professional instincts of the
agricultural engineers led them to try to replicate as much as possible the features of the

17 Colin Scott-Moncrieff, “Note on Egyptian Irrigation,” Indian Engineering (11 July 1891): 33. In his time
as Inspector-General, Scott-Moncrieff kept his subordinate Anglo-Indian engineers muzzled, with the
notable exception of Willcocks’ Egyptian Irrigation (1889). See: William Willcocks and R. Hanbury
18 Colin Scott-Moncrieff, “Note on the Nile Barrage,” 24 June 1890, in House of Commons, Egypt. No. 2
(1890) Further Correspondence respecting the finances and condition of Egypt, House of Commons
Session 1890, Command Papers 6135, LXXXIII.
19 The reasons for the second point are engineering details, and deal with flow and relation of the canal to
the river. See: R. Hanbury Brown, Irrigation: Its Principles and Practice as a Branch of Engineering (New
modern factory” which meant creating a “visual orderliness,” managing time, and controlling water.\(^{20}\)

In the Egyptian Delta, the British engineers, therefore, built concrete canal “heads” with moveable gates which regulated both the amount and depth of water brought into a particular canal.\(^{21}\) In this articulation of perennial irrigation, regulation of water took place at the point at which the canal takes the water away from the source, and at each smaller “branch” canal sprouting off from the main canal.

Artificial regulation of the depth of the water was meant to ease taking the water from the branch canal onto the field. By limiting the number of days each canal could take in water, and with knowledge of the amount of land to be irrigated (area in feddans), the crops to be watered (water duty), and the amount of water in the canal/day (cubic meters per second), the engineers exercised water control in Lower Egypt.\(^{22}\) In 1900, for instance, the engineers proclaimed a “very low” flood, which meant that summer water was used parsimoniously for irrigation. In practical terms, this meant that watering was only allowed every 20, then 24, and finally every 28 days, with a six day window available to the cultivators to put water onto the fields. In 1900, the Irrigation Inspectors agreed that the Egyptian farmers respected watering restrictions for fear of having their


\(^{21}\) However in the minds of the engineers and the British dominated Egyptian government, Upper and Lower Egypt were not deserving of equal shares of the summer water; Lower Egypt took precedence before 1902 because of its cotton growing pre-eminence.

\(^{22}\) Each of the latter three factors was based on a complex series of mathematical abstractions; in late nineteenth century Egypt, none was particularly accurate. In the discussion that follows, all the exact facts and figures quoted should be regarded with extreme suspicion.
pumping privileges cancelled.\textsuperscript{23} However the water restrictions also epitomize Michael Lewis’s arguments about the false dichotomy between mathematical theory that the engineers preached and the importance of local knowledge that they perforce practiced.\textsuperscript{24} The governmental actions to deal with the flood of 1900, in fact, represented a drastic reduction from the stated practice of watering the cotton crop every fourteen days.\textsuperscript{25} In this instance and possibly every year in Egypt, the irrigation engineers responded to events ‘on the ground’ as a necessity, instead of following their own prescriptive official policies.

Scott-Moncrieff and his subordinates felt sure that, if not monitored, those whose lands happened to be at the head of the canal would take all the canal water, and leave nothing for those at the “tail” end. In order to ensure that there was going to be just enough water, therefore, engineers calculated water duty: the volume of water (\(m^3\)) needed to grow a feddan’s worth of crop – the higher the number, the less “productive” the water in that region. In the late 1890s, there was still a lack of consensus about how much water was needed.\textsuperscript{26} In 1875, for instance, British engineer John Fowler estimated

\begin{footnotesize}
\begin{tabular}{ll}
\textsuperscript{23} & Sir W.E. Garstin, \textit{Report upon the Administration of the Public Works Department for 1900: with reports by the officers in charge of the several branches of the administration} (Cairo: National Printing Department, 1901), 135, 137. Pumps had to be licensed in Egypt, and by taking away pumping privileges, the government forced the landowner to apply for a new pump, pay license fees, and submit to a delay when his (almost invariably men) crops were not being watered. This also allowed the Egyptian government to issue a new (regulation) size of pump, and therefore better determine how much water was being taken from the canal. Finally, the process of applying for a license meant that the government could refuse to grant a new pump.
\textsuperscript{26} & These measurements were calculated in \(m^3/\text{feddan}\).
\end{tabular}
\end{footnotesize}
that 7 m$^3$/feddan was necessary for minimum supply.$^{27}$ By 1899, Hanbury Brown, as the engineer in charge of Lower Egypt, wrote that the accepted standard, as prescribed by William Willcocks was 22 m$^3$/feddan, but an allowance of 25 m$^3$/feddan was sufficient (30 m$^3$/feddan seemed more than enough).$^{28}$ However, he made a series of distinctions between the first, second, and third circles, in which the duties of water had been, respectively, 29 m$^3$/feddan, 23 m$^3$/feddan, and 26 m$^3$/feddan. Brown ended the section in the following frustrated manner: “the data for the calculation, both areas of Crop and canal discharges, are very unreliable.”$^{29}$ In the late 1890s the Irrigation Department’s engineers were focused on calculations to find sufficient amounts of water without damaging the crops.$^{30}$ These attempts to understand water duty seem to be adaptive – that is, based on trial and error in low and high Niles, the engineers attempted to find a median amount of water. The fact that the amounts of water kept increasing (7 to 22 to 30 m$^3$/feddan), also represented the engineers obsession with providing more water to the fields, but receiving less in return. As Kapil Raj has argued, the engineers’ attempts to understand and calculate water duty are representative of the scientific process of calibration. In Raj’s words, “knowledge is made universal through a series of mediations,

$^{28}$ The difference between the two can probably be attributed to an increased area devoted to cotton and rice, a greater familiarity with Egyptian growing conditions, and a need to prove that the expensive irrigation works were necessary. W.E. Garstin, *Report upon the Administration of the Public Works Department for 1899, with reports by the officers in charge of the several branches of the administration* (Cairo: National Printing Department, 1900), 143.
$^{29}$ Ibid., 144.
$^{30}$ Ibid. The Indian-experienced engineers realized that their calculations were both highly abstracted and could be massively incorrect. In response to this question, R.B. Buckley wrote that, “since no irrigation project can be intelligently designed without calculation of the quantity of water needed for the irrigation of the crops, a study of duties is of great importance.” He advised meticulous calculation as a precautionary measure. R.B. Buckley, *Irrigation works in India and Egypt* (London: E.&F.N. Spon, 1893), 221.
measurement [including] its calibration... It is through calibration that instruments or techniques developed in a given place can be compared with those developed in another place that the results obtained through one set can be compared with those obtained through another set.”

As mentioned in the previous chapter, the measurement of water duty represented not merely an “extraction of productive capacity from water,” but also engineers’ “concern for the efficiency of energy use within a closed mechanical system.” This definition highlights two points: the importance of energy conservation and the overarching importance of scientific systems in the engineers’ epistemologies. Not merely water but also hydraulic energy itself became the focus of engineers’ idealized attempts to control Egyptian agriculture. In the 1899 report, Hanbury Brown was at pains to describe what water duty represented:

In the Third Circle, the ‘duty’ generally works out lower than in the other Circles, that is, the quantity of water used per feddan is represented by a higher figure; which is the same as saying that the amount of work got out of each cubic meter in the Third Circle is less than in others.32

In this way, the water was perceived as two steps removed from the conception of the Nile as a river. Secondly, an increased scientific emphasis on nature as perpetual change led engineers to focus on “the tendency of natural systems to move relentlessly toward

32 Quoted in Garstin, Report upon Public Works Department for 1899, 144.
energy dissipation.”\(^{33}\) The systems of basins and canals became not merely a technological framework for Egyptian agriculture, but something concrete to be guarded, protected, and nurtured. From their theories of technological systems up, engineers cast themselves into the dual role of scientist-protector but used their experience-based methodologies as a guide for how to understand Egypt.\(^{34}\)

5.2.2 Upper Egypt and Sharaqi Land

By contrast to the care and scrutiny taken to reform canal irrigation in the Delta, in Upper Egypt the basins were all but ignored during the high floods of the mid-1880s. In his 1885 article, Scott-Moncrieff confirmed to his audience that in Upper Egypt, “the Egyptian has little to learn” about the practice of basin irrigation.\(^{35}\) From his perspective, in a year of high or average flood, the fellahin in Upper Egypt could be safely trusted to produce grain, while the Irrigation officers worked on canal construction, cotton production, and barrage rehabilitation in Lower Egypt. Although the Indian-experienced irrigation officers thought that the basin system was not as productive as it might be, their priorities and attention were fixed on the Delta.\(^{36}\) In the mid-1880s, with five British irrigation engineers in Egypt and a serious attempt to change existing irrigation practice

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\(^{35}\) Colin Scott-Moncrieff, “Irrigation in Egypt,” Nineteenth Century 17:96 (Feb 1885), 344.

in Lower Egypt, the Irrigation Department engineers congratulated themselves on the work that they did achieve.

Until 1888, irrigation engineering in southern Egypt was all but ignored in favor of the canal construction, cotton production, and barrage rehabilitation in Lower Egypt. However, in 1888 a very low flood occurred and many of the basins were not filled. When the basins were not filled, the crops were not sown, or simply did not grow, the farmers lost their primary source of income, and the government lost its revenue. In the contemporary engineering terminology, land that had to be left un-irrigated was called “sharaqi” (or fallow) land. In 1888, the government estimated that 260,000 feddans were uncultivated, and the total government revenue loss was £300,000, because according to existing tax law, land left uncultivated was not taxable. Colonel Justin Ross, RE, the Inspector-General of Upper Egypt, therefore, felt he needed to “prevent” or “remedy” Upper Egypt from this unproductive sharaqi land. Since British-occupied Egypt had recorded its first budgetary surplus, the reputation of the government’s financial measures was therefore controversial immediately after they had achieved success. Ross combated the unirrigated land by taking specific measures; he proposed a series of canal

38 House of Commons, “Egypt. No. 3 (1889) Correspondence Respecting the Prevention of “sharaki” land in Egypt, House of Commons Session 1889. C.5676, LXXXVII.865. Garstin, Report upon Public Works Department for 1899, 10. The language of medical salvation for saving the irrigation of Upper Egypt became common among the Anglo-Indian engineers. This seemingly unconscious word association may have been as simple as the association between crop/irrigation failure and famines. For more information about engineers borrowing medical or contemporary scientific terminology to discuss their disciplines, see: Thomas P. Hughes, Human Built-World: How to Think about Technology and Culture (Chicago: University of Chicago Press, 2004), 45.
39 Welch, No country for a gentleman, 56.
adjustments, embankments, and masonry works in the forms of escapes, regulators, and syphons. The total cost of these projects was estimated at almost £800,000. Ross calculated that even in a very low year, there was enough water in the Nile to water all the crops, “if it could only be got onto the land.”

Justin Ross felt that he needed to justify the proposed expenditures by “writing back” the cost of preventing fallow land in order to justify a major expense. Therefore in his prefatory note for Ross’s figures, Scott-Moncrieff estimated that on average (basing his averages on the years between 1877 and 1888) 45,000 feddans of potentially agricultural land had been left without water, and £30,000 had been lost. In this instance, Ross’ attempts to prevent sharaki were borne out; the following two years resulted in a low flood of 1889 and a partial failure in 1890. In these instances and later low floods, engineering interest in sharaki land peaked again, and the measures that Ross designed and had built were hailed by irrigation engineers for saving later crops.

Ross attempted to minimize sharaki land by increasing maintenance of water distribution, and minimizing land “wastage” in the basins. Using Thomas P. Hughes’ terminology, to this “reverse salient,” he applied a typical answer: increase water supply. Ross proposed works that amounted to straightening, lengthening and deepening the feeder canals to increase the limited supply from the Nile. Scott-Moncrieff approvingly mentioned that “[Ross] has proved that, by a judicious system of canals, sluices, siphons,

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40 Prevention of “sharaki” Land in Egypt, House of Commons Session 1889, C.5676.
41 Scott-Moncrieff, “Note on Egyptian Irrigation,” 33.
42 Prevention of “sharaki” Land in Egypt, House of Commons Session 1889, C.5676.
escapes, weirs, etc., it may be arranged that, even in the worst years, the whole Nile valley shall receive its share of mud-charged water.” 44 Many of proposals were installing regulators on existing canals and extending said canals; the extension and deepening of canal works was an attempt to increase the flow of summer water to Upper Egypt, and therefore create the opportunity of cultivators to grow more crops in summer. 45 Until the 1880s, basin irrigation in Upper Egypt had built temporary dams to prevent the flow of water from one basin to the next, and these dams were subsequently cut to release the water when it was time to allow the water to flow into the second basin. 46 Canals with masonry regulators acted like the temporary dams, but were easily handled by a single government irrigation inspector rather than entire communities. The purpose of installing regulators allowed the state to “see” the distribution and drainage of the Nile’s water, and formalize laws regarding when that water should be distributed or drained. 47 As mentioned above, it also served to increase the amount of state water – as opposed to non-state water – that flowed unchecked and un-utilized.

For the Anglo-Egyptian government, however, Upper Egypt remained a lesser priority than Lower Egypt. In response to Ross’s planned irrigation works, Financial Advisor Sir Edgar Vincent questioned the necessity of major changes in the irrigation system. He accomplished this by questioning the effects of the low Nile in Upper Egypt: “the gravity of the effects of the failure of the Nile of 1888 have been greatly

44 Scott-Moncrieff, “Note on Egyptian Irrigation,” 33.
45 An example of the deepening of canals in Upper Egypt is that of the Debarra Canal south of Aswan. See: F. Grenfell to Riaz Pasha, Inclosure 2 in No. 7, May 1889, in House of Commons Session, 1890, C.6135.
46 W.E. Garstin, Report upon the Public Works Department for 1899, 72.
47 Scott, Seeing like a state, 2.
exaggerated.”

Vincent’s scepticism frustrated the engineers, not least because Ross proposed 167 projects to prevent annual *sharaqi* land without a clear plan for most of the long-term funding. Ross was able to secure funding for about three-quarters of the proposed projects; in 1891 Scott-Moncrieff wrote that the total cost was about £600,000 and these projects would be completed in 1893.

Despite Scott-Moncrieff’s political power, clashes between administrators and engineers over irrigation budgets seem to have been a recurring problem. On the one hand, the Irrigation Department, and more generally the Public Works Ministry was massively over-funded in comparison to other Egyptian departments. On the other hand, the Irrigation Department was entirely responsible for ensuring and securing the annual cotton crop which made up over 80% of Egyptian exports by 1900, as well as other Egyptian agricultural produce. This responsibility on the part of the irrigation officials only guaranteed them funding for Lower Egypt; Upper Egypt remained a lesser priority. In 1888, for instance, Scott-Moncrieff mentioned the “long-proposed escape for the [Upper Egyptian] Koshesha Basin” which was supposed to be constructed with the million pound grant of 1885, but had not because “funds failed to carry it out.” Upper Egypt continued to suffer from less public works funding throughout the period discussed in this chapter – in 1899 the Inspector General for Upper Egypt A.L. Webb complained

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48 *Prevention of “sharaki” Land in Egypt*, House of Commons Session 1889, C.5676. Vincent’s document raises questions about the timing of Ross’ document – had Ross become convinced in the early 1880s of the utility of these projects and only produced his document upon the failure of the Nile? Such questions probably cannot be concretely answered since Ross did not leave private papers.

49 For instance, in 1893, the sanitary department was annually allotted a budget of £73,000, the year in which Scott-Moncrieff estimated that £600,000 had been spent in Upper Egypt alone where cash crop cotton was not grown. “Egyptian Sanitation,” *British Medical Journal* 2:1722 (30 December 1893): 1435.
that the regulator for the Sohagiayah canal into the Beni Smia basin had been proposed by Ross in 1888, was still not constructed, and estimated costs had risen by 75% in the meantime.  

The sometime failure of the Egyptian state to build long-term masonry regulators and canal headworks in Upper Egypt, although the British engineers stated that these engineering projects were useful, reflects a several of biases of the British-occupied Egyptian government. Firstly, it reflected the reality that basin irrigation engineering functioned in all but the lowest floods. Although the Irrigation Department engineers complained about the lack of governmental regulation of basin irrigation, if funding was unavailable, the basins and local methods of employing them worked. Secondly, the British government saw the Delta as primary area of agricultural profit and therefore its engineers concentrated their engineering efforts and funds there. As will be discussed below, the proposed budget for the Delta Barrage in 1887 started at £400,000. Although the engineers may have wanted to make Upper Egypt more regulated, with more state water, the needs of the bankrupt Egyptian state won out, at least in the 1880s and early1890s.

Other interests within Egypt played a critical role in the purposeful political marginalization of Upper Egypt. The Egyptian body of elected representatives predominantly represented powerful political and economic landowners from the Delta. These men actively worked to promote their own irrigation interests (increasing water

supply for Delta cotton) at the expense of Upper Egypt. In 1893, these vested interests ensured that an irrigation proposal from a southern representative was vetoed by northern landlords and “decided not to inform the government about them on the grounds that the state’s budget would not cover the projects’ high costs.”  

These issues about north and south would again play out during debates about the Aswan Dam, and will be discussed in the next chapter. Due to the importance of cotton and because cotton did not grow well south of Asyut, Nubia was the last region to be irrigated by state-run irrigation systems. Small-scale projects like canals and basin repair were carried out alongside the much more well-published debates about the Delta Barrage and the Nile Reservoir, which are the subjects of the next section.

5.3 Irrigation Technologies: the Wadi Rayan and Nile Barrage.

The Wadi Rayan reservoir scheme and the repair of the Nile Barrage were both proposed in the immediate aftermath of the British occupation, and represent two distinct solutions to the same “critical problem”: Egyptian agriculture was running out of summer water. Due to limited funds, Scott-Moncrieff believed from the outset that only one scheme could be successfully implemented in Lower Egypt. The Nile Barrage had the advantage of already being a physical structure, but the Rayan Reservoir would have

fulfilled several purposes, namely flood protection and water for irrigated agriculture.
The reservoir was also the earliest example of the reaction of Egyptian government
engineers to a challenge to their expertise – it was proposed and promoted by an
American scholar Cope Whitehouse. The repair of the barrage set in motion British
attempts to implement a singular system of perennial irrigation based on artificially
raising the water level in the Nile rather than pumping the river water. The Barrage
became the metaphorical “heart” of the system of perennial irrigation in Lower Egypt,
and represented a singular organizing idea for that irrigation system.\textsuperscript{53} The reservoir, by
contrast, was officially deemed too expensive and unproductive; the scheme was
accordingly scrapped. Both projects demonstrate not only the political actions of the
engineers, but also the socio-political assumptions that underwrote their technological
systems.

\textbf{5.3.1 The Wadi Rayan Reservoir Scheme}

In 1882, a Mr. Cope Whitehouse, found a large depression in the Egyptian
Western Desert, which he called the “Wadi Rayan.” The Wadi El-Rayyan is located in
Middle Egypt, about 25km west of the Nile, and about 100km southwest of Cairo. This
shallow depression is separated from the Nile not only by distance, but also a line of low

\textsuperscript{53} Terje Tvedt has proposed the rather stylized idea that the focus of British power on the Nile migrated
southwards along the river as new projects were proposed. See: Tvedt, \textit{River Nile in the Age of the British}, 7.
hills.\textsuperscript{54} Since the construction of a drainage canal in the 1970s, the Wadi El-Rayyan is used to drain fields from Faiyum province. It is currently composed of two shallow lakes; the northern one is about 51km\textsuperscript{2} and the southern one is about 62km\textsuperscript{2}. Due to the drainage water which flows into them, these lakes are both becoming saline.\textsuperscript{55} The lakes are a protected area and habitat to a number of rare and threatened flora and fauna species. The Wadi El-Rayyan is also currently notable because of the waterfalls that are a consequence of water flowing from the northern lake into the southern one. In contrast to the relative lushness today, in the 1880s the Wadi El-Rayyan was just another expanse of the Western Desert albeit forty-five meters below sea level.\textsuperscript{56}

Cope Whitehouse (1842-1911) was an American scholar; he had a Masters of Arts from Columbia and took the bar exam in 1871.\textsuperscript{57} His “discovery” of the Wadi El-Rayyan was the result of historical research in Cairo, after he noticed that in historical maps of the Fayum, the lake Birket Qarun was much bigger than contemporary maps showed. He then noted that there was a second lake in the medieval maps which was not present on the contemporary maps. Whitehouse explored the Middle Egyptian Western Desert, using the historical maps as a guide, to find the Wadi El-Rayyan. He became immediately convinced that this would solve Egypt’s agricultural problems, and presented his findings to the Anglo-Egyptian government.

\textsuperscript{57} “Frederic Cope Whitehouse,” \textit{New York Daily Tribune} (17 November 1911), 7c-d.
Whitehouse first gained the attention of the government in 1885 when the Irrigation Department was granted an extra £1,000,000 to improve agricultural productivity of the occupied Ottoman colony. He proposed that this depression could be used “for the regulation of the Nile and as a reservoir to impound a portion of its surplus water” for perennial irrigation of Middle Egypt. Whitehouse claimed that “his” depression had been used in that way before as the ancient Lake Moeris connected to the Nile via a canal. Over the next two years a series of preliminary surveys and then more detailed investigations were conducted to determine the potential use of the Rayan Reservoir as a basin perennially fed by canal. The reservoir would be utilized for both the assistance of perennial irrigation and flood protection against a high Nile flood. Although Whitehouse came to advocate both, his initial idea was for a “storage reservoir.”

The Irrigation Department duly investigated Whitehouse’s claims, and initial estimates looked promising, but the engineers harboured some reservations. Irrigation Department engineer Colonel James H. Western, RE submitted a preliminary report which stated that the Rayan basin “proved to be of a reasonably large area with a bed level well below that of the Nile ... and is situated to lead to fair hopes of the possibility of its being filled with Nile water.” Western estimated average amounts available to be drawn off from the Nile flood, and came to the conclusion that from an engineering

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59 Whitehouse theorized that this depression was the mythical Lake Moeris, which was supposed to have been utilized as a reservoir, and therefore would have left less permeable soil. Cope Whitehouse, “The Raian Moeris,” [undated memo, speech to the British Association] FO 78/5261.

60 J.H. Western, “Memo: on the Wadi Raian as a reservoir for irrigation,” 12 May 1887, FO 78/5261, 1.
perspective, the project was “feasible,” although he seems to have been concerned about evaporation and overall cost. Western was also careful to state that his calculations were based on averages from 11 (fairly good) flood years, and he still had to state that the reservoir would only be open to filling for approximately the month of December. Whitehouse’s project also received generally favourable reports from Royal Engineers Captain H. Brown, and Colonel Ardagh, as well as Captain Cowyers, Coldstream Guards. Ardagh and Cowyers had been lent to Whitehouse by the Egyptian government, and Whitehouse went so far as to claim that Sir Colin Scott-Moncrieff had personally promised his project £200,000 to investigate the necessary costs. Whitehouse estimated that it would cost £1 million, but would reap £2.5 million by 1890 and £100 million after ten years. British Consul-General Evelyn Baring wrote cautiously that if the scheme proved to be profitable, “Mr. Whitehouse will have a fair claim to a reward ... More information, however, is required before the best method of utilizing the newly discovered depression can be ascertained.” Baring emphasized potential environmental obstacles, and the need for closer cost/benefit estimates.

The Wadi Rayan project never got beyond the planning stages. British engineers, especially Scott-Moncrieff, argued that it would never be as profitable as Whitehouse claimed because of the existing agricultural conditions in Egypt. Scott-Moncrieff stated

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61 Ibid., 5-6.
62 Ibid., 4. The river needed to be very high in order to ensure that water would travel from the Nile to the reservoir, because of the slope of the proposed canal.
63 Cope Whitehouse to Marquis of Salisbury, 17 October 1887, FO 78.5261, 6. Scott-Moncrieff denied that he had made this promise.
64 Ibid., 6-7.
65 E. Baring to Marquis of Salisbury, 11 November 1887, FO 78/5261, 9-10.
that his own calculations of cost and profit had resulted in much different estimates than Whitehouse. Regarding Whitehouse’s statement that the El-Rayan basin would yield £2.5million by 1890, Scott-Moncrieff mildly responded, “I have no idea how he arrives at this figure.” His own calculations came to £115,000 in direct revenue overall if the reservoir was utilized in a storage capacity to reclaim desertified land and provide perennial irrigation to the Fayum and surrounding provinces.66 By comparison, Scott-Moncrieff’s estimations totalled a cost of at least £680,000 if the reservoir would be put to flood protection.67 He concluded, “the money spent on making the Wady Raian[sic] into a reservoir of control of the Nile floods would be at least £680,000 and the protection afforded would not be worth the outlay. I believe in every case, these figures are too favourable.”68 Scott-Moncrieff in fact went out of his way to demonstrate that Whitehouse had a superficial understanding of the Egyptian taxation systems, let alone basic irrigation information. Scott-Moncrieff calculated that although an extra 500,000 feddans would be added to a project utilizing the Rayan reservoir for extending perennial irrigation, only half of that land would be reclaimed desert. Since the Egyptian government did not directly receive money from crops but through land taxes, he concluded that “the other half would go to lands already taxed and no additional burden would be laid on them... Land revenue in Egypt is so very unequal that it is hard to say

67 Ibid., 3.  
68 Ibid., 8.
what tax might be placed on lands watered throughout the year,” as opposed to lands watered in winter.69

After further surveys, Whitehouse’s competence at preparing environmentally and especially economically soluble schemes was seriously questioned in both Whitehall and the Anglo-Egyptian government. Most troublesome for Sir Evelyn Baring was the fact that “a low line of hills intervenes between the Nile and the Rayan basin. The first point is to ascertain whether any suitable passage through the hills can be found.”70 These hills meant that a new canal would have been exorbitantly expensive. Instead, Whitehouse proposed to utilize the Bahr Yusuf which already watered the surrounding Fayum province to bring reservoir water to the provinces of Lower and Middle Egypt. However, Scott-Moncrieff argued that the existing canals would not be able to handle the amount of water required to pass through them if the project was to be used for flood protection, and that they could only be modified over the course of at least 2 years and more money than the project was worth.71 These environmental obstacles, coupled with the discrepancies of financial value, convinced the Egyptian government that the project was “incapable of realization.”72

In early 1888, upon completion of the final surveys, the two possible projects of the Wadi Rayan were separated, studied, and both rejected. The first, the Wadi Rayan as

69 Ibid., 5. Scott-Moncrieff went on to speculate that an extra 30 piastres/a could be added to land watered year-round (in some areas of Egypt), but thought that this would only add an extra £90,000.
70 E. Baring to Marquis of Salisbury, 11 November 1887, FO 78/5261, 10.
72 Sir Evelyn Baring to Marquis of Salisbury, 29 April 1888, FO 78/5261, 4-5.
a system of basin irrigation, was barely considered: “many other tracts... could be rendered fit for considerably less money.” The second option, as a reservoir to perennially irrigate large portions of Lower and Middle Egypt by storing 2,000 million m³, was deemed to be a more financially solvent project, but not comparable with other projects that needed to be pursued. Both Consul-General Sir Evelyn Baring and Sir Edgar Vincent agreed with the engineers that drainage works were more important than a new construction project. Finally, both of Whitehouse’s intertwined schemes were also rejected because of the time-spans involved. Irrigation Department engineers argued that the project would take at least three years to become profitable, most of that time was required to fill the reservoir. Whitehouse, by contrast, insisted that the project would be profitable immediately.

The Wadi Rayan reservoir scheme was, in 1887-1888, rejected on geographical and financial grounds – the lack of easy access to the river, and the lack of easily irrigable and taxable land from the reservoir. However, in the 1890s, Whitehouse presented his claim again as an alternative to a permanent dam across the Nile. According to the scholar, until his project was proposed, “the only remedy which suggested itself was the costly... experiment of immense dams in the valley itself.” In this, he seems to have received the aid of Justin Ross, whose 1890 article stated that the Nile barrage had failed to adequately provide Lower Egypt with all the water that could be wanted for summer

73 Colin Scott-Moncrieff, “Note on the Wadi Raian,” 5 April 1888, FO/78/5261, 1.
75 “Cope Whitehouse to Marquis of Salisbury,” 19 October 1887, FO 78/5261, 6.
irrigation. In 1888 and 1889 the low Niles had meant the irrigation engineers had difficulty irrigating half of the Delta. Ross was further worried by the fact that averages from seven out of twenty years (35%) were low Niles, and therefore “there is no other means of increasing the supply except by storage in reservoirs.”Ross was careful not to suggest which reservoir would be the best for Nile storage; he thought the engineering questions should be discussed by engineers in public forums. In 1891, the Irrigation Department’s engineers could not come to a consensus on which storage reservoir would be the best, although five projects were proposed, including Whitehouse’s Wadi Rayan. Scott-Moncrieff suggested an international commission of skilled irrigation engineers to recommend a final decision on the project.77 The resultant Technical Commission on Reservoirs (1894) will be discussed at length in the next chapter, but Whitehouse was strictly barred from personally making any contact with the Commission.

By the 1890s, personality clashes between the administration and Whitehouse had cooled the Egyptian government to the Wadi El-Rayyan reservoir scheme. Whitehouse thought that if his project was developed he was due a monetary reward, and estimated this “finder’s fee” at a cool £5,000,000. Baring first called this sum “preposterous” and then questioned the propriety of Whitehouse receiving a reward at all. During the low Niles in 1888 and 1889, Cope Whitehouse had sent increasingly frantic letters to Baring, and officials at the Foreign Office, in which he pled to be allowed to construct the masonry and canal works through private contractors. In his eyes, these low years

76 Justin Ross, “Storage reservoirs in the Nile Valley,” 30 October 1890, FO 78/5261, 3-4.
77 “E. Baring to Marquis of Salisbury,” 21 October 1891, FO 78/5261, 3-5.
demonstrated the necessity of his project, and he became convinced that the reluctance on the part of government officials was nothing less than criminal. In his words, “there will be a day of reckoning for someone if it should prove that there has been criminal neglect in dealing with the matter... Sir Evelyn Baring should have been less supine.”

Baring never forgot and never forgave Whitehouse for this comment, and it caused the Foreign Office to look much less favourably on an already unpopular project.

The idea of American private contractors for large-scale irrigation works was another sore point for the Irrigation Department. All the Indian-experienced officials in Egypt (including Baring himself) agreed that only the government should pay for and benefit from such irrigation systems. As mentioned in Chapter 2, the Indian government had become convinced in the 1860s – formative years for both Baring and the engineers – that private companies would not be solvent if they tried to build large-scale irrigation works. For the older generation of Irrigation Department engineers, the idea of private companies was anathema. More directly, both Scott-Moncrieff and Justin Ross had been in India during the experiment of private irrigation companies, and personally seen the aftermath of Arthur Cotton’s insolvent companies. Whitehouse was from Rochester and had a background in historical and American legal study. In the American West during Whitehouse’s lifetime, most irrigation projects were being constructed by small-scale irrigation companies, and federal government interference was at best controversial and

78 “Cope Whitehouse to Sir Thomas Sanderson,” 24 November 1888, FO 78/5261, 2-3.
79 Lord Cromer’s policies were heavily influenced by the bankruptcy of Arthur Cotton’s private irrigation companies. See: Owen, “The Influence of Lord Cromer’s Indian Experience,” 115.
at worst heavily protested as a violation of states’ rights.\textsuperscript{80} Whitehouse’s actions suggest a baseline acceptance of private irrigation companies and private money to finance these companies and indeed incomprehension at the reaction of the Egyptian government towards his schemes.

The refusal of the Anglo-Egyptian government to countenance private irrigation works also reflected a conflicting series of pragmatic, and peculiarly Egyptian, considerations. For the British-occupied Egyptian government, limiting the role of private companies in public works projects was paramount because of a series of legal Capitulations to foreign nationals. The Capitulations, as mentioned in Chapter 1, were a series of originally legal concessions that Europeans living in the Ottoman Empire were not subject to Ottoman laws – either criminal or civil. By the late nineteenth century, however, the Capitulations had been extended to include taxation rights – in brief, these restricted the government from taxing European and American subjects, except on direct land tax, and made new taxes dependent on approval of the subjects’ national governments as represented by their Egyptian Consuls.\textsuperscript{81} For instance, the Egyptian government could not apply the Canal and Drainage Act (1894) to European citizens because two European Consuls refused to approve of its conditions.\textsuperscript{82} Before occupying Egypt, the British government, entrepreneurs, and travellers had been content to allow the Capitulations to keep the Egyptian state weak when it came to foreign nationals. After the

\textsuperscript{80} Hundley Jr., \textit{Great Thirst}, 116.
\textsuperscript{81} Welch, \textit{No Country for a Gentleman}, 50; Landes, \textit{Bankers and Pashas}, 95-96.
\textsuperscript{82} House of Commons, \textit{Egypt, No. 1 (1895). Report on the Finances, Administration, and Condition of Egypt and the Progress of its reforms}, House of Commons Session 1895, Command Papers 7644, CIX.895.
occupation, the government tried to prevent the abuses associated with untouchable European or American citizens. As David Landes has written the choicest business deals in the period before 1882 were contracts for public works; some of these businesses were respectable and many were fraudulent.

The Anglo-Egyptian government was willing to allow private companies in Egypt to construct other large engineering projects (railways) and also, under the supervision of its engineers, construct smaller irrigation works (canals). However, local and national public works projects were carefully watched to prevent any fraudulent behaviour. This point brings us back to Whitehouse. Given his overblown claims of immediate profits and the cost/benefit discrepancies between Whitehouse and the government engineers, the entire scenario may be read as the British-occupied Egyptian government attempting to protect themselves from a con man. At the very least, his actions were not indicative of good “character” which, given the Capitulations in Egypt, was an essential characteristic for foreign nationals applying to build public works projects.

Whitehouse’s method of pressuring the Egyptian Irrigation Department into approving his scheme was calculated to embarrass the Foreign Office, and through them Baring and Scott-Moncrieff. Whitehouse was an expert self-promoter who started

83 Welch goes into some detail about Sir Evelyn Baring’s attempts to convince the British government to abolish the capitulations. See: Welch, No country for a gentleman, 129-134. The capitulations were abolished in the 1930s.
85 Owen, Cotton and the Egyptian Economy, 214, 266-67.
publishing his scientific findings on Lake Moeris as soon as he could.\textsuperscript{87} During his struggle with the Egyptian government, between 1887 and 1890, he published a flurry of articles, went on a speaking tour around Britain to drum up popular \textit{British} support for his project, and even organized questions in Parliamentary question period.\textsuperscript{88} Whitehouse followed these acts by attempting to contract private companies for the work, ostensibly to spare the Egyptian government the necessity of paying for the reservoir. However, Whitehouse was also set to make a handsome profit off the proceeds (made all the greater because of the Capitulations), and this tactic gave his proposed reservoir more publicity and backing in both the British and American presses.\textsuperscript{89} When all of the above methods failed to get his reservoir built, he took his claims to the American Foreign Affairs Department, arguing that the British government had broken promises to him.\textsuperscript{90} Whitehouse eventually retired to New York, perennially disappointed that the Egyptian government had not utilized his ambitious scheme. His reservoir projects had been superseded by an extant Egyptian and Indian-influenced approach to perennial irrigation.

\textbf{5.3.2 Repairing the Nile Barrage}

By late 1891, instead of proceeding with Whitehouse’s project, the British-Egyptian government had chosen the beginnings of a three-pronged approach to Nile control. The presence of Indian-experienced engineers brought a degree of internal

\textsuperscript{87} His earliest publication seems to have been in 1884 when he wrote a book proving the antiquity of Lake Moeris. Cope Whitehouse, \textit{Lake Moeris and the Pyramids} (New York: Van Nostrand, 1884).

\textsuperscript{88} Mr. Woodall, 9, 11 July 1888, FO 78/5261.

\textsuperscript{89} “A Reservoir Boom in Egypt,” \textit{New York Times} (30 May 1895).

\textsuperscript{90} In 1896 Colonel Ardagh, one of the engineer officers leant to Whitehouse in the early 1880s, was warned by FO official T.H. Sanderson to avoid contact with Whitehouse because of these threats. T.H. Sanderson to Colonel Ardagh, 30 May 1896, FO 78/5261, 2-3.
cohesion and hydrological agreement to the British-Egyptian Irrigation Department about the way the irrigation systems should be modernized.\textsuperscript{91} The first part of water control stressed the repair of the Delta Barrage, a structure that had failed almost as soon as it was tested in the 1863. The Nile Barrage is discussed in this section. The second part of this three-pronged approach, their stated immediate goal, revolved around “improving” and straightening drainage canals; the canals will be discussed below in this chapter. The third aspect of water control in Egypt was the creation of a permanent reservoir in the valley of the Nile, and this will be discussed in more detail in the next chapter.\textsuperscript{92} This engineering discussion led to the construction of the Aswan Dam as the third prong of Egyptian control.

The Delta Barrage was originally conceived by Mehmet ‘Ali as a money-saving device.\textsuperscript{93} In principle, the barrage was supposed to replace or supplement the system of pumping silt-laden water out of the deepened branch canals, and onto the fields. The Barrage consisted of two dams spanning the Rosetta and Damietta branches of the Nile. These dams were not solid, but bridges fitted with iron gates which could raise and lower to control the height of the river’s water; the Rosetta Barrage was supposed to have sixty-

\textsuperscript{91} At the very least the engineers presented a united front for Baring and the British Foreign Office reports. Given their later commentary, the engineers certainly became convinced of the general correctness of this plan although not necessarily the precise details. I may also be incorrect about calling this a premeditated approach, but certainly by 1891 the engineers were taking steps toward total Nile control.
\textsuperscript{92} In his recent article Terje Tvedt has argued that the Aswan Dam became the centrepiece of a totalizing discourse towards the Nile. He argues that this discourse a direct response to the 1888 and 1889 low floods, and the subsequently perceived need to ensure more water for cotton crops. Terje Tvedt, “Hydrology and empire: the Nile, water imperialism, and the partition of Africa,” Journal of Imperial and Commonwealth History 39:2 (June 2011): 178-179.
\textsuperscript{93} Mehmet ‘Ali, after all, was the leader who instituted the nationalized corvée system in the first place to take advantage of the summer water. For instance see: Scott-Moncrieff, “Note on Egyptian Irrigation,”32.
one gates, and the Damietta seventy-one, although the Damietta’s gates were not fitted until British repairs. The raised water was supposed to flow through three specially constructed canals to irrigate the Delta but, as mentioned above, only one was originally constructed.  

British engineers told and retold an anecdote about the Nile Barrage: the proposed use of stone from the Pyramids to build the barrage in 1843.\textsuperscript{95} Like the corvée, the Nile

Barrage became a watchword for Egyptian lack of civilization.\footnote{This will be discussed in more detail in the next chapter with regard to the Philae Temples outcry in 1894.} They also had engineering reasons to be scornful of the original Delta Barrage. In an 1847 effort to finish the Barrage, 1000 tons of concrete was poured every day. The concrete was poured into running water and ruined the foundation of the Rosetta Barrage. Furthermore, given the sandy river bed, the foundation (and entire structure) slipped downstream, and streams of water ran underneath. When tested in 1863, although the water was only raised to a level of almost 2 meters, cracks appeared in the masonry.\footnote{Headrick, \textit{Tentacles of Progress}, 197-198.} Dam historian Norman Smith, for the above reasons, states that “while the projects were entirely sound in principle, they were shoddily constructed.”\footnote{Norman Smith, \textit{History of Dams} (London: P. Davies, 1971), 188.} However, Daniel Headrick argues that the “project was perhaps too ambitious for the engineering knowledge of the time.”\footnote{Headrick, \textit{Tentacles of Progress}, 198. Headrick, surprisingly, goes on to say that “the art of laying a foundation on shifting sand was not yet understood,” yet Norman Smith gives the example of the Coleroon dam not only being laid on an alluvial foundation, but also fixed there.} Whether the problems were due to poor construction or design, the fact that the Nile Barrage was designed and supervised by French engineers was something that later Indian-experienced engineers were both wary of and pleased about. To explain the engineering failure, British irrigation engineering texts stressed the incompetence of the Egyptian labour force, the hurried nature of the work rather than a failure in the hydraulic theory, and the fact that the French engineers were advisors rather than authorities in
mid-century Egypt. This compromise meant that these were construction problems caused by poor engineering. In the 1870s, British engineer Sir John Fowler examined the Barrage and concluded that repairs would cost £1,200,000 and even then he could not guarantee its safe functioning. As Sir Evelyn Baring remarked, the “costly and inefficient system of pumping” perennial irrigated water was “warmly supported by all the local authorities,” although Baring was unclear about the identity of those authorities.

According to Scott-Moncrieff, his decision to repair the barrage was based on a sense that coal-pumped water from the Nile was too expensive for a bankrupt state and corvée labour too odious for its engineers. The Egyptian government had recently finalized a deal with private contractors worth £50,000/annum until 1915 to provide irrigation water to Behara province. Since Behara province was only one of many Delta provinces, Scott-Moncrieff estimated that it would have cost £250,000/a as well as an additional outlay of £700,000. In his words, “I felt I must be certain that the Barrage was the worthless failure it was represented.” Furthermore, he expressed shock at, in his perspective, the exorbitant cost of pumping water given the size of the river. In his words,
“to spend such a sum every year in the great valleys of the Ganges or of the Punjab rivers would have been startling enough. But to spend it on this little Delta of Egypt!”

Scott-Moncrieff implied that his sense of economy was insulted by the expense involved. In a colony where finances were the government’s highest priority, and indeed were controlled by foreign hands, the only thorough mathematical and financial proof of perennial irrigation had enough political currency to justify the necessity of modified large-scale irrigation technologies. All proposed irrigation projects were couched in a language of hydraulic, mathematical engineering, juxtaposed with financial gain. As described in Chapter 2, Indian-experienced engineers had always been highly conscious of the finances of Public Works projects, but financial sobriety became something of an obsession for the engineers in Egypt. In this instance necessity as defined by the engineers trumped the conventions and habits of long-time irrigation practitioners.

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106 The implementation of a form of perennial irrigation had been the driving force behind the construction of the Ganges Canal.
Figure 6: Type Section for Barrage Additions. Source: R.H. Brown, The Delta Barrage (1902).
The method by which the Barrage’s foundations were mended was indicative of the Indian experience of the engineers. Specifically, William Willcocks’ conviction that the Barrage was fixable was indicative of his specific engineering background. Sir John Fowler had found the masonry-facing solid, regardless of the foundation, that “severe [river] action” after lowering a gate on the Barrage was due to the iron gratings in the foundation, not the foundation itself, and that the Okhla Dam on the Jumna River was a foundation-less structure which held up 3m annually. Thus, Willcocks’ reasons were partially dependent upon the local conditions and previous experience. However, he also double-checked the coefficients of water pressure of the Okhla Dam and utilized theoretical formulae to determine how much weight per lineal meter of water pressure the Nile Barrage would be able to hold while under repairs.\footnote{Willcocks and Craig, \textit{Egyptian Irrigation} (1913), 638.} Willcocks was committed to a mathematically theoretical understanding, but utilized the experiential preferences of the military engineers. The Okhla Dam only provided a basic model that dams like this would probably not fail, while Willcocks turned to engineering theory to understand the specific stressors and pressures that would act on the dam.

The starting point for a new system of perennial irrigation was, for both the British engineers and government, essentially risk-free. In 1884, William Willcocks authorized the closing of the Nile Barrage’s gates after patching cracks in the masonry. These patches cost relatively little (£25,000), and in the early 1880s Whitehall was still
planning to evacuate their personnel from Egypt within a few years. In 1885, without catastrophic failure, Willcocks and Scott-Moncrieff continued repairs, and subsequently held the water up to a height of 3m, at the cost of £18,000. After two years of increased water in the Delta and for relatively little output, the Egyptian Irrigation Department was able to better able to control, direct water and ultimately grow cotton.

The expected cotton crop in 1884 was 30,000 tons more than the previous year, even though the water in the Nile canals was only raised 2.2m, and the Nile had been officially declared a “low” Nile. Despite the half-finished state of the perennial canals and the seven more years of work to widen the foundations, and repair the barrage, the initial test proved an important point to Sir Evelyn Baring and the irrigation officials. Perennial irrigation was proven successful with technologies that the irrigation engineers had recommended. The Indian-experienced engineers abhorred the pumping and corvée system of perennial irrigation because they saw both as wasteful of labour, money, and time. In the minds of Scott-Moncrieff and Willcocks, the Barrage was perceived as a cost and labour-saving device, especially in the mid-1880s when the Nile floods were relatively “high.”

The personality of the individual engineer, in this instance, was also important. William Willcocks was impossible to convince after his mind was made up, although “a number of engineers from Cairo... tried to dissuade [Willcocks] from running any

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108 Cromer’s most recent biographer, Roger Owen, wrote that in early 1886 Cromer had decided that the best way for Britain to control Egypt was to continue the occupation. Roger Owen, Lord Cromer: Victorian Imperialist, Edwardian Proconsul (Oxford: Oxford University Press, 2004), 219.
risks.”\textsuperscript{110} Scott-Moncrieff, in fact, assured Willcocks that Scott-Moncrieff would take the blame for any accidents and give Willcocks the credit for any success. As an Egyptian colleague reminded him, “if I [Willcocks] had failed, a return to India was all that was before me; but if he [the engineer Abd el-Fatteh Bey] had experimented and failed... he would have been banished to Fashoda.”\textsuperscript{111} Willcocks had nothing personally to lose by testing the Barrage, and Scott-Moncrieff and the British occupation would have only lost £43,000.

After being assured of the structure’s soundness and utility, the Public Works Department was willing to invest significantly in the Barrage’s repair. In fact, the Barrage became the center-piece of perennial irrigation in Egypt until the construction of the Aswan Dam in 1902 – it was positively discussed by members of the international engineering community around the world, and Willcocks especially was hailed as a visionary for recognizing the dam had been salvageable. Permanent repairs began in 1887 and continued until 1890. As of 1891, total costs of repairing the Barrage were approximately £460,000.\textsuperscript{112} Between 1887 and 1890, permanent repairs continued under the direct supervision of two more Indian-experienced engineers, namely Colonel James Western, RE and Mr. A.G. Reid. Reid retired from Egyptian service after his work on the Barrage, and returned to India; Western is known predominantly for his engineering

\textsuperscript{110} William Willcocks, \textit{Sixty Years in the East} (Edinburgh: William Blackwood and Sons, 1935), 91. Willcocks here saw the act of Scott-Moncrieff as a personal vindication of his work, and appeared to resent the other engineers who tried to convince Willcocks not to put forward the proposal. Willcocks tended to see all those who sided with him as friends, and those who disagreed with his engineering decisions as enemies.

\textsuperscript{111} Ibid., 93.

\textsuperscript{112} Scott-Moncrieff, “Note on Egyptian Irrigation,” 32.
works in India and Egypt. Both left the irrigation service after completing repairs to the Barrage, but received Companionships of St. Michael and St. George. Western and Reid used their Indian experience and knowledge to control the flow of water underneath the Delta Barrage. These principles were borrowed from practices first developed on the Coleroon dam, which slipped downstream after being built on the sandy river bed.

Mentioned in Chapter 2, the Coleroon dam partially failed in its first year because the foundations were built on alluvial silt in the manner of the original dam on the river. Like the Coleroon solution, Western and Reid built an earthen dam, pumped the water out to expose the foundations then horizontally broadened the foundations of the Nile Barrage with Portland cement. Reid and Western had abutments built with Egyptian labour which prevented the water from flowing underneath the dam and pushing it downstream.

Stabilizing horizontally was done instead of making the foundations vertically deeper, because of the depth of the river bed, and the inability of the engineers to divert the entire Nile.

In his final report about the Barrage repairs, Scott-Moncrieff painted both men as having made the repairs themselves, especially Reid. In his words, “Mr. Reid was always on the spot, never sparing himself day and night (and the days were often excessively

113 Western’s formal obituary notice in the Royal Engineers Journal, written by Robert Hanbury Brown, focused on his engineering accomplishments, and his “reputation as a sound and safe man,” but neglected to mention his family, marital status, or even where he was born. As such, Western must remain enigmatic. R. Hanbury Brown, “Lt-Col. James Halifax Western, CMG, late RE” Royal Engineers Journal 25 (1917), 267-270.


115 Ibid.
hot)."\textsuperscript{116} As Casper Andersen has outlined, engineers in Africa often portrayed themselves as “explorer-engineers,” combining the heroic traits of competent professional engineers and mid-Victorian explorers, and conquered the nearly overwhelming difficulties of African large-scale projects.\textsuperscript{117} This statement, of course, hides the suffering that accompanied the repairs of the barrage. The “excessively hot” days for the Egyptian workmen were followed by night-long shift work. Historian Robert Tignor mentions that since the working season was from March through June, “[work] continued without interruption night and day until the end of June when the flood had to be prepared for.”\textsuperscript{118} The Egyptian workmen themselves, however, have been all but erased from the historical record. An anonymous journal article gave a rough estimate of up to 10,000 per working season – still, the repair of the Barrage, from the perspective of the British archives at least, might have been conducted by 10,000 fairies.\textsuperscript{119} More troubling is a lack of record of pay for the workmen. Although the Irrigation Department hired 5 interpreters, and the extraordinary budget for the barrage was about £470,000, this amount does not include any estimates of the workmen’s pay.\textsuperscript{120} The only mention of staff pay was that of the 1899 Report of the Irrigation Department, which mentioned that

\textsuperscript{116} Ibid.
\textsuperscript{117} As will be discussed in the next two chapters, these engineers also believed in what I call the power of “personal observation” – a feeling that by journeying to a potential construction site, the engineers could know whether that was a good site for a dam, barrage or reservoir\textit{just by looking at it}. Casper Andersen has called this tendency in the 19th century civil engineers, “engineer-explorers.” See: Casper Andersen,\textit{British Engineers and Africa, 1875-1914} (London: Pickering and Chatto, 2011), 114-120.
\textsuperscript{118} Tignor, “Agricultural and Hydraulic Policy,” 68.
\textsuperscript{119} “Engineer’s Innings,”\textit{National Observer and British review of politics, economics, literature, science, and art} 13:313 (17 November 1894), 12b.
\textsuperscript{120} Sir E. Baring to the Earl of Iddlesleigh, 10 January 1887, Inclosure in No. 39, FO 407/55,\textit{Further Correspondence Respecting the Finances of Egypt, January to March 1887}, Foreign Office, British National Archives, Kew. Translated by S.D. Jowett (6 March 2011).
the repair work for 1899 totalled £15, 647, but the sum included maintenance, “river protection,” garden costs, and the pay of the temporary and permanent staff; the workmen could not have been paid much.\textsuperscript{121} Given the working conditions, and the fact that the government was in the process of abolishing the corvée, the workmen for actual Barrage repair were probably paid a pittance, but their identities and voices must remain silent at the time of writing.

The Delta Barrage was added to in the 1890s, in order to better accommodate the stresses of increasing amounts of water that it had to hold up, and ensure that the foundations were in solid earth rather than river silt. Probably in the aftermath of the low Niles of the late 1880s and an ever-increasing demand for water supply, the project “grew... beyond the original idea” to hold water to a height of 6.2m at Cairo.\textsuperscript{122} As Thomas P. Hughes has remarked this conception of engineering assumed “a seemingly endless supply of natural resources.” The most important “critical problem” was harnessing a water supply.\textsuperscript{123} After its successful testing and subsequent repair, the Barrage became a symbol of competing imagery surrounding the “rehabilitation” of Egypt itself under the British military occupation.

First of all, it was a symbol of British success in engineering where not merely Egyptians but also French engineers had failed. On an environmental level, the success of repairing the barrage meant that much less water went to “waste.” That is, the low flood

\textsuperscript{121} W.E. Garstin, \textit{Report upon the Public Works Department for 1899}, 20.
\textsuperscript{122} R. Hanbury Brown, \textit{Irrigation: its principles and practices}, 131.
\textsuperscript{123} Hughes, \textit{Human-Built World}, 39-40.
of the Nile flowing into the Mediterranean Sea had been perceived by the engineers as “lost.” Scott-Moncrieff articulated this point in 1891: “in former days, during the low Nile, the canals were left high and dry, and what water there was flowed out to the sea, useless.” He contrasted this with his present in which the Nile barrage successfully diverted most of the Nile waters into canals, “and none flows out useless to the sea.”

As James Scott has argued, if the Nile is part of nature, then flowing into the sea is part of its journey. If however, the Nile is a natural resource, then allowing such a precious resource to let flow “uselessly” into the Mediterranean would be a waste, especially during the late 1880s when the water was scarce. These perceptions were part of Royal Engineers’ training doctrine, which stressed the practical usefulness of the natural world as the place to get the tools necessary for engineering projects. In David Arnold’s discussion of technology in India, public works projects became “monuments to their power and munificence... [the British were able] to master forces of nature that had defied and enslaved Indians for centuries.”

In an Egyptian context, the idea of technological dominance had the potential to free the fellahin from their millennial enslavement to the fields. The British engineers, therefore, saw themselves as fulfilling the role as redeemers of Egyptian irrigation by controlling the Nile’s entire gift.

Secondly, the Barrage was a site of the new perennial irrigation and a physical symbol of the importance of irrigation to the colony’s finances.\textsuperscript{126} As Hanbury Brown rhapsodized: “in this way a more perfect control over the distribution of water at the apex of the Delta has been obtained; not only in summer but also in flood.”\textsuperscript{127} The expense and the promised reward of perennially irrigated agriculture were contained in the physical structure. By 1890, the British had already spent over £E1 million of borrowed money on irrigation projects, but the Barrage was the most visible, partially because it was still under construction. The Delta Barrage, as mentioned above, was also in Cairo, and its placement meant that tourists, travellers, government officials, and Cairenes themselves also saw the Barrage as the most obvious work of the Irrigation Department. The off-hand remarks of passing colonial surveyor G.E. Smith, RE, who “[felt] more interest in the Barrage than the Pyramids,”\textsuperscript{128} are probably not typical, but reflect a consciousness of the Barrage in both Egypt and the United Kingdom. Indeed, a series of prominent writers and commentators also dwelt on the Barrage, including G.W. Steevens, A. Colvin, and Sir Evelyn Baring.

Contemporary British engineers and more recent hydrologists have not doubted that the Barrage’s repairs were tied to an increasing population and the necessity of feeding them. The first general survey of the Egyptian population commenced in 1897

\textsuperscript{126} The Aswan Dam would later take over this role as a physical symbol of British power. Timothy Mitchell, \textit{Rule of Experts: Egypt, Technopolitics, Modernity} (Berkeley: University of California Press, 2002), 35-36.
\textsuperscript{127} Brown, \textit{Irrigation: practices and principles}, 131.
under Captain Henry Lyons, RE as the Director-General of Surveys, and it was at that point, that the potential problems of Egyptian population growth became apparent to the Anglo-Egyptian government. In the 1910s, therefore, the Barrage took on a retrospective importance, as it had been the first innovation to increase the crop production. The rulers of the British Empire had long been haunted by Malthusian principles of food production and birth rates, and in the wake of the census, Lord Cromer and the engineers were too.  

Twentieth century commentator and tourist Alfred Cunningham connected these two necessities, when he wrote “the regeneration of the people carried with it of necessity the regeneration of the land,” but he is careful to only juxtapose the two ideas: increasing population and increasing scarcity of food and water.

Finally, the Nile Barrage remained a physical reminder of the vulnerability of British Egypt. As historian Robert O. Collins has emphasized, the hydropolitical aspects to British policy dominated even economic aspects of the perennial irrigation. As Collins has stated after 1890:

> The primary consideration of Britain’s imperium on the Nile and at Suez was the security of its waters… British engineers must not only increase the supply of water available to irrigate the land to feed the expanding Egyptian population, but to defend any threat to that precious water throughout the length and breadth of the Nile Basin to secure Britain’s strategic position at Cairo and Suez.

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The vulnerability of large-scale public works meant that Mohammed Ali had apparently originally conceived of a fortified Barrage, the British engineers scoffed at that. However, hydropolitical issues were perceived as more acute after 1898, when the Fashoda crisis had demonstrated the abilities of other European powers to threaten the Upper Nile. The conquest of the Sudan in the same year meant that the Egyptian government was able to explore their strategic options. However, regardless of the hydropolitical, strategic, or economic situations in Egypt throughout this time period, the Anglo-Egyptian government was reluctant to invest large sums of money in drains. It is the curious of case of Egyptian drains to which this chapter will now turn.

5.4 What about Drainage?

The technologies documented above demonstrate a commitment to expanding the system of water delivery to Egyptian fields, if through a series of limited and specific reforms. And, to the credit and fame of the engineers, after the repair of the Nile Barrage, crop yields rose in the early 1890s. However, drainage systems continued to be ignored, despite a continued stated commitment to their clearance and creation. As mentioned above, one of the primary reasons why the Wadi Rayan reservoir was not

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133 Tignor, “Agricultural and Hydraulic Policy,” 68.
promoted by the Irrigation Department was the efforts of the British engineers to garner some money for drainage works. Indian-experienced William Garstin wrote in 1888, “I do not want any more money for reclamation for many years to come. I want money for my drains.” Garstin was specifically replying to the proposed Wadi Rayan Reservoir, so although his statement may be taken as reliable, given the animosity that the irrigation engineers felt toward Cope Whitehouse’s project, there may have been other projects that were more important to Garstin’s superior than drainage. Still, both Scott-Moncrieff and Baring agreed that drainage works should absorb most of the available irrigation budget.135

Drainage is critical for irrigated agriculture for three primary reasons. Firstly, in temperate climates, good drainage allows the soil to warm up faster in spring. Secondly, better drainage improves the amount of oxygen in the soil, which is beneficial for root systems. Finally, drainage “improves soil aggregation” which means that the soil can be disturbed without it blowing away.136 In Egypt, naturally high soil salinity meant that irrigation water had to be perennially flushed to prevent damage to crops. Environmental historian Alan Mikhail argues that irrigation always causes salinization in arid climates because

Standing water dissolves salts in the root zone of plants, thereby elevating salt into the very fresh water meant to grow crops. Much of the accumulated salt can be flushed

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134 Quoted in Scott-Moncrieff “Note on the Wadi Rayan,” 5 April 1888, FO 78/5261, 5.
135 Ibid., 5-6; Sir Evelyn Baring to Marquis of Salisbury, 29 April 1888, FO 78/5261, 3-4.
away with the replenishing waters of each flood, [less possible after the introduction of perennial irrigation] but [the Nile Delta] had to deal with the steady accumulation of salt along the entire length of the world’s longest river.\textsuperscript{137}

High soil salinity is toxic to land-plant growth and causes soil sterility.\textsuperscript{138} Too much water in the soil is also damaging to crops, and waterlogging is therefore another serious problem.

Finally, without drainage, standing water and higher water tables encourages opportunistic species to colonize the region. The snails that host bilharzia worms thrive in still water, and malarial mosquitoes need standing water to lay their eggs.\textsuperscript{139} Furthermore, the weed water hyacinth grows best in still water along canal banks, and outbreaks of it occurred after it escaped from Cairene gardens in the late 1870s.\textsuperscript{140} The irrigation engineers were aware of these problems, but were not able to procure enough money to fully combat the infestation, especially after the 1894 decision to construct the Aswan Dam.

The only government officials who seem to have been interested in drainage were the Irrigation Inspectors, who pleaded with the government to give more money for drainage and canal clearance. In his 1899 Report, Garstin repeated himself, “In last year’s

\footnotesize{\textsuperscript{137} Mikhail, \textit{Nature and Empire in Ottoman Egypt}, 127-128. \\
\textsuperscript{138} As detailed in his 1896 article, Justin Ross understood that salt came from the desert. Most of North Africa is a naturally occurring salt deposit. Justin Ross, “Irrigation and Agriculture in Egypt,” \textit{Scottish Geographical Magazine} 9 (1883), 180. \\
\textsuperscript{139} William Beinart and Lotte Hughes, \textit{Environment and Empire} (Oxford: Oxford University Press, 2007), 145. \\
\textsuperscript{140} Henri J. Dumont, “A Description of the Nile Basin and a Synopsis of its history, ecology, biogeography, hydrology, and natural resources,” in \textit{The Nile: Origin, environments, limnology, and human use}, Monographiae Biologicae 89, Henri J. Dumont, ed. (Ghent: Springer, 2009), 13.}
Report, I drew attention to the fact that the question of drain maintenance [in Middle Egypt] was one of serious and increasing importance. It is practically certain that in a few years time, the regular budget will be unable to meet the cost of clearing all the new drains annually." Willcocks, in the same year, noted that in the Delta, there were 10,010km of canal, and 2,669km of drains. A year later, for all of Lower Egypt, for instance, 185.5km of new drains were constructed, and 110.5km of older drains were remodelled, but the cost of such a small area was £167,000.

Several historiographical explanations have been put forward to explain the problem of unsolved drainage. The British engineers were undoubtedly aware that undrained water contributed to increasing soil salinity, even before the construction of the Aswan Dam stripped much of the nutrients out of the Nile waters. Robert Tignor suggests that “irrigation works had consumed such a large part of the budget that little was left for drainage improvement.” Given the sheer expense of constructing and maintaining drains, Tignor is undoubtedly correct to some extent. However, the vast majority of the irrigation projects completed by the Irrigation Department were small – like canal head works to control flood waters. Here again the water-control priorities of the irrigation department engineers played into a reluctance to invest heavily in the necessity of drainage works. Furthermore, given the commitment of the government to the Irrigation

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141 Garstin, Report upon the Public Works Department for 1899, 24.
142 Willcocks and Hanbury Brown, Egyptian Irrigation, (1899), 171.
143 Garstin, Report upon the Public Works Department for 1900, 163.
144 Tignor, “Agricultural and Hydraulic Policy,” 72.
Department and its engineers, Tignor’s statement of expense seems an incomplete explanation.

Another answer has been offered by Roger Owen who proposed that part of the problem with the construction of drainage works was “a habitual tendency to think on a scale which totally failed to match the scope of the country’s requirements.” Clearly this also applied, as the insignificant number of remodelled drains in 1900 demonstrated. It was not until the early 1910s that a comprehensive solution for drainage was proposed by the Irrigation Department. Both explanations were borne out by the primary sources. It seems probable that the cost and the scale of the works was simply too exorbitant for Anglo-Egyptian governments until Lord Kitchener (Consul-General 1911-1914) was willing to countenance remodelling the entire drainage system of Egypt and the Sudan. Kitchener was, in many ways, freer to act than Cromer was, due to the abolition of the powers of the Caisse increased control of the press and a dictatorial attitude towards anti-government protests.

To these explanations must be added its lack of easily quantitative results but also the snarled nature of drainage. In an 1893 article, Justin Ross vented his frustration at the state of drainage because some drainage canals had become irrigation canals; “we have had the very greatest difficulty in disentangling this complicated series of canals and in many instances the vested rights had been too much for us, and the expense of making

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145 Owen, Cotton and the Egyptian Economy, 253.
146 Moseley, With Kitchener in Cairo, 92-93.
147 Ibid., x-xii. Moseley, as a journalist in Cairo in the 1910s, was horrified at Kitchener’s attempts to control the press (both English and vernacular) by shutting down newspapers deemed even remotely critical.
new drains far beyond our budget reforms.” This rare statement of failure could probably only have been discussed in reference to drainage – drainage became a catchall for problems in water supply.

In an atmosphere of rewarding quantitatively verifiable one-shot projects, the Anglo-Egyptian government of the 1880s and 1890s almost entirely ignored demands for better drainage. This predilection for large-scale irrigation structures, as mentioned above, probably stemmed from an attempt to justify to the Foreign Office and the Caisse the continued utility of the Egyptian occupation, and the emphasis that this occupation placed on irrigation science. Structures (canal heads, temporary dams, etc.) represented by facts and figures were quantifiable examples of the expansion of the cotton crop, and the subsequent extension of Egyptian stability and British profits. Drainage canals, by contrast, implied a failure on the part of the engineers to utilize all the available water in a land where every drop was precious. Of course, such a feat is impossible – some water will always escape into the surrounding soil or air – but the necessity of drainage works meant that the irrigation engineers were not entirely successful at totalizing either water control or social control.

5.5 Conclusion

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The waters of the Nile were analyzed, the bed studied, and their usage scrutinized with an intensity that had never been as all-consuming, coordinated, and meant to distance the people from the waters they utilized. The Indian-experienced engineers approached Egypt with the collective assumption that through the provision of more water, bigger cotton crops would produce more tax revenues. They therefore turned their attention to providing more water for the farmers by doing what they knew how to do: direct and control the water through large-scale projects. However, the British engineers did not see the Nile as a river, with its own patterns and behaviours – but a source of water – a natural resource to be tapped, managed, divided, and re-packaged. Water became a consumable product, valuable because of its scarcity. This deceptively simple abstraction had long-term consequences for those engineers supplying water to the cotton crops. To use Hughes’ terminology, once the scarcity of water was defined as a critical problem then the answer that presented itself to irrigation engineers was to manufacture bigger and bigger reservoirs to catch and redistribute the available water. As will be described below, this impetus was first acted upon with the Aswan Dam, first constructed and then heightened in the space of fourteen years (1898-1912).

This chapter has not meant to imply that the mechanisms of British power resulted in perfectly regimented system of perennially irrigated agriculture. Rather, I have sought to demonstrate the nexus of Anglo-Egyptian power over the irrigation technological systems – like the irrigation practices – radiated from the Delta Barrage first northwards, and then southwards. The system of irrigation promoted by Indian-
experienced engineers was designed to allow them to control both the water and the people who used that water. Not a malevolent plot, nor a “fit of absence of mind,” the engineers simply understood that population-control and water control went hand-in-hand and constructed the technological system that would allow them to do precisely that.

The engineers utilized personal experiences and incorporated local conditions in constructing permanent irrigation systems. This chapter has therefore endeavored to explain why the Wadi El-Rayen reservoir scheme was not utilized and part of that explanation was the conviction that the Delta was the richest part of Egypt, and as such needed to be rehabilitated first. “Rehabilitation,” of course, was the engineers’ conceptualization of Egyptian irrigation. The omdehs, large landowners, and fellahin rightly understood that state “rehabilitation” over Egyptian agriculture meant state interference in their ability to grow crops. Undoubtedly, the burden of such regulations fell on those least able to resist government control: the small-landholders and the landless workers. In the years after the construction of the Aswan Dam, another generation of British engineers would work on eliminating the “system” of basin irrigation to promote the more lucrative practices of perennially irrigated agriculture. Chapters 6 and 7 discuss the consolidation of perennial irrigation as the only technological system in Egypt and the upper Nile basin. Even before the conversion of the basins in the early 1900s, as this chapter has documented, the British irrigation engineers were introducing a version of deepened summer canals as a way of perennially irrigating Upper Egypt. As will be discussed below, the Aswan Dam marked a “point of
no return” in Egyptian irrigation history; since its construction the Egyptian government (whether British or Egyptian controlled) was committed to the necessity of total Nile control through perennial irrigation. This commitment will be partially attributed to what Mark Elvin has called “technological lock-in,” wherein once a state is socially and economically committed to a technological system, that state cannot abandon it, even though the technology produces fewer and fewer returns.149 Such commitment, however, was also the result of carefully crafted engineering decisions about the morality of irrigation engineering and a set of historically constraining circumstances. The British-occupied Egyptian state chose to construct and heighten the Aswan dam, but was pulled to the specifics of these decisions by a set of circumstances not precisely of their own volition.

Chapter 6

The Aswan Dam and Technological Imperialism, 1890-1902

6.1 Introduction

The members of the Society of the Preservation of the Monuments of Ancient Egypt were furious. Led by their President, the Earl of Carlisle, the Society declared war on the Egyptian government in a general meeting in London on 23 February 1894. Their next move was to send a memorandum to the Foreign Office, addressed directly to the Foreign Secretary, the Earl of Kimberley. They “ventured to call your Lordship’s attention to a resolution passed at a general meeting of the society… in condemnation of a scheme for making a dam at Assouan.” The Anglo-Egyptian government planned to build a dam across the Nile at Aswan, thereby creating a reservoir large enough to provide excess water for irrigated agriculture but swamping the celebrated Island of Philae with its ancient Temples and a large number of the Nubian monuments south of Aswan. The society’s letter went on to note that according to the Egyptian Government the Temples on the Island of Philae would be either destroyed or moved – but either prospect would be “equally fatal” in the honorable members’ eyes. Instead, they argued that there were other sites for a reservoir, and thought that the Foreign Secretary would support their suggestions.¹

¹ Society of the Preservation of the Monuments of Ancient Egypt to the Earl of Kitchener, 7 March 1894, No. 95 in FO 407/126, Foreign Office, British National Archives, Kew.
Having delivered their opening salvo, the Society continued their attempts to sway opinion in both Egypt and Britain. In August, the Society forwarded their memorandum to the Egyptian Prime Minister, Nubar Pasha.² In that letter, the Society “heartily rejoice[d]” at the reservoir scheme, because it would increase the wealth of Egypt, while pleading with the Egyptian Prime Minister to find another project that would preserve Nubia’s “valuable monuments.”³ The Society also tried to persuade a wide British public to their position about the destruction of the Philae Temples. The secretary, noted architect Edward J. Poynter, announced their intentions to the London Times on February 1894, even before the Society met to draft a resolution.⁴ Furthermore, the Society attached its name to a pamphlet outlining in some detail the schemes of the reservoirs of the Nile and how these schemes would destroy the ancient Egyptian monuments.⁵ This pamphlet left no doubts about the members’ feelings on the proposed reservoir: “to devastate the Island of Philae is nothing less than to rudely tear an important leaf out of the sadly mutilated volume upon which… modern civilization [is studied].”⁶ Their efforts, therefore, inextricably linked three apparently distinct audiences for their protests: the Foreign Office, the Egyptian government, and the British public.

The Egyptian public, while interested, were not consulted nor were they interesting to the

³ Ibid.
⁴ Society for the Preservation of the Ancient Monuments of Egypt” 11e.
⁶ Society, Reservoirs in the Valley of the Nile, 6.
Society; like so many other decisions of the Egyptian government, the farmers at the heart of this controversy were presumed to be passive witnesses to their own history.  

The Society for the Preservation of the Monuments of Egypt was particularly tenacious and single-minded when it came to the proposal that would destroy the Philae Temples. A variety of newspapers, magazines, and scholarly journals in Britain published articles and editorial opinions about the controversy, and other antiquarian and conservation societies sent letters to the Egyptian Government. However, the Society for the Preservation of the Monuments of Ancient Egypt was unique in the variety, number and fervor of their efforts, and the distinguished nature of their members. In their own words, these “men of science, artists, and others in public positions” were committed to the exploration of other reservoir options than a dam at Aswan. Members of the Society understood that the Aswan Dam was a political technology, one whose construction could be affected with political pressure, and in the short term, their pressure succeeded.

The Society did help get the height of the dam lowered – but these changes were also part of a more general socio-technical process that started from the basic concept of a reservoir in Egypt and was winnowed down to a very specific dam at Aswan. In this chapter, I argue that this technology (the Aswan dam) was shaped from the assumptions its designers, contemporary politics, financial considerations, and environmental factors. As an integral part of the imperial project, engineering science was, in the words of Gyan

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7 Like so many questions in this dissertation, the reaction of Egyptians to the construction of the Aswan Dam must remain frustratingly speculative. Imperial scandals often included individuals or groups whose voices were erased in favour of hegemonic male perspectives. See Kirsten McKenzie, *Scandal in the Colonies: Sydney and Cape Town 1820-1850* (Carleton, Victoria: Melbourne University Press, 2004).

8 “Proposed Dam at Assouan,” 90.
Prakash, “the legitimating sign of rationality and progress.” The dam’s successful construction vindicated the technical expertise of the irrigation engineers, their collective image of irrigation systems, and the authority of the Anglo-Egyptian government.

In this chapter, the technology of the dam will be used to describe the political complexities of the reservoir project, and the extension of Egyptian perennial irrigation and water control. The construction of the Aswan Dam represents the point at which the Egyptian government started to create new permanent structures on the Nile, an equivalent point to the construction of the Ganges Canal in India. Like the Ganges Canal, the Aswan Dam was later modified significantly to compensate for structural errors and the designing engineers traded recriminations to apportion blame. Unlike the Ganges Canal works, the dam was primarily modified to provide more water for an ever-increasing demand in Egypt. The Aswan Dam represented a major break with the irrigation work of Indian-experienced engineers in the first decade of British occupation, which had concentrated on the deconstruction of local practice, but the adaptation of local technologies.

The first section of this chapter, therefore, starts with the decision of the Egyptian government to construct a permanent dam and reservoir in the valley of the Nile. I argue that number of inter-related factors contributed to that decision, including a number of unforeseen environmental obstacles caused by the Nile Barrage’s renovation. The

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10 The heightening of the Aswan Dam will be discussed in the next chapter, alongside the extension of perennial irrigation in both Egypt, the Sudan, and southwards along the Nile.
Egyptian government’s technocrats’ efforts were focused on the effort to design a viable, scientific, inexpensive reservoir project that signified the grandeur of the British Empire and its engineers. This project was inseparable from the British engineers’ assumptions about what irrigated agriculture should be, what their roles in the Irrigation Department should be, and how a dam should be constructed. These assumptions fed into not only the type of dam but the geographical choice for where that dam should be constructed. This section also deals with an 1894 Technical Commission composed of internationally-renowned engineers formed to oversee the project’s designs and make recommendations to the Irrigation Department. Of the possible sites, the one most favoured by the Irrigation Department’s engineers and the majority of the Technical Commission promoted a high dam at Aswan, which would have swamped the famed Temples of Philae.

The second section discusses the public outcry to the proposed destruction of the Philae Temples. This section argues for the imbrication of Britain and the empire, at least in the limited context of a controversial engineering project. Although French and German archaeologists and antiquarians publically objected, the majority of the outcry came from British travelers, art lovers, architects, archaeologists, and aficionados of ancient Egypt. In the popular and literary British press, the public debates rested on two apparently competing definitions of civilization: civilization as preserving delicate, beautiful ancient monuments, and civilization as revivifying Egyptian agriculture through irrigation schemes. This section also argues for an underlying British acceptance of the right to speak for and make decisions about Egypt, its irrigation and peoples. Protesters,
including those at the Society of the Preservation of the Monuments of Ancient Egypt critiqued the specific project, but did not question the right of the Egyptian government to construct reservoirs, and Egyptian voices were not part of the British public discussion.

The final section of this chapter examines harnessing the Nile at Aswan, and the ways in which it changed both Upper Egypt and British perceptions of that land. The Aswan Dam was challenging from both engineering and financial perspectives, and the solutions created were indicative of a new relationship with and reliance on British technology and engineering solutions. However, some aspects of the engineering science were entirely innovative, and supported the creation of uniquely Anglo-Egyptian methods of financing and engineering large-scale public works. By contrast, the construction site itself represented for Britons a site where the natural landscape had been transformed into a hub of urban, industrial activity. This overly simplistic dichotomy nevertheless reinforced the glory and grandeur of British science and technology – British tourists especially were impressed by the Aswan Dam.

As technological historian Langdon Winner has written, "what we see … is an ongoing social process in which scientific knowledge, technological invention, and corporate profit reinforce each other in deeply entrenched patterns, patterns that bear the unmistakable stamp of political and economic power."11 In this chapter, Egypt-making through irrigation engineering reached its peak of scientific and economic dominance. During construction of the dam, the engineers probably had the most direct influence

over Egyptian labourers too. For these reasons, as well as the direct involvement of Britons into an Egyptian technological project, the Aswan Dam is critical to this dissertation.

6.2 The Technocrats’ Reservoir

6.2.1 A Brief Explanation for why Egypt needed a reservoir

Before diving into the 1894 controversies surrounding the Aswan Dam, it is first necessary to understand why the Egyptian government considered constructing reservoirs at all, since in 1888 they had thought that reservoirs were too expensive, and hoped that the Delta Barrages would provide enough water. The idea of reservoir construction in Egypt had a long history – the Wadi Rayan reservoir scheme had merely been the most recent. However, as mentioned in Chapter 5, Colin Scott-Moncrieff had deliberately distanced himself from such a large undertaking. At the time, Scott-Moncrieff cited the bankruptcy of the Egyptian government, and its need to discard existing irrigation practices, and modify the irrigation technologies instead of building large dam projects.12

However, the political situation that existed in Egypt in the 1880s had significantly changed by the early 1890s. The British government increasingly felt that European intervention in Egypt was tantamount to meddling. Hydro-politically, the Egyptian government was anxious to gain water security from the Sudanese rebellion,

and budgetary security from the French. British administrators were anxious about other European powers cutting off Egypt’s water supply. Robert Collins has argued strongly that, from a hydropolitical perspective, the Anglo-Egyptian government needed to feed its burgeoning population and defend against any security threats. Similarly, Cromer and his financial advisors saw the promised increase of revenue from expanded perennial irrigation as a way to become freer from the Caisse, which in the irrigation department seems to have been considered a hindrance. Garstin wrote to Cromer that “I can imagine nothing more fatal to the successful completion of a work such as the above [dam] than any sort of international control.” By boosting revenue, and paying down the debts, the Egyptian government would have less need of internationally approved loans.

Another possible partial explanation was the fact that by 1894, Scott-Moncrieff and Justin Ross had retired to be replaced by William Garstin, who would be the head of the Irrigation Department, Under-Secretary of Public Works, and finally Advisor to Public Works until 1908. As Collins has written, Garstin joined “the Establishment.” With his “affable personality and one of the most perceptive minds in understanding

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13 Writing in 1952, H.E. Hurst mentioned that a 3rd heightening of the Aswan Dam had recently been rejected “largely to avoid having too many eggs in one basket.” H.E. Hurst, The Nile: A General Account of the River and the Utilization of its Waters (London: Constable, 1952), 31. In his article, “Hydrology and Empire,” Tvedt has challenged this assumption, and argued instead that “British advances into tropical Africa from Egypt were a kind of expansionism that went far ahead of conventional commercial expansion, because their aims were essentially hydrological and related to Nile control upstream and/or the benefit of British economic interests in Egypt.” Terje Tvedt, “Hydrology and empire: the Nile, water imperialism, and the partition of Africa,” Journal of Imperial and Commonwealth History 39:2 (June 2011): 174.


15 “Note by Mr. Garstin upon Sir Edwin Palmer’s proposals for carrying out the Assouan Reservoir,” 10 June 1894, Inclosure No.2 in No. 10 in FO 407/127, Further Correspondence Respecting the Affairs of Egypt, July-December 1894, Foreign Office, British National Archives, Kew.
water and how it flows,“16 Garstin was one of the single most responsible engineers for developing and putting into practice the system of total Nile control that will be discussed in the next chapter. Furthermore Willcocks, sometime friend and longtime admirer of Garstin’s perseverance wrote, “Sir William Garstin… will undertake [colonial projects]…in his own way; careful in inception, deliberate in execution, but with no looking back once the hand has been put to the plough.”17 As will be discussed below, this certainly characterized Garstin’s approach to the Aswan Dam: once he had made up his mind the only variables to the project were how high and when it would be constructed. He was also personal friends with Lord Cromer, which certainly aided their collaborative efforts to dam the Nile.

There was a water supply crisis in Egypt in the early 1890s, but one that was only obliquely referred to by the Anglo-Egyptian engineers – because they had caused it. As Scott-Moncrieff had mentioned in 1891, “practically the whole summer supply… is diverted by the Barrage and none flows out useless to the sea.” He continued, “however low the river may fall, the water will get onto the fields.”18 Scott-Moncrieff as an irrigation engineer was not terribly interested in the fact that the villages, towns and cities of the Delta also drew their water supply from the river. This may have been an early instance of policy makers focusing on what political scientist John Waterbury has termed “willfully fragmented” information. According to Waterbury, “planners and policy

17 William Willcocks, “Egypt Fifty Years Hence,” (Cairo: National Printing Department, 1902), ICE Tracts 8 V.596, No. 5, Institution of Civil Engineers Library, London, pg. 9.
makers limit their responsibility by limiting their range of vision and by retreating into narrowly defined competences.”

In this instance, the engineers did not attempt to calculate the amount of water needed for sanitation, drinking, and cooking purposes. And, after the renovation of the Nile Barrage, as Cope Whitehouse wrote, “there was not water enough in the Nile for the supply of the two main branches of the river, and an increase in the cultivated area…The Barrage was, in fact, repaired on a miscalculation of the water available.” With so little water left in the Nile, the deep canals of the Delta were below sea level, so sea water seeped into the riverbed, from which the towns drew their water. Because of the depth of the canals, the water from fields and sewage from the settlements upriver drained into the increasingly polluted Damietta and Rosetta riverbed. Without reservoir water to flush out the seawater and the waste water, the health of municipal water supplies was both unsanitary and in danger of drying up altogether in years of low flood. Justin Ross mentioned that, among irrigation engineers, it had been hoped that “the utilization of the total summer supply arrested by the Barrage and turned into the Delta channels would give satisfactory results” for irrigating all of Lower Egypt. However, according to Ross, from experiences in 1888 and 1889, in low years with only 22 million m$^3$ passing Cairo

20 Cope Whitehouse, “How to Save Egypt,” *Fortnightly* 54:323 (November 1893), 660. Whitehouse, in this case, does not seem to be merely badmouthing the British engineers. The *British Medical Journal* ran a series of very critical articles about public health in the Egyptian delta, at least one of which was written by former Public Health official H.R. Greene. However, it is worth noting that the BMJ did endorse Whitehouse’s Wadi Rayan reservoir scheme. H.R. Green, “Quality of Nile Water,” *British Medical Journal* 2: 1697 (8 July 1893), 96-97; “Pollution of the Nile,” *British Medical Journal* 1: 1699 (22 July 1893), 199.
21 Whitehouse, “How to Save Egypt,” 660; “Pollution of the Nile,” 199.
daily, the water supply in Alexandria was “precarious.” Combined with the other reasons listed above, the governmental reaction to this sanitary crisis was to supply more water for irrigated agriculture and municipal water supplies, rather than allow the Nile to flow to the sea and risk the summer cotton crop.

After low floods and more importantly low summer water supplies in 1889 and 1890, the Irrigation Department engineers, especially Willcocks and Garstin, became convinced that the construction of a reservoir in the Nile valley was the only way to increase the summer water supply. As mentioned in the two previous chapters, water supply calculations were based on what can only be termed “best guesses,” and these estimates continually went up. Furthermore, the calculations themselves were based on a triennial cotton rotation, which the smaller landowners did not follow. The engineers were trying to impose a national water discipline (what Scott would call a series of “state simplifications”) onto a fluctuating water supply in a place where they had neither good estimates of water use nor the sustained local authority to enforce this discipline.

The way the engineers thought about the Nile was also changing – after these low floods, the fluctuations of the Nile ceased to be “natural” and turned into conditions that

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22 Justin Ross, “Storage Reservoirs in the Nile Valley,” 30 October 1890, FO 78/5261 Irrigation of the Nile Valley. Scheme of Mr. Cope Whitehouse. Raijan Reservoir, etc. Vol. 1, Foreign Office, British National Archives, Kew, pg. 3-4. Ross mentioned that in a normal year, the low Nile was about 30 million m³/diem.
23 Another reason for building the Aswan Dam, according to Robert Collins was also the exponential increase in Egypt’s population and continuing governmental difficulties in feeding the population with the food supplies at hand. Collins, Waters of the Nile, 105.
24 Jennifer Derr reminds her readers that the authority of the irrigation engineers, and therefore the imperial state, was both “spatially” and “temporally” variable – concentrated on regions producing cotton and specifically powerful at certain times of year. Jennifer L. Derr, “Cultivating the State: Cash Crop Agriculture, Irrigation, and the Geography of Authority in Colonial Southern Egypt, 1868-1931” (PhD Thesis, Stanford University, 2009), 238.
needed to be fought against, avoided, and solved. In an 1891 report on the feasibility of reservoir construction in Egypt, Willcocks was explicit about this:

There have been years like 1879 when the discharge of the Nile at Cairo was 62,000,000 cubic meters per day, and years like 1889… when the supply was barely 16,000,000 cubic meters per day... The very good years are few, while the bad years are common. Up to 1889 we habitually made all our calculations on the mean discharge available, but [low years] have taught us that the mean discharge is no true gauge of the capacity of a canal system to meet the agricultural requirements of a country like Egypt… The weakest link in a chain is the true gauge of the strength of the chain.\textsuperscript{25}

Willcocks recommended that engineers make their mathematical calculations on the lowest possible discharge, and thereby ensure a constant supply of water, Lower Egypt could be protected from drought. Although Scott-Moncrieff harboured reservations about this line of logic, they were buried in a footnote and seem to have been downplayed by Scott-Moncrieff’s successor to the post of Under-Secretary of Public Works, William Garstin.\textsuperscript{26} The river itself became a “critical problem”; how to increase the water supply and regularity of that supply? All problems had solutions, some were just more expensive than others. In order to solve the water crises and gather enough water to increase


\textsuperscript{26} In Scott-Moncrieff’s words: “The analogy between the minimum year and the weakest link in the chain can hardly be accepted. The value of the whole chain depends on its weakest link. The value of to the country of a fruitful year is not lessened because the next year is unfruitful. If an irrigation system could be invented sufficient for a country’s wants nine years out of ten, and if it would cost double to make such a system applicable to the tenth year, it would by no means follow that the more expensive system would be true one to adopt.” Colin Scott-Moncrieff, \textit{Nile Reservoirs}, Note A page 18.
summer cotton crops, the engineers initially hoped that a reservoir would be large enough to irrigate all of Middle and Lower Egypt perennially.\textsuperscript{27}

If water supply was part of the reason for drastically altering the way that Egyptian irrigation had been conducted, land reclamation was the other half of the equation. According to Willcocks, 1.2 million feddans in Lower Egypt were either swamp or salted land (and were therefore “lost” to cultivation). The potential for summer irrigation to Upper Egypt provided the greatest incentive to promoting the scheme: if these lost lands could be reclaimed then they could be made profitable.\textsuperscript{28} In this understanding of the environment as natural resource, water \textit{and} land needed to be more perfectly utilized to create more wealth for Egypt – Willcocks estimated that £1 million more would go directly to the Treasury.\textsuperscript{29}

Tied to land reclamation was the realization that the Egyptian economy, with its dependence on a single cash-crop, had lost its ability to absorb poor harvests. Land needed to be reclaimed to increase the total area under cotton – thereby insuring from total harvest failure the country through sheer volume of cotton crop against a failed year. Since the Nile – either too low or too high – was regarded as the cause of poor harvests,

\textsuperscript{27} Garstin, “Note” in \textit{Perennial Irrigation and Flood Protection}, 30. A lower dam (proposed at RL 110m) was supposed to only regulate Lower Egypt. The use of the lower dam to irrigate Lower Egypt was a significant departure from later plans and from what was actually carried out.
\textsuperscript{28} Willcocks, \textit{Nile Reservoirs}, 16-17, 19.
\textsuperscript{29} Willcocks, \textit{Nile Reservoirs}, 20. He also estimated that the “increase to the wealth of the country” would total £6,625,000.
the decision to build a dam to ensure a minimum amount of water was regarded as a way to guard the economy from the vagaries of the river.\textsuperscript{30}

The final factor in the Irrigation Department’s sponsorship of a permanent reservoir was the contingency of the repaired Barrages. The Barrage repair had created the technical and conceptual space for a reservoir, because reservoir water for Lower Egypt would have been useless without barrages to raise the water level at Cairo. As military engineer F. Seymour Leslie wrote, “a reservoir in Upper Egypt would have been inoperative as long as the Barrages were unable to perform… [Reservoir water] would not have risen high enough to enter the Lower Egyptian canals.”\textsuperscript{31} The physical presence of the Barrage allowed the reservoir to become a conceptual reality.

By 1891, a reservoir was gaining epistemological solidity. Rather than an engineer’s daydream, the reservoir scheme was seen by at least Scott-Moncrieff, Ross, Willcocks, and Garstin as a viable engineering solution to Egypt’s water crises. The Irrigation Department unreservedly embraced the concept of a reservoir, although the site was less certain.\textsuperscript{32} The most prominent governmental reasons for this decision was based on financial development, sanitation and hydro-politics. Despite the perceived need for a permanent dam in Egypt, the engineers were less certain about where a dam should be placed. The next section discusses not only the placement of the dam, but the engineering

\textsuperscript{30} Goldsmith and Hildyard, \textit{Social and Environmental Effects of Large Dams}, 244.
\textsuperscript{31} F. Seymour Leslie, “Proposal to raise the temples of Philae and the circumstances that gave rise to that scheme,” \textit{Architecture, a magazine of architecture and the applied arts and crafts} 1:9 (July 1894), 156.
\textsuperscript{32} Willcocks recommended Aswan as the best site in 1891, but his conclusions were still tentative. In the aftermath of his report, he was appointed to an entirely new position, Director-General of Reservoirs. The post was meant for him and his successors to investigate, design and eventually to oversee the construction of a reservoir. Willcocks, \textit{Nile Reservoirs}, 31-32.
factors that governed its placement. The debates about where to place a dam and how that dam might be constructed, revealed a continued commitment to the epistemologies of military irrigation engineering.

6.2.2 Where to place a dam? Reservoir sites, 1891-1894

After considerable preliminary work, Willcocks presented his report for the construction of a reservoir, detailing the best site, costs, irrigation and economic benefits, and any future plans. This work included a tour of irrigation works in Italy and France to “investigate various irrigation technologies and plan for the construction of a dam at Aswan.” His travels suggest that military irrigation engineers’ engineering methodologies were still being followed by their pupils, because Baird Smith and Scott-Moncrieff himself had undertaken similar journeys to assist works in India. For instance, while touring the Shannon river “[Willcocks] saw the type of regulators we needed at Aswan.” Willcocks specifically looked for inspiration for an Egyptian problem in both Ireland and Italy – even though his regulators were originally designed for a transportation canal. Willcocks was also reinforcing the importance of personal observation among engineers in Egypt: by personal observation, I mean the physical act of visiting, touring, and exploring irrigation sites (and potential sites) to understand their geographical features and technological mechanisms. This “observational” form of colonial knowledge implied that technologies constructed in one location could be

applied in another; this knowledge prioritized the importance of irrigation technologies over practices.\textsuperscript{35}

Willcocks’ resultant \textit{Report on Perennial Irrigation and Flood Protection for Egypt} (1894) formally suggested the Aswan province location as the best site, with a proposed height of RL114m.\textsuperscript{36} The river was fairly shallow here, the river banks close together, the bedrock solid, good materials in close proximity, and the other possible sites, by Willcocks’ estimate, were all of lesser quality, more expensive, or both.\textsuperscript{37} Compared to other sites, Aswan was also close to the areas intended to be perennially irrigated, thereby reducing the amount of water lost to evaporation and seepage into the soil. Aswan was also well within Egypt’s borders should a threat arise in the south.

Willcock’s investigations concentrated on locations far away from the major population centers and areas with limited political power – the British-occupied Egyptian government could act without damaging entrenched political interests (either Egyptian or international).\textsuperscript{38}

\textsuperscript{35} Bernard S. Cohn, \textit{Colonialism and its forms of knowledge: the British in India} (Princeton: Princeton University Press, 1996), 6-7. According to Cohn, “the questions that arise in examining this modality are related to the creation of a repertoire of images and typifications that determined what was significant.” Ibid., 6. Unfortunately, without further study of these travels, what the engineers saw as significant can only be guessed at.

\textsuperscript{36} Reduced Level refers to the height above sea level of the Mediterranean Sea. Both William Garstin, who wrote an introductory note, and William Willcocks, the author of the report itself, agreed on this fact. Willcocks, \textit{Perennial Irrigation and Flood Protection}, 25, 79.

\textsuperscript{37} It must be noted that the survey did not consider dam sites in the Sudan. The Sudan was at that time governed by the forces of the Mahdi Muhammad Ahmed; the Sudan was re-conquered in 1898 in a short and brutal campaign.

\textsuperscript{38} Even the Wadi El-Rayan reservoir was in the Western desert, fairly remote from large towns and not a center of political power. For two recent popular history perspectives on the late nineteenth century Sudan, see: Brian Thompson, \textit{Imperial Vanities: The Adventures of the Baker Brothers and Gordon of Khartoum} (London: Harper Collins Publishers, 2003); Dominic Green, \textit{Three Empires on the Nile: The Victorian Jihad, 1869-1899} (New York: Free Press, 2007).
As implied above, the dam that Willcocks suggested for the Aswan site was heavily influenced by his personal observations and experiences in Britain and India. His design was an arched masonry dam (meaning that its foundation followed a vague curve) but with sluices. Most masonry dams at the time were designed to allow the water to flow over the top of the dam or through a chute. Internal masonry (called the hearting) was made of cement mortar.\(^{39}\) The most important point, according to late nineteenth century and early twentieth century dam builders was the presence of a solid foundation.\(^{40}\) The foundation design was borrowed from the Betwa Dam on the Jumna. The curved foundation was supposed to be strong, with the flexibility to move the foundations slightly if the engineers found poor bedrock, and was punctured by sluice gates.\(^{41}\) He argued that only a dam with sluices could be constructed in the Nile Valley to ensure the Egyptian farmland did not lose the silt-laden flood waters.

Willcocks’s proposed dam needed to be heavily monitored by competent engineers. The sluices were to be fully open during the flood, to let the silt-laden waters pass through. If not allowed to pass through Aswan to the fields and sea, the flood would not only silt up the dam, but also necessitate fertilization of the soil. Since the stresses of siltation were known to cause dam failure, Willcocks planned to avoid this eventuality by planning for a solid masonry dam with sluices, believing that the river would move fast enough to prevent the silt from settling to the bottom, and the dam from silting up. After


\(^{40}\) Ibid., 398.

the flood had passed through the dam, however, the sluices gates would be gradually closed and the Nile waters would be allowed to fill up behind the dam. From November through January, the reservoir would fill, and only when the Nile dropped again would the sluice gates start opening to allow the stored water into the river’s channels. All summer, therefore, the necessary irrigation and sanitation water would come from a mix of the reservoir’s water and the river’s current.

The reservoir needed a high degree of control and maintenance because the sluices had to be opened in certain sequences to prevent undue pressure on any single sluice. In his detailed account of the construction of the Aswan Dam, Anglo-Irish engineer Maurice Fitzmaurice gave an extensive outline of sluice regulation:

The twenty-five roller sluices at R.L. 92.00 are lowered gradually. By the time these 25 gates are down, say early February, the water-level in the reservoir will have reached R.L. 103.00; and the water passing down the river will be discharging through the sluices at RL 96 and 100, which, with the reservoir level at 103, are capable of discharging 1,450m³ per second… [Fitzmaurice summarized:] the above outline of the operations during one season is… applicable only to an average year.

In order to operate the sluice gates properly, the superintending engineer needed to utilize both mathematics and long-term study of the river. The necessity of continuous monitoring and careful maintenance of the sluice gates also needed to be modified as

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42 Ibid., 14-16.
required by the precise height of the river.\textsuperscript{44} By planning a long-term project which drew upon the necessity of ongoing mathematical precision, the Irrigation Department ensured for themselves an ongoing role in the water supply of Egypt.

Willcocks admitted in his report some “deference to public opinion” on the matter of the flooding of the Philae Temples, but was not overly sentimental toward archaeologists, and would later disassociate himself from the completed Aswan Dam altogether.\textsuperscript{45} Even in 1894, his “deference” was restricted to drafting plans for smaller dams that would not inundate Philae for 5 months of the year, although he stressed that such a dam upstream of Philae would be “expensive as the main channel of the Nile is deep.”\textsuperscript{46} He believed that the temples of Philae should be physically moved and proposed cost estimates for their removal to another island.\textsuperscript{47} Indeed, according to some sources, Willcocks went so far as to offer to sell the temples to Americans so that they might bear the burden of paying for the preservation.\textsuperscript{48} That story might be apocryphal, but it speaks to his recognition that these temples held significance to the British government, and that some interesting schemes were developed on their account.

In spring 1894, the Egyptian government had chosen to construct a reservoir to augment the supply of summer water for cotton crop production. Political and financial choices informed the engineers’ understandings of what an irrigation system should be:

\textsuperscript{44} The entire perennial irrigation system was predicated on a thorough hydrological knowledge of the Nile. Collins, \textit{Waters of the Nile}, 105.
\textsuperscript{45} Willcocks, \textit{Perennial Irrigation and Flood Protection}, 74.
\textsuperscript{46} Ibid., 82.
\textsuperscript{47} Ibid., 74, 94.
\textsuperscript{48} Benjamin Baker, “Nile Reservoirs and Philae,” \textit{Nineteenth Century} (May 1894), 868. This is not to say that the American archaeological communities were not interested in what was happening at Philae.
perennially irrigated with a singular structure holding up the water to minimize cost and centralize control. The ill-defined reservoir project which had been proposed in 1891 had by 1894 become a choice of 4 specific reservoirs. Of these (Gebel el-Silsila, Kalabsha, Aswan, or the Wadi Rayan), the Egyptian government placed a strong emphasis on Aswan. To borrow historian of technology Langdon Winner’s phrasing, “because choices tend to become strongly fixed in material equipment, economic investment, and social habit, the original flexibility vanishes for all practical purposes once the initial commitments are made.”\textsuperscript{49} The initial commitments, in this instance, strongly recommended a particular type of masonry dam, meant to minimize cost and maximize water control for perennial irrigation.

Immediately after Willcocks’ \textit{Report}, Garstin recommended an International Technical Commission be convened. He emphasized “the magnitude of the reservoir projects, [and therefore] we have asked that a commission of three of the most eminent hydraulic engineers in Europe be appointed for the purpose of considering the several schemes and advising the government as to which of them should be adopted.”\textsuperscript{50} The Committee was not given \textit{carte blanche}, but rather were asked to answer a very specific set of questions. These were to consider the proposals to create a reservoir in the valley of the Nile or the Wadi Rayan, to examine extant plans for the projects, develop an opinion about the sanitary conditions of the Nile after a reservoir, and select the best site.\textsuperscript{51} The

\textsuperscript{49} Winner, \textit{Whale and the Reactor}, 29.  
\textsuperscript{50} Garstin, “Note,” in \textit{Perennial Irrigation and Flood Protection}, 7.  
\textsuperscript{51} W.E. Garstin, “Note,” in \textit{Reports of the Technical Commission on Reservoirs, with a Note by W.E. Garstin} (Cairo: National Printing Office, 1894), vii-viii.
Irrigation Department’s engineers limited the Technical Commission to what they deemed to be universal – the principles of engineering, rather than what was unique to Egypt – the specific irrigation practices. The precise duties of the Technical Commission speak to a bureaucratic self-confidence in the Irrigation Department’s abilities to manage Egyptian irrigation. These engineering principles did not take into account the wishes of the Egyptian people, their loss of land and income, and the engineering principles also did not consider seriously any potential environmental side-effects of the reservoir. For all the debates about where to place the dam, the engineers were only concerned that a dam at Aswan might make them look “uncivilized” because it might destroy ancient Egyptian architecture.

6.2.3 The Technical Commission

The Technical Commission was duly formed in late February 1894 travelled throughout Egypt in March, deliberated in Cairo in April, and produced a final report in June 1894. Although a few technical articles in the engineering literature questioned the need for a commission, these did not question the engineers who made it up. Of the three only Giacomo Torricelli specialized in irrigated agriculture, however, he was the least experienced of the Commissioners. Sir Benjamin Baker and Mr. Auguste Boulé could be considered hydrological engineers as both worked on railway bridges, but neither had

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52 This is not to suggest that all the Egyptian people held similar beliefs about the Aswan Dam, but rather to assert that their multitudinous perspectives were never counted.
direct experience with reservoirs for irrigation purposes. The report the Commission produced was broken into three parts, the first of which rejected the Wadi Rayan, and the last two discussed the proposed projects in the Nile valley; a majority report was written by Sir Benjamin Baker and Professor Torricelli, and a minority report submitted by Mr. Boulé. Garstin agreed to Baker and Torricelli’s recommendations since they made up the majority of the commission and because they formally requested that the Aswan Dam be redesigned according to their specifications but was a valid technological project. The recommendations of Baker and Torricelli did not significantly deviate from the recommendations of William Willcocks in type of dam, but in its form and design. Boulé’s report provided a good counterpoint to the other two and will be discussed at length below; as an engineer he believed strongly in progress, but had slightly different conceptions about the priorities of civil engineering science.

The majority of the Technical Commission officially suggested three basic considerations for the construction of a dam in the Nile valley, with a fourth critical reason for rejecting the Wadi Rayan reservoir. The three important factors for a dam in the valley were a wide, shallow section of river with a solid riverbed. The fourth was simply cost; “the Commission thinks that… in all questions of public works it is impossible to leave to one side the first cost of construction.” From these four principles, three possible sites (Wadi Rayan, Gebel Silsileh, and Kalabsha) were rejected; Wadi

Rayan was too costly for the amount of water that would be saved, Silsileh’s riverbed was unstable, and Kalabsha’s banks were too high and narrow.\textsuperscript{54} In the latter two cases, the Commission felt that dam construction would be both costly and dangerous. Aswan, however, was just right: solid riverbed, and wide and shallow banks. Sir Benjamin Baker later wrote sourly, “reading between the lines, it was clear enough that [the government engineers] … expressly threw the final responsibility of rejection [of three of the four proposed projects] upon the commission.”\textsuperscript{55} Baker therefore questioned the Egyptian government’s attempt to turn three eminent engineers into yes-men.

From a design and construction perspective, Baker’s and Torricelli’s first concerns were about the stability of the proposed dam, and they used then-common mathematical formulae to work out stability. As Norman Smith has stated, “existing gravity dam design presupposed a solid masonry wall of essentially triangular shape from which a typical cross section could be isolated and then designed to resist the maximum water load.”\textsuperscript{56} From these perspectives, the problems with the proposed Aswan dam were that it was not solid because of the sluices, the sluices themselves got in the way of a “typical” cross-section. The commission also had issues with the idea of an arched foundation, because they believed that the strongest foundations were those that were not curved. Therefore, the majority of the technical commission strongly recommended making fewer and smaller sluices on a thicker and straight-lined triangular dam. In their

\textsuperscript{54} Reports of the Technical Commission, 14-17.
\textsuperscript{55} Baker, “Nile Reservoirs and Philae,” 865.
\textsuperscript{56} Smith, Centenary, 24.
words, “the essential condition of any design is the assurance that there will be absolute security and this can only be obtained by the construction of a weir approaching as nearly as possible a solid dam.”\(^{57}\) The majority of the Technical Commission did not take issue with the height of the proposed dam. In their words, the majority “unhesitatingly recommended” an Aswan dam with a height of RL114m, and thought it would cost about £2,055,000 with the new design features.\(^{58}\) Baker and Torricelli put aside Willcocks’ style of dam for a less flexible and overdesigned construction project. They also thickened the dam, and modified the design of the sluices to reduce the chance of failure at those locations – although they agreed that the Nile should be allowed to pass through the dam rather than over it, these engineers tried to make it as much like a solid wall as possible. Nineteenth century engineers usually compensated for their inability to precisely calculate stresses by overbuilding their dams.\(^{59}\)

\(^{57}\) Reports of the Technical Commission, 21.

\(^{58}\) Reports of the Technical Commission, 15, 23.

\(^{59}\) Harriet Ritvo, *Dawn of Green: Manchester, Thirlmere, and Modern Environmentalism* (Chicago: University of Chicago Press, 2009), 152. Baker and Toricelli may have been correct in their assessment of Willcocks’ proposed dam. Contemporary masonry dams were constructed according to certain universal mathematical principles which tended to overbuild. Where engineers experimented with high pressure stressors, the results were sometimes disastrous, such as at Bouzey in France where the dam collapsed in 1895 killing 78 people. See: Norman Smith, “Failure of the Bouzey Dam in 1895,” *Construction History* 10 (1994): 47-65.
Figure 7: Section of Pierced Dam, 1902. Source: W. Garstin Scrapbook, Institute of Civil Engineers Library.
It is not my intention to discuss the relative failures or successes of the Aswan Dam project. However, for all the design changes to Willcocks’ dam at Aswan, Torricelli, Baker, and Garstin saw the dam as “modified.” In Garstin’s words, the Commissioners’ recommendations would “improve but not materially alter” the dam.\(^6^0\) Since the width, sluice size, foundational alignment, and profile had been redesigned, the only commonality left was the type of dam. For Garstin, the essential fact about the Aswan dam was that it was not a solid masonry dam. The engineers, therefore, were describing an archetype – one which could be adapted to whichever site along the Nile valley that the Commissioners selected. Later Irrigation Department engineers would also accept the rationale that the dam had been “modified” and not re-conceptualized.\(^6^1\)

Another reason for insisting that the reservoir project had merely been “modified” may have been an attempt to save face among the Irrigation Department’s engineers. British public scandals often resulted in scapegoating individuals in lieu of changing the underlying institutional practices.\(^6^2\) Given the outcry about the Philae Temples, and the vigour which some groups (like the Society for the Preservation of the Monuments of Ancient Egypt) prosecuted their opposition to the Aswan scheme, there was a distinct possibility that calling the changes to the project a “new” structure would tip the outcry into a public scandal, in Britain. If so, the British and Italian Commissioners acted to

\(^{60}\) Garstin, “Note,” in *Reports of the Technical Commission*, xi.

\(^{61}\) See for instance, Fitzmaurice, “Nile Reservoir,” 75. To quote Fitzmaurice: “The Commissioners [Baker and Torricelli] also recommended *alterations* in the Government design for a dam at [Aswan]… All the *modifications* were in the direction of making this design approach more closely to that of a solid dam.” My emphasis.

\(^{62}\) Nicholas Dirks, *Scandal of Empire: India and the creation of Imperial Britain* (Cambridge, Mass.: Harvard University, 2006), 30.
minimize negative publicity about the fact that the Technical Commission had discovered a series of decisions that they took to be unsound in a project that had been planned for the past three years. By calling their changes to the proposed project a “modified” version of the same dam, Baker and Torricelli helped maintain the pristine reputation of the department’s engineers. Willcocks is still widely credited with “designing” the first Aswan Dam.\(^63\)

Boulé was keenly aware of the new structure’s differences from Willcocks’ dam. He wrote that this was “a project altogether new whose details have yet to be studied, because the plan, the length of the dam, its thickness, its sections, and its arrangement of sluices and gates will be altogether different.”\(^64\) These design changes meant, to the French engineer, a completely different project, because each project was not representative of universally applicable mathematical principles but rather individually contingent on the site’s own properties.\(^65\) The idea that each site needed individual, holistic consideration explains Boulé’s rejection of Aswan. He “refused to disassociate [himself] from any side of the Aswan dam question, even if it were foreign to the engineer’s profession… [The engineer much examine everything]: the interests of the population, of navigation, of commerce, of industry, and even questions of art and

\(^63\) Willcocks later bitterly complained that “his” Aswan dam had been tampered with to such an extent that it should not be associated with his name because it was so poorly designed and constructed. Although the engineers may have kept their reputation in Britain and the empire, it may not have been so within the irrigation department himself. Willcocks mentions that he was persona non grata by the time he finally left the irrigation department in 1897, but does not go into detail about the reasons. Willcocks, Sixty Years, 166. \(^64\) Reports of the Technical Commission, 42. \(^65\) For an interesting transnational perspective on French and American engineers, and their educations, see: Eda Kranakis, “Social Determinants of Engineering Practice: A Comparative View of France and America in the Nineteenth Century,” Social Studies of Science 19:1 (Feb 1989): 5-70.
archaeology as well.”\textsuperscript{66} Boulé also felt he would have been “held in contempt, not only by [his] countrymen but by the public opinion of the whole of Europe,” if he had recommended the destruction of the Philae Temples.\textsuperscript{67}

After Boulé articulated his position regarding the dam site, his nationality would become a point of paranoia on the part of the Anglo-Egyptian government. In a letter to the Foreign Secretary, the Earl of Kimberley, Lord Cromer explicitly stated his opinions: “before entering into any [financial] details, I should wish to observe that if once the archaeological difficulty based on the position of the Philae Temple be settled, all solid objections... fall to the ground. The difficulties which remain to be encountered are mainly due to international rivalry.”\textsuperscript{68} Cromer believed that the French government had taken the opportunity to tamper with Britain’s position in Egypt through Boulé and his objections to the site for the proposed reservoir.

Cromer was especially afraid that Boulé was exerting pressure on the Italian engineer to force Torricelli into voting against the proposed reservoir at Aswan. As was clear from their report, both Torricelli and Baker were “strongly in favour” of Aswan.\textsuperscript{69} Boulé tried to persuade the Italian commissioner that the proposed project was irreparably flawed because of the Philae temples. According to Cromer, “the French are doing their utmost to get M. Torricelli to acquiesce to their views... the Italian member is very much afraid of responsibility and I should not in the least wonder if the French won

\textsuperscript{66} Reports of the Technical Commission, 48-49.
\textsuperscript{67} Ibid., 49.
\textsuperscript{68} Lord Cromer to the Earl of Kimberley, 27 June 1894, No. 10 in FO 407/127.
\textsuperscript{69} Lord Cromer to the Earl of Kimberley, 22 March 1894, No. 94 in FO 407/126.
him over to their side.”70 Whether Boulé acted out of personal convictions or national loyalty is impossible to parse, and who “the French” are, in this instance, is unclear, since the plural implies the French Consul-General, or possibly the French government rather than just Boulé. Cromer’s reaction to this perceived threat, however, is significant. The Foreign Office contacted the Italian government directly, and the Italians were told to inform Torricelli to “resist the intrigues of the French.”71 Cromer certainly believed that the French were willing to exert undue political influence on the Italian Commissioner because they were intent on sabotaging British rule in Egypt. His actions imply that he was willing to go to great lengths to ensure that his government would not be embarrassed by its own Technical Commission.

Cromer personally reacted to the proposed Aswan Dam and the possible destruction of the Philae Temples by placing it in the context of international rivalry, financial difficulties, and confidence in the irrigation engineers. In terms of the proposed dam, he thought that “those who… cannot lay claim to any technical knowledge of hydraulic engineering, can only judge by looking to the weight of authority.”72 In this instance, all the consulting engineers except Boulé had agreed that the Aswan site was the best for a reservoir. Furthermore, since the government’s engineers were “aware of the censure they [faced]” their opinions should be understood to have been formed by

70 Cromer to Kimberley, 30 March 1894, No. 98A in FO 407/126.
71 Lord Kimberley, to Sir Clare Ford, 2 April 1894, No. 103 in FO 407/126.
72 Cromer to Kimberley, 27 June 1894, No. 10 in FO 407/127.
considering all angles. In June of 1894, Cromer, therefore, supported the proposed site of the engineers.

This section has examined the multi-faceted decision-making process that generated Egyptian government approval of the Aswan Dam in summer 1894. For the British-occupied Egyptian government, with its prevalence of Deltaic landlords, urban Egyptians, and British bureaucrats, a reservoir in Upper Egypt was an acceptable project; the risks were engineering risks, and the Egyptian government therefore took the unusual step of calling an international Technical Commission to assess those risks. Engineering debates focused on the geographical and geological requirements for a reservoir and the type of dam that should be constructed and did not delve into potential social or environmental effects. These debates focused on the Philae Temples only insofar as the monuments were in the way of the best site. To interested Britons, however, the threatened destruction of these temples was unacceptable; it is to Britain that this chapter now turns.

6.3 Building Up: Britain, the press, and controversy

6.3.1 The British Public and the Proposed Aswan Dam

While the Commission was debating the relative merits of the different reservoir sites, their activities sharpened interest in England. The Commissioners’ eventual recommendation of a higher dam at the Aswan site (RL 114m) meant that the British media was very interested in the weeks that followed. As mentioned in the introduction,
the archaeological societies contended that the “civilized world” had a form of ownership over Philae. In this instance, as Harriet Ritvo has argued in her work, *Dawn of Green* (2009), the “most vocal and energetic opponents of the scheme had neither a legal right… nor a direct financial stake in the outcome of the debate.” Cromer explicitly referenced this point when he stated: “the ancient Egyptian monuments… can hardly be said to belong to Egypt only. The whole civilized world is interested in them.” Cromer’s concession that the “civilized world” had at least “intangible ownership” to the ancient Egyptian monuments gave the representatives of the “civilized world” some discretion over the monuments’ future.

In the British archaeological and interested European public debates the Aswan Dam project became about two interconnected issues. The first was about how to irrigate all of Egypt; the second was about how to save the Philae Temples, and both issues were about conflicting definitions of civilization. In his recent article “Philae Controversy” (2011) Casper Andersen has called these two civilizing missions, “muscular modernization” and “paternalistic preservation,” respectively. The duty to modernize has been defined by Andersen as “the obligation to increase agricultural production in Egypt for the benefit of the Egyptian economy, creditors in Britain and the glory of the British Empire.” By contrast, the preservationist impulse acknowledged the importance

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74 Cromer to Kimberley, 27 June 1894, No. 10 in FO 407/127.
of modernizing projects, but not at the cost of monuments. Both of these positions reinforced the right of Britain to rule over Egypt with impunity.

The conflict between “protect[ing] or irrigat[ing]” was sharper because of the prevailing tourist perspectives of Egypt as a country inhabited predominantly by the ghosts of pharaohs.\textsuperscript{77} Egyptologist Michael Jones has argued that in the late nineteenth and early twentieth century, the British archaeologists, tourists, and officials in Egypt believed that the palimpsest of the Egyptian landscape should be altered to reflect “Pharaonic splendor and power.”\textsuperscript{78} Nineteenth century tourists and travelers in Egypt were increasingly interested in conserving artifacts through a process of “freezing or mummifying.” Travelers “inspired and initiated the conservation of ‘the exotic image of Egypt’.”\textsuperscript{79} The land was predominantly a canvas for the works of the ancients, and the living Egyptians inhabited an intellectual space that was not as fully “real,” or as Timothy Mitchell theorized, part of an already constructed image of contemporary Egypt in the tourists’ minds \textit{before they arrived}.\textsuperscript{80} In this context, the patently modernist Aswan Dam imposed on the picturesque landscape of ancient Egypt; Philae needed to be conserved and preserved as ancient.

Much of this debate echoes Nicholas Dirks in his \textit{Scandal of Empire} (2006), in which he argued that the late eighteenth century imperial scandals reprimanded the

\textsuperscript{77} Ibid., 154, 140.
excesses of a few venal individuals and left untouched the processes by which the empire was run; the essence of these colonial scandals was a set of questions about British civilization.\textsuperscript{81} And, as Hall has articulated, even the most self-assured nineteenth century Briton questioned whether Britain was, in fact, civilized.\textsuperscript{82} The architectural taste of British engineering projects and their engineers were sometimes questioned because they destroyed or modified irreparably the land or cityscapes.\textsuperscript{83} The destruction of the Philae Temples played into these fear of British engineers’ barbarism or at least poor judgment, just when issues of conservationism were becoming popular.\textsuperscript{84} One of the most groundbreaking attempts at conservation in Britain was the arguments of the Thirlmere Defense Association (TDA). The TDA had been formed in the 1870s in an effort to protest the damming and sale of Thirlmere’s waters to the city of Manchester for a municipal water supply. The TDA advocated the position that they were not merely interested in the aesthetics and “natural” beauty of Thirlmere, but that its destruction would be detrimental to the “entire British polity.”\textsuperscript{85} Like the discussions of “civilization” surrounding the Philae Temples, the Thirlmere scheme highlighted the intellectual unease that was felt by artists, intellectuals, archaeologists, and travelers.

\textsuperscript{81} Dirks, \textit{Scandal of Empire}, 23-24. Dirks clearly states that eighteenth century imperial scandals had the outcome of “making empire safe for Britain,” in other words, a transformative venture into something that had less “personal corruption.” Ibid., 31,125.


\textsuperscript{83} Andersen, \textit{British Engineers and Africa}, 158.

\textsuperscript{84} The Society for the Preservation of Ancient Egyptian Monuments was founded in 1888. Andersen, \textit{British Engineers and Africa}, 146.

\textsuperscript{85} Quoted in Ritvo, \textit{Dawn of Green}, 103.
The Philae Temples were artistically much favoured by nineteenth century tourists and archaeologists. The island was sacred, in ancient Egyptian mythology, to the goddess Isis as one of the graves of her husband Osiris. The earliest buildings in this temple complex had been started in by Late Egyptian Dynasties in the 4th Century BCE. Captain Henry Lyons RE found evidence of 14 temples on the island built by Egyptians, Ptolemies, and Romans. Later still, the island, only 366m long and 123m wide, also been home to a Coptic village that had been inhabited until the early 19th century, and the villagers had constructed two ancient Coptic churches there. It was therefore not only a site of great beauty (palm trees even grew on the island) but also a site for amateur archaeological treasure-hunters. Baedekker’s guidebook described the temples at length, and recommended that tourists spend at least a single day on the island. Baedekker’s called it the “pearl of Egypt,” and French Commissioner Boulé wrote in the following terms: “the ruins which are to be found on Philae Island appeared to me to be of almost equal value to those on the Acropolis of Athens.” The Philae Temples therefore were not merely the Roman ruins that some critics tried to dismiss them as, but artistically impressive and historically significant in their own right. One of the strongest protests was that if the temples were to be lifted to a higher level, repaired, or even moved to another island, their archaeological significance would be destroyed.

87 K. Baedekker, ed. Egypt handbook for travelers. Part Second: Upper Egypt with Nubia as far as the second cataract and the Western Oases (Leipsic: Karl Baedekker, 1892), 283. Reports of the Technical Commission on Reservoirs, 33-34.
88 In the 1960s, as a way to prepare for the completion of the Aswan High Dam, the Aswan Temples were dismantled and removed from Philae to the nearby, but unthreatened, island of Elephantine. See: T.S. Save-
Art enthusiasts deemed either removal or raising unthinkable. Since the Government plans allocated £200,000-300,000 (depending on the plan) for one or both of these propositions, the British public took them seriously and was almost universally scornful. The Philae Temples, according to former consulting engineer to the Egyptian government John Fowler, could be either submerged or moved and “neither of these suggestions would receive many supporters.” Royal Engineer F. Seymour Leslie, like others horrified at this option, appealed to the specific aesthetics of the location when explaining why the temple complex could not be moved: “the temples at their present level harmonize… with their surroundings… any alteration of the present levels would destroy the artistic balance… From an archaeological point of view, the temples would be valueless were they raised.” The impulse to preserve Egyptian monuments has been described by scholar Hossam Mahdy as an attempt to create either a “huge Oriental theme park… [or] for a more serious traveler… a zoo.” According to Mahdy’s cynical perspective, the theme park/zoo allowed tourists to visit their “favorite” monuments at their leisure, comfort and safety.

The debates surrounding the Philae temples also concerned the fact that these temples had not been properly surveyed and catalogued. Many of the archaeologists were

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89 “Philae Temples,” *British architect* (1 June 1894), 391a. For a much more thorough description of why the Temples could not be moved, see Leslie, “Proposal to Raise the Temples of Philae,” 150-152. Andersen has explained in some detail the position that Fowler found himself in 1894 – he was both the President of the Society for the Preservation of the Monuments of Ancient Egypt and business partner and long-time friend of Benjamin Baker. See: Andersen, *British Engineers and Africa*, 155-158.

90 Leslie, “Proposal to Raise the Temples of Philae,” 152.

91 Mahdy, “Travelers, Colonisers, and Conservationists,” 162.
insistent upon this point: ancient Nubia was in danger of being absolutely lost to posterity. In its direct letter to the British Foreign Office, the Society of Antiquarians of London mentioned that “the Council hopes that something may be done in the interests of archaeology so as in some measure to lessen the evil. This would be done by a careful survey.” The willingness of the archaeologists to compromise alludes to entwined assumptions: that in order for something to be “known” it must be scientifically catalogued, and that once the artifact has been made known this knowledge was a sort of preservation, even if the physical site was destroyed.

With the notable exception of the contributions from the Society for the Preservation of the Monuments of Ancient Egypt and other archaeological and antiquarian societies, most of the discussion about the drowning of the Philae Temples originated within a wide cross-section of the British press predominantly aimed at middle and upper class men and women. A wide variety of newspaper, magazines, and professional journals reported the controversy. Most of these pieces were short, anonymous news articles which tried to present both sides of the issue. As in the Thirlmere scheme, the press “tacitly adopted the… assumption of a kind of intangible

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92 Some skeptics believed that there was little of archaeological value at the temples of Philae. Civil Engineer, “Submerged Philae and the Assouan Reservoir,” London Times (28 February 1894), 4f. Other critical Britons mentioned snidely that “although archaeologists write much, they subscribe little of the money required for explorations.” “Nile Reservoirs and Philae,” Engineering 58 (3 August 1894), 161.
94 Newspapers included the Manchester Guardian, The London Times, and the Illustrated London News. Magazines included the Review of Reviews, The Athenaeum, and the National Observer. Professional journals included the British Architect, Engineering, The Engineer, the British Medical Journal, and Nature. Most of the aforementioned periodicals were not women’s journals or associated with radical politics. This controversy, then, was predominantly one fought by professional middle and upper class men, if the journals that it played out in are reflective of interest.
ownership ungrounded in legal deeds.”

The London Illustrated News’ coverage is an illuminating example of this type of anonymous article. In mid-March, while the Commission was still deliberating, they printed a full-page spread with four pictures and three columns of text. The article situated itself in the debate between muscular modernization and paternalistic preservation: “the complaints… against the utilitarian spirit of the age and its ruthless destruction of romantic associations will probably be renewed, with some apparent provocation.” However, the article was not wholly in favor of the protests, ending ambiguously with the statement that “the existing ruins are not of such sublime antiquity… [but] we cannot wish that these should be swept away, though irrigation is a good work.” Irrigation as a “good work” imbued political credibility into the projects of the Egyptian government’s engineers, even though the Temples were threatened.

Editorials were much more likely to be inflammatory – coming down on one side or the other. One “Civil Engineer,” for instance, wrote in to the Times to say that, “the temples themselves are not remarkable, either from an architectural or archeological standpoint… the alarm raised by the supposed destruction of the Philae temples may raise opposition to the Assouan Reservoir which is otherwise admitted to be the best possible

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95 Ritvo, Dawn of Green, 85.
96 The newspaper also declared that Philae, with its “interesting architectural remains [was] the most beautiful scenery, from a picturesque point of view, that tourists in Egypt could find.” (My emphasis) Although not overt, the connection between picturesque-ness and tourism is, according to Inderpal Grewal, not coincidental and not necessarily complimentary. “The Isle and Temple of Philae on the Upper Nile,” Illustrated London News 44: 2865 (17 March 1894).
97 The other conception of irrigation as a “good work” had of course religious connotations. The engineers themselves did not refer to the Aswan Dam as a “good work,” but several were highly religious, especially John Fowler and William Willcocks. Andersen, British Engineers and Africa, 156; William Willcocks, Sixty Years, 23, 41-42.
irrigation scheme for Egypt.” At the other extreme, retired from irrigation department service, Colonel Justin Ross wrote “it is well known that engineers, when swayed by the interests of their calling, do not take into consideration the art side of the question; and it is not to them that we would naturally turn when we wish to preserve a world-famous monument.” Ross called the proposed destruction an “avoidable act of vandalism.”

Ross, as a military engineer formerly employed by the Egyptian Irrigation Department, considered Philae to be an important monument, but contended that it would be safer, although admittedly more expensive, to construct a series of dams further south. In the above examples, it is clear that the arguments about civilization cut both ways.

British (civil) engineers, as the objects of both scorn and praise, did not respond to this controversy in a singular manner, although the editors of the engineering press were generally in favour of the scheme. Many claimed to be genuinely distraught about the prospect of submerging the Philae Temples – for example J.P. wrote the journal *Engineering* to argue that “to destroy [the monuments of Egypt]... to my mind would be nothing short of vandalism.” However, the engineers were also more likely to propose engineering solutions to what they clearly perceived as an engineering problem. In this way, the British engineers approached the Aswan project from a modernizing

98 Civil Engineer, “Submerged Philae and the Assouan Reservoir,” 4f.
100 Justin Ross, “Irrigation and Agriculture in Egypt,” *Scottish Geographical Magazine* 9 (1883), 191. Ross’s involvement in this controversy represents the difficult position in which engineers found themselves – he informed the Egyptian Exploration Fund (an antiquarian society) in 1891 that the Egyptian government was contemplating the dam site at Aswan. Andersen, *British Engineers and Africa*, 147.
101 Ibid., 150.
102 J.P. “Nile Reservoir,” *Engineering* 58 (17 August 1894), 239.
perspective, proclaiming that the “material benefits” of Aswan were “universally admitted.”

Ross’ article ended with his insistence that the safest way to increase the Nile’s supply would be to have two dams at Aswan. In the civil engineering journals those who wrote both editorials and articles suggested building a wall around the Temples as a way to have the dam and temples too. Although not universally praised, these suggestions avoided the critical issues of the Aswan project. Those former Irrigation Department engineers who wrote publically about the controversy, including Ross and John Fowler suggested that the archaeological societies of Britain should protest the temples’ destruction to the Egyptian government. The engineers were therefore the most critical of the specific Aswan Dam site and the least critical of the reservoir. By promoting alternative projects, they encouraged the British public to accept the ideal of the reservoir, while being critical of the specific scheme.

All of the above debates rested on a series of assumptions about Egypt, namely that Egyptians were too passive to know, care, or promote their own interests in the

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105 The engineers admitted that the wall would have to be as high as the reservoir itself, and one critic of the plan went so far as to say that it would have been like enclosing the temples in a well in order to preserve them. See for example, “Utilization of the Nile,” *Engineer* 77 (6 April 1894), 290; F.W. Webb, “Nile Reservoir,” *Engineering* 58 (10 August 1894), 197; Crede “Assouan Dams on the Nile,” *Engineering* 57 (25 May 1894), 678.
106 J.P. wrote to *Engineering* in late August to discuss the problems of building a wall around the Island of Philae. In his words, “Philae is beautiful as seen from the shore, and in turn for the views from the island, with the background of sea, rock and water. What would it be worth to the artistic eye inclosed in a well with walls 50 feet high[?]” J.P. “Nile Reservoir,” *Engineering* 58 (24 August 1894), 277
irrigation schemes of British engineers. Egyptians were portrayed as ciphers without face, voice, or opinion. Their anonymous role in the debate meant that the British press on both sides appropriated their voices in absentia. The Egyptians were either in favour of swamping the temples, or they were adamantly opposed. Fellahin were, therefore, either helpless victims of their landlords and the British engineers, or the beneficiaries of these projects. It is tempting to dismiss such portrayals as self-serving and ignorant, which they were. Fundamentally these portrayals were important, however, especially when the writer had political power; Lord Cromer marshaled the fact that many Egyptians did not (apparently) feel remorseful at the temples’ destruction as a reason to take the matter out of their hands entirely. The majority of discussion of the Philae Temples reinforced the sorts of images that British travelers and technocrats in Egypt articulated about Egyptians: as a people they were incapable of making civilized decisions for themselves. All participants agreed on the facts: that 100 (or maybe 150 miles) of Nile Valley were going to be swamped, and that approximately 30,000 people were going to lose their lands.

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108 Egyptian engineers played a large role in the planning of the Aswan Dam scheme but one that was almost completely suppressed in Britain. William Willcocks names eight engineers with Arabic names in his *Report on Perennial Irrigation and Flood Protection*: Amir Bey, Abd el Bar, Abder Rahman Rushdy, Mohamed Shukri, Abdalla Hassib, Abdalla Rifat, Mohamed Sabir, Mohamed Baliy. These engineers, along with four unidentified others, who can be placed in the imperial category of “go-betweens,” were “placed at my disposal and this report and the plans which accompany it are the result of our labours.” Willcocks, *Perennial Irrigation and Flood Protection*, 75.

109 Cromer to Kimberley, 27 June 1894, No 10 in FO 407/127.

110 It is difficult to know where this figure comes from. The last population survey in Egypt was conducted in 1882, and the population had risen dramatically by 1894. Leslie, “Proposal to raise the temples of Philae,” 160.
A few skeptics did question the necessity of the dam itself. Long-time imperial critic Wilifred Scawen Blunt wrote to the *Times* to discuss what he termed the overwhelming Egyptian opposition to the project on the grounds that “the advantage of the reservoir on its proposed colossal scale… is certainly not required by them [the peasantry], and that they would infinitely prefer to it a diminution of the existing land tax.”111 Blunt therefore questioned the imperative of connecting the civilizing mission to the irrigation projects, and instead suggested that if the government were serious about lightening the burdens of the *fellahin*, there would be other ways to do so.112 Classist J. P. Mahaffy discussed the flooding of Nubians’ homes as part of the cost of the reservoir, and one that had not been factored into the government’s calculations.113 Furthermore, “if these poor people are as fond of their homes as other nations, the hardship of having these homes put under water to make people 500 miles off richer is surely a grave objection.” Although he returned to the “civilizing mission” being put in jeopardy because of the temples’ destruction, Mahaffy’s central thesis was about the loss of Egyptians’ homes and livelihood.114 These questioning pieces were exceptional; most

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112 Blunt has been describes as a positivist imperial skeptic who, after a series of personal experiences with Arabic peoples, especially Egyptians, grew disenchanted with what he perceived as British greed and cynicism. See Gregory Claeys, *Imperial Sceptics: British critics of Empire, 1850-1920* (Cambridge: Cambridge University Press, 2010), 36-40.
113 This is technically not true. The Commission’s engineers thought that £350,000 of the dam’s costs should be allocated to compensation for the homes destroyed. However, the government also mentioned that these costs could be paid in reclaimed land. “Appendix VIII,” in *Perennial Irrigation and Flood Protection*, 11-12.
114 J. P. Mahaffy, “The Proposed Nile Reservoir, I: The Devastation of Nubia,” *Nineteenth Century* 35:6 (June 1894), 1015. He went on to state, “They may dam up the Nile, but they will not dam up public opinion; they may submerge the most beautiful and historic island in the world, but they will not choke the love of the beautiful in the hearts of civilized men.” Ibid., 1017.
articles confined themselves to the Philae Temples, or sniffed at the idea that the project would not civilize and develop Egypt.

The local Egyptian response to the construction of the Aswan Dam is much more difficult to verify. As John Chalcraft has shown, the *fellahin* were highly active in protesting the loss of their political and economic rights. Chalcraft demonstrates that these actions included petitions, strikes, and other forms of protest both organized and unorganized.\(^\text{115}\) Despite the destruction to their landscapes, finances and lifeways, there is little evidence that the Upper Egyptian *fellahin* protested strongly against the flooding of 160km of Aswan Province. In fact, Jennifer Derr has uncovered some evidence that the *fellahin* who lived near Aswan celebrated the opening of the Aswan Dam because it brought construction work and/or compensation money to families in the region.\(^\text{116}\) By contrast, in his 1896 article, “Egypt,” liberal imperialist Alfred Milner alludes to protest at irrigation projects, but does not name the irrigation projects nor the class of people who protested: “almost all of the great reforms which these [irrigation] officers have introduced... were in the first instance opposed by native opinion.”\(^\text{117}\) Torgny Säve-Söderburgh states that the response of the Kenuzi Nubians was to simply refuse resettlement programs to areas north of Aswan that would move their villages away from

\(^{115}\) John Chalcraft, “Popular Protest, the Market and the State in Nineteenth and Early Twentieth century Egypt,” in *Subalterns and Social protest: history from below in the Middle East and North Africa*, ed. Stephanie Cronin (London: Routledge, 2008), 69-70.

\(^{116}\) Derr, *Cultivating the State*, 127-128. Such popular excitement might also be linked to the fact that a one of the region’s oldest industries was quarrying granite, and the Aswan Dam promised lots of work. Herbert Addison, *Sun and Shadow at Aswan: a commentary on dams and reservoirs on the Nile at Aswan, yesterday, today, and perhaps tomorrow* (London: Chapman and Hall, 1959), 25.

the banks of the Nile. The Kenuzi Nubians “built new villages higher up on the desert terraces and lived on in their inundated land.”

The Egyptian government, for their part, did not record in the *Foreign Office Correspondence* how they reacted to the attempt by the Nubians to side-step the miserly compensation programs that were being offered – compensation for palms, land, islands, and even whole villages was to be given in land reclaimed from desert or marsh. In total misapprehension of the relationship of people to their land, Finance Minister Sir E. Palmer remarked, “nearly the whole of this compensation [an estimated £350,000] I calculate could be given in free lands. It would merely be an exchange of other lands for the lands the people now hold.”

Säve-Söderburgh suggests that resettlement programs were offered, and some *fellahin* in the affected areas did indeed move, either resettling nearby or moving to the cities.

Although most of the letters and articles within the British public did not accept the destruction of the temple complex, they agreed with the importance of the irrigation department’s schemes in principle. That is, the utility of the engineers’ project was accepted by almost all of those protesting the destruction of the Temples. According to one anonymous author, “whatever else foreign critics may find abominable in the English administration of Egypt, the one thing they carefully abstain from attacking is the work of

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119 “Memorandum by Sir E. Palmer,” Inclosure 1, No. 10 in FO 407/127. Säve-Söderburgh mentioned that the Kenuzi had a culture that partially revolved around the jointly owned *sagias* (waterwheels) and the date palms, which were un-transportable. Säve-Söderburgh, *Temples and Tombs of Ancient Nubia*, 47, 58.
120 Chalcraft mentions that Upper Egyptian *fellahin* were migrating to Port Said, for instance, to become coal heavers. Chalcraft, “Popular Protest,” 70-71.
our engineers.” The article then mentioned the “good works” of Irrigation engineers – specifically the repair of the Barrage as an example of the prescience of the engineers and ended with: “we may rejoice that the splendid achievements of the English engineers will now be extended to the upper valley.”¹²¹ In so doing, the British press reinforced the importance of the irrigation engineers to Egypt, while trying to protest their projects. Most of the articles went through a well-worn litany of the necessity of irrigation to Egypt, the good works of the Irrigation Department, and finally the importance of the dam and reservoir.¹²² The Philae Temples, while not an acceptable loss, were also not enough to make the British public protest the modification to the irrigation system.

By June 1894, the Egyptian government conceded that public sentiment was against flooding of the Philae Temples for even 6 months every year. The Egyptian and British governments received many formal protests from academic societies, and the public censure of several of their own former eminent engineers. Cromer wrote, “so far as I can gather from the various public utterances… many, who certainly cannot be suspected of being guided by any other feelings than of genuine interest in the preservation of Egyptian monuments, are disposed to share M. Boulé’s views.”¹²³ Accordingly, the Irrigation Department, in an attempt to salvage political credibility from a situation that had gotten far beyond their control, proposed a lowered dam, and Garstin

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¹²³ Cromer to Kimberley, 27 June 1894, No. 10 in 407/127.
strongly suggested that Middle Egypt would be the most financially beneficial place to utilize the extra waters.\textsuperscript{124} This seemingly simple administrative decision had long-term repercussions for how the perennial irrigation would be distributed in Egypt, and will be discussed at length in the next chapter. The new plan (which included a dam of 20m not 28m, and would only hold one billion cubic meters of water) ended the British public protests.

The Egyptian government also made clear that it would not attempt to move, raise or sell the Philae Temples. As Cromer later explained, “in accepting this modified scheme, the Egyptian Government signified its intention of adding the cost of a scientific and archaeological investigation... to the cost of the dam itself.”\textsuperscript{125} Preliminary archaeological work started in early 1895. European archaeologists were invited to work with the Egyptian government to survey the Island of Philae and the monuments of Lower Nubia, which would not be submerged, and proclaimed themselves satisfied with the compromise. By using the technical skills of European archaeologists, Cromer circumvented their protests by promising that documentation of them would be preserved for posterity.\textsuperscript{126} The Anglo-Egyptian government secured final approval for their reservoir by co-opting its staunchest opponents.

\textsuperscript{124} William Garstin “Note upon the proposed modifications in the Assouan Dam Project,” 14 November 1894, Inclosure in No. 166, FO 407/127.
\textsuperscript{126} An example of one of these people is H. Villier Stuart, “Temples of Philae,” \textit{London Times}, (7 March 1894), 12.
The British public and European archaeologists confined their protests to the destruction of the Philae Temples rather than the extension of perennial irrigation, so once the Philae Temples were assured, they declared victory and stopped protesting the dam. A London Times correspondent wrote gleefully that, “sentiment prevails over utility so rarely in the present age that its triumph in the matter of Philae calls for more than a passing remark. The lay protests of artists, archaeologists, and amateurs of things beautiful have won the day.”\textsuperscript{127} No mention was made of the Egyptian homes, villages, and livelihoods that were going to be flooded by the reservoir.\textsuperscript{128}

**6.4 The Dam constructed, 1898-1902**

The British-occupied Egyptian Government’s irrigation engineers accepted the Technical Commission’s recommendations and agreed to an Aswan dam at RL 106m. This final section of the chapter examines how the technology’s construction was both an outcome and a tool of imperial engineering. Construction of the Aswan Dam clearly required a commitment to accepted masonry dam construction. However, as Timothy Mitchell points out, “the projects themselves formed the science,” – by which he means that engineering expertise was a hybrid between what was learnt from Egyptian irrigation

\textsuperscript{127} Correspondent, “Philae and the Low Level Dam,” London Times (29 December 1894), 18.

\textsuperscript{128} Derr contrasts the outcry against the destruction of Philae with the acceptance and lack of public debate about nationalization and flooding of villages (especially Shellal) around the Aswan Dam. She comes to the conclusion that, “whereas international outrage erupted at the prospect of destroying an ancient monument, Egyptian peasants existed as mobile pieces of an agricultural landscape… the imagined simplicity of Egyptian peasants prevented colonial technocrats from grasping the significance of human components of that landscape.” Derr, “Drafting a map of Egypt,” 150.
systems, British hydraulic science, and “discovered” by the engineers in the course of building the Dam. The projects bred new construction methods between European construction techniques and colonial irrigation science.

As part of these hybrid construction methods employed by the engineers, the town of Aswan, the construction site, and the surrounding area were significantly modified. The final section of this chapter discusses in some detail not only some of the ways in which these parts of Upper Egypt changed dramatically, but how Britons saw and interpreted these changes. The Aswan Dam when constructed, like the design phases, allowed the engineers to publically promote their expertise and dominance not only over the river, but the entire Egyptian landscape and its people.

6.4.1 Construction as Adaptation of Design and Materials

Financing the Aswan Dam required delicate maneuvering, and the economic solution reflected a dedication to Public Works Departmental policy. Some aspects of the construction itself demonstrate devotion to standardized European methods, such as importing mortar, strong foundations, and local unskilled labor. Entirely innovative aspects of the Aswan Dam were connected to solving engineering problems, such as cofferdams, with innovative inherently local solutions.

130 The influx of European hydraulic theory was predominantly a result of Benjamin Baker’s influence – he not only brought his own British engineering epistemologies to the project as consulting engineer, but also recommended hiring his former apprentices.
Economic problems arose with financing during meetings of the Technical Commission. The *Caisse de la Dette Publique* expressed skepticism, and the French Consul-General refused to support a scheme to convert existing debts into cash to pay for the reservoir.\(^{131}\) Thereafter, the British-occupied Egyptian government was extremely

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\(^{131}\) Cromer to Rosebery, 28 December 1893, No. 6 in FO 407/126; Cromer to Rosebery, 26 February 1894, No. 9 in FO 407/130 *Further Correspondence respecting the Finances of Egypt, 1894*, Foreign Office, British National Archives, Kew.
suspicious of what they believed was the Caisse’s attempt to politically manage the reservoir and its uses. At the urging of both Garstin and the Finance Department, Cromer authorized his ministries to make complex contracts with contracting firms. The plan, followed in 1898, allowed a British contracting firm, Messers John Aird and Co, to build the dam and subsidiary works.\textsuperscript{132} This contracting firm was financially secured during the construction phase by major banking houses and was paid in annuities plus interest for much more than they had constructed the dam. The cost of the Aswan Dam itself was supposed to be £1.4 million pounds, although subsidiary works brought the contract to £2 million.\textsuperscript{133} The Anglo-Egyptian government signed a contract with the firm for a thirty year term at a rate of £78,000, paid biennially.\textsuperscript{134} The Egyptian government agreed to pay for any excess materiel and appropriated land for the site of the dam and to the south, and displacing 30,000 people.\textsuperscript{135} In exchange, the Egyptian government received a legal way to have the dam constructed, and a dam in a guaranteed five years after construction, with payments starting in 1903 and ending in 1933. The contract also stipulated that Aird and Co “will not interfere in the use of the said dams. [The contractor] accepts in advance all measures which the Government believes must be taken in the interest of this use, and he

\textsuperscript{132} The Assyuit Barrage was also constructed between 1898 and 1902 by Aird and Co. It will be discussed in Chapter 7, but followed the same pattern as the Delta Barrage and was meant to divert the river water into a large canal rather than dam the river per se.

\textsuperscript{133} Cromer to Salisbury, 26 Feb. 1898, No. 103 in FO 407/146, \textit{Further Correspondence Respecting the Affairs of Egypt, Jan-June 1898}, Foreign Office, British National Archives, Kew. Andersen mentions that the securing of Messrs Aird and Co was done through the influence of Baker, who was John Aird’s next-door neighbour in London and long-time business associate. Andersen, \textit{British Engineers and Africa}, 75.

\textsuperscript{134} The cost of the dam, after 30 years was to equal 4,716,780, as compared to the 2,000,000 that the dam was contracted to cost the contractor Messers Aird and Co.

\textsuperscript{135} Fitzmaurice, “Nile Reservoir,” 77, 83; Derr, \textit{Cultivating the State}, 163-171.
will refrain from raising any claim whatsoever on this subject.”\(^{136}\) By forcing Aird and Co to accept these legal conditions, the Egyptian government prevented them from having any future investment in the dam which they had constructed.

This system of financing projects through annuities was an experiment for the Irrigation Department, but not to the Public Works Ministry. When the project was finally proposed to the Khedive and the Caisse, railways were the main example used to prove that a system of annuities was not a debt.\(^{137}\) Proposed in June 1894, the system of annuities, in the words of Sir E. Palmer, Egyptian finance minister, was “to follow the same system as has been adopted during the past few years for the extension of railways.”\(^{138}\) According to Cromer, it would be difficult to get the consent of the Sultan and the Caisse was taking orders from the individual governments.\(^{139}\) Both Garstin and Cromer wanted to remove the Public Works Department from all aspects of international control, thus bringing the last vestiges of a checks and balance system to an end. The system of annuities therefore was a shrewd attempt to avoid international influence.

However, difficulties in construction were almost ruinous for this intricately arranged system of financing. The bedrock at Aswan was not as strong as had been assumed, and this meant that, given the theoretical importance of a solid foundation, the dam-builders had to dig deep in several of the channels’ foundations. As Boulé mentioned in his report, at least at Gebel Silsila the tools used to bore into the bedrock

\(^{136}\) “Assouan Dam Contract,” 20 February 1898, Inclosure 1, No. 103 in FO 407/146.
\(^{137}\) Cromer to Salisbury,” 25 May 1897, No. 31 in FO 407/143, Further Correspondence respecting the affairs of Egypt. April to June 1897, Foreign Office, British National Archives, Kew.
\(^{139}\) Cromer to Kimberley, 27 June 1894, No, 10 in FO 407/127.
were not strong enough to penetrate hard rock.\(^{140}\) A similar procedure must have been followed at the Aswan site, for no sign of the soft bedrock had been uncovered. Fitzmaurice wrote that “the most abundant rock, and practically the only one which was exposed until excavation was begun, is a coarse-grained red granite,” however the excavations quickly uncovered that the granite bedrock alternated irregularly with diorite and syenite. Diorite and syenite are not “soft” rocks, but they had “undergone great decomposition under the combined agency of crushing and water-action.”\(^{141}\) Such unexpectedly soft rock was dug out, and was replaced with masonry; from its top to the deepest foundations, the dam was 36.5m, and the cost of the extra masonry, mortar, and labor was very high. Rather than risk the foundations, the irrigation engineers instead overran costs – in accordance with the aforementioned dictates of European engineering theory, having a solid foundation was not something that could be compromised upon.\(^{142}\) In this respect, the irrigation engineers followed contemporary technological standards and were willing to compromise their long-held principles of liberal economy.

Mortar too proved to be more problematic than expected. High-quality lime and clay was locally available that had a very high tensile strength, and had been planned for the mortar. However, because of the need to import coal from England to heat the mortar

\(^{140}\) *Reports of the Technical Commission*, 46.

\(^{141}\) Fitzmaurice, “Nile Reservoir,” 77. Furthermore, having scrapped Willcocks’ idea for a curved dam, there was no flexibility in the designs, and therefore no options for finding better bedrock. Norman Smith, *Centennary*, 20-21.

\(^{142}\) See Smith, “Failure of the Bouzey Dam” for an explanation of contemporary European hydraulic principles and where the European engineers were willing to compromise. In 1895, the Bouzey dam in France had failed catastrophically, and therefore served as a stark and recent reminder to the engineers of the potential problems with under-designed dams. Smith, “Bouzey Dam,” 58-61.
into a paste, the mortar was expensive. It also dried slowly and, as according to contractual obligations the dam had to be finished by 1903; time was a precious commodity. Cement mortar was therefore imported from England, along with coal, sluice gates, and the supervising engineers. The lack of local quick-setting mortar was solved in a way that was acceptable to Aird & Co and its engineers, it also provided jobs and contracts in Britain, and took them away from Egyptians.

Director-General of Reservoirs, William John Wilson (Willcocks’ successor to the post) encountered problems with the construction of cofferdams. These temporary structures were meant to keep out the river water and the construction floor dry while the dam was constructed. As he described it, “the system of enclosing the floor with masonry wells to form a cofferdam, though very extensively used in India, does not appear suitable to this country. In the first place, it is not a system known to the Egyptians.” Wilson complained that it would have taken a lot of material to construct the right type of cofferdam in the short time span afforded him by the low river. Wilson was a Coopers Hill engineer, who had graduated in one of the first classes from that college, and had taken service in Egypt from India. Wilson compared much of the

143 Fitzmaurice, “Nile Reservoir,” 87-88.
144 W.J. Wilson, “Report of the Nile Reservoir Works, 1899” in Report upon the Administration of the Public Works Department for 1899, with reports by the officers in charge of the several branches of the administration, William Garstin. (Cairo: National Printing Department, 1900), 221.
practical dealings of his work as Director-General of Reservoirs to his work in India.\footnote{146} He mentioned, for instance “in the part of India with which I am acquainted every village has its well-sinkers,” and compared the low floods in India to those in Egypt, concluding, “that the conditions of the Nile vary very considerably from those of the snow-fed Indian rivers.”\footnote{147} Wilson’s attempted application of Indian cofferdams to Egypt implied strongly that, although not always useful, the Indian-experienced engineers often drew upon their experiences and their Coopers Hill epistemologies to help them make sense of the engineering difficulties that confronted them on the Nile.

Maurice Fitzmaurice, as the engineer in charge of construction, crafted an innovative solution to the problem of cofferdams. Aside from Wilson’s complaints about the lack of qualified well-sinkers, the rocks that were supposed to be used to form the cofferdams were being washed away. As sixty trains a day serviced the reservoir site, extra railway cars were plentiful, and these became the materials used to close the gap in the river.\footnote{148} Fitzmaurice ordered railcars to be filled with boulders and enclosed with wire weighing twenty-five tons, and had track laid as far as possible into the river, and the “wagons were run bodily into the gap. They formed a mass, against which it was possible to pile in stone, and the opening was closed.”\footnote{149} Garstin called Fitzmaurice’s solution an “ingenious expedient,” and Fitzmaurice himself acknowledged this part to be

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\begin{itemize}
\item \footnote{146} Wilcocks mentions joining a Mr. Wilson, Inspector General of Upper Egypt on Wilson’s steamer in early 1896. Wilcocks, \textit{Sixty Years}, 165.
\item \footnote{147} Wilson, “Report of the Nile Reservoir Works, 1899” in \textit{Report upon the Public Works Department for 1899}, 221.
\item \footnote{148} Smith, \textit{Centenary}, 32.
\item \footnote{149} Garstin, \textit{Report upon the Public Works Department for 1899}, 31-32.
\end{itemize}
“some of the most interesting work in connection with the dam.” Fitzmaurice, however, did not have previous experience outside of the British Isles – an Irish engineer educated at Trinity College, Fitzmaurice had been brought to Egypt by Benjamin Baker because he had articed with Benjamin Baker. His cofferdam solution seems to have been his own innovation.

Questions of who was going to build the dam were resolved in a way that highlighted the political prejudices of the Anglo-Egyptian government’s officials. At Aswan the laborers were predominantly Lower and Middle Egyptians; a few Upper Egyptians were hired as boatmen, but they were not widely employed on the Aswan Dam works. In his authoritative article, Maurice Fitzmaurice refrained from explaining why local populations were not hired. The Middle and Lower Egyptians were hired as unskilled labourers and Italians were brought in as stone masons. The Italian workmen were treated with some cultural sensitivity as they received a Catholic church in which to worship. The average workforce at Aswan in 1898 was about 6000, of which about 800

150 Fitzmaurice, “Nile Reservoir,” 92.
152 Because of the British press’ interest in the Aswan Dam, in the British archives at least, the men who actually built the Aswan dam are slightly more observable than the builders of the Nile Barrage, what follows are some general observations, but like the Barrage, the work is almost unperceivable from anything other than an official perspective.
153 His use of the term implies that the inhabitants of Upper Egypt were part of a different country, and serves to reify the difference between Nubian and Egyptians. For more about British officials’ perspectives about the differences between Upper and Lower Egyptians, see: Jennifer Derr, Cultivating the State (2009).
were Italians.  

The summer heat at Aswan was so intense, according to one British traveler, that “iron rails are hot enough to blister fingers.”  

The average temperature at Aswan in June and July is 33.5°C, and the average maximum is over 40 degrees.  

According to Fitzmaurice, “during the first two years while excavation was going on in deep trenches, there were many cases of sunstroke.”  

Excavation, of course, was conducted solely by the Egyptian workpeople – individuals’ continued health was not a priority, although preventing a major epidemic was. In 1899, because of unexpectedly poor bedrock, the unskilled labourers worked night and day throughout the month of June, although the masons would have been expected to work long hours as well. The differing treatment of the Italians and Egyptians spoke to a series of existing prejudices.  

These prejudices created a hierarchy of workers at the Aswan construction site and set precedents for how much compensation skilled and unskilled labourers could expect. Skilled masons were provided with their own church, while Egyptian labourers were provided with barrack-type group housing. The most important people were the supervising British engineers –

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154 Although there is no direct proof that I have been able to uncover, I believe that the hiring of Italian stonemasons was meant to reward the Italian Government for its co-operation on the Technical Commission. Garstin, *Report upon the Public Works Department for 1899*, 228.


158 Jennifer Derr has searched for archival material about who constructed the Aswan Dam and how much they were paid. She did not find very much information. See: Derr, *Cultivating the State*, 133-135.
although “many cases of sunstroke” occurred, when a single British engineer died on the construction site, he got special mention in the Annual Report.\textsuperscript{159}

The dam and its politics were mutually constitutive, and they both reinforced the technological dominance of the engineers. Certain points in its construction required solutions that were intensely political: the hiring of Italian stonemasons, the use of English cement mortar, for instance. Since the Egyptian government had invested much political and economic capital in the construction of the Aswan Dam, the only thing that they could not accept was its failure.

\textbf{6.4.2 Construction as Destruction of Environment and Space}

A short discussion of the dam’s short-term repercussions is necessary to finish this story of technological change and continuity. The Aswan Dam represented a major public works undertaking – the largest single British-Egyptian project at the time of construction; the railways and roads were predominantly conducted piecemeal, and the Suez Canal had, of course, been designed by Ferdinand de Lesseps and constructed by Egyptian corvée. For British administrators neither railroads nor Suez had the cachet of irrigation projects in Egypt, since the Aswan Dam was the center-piece of “Egypt-making.” The construction of the dam, therefore, brought almost unadulterated popular praise from the British and foreign presses, and represented a major intellectual enterprise surrounding the popular image of British-occupied Egypt.

\textsuperscript{159} W.E. Garstin, \textit{Report upon the Administration of the Public Works Department for 1900: with reports by the officers in charge of the several branches of the administration} (Cairo: National Printing Department, 1901), 227. Refer to Chapter 3 for more about how death affected the fledgling community of British hydraulic engineers in Egypt.
This sub-section utilizes Timothy Mitchell’s emphasis on the unexpected and unpredictable aspects of technological design and construction. Mitchell asserts that Egyptian history was so complex that human agency and intention were inseparable from the non-human – and should be treated as messy and inextricable. For their part, the Irrigation Department engineers were integral to an imperial project in which “politics itself was working to simplify the world… by resolving it into simple forces and oppositions.”\textsuperscript{160} The engineers’ expertise hinged on their successful definition of a definite nature as well as its opposite science. He argues that this binary was artificially created through “the concentration of river control mechanisms at one site… [and] the concentration of engineering required and a parallel concentration of capital.”\textsuperscript{161} Mitchell’s analysis is undoubtedly correct, in the broad strokes, but he leaves open-ended the precise mechanisms by which the engineers created this image. The distinction would have appeared starkly visible to European travelers in the early twentieth century and it would have reinforced perceptions of a technological imperialism. Aswan had been transformed from a verdant, palpably wild and “uncivilized” spot to one that exuded the modern, sanitized lines of contemporary engineering. By focusing on the sensory and perceptible differences between Aswan 1897 and Aswan 1903, this section foregrounds how the dam created the political illusion of a simple dichotomy between riparian nature and British engineering technology. These distinctions helped to naturalize the Egyptian state. As Esmeir has argued, “irrigation work came to connect the state with nature, with

\textsuperscript{160} Mitchell, \textit{Rule of Experts}, 34.
\textsuperscript{161} Ibid., 35-36.
the Nile. Consequently the state, with its irrigation projects, came to stand for the Nile. The state could be constituted as part of nature: its irrigation interests could be depicted as natural.” And, as usually happened with large-scale development projects, rural Egyptians were both financially and socially pushed out of the picture.

Part of the distinction between Aswan before and after the dam was an absence of greenery. Before the construction of the dam, Aswan and Philae had been fairly lush with palms and other trees. In his *Report on the Island and Temples of Philae*, Lyons was careful to document how care had been taken to avoid damaging or killing the palms on Philae. Only one tree was accidentally damaged during the entire archaeological dig. The town of Aswan itself had “a few wretched plants” and at least a few palms. From Aswan south, the desert encroached on the river, and the belt of cultivation became much narrower. Therefore, the contrast between the greenery of Philae and the desert was all the more striking. Furthermore, as Willcocks detailed in his *Report on Perennial Irrigation* (1894), the trees that grew in Upper Egypt had monetary value. For a dam at RL 106.00, he allowed for £57,334 for compensation of lost date palms. This figure was more than double the amount that he estimated for the loss of entire villages (£28,616). Although dates were a lucrative crop, his calculations also demonstrated the amount of greenery that was lost in Upper Egypt after the construction of the Aswan

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165 “Appendix VIII,” in *Perennial Irrigation and Flood Protection*, 12.
Dam. Although, of course these trees were not all on Philae or even near the dam site itself, palms appeared frequently in descriptions of the isle. One writer reminisced: “I had lived in a little hut under the palm trees’ shade and made drawings… the shady palms… are gone” – presumably cut down for the construction project. After the dam was constructed the roots would have been submerged for 6 months of the year, and while the temples stood, the trees must have died.

Another important distinction before and after the dam’s construction was the visual changes in the river itself. Before the Aswan dam was constructed, Aswan was the site of the first cataract on the Nile. This fall in the river level meant that the rocky riverbed was exposed in thousands of tiny islets, most were smaller than Philae. Some of these islands were inhabited, as many travelers mentioned the presences of homes. Willcocks, therefore, estimated £10,000 for lost islands if a dam at RL 106m was to be constructed. The river probably gave the impression of being tamed after construction had finished. Because the sluices let the river through slowly, a ponding effect was created on the south side of the dam. It raised the river level and flooded many of the lower islands, along with Philae. On the north side, the river became narrower and shallower. As Norman Smith has remarked, “with every gate open, the total width of flow available was 360m, something like the width of the Thames as it rounds the Isle of Dogs.” Since “water control” was associated with moderating flow and speed, which it often was because of Anglo-Egyptian fears about the devastation of high floods, British

\[167\] Smith, Centenary, 14.
travelers were likely to see the dam in terms of the dam being tamed or harnessed (with
divine sanction) by the power of British engineering.\textsuperscript{168} The visual effect leveled out the
river, making it shallow and placid, and replacing the waterfalls which the place had been
known for with the river flowing through regular, evenly spaced sluices.

During the four years of construction, the dam site itself took on characteristics of
European construction sites. Tourist John Ward, visiting in 1899 wondered if Crewe
Station, the Wolverhampton forges and the Aberdeen granite quarries “may have gotten
mixed up and all have been dropped down together?”\textsuperscript{169} Ward was most impressed by the
noise, and described what he heard at some length: “Great blasts [caused by
nitroglycerine charges] fired each day at noon dislodge thousands of tons of granite with
terrific explosions… Added to this, the roar of the waters, the shrill screams of the
locomotives – all constitute a pandemonium of noises.”\textsuperscript{170} He gives the impression of
being overwhelmed by the noise pollution, especially since he could not stop being
amazed that all of this was happening in rural Egypt where, presumably, there were not
many industrial sounds. Other travelers, such as barrister Basil Worsfeld, were impressed
by the amount of movement: “on this side and that, busy locomotives were hauling trucks
of materials over the rails which had been laid down, and everywhere huge cranes raised

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\textsuperscript{168} Gyan Prakash, \textit{Another Reason: Science and the Imagination of Modern India} (Princeton: Princeton
University Press, 1999), 167-168. These, at least, are the terms that Kipling used to articulate the
harnessing of the Ganges in “The Bridge Builders” (1893). In the short story, the goddess of the river
Ganges had been tied down by a completed railway bridge and unable to free herself; the other assembled
deities of Hindu India were unwilling to help her – they thought that she should be tamed by the power of
the British.
\textsuperscript{169} Ward, “Water for a Thirsty Land,” 615.
\textsuperscript{170} Ibid.
\end{flushleft}
their iron arms over jagged masses of rock.” Worsfeld then went to a promontory where the working labourers looked like “swarms of ants.” 171 His dehumanizing analogy highlighted the almost seven thousand people employed at the Aswan site both day and night. Reminiscent of the Delta Barrage repair, in order to fit as much work as possible into a single season, the engineers used electric lights at night. 172 Aswan must have radiated energy (kinetic, phonic, heat, light), which European visitors were familiar with if not completely inured to. The fact that the Aswan Dam was such a large project was also extraordinary to the commentators. Whether travelers and tourists saw Egypt as a zoo or a theme park, when placed in juxtaposition with their expectations, the impressions the Aswan dam left were those of a very large, high modern, 173 progressive worksite.

The town of Shallal became itself transformed into a European town with, if not the exact forms, then all the amenities. Shallal, just south of Aswan proper, was the docking place for the boats to and from Philae. According to G.W. Steevens in 1898, although a popular destination for tourists, the town was quite small. Aside from the main road away from the quay - walking down a side-street took one to the edge of the town in

173 I am using “high modern” in James Scott’s understanding of the term: “a strong (one might even say muscle-bound) version of the beliefs in scientific and technical progress that were associated with industrialization in Western Europe… At its center was a supreme self-confidence about continued linear progress, the development of scientific and technical knowledge…” James C. Scott, Seeing like a State: How Certain Schemes to Improve the Human Condition have Failed (New Haven: Yale University Press, 1998), 89-90.
a few moments. The town, however, bustled in winter during tourist season. Geo. Montbard described a “crowd” complete with English women, a butcher, saddlers, blacksmiths, and shopkeepers, and his own hired boatmen and donkey-owner. In the 1890s, Aswan itself was also the home of an Egyptian regiment.

Figure 9: Aswan Dam Construction (circa. 1899). Mott McDonald Photo Library, Institute of Civil Engineers, London.

During the Aswan Dam’s construction, Shallal was first completely appropriated by the Egyptian government to make space for the construction project, and then boomed – up to around a total population of 15,000. Fitzmaurice himself described it as “a large European village, with about a dozen shops and a large restaurant.” Much of the town, and its entire infrastructure, were created for the construction of the dam. For Europeans, the amenities included “houses, offices, sheds, restaurants, shops, and a hospital.” A tank was constructed to hold clean water, the drinking water was filtered, and an ice machine imported. The hospital had 3 doctors and a staff of nurses and, according to Fitzmaurice, “it was necessary to erect also a police-station, post- and telegraph offices, public baths [and] a church for Italian workmen.” Contemporaries remarked at great length on the extensive use of narrow-gauge railways around Aswan and Shallal, and during the first few months, these railways ran south to speed the coincidental conquest of the Sudan. Fitzmaurice mentioned dourly the fact that most of the available food went to feed the soldiers rather than Shallal’s workforce. The original inhabitants had been officially categorized by the imperial state as “in the way” and their removal necessarily led to the creation of a modernist construction project.

176 Derr, “Drafting a Map of Egypt,” 149.
177 Fitzmaurice, “Nile Reservoir,” 85.
178 Ibid.
179 Worsfeld, Redemption of Egypt, 289.
180 Fitzmaurice, “Nile Reservoir, 85-86.
181 The Sudan, its conquest, and the repercussions for Nile water control will be discussed in some length in the next chapter.
182 In Berman’s words: “The crucial point is to spare nothing and no one, to overleap all boundaries: not only the boundary between land and sea not only traditional moral limits of the exploitation of labour, but even the primary human dualism of day and night. All natural and human barriers fall before the rush of
In the minds of the British tourists, press, and Foreign Office bureaucrats, the Aswan Dam solidified Egypt as part of the empire. For the Irrigation Department engineers and for the British officials running Egypt, of course, it had long been a colony, albeit one complicated by the interference of European powers and its historic ties to the Ottoman Empire. Mitchell stated that the dam “helped produce the effect of a world divided into human expertise on one side and nature on the other.”\(^{183}\) Politically, as Mitchell insists, the Aswan Dam became another stick with which to beat the Egyptians, in terms of their lack of technological “civilization.”\(^{184}\) After 1902 the Aswan Dam, and by extension Egypt, had all the trappings of a twentieth century development project, complete with a regulated river, new technological structure, and a model European village. The success of the Aswan Dam gave glory to its designers – not the builders – and the British-occupied Egyptian state for its “muscular modernizing” mission. After the completion of the Aswan Dam and all it stood for, civilizing missions would become increasingly bound up with development projects.\(^{185}\) As summarized in an anonymous production and construction.” Marshall Berman, *All that is Solid Melts into Air: The Experience of Modernity* (New York: Viking Penguin, 1988), 64, 67.


1906 article from the journal *Nature*, Egypt “[had] consisted principally in its natural state” until the construction of the Aswan Dam had begun its process towards modernization.\textsuperscript{186}

### 6.5 Conclusion

The Aswan Dam, technologically, politically, socially, and economically, represented both continuity and change for the Egyptian Irrigation Department. In many ways, it solidified a relationship with Britain and British civil engineers, at the expense of British-Indian and therefore military engineering traditions. The consulting presence of Baker and his former apprentices (Fitzmaurice and MacDonald), the contracting of John Aird and Co and British banks, the importance of the Philae controversy all brought Britain and Egyptian irrigation into a more complex and dynamic political relationship. However, these were solutions to engineering problems conceived in terms of military engineering discourses. Scott-Moncrieff, Ross, Willcocks, and Garst in attempted to increase water control over Egypt’s agriculture and rural population by means of a singular technology. The importance of irrigation practice was minimized and the human elements of Egyptian geography were ignored or “in the way.” The Aswan site may have been “superior from a technological and economic perspective” but it was conceived as a way to solidify the British Empire in Egypt along British-Indian methodologies.\textsuperscript{187}

This chapter has discussed how an inherently political technology was negotiated in both Egypt and Britain. In Egypt, rather than deal with approximately nine million

\textsuperscript{187} Andersen, “Philae Controversy,” 206.
Egyptians, the government concentrated its efforts on soliciting the opinions of first its own technical experts, a handful of whom had political clout, and then the views of three international engineers. Although Boulé was exceptional due to his protests against the construction of a dam at Aswan, the views being propounded by the Egyptian government and its experts looked unanimous – mostly because only a select number of British male technocrats had been polled. Irrigation engineers, to whom the government turned to for its practical advice, were in favour of a reservoir because it allowed them to advocate extending perennial irrigation in a way directly beneficial to their credibility and expertise. They were also genuinely hopeful that by providing the requisite supply of water for Egypt, the Aswan Dam would minimize the destructive effects of the river and prevent crop failure. When presenting it to the government the engineers minimized the risks of silting, water-logged soil, and higher floods. Top Anglo-Egyptian politicians were in favor of the project because it was calculated to increase Egypt’s direct and indirect revenues, and the acreage of the cotton-crop. Within the British officials of the Egyptian government, the Aswan Dam was an easy sell.

In Britain, this technology appeared to be more controversial: the specific site of the project affected the political debates which in turn shaped the dam. Critical discussions in Britain were not protests against the development project itself, although individual commentators discussed the negative social and cultural impacts; little attention was paid in Britain to the possible environmental and social impact of the
reservoir. The objections revolved around conservation of the Philae Temples. Because archaeologists were not fundamentally interested in protesting Egyptian irrigation projects, but only the destruction of Philae, once the Egyptian government promised to lower the dam and therefore save the Temples, they withdrew their objections. Politically, then, the archaeologists were trying to accomplish the same outcome as the Egyptian government: the grandeur of and continued occupation by the British. Archaeologists and self-proclaimed lovers of Egypt had a stake in the continued occupation of Egypt: the British presence allowed them to enjoy the country at their leisure, with no taxes, with few limitations on their removal of relics. Some British travelers and tourists felt a sense of loss at the construction of the reservoir, but this was tempered by the comfort that the Egyptian irrigation projects were designed by Britons for the benefit of British civilization and Egyptian prosperity. The discomfited travelers did not often ask which Egyptians were going to prosper from the construction of the dam, and were happy to assume that it would be the fellahin. As will be discussed in the next chapter, the effects of the extension of perennial irrigation into Middle Egypt were not quite what the tourists imagined. Instead, they agreed with former Egyptian-official Alfred Milner in an 1896 article, in which he quoted Garstin on the switch to perennial irrigation: “Those who do not [wish to change] must be saved from

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188 The Irrigation Department engineers were well aware of the potential environmental effects of a dam in the valley of the Nile. William Garstin in his 1894 “Note” in the Report on Perennial Irrigation and Flood Protection described as potential negatives: higher floods, “drainage [being] impossible, [and] possible encroachment of the desert sands.” Garstin, “Note” in Perennial Irrigation and Flood Protection, 42.

189 How this “loss” manifested was dependent on the individual or the organization for which he or she wrote: some felt that the loss of the “natural” beauty was the most regretful, others felt that the serenity and sanctity of the Temples had been disrupted.
themselves, even if against their will.’ [Milner continues:] Saved from themselves! These three words sum up the essence of all our work for the benefit of the Egyptian people.”

Milner’s words encouraged a sort of “technological somnambulism” in which Britons “willingly sleepwalk[ed] through the process of reconstituting the conditions of human existence,” especially since these technologies only seemed to involve people thousands of miles away. Milner, in effect, allowed his British reader to leave the process of “civilization” to the professional scientists. This allowed both the British-occupied Egyptian government to gain credibility for itself and its scientists, and reinforced the connections between imperial science, “civilization,” and political power.

191 Winner, The Whale and the reactor, 10.
Chapter 7

Irrigation Technologies and Practices, 1902-1913

7.1 Introduction

In an address to the Khedival Geographical Society in 1902, entitled “Egypt Fifty Years Hence,” William Willcocks plied his precognitive powers by predicting what Egypt would look like in 1952, naturally concentrating on irrigation and the agricultural landscape of the country. Willcocks’ paper predicted a need for sweeping policy changes, some of which were implemented.1 “Fifty Years Hence” described how, by the early 1950s, the entire Nile would be regulated from the Aswan Dam to the Central African lakes. The Aswan Dam would be raised “to its full height,” but this was overshadowed by the new projects that the Irrigation Department would construct.2 The tributaries of the Nile (White and Blue Niles and the Atbara) would be outfitted with barrages in order to raise the water without losing the red flood waters. Britain would control the entire length of the Nile, including independent Abyssinia. He predicted the Jonglei Canal between Lado in South Sudan and Khartoum, “one unbroken stream about 500 meters in width of pure and wholesome water.” Willcocks also felt that the Egyptian fellahin, the “crown of

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1 William Willcocks, as a man of many unwavering opinions also recommended a series of other policy changes, but for the purpose of this chapter I highlight the work of the Irrigation and Agricultural Departments. To name a couple, he also thought that railways were a waste of time and suggested beautification projects for Cairo. William Wilcocks, “Egypt Fifty Years Hence,” (Cairo: National Printing Department, 1902), ICE Tracts 8 V.596, No. 5, Institution of Civil Engineers Library, London, pg. 17, 27.
2 Ibid., 18. This raising of the dam would have made perennial irrigation possible in Upper Egypt because Aswan and Esna. “The dam will be supplying perennial irrigation to the 50,000 acres of land in the Kom Ombos plain and creating a new district.” Ibid., 18-19.
the agricultural populations of this earth” would colonize the river all along its watercourse. The fellahin would make the Sennar plain green and prosperous with perennial irrigation.

Willcocks’ musings on the Aswan Dam and the Sudan reflected a series of ongoing debates within the Egyptian Irrigation Department. The former irrigation department engineer critiqued the current Aswan Dam because, as he saw it, the Egyptian government had folded before an archaeological outcry rather than keep its eyes on the perennial prize. In the aftermath of the conquest of the Sudan in 1899, the Anglo-Egyptian Condominium started exploring the agricultural opportunities of its new territory. By 1902, the Egyptian Irrigation Department was making decisions about the Nile’s tributaries, such as concluding a treaty with Ethiopia which guaranteed the paramountcy of Egypt’s water needs along the Blue Nile and its source in Ethiopian highlands. Similarly, the Sudanese Irrigation Service, a branch of the Egyptian Irrigation Department, set up Nilometers along the basin of the Upper Nile to begin scientific measurement of the river. The British-occupied Egyptian government had begun to

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3 Ibid., 7.
5 As one 1908 memorandum reported, the situation agreement meant that “the role of... [Britain] consists of... taking the leading part in prescribing the system under which the Soudan is governed, leaving the whole of the financial burden to be supported by Egypt.” Sir E. Gorst, “Memorandum Respecting the Situation in the Sudan,” 1908, pg. 2, FO 881/9298, Confidential Print Series: Egypt, Foreign Office, British National Archives, Kew.
pursue a water policy meant to control – and ensure Anglo-Egyptian dominance over – the entire length of the river.\textsuperscript{6}

Willcocks did not limit himself to irrigation projects: “Egypt Fifty Years Hence also predicted the rise of a Egyptian Ministry of Agriculture. This ministry would work to improve the quality of the cotton crop, implying not only that the Irrigation Department provided incomplete agricultural science, but that the continued primary crop of Egypt would be cotton. However, cotton was merely the beginning of Willcocks’ plans for the ministry: he suggested bureaus of pisciculture, statistics, forestry, animal industry, foreign products, plant industry, chemistry, soils, and experimental stations to develop agricultural science in Egypt. Although he was careful to state that irrigation would have a free hand, he was clearly eager to see Egypt develop what he perceived as scientific agriculture.

Willcocks’ work reflected discussions already ongoing in Egyptian scientific and bureaucratic circles. By 1902, the recently formed Khedival Agricultural Society was acting as a liaison between the government and those landowners looking to improve cotton yields. The Society also monitored cotton yields, maintained experimental farms, and disseminated cotton rotation knowledge. These Egyptian efforts paralleled the increasing governmental interest in agricultural science; in most British colonies,

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agricultural departments already existed. Willcocks went so far as to suggest that the Agricultural Ministry could be modelled after the American agricultural ministry.7

Like William Willcocks’ paper, the focus of this chapter is the changing role of irrigation in Egypt and the Sudan after 1902 ending in 1912-1913 with the formalizing of the Gezira scheme, the heightened Aswan Dam, and the creation of a Ministry of Agriculture. After 1911 the Egyptian government through its official agricultural bodies took an explicitly developmental stance on Egyptian agriculture. Irrigation science had started from expanding definitions of “state” and “non-state” water control, to incorporate irrigation practices, including watering schedules and crop rotations.8 In 1912, the agricultural ministry “took over” the management of what had formerly been classified as irrigation practice, and the Irrigation Department focused its efforts on technologies. This chapter will act as a dénouement for my thesis; the political influence of the military irrigation engineers and their civil engineering pupils peaked in 1902, immediately after the construction of the Aswan Dam. With the end of Coopers Hill in 1906 and the import of British consulting engineers into Egypt from 1898, the military engineering emphasis of irrigation engineers as agricultural managers and technological experts ended. From

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7 Willcocks, “Fifty Years Hence,” 17.
8 James C. Scott, Seeing like a State: How Certain Schemes to Improve the Human Condition have Failed (New Haven: Yale University Press, 1998), 186. This chapter refers to both agricultural practices and irrigation practices, and is referential of the expanding government ideas about the existence of agriculture beyond water practices. Irrigation practice, as mentioned in previous chapters, is meant to discuss those practices surrounding getting water onto the fields, and off. Agricultural practices is a general catch-all phrase dealing with the methods of agriculture including irrigation practice, harvesting, worm removal, and animal husbandry among others.
the early 1900s onwards, British consulting engineers looked to the universalist mathematical principles of hydraulic theory to re-make Egypt’s technological projects.

Chapter 7 is divided into three sections, and these sections represent the culmination and repercussions of engineering efforts in the Sudan and Egypt to create “total control” of the entire Nile. Historiographically, “total Nile control” has been used to convey the attempt by the Anglo-Egyptian government to control the length of the Nile from the central African lakes to the Egyptian Delta, and the attempt by the Anglo-Egyptian government to politically create that control is the subject of the first section. However, in the second section, “total Nile control” is again deployed to refer to a concerted Irrigation Department attempt to direct and manipulate all of the water supply along the length of the Egyptian Nile, in both spatial and temporal contexts, and finalized the transformation of the Nile into a fluid natural resource. These sections discuss different projects that formalized and finalized Nile management. However, centralized control over water supply did not mean that cotton yields went up. Instead, the cotton yields declined due to a series of “critical problems” that the Irrigation Department could not solve by building dams, barrages or headworks. Instead, Egyptians argued that a Department of Agriculture was necessary to shift the role of official agricultural oversight from the Irrigation Department to a new Ministry of Agriculture, which had different, but no less coercive mechanisms of power; the site of their power was not the Nile water but

the Egyptian peoples.\textsuperscript{10} Interwoven through these narratives, are changing conceptions of irrigation and agriculture.\textsuperscript{11}

First, in the Anglo-Egyptian Sudan, the irrigation engineers attempted to direct the flow of the entire length of the Nile from Lakes Victoria and Albert to the Egyptian Delta. The Irrigation Department measured the river’s flow and discharge scientifically; they also began planning what they perceived as the next set of large-scale dams. The programme of large-scale public works projects reinforced the technologically-based nature of Egyptian water control, and made its universalist science integral to riparian knowledge.

The second section focuses on Egypt itself; here the Irrigation Department invested time, resources, personnel, and credibility in irrigation technologies, including drainage projects, land reclamation, and raising the Aswan dam to better control the Nile in Egypt. The department increasingly sub-concentrated the work of monitoring irrigation practice in order to complete these large-scale technology-heavy systems.

As the final section details, the Egyptian government became increasingly frustrated with the Irrigation Department’s inability to prevent cotton crop losses and declining yields; these failures seemed directly caused by the previous efforts of the

\textsuperscript{10} Here, again, Egyptian is not a unified category. Initially, the Agricultural Ministry’s power fell specifically on rural Egyptian cotton farmers, probably those farmers who did not have tenants on their lands (small to mid-sized landowners), or were tenants themselves. Within a few years, the Agricultural Ministry was involved in many other aspects of agriculture.

\textsuperscript{11} To clarify, irrigation is the system of water delivery, placement onto the crops and water drainage that facilitates specifically plant-based growth for human and animal food, consumption, clothing, etc. Agriculture is either plant-based cultivation of crops, and/or feeding, raising or breeding livestock, poultry, etc.
irrigation engineers – the engineers had downplayed the possibility of increased salinity, waterlogging or the spread of cotton-diseases. In 1911, therefore, the government created a Department of Agriculture, designed to change how the Anglo-Egyptian government knew, monitored and controlled the fellahin rather than their water.

7.2 Introduction of total Nile Control

In 1898-99, the British conquered the Sudan in a swift and brutal military campaign. This venture, which was conducted by a joint British and Egyptian force, presaged the governance of the Sudan: the Egyptian government first provided most of the enlisted men, and later the money, while the British sent officers and then colonial officials. Water historian Terje Tvedt has argued that the British occupied Sudan in order to guarantee the security of Egypt’s water interests. Tvedt stresses the importance of water control in both Egypt and the Sudan and, the British conceptual inseparability of the Nile and Egypt, and the Egyptian Nile from its Upper Basin headwaters. Certainly, after 1899, the Anglo-Egyptian Condominium explored the agricultural opportunities of its new territory while subordinating Sudanese interests to those of Egypt. This perceived necessity meant that the Egyptian Irrigation Department was called upon to decide what to do with the Nile during its journeys through the Sudan.

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12 Tvedt, River Nile in the Age of the British, 19-20.
13 Ibid., 2.
For the Egyptian government, the priority was to protect Egypt’s water source, so the Irrigation Department developed a totalizing vision of water control that is historiographically discussed as “total Nile control.” As David Gilmartin has argued, from the 1880s onward, the imperial state, especially in India “pushed engineers towards viewing rivers, the sources of irrigation water, as systems whose interrelated parts needed to be controlled.”\(^{14}\) For William Garstin, total Nile control represented an attempt to manage all the river water perennially, and built on Scott-Moncrieff’s conception that no water should be allowed to flow uselessly to the sea. By 1919, Whitehall was also espousing such statements; in a Treasury Report, the “[Nile’s] flow is so variable that at some periods water has to be wasted to the sea, while at others there is an actual shortage.”\(^{15}\) Unlike Scott-Moncrieff, Garstin thought that the best way to control the Nile was to control the water in the Sudan – specifically at the Blue Nile.\(^{16}\) This type of water control, therefore, imagined over-year storage\(^{17}\) along the length of the Nile, its tributaries and sources. In the 1900s most of this perennial control was done in Egypt, but

\(^{14}\) David Gilmartin, “Imperial Rivers: Irrigation and British visions of Empire,” in Decentring Empire: Britain, India, and the Transcolonial World, ed. Durba Ghosh and Dane Kennedy (London: Orient Longman, 2006), 86-87. As Gilmartin stresses, the theory of river systems was reinforced in India by none other than Scott-Moncrieff as head of the 1901-1903 Indian Irrigation Commission. Ibid., 87-88.

\(^{15}\) “Memoranda: Sudan Loan Bill,” 1919, pg 3, T 1/12451 f, 55675, part 55425, Treasury Papers, British National Archives, Kew.

\(^{16}\) According to Collins, Garstin, Willcocks, and Murdoch MacDonald were the originators of “total Nile control.” Collins, Waters of the Nile, 108-109. Tvedt, by contrast, argues that Scott-Moncrieff, Ross, Willcocks, and Garstin were together responsible for the plans for controlling the upper Nile. Terje Tvedt, “hydrology and empire: the Nile, water imperialism, and the partition of Africa,” Journal of Imperial and Commonwealth History 39:2 (June 2011): 181.

\(^{17}\) Over-year water storage was only effected with the construction of the Aswan High Dam, when more water was stored than could be used by Egyptians during a year.
by the early 1910s Sudanese perennial water control was a highly theorized topic of governmental discussion, even though the physical structures were not completed.

The Egyptian government, following recommendations from Garstin, divided the Nile’s tributaries into utilizing the White Nile for Egypt and the Blue Nile for the Sudan. Garstin’s recommendations were probably based on a combination of political and ecological reasons. The Blue Nile’s flow was very low during the months of March and July, precisely when the Egyptian government needed its waters the most. More importantly, the Egyptian government could not guarantee that the Blue Nile would not be cut off, although they negotiated treaties with Ethiopia towards this goal. In 1902, the British government signed a treaty with the Ethiopian emperor, who “agreed not to construct ‘any works across the Blue Nile, Lake Tana, or the Sobat, which would arrest the flow of the waters into the Nile except in agreement with His Britannic Majesty’s Government and the government of the Sudan’.” The White Nile, by contrast, was under direct British colonial control along its length from Egypt to the central African Lakes; although the White Nile supplied only a fraction of the Nile’s waters and practically none of the silt, it was therefore to guarantee its waters despite Ethiopian treaties. Furthermore, the British knew that the White Nile lost large quantities of its water in the sadd swamps in the southern Sudan, and if these swamps were clear, Egypt’s water problems would be solved. The decision to enact “the principle of utilizing the

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19 Ibid., 670.
20 Tvedt, “Hydrology and Empire,” 181.
waters of the White Nile for the benefit of Egypt and those of the Blue Nile for the benefit of the Soudan” was therefore set in place by early 1904.²¹

7.2.1 Total Nile Control: plans and schemes, 1904

The Irrigation Department started their “conceptual conquest” of the Sudan by setting up current meters to gather scientific observations of the river and its flow. Surveyors also mapped the landscape. In his 1904 Report upon the Basin of the Upper Nile, William Garstin complained about the general lack of knowledge about the Sudan. As Garstin was as pains to state, the “want of levels in the Soudan is a crying one.”²² The statistical basis behind the proposed projects in his report suggested was a series of river gauges set up in May 1902, which had been checked on a monthly basis to calculate the discharge. Garstin acknowledged the drawbacks of this system, “it is not pretended that the information, thus collected, is… complete, or even that any definite conclusions can be arrived therefrom. Two years represent an extremely short period of time for observations regard the regimen of an important river.”²³ However this admission did not stop Garstin from suggesting a series of extensive and irreparable changes to the river system. His primary concern was whether or not a project was feasible from an engineering perspective, which allowed Garstin to evaluate the proposals on grounds

²² Sir William Garstin, Report upon the Basin of the Upper Nile: with proposals for the improvement of that river. To which is attached a report upon Lake Tsana and the rivers of the Eastern Soudan by Mr. C. Dupuis (Cairo: National Printing Department, 1904), 191.
²³ Ibid., 171.
unconnected to labour, cost, transport, materials, and other practical considerations.\textsuperscript{24} In fact, his only word of warning was about the Bahr el-Gebel and Bahr el Zaraf, long tributaries of the White Nile, on which he proposed deepening and straightening the channels, but which Garstin admitted might be impossible.\textsuperscript{25} In so doing, he divorced the physical river and the problems that these works represented, from the conceptual water. As this dissertation has demonstrated, by presenting the plans in terms of their conceptual shadow, Garstin was able to maintain the pretence of scientific expertise.\textsuperscript{26}

Garstin proposed creating a Sudanese Irrigation Department in order to gather and interpret the data that would be necessary to carry out these construction projects. His words are worth quoting at length because they indicated the sheer frustration of the irrigation engineers:

Those who have read this report will have observed that, in almost every instance, the proposals made have been subordinate to the results that may be afterwards obtained by actual leveling of the country... One of the very first duties of the Irrigation Officers in that country, will be to run lines of levels up either branch of the Nile, with cross lines across the Gezireh and to the east of the Blue Nile. Until this has been done, all proposals, regarding works to be carried out, or estimates of their cost, must be mere

\textsuperscript{24} For instance, he suggested: “the construction of a regulator on the Blue Nile would not be a work of any supreme difficulty, except for the absence of labour and limestone, and those others connected with transport and supply.” Ibid., 185. When discussing a project he was not in favor of from an engineering perspective, Garstin also mentioned the cost. He does this with the Bahr el-Zaraf. Garstin, \textit{Report}, 181.

\textsuperscript{25} “As it is proposed, in these projects, to interfere with Nature upon a very considerable scale, such interference can only be attempted safely, if accompanied by great caution... Although in theory, it may be possible to shorten, or straighten a great river – in actual practice, this is impossible over a long distance, beyond a certain point. Any works, having such an end in view, must then be carried out very gradually, and the progressive effect watched with the greatest care.”Ibid., 181.

\textsuperscript{26} Timothy Mitchell, \textit{Rule of Experts: Egypt, Technopolitics, Modernity} (Berkeley: University of California Press, 2002), 42.
guess work, founded upon nothing better than general probabilities.\textsuperscript{27}

Garstin’s annoyance highlights the dependence of these men on their technical data. Garstin’s diatribe also laid out the practical steps that the Egyptian government was willing to countenance in order to learn about the river in the Sudan.\textsuperscript{28} His “steps” also included the limits of governmental action – for instance, the government did not stop to measure the rainfall or the water tables of the Sudan, they did not focus on local irrigation schemes, and did not involve themselves in agricultural practices of the Sudanese.

In 1904 the Sudanese Irrigation Service was created as a branch of the Egyptian Irrigation Department and therefore subordinate to the Egyptian Ministry of Public Works.\textsuperscript{29} By making it a sub-department of Egyptian Irrigation, Garstin ensured that Sudanese irrigation would be viewed through the lens of Egypt’s water needs. More importantly, Sudanese irrigation would be executed in ways acceptable to the Anglo-Egyptian government. In 1901, for instance, the Egyptian Irrigation Department set a cap on the amount of summer cotton that could be grown in the Sudan. The Sudan was only allowed to use artificial irrigation systems to irrigate up to 10,000 feddans of crops

\begin{footnotesize}
\textsuperscript{27} Garstin, \textit{Basin of the Upper Nile}, 191.

\textsuperscript{28} Garstin’s steps seem to have been followed – according to a 1937 report, over 2000 discharges were measured annually in the Sudan alone. H. Sirry Pasha, \textit{Irrigation in Egypt: a brief resume of its history and development} (Cairo: Government Press, 1937), 8.

\textsuperscript{29} William Garstin, \textit{Report upon the Administration of the Public Works Department in Egypt for 1905} (Cairo: National Printing Department, 1906), 14.
\end{footnotesize}
between 1 February and 15 July. These restrictions were meant to ensure that Egypt would have enough summer water.

Garstín outlined his programme for total Nile control in his book, *Report upon the Basin of the Upper Nile* (1904). This monograph, however, was a strange mix of travelogue and engineering text. Garstín insisted on taking this journey personally rather than relying on levels and surveys from these locations, although from his descriptions these probably seemed suspect. Personal observation was a mid-Victorian, and increasingly perceived as non-scientific style, of knowledge gathering. Yet the ethnographic aspects of his work reflected the Romantic traditions of what Nile Green has described as the “scholar as hero.” By journeying down the Nile, Garstín travelled in the footsteps of Richard Burton, Samuel Baker, and John Speke, of which company Burton was especially anthropologically interested. Whether Garstín read the published works of the nineteenth century heroic travelers is impossible to state conclusively, but his inclusion of ethnographic notes seems to indicate that he was aware of the tradition in which he wrote, and the broader appeal of Nile journeys to a British audience. Garstín’s

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34 For instance, Garstín described Buddu, in southern Uganda. “In Buddu, there are no villages… The huts are scattered about the forest and grass… [they] are circular, with bee-hive roofs, very neatly made… The people of Buddu are very dark-coloured, but are not of a pronounced negro-type. Many of them have oval faces and good features. All of them are clothed.” Garstín was eager to portray the Buddu people as
1904 text, therefore, included descriptions of the sights and people of his journey up the White Nile south past Lake Victoria Nyanza as well as discussions of dam sites and calculations of water loss.

When Garstin discussed possibilities for irrigation projects on the Upper Nile, his rambling prose became much more pointed. He first discussed the discharges of the Nile’s tributaries, and then outlined ten schemes for irrigating the length of the Nile: five on the White Nile and another five projects on the Blue Nile. These projects represented the imagination of the Irrigation Service – Garstin “conceptually conquered” the Nile basin, to use Tvedt’s phrase. Garstin suggested dams at the Victoria and Albert Lakes and at Lake Tana in Ethiopia even though he realized the political and engineering difficulties might be insurmountable. For instance, as will be discussed below, the likelihood that an acceptable agreement could be arranged with the Ethiopian government he felt was vanishingly small – and as a result he suggested three other places along the Blue Nile for reservoirs. However, if these longer-term projects were not immediately applicable he suggested another series of projects based upon the current political situation.

civilized despite their skin color because “nearly two-thirds of the population of the province have embraced the Christian religion, most of them being Roman Catholics.” Garstin, *Basin of the Upper Nile*, 32.


36 In Garstin’s words: “the political difficulties appear to be so great, that the chance of any such work being carried out must be relegated to a very distant future, if not abandoned altogether. Doubtless, at some period in the world’s history, these difficulties will disappear, and the advantage will be taken of the obvious suitability of this lake.” Garstin, *Basin of the Upper Nile*, 185.
Although Garstin proposed five separate projects for each, the White and Blue Niles did not equally merit consideration. The White Nile, contributing 20% of the Nile in flood, was to be Egypt’s water source; for the Blue Nile, which contributed 70% of the Nile, “reserve the waters… for the improvement of the countries bordering the river.”37 He believed that the most important of the White Nile projects would generate more water for Egypt at the right time of year. He proposed to do this by either deepening the channels of the tributaries which cut through the sadd, or cutting an artificial canal across the country to the east and bypassing the swamp lands altogether.38 The latter idea, afterwards called the Jonglei Canal, was heavily favoured by Garstin, although he acknowledged that it mostly looked like a good idea “upon paper” due to a lack of hydrological and geographical knowledge about the area.39

Garstin’s report, therefore, was an ambitious plan for how to use the Nile Basin to obtain more water for Egypt, one which heavily utilized the expertise and technologies of the extant engineering staff. He realized that many of these plans were implausible in the short term given the lack of scientific knowledge and extant technological infrastructure. Indeed, because there was no easy way of completing any of the projects, Cromer

37 Ibid., 172. The Atbara which joins the Nile north of Khartoum makes up the last 10% of the Egyptian Nile’s waters.
38 In the early 1900s, even before the formal development of the Jonglei Canal scheme, the British were involved in sadd clearance to survey, run levels, and the construction of a rest house and irrigation station at Malakal, South Sudan. A.L. Webb, Reports upon the Administration of the Irrigation Services in Egypt and the Sudan for the year 1907 (Cairo: National Printing Department, 1908), 29-30.
publically dismissed them.\textsuperscript{40} However, it is also possible to look at the \textit{Report} as one of the first complete set of plans for British utilization of the Nile Basin.\textsuperscript{41} Garstin acknowledged such: “the main idea of the present note is to suggest schemes for the improvement of the Nile supply, based upon the experience gained and the observations made, during the past five years.”\textsuperscript{42} Despite Cromer’s dismissal, the report came to guide British irrigation policy in both the long and short terms.\textsuperscript{43} As Tvedt has argued, in the long term, the Nile was framed as a conceptually unified river system. “By their understanding of the Nile as a single hydrological unit... the British established a close connection between Egypt and the Central African lakes and between London and the all the people who lived within the Nile watershed.”\textsuperscript{44} River systems themselves, as mentioned above, were a late nineteenth century idea meant to “maximize productive efficiency” of the river as the source of water – that is, to see the Nile entirely as an inefficient mechanism for supplying water for irrigation.\textsuperscript{45}

\textit{7.2.2 Total Nile Control: Anglo-Egyptian diplomacy, 1902-1914}

Egypt’s water supply dominated all considerations revolving around total Nile control. In 1904, Cromer mentioned that the total estimated costs of Garstin’s projects were about £13 million. He assured his British audience: “It is not to be thought that the

\textsuperscript{40} Serels, “Political landscaping,” 70.
\textsuperscript{42} Garstin, \textit{Basin of the Upper Nile}, 172.
\textsuperscript{43} According to Steven Serels, Sir William Mather’s (of the British Cotton Growing Association) positive assessment of Garstin’s plans in 1910 forced the British-occupied Egyptian government to reconsider the utility of these plans. Serels, “Political landscaping,” 70.
\textsuperscript{44} Tvedt, \textit{River Nile in the Age of the British}, 56.
\textsuperscript{45} Gilmartin, “Imperial Rivers,” 86, 88.
proposed expenditure in the Soudan will only benefit that country. The main item is £5.5 million on the Bahr el-Jabal. This expenditure is mainly on Egyptian account... the whole plan is based on utilizing the waters of the White Nile for the benefit of Egypt and those of the Blue Nile for the benefit of the Soudan.”

For Garstin, total Nile control meant a “conceptual conquest” rather than a physical one, but this conquest held expectations that the British would politically and economically control the upstream states for Egypt’s benefit. These included a dam on the Blue Nile at Sennar (completed in 1925) a dam on the White Nile at Jebel Aulia (completed in 1937), and a canal through the sadder. The Foreign Office (FO) was also informed of the Egyptian Irrigation Department’s long-term thoughts about utilizing the central African lakes for total Nile control.

In 1902, the British-occupied Egyptian government made a treaty with Ethiopia to utilize Lake Tana. Lake Tana, the source of the Blue Nile, was to be used to irrigate the Gezira. According to Ethiopian historian James MacCann, the British pursued active negotiations at several points between the early 1900s but these failed for a variety of British and local Ethiopian concerns. In the early 1900s, for instance, Cromer was distinctly leery of the “political grounds” surrounding a dam at Lake Tana. These political problems revolved around issues of giving up potential control of Egyptian

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47 Tvedt, River Nile in the Age of the British, 56-57.
48 According to Haggai Erlich, the Ethiopians have not placed the same cultural and historical importance on the Nile as in Egypt. For Ethiopians, the Blue Nile divides, erodes, kills. However, it is also a historical bargaining chip to be used against the Egyptians and the rest of the Middle East. Haggai Erlich, The Cross and the River: Ethiopia, Egypt and the Nile (London: Lynne Rienner Publishers, 2002), 8.
49 “Cromer to Landsdowne,” 22 April 1904, No. 29 in FO 407/163.
water to a foreign power – especially since the Blue Nile provided 70% of the water to the Nile. In the words of one Ethiopian historian, after the British sent an expedition to Lake Tana in 1902 and decided that a dam there would be cheap and easy to build, “the British vision of an all-Nile system under their control focused on the idea of a Lake Tana dam.” This statement goes a long way to explain why the British governments attempted for most of 30 years to try and broker a deal with the Ethiopians, specifically the Lake Tana scheme. By the early 1920s the Ethiopians, especially the regent, refused to accept British offers because of the potential political instability, a post-war recession, and potential international threats to Ethiopia.

The Egyptian government started to work with neighbouring countries to secure water rights in both Egypt and the Sudan. In 1906, for instance the Sudanese government and the Italian colony of Eritrea conducted negotiations to determine the use of the river Gash (today called the Mareb River) which ran through the Sudanese province of Kassala. Although the Mareb River does not terminate in the Nile, meetings were arranged in Cairo between irrigation engineers from the respective governments. By 1908, the Sudanese government was utilizing the Mareb to construct an irrigation scheme.

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50 Erlich, *Cross and the River*, 82.
51 McCann, “Lake Tana Dam,” 676-682. According to McCann, the regent dealt with these threats and intrigues by stalling the British by saying that he needed time to convince the conservative members of his government to agree to the Lake Tana project.
for 100,000 feddans. The governor of Kassala estimated that the scheme would produce 100,000-150,000 kantars of cotton per year.53

In 1905, similarly, the Foreign Office was approached by an agent of the Belgians to create an Anglo-Belgian Company “for the development of the Upper Nile,” by improving navigation. However, the scheme was promptly shut down by Cromer and the Ministry of Public Works. Firstly, Cromer cited the probative costs of constructing navigation locks and barrages. Secondly, however, he reasserted the doctrine of total Nile control: “throughout the entire course of the Nile, no private society or individual should be permitted to construct works of any kind involving a control of the waters of the river... all such works should be constructed by and remain in the hands of the Government of Egypt.”54

The different ways that the British handled these governments was indicative of their overarching priorities. The Mareb, for instance, had the potential to produce cotton fairly quickly and without any danger to the Egyptian Nile, and therefore an agreement with the Italians was put into place. The threat to the Egyptian Nile mediated both discussions with the Ethiopian and Belgian governments, and although the Belgians were a colonial power, the Ethiopian government held out the economic promise of a great cotton scheme. The Foreign Office, therefore, tried harder for longer to negotiate with

Ethiopia. Clearly, the Egyptian government and Foreign Office were willing to accept some risk with the Ethiopian government for cotton, but not with a private company for riparian navigation. By contrast, the relationship between the Egyptian and Sudanese governments and the British colonies along the White Nile was in some respects a cooperative one – certainly Garstin assumed that the governments would be friendly to the development of total Nile control – and documentary evidence seems to bear this out.

### 7.2.3 Gezira: the first Upper Nile project

The Gezira scheme, by contrast, epitomized Egypt’s hydropolitical insecurities – both about the colonization of the Sudan and the use of Blue Nile water for irrigation projects. Egyptian historian John Waterbury argues that Egypt had always known that it was dependent upon the Sudan for its water supply, but after the Anglo-Egyptian Condominium, “its dependency had been multiplied by two: the supply of summer water could conceivably be altered by an upstream power; and the upstream power, however solicitous of Egyptian interests, was the leader of the European industrialized world.”

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55 The lack of investment in riparian navigation is only logical if one remembers the power and appeal of railroad construction, which was the primary British method of transportation and being enthusiastically adopted across Britain’s African colonies. Willcocks, for his part, thought the construction of railways in Egypt asinine. Op. Cit. Willcocks, Fifty Years Hence, 19.

56 This is the term that John Waterbury uses in his classic *Hydropolitics of the Nile Valley* (1979) to describe the system of dams and reservoirs that would “remove the unpredictable element from the Nile discharge [and] would require storing several successive annual floods.” John Waterbury, *Hydropolotics of the Nile Valley* (Syracuse: Syracuse University Press, 1979), 87.


Although Waterbury is unclear about who represented “Egypt” in the early twentieth century, his description is accurate when applied to the dual purposes of the Egyptian government, especially with regard to the Gezira scheme. On one hand, the engineers and official policy in the Sudanese Irrigation Department acted to secure Egyptian water rights. On the other hand, the British government was under pressure from the cotton lobby to produce more cotton in the African colonies, and this pushed Foreign Office personnel and the Sudanese Government to work with the Gezira Plantation Syndicate\(^{59}\) to test if the Gezira plain located south of Khartoum could viably grow large amounts of cotton when properly irrigated. In this way, as Jennifer Derr has argued with regard to the Egyptian south, governance of the Sudan followed irrigated agriculture.\(^{60}\)

Local cultivators were growing cotton in the Gezira when the Anglo-Egyptian Condominium took control of the Sudan, along with sorghum and raising livestock.\(^{61}\) At the time, the cotton was “stunted” because it was being watered by the unpredictable rainfall. However, the very existence of the plants meant that the Egyptian government could utilize local agricultural knowledge to develop the locally grown cotton into a cash crop. The most important aspects to this cannibalized local knowledge were that cotton

\(^{59}\) The Gezira and Sudan Plantations Syndicates were subsidiary corporations of the British Cotton Growing Association, which will be discussed at length below. The BCGA was involved in promoting suitable cotton for the Lancashire mills around the empire, including the Sudan, the West Indies, and West Africa. Serels, “Political landscaping,” 68.


could be grown at all and that the plants flourished during the winter months. In 1908, when the Gezira scheme first came to the attention of the British government, the project was meant to be limited to a main canal, a couple of branch canals, and a regulating barrage (much as Willcocks had suggested in his 1902 address to the Khedival Society). The limited nature of the project was probably a reaction to the limited ability of the government to use the Blue Nile’s summer water, and the fact that the Sudan government had only been able to buy 10,000 feddans of poor quality land in the northern part of the Gezira region.

Local economic pressures probably contributed to the project’s expansion being delayed for two years. However, by 1910, the Foreign Office was willing to put political pressure on Egyptian Consul-General Eldon Gorst to either allow an interest group to create an experimental farm, or have the Sudanese government run an experimental farm themselves. Since the interest group, the Gezira Plantation Syndicate, lobbied with Grey personally, he was inclined towards allowing them to own an experimental farm. Sir Edward Grey wrote, “the subject... is one of great importance to our cotton industry and therefore one in which the British government are bound to take a keen interest and to help in every way they can.” In his letter to Gorst, Garst pointed out that there were pressing reasons that the British government needed to ensure the creation of these

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62 “Project for irrigation of the Gezira Plain, preliminary report April 1908,” FO 141/578/1. Likely, the cotton that was being locally grown in the Gezira was short-staple cotton, like other varieties of indigenous African cotton.

63 Serels, “Political landscaping,” 66, 68.

64 Sir Edward Grey to Eldon Gorst, 11 November 1910, FO 141/578/1, Irrigation of Gezira plain, between Blue and White Nile, South of Khartoum; proposed establishment of cotton plantation there; with map. Foreign Office, British National Archives, Kew.
experimental farms: Lancashire mills were experiencing a cotton shortage and could “[drift] into a parlous state.” Although cotton was being grown by local farmers, Garstin still had doubts that cotton could be planted in July and irrigated until December. For Garstin, the burden of proof was two-fold: 1) that cotton could be grown in the winter in the Gezira, and 2) that the irrigation water could be taken out of the Nile without concern for Egypt’s water needs. Garstin believed that two years would provide sufficient data to determine whether both of the scientific questions could be met. Garstin’s priorities were to ensure that Egyptian water needs were met before those of the Sudan; he referred to the Gezira as the Sudan’s “great hope.”

Garstin ensured that Anglo-Egyptian conceptions of water control were woven throughout the negotiations. In Egypt, as has been mentioned in other chapters, water control was parsed along physical and temporal lines – both where and when water would be delivered to Egyptian farmers in Middle and Lower Egypt. In this instance, the temporal aspects of Egyptian water control were preeminent and imposed on the Gezira scheme from the beginning. In effect, the Gezira Plantation Syndicate bargained with the Irrigation Department for when it would be allowed water. Garstin mentioned that by his calculations, the Irrigation Department would be able to spare the water for one million cultivated acres of wheat between July and March 15th, although the Syndicate at first

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65 William Garstin to Eldon Gorst, 12 November 1910, FO 141/578/1.
66 Ibid.
67 The Egyptian government seems to have taken no interest in the water from rainfall. In the region of the Gezira, rainfall is measured is effectively approximately 400ml/year, since much of the water becomes runoff and does not sink into the soil. “Sudan” BBC Weather (accessed 22 March 2012) http://news.bbc.co.uk/weather/hi/country_guides/newsid_9384000/9384330.stm
68 “Project for irrigation of the Gezira Plain, preliminary report,” April 1908, FO 141/578/1.
only asked for water between July and December.\textsuperscript{69} After more negotiations, the dates for water were set at 15 July and the end of February for 500,000 acres under cotton cultivation.\textsuperscript{70}

In 1911, the first experimental farm of 600 feddans and pumping station were set up at Tayiba, and the experiments were successful enough to continue building pumping stations without the immediate construction of a dam.\textsuperscript{71} Pumping stations were necessary in the Gezira because although the land to the west of the Blue Nile sloped away from the river bed, the amount of water that was being moved was too much to flow as far as it was needed.\textsuperscript{72} Pumping had been anathema for Egyptian Irrigation Department engineers in the 1870s and 1880s, the acceptance of it in 1911 probably represented an economic concession since the Egyptian government was funding the Sudan, and the Sudanese government could not count on a loan from Britain until the farm had been proven economical. It was not, but the rationalities of the scheme necessitated further investment. By the 1920s, according to historical anthropologist Victoria Bernal, the scheme itself came to represent “the triumph of modern civilization over nature and ignorant tradition,” and therefore demanded continued investment, infrastructure, and the incorporation of Sudanese villages into the scheme.\textsuperscript{73} Accordingly, in 1913-1914, the

\textsuperscript{69} “Garstin to Gorst,” 12 November 1910, FO 141/578/1.
\textsuperscript{70} “No. 5,” 3 January 1911, FO 141/578/1. In 1920, the British government capped the size of the Gezira scheme at 300,000 acres, thus attempting to ensure that Egypt would have enough water.
\textsuperscript{71} Serels, “Political landscaping,” 71.
\textsuperscript{73} Bernal, “Colonial moral economy,” 451. As Bernal argues, “every time the actual cost of the Sennar Dam and associated major works appeared out of proportion to what the scheme might be expected to
British government arranged to loan the Sudanese government a total sum of 3,000,000, of which 2,000,000 was to go towards constructing irrigation works in the Gezira plain. £500,000 was advanced in January 1914 specifically to start irrigation works in the Gezira, but the disastrously low flood of 1913-1914 and then the outbreak of World War I stalled further payments. In 1919, when the British government came back to its colonial commitments, the government found that the price of the irrigation works had doubled, and that the cost was estimated at 6,000,000. By 1924, water was supplied between 15 July to 15 April. Of these schemes, Sennar was the one first developed because of British political pressure to grow winter cotton in Gezira plain. The Sennar Dam was finished in 1926.

The alliance between the irrigation department and the cotton growers was one of the first major coordination efforts between agricultural scientists and irrigation engineers to achieve a large-scale project. The first Committee appointed to discuss the finalization of the contracts included both the legal and financial secretaries of the Sudanese government, as well as the head of the Sudanese Department of Agriculture and Irrigation. Their vision of the Gezira plain came at the direct expense of the political and cultural autonomy of the communities that had lived there beforehand. As early as the first agreements, the Syndicate proposed that the experiment would be

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yield, the proposed size of the irrigated area was increased, thus reducing the relative cost of the dam and making balance sheets appear more favourable.” Ibid., 452.


75 “Memoranda: Sudan Loan Bill,” 1919, T 1/12451 f, 55675, part 55425.

76 Allen, “Irrigation in the Sudan,” 259.

77 “No. 5,” 3 January 1911, FO 141/578/1.
overwhelmingly farmed by tenants.\textsuperscript{78} As the scheme expanded, this plan was enacted on a much larger scale, taking land away from its owners and giving them tenancies in return, until the practice covered the entire Gezira plain.\textsuperscript{79} These tenancies enacted a vision of African communalism that had originally been modelled on Egyptian lines – pay a lump sum for land and water – but became a rental system that provided water and land for free, but “shared” the cotton profits sixty per cent and forty percent between government (and Syndicate) and farmers respectively. Presented as being an adaptation of local traditional practices, this system was a bastardization that left the farmers vulnerable to the global cotton market. Like Egyptian fellahin, the Sudanese farmers’ agricultural system was seen as inherently corrupt and needing to be overhauled.\textsuperscript{80}

As this section has tried to describe, using the Sudan as “command center,” the British imperial state tried to secure the rights to the length of the Nile. In the Gezira, the state started the task of remodelling the agricultural practices as well planning ambitious irrigation schemes. Regarding these schemes, the Egyptian Irrigation Department was the arbiter of the possible and impossible. Since the Sudanese government perceived the indigenous agricultural system to be nearly a tabula rasa, the Sudanese Agricultural Department (while predating its Egyptian counterpart) during the fin de siècle was involved in tallying general agricultural statistics and working closely with the

\textsuperscript{78} “No. 2,” January 1911? FO 141/578/1.
\textsuperscript{79} Bernal, “Colonial moral economy,” 453.
\textsuperscript{80} Ibid., 456, 458.
experimenatal farms at Zeidab and Tayiba to determine the agricultural “potential” of the colony.\(^{81}\)

### 7.3 Irrigation Projects in Egypt

#### 7.3.1 Technologies, projects and practices, 1902-1914

After 1902, the Irrigation Department and the Egyptian government conceived of the Egyptian Nile as both more and less fluid. The irrigation engineers, as mentioned in the previous chapters, increasingly saw the Nile as a one giant water delivery system, which could be broken down into scalable “shares” or “portions”\(^{82}\) that would be distributed through pre-measured canals to where the water was needed. As the water itself was epistemologically solid, temporal movement – that is, the ability to store water and use it later – created a sense of fluidity. Any sense of that water as the Nile river (a natural, political and geographical entity) was officially, ostensibly suppressed, but colonized. The engineers broke away from the necessity of water during the flood and were able to move their water “portions” through time – to whenever during the calendar year they were needed. As expressed by Kitchener in 1912, “the advantage of a rather low flood, consisting in the absence of danger, diminished infiltration, and the escape of

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\(^{81}\) Serels’ article discusses at length the different ways that the Sudanese government dealt with land tenure. By the 1910s, the government had settled on promoting the land rights of foreign capital. See Serels, “Political landscaping,” 59-75.

\(^{82}\) These are the terms used in the 1910 Irrigation Department Report. A share or a portion implies a moral element of the amount of water each region required. C.E. Dupuis, Annual Report of the Irrigation Department, 1910 (Cairo: National Printing Department, 1911), 165-167.
valuable crops on the... [canal banks] of the river from flooding, considerably exceed the disadvantages, and the old idea that a high flood is a good flood requires modification."\(^{83}\)

With the Aswan Dam, too much flood water became a distinct problem because it, paradoxically, limited the ease with which the water could be moved around.\(^{84}\)

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**Table 1:** Calculation of Water Duty. Source: K.G. Ghaleb, "Extension of Perennial Irrigation," Institute of Civil Engineers Library (1908)

<table>
<thead>
<tr>
<th>Seasons and Crops</th>
<th>No. of waterings</th>
<th>Intervals between waterings (days)</th>
<th>Depth of waterings (centis)</th>
<th>Quantity Required (m(^3))</th>
<th>Quantity per Crop (m(^3))</th>
<th>Quantity per Diem (m(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sefee or summer (Cotton, sugar-cane)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before sowing, 1st March</td>
<td>1</td>
<td>15</td>
<td>11 ½</td>
<td>483</td>
<td>4487</td>
<td>32.20</td>
</tr>
<tr>
<td>First watering, 16th March</td>
<td>1</td>
<td>15</td>
<td>8 2/3</td>
<td>364</td>
<td>4487</td>
<td>24.26</td>
</tr>
<tr>
<td>1st April – 14th April</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4487</td>
<td>0</td>
</tr>
<tr>
<td>15th April – 10th November</td>
<td>10</td>
<td>21</td>
<td>8 2/3</td>
<td>3640</td>
<td>4487</td>
<td>17.33</td>
</tr>
<tr>
<td><strong>Nili or flood (dura or maize)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before sowing, 20th July</td>
<td>1</td>
<td>20</td>
<td>15</td>
<td>630</td>
<td>3178</td>
<td>31.50</td>
</tr>
<tr>
<td>11th August – 23rd Nov.</td>
<td>7</td>
<td>15</td>
<td>8 2/3</td>
<td>2548</td>
<td>3178</td>
<td>24.26</td>
</tr>
<tr>
<td><strong>Shetwee or winter (wheat, beans, etc.)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First watering, 1st Dec.</td>
<td>1</td>
<td>15</td>
<td>10</td>
<td>420</td>
<td>1680</td>
<td>28.00</td>
</tr>
<tr>
<td>16th Dec. – 15th Jan.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1680</td>
<td>0</td>
</tr>
<tr>
<td>16th Jan. – 18th April</td>
<td>3</td>
<td>31</td>
<td>10</td>
<td>1260</td>
<td>1680</td>
<td>13.55</td>
</tr>
</tbody>
</table>


\(^{84}\) Irrigated agriculture in Egypt became entirely free from the vacillations of the Nile after the construction of the Aswan High Dam and its ability to store over a year’s worth of water.
<table>
<thead>
<tr>
<th>Date</th>
<th>% of area under crops</th>
<th>Extra in m³ for Lucerne crop</th>
<th>Quantity of water required per diem in m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Winter</td>
<td>Summer</td>
<td>Flood</td>
</tr>
<tr>
<td>1st March – 15th March</td>
<td>60</td>
<td>40</td>
<td>--</td>
</tr>
<tr>
<td>16th March – 31st March</td>
<td>60</td>
<td>40</td>
<td>--</td>
</tr>
<tr>
<td>1st April – 14th April</td>
<td>60</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>15th April – 20th July</td>
<td>--</td>
<td>40</td>
<td>--</td>
</tr>
<tr>
<td>21st July – 10th August</td>
<td>--</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>11th August – 10th November</td>
<td>--</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>11th November – 23rd Nov.</td>
<td>--</td>
<td>--</td>
<td>60</td>
</tr>
<tr>
<td>24 Nov. – 31st Nov.</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>1st Dec – 15th Dec</td>
<td>60</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>16th Dec. – 15th Jan.</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>16th Jan. – 28th Feb.</td>
<td>60</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

As Timothy Mitchell argues, these assertions, as well as the physical projects, were “built to manufacture... the political effectiveness of an imperial power.”\(^85\) The irrigation engineers tried to create a separation between human expertise and the natural river which masked their own inability to always move the water around when and where they wanted. Indeed, their ability to know the quantity of water was doubtful. It was not until 1905, for instance, that a dedicated river gauging station was erected at Sarras, about 50km south of Wadi Halfa.\(^86\) Although the authors of the subsequent report admitted a series of assumptions and approximations, they believed that “the results obtained are the

\(^85\) Mitchell, *Rule of Experts*, 42.

\(^86\) According to engineer E.M. Dowson the purpose of this discharge station was to “obtain a regular series of determinations of the volumes discharged by the Nile at various seasons.” E.M. Dowson, *Measurement of the Volumes discharged by the Nile during 1905 and 1906* (Cairo: National Printing Department, 1909), 17.
most complete and probably the most reliable set of measurements and volumes discharged by the river.”

As implied in the previous section, in both Egypt and the Sudan, Irrigation Department engineers predominantly made due with levels and measurements that recorded only a few years of averages. The engineers retreated into quantitative universalism as a panacea for the absence of long-term data about how the Nile acted under perennial irrigation.

The mechanisms by which the Irrigation Department created the epistemological frameworks for interpreting and using scientific data were those of mathematical formulae and percentage. For instance, Irrigation Department engineer K.G. Ghaleb wrote about water rotations: “it is estimated that a layer of water 0.0019m is the thickness is absorbed by the soil in 24 hours... [and therefore] a continuous discharge at the canal head of 30 m$^3$ per 24 hours is sufficient for the irrigation of one feddan...”

More important than the exact figures, Ghaleb’s article conflated precision with accuracy, which as David Lambert has highlighted was often used in the nineteenth century to promote credibility yet made the epistemological structures increasingly rule-bound.

Ghaleb also stressed the importance of national averages as the best way to calculate these figures. As a way to account for different amounts of water in the Nile every year, and even every season, the engineers based their calculations on a percentage of the Nile. For instance, in Lower Egypt in 1910, the percentages of the four circles were as follows:

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87 Ibid., 18, 20.
89 David Lambert, “Mastering the Niger: slavery, geographical knowledge, and Britain’s Empire in Africa,” 2 November 2011, (Public Lecture, Queen’s University, Kingston, Canada).
First Circle: 25% of the water entering Lower Egypt as measured at the Delta Barrage; Second Circle: 25.5%; Third Circle: 21%; Zifta Circle: 28.5%. The percentage difference between the circles can probably be attributed to the average amount of heavy water-use crops, and their ability to produce cotton. Inspector-General of Lower Egypt, W.R. Williams wrote somewhat sourly “This rather complicated distribution programme worked as well as could be expected under the circumstances… the present method of obtaining data on which to apportion the supply between Upper and Lower Egypt is very approximate and capable of considerable improvement.” Such averages failed to take into account the wide disparities across Egypt’s physical geography, and suggested a universalising mentality among the engineers.

This rule-bound system was obsessed with its own care and maintenance.

Cromer’s replacement Consul-General Eldon Gorst, in 1908 admitted that “the work of discharging the reservoir is one that calls for very considerable study and calculation” – the reservoir was, of course, one among many large scale technologies that the Egyptian

90 In fact, the system was much more complicated than this, because of difficulties getting canal water to the Zifta Circle. For instance, the engineers had to allow 29% of the water in the Nile to pass through the First Circle, and then send 4% down to the Zifta Circle. In addition, these calculations also occurred: “The excess 25.5% due to the 2nd Circle, taken by the Rayah Menufia, owing to lack of control at the head, was passed on to the Zifta Circle through Santa Regulator. 24.5% of the total discharge entering Lower Egypt less the excess of the 2nd Circle’s share passed through Santa Regulator, was passed down the Damietta branch and distributed under the control of Zifta Circle to the Rayah Abbas and the Mansuria Canal as required.” Dupuis, Annual Report of the Irrigation Department. 1910. 166.
91 Ibid., 167. Williams was a Coopers Hill engineer, who graduated from that institution in 1887. He had worked in Indian service until 1901, when he took a position in Egypt. A.R. Astbury, comp. “W.R. Williams,” Register of Students Admitted to the Royal Indian Engineering College, Coopers Hill, 1871-1906, 92: 378.962, Institution of Civil Engineers Library, London, pg. 402.
Irrigation Department had invested in. By 1908, the Egyptian government had constructed not only the Delta Barrage, and the Aswan Dam but also the Asyuit Barrage (1902), the Esna Barrage (1906) and the Zifta Barrage (1902). All of the last three major projects were designed to raise the water level above their points along the river and maximize the ability of the irrigation engineers to manage the water’s flow into perennial irrigation canals. The Zifta Barrage, for instance was a barrage constructed on the Damietta branch of the Nile, north of Cairo. According to F.A. Hurley, one of the superintending engineers for the Zifta Barrage, that technology was meant to be “a subsidiary work to the Assuan Reservoir scheme as regards its uses during the summer months, but after the arrival of the flood it acts as a subsidiary work to the Delta Barrage” to push the flood waters into the canals above Cairo. Hurley mentioned in his article to the Institution of Civil Engineers that the barrage had been designed by William Willcocks, “with the well-laid foundations of Indian practice,” by which he meant along the lines of the repaired Delta Barrage with some modifications introduced to Egyptian irrigation by the Asyuit Barrage. The Zifta Barrage, therefore, as a large construction project with its perennial usefulness, and the importance of maintenance was a stereotypical addition to the perennial irrigation system.

The Irrigation Department itself focused personnel, time, and capital on large-scale, management-heavy projects including the switch from basin to perennial irrigation

92 Gorst to Grey, 7 March 1908, No. 36 in FO 407/172, Further Correspondence Respecting the Affairs of Egypt and the Sudan, Foreign Office, British National Archives, Kew.
94 Ibid., 326-327.
in Middle Egypt and land reclamation in the Delta. In the immediate aftermath of the
construction of the Aswan Dam, the Irrigation Department asked for, and received
funding to hire more employees to work on basin conversion works. In 1903, Cromer
estimated that the Irrigation Department would require £600,000 in 1904 and an extra
£1,000,000 in the next few years – his tone implied that he was quite willing to find this
money.95 After the basin conversion works in Middle Egypt were completed in 1909, the
department started transferring its personnel to land reclamation.96 By 1913, Willcocks
estimated that 2.5 million feddans had been reclaimed, but there were still 1.5 million
acres of reclaim-able land in the Delta.97 As has been mentioned before, the irrigation
engineers ensured that their expertise and skills were needed to shepherd the Nile’s
waters and the cultivators to greater efficiency.

For all the engineers’ stated beliefs in the importance of liberal capitalism, the
system they set up for modifying basin to perennial irrigation was a hybrid of the long-
established corvée system.98 During basin conversion, for instance, 6-8 contracts were
assigned by tender, and these companies would work under the supervision of
government engineers. The earthwork was done by manual labour, with individuals paid
about 25 milliemes for every cubic meter of earth moved. An especially good worker

97 Willcocks and Craig, Egyptian Irrigation (1913), 83.
98 Roger Owen makes a distinction between the period 1882-1893 and 1893-1907. After the abolition of
corvée, public works contracts, especially for canal-dredging, was lucrative, but undertaken by local
companies. Between 1893 and 1907, foreign investment and foreign companies invested heavily in Egypt.
Owen is less clear about whether these foreign companies (although clearly involved in irrigation, pumping
stations, and drainage) were contracted public works directly. I am inclined to believe that these companies
were contracting public works. See Roger Owen, Cotton and the Egyptian Economy, 1820-1914: A Study
could shift about four cubic meters each day. According to one estimate, 10 million cubic meters of earth were moved by manual labour each year in Egypt – meaning that at least 2.5 million days of work were contracted each year.\(^9^9\) Working conditions were similar to what Willcocks discovered upon being sent to clear canals in the Delta in the early 1880s, but mediated through contractors in the early 1900s. Contractors worked with Upper Egyptian labourers, and sent representatives to the villages to “engage the workmen through their chiefs.”\(^1^0^0\) The headmen arranged for the numbers and accepted payment on behalf of the villagers and accepted responsibility for those who did not show up for work.\(^1^0^1\) This system of manual labour was made “capitalist” through the intervention of a contractor and a pittance, but utilized the same social structure of Egyptian corvée, down to the authority of village “chiefs” who awarded the contracts.

According to Egyptian historian Samera Esmeir, the British state portrayed itself as bringing humane reforms to the fellahin, but did so through monitoring and controlling state officials. She emphasizes that “what was absent from these ‘humane reforms’ were interventions into the conditions under which peasants labored for private employers.”\(^1^0^2\) By contracting the work to private companies, the government removed itself from the necessity of oversight of the legal structure and demonstrated the priorities of the

\(^1^0^0\) According to Roger Owen, the reason why Upper Egyptians were used as agricultural labourers was due to the fact that they were less prone to bilharzia. This snail-borne disease flourished in the still-water canals in the Delta and infected a majority of the population there. Owen, *Cotton and the Egyptian economy*, 266-267; William Beinart and Lotte Hughes, *Environment and Empire* (Oxford: Oxford University Press, 2007), 145-146.
\(^1^0^1\) Ghaleb, “Extension of Perennial Irrigation,” 12-14. A millieme was \(1/10^\text{th}\) of a piastre. The best workmen were therefore making about 10 piastres a day.
department – to continue perennial irrigation in spite of legislation. Even the partial success that was achieved by the Irrigation Department represents an alliance of interests working together to force Egyptian cultivators to cultivate the right crops the right way by watering at the right times – the Irrigation Department was both supported by the police and the legal administration of Egypt, as well as the contractors, landowners, and even local village leaders. The vast majority of these individuals were Egyptians.

The power of the irrigation engineers over the *fellahin* was never complete. In fact, the efforts of the engineers can be seen as an ongoing conflict with the Egyptian tenants and landowning *fellahin*. Ghaleb detailed the controls that Irrigation Department engineers put on Egyptian farmers. As has been documented in previous chapters and affirmed by Ghaleb, the primary mechanism of agricultural control in perennial irrigation was that of a carefully regulated water distribution system of permanent and temporary canal headworks. The engineers, or their local subordinates, regulated the system by allowing to flow into the canals in set patterns of “canals open for 6 days and shut for 12 [days].” However he also mentioned that the masonry regulators had to have locks “to prevent the cultivators’ interference.”

Ghaleb went on to mention that both regulators and drainage intakes “resembled head-sluices in every respect” – implying that locks were also installed in these was well.

The single area where the Irrigation Department accepted some culpability, unsurprisingly, was in drainage efforts. Between 1895 and 1905 the department spent

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103 Ghaleb, “Extension of Perennial Irrigation,” 6, 16.
104 Ibid. 16-17.
£1.4 million on drainage. Their efforts, however, were concentrated on the local level and revolved around remodelling existing drains rather than maintaining current drains or constructing new ones. In fact, this policy was partially response to the Department’s inability to predict the water levels after the Aswan dam’s construction – functioning drainage canals had been flooded and needed to be remodelled. Remodelling was effectively uneven, and probably most of the drainage efforts went into the cotton-producing regions of the delta. By 1911, at the beginning of his tenure as Consul-General, Kitchener felt that it was an “incontestable fact” that too much water did “actual harm to the crops.” Kitchener’s government, therefore, inaugurated a large drainage project in 1911, which was designed to be a comprehensive, unified attempt to improve northern Egyptian drainage. In his 1911 Public Works Department Report, civil engineer C.E. Dupuis explained that the drainage project was “a natural sequel to the policy of improving the water supply that has been so actively pursued in the immediate past, and it is also a necessary preliminary to the reclamation of the large areas of waste land still remaining in the north which has only been rendered possible by the improved supply.” The new drainage scheme was projected to cost £2,500,000 over three years of work. The project was supposed to “deepen and enlarge the existing drains, create new

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106 Derr, “Drafting a map of Egypt,” 149.
107 Owen mentions that the greatest provincial increase in the cotton crop happened in areas where the British spent time and capital modifying existing canals and reclaiming land. Owen, *Cotton and the Egyptian economy*, 185-188.
108 Kitchener to Grey, 6 April 1912, No. 136 in FO 407/178.
ones, and involve the pumping of all the drainage water into the sea at Lake Meriout and
the eastern end of Lake Borollos [in Lower Egypt].”\textsuperscript{110} The next year, Kitchener reported
that drainage works were underway in the Delta provinces of Behera and Gharbia.\textsuperscript{111}

After 1902, the Egyptian Irrigation Department concentrated on the construction
of large-scale technologies in both Egypt and the Sudan, and increasingly turned
irrigation practice over to the Khedival Agricultural Society,\textsuperscript{112} large landowners, and
contractors. Therefore the Irrigation Department was less involved in the agricultural
management of Egypt’s cultivators than they had been in the 1890s. Before moving on to
discuss the creation of the Department of Agriculture, this section discusses the
heightening of the Aswan Dam. Although the original Aswan Dam started the process of
reservoir construction on the Nile, heightening the dam set the answer to the “critical
question” of how to cope when Egypt’s perceived water needs outstripped the reservoir
size: build a bigger dam. In both 1929 and 1959, this was the answer of the British-
occupied and Egyptian nationalist governments respectively.

\textit{7.3.2 The first heightening of the Aswan Dam}

\textsuperscript{110} Quoted in Sidney A. Mosley, \textit{With Kitchener in Cairo} (London: Cassell and Co., 1917), 93. Mosley
mentions at some length the fact that at this time William Willcocks made himself very unpopular with the
Irrigation Department engineers for heavily criticizing their new drainage scheme. Willcocks believed, and
publically stated, that the best method of drainage was “drainage by zones” because the zones were a local
solution, and could take into account differences in water table, canal alignment, and geographical features.
\textsuperscript{111} Kitchener to Grey, 22 March 1913, No. 99 in FO 407/180, \textit{Further Correspondence Respecting the
Affairs of Egypt and the Sudan January to June 1913}, Foreign Office, British National Archives, Kew.
\textsuperscript{112} The Khedival Agricultural Society will be discussed at length below in relation to the creation of the
Agricultural Department.
A mere three years after construction was completed on the Aswan Dam, the Irrigation Department decided to raise the structure. Why was this? What had changed so momentously between 1902 and early 1905 that made the government draft plans to raise the Aswan Dam? As Terje Tvedt and Richard Coopey have argued, “the dam made the Egyptians more dependent on the Nile than ever before.” The Egyptian government, realizing their increased reliance on the river, came to the conclusion that there was both not enough water and not enough water at the right times of year.

Parcelling out specific amounts of water informed the government’s decision to heighten the Aswan Dam. The Egyptian Irrigation Department became convinced that they would not have enough water to supply summer water to Lower Egypt and transform Middle Egyptian irrigation from basin to perennial. In the words of William Garstin:

I have alluded to the assurance of the cotton crop in Lower Egypt against failure in years of bad supply. Such an assurance cannot, however, be considered as permanent until further water storage has been arranged for... In Middle Egypt, that locality has not hitherto drawn upon the reservoir for the full amount of water that must eventually be allotted to it. For some years, therefore, Lower Egypt has been permitted to utilize the surplus supply, and to profit by it to an extent that will be hereafter impossible, until such time as the amount stored has been largely increased.

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113 Benjamin Baker, 15 Feb 1907, “Inclosure 2, No. 41 in FO 407/170 Further Correspondence Respecting the Affairs of Egypt, January to June 1907, Foreing Office, British National Archives, Kew.
115 W. Garstin, March 1907, Inclosure 1, No. 41 in FO 407/170.
For the Irrigation Department, the priority was Lower Egypt, although Garstin wanted to extend perennial irrigation southwards to Middle Egypt. Since he personally had suggested that Middle Egypt was the place where the new perennial water could do the most good, as mentioned in Chapter 6, Garstin had his professional reputation at stake as well as the Department’s categorization of water.
Figure 10: Progress at Aswan (circa. 1933). Source: “The Second Heightening of the Aswan Dam,” Institute of Civil Engineers Library, London
For both Cromer and Garstin, the reasons for raising the Aswan Dam could be reduced to increasing the area under cultivation. Cromer presented this to the Foreign Office as benefitting the government indirectly, but the Egyptian people directly. However, the fiction that the government was working for the aid of the fellahin was quickly dropped. In his discussions of direct “gain,” to Egyptians, Garstin discussed the sale value of the lands, and the “average rental,” clearly not the issues of the fellahin.\(^{116}\) Although Cromer waxed poetic about the extra money left “to fructify in the pockets of the population,” Garstin’s discussion about increased rental values and the increased ability to buy and sell land undercut this assertion.\(^{117}\) Unsurprisingly, large landowners used the switch from basin to perennial agriculture in Middle Egypt to consolidate landholdings and increase rental rates.

Like previous irrigation projects, these nebulous gains were presented as specifically predicted statistics and monetary facts. In the official correspondence, Garstin bombarded the Foreign Office audience with numbers. One quarter of the water in Egypt came from the Aswan Dam. The average land rental, the Foreign Office was told, had increased from £E2.5-£E3 in 1901 to between £E4-£E5 in 1906. All the 404,470 feddans in Middle Egypt would be perennially irrigated by 1909, and increasing rentals to £E1,465,000.\(^{118}\) By quantifying the direct and indirect gains of the dam’s heightening, the government minimized qualitative concerns, such as ongoing

\(^{116}\) Ibid.

\(^{117}\) Cromer to Grey, March 1907, No. 41 in FO 407/170.

\(^{118}\) W. Garstin, March 1907, Inclosure 1, No. 41 in FO 407/170.
archaeological concerns, potential engineering difficulties, and the fact that the Aswan dam had only recently been constructed. In both Egypt and London, therefore, the new project had to be presented in terms of future numerical success.

The engineers certainly believed that qualitative concerns, such as those raised above should have been ignored, and the fact that they were able to convince the Egyptian government to heighten the dam has been accepted as an *ex post facto* argument by historians for its necessity.¹¹⁹ Such, however, qualitative concerns should not be automatically discounted. The Foreign Office might justifiably have confronted the Irrigation Department for the so-called necessity of raising the Aswan Dam just five years after its original construction. Only a few years into a 30 year repayment scheme, the Irrigation Department was already paying an annuity of £E.157, 226 for the original construction project.¹²⁰ The media’s publicity in 1902 had certainly not anticipated a need for heightening, and similarly, the Egyptian government’s plan must have seemed rather hasty. Cromer’s 1902 report mentioned that it was “probable” that Egypt would eventually need more water, but not immediately.¹²¹ As recently as 1903, the Foreign Office had affirmed in the House of Commons that “it is not at present proposed to make

¹²⁰ W. Garstin, March 1907, Inclosure 1, No. 41 in FO 407/170.
any alterations in the dam.”¹²² This is not to say that the British government was taken entirely by surprise. In 1904, Cromer recommended that the next work would be heightening the Aswan Dam. However, all considerations of raising the Aswan Dam disappear from the official FO “Further Correspondence” files between 1904 and 1907.

By early 1907 official British concerns had been laid to rest about the necessity of the proposed heightening. Benjamin Baker had, to the minds of the Irrigation Department, successfully negotiated the contingent local engineering factors that could not be predicted by universal mathematics.¹²³ Baker’s death in May 1907 did not prevent his designs from being implemented wholesale by the Egyptian Irrigation Department. Baker designed an independent structure with its own foundations attached to the original dam with steel rods. The dam and its new addition could be grouted together after both had dried and settled. He summed up his proposal with the confident statement that “any slight settlement of the new masonry or temperature differences of the same would thus not induce heavy stresses on the masonry of the existing dam.”¹²⁴ Baker’s concerns lay in the difficulties of attaching a new piece of masonry to the original dam during the hot summer months, since the new masonry would “shrink in [winter] time, and be a load rather than an assistance to the old work.” Again, his concerns reflected the absolute

¹²² “Question asked in the House of Commons,” 14 July 1903, No. 20 in FO 407/161.
¹²³ Smith, Centenary, 39.
necessity that the dam “would still remain not only strong enough, but stronger than any other important dam in the world.”

The ways that Baker and the Irrigation Department engineers arrived at their conclusions, reflected a changing set of standards for the engineering profession. Baker himself was born and raised in the same era as Colin Scott-Moncrieff, and therefore had a very different formative experience of engineering than the younger men who worked in the Egyptian Irrigation Department. Baker had worked through the British apprenticeship model discussed in Chapter 3, but his engineering epistemologies had evolved. His predominant modality was an appeal to the mathematics of dam construction that had been a mainstay of engineering that reflected early twentieth century ideas of engineering design. In accordance with the very latest engineering trends, Baker used models, including an “Indian rubber dam,” to determine that the stresses of heightening were more complex than had been earlier believed. However, his report also referred to his personal observations and personal experience: “[he had] inspected the dam and [had] seen... the shrinkage cracks in the masonry.” He also drew on a successful heightening of a dam on the Colombo in Sri Lanka. However, these individual experiences were secondary to contemporary engineering principles.

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125 B. Baker, 15 February 1907, Inclosure 2, No. 41 in FO 407/170.
128 Ibid.
As mentioned above, Baker used mathematical theories to understand where to place a dam. However, by the Edwardian era, these mathematics placed an increasing amount of emphasis on measurable standards and less on individual assessment. The criteria for finding a dam site, for instance, had changed significantly since the Technical Commission’s recommendations in 1894. The 1894 engineering requirements were simply the necessity of a wide and shallow section of river with a solid riverbed. Such standards were clearly open to a little interpretation. In 1907, by contrast, these three engineering considerations had been amended to include, according to A.L. Webb as head of the Irrigation Department:

a) A reach of river valley, inclosed by rising ground and not of excessive width, with a low gradient.

b) A foundation of sound hard rock at the downstream end of the reach.

c) A width of at least 1,500m for the sluices of the dam.

d) Height of dam, 20m above low water level.

e) Capacity of reservoir at least 1,000,000 cubic meters.

f) Depth of river channels at site not to be excessive.\(^{130}\)

This list of criteria, aside from being a lot longer, demonstrated a modified set of priorities, and one that set minimum requirements on the size of the reservoir and height of the dam. The requirements for a dam were predominantly the same: wide, shallow, with strong foundations. However, these requirements also incorporated the importance

\(^{129}\) Reports of the Technical Commission on Reservoirs with a Note by W.E. Garstin (Cairo: National Printing Office, 1894), 15.

of local conditions in the importance of a specific channel width for sluices. This represents, in the words of William Beinart and Lotte Hughes, an instance of scientists acting as both “generalizers and developers of local knowledge.”\textsuperscript{131} These criteria, therefore, also reflect a concern for the specific reservoir that would be formed, and the necessity of it feeding into the Aswan Reservoir. The precise conditions that the engineers believed they required were probably borne out of five years’ monitoring at Aswan: the slope of the riverbed and the rising ground of the valley – both ensured a shallow reservoir, but not so shallow as to lose much water to evaporation.\textsuperscript{132}

Despite the ability of the Irrigation Department to freely explore and assess Sudanese dam sites, they rejected four more at the second, fourth, fifth, and sixth cataracts between Wadi Halfa and Khartoum. The Dal rapids, at the second cataract, for example were rejected because the width of the river was not sufficient to pass the entire flood through sluices, the high hills on both sides meant that the river could not be widened, and finally, the river itself was too deep to allow good foundations.\textsuperscript{133}

Although most of the sites were rejected using surveys and data provided by the Sudan Irrigation Department, one final site at Shabluka was still plausible. In February 1907, Baker, Dupuis, Webb, and Lyons personally inspected the Shabluka site. Webb stated that Shabluka was finally excluded by observations at the site (specifically that the site was not wide enough and too deep). They also took a trip to Khartoum, where a dam

\textsuperscript{131} Beinart and Hughes, \textit{Environment and Empire}, 203.  
\textsuperscript{132} The irrigation engineers seem to have assumed that the Aswan Reservoir was the model for all reservoirs in Egypt, so their understandings of reservoirs may have been skewed.  
\textsuperscript{133} W. Garstin, March 1907, Inclosure 1, No. 41, in FO 407/170.
at nearby Shabluka would have raised the groundwater levels enough to turn Khartoum into a swamp, “and render it almost uninhabitable.” In his diary, H.G. Lyons, Inspector General of the Survey Department also described the trip, and similarly rejected it for engineering reasons. Lyons thought that the water would be stagnant and algae-filled, making Khartoum uninhabitable. He also worried about the height of water in the reservoir in comparison to when Egypt would need the reservoir filled.

In these sources Lyons made clear that he had not proposed the visit to Khartoum and Shabluka. “Told to go to Awan [on Feb.] 16th [1907] and to discuss Reservoir files and afterwards to... Shabluka with Baker and Webb.” This statement, taken with Webb’s ambiguous “it was determined,” implies strongly that the decision came from either Baker or Garstin. As discussed above, Garstin favoured personal investigation and reconnaissance to determine project sites. Lyons dutifully recorded “visited Shabluka gorge south end, stayed the night at Medeni rest house.” His lack of self-reflective engagement with the physical site strongly suggests that Lyons, at least, was unconvinced of the necessity of the engineers’ visit. Lyons was more interested in the age and type of the rock than the reservoir; all the criteria for a dam site seemed to be lacking, “and [the

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135 Lyons’ reasoning is not wholly explicit here. He states: “by end of October, when the reservoir must begin to fill the river on the average has not fallen to 374m on gauge.” Henry Lyons, 25 February 1907, Journal (17 June 1905 to 12 Oct. 1943), MS 570, Science Museum Library, Swindon.
136 Lyons’ Journal, 6 Feb. 1907, MS 570
137 C.E. Dupuis, as Inspector-General of Irrigation in the Sudan must have met Lyons, Baker, and Webb at Khartoum as Lyons makes no mention of Dupuis at the meetings in Aswan. Garstin had also made and discussed at length his several journeys along the Nile and its tributaries.
site] was rejected.” Indeed, the expedition’s travel plans seem like a necessary conceit (to a distant authority?), as the engineers visited Shabluka after deciding that the site was unsuitable.

Raising the dam would almost completely submerge the Philae Temples year-round. In Cromer’s words, the Society of the Antiquarians of London was “bound to enter a protest against any scheme that would involve the wholesale destruction of archaeological remains,” unless the scheme was “an absolute necessity.” Indeed, the Society of Antiquarians of London had already acted. At the first hint of a formalized raised scheme in late January 1907, the Society sent a formal protest to Cromer and a memorandum to the Times. The Society’s protest to Cromer stated that they could only accept the scheme “unless it be clearly demonstrated that the scheme is an absolute necessity for the well-being of Egypt, and that the same benefits cannot be obtained in any other way.” The repetition of language between the Society and Cromer suggest that the Egyptian government crafted their official response around the Society of Antiquarians’ protests. The Society’s protest may also partially explain why the engineers were physically sent to the Sudan: to demonstrate that the Egyptian government had done everything in its power to make sure that no other potential site was as good as Aswan.

The Egyptian government’s attempt to stymie archaeological protest does not explain why interested Britons accepted the decision. A number of factors probably

138 Lyons Journal, 26-27 Feb. 1907, MS570.
139 Cromer to Grey, March 1907, No. 41 in FO 407/170.
140 Quoted in George Latimer, “Proceedings of Archaeological Societies,” The Antiquary 3:3 (March 1907), 113.
contributed to the relatively toothless popular and media reaction. The archaeological societies were blatantly bribed to ensure their silence, and this silence contributed to the lack of British popular reaction. In the immediate aftermath of the official announcement of the government’s request to raise the Aswan Dam, the Egyptian government opened negotiations with the archaeological societies to conduct extensive surveying expeditions.\textsuperscript{141} In May, the Society of Antiquarians’ secretary for Egypt reported that the Egyptian government was prepared to “minimize the evil” by negotiating a full survey of the endangered ancient Egyptian temples, towns, and cemeteries. The government invited archaeological societies from across Europe to accomplish this, and by July, the archaeological papers in Britain announced that the Egyptian government was willing to spend £60,000 for this survey.\textsuperscript{142} Because the archaeological outcry had always limited itself to protesting the unnecessary destruction of the temple complex, the antiquarian societies found themselves without a rhetorical leg to stand on after the Egyptian Irrigation Department asserted that no other site was suitable to create a reservoir.

Other political circumstances in 1907 probably diminished protest against the Egyptian government.\textsuperscript{143} Less than three weeks after the Egyptian government approved raising the Aswan Dam on March 21, Cromer “acting on medical advice,” resigned as Consul-General on 11 April 1907.\textsuperscript{144} Cromer left Egypt under a political cloud, resulting

\textsuperscript{141} Lyons \textit{Journal}, 8 March 1907, MS 570.
\textsuperscript{142} “Proceedings of the Archaeological Societies,” \textit{Antiquary} 3:7 (July 1907), 243, 273.
\textsuperscript{143} Although there were a series of questions in the House of Commons about the proposed changes to the Aswan Dam, the majority of these questions were about whether or not tenders had been offered. These questions assumed that the dam was going to be heightened.
from continuing fallout from the Dinshawai affair in summer 1906. Then on 19 May 1907, Benjamin Baker died suddenly in Britain. Baker’s death made media critique of his engineering works much more difficult. As one anonymous obituary writer noted, “it is remarkable that his death should synchronize so nearly with the termination of Lord Cromer’s connection with Egypt.”

These unhappy coincidences meant that public protest against the raised dam was significantly dulled. One of the only negative references to the destruction of the Philae Temples came in a short, wistful article in *The Biblical World*. Although the two-page article stressed the submergence of Philae and the ruin of other monuments, the unnamed author was forced to admit, “the government has foreseen this dissatisfaction and has appropriated several hundred thousand [American] dollars for the investigation and conservation of the ancient remains.” Even this more critical article was, however, published in October 1908, a full year and a half after the government confirmed the flooding of the Philae Temples and monuments of ancient Nubia, and would seem to corroborate a reluctance to critique the retired and the dead. By fall 1908 the government’s engineering designs were well advanced.

The projects in Egypt after 1902 reflect a set of engineering priorities that emphasized the “scientific” nature of irrigation in Egypt. The Irrigation Department engineers sought to bring universal mathematical principles about hydrology and water

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145 See Chapter 4, footnote 94 for a brief description of the Dinshawai affair. The political effects from Dinshawai were long-term and undermined the British-occupation of Egypt.
146 “Literary Week,” *Academy and literature* (25 May 1907): 500.
control to bear on the river, the crops, and the people. As clearly demonstrated, the adaptability to current technological circumstances discussed in Chapter 5 had been completely lost in the engineers’ drive to control the Nile using a series of new barrages and dams. Universalist mathematical principles ruled everything from the rate of water seepage into the soil, to the amount of water needed to fill the Aswan reservoir. As this section has emphasized, total political and economic control over the agriculturalists was supposed to be a function of total Egyptian Nile control. As the next section will demonstrate, this assumption was increasingly questioned after 1902, and resulted in the creation of a Ministry of Agriculture.

7.4 Seeing like a Ministry of Agriculture

Up until 1910, the Irrigation Department was the only official government bureaucracy that dealt with agricultural policy. Beforehand, the mechanisms for agricultural policy, in contrast to those of irrigation policy, were informal, semi-official, or a series of haphazard legal measures dictated by Irrigation Department need. In 1910, however, the Egyptian government changed their fundamental policy on agricultural issues. By forming a Department of Agriculture, the government instituted a much more aggressive policy of agricultural control through a policy of applied science. This Department, placed under the auspices of Public Works, was expanded into a full...

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148 For the year 1911, boll worm measures were to include the creation of worm inspectors and subinspectors for each region. The sub-inspectors were able to work with the ‘umdas, shayks, and district governors to superintend the work of picking the infected cotton leaves and burning them. Ten thousand cultivators were prosecuted for not destroying affected leaves. Esmeir, Work of law in the age of empire, 228-230.
Ministry in 1913, and marks the consolidation of agricultural science in Egypt. Agricultural science was increasingly epistemologically distinct from the water delivery-based methods of agricultural control that the Public Works Ministry had been utilizing, and represents an Egyptian response to a wider British imperial developmental framework. This section will discuss the Irrigation Department’s transformation from providing a basic level of irrigation practice to predominantly irrigation technology, and concurrently, agricultural practices became the purview of the Department of Agriculture.

The Egyptian government pursued a self-consciously agricultural strategy of cotton management after 1911. The Egyptian state increasing committed itself to agricultural science as an parallel policy to water control. Irrigation projects were not less important, but the Irrigation Department stopped being the only official source of control over agriculture.

In the early 1900s, the Egyptian government began to regard its Irrigation Department as a provider of technologies rather than a manufacturer of agricultural control through irrigation practice, although this process represented a gradual drift rather than stated policy until 1910. The Irrigation Department was increasingly involved in building and designing large technologically-complex projects. Because of the number of personnel, and timeframe involved, the government evidently felt that the Irrigation Department was at least busy if not overtaxed. Institutionally, however, the Irrigation Department was still committed to the reconstruction of Egyptian irrigation, but had less and less authority over its practices. In 1910, for instance, C.E. Dupuis wrote in the
annual Irrigation Department Report that, “the ordinary routine work cannot be carried out satisfactorily with the sanctioned scale of permanent staff.” According to Dupuis, the Irrigation Department had to rely on undertrained temporary staff, which caused “a considerable degree of confusion.”

Overseeing perennial irrigation networks also took time and personnel for the Irrigation Department—since their system of perennial irrigation was so complex, and required a lot of numerical precision to administer, the engineers ended up monitoring carefully the water control mechanisms.

Several reasons explained why the Ministry of Agriculture was created to control agricultural practices. The first of these was the increasing certainty of the Egyptian government that its anemic drainage efforts were contributing to cotton problems. The efforts at effective drainage came under scrutiny after the construction of the Aswan Dam. In the early 1900s, the government became aware that lack of drainage was increasing the water-table levels, leading to the plants becoming waterlogged. The levels of subsoil water rose precipitously from 3-4m below the land in 1886-87 to about one meter in 1908. In his Annual Report in 1908, Gorst admitted that “a theory has recently been put forward that falling off in the yield [of cotton] is due to a rise in the level of the subsoil water in parts where there is insufficient drainage.” Gorst was convinced that cotton yields per feddan were decreasing (from about 5.55 kantars/feddan in 1895-1897 to 4.29 kantars/feddan in 1904-1906) however he laid most of the blame at the feet of the

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150 Richards, *Egypt’s Agricultural Development*, 74.
fellahin who over-cropped their fields.\textsuperscript{151} Since cotton yields represented the bottom line of agricultural success, this critique fell squarely on the short-comings of the Irrigation Department. Without making too much of the loss of face that the Irrigation Department suffered, it might be argued that Kitchener expected the Irrigation Department to focus on project design and development, and leave irrigation practice to agricultural scientists in the Department of Agriculture.

As both critics and the government admitted, the Irrigation Department was patently not equipped to handle cotton pests, seed quality, and improper rotations. All three factors were officially held responsible for declining cotton yields. Gorst was careful to state that the Irrigation Department had discouraged overwatering, but that they needed an Agricultural Department “to supervise operations against the cotton worm.”\textsuperscript{152} Critics outside the government were not as circumspect. In 1907, for instance, the \textit{Egyptian Gazette} wrote, “however eminent the irrigation engineers may be in their own profession, they are not agriculturalists, and are naturally pursuing their own policy without proper regard to agricultural consideration.”\textsuperscript{153} This article, from a publically critical newspaper,\textsuperscript{154} questioned the abilities of the Irrigation Department to deal with matters of \textit{agricultural} science, and their priorities in attempting to do so.

A series of environmental questions dogged the Irrigation Department, which they were seemingly helpless to solve. Poor floods between 1902 and 1907 demonstrated that

\textsuperscript{151} Gorst to Grey, 7 March 1908, No. 36 in FO 407/172.
\textsuperscript{152} Gorst to Grey, 25 March 1911, No.35 in FO 407/176, \textit{Further Correspondence Respecting the Affairs of Egypt and Soudan}, Foreign Office, British National Archives, Kew.
\textsuperscript{154} Mosley, \textit{With Kitchener in Cairo}, 91.
the Irrigation Department was not able to get as much water to the fields as was wanted at every moment. This led to the Irrigation Department pushing for a heightened Aswan Dam as a way to deliver the correct amount of water. Poor floods led to draconian flood rotations, which were not received well, but which the government proved were not responsible for declining cotton yields. In 1909, for instance, there was lots of water with a high summer Nile and high flood, but the cotton crop was still attacked by the cotton worms. Despite the presence of the sluices in the Aswan Dam, the fields were being overtaxed – three crops a year meant that the silty flood could not replenish all the nutrients leached out of the Deltaic soils by cotton crops. The Irrigation Department discouraged 2 year cotton rotations, but was not really equipped to prevent the cotton crop being grown every two years. Cotton seed deterioration was also blamed for declining yields. Despite the efforts of the Khedival Agricultural Society to distribute cheap “pure” seed, these efforts were limited. Their experts started looking into other varieties of long-staple cotton, and introduced the new types in small areas.

The Irrigation Department’s apparent inability to provide adequate drainage for cotton crops is probably inseparable from the creation of a Department of Agriculture, but the connection is not quite simple causality. According to historian Robert Tignor, the Egyptian government, firmly committed to its liberal economic principles of limiting

155 “Gorst to Grey” 25 March 1910, No. 46 in FO 407/175, Further Correspondence Respecting the Affairs of Egypt and Soudan 1910, Foreign Office, British National Archives, Kew.
157 “Gorst to Grey”, 25 March 1911, No. 35 in FO 407/176.
158 Owen, Cotton and the Egyptian Economy, 193-194.
government interference in economic matters, ignored the demands of the Khedival Agricultural Society and delayed creating an agricultural department.\textsuperscript{159} Tignor’s statement might be partially correct, but after Kitchener’s instalment as Consul-General and continuing problems with cotton production, the Department of Agriculture was enthusiastically embraced. In fact, in a list of proposals sent from the Egyptian General Assembly to the British government in 1907, the General Assembly listed creation of a Ministry of Agriculture as number eleven of fifty-four.\textsuperscript{160} Since the General Assembly was overwhelmingly composed of large landowners from the Delta, the Ministry of Agriculture must have been perceived as a boon to the influential classes in Egypt. In this political struggle, drainage became perceived (by both the Egyptians in government and the Britons) as a symptom of the issues with agricultural policy. Agricultural policy was conflated with cotton yields, which as mentioned above, were declining.\textsuperscript{161} The Irrigation Department was clearly unprepared to deal with some aspects of agriculture such as cotton seed deterioration, and cotton pests.

The Egyptian Irrigation Department, however, did not operate within a vacuum. International and national pressures on the Egyptian government also combined to push

\textsuperscript{159} Tignor, Modernization and British Colonial Rule, 229-230.
\textsuperscript{160} It is important, however, not to make too much of the placement of items on this list, as it is hard to see these proposals as being in any order. Number ten on the list was a proposal that the tax on date palms be abolished, and number nine called for a constitution. However, the mere fact that a Ministry of Agriculture was listed means that the General Assembly thought it was a useful proposal. “Egyptian General Assembly,” 8 March 1907, FO 371/245 No. 8478, Political Departments, General Correspondence, 1907, Foreign Office, British National Archives, Kew.
\textsuperscript{161} Roger Owen provides a good explanation for why cotton yields were declining between 1905-1913. His explanation balanced between the increasing water table, poor drainage, and cotton worm attacks, as well as the presentation of the figures themselves, which indicated a national average rather than cotton regions, and an unfavorable comparison between the particularly flourishing yields of 1895-1899. Owen, Cotton and the Egyptian economy, 195-196.
the Egyptian government to maximize the production of cash crops. Between 1898 and 1910 the Khedival Agricultural Society and the School of Agriculture were the only semi-official attempts to utilize agricultural science. The Agricultural Society was a nominally independent institution, not a governmental agency. However, they were increasingly treated as semi-official by Gorst and Kitchener. In 1908, the Khedival Agricultural Society brought information to the government attention confirming that cotton yields were decreasing from 5.55 kantars per feddan between 1895-1897 to 4.29 between 1904-1906.\textsuperscript{162} Between 1908 and 1911, the Khedival Agricultural Society monitored cotton yield, seed and variety usage and working experimental farms – and received government monies to continue their efforts.\textsuperscript{163} In 1910, the Society worked with the government directly by creating a program to provide better seed to large landowners. In that year, Gorst mentioned that the Society “continues to render most valuable assistance to the Government in the consideration of the many difficult problems which attend the \textit{cultivation} of cotton... its work produces results unattainable by a Government Department.”\textsuperscript{164} In this case, the “problems” were defined not as a water shortage, but rather with the practices of agriculture which had formerly been the province of the Irrigation Department. The final connection with the Agricultural Society and the government happened in 1911, when a Department of Agriculture was formed in

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\textsuperscript{162} Gorst to Grey, 25 March 1911, No.35 in FO 407/176.Gorst to Grey, 7 March 1908, No. 36 in FO 407/172.
\textsuperscript{163} Gorst to Grey, 25 March 1911, No.35 in FO 407/176.
\textsuperscript{164} “Gorst to Grey 25 March 1910, No. 46 in FO 407/175. My emphasis.
\end{flushright}
1911 when the Department took over “practically the whole of the scientific and inspectorate staff” of the Society.\(^{165}\)

The international context for the creation of the Khedival Agricultural Society was that British cotton mills were experiencing a cotton shortage. As America consumed more of its cotton, the Lancashire cotton industries pressed the British government to encourage African colonies to produce long-staple cotton. As the powerful lobby group, the British Cotton Growing Association (BCGA, formed 1904) not only pressed the imperial government directly, but utilized agricultural science to press plantation owners directly through provision of financial assistance, technical advice and free seeds.\(^{166}\) The BCGA was “completely immersed” in cotton supply, and solved supply problems through the techniques of burgeoning agricultural science.\(^{167}\) The BCGA was involved in promoting suitable cotton for the Lancashire mills around the empire, including the Sudan, the West Indies, and West Africa.\(^{168}\) This form of agricultural science epitomized epistemologies of universalism and reductionism. The reductionist tendencies of agricultural science strongly implied that all soils could be improved by utilizing a mix of the Nitrogen- Phosphorous-Potassium [NPK] elements in the soil.\(^{169}\)

\(^{165}\) Gorst to Grey, 25 March 1911, No.35 in FO 407/176.


\(^{167}\) Ibid., 118.

\(^{168}\) Serels, “Political landscaping,” 68.

\(^{169}\) As journalist Michael Pollan has argued in his work, that the reductionism inherent in reducing soil fertility to NPK, “fostered the wholesale reimagining of soil (and with it agriculture) from a living system to a kind of machine: apply inputs of NPK at this end and you will get yields of wheat or corn on the other end.” Michael Pollan, *Omnivore’s Dilemma: A Natural History of Four Meals* (New York: Penguin Books, 2007), 146-147.
The Department of Agriculture was, of course, not formed in isolation from the rest of the British Empire. Just as irrigation engineering was the cutting-edge of bureaucratic practice in the 1870s, agricultural science was becoming more and more accepted as a discipline in its own right in the early 1900s. British agricultural science, as discussed by G.B. Masefield and Richard Drayton was explicitly connected with the development of agriculture in the colonies, and was executed by first the Botanical Gardens (in both Kew and the Empire) and secondly with the Imperial Institute in 1893. African historian Joseph Hodge, in his *Triumph of the Expert* (2007), argues that the driving force behind an increasingly agricultural policy was to utilize the colonies for British development. In his words, “the Chamberlainite doctrine... linked colonial development abroad to social reform at home in an effort to solve the problems of industrial decline and surplus population in Britain... [Chamberlain’s development policies were] expansionary schemes to pry open the colonies for British investment... with science directing the exploitation of colonial nature.” By the early 1910s, in fact, Egyptian agricultural science was lagging behind developments in the rest of the empire.

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172 Chamberlain, as Colonial Secretary had presided over the creation of the Imperial Department of Agriculture in 1897. The Imperial Department of Agriculture was formed to conduct agricultural research towards the development of crop improvements, disease and pest control, and agricultural instruction, among other tasks. This institution was followed by the Indian creation of a Board of Scientific Advice in the early 1900s, whose goals also included the exploration and development of soil fertility and crop pests. Michael Worboys, “Imperial Institute: the state and the development of the natural resources of the Colonial Empire, 1887-1923,” in *Imperialism and the Natural World* ed. John M. MacKenzie (Manchester: Manchester University Press, 1990), 167; Roy MacLeod, “Advice for British India: Imperial Perceptions and Administrative Goals, 1898-1923,” *Modern Asian Studies* 9:3 (1975), 353.
In the early 1900s, the BCGA and the Imperial Institute worked with the Khedival Agricultural Society to fund its experimental cotton farms and soil fertility experiments.¹⁷⁴

Reinhard D. Schulze hints at another explanation for the creation of a Department of Agriculture. In his article, “Egyptian Peasant Rebellion” (1991) the Dinshawai incident in 1906 was a watershed moment in Egyptian politics. After Dinshawai, both the colonial regime and the Egyptian nationalist intellectuals “regarded [the peasant] as an object of politics... The regime promoted integration of the peasant communities into the colonial society through a more or less successful agrarian policy.”¹⁷⁵ Although Shulze does not elaborate on what he means by “agrarian policy” increased colonial scrutiny of the Egyptian fellahin was carried out by the Department of Agriculture after 1911 – at least it scrutinized the Egyptian peasants in a more comprehensive way than the Irrigation Department had been able to do. The Dinshawai incident also coincides closely with Egyptian calls for an agricultural ministry.

Another partial explanation for the changes in governmental policy was the changing personalities controlling Egypt. Cromer had been very much in favour of using public works as an indirect control on the economy. Sir Eldon Gorst, in his role as Consul-General between 1907 and 1911 was willing to listen to the Agricultural Society and therefore expand their role, but Lord Kitchener, RE, Consul-General between 1911

and 1914 heavily favoured state control. Kitchener had no compunctions about shutting down newspapers, and this attitude might be inferentially extended to a need for direct control over the *fellahin* and their agricultural decisions. As described in the previous chapter, Garstin was a forceful personality, committed to developing irrigation “science…at the service of British expansionism,” as his biographer Elizabeth Baigent has articulated. His successor, Murdoch MacDonald, by contrast, was apparently a different sort of man, courteous, shrewd and industrious, but “consistently subservient to the British Agent.” Although too much importance should not be ascribed to these personalities, British Egypt was epitomized by the personal style of governance, and it changed depending on the individuals in charge of government.

Each of the aforementioned explanations for the creation of an Agricultural Ministry provide part of an answer. Given the importance of cotton to this thesis, the explanations surrounding the declining cotton yields were probably of the uppermost importance to the Egyptian government, and had been recommended by two committees. However, the ability of the state to better “see” the peasants’ activities surrounding this all-important (and now apparently jeopardized) agricultural resource through formalized agricultural control mechanisms must not have been lost on Kitchener, whose military background inclined him to be supportive of direct mechanisms of control. Finally, the application of direct political pressure by the

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176 For a contemporary critical account of Kitchener’s consul-generalship, especially as regarded members of the press, see: Moseley, *With Kitchener in Cairo*, 181, 211-212.
177 Baigent, “Garstin, Sir William Edmund.”
178 Mosely, *With Kitchener in Cairo*, xiii.
financially influential BCGA meant that agricultural science, which was already being heavily promoted by the Khedival Agricultural Society, was adopted perforce.

As the Egyptian government instilled its Agricultural Department with political power to investigate the state of agriculture, rather than just cotton, they quickly took advantage of this mandate.\(^{180}\) Within two years of formation, the Department of Agriculture was examining all the other crops, farm animals, imports and exports of primary resources, and experimental cotton growth that the Irrigation Department had not had the personnel or resources to follow.\(^{181}\) In 1912, for instance, despite the appearance of cotton worm in 950,000 feddans, the annual report portrayed the department in a positive and proactive light – personnel were experimenting to see how best to grow and water cotton, and they were introducing parasites from the Indian cotton worms to kill Egyptian boll worms.\(^{182}\) In that year’s report, the Ministry of Agriculture received 6 pages of text, as opposed to the Irrigation Department’s one paragraph, which was firmly placed under the Ministry of Public Works. Such a comparison suggests the importance that Kitchener attached to his newest Ministry. By the 1920s, the Ministry of Agriculture had undertaken a series of different projects with a more self-consciously developmental purview. For instance, in 1923, a Cooperative Department was created within the

\(^{180}\) For one of the scientific reports see: Gerald C. Dudgeon, “The Problems of Cotton Cultivation in Egypt.” PRO 30/57/9 No.4, Kitchener Papers. Egypt 1891-1914, Domestic Files of the Public Records Office, British National Archives, Kew.


Ministry of Agriculture, in response to a call for governing a growing number of agricultural cooperatives.183

The Agricultural Ministry also continued its attempts to manage the cotton boll worm outbreaks. In 1911, for instance, the total area under cotton was 1,708,504 feddans, of which approximately 830,000 feddans were attacked by boll worms. It was also not the only policy undertaken during the cotton boll worm plagues. In Kitchener’s words: “in several provinces, every administrative official, including the rank and file of the police, was working in the fields encouraging or forcing the peasants to clear their crops [of worms].” The government also undertook scientific study of cotton pests and best varieties of seed.184

The beginnings of this developmental mandate began in the Department of Agriculture. According to Hodge, in the early twentieth century, “development” was “the means by which the state [through the use of science] might intentionally exploit and manage the natural, including human, resources of different regions.”185 Rather than a radically new program – for the irrigation engineers had been utilizing science to exploit and manage Egyptian natural resources since 1883 – the development projects of the early twentieth century targeted new subjects of knowledge. The Agricultural Ministry,

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185 Hodge, Triumph of the Experts, 42.
as Willcocks had predicted, quickly started examining the state of Egyptian agriculture, including records of other crops, agricultural animals, and railway usage.\footnote{Kitchener to Grey, “Annual Report for 1912,” 22 March 1913, No. 99 in FO 407/180.}

The Department of Agriculture’s knowledge was therefore somewhat different than the Irrigation Department engineers, but not substantially different in its effects – Egyptian \textit{fellahin} were still told what to do and penalized if they refused. Agriculture became involved in recommending the type of cotton seed, protection against cotton pests, and how best to plant – as well as how to water.\footnote{Kitchener to Grey, Annual Report for 1911,” 6 April 1912, No. 136 in FO 407/178.} In practice, this meant that the Department of Agriculture started producing circulars to be distributed widely, including one about planting cotton “included in every sack of cotton seed sold to the small cultivators,” and another about pests “publically read in the villages.”\footnote{Ibid.} The basic tone of these circulars can be inferred from a 1912 circular entitled: “The Reconnaissance before the battle. The Cotton worm, its destruction, and the best method of obtaining a good yield” (1911). The circular details not only how to get rid of the extant cotton worm, but also apparently preventative measures, including what seed to buy, time of planting, watering, and weeding. The government even recommended how to plant: “good land the spacing between the plants should be from 40 to 50 cm... The ridges should run from east to west so that the seed may be planted upon the south side of each ridge to protect the young plants from the cold north winds.”\footnote{“Circular 17: The Reconnaissance before the battle. The Cotton worm, its destruction, and the best method of obtaining a good yield,” 1911, PRO 30/57/9 No. 3.} The circular explained why the \textit{fellahin} should not overwater: “Remember that the water is given to the plant so that it may drink

\begin{itemize}
  \item \footnote{Kitchener to Grey, “Annual Report for 1912,” 22 March 1913, No. 99 in FO 407/180.}
  \item \footnote{Kitchener to Grey, Annual Report for 1911,” 6 April 1912, No. 136 in FO 407/178.}
  \item \footnote{Ibid.}
  \item \footnote{“Circular 17: The Reconnaissance before the battle. The Cotton worm, its destruction, and the best method of obtaining a good yield,” 1911, PRO 30/57/9 No. 3.}
\end{itemize}
it in through the roots... *If you wished to satisfy your own thirst you would only take enough water to do so; you would not keep your head under water for a long time and get drowned.* Why, then, should you flood your cotton so heavily at some times of the year?" However ham-handed, this language implies not only an attempt to prescribe but explain the recommended agricultural practice.

The Ministry of Agriculture, at least in the early years, was dedicated to define and extend governmental control over the Egyptian *fellahin*. This may have represented a governmental attempt to extend the usually temporally and geographically specific nature of irrigation practical control into a more unified and evenly-distributed set of measures governing agricultural behavior. Irrigation engineering was increasingly perceived by top governmental officials as necessary but that it did not provide enough guidance over agricultural practice.

### 7.5 Conclusion

Between 1902 and 1913, the Egyptian Irrigation Department was responsible for many large-scale public works projects. Aside from constructing two major barrages and heightening the Aswan Dam, the Department started the greatest transformation of Egyptian agriculture since the introduction of perennial irrigation in the 1820s. Although it increased tax revenue and allowed Egyptians to grow summer cash crops, the introduction of perennial irrigation into Middle Egypt also brought large-scale

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190 Ibid. My emphasis.
environmental degradation and increased the government’s scrutiny over that region, as well as the associated social dislocation involved in the loss of traditional irrigation practices. Large landowners, for instance, took over the newly reclaimed plots of land and created large-scale cotton with landless peasants becoming tenants or labourers.

In the Sudan, by contrast, the Irrigation Department was involved in setting limits on agricultural activities, monitoring, and “conceptually conquering” the entire Nile. Of course, these three activities were interconnected – the water monitoring and scientific experiments were the mechanisms utilized to conquer the river. As Mitchell has argued, the “ability to rearrange the natural and social environment became a means to demonstrate the strength of the modern state as a techno-economic power.” For the Egyptian Irrigation Department, this techno-economic power meant not only the ability to canalize and then irrigate the Gezira plain, but also prevent or limit the Sudan’s agricultural development according to Egypt’s water needs. The irrigation engineers, especially Garstin, placed pressure on the Consuls-General to negotiate for water rights to facilitate Egypt’s water needs.

Partially because of these other duties, the Irrigation Department was increasingly divorced from monitoring Egyptian fellahin. This came at a time when the all-important cotton crop grown per feddan was declining even as its acreage was increasing. Also because of apparent successes in other parts of the globe, the creation of an Agricultural

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191 Derr, *Cultivating the State*, 238.
192 Owen, *Cotton and the Egyptian economy*, 265-266.
Department therefore seemed to be the best way to focus on the *fellahin* and secure the cotton crop. Agricultural practices took on a new importance, and were identified as a new site of observation of the peasants by for the Anglo-Egyptian government.

Without belabouring the aforementioned point, the Irrigation Department engineers, with their frenzied pace of technological construction and consequent destruction of basin irrigation, seemed to be attacking “all natural and human barriers [which must] fall before the rush of production and construction.” In this way, the engineers became the “dark and deeply ambiguous figure that our age has come to call the ‘developer’.”\(^{195}\) As “developers,” the engineers (and increasingly agricultural scientists) brought their technological expertise to essentially a moral project – the attempt to transform the social practices of the *fellahin*. Until the basin conversion works began after 1902, on some level the engineers accepted the utility of basin irrigation as a sociotechnical system; afterwards, they declared war on local practices in Middle and Upper Egypt. Ironically, it was British civil engineers who were predominantly responsible for this attack. However, the Indian-experienced military engineers and their protégées had created the epistemological and technological framework within which these engineers worked as “developers.”

Chapter 8

Conclusion: A Vision of the Future

At points in his dahabiya journey, French traveller Pierre Loti (1850-1923) saw “green fields… the woods of palm trees, ... little oases… and above all the shaduf worked by men whose naked bodies stream with the cold water.” He contrasted these pastoral scenes with: “suddenly, at some bend in the river, the old Pharaohonic rigging disappears, to give place to the succession of steam machines… busy at the water drawing.” Loti used rapidity to convey the sense of abruptness that these machines created both in his individual journey and his era; he assumed that fellahin and their shadufs had been part of Egypt since antiquity. Loti’s description of the fin de siècle Nile evoked loss and incomprehension at juxtaposition of river and steam pumps, even though both technologies were accomplishing the same task.

It seemed to Loti that the Nile was a female slave, sleeping peacefully during the long regime of basin irrigation only to be roused by the modern world. The British had woken the Nile to bind her, to shackle her with machinery: “Poor poor Nile!... To be awakened from that disdainful sleep of twenty centuries and made to carry the floating

2 Loti was a French naval officer turned novelist who travelled through Egypt sometime between 1902 and 1907. His popular novels were known for their exoticism and descriptive prose, which was certainly evident in his account of the Egyptian journey, La Mort de Philae. By 1909, when his travelogue was published, Loti reported that the Aswan Dam was being raised to facilitate cotton cultivation. Ibid., 303. See Encyclopedia Britannica Online, s. v. “Pierre Loti,” accessed February 12, 2012, http://www.britannica.com.proxy.queensu.ca/EBchecked/topic/348535/Pierre-Loti.
barracks of Thomas Cook and Son, to feed sugar factories, and to exhaust itself in nourishing with its mud, the raw material for English cotton-stuffs.”

Loti’s Nile was a supine intelligence – mistreated yet powerless, perhaps even owing her very self-awareness to British malfeasance. Loti challenged the British “civilizing mission,” not because the British had awoken the Nile, but because they had proceeded to enslave it for their own purposes – tourism and manufacturing.

Although the British occupiers would have been insulted by his derisive characterization of the administration, they might have found common cause with his portrayal of the Nile’s spirit. Like the “paternalistic preservation and muscular modernization” debates about Philae, his travelogue, for all its attention to Egyptian “traditional” technologies, overlooked reactions from and actions upon the Egyptian cultivators. It was a supreme point of pride for the colonizers that the Nile being harnessed and put to useful work. The river became an abacus of crop-hydration in which its waters were divided into “shares” for distribution as needed. The precise amount of

3 Loti, Philae, 160. Loti’s precise description invokes similar wording to Yeats’ The Second Coming. Yeats’ words, “twenty centuries of stony sleep,” are eerily close, in translation at least, to a ‘disdainful sleep of twenty centuries.’ Other clear parallels could be made between Loti’s description of the chained river, and Kipling’s evocative description of the chained Ganges in his short story, “The Bridge Builders.” Kipling’s work, however, celebrated the engineers; Loti’s turns that on its head, and asked about what the colonizers were doing with their chained riparian forces of nature. William Butler Yeats, “The Second Coming,” http://www.potw.org/archive/potw351.html (accessed 8 November 2012); Rudyard Kipling, “The Bridge Builders,” http://www.gutenberg.org/files/2163/2163-h/2163-h.htm (accessed 8 November 2012).

4 Loti referred to the British and their occupation derisively. He saw Nile tourism as little more than “three-decked tourist boats… laden for the most part with ugly women, snobs, and imbeciles,” and the occupying British administrators as sanctimonious: “the tutelary Albion… [with sarcasm] the noble foreigners who have come to brandish there the torch of civilization.” Loti, Philae, 160, 279, 283.

work each water share was supposed to accomplish – as the water’s duty – became calculable, knowable, and the site of active intervention for the colonial state. In order to legitimize that intervention, the Irrigation Department engineers portrayed an idealized version of their expertise as the singular solution to Egypt’s water agricultural problems. Both Loti and the engineers agreed that “making Egypt” meant enslaving the great river.

Rather than treating the Nile as a slave or a water-delivery system, this thesis has sought to qualify and historicize the sentiments of the technocrats and the traveler. The British engineers attempted to persuade themselves, the British public, and the Anglo-Egyptian government that the river had been broken and yoked like a particularly obstinate beast of burden. The river’s water never quite went where the engineers wanted, and their attempts to “break” it only increased their dependence on large-scale irrigation technologies. These technologies were historical and geographical artifacts; their construction was never quite what the engineers designed, and the consequences were often unforeseen. In order to cover up their engineering inabilities, the engineers,

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6 Indeed, their apportionment of the Nile resembles not ‘training but vivisection. In maps of Egypt today, the Delta looks like a series of veins opened for vivisection. The network of canals is so extensive that the Damietta branch has entirely been replaced by short, ruler-straight lines. These lines obscure as much as they reveal about contemporary Egyptian irrigation, but the point remains that, like the Colorado, the Damietta does not run to the sea.

7 For a study about the rise of capitalism and unforeseen consequences, see: Albert O. Hirschman, The Passions and the Interests: Political Arguments for Capitalism before its Triumph (Princeton: Princeton University Press, 1977). It is from Hirschman that I borrow the importance of unintended consequences and unrealized expectations.
their Anglo-Egyptian administrative superiors, and an admiring British public cloaked the projects in the rhetoric of improvement, civilization, and development.\footnote{For an excellent summary of the public perceptions of Egyptian irrigation technologies, see: William Garstin, “Scrapbook of the Aswan Dam, 1902” ICE Archives UDC No. 627.82 (62), Institute of Civil Engineers Library, London.}

As this thesis has argued, Egypt-making through perennially irrigated agriculture became the Anglo-Egyptian government’s solution to the perceived necessity of increasing cash crop cultivation. That solution was built on a prevalent assumption about the primacy of water supply technologies instead of drainage technologies or irrigation practices. The engineers made a series of political decisions in bankrupt Egypt about how to ask the government for money for irrigated agriculture; these decisions centred upon proving that the cotton crop was increasing, and that the government would get more tax monies out of switching the irrigation system to perennially irrigated agriculture. The engineers perceived perennial irrigation as a modernizing system to develop rural Egypt and grow cash-crop cotton for Britain and British business. The engineers’ advocacy of the specifics of perennial irrigation was culturally constructed and derived from army engineering. These military engineers, and their civil engineer pupils, focused on the importance of adapting local large-scale technology and dismantling local irrigation practices. In the 1880s and 1890s, local practices were perceived as inefficient, corrupt, and as having been the political foundation upon which the Khedival governments operated. By removing these practices, the Irrigation Department engineers believed they were engaged in modernizing and civilizing Egypt along rational British imperial lines.
In both India and Egypt, public works bureaucracy and irrigation science stressed the importance of control over water and rural populations. Irrigation Department engineers’ efforts to modify irrigation practice concentrated on the introduction of controlling technologies and new legal definitions of when, where, and how much water could be drawn from the river or canals. Insidiously, the British administrators also endeavoured to divorce the *fellahin*, their lands, and their practices from the river. After the Egyptian government had made the worst abuses of nepotism, canal-clearance *corvée*, and the *kurbaj* illegal, the irrigation engineers were free to encourage contracted labour and capitalistic cotton production.

This thesis has emphasized technological lock-in: the Delta Barrage – the Egyptian Irrigation Department’s first large-scale construction project – represented an early commitment to empirical visions of water management. Once the Indian-experienced British engineers were locked into a system of perennially irrigated agriculture through state-funded large-scale technologies (dams, barrages, and reservoirs), they acted to ensure its deliberate extension to the rest of Egypt. Barrage renovation schemes tapped into long-held military engineering principles about the value of fiscal frugality and adaptability to local situations (regardless of whether those local

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10 Sugheiroun el Zain Sugheiroun says that without the high and low floods and therefore Egyptian seasons, the idea of time itself has changed. Quoted in Francesca de Châtel, *Water Sheikhs and Dam Builders: stories of people and water in the Middle East* (London: Transaction Publishers, 2007), 68-69.


The repair of the Delta Barrage raised as many questions as it solved, especially about reliance on the amounts of water and the necessity of delivering those quantities to the cotton-producing regions of the Delta. Their solution was to supply more water by creating a reservoir by building the Aswan Dam. The Aswan Dam project manufactured the desired water control and created the appearance of engineering expertise. The dam, as an entirely new engineering solution in Egypt permanently broke the engineers’ dependence on adapting extant local technology, but reinforced their commitment to imperial engineering science. The technology itself represented the first time that non-military influenced engineers had a significant amount of power over the form of Egyptian engineering. One of the longest-lasting consequences of the Aswan Dam was to buttress engineering, financial, and business connections with Britain while transforming the landscape around Aswan. Egyptian Irrigation Department engineers had looked to India and the Mediterranean region for their examples. Instead, by the late 1890s, the importance of Sir Benjamin Baker, the Institute of Civil Engineers, and the increasing prestige of British hydraulic science superseded the engineering importance of India.

After the Aswan Dam’s construction, the Egyptian Irrigation Department engaged in a radical conceptual reorganization of the Nile. “Total Nile control” hypothesized that the river started not at the Egyptian borders, but in central Africa and therefore that the solutions had been successful or not). The army engineers left their intellectual habits of thought deeply embedded within the technological/political structures of the empire; the militarization of the British Empire continued long after military campaigns ended.
tributaries of the Nile needed to be understood, scientifically measured, and put to useful work. Total Nile control was an expansion southwards of the Egyptian Irrigation Department’s political tendencies to construct large-scale technologies and quickly included utilizing the Gezira plain for perennially irrigated cash-crop cotton growth. In Egypt itself, the engineers pursued ever more ambitious water supply goals in order to more closely manage the Nile’s water and the people that used it. However, for a series of British imperial, scientific, and local reasons, the Irrigation Department focused its efforts on irrigation technologies and lost its exclusive control over irrigation practice. In place of irrigation practice, the Ministry of Agriculture (est. 1913) developed its own bureaucratic mechanisms designed to manufacture governmental power over a range of agricultural practices. This thesis therefore, ends with the changing role of irrigation in Egypt away from the primary mechanism for government oversight of rural water and agricultural management. Similarly, the Egyptian Irrigation Department itself changed from being dominated by Indian-experienced civil and military engineers to British-trained personnel and increasingly Egyptian engineers.

Nevertheless, the military engineers left their imprint on Egypt. Technological-lock in led to the second heightening of the Aswan Dam (1929-1933) and the eventual construction of the Aswan High Dam (1960-1970), along with a host of other projects designed to complete the management and training of the enslaved Nile. The second heightening of the Aswan Dam allowed the Egyptian government to complete
canalization of the entire country. After the High Dam, according to hydrologist Sugheiroun el Zain Sugheiroun, “North of Aswan the Nile no longer exists.” In the place of the Nile are a series of canals which supply over-year storage of the water.

Almost all scholars agree that the environmental costs are quickly becoming untenable in the face of an increasing Egyptian population and high density demographics along the river. Scientist Gamal M. El-Shabrawy states unequivocally, “the real question is not whether the Egyptians should have built the Aswan High Dam or not – for Egypt realistically had no choice – but what steps could have been taken to reduce the adverse environmental impacts to a minimum.” These environmental impacts range from the recession of Egypt’s coastlines to a massive loss of soil fertility, to increasing bacterial counts and phytoplankton blooms because of the pollutants from fishing boats in Lake Nasser/Nubia. Terrifyingly, a new river delta is forming south of the Aswan High Dam from the deposit of the red silt as the current slows down.

Hydropolitically, after the end of British rule in Egypt in 1922, the imperial doctrine of “total Nile control” became a liability for Egypt. Egyptian independence meant a de-coupling of the Sudanese state apparatus from Egypt, and an increasing

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14 Quoted in de Châtel, Water Sheikhs and Dam Builders, 68-69.
awareness of Egypt’s vulnerability upon the river system. The Nile Waters Agreements of 1929 and 1959, therefore, represented an attempt to codify and formalize the distribution of the Nile between the British-colonized Sudanese government, and the Egyptian government. Out of an annual average of 84 billion m$^3$, Egypt received 55.5 billion m$^3$ and the Sudan got 18.5 billion m$^3$. The Upper Nile basin countries did not receive formal “shares” of the water, and the Sudan does not utilize all of its allotted water, but Egypt uses all of its water and part of the Sudan’s. The Agreements secured the principles of current water use (in Egypt) as more important than future potential (in the Sudan and other Nile Basin countries) and were entirely favourable to Egypt’s water needs. However, the water that currently flows into the Mediterranean Sea is recycled an average of three times; on a per capita basis Egypt’s population faces water scarcity.

Through their technologies and water policies, British irrigation engineers enacted the imperial priorities of cotton growth, liberal economics, and water control. Engineering and public debates about large-scale, technologically-dominated, perennially irrigated agriculture focused on engineering science. Although the engineers were conscious of possible environmental repercussions such as poor drainage, soil salination, desertification, waterlogging, and worms, they were confident that imperial science could solve local problems. In the final analysis, although the engineers were aware that they might be locking Egypt into an unsustainable irrigation system, environmental and

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Hydropolitical concerns were ancillary to engineering design. All of these issues have plagued the Egyptian state during the 130 years since the British army invaded Egypt, and those who take power in Egypt will have to manage continuing environmental repercussions.

Although none of the engineers discussed in this dissertation could be considered great critics of empire or their own engineering projects, William Willcocks was probably the single most brilliant, and certainly the most critical of the Egyptian Irrigation Department. Willcocks sounded a warning about the system that he had helped to create. He contrasted basin and perennial irrigation in the following terms:

> Basin irrigation, ‘could defy time and defy neglect’ perennial irrigation “will only be able to flourish while Egypt enjoys peace within her borders... [because it] needs perpetual and constant attention; it is typical of the structures of our days, the dams and weirs on the Nile, which need unremitting toil and observation to preserve them from destruction.”

Willcocks’ words epitomized nineteenth century modernism: a clear-sighted vision that exposed the contradiction at its foundations. The irrigation structures were inseparable from the engineers’ attempts to retain their power. If, as Ken Alder has theorized, the assumptions of a technological system are those of its creators, the “perpetual and constant attention” was intentional. Willcocks’ comments certainly implied a degree of self-reflexivity because he was instrumental in the design and implementation of the

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20 William Willcocks, “Egypt Fifty Years Hence,” (Cairo: National Printing Department, 1902), ICE Tracts 8 V.596, No. 5, Institution of Civil Engineers Library, London, pg. 4-5.
technological system’s most important building blocks: the Delta Barrage and the Aswan Dam. Willcocks’ intentions also highlight that other great hallmark of nineteenth century modernity: the willingness to fight to change the world.\textsuperscript{21} What the engineers changed the world into, however, was what was politically expedient at the time. Their vision of the future, while bequeathing the legacy of “unremitting toil and observation” did not account for the possibility of a world without the British Empire.

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