

**River as Resource and Land to Own: The  
Great Hydraulic Transition in Eastern India**

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**FINAL DRAFT**

**River as Resource and Land to Own: The Great Hydraulic Transition in Eastern India**

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*The Drowned World* by J.G. Ballard was published in 1962. A novel that today seems strikingly clairvoyant. Central to the plot is an extreme climate event (prolonged solar storms), causing the Arctic ice cap to melt. Europe rapidly dissolves into a trembling lattice of lakes, lagoons and creeks, with spectral green waters overwhelming all but a few buildings in erstwhile London city. Environments now shaped by unrelenting dissolution, clouds of steaming heat, corrosive humidity, thick coiling vegetation and vast lacustrine expanses pocked with silt flats; habitats that zealously multiply water-snakes, iguanas, crocodiles and alligators. This lagoon ecology — an admixture of fecund soil and life-teaming water — maroons man and only grudgingly gives to a few anomalous species of birds. In such a 'zone of transit' between gill-breathing fish and air-breathing mammals, the amphibian acquires ascendancy. Reptiles, recalling Triassic deep time, emerge as the dominant species with all the 'implacable hatred that one zoological class feels towards those that usurped' them during the Paleocene — the 'early dawn of the recent'.

Narrated as a gripping tale about habitat relapse, specie regression and the cataclysmic rewinding of social time, *The Drowned World* asserts a strong version of ecological evolutionism. A belief that Nature cannot move sideways or in sudden punctuated spurts but uncurls in linear paths.<sup>1</sup> Accordingly, to advance is to move from lower to higher forms or the simple to the complex, with hierarchies invariably defining and shaping ecological orders. In such a one-way evolutionary street, ironically, hurtling backwards becomes the only other possible countermovement to progress. Nature and culture, hence, can either ascend or descend in a time-

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<sup>1</sup> For two recent exhaustive treatments of the shifts in ecological theory see Mark Sagoff, 'Muddle of Muddle Through? Takings Jurisprudence meets the Endangered Species Act' *College of William Mary Law Review*, 38(3), 1997, pp. 825-993 and Ian Scoones 'New Ecology and the Social Sciences: What prospects for a Fruitful Engagement?' *Annual Review of Anthropology*, 28, 1999, pp.479-507.

tunnel. Lagoons, therefore, by overrunning Europe, for Ballard, signalled not merely dramatic environmental transformation but, more pointedly, suggested that ecologies can regress and reverse social time.

Marshes, swamps, fens or bog ecologies, in fact, had profoundly influenced modern European environmental and agrarian imaginations. Whilst, on the one hand, these soil-liquid hybrids were dominantly held as uninhabitable and treacherous places, on the other, they were harnessed as great outdoor laboratories for fabricating ideas on agricultural ‘improvements’.<sup>2</sup> Between the 16<sup>th</sup> and 17<sup>th</sup> centuries, innumerable drainage, reclamation and embankment campaigns were carried out in northeast Italy, the lower Loire, East Anglian Fenlands and the coastal deltas in the low countries (Netherlands).<sup>3</sup> Pumps, dredging devices, locks and sluices were deployed in many an arduous attempt at transforming once soluble and precarious waterscapes into firm and durable landscapes. Interventions spurred onwards and surmised by a Venetian hydrologist as the divinely decreed quest for effecting ‘separations’ between ‘water and land, between fresh and salt waters, between clear and turbid flows, between individual channels, between lagoon water and river water and between city and terraferma’<sup>4</sup> In effect, through a steady chain of such separations chunks of European territory were dried out and settled as agricultural lands. Water, in contrast, began to be treated as flows and increasingly sought to be contained in river channels.

The splitting of soils and fluids into discrete domains, however, prompted a decisive economic and technical divergence. Land exorcised of water was transformed into property, to be then elaborated as socio-economic-legal objects. Flowing waters telescoped into contained channels, on the other hand, were revealed principally as engineering visions. Efforts to retain flows in bounded channels, with the ‘geometrical precision of an aqueduct’, became realms for

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<sup>2</sup> Denis Cosgrove and Geoff Petts (eds), *Water, Engineering and Landscape: water control and landscape transformation in the modern period*, Belhaven press: London and New York, 1990.

<sup>3</sup> See Keith Lindley, *Fenland Riots and the English Revolution*, Heinemann Educational Books: London, 1982; Johan van Veen, *Dredge Drain Reclaim: The Art of a Nation*, *The Hague: Martinus Nijhoff*, 1962. Denis Cosgrove, ‘Platonism and Practicality: hydrology, engineering and landscape in sixteenth-century Venice’, in Denis Cosgrove and Geoff Petts (eds), *Water, Engineering and Landscape: water control and landscape transformation in the modern period*, Belhaven press: London and New York, 1990, pp.44.

<sup>4</sup> Denis Cosgrove, ‘Platonism and Practicality: hydrology, engineering and landscape in sixteenth-century Venice’, in Denis Cosgrove and Geoff Petts (eds), *Water, Engineering and Landscape: water control and landscape transformation in the modern period*, Belhaven press: London and New York, 1990, pp.44. The Venetian hydrologist in question is Nicolo Zen.

the ‘specialized skills of the surveyor, cartographer, military engineer and architect’.<sup>5</sup> That is, Europe’s modern transformation of its lands into exclusive ownership was simultaneous with the emergence of new methods for water control. Put differently, land as permanent property emerged as the fixed and stable opposite to the impermanence of currents, ebbs, volumes and flows.

From the early 16<sup>th</sup> century onwards, spurred by the logic of separations, many a European river was channelized, shortened, dredged, embanked and straightened; eliminating in the process a vast number of meanders, bends, loops, braids, adjoining wetlands, marshes, swamps and other forms of water-soil admixtures. These ‘river improvements’, as canalized flows, were intended to compete against or, if not entirely, supplant the cumbersome and ponderous movement of wheeled traffic on highways. Waterways, thus, with their smooth and relatively frictionless liquid surfaces were designed to serve as the cheapest and quickest means to heave across enormous quantities of merchandise and manufactures.<sup>6</sup> These channelized rivers, calibrated as arteries for trade, however, principally served as technical arrangements to circulate the economy of land. That is, water was rationalised chiefly as communication, transport and movement rather than as a site for production. Put differently, waterways became a lubricant to connect markets for produced commodities. Canalized rivers, unlike cultivated fields, involved the technical rearrangement of flows by a systems of locks, dredged beds to adjust depth levels and dikes and dams to sustain navigable waters.

Here, in order to explain why it would be important to treat canalised rivers, in the early modern period, as technical arrangements rather than as economic resources, I briefly detour, mid-stream as it were, to echo Andre Gorz’s apt discussion on economic rationalisation. In *Critique of Economic Reason*, Gorz suggests that the transformation of ‘work’ into capitalist ‘labour-power’ involved a complex and contentious set of interventions in order to recalibrate the social body of the worker as a productive force. For Gorz, this implied the troubled quest to make the ‘cost of labour calculable’, so that labour power could become a ‘quantifiable material unit’.

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<sup>5</sup> Denis Cosgrove, ‘An elemental division: water control and engineered landscapes’ in Denis Cosgrove and Geoff Petts (eds), *Water, Engineering and Landscape: water control and landscape transformation in the modern period*, Belhaven press: London and New York, 1990, p.6.

<sup>6</sup> See Reed G. Geiger, *Planning the French Canals: Bureaucracy, Politics and Enterprise Under the Restoration*, University of Delaware Press: London, Newark and Toronto, 1994; L.T.C. Holt, *Navigable Waterways*, Longmans: London, 1963 ; Pierre Claude Reynard, ‘Charting Environmental Concerns: reactions to Hydraulic Public Works in Eighteenth-Century France’, *Environment and History*, 9(3), August 2003, pp.251-273 and Marc Chioc, *The Rhine; An Eco-Biography, 1815-2000*, University of Washington Press; London and Seattle, 2002.

...workers would enter the process of production stripped of their personality and individuality, their personal goals and desires, as simple *labour power*, which was interchangeable and comparable to that of any other workers and which served goals which were not their own and, moreover, meant nothing to them.<sup>7</sup>

Thus, Gorz suggests that interventions through the logics of economic rationality became critical to dissolving pre-capitalist livelihoods and work rhythms; attempts involving the ‘constant effort to separate labour, as a quantifiable economic category, from the workers themselves’.<sup>8</sup> Put differently, the modern industrial worker could only be measured, assessed, evaluated or formulated as costs upon his labour power being separated from him through the process of economic rationality and scientific quantification.

Along similar lines, I suggest in this paper that an entire range of economic, legal and quantitative calculations had to be brought in concert in order to disclose rivers or water as modern resources. Technical arrangements such as dams, dikes or canals from the 16<sup>th</sup> century in Europe, therefore, whilst marking new technological moments in harnessing rivers were nevertheless elements to an evolving template for the latter’s rationalization as an altogether new economic force. Attempts to achieve truly modern flows, in fact, had to await the invention of modern irrigation. First elaborated by colonial engineers in the British Empire’s territorial acquisitions in the Indian sub-continent, modern irrigation aimed at delivering water as calculable, interchangeable and comparable units.<sup>9</sup>

The English East India Company, through a clutch of spirited military engineers, initiated a radical break in both technique and hydraulic principle by introducing perennial canal irrigation. For the first time in British India, permanent head-works in the form of barrages and weirs were thrown across river-beds and their waters diverted through extensive canal systems. These barrages and weirs were equipped with a series of shutters to regulate flows by impounding water during lean seasons and diverting it into canals and on the reverse the former could be flipped open to release

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<sup>7</sup> Andre Gorz (translated by Gillian Handyside and Chris Turner), *Critique of Economic Reason*, Verso: London, New York, 1989, p.20.

<sup>8</sup> *Ibid.*, p.21.

<sup>9</sup> On British colonial irrigation engineers see Joyce Brown, ‘A Memoir of Colonel Sir Proby Cautley, F.R.S., 1802-1871, Engineer and Palaeontologist’, *Notes and Records of the Royal Society of London*, 34.( 2), 1980, pp. 185 -225; R. A. Buchanan, ‘The Diaspora of British Engineering’, *Technology and Culture*, 27( 3) , 1986, pp. 501-524. Also see Ian Stone, *Canal Irrigation in British India: Perspectives on Technological Change in a Peasant Economy*, Cambridge University Press: Cambridge, 1985, pp.60-7 & pp.348-49.

waters during periods of the river's peak discharges.<sup>10</sup> In effect, by impounding the river's variable flow regime at certain points along its course, irrigation was transformed from a seasonal to a perennial possibility.<sup>11</sup> This phase, often referred to as the advent of the era of modern irrigation,<sup>12</sup> witnessed the construction of several large perennial canal irrigation schemes with permanent head-works such as the Ganges Canal (1854), the Godavery canals (1852) and the Krishna canal systems (1855).<sup>13</sup>

Explaining the varied impacts of these gargantuan projects, however, will not detain us in this paper. Instead, I will take a less travelled road: notably, debating the inadequate characterisation of South Asia's modern hydraulic moment: marked as a movement towards sturdier and centralised water technologies.<sup>14</sup> Instead, I will argue that the hydraulic divergence between what has been termed as the modern and the traditional in British India was not centrally about technology. Rather, in step with the philosopher Martin Heidegger's (1889-1976) instructive contention that 'the essence of technology is by no means anything technological'<sup>15</sup>, I argue that hydraulic modernity in South Asia was assembled by forcing a series of separations between land and water through the rubric of economic rationalisation. In this modern arrangement, land was classified as property and water termed as resource. It was only by thus rendering land and water into discrete domains could a wave of new water technologies and techniques be deployed to constitute a modern ecological and productive regime. Through a series of snapshot debates, this paper will discuss the many

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<sup>10</sup> Herbert M. Wilson, *Irrigation in India*, Daya Publishing House, New Delhi, 1989, (Reprint, First published 1903), pp. 78-81 and D.G. Harris, *Irrigation in India*, H. Milford, Oxford University Press: London, 1923, pp.5-7.

<sup>11</sup> According to Joyce Brown, Sir Proby Cautley was "the father of the perennial canal system in northern India"; see Joyce Brown, 'A Memoir of Colonel Sir Proby Cautley', p.52.

<sup>12</sup> See Sandra Postel, *Pillar of Sand: Can the Irrigation Miracle Last?*, New York, 1999, pp. 40-64.

<sup>13</sup> Following the 'sepoy mutiny' of 1857, the Indus river system was over-run by a series of irrigation schemes. Beginning with the Bari Doab canal (1859) and the Sirhind system (1882), the drive climaxed with the 'most ambitious' irrigation project of the colonial period- the Triple Canal Project (1916). For studies on colonial irrigation history in the Punjab see Imran Ali, *The Punjab Under Imperialism (1885-1947)*, Oxford University Press: New Delhi, 1988, and for a broad overview of irrigation in the colonial period see Whitcombe, Elizabeth (reprint, 1984), 'Irrigation', in Dharma Kumar (ed.), *The Cambridge Economic History of India, C.1757 - C.1970*, vol. II, Orient Longman, Hyderabad. pp.677-732.

<sup>14</sup> To take but one example, Nirmal Sengupta argues that the 'traditional' or 'indigenous' can be separated from modern irrigation systems by the difference in their participatory character. While traditional systems require extensive participation and cooperation amongst its users, modern systems are governed by formal and centralised bureaucratic management. This distinction, however, tends to convey the impression that systems prior to British rule were rooted in democratic decision making and principles of equity. A claim that ignores caste practices in water distribution or the use of forced labour in repair and maintenance. Secondly, it is sometimes difficult to draw a hard and fast line between traditional and modern irrigation technologies as several modern schemes have incorporated technical aspects from pre-existing structures. See Nirmal Sengupta, *User Friendly Irrigation Designs* (New Delhi, 1993), p.10.

<sup>15</sup> Martin Heidegger, *The Question Concerning Technology and Other Essays* (Trans. William Lovitt), Harper & Row: New York, 1977 (First Published 1953), p. 4

attempts of the English East India Company to separate land and water in Eastern India. These initiatives were aimed at making the Bengal delta legible and calculable for colonial rule and thereby heralding what I refer to as the great hydraulic transition.

### **Shifting Heads, Shoals and River Improvement**

Our first snapshot, concerns the East India Company's encounters with rivers in the district of *Nadia* (in modern West Bengal). What came to be treated as the administrative district of *Nadia* in the colonial period was observed to be crisscrossed by several flailing fluvial arms that erupted directly from the main stem of the Ganges (notably the *Bhagirathi*, *Jalangi*, and *Mathabanga*).<sup>16</sup> In one of the first references in 1813, it was recorded that the Company administration had entrusted the 'improvement' of the Mathabanga to the offices of the Collectorate and the local police department. And by way of improvement, the tasks listed were the regular clearing of the bed of the river channel from sunken boat wrecks, loose timber and large trees.<sup>17</sup> Such clearances, it was reasoned, would make the river safe for navigation. In 1818, however, the 'obstructions' were deemed to have become so dangerous that innumerable boats were wrecked and costs, on account of demurrage paid for detention of cargo laden ships, spiralled. The merchants of Calcutta, in that year, also urgently petitioned Government, that steps immediately needed to be taken to remedy the 'evil from which commercial interests suffered so severely'.<sup>18</sup> Subsequent to these developments, one Mr. C.K. Robinson was appointed Superintendent (Spdt.) and Collector of the Mathabanga and commenced his duties in winter season of 1819-20. In January 1820, a toll office was established at Kissenganj, aimed primarily at recovering the now rapidly mounting expenses for river improvement.

The pursuit of river improvement, however, increasingly pushed the navigation establishment into more troubled and muddied depths. From initially simply clearing obstructive logs and capsized boats from the channel, the EEIC officials began to debate the need for making

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<sup>16</sup> *Selections from the Records of the Government of Bengal Relating to the Nadia Rivers (From 1848 to 1926)*, Calcutta: Bengal Secretariat Press, 1931. (henceforth *Nadia River (1848-1926)*)

<sup>17</sup> 'Notes on the changes of the heads of the Mathabanga river since 1825' compiled by Mr. S. C. Sur, Executive Engineer, Nadia Rivers Division, in, *Nadia Rivers (From 1848 to 1926)*, p.35.

<sup>18</sup> Report on the Nuddea Rivers and the advantages derived from the measures annually adopted for facilitating their navigation. No. 89, dated Kishnaghur, the 14<sup>th</sup> July 1848. From Captain John Lang, 36<sup>th</sup> Regiment, Bengal N.I., Officiating Superintendent, Nuddea Rivers. To The Officiating Superintending Engineer, Lower Provinces, in *Nadia River (1848-1926)* pp. 72-89.

the often times moody and capricious currents more stable and predictable. Driven thus, Mr Robinson, sometime in 1820 itself, sought to divert a part of the current of the *Como* (*katcheekatta*) river into the Mathabhanga by erecting an embankment across the former and running its waters down a canal and into a cut made into the latter.<sup>19</sup> The embankment, unfortunately, immediately gave way and was followed soon enough by Mr Robinson being ejected from the responsibility, with the position of Spdt. now being given to one Mr May in June of 1820.<sup>20</sup> Mr May, in time, became the longest serving Spdt. for the Nadia rivers (1820-1840). And in the course of his turbulent twenty odd years of service, Mr May grimly wrestled with the recurring challenges that were thrown to the EEIC administration by the truculent rivers of the delta.

In particular, was the growing realisation that the flows of the Nadia rivers would regularly wax or wane in either extremes rather than maintain a steady volume. Such fickleness was complicated further by the fact that the entrances or 'heads' from which these rivers respectively drew their waters from the Ganges regularly shifted. Thus, in virtually every season the very character or nature of the river's channel could be substantially altered, often by cutting an altogether new path or channel. In 1823, for example, at the head of the Mathabhanga, a series of shoals<sup>21</sup> rapidly emerged and threatened to disrupt navigation. Mr May in an attempt to keep the river open for shipping, spent £1,040 to remove the shoals by employing dredging machines worked by oxen. Amidst these onerous efforts, however, the Ganges suddenly flexed and deposited 'masses of sand' onto the Mathabhanga's head and thereby forcibly brought the dredging machines to a complete halt. Having thus suffered a complete rout, Mr May was caused to wearily 'remark 'that the constant changes in the course of the Ganges rendered it almost impossible to keep the heads of the Mathabhanga and Jalangi fixed.'<sup>22</sup> In fact, in no two seasons had he ever seen the heads of these rivers in the same position.

Besides carrying out regular dredging operations, aimed to flush out shoals by physically stirring the muddy waters, the navigation establishment had also advocated *bandalling*. As a device, the bandal was ingenious; it comprised a set of fixed vertical screens mounted on a frame. Typically, the screens were made of bamboo mats and the frames consisted of bamboos driven into the river bed. These bandals were placed at an angle to the flowing current so that the water near the

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<sup>19</sup> Ibid., p.73.

<sup>20</sup> 'Notes on the changes of the heads of the Mathabanga river since 1825', pp. 34-38.

<sup>21</sup> Shoals: A sandy elevation at the bottom of a body of water constituting a hazard for navigation.

<sup>22</sup> 'Notes on the changes of the heads of the Mathabanga river since 1825', p.35.

surface got deflected on hitting the screens, whilst the heavier sediment-laden water that was ponderously moving near the depths of the channel passed more or less perpendicularly under the screens.<sup>23</sup> The intended result from the bandal was to at first increase the velocity of the current within the channel before then being able to guide the flows elsewhere.<sup>24</sup>

The Nadia river's navigation establishment also constructed minor dams and carried out cuts into the banks of rivers in order to move waters between channels; all efforts intended in the final scheme of things to enable the river bed to carry enough draught for shipping. Many of these efforts, however, often came to grief. The Bhagirathi river, despite many such interventions, it was observed, had upwards of 23 shoals developing in 1830 near its entrance and between 1826-27 to 1830-31 could not be navigable in the dry season.<sup>25</sup> But paralleling the perplexing concern with maintaining the river's depth and volume for navigation was the equally troubling consequences when these fluvial forces began to 'encroach' upon the land. In particular, noted Mr. May, the 'mischief' arising when trees being allowed to stand near the edge of the rivers banks. When the rivers shifted their banks, these trees were simply dragged into the river's raging torrents. Much of these obstructions, in the opinion of Mr May, in fact, could have been stopped by the cutting and disposal of the trees in advance. Given, however the 'aversion of the Hindoos to cut the Peepul and Bur (Banyan)', he irately declaimed, these large trees were simply left standing perilously at the edges of the fast eroding banks until they were ultimately gulped by the dreary current and lodged dangerously in the river's bed, much unsurprisingly to the detriment of shipping.<sup>26</sup>

The trying nature of the routines and the relentless ratcheting upwards in the requirements for keeping the Nadia rivers navigable was made vividly visible by Mr May in a statement of accounts submitted to the Military Board in early 1833. In it, Mr. May furnished a list of works that had been aimed for the past three years at improving the rivers:

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<sup>23</sup> Jansen, L. van Bendegom, J. van den Berg, M. de Vries & A. Zanen, *Principles of river Engineering; The non-tidal alluvial river*. Pitman, London, 1979. Also see C.V.J. Varma, K.R. Saxena & M.K. Rao, eds., *River Behaviour, Management and Training* Central Board of Irrigation and Power, Publ. No.204, Vol.I, New Delhi, 1989.

<sup>24</sup> Report on the state of the Bhaugirutty and Jellinghee Rivers between the Ganges and Nuddea, with the result of the means used to improve Navigation during the dry season of 1847-48., in *Nadia Rivers (From 1848 to 1926)*, p.90.

<sup>25</sup> 'History of the Bhagirathi river compiled by B.R. Haldar, Executive Engineer, Nadia Rivers Division' [6<sup>th</sup> September, 1925], in *Nadia Rivers (From 1848 to 1926)*, p.2.

<sup>26</sup> Report on the Nuddea Rivers and the advantages derived from the measures annually adopted for facilitating their navigation. No. 89, dated Kishnaghur, the 14<sup>th</sup> July 1848. From --- Captain John Lang, 36<sup>th</sup> Regiment, Bengal N.I., Officiating Superintendent, Nuddea Rivers. To----- The Officiating Superintending Engineer, Lower Provinces., in *Nadia Rivers (From 1848 to 1926)*, p. 72.

Bandhals constructed .....	359
Sunken Boast removed .....	118
Ditto trees and timbers ditto.....	219
<i>Pucca</i> [permanent] buildings pulled down .....	12
Trees cut down on the banks .....	1,731

Mr May, nevertheless, besides flatly revealing what was clearly a formidable list of interventions and expenses also felt it pertinent to acknowledge in the very same account that ‘ it was impossible to lay down any fixed rules of guidance or plan of operations; by which the navigation of the Nuddea rivers could be permanently maintained’. A claim that was followed by concluding somewhat glumly that after almost 13 years of experience of handling the unpredictable inundations ‘no assurance that the measures adopted for mitigating or repairing the evils of one season would be of the least avail in the ensuing one’.<sup>27</sup>

In the dying years of the EEIC presence in the Bengal delta, Mr. May’s prescience seemed to have been redoubled in the pronouncements of one Major J. Lang who had summed up on similar lines in a comprehensive report submitted in 1854 entitled *Memorandum on the Ganges and the Nadia Rivers*.<sup>28</sup> In the report, Major Lang noted in a forceful tone ‘that the deepening or shoaling of a channel, in many cases, indicates nothing more than a change in the distribution of the water, and are, of themselves, no criterion of the improvement or deterioration of a river.’<sup>29</sup> He then concluded with seeming clarity that the real problem of the delta’s rivers lay with the fact that it was ‘the vast disproportion between the supply of the inundation and that of the dry season that the real evil lies.’<sup>30</sup> Put differently, navigation meant that the river channels were meant to be stabilized as flows to be contained in fixed channels and treated as adjuncts to land. For the Company officials, therefore, the temperamental seasonal admixtures of soil and water had to be checked in order to transform river channels into permanent arteries for communication. The template, however, for organising the sustained rupture between land and water was formulated through a set of economic calculations; involving in the main drawing repeated links between ‘expenses’ for keeping the channels open and the presumed income from shipping.

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<sup>27</sup> Ibid., pp.75-80.

<sup>28</sup> ‘ Notes on Changes of the Jalangi and Jalangi-Bhairab rivers’, Compiled by Mr. S. C. Sur, Executive Engineer, Nadia Rivers Division, *Nadia Rivers (From 1848 to 1926)*, pp. 28.

<sup>29</sup> Ibid., p.29.

<sup>30</sup> Ibid., 28.

## Revenue and the ‘craze’ for embankments

The second snapshot, reviews the Company’s various administrative strategies and technical interventions that were aimed at enabling it to collect revenue claims that were singularly tied to the issue of productivity in land. Company administrators early on realised that preventing seasonal inundations was inextricably tied to the quest for revenue realisation alongside the other equally perplexing problem of organising exclusive property in land. Unlike the relatively stable landscapes that Company officials had been used to in England, lands surrounded by active deltaic rivers had to contend with the latter’s seasonal overflow, unpredictability, wild oscillations, avulsions, dramatic channel alteration and, often times, onrushing currents that swamped vast swathes of adjoining cultivated tracts into watery depths. A dynamic environment, in other words, part water part land, involving a geography that was relentlessly rearranged. Not, unsurprisingly, the Company’s ‘rigid’ economic practices for revenue assessment and collection were regularly undermined in the delta.<sup>31</sup>

In the course of formulating the revenue demand for Bengal, as part of the exercise for the permanent settlement elaborated in 1793, the incipient Company administration declared that certain estates were to be granted allowances on the revenue demand (*Jama*) as compensation for maintaining their *bunds* (flood control embankment).<sup>32</sup> In 1796, the Board of Revenue received a report that the neglect of the bunds by the *zamindars* or landlords of *Kasijorah* pargana in the district of Midnapore had resulted in ‘serious inundation’. After another report of allegedly similar zamindari laxity and indifference in the pargana of *Mynachour*, the Company administration realised that embankment repair and maintenance had become a source of considerable contention and dispute and required a far more forceful administrative approach.

In March 1798, the Board of Revenue authorised the Collector of Midnapore to undertake embankment repairs in the parganas of *Kasijorah* and *Shahpore*, and recover the expenses from the zamindars in ‘proportion to the interest which they respectively possess[ed] in the bunds.’ The decision immediately drew the ire of several zamindars, who insisted that rather than pay potentially higher costs to the Company for repairs that the latter might carry out, the estate owners

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<sup>31</sup> Rohan D’Souza, ‘Rigidity and the Affliction of Capitalist Property: Colonial Land Revenue and the Recasting of Nature’ in *Studies in History*, 20 (2), 2004, pp.237-272.

<sup>32</sup> H.L. Harrison, Collector Midnapore, to the Officiating Commissioner of the Burdwan Division, 3<sup>rd</sup> December 1877, *Cossye and Seyle Floods, May 1860 to September 1893, vol. I*, (Calcutta, 1928). p.331. (Henceforth Harrison, *Cossye and Seyle Floods*)

should be allowed to do it themselves. Some zamindars, however, even chose to refuse to undertake any repairs altogether. This caused the Board of Revenue to extend an order passed earlier in January 1798 to the parganas, specifying that if the zamindars failed to repair their bunds the Company administration would then carry them out on its own initiative and forcibly recover the expenses from the intractable landlords.<sup>33</sup>

In the adjoining district of Murshidabad, as well, the Company found itself 'habitually compelled' to carry out repairs because of what was perceived to be zamindari recalcitrance. In 1800, for example, the Collector of Murshidabad was directed by the Board of Revenue to spend Rs. 32,788 on the bunds in the district and was authorised to put up for sale the lands of the 'defaulting' zamindars to recover the costs of the repairs.<sup>34</sup> The Company's sale laws brought into effect in the permanent settlement territories, however, further frustrated the administration as frequent changes in estate ownership and regular dismemberment of large holdings into smaller plots defeated attempts to stabilise procedures for allocating and clarifying responsibilities for bund maintenance.<sup>35</sup>

Thus, throughout the early tumultuous years of rule, Company officials found themselves increasingly, on the one hand, arrogating onto themselves the right to establish the need for embankment repair, while, on the other, they were being entangled in the fairly sordid task of ascertaining and recovering from the concerned zamindars the costs for restoring the 'protective' works. Not unexpectedly, in the subsequent enactment of Embankment Regulation VI of 1806, the Company's first directives on the subject of flood control in Bengal, the administration sought to officially endorse their then ongoing efforts to enforce private responsibility in the maintenance of the bunds.<sup>36</sup> Through Regulation VI of 1806, Embankment Committees were set up and empowered to act:

... if the zemindars neglected their duty, [the Embankment Committees had ]  
to call upon them to make the repairs, and, if they still persisted in their

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<sup>33</sup> Harrison, *Cossye and Seyle Floods*, p.331.

<sup>34</sup> Embankments in Murshidabad, *Selection from the Records of the Government of Bengal Relating to the Nadia Rivers, 1848 to 1926* (Calcutta, 1931), p.53.

<sup>35</sup>The Company administration in a bid to maximize its income and enforce its new proprietary laws initiated the sale of any estate whose owner had defaulted on the revenue installments. In both Orissa and Bengal an innumerable number of such defaulting zamindaris were sold in the first two decades of colonial rule. See B.B. Chaudhuri, 'Agrarian Relations: Eastern India' in Dharma Kumar (ed) *The Cambridge Economic History of India 1757-1970*, vol. .II, (Delhi, 1982), pp.91-8.

<sup>36</sup> Regulation XXXII of 1793 was the first directive on the embankments, followed by the appointment of local Committees in 1801 to supervise the embankments. Regulation VI of 1806, in fact, superseded the previous two rulings. See *Embankments in Bengal*, pp.131-2.

neglect, to submit an estimate to Government, and after approval to carry out the repairs, and recover the amounts from the zemindars (sic) or farmer bound to keep the embankments in a proper state of repair.<sup>37</sup>

But in attempting to compel the zamindars to bear the financial costs for protecting their estates, the Company inadvertently also devolved onto itself the task for monitoring and ascertaining the nature of the supposed threat posed by the deltaic rivers. In effect, the incipient Company bureaucracy through the Embankment Committees and armed with Regulation VI of 1806 ended up singularly acquiring the onerous responsibility of defining, maintaining and interminably perpetuating the separation of land and water. Thus, urged by the need to secure property and the recovery of revenue, the colonial authorities increasingly felt compelled to encourage the construction of permanent protective embankments — structures designed to insulate lands comprehensively from inundation. Inevitably, to the official colonial mind, the plan for running protective embankments, as some sort of barrier separating cultivated tracts from the inundating channel, began to assume an overwhelming administrative imperative in which the interests on land were categorically viewed as being dependent on restraining the rivers.

The earliest colonial observations on structures that were presumed to be flood control embankments were made as references to the term “pool bundy”. These obstructions or small dams that were thrown across the beds of rivers or alongside (at various angles) of the flowing channel were interpreted as being structures “for the protection of the tract of country, against the irruption of waters”.<sup>38</sup> To the Company’s consternation, however, the native embankments turned out to be not only constructed in several shapes and sizes but appeared to have been deployed for functions other than that for exclusively insulating lands from seasonal river inundation.

In an 1838 report on the status of the embankments in an the adjoining district of Cuttack, an enquiry Committee chose to classify the innumerable types of structures under eight broad groups, based largely on the latter’s location and presumed functions.<sup>39</sup> According to the Committee, the embankments or bunds served a number of purposes such as: a) excluding salt water during spring tides, b) damming mouths of hollows (*khalls*) in order to retain fresh water, c)

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<sup>37</sup> *Cossye and Seyle Floods*, p.331.

<sup>38</sup> *Report on the Embankments of the Rivers of Bengal*, Bengal Military Orphan Press, Calcutta, 1846. V/27/732/36 Oriental and India Office Collection, (the British Library,) London, p. 2.

<sup>39</sup> *Gungooreah Bundee, Bahar Bundee, Hussea Bundee, Khall Bundee, Khall Kunder, Falni Kassie, Bheera Bundee and Bheree Bundee* See *Embankments in Bengal: Note on their Origin, Development and Utility (1772-1850)*, p.33, Land Revenue Records (28 March 1851), 20-21, in *Index to Land Revenue Records (1838-59)*, vol. II. NAI. (Henceforth *Embankments in Bengal*)

diverting water for irrigation d) leading excess water into drainage channels and e) protecting lands that adjoined river channels from flood spill. Many of these structures, they further concluded, were intended to perform different functions in different seasons or situations; a protective structure for excluding the salt water of spring tides, for example, was often also used to retain fresh water for irrigation. Cultivators, furthermore, often made ‘cuts’ into the bunds to allow or quicken the passage of water for drainage or irrigation and in certain circumstances they were not averse to either abandoning some embankments altogether or constructing a bund or two for a single season only. Lastly, the colonial authorities noticed that the ‘native’ bunds were more like a patchwork of haphazard constructions that often ran perpendicular to the river rather than parallel to it and did not comprise a ‘uniform’ or ‘continuous’ system.<sup>40</sup> And yet, the virtual kaleidoscope in bund types and their innumerable functional possibilities, nevertheless, appeared to have also been harmonised by the cultivators to complement an intricate system for irrigation and drainage.<sup>41</sup> Clearly, the colonial view that bunds were exclusively part of a system of permanent structures for insulating lands from floods was not necessarily the shared view on the ground.<sup>42</sup> In effect colonial embankment policies sought to treat land and water as two discrete and separate domains of the colonial resource regime.

Thus, the Company’s overriding need to secure its revenue claims from land decisively moved them towards dismantling the ‘native bunds’ as structures for enabling drainage and irrigation to instead becoming exclusive flood control structures.

### **Plugging leaks and Shoring up the Land: The Drainage Conundrum**

The third snapshot refers to the many dilemmas caused by drainage. As pointed out earlier, the delta is riven by innumerable drainage lines that leak waters into surrounding basins, channels and ultimately into the Bay of Bengal. A kind of encompassing fluvial tapestry of crisscrossing rivulets, lean streams and circuitous flows that sustain the overall hydraulic vitality of delta. Prior to the colonial presence, it appears, that ‘natural drainage’ in the deltaic tracts was a crucial factor in setting possibilities for habitation and agrarian production. Some of this orientation is indicated in an account on the ‘general system’ of village drainage in Bengal in the *Bengal*

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<sup>40</sup> *Embankments in Bengal*, pp.33-38.

<sup>41</sup> Embankment Committees Reports ( Calcutta, 1901), pp.36-40, V/27/730/7. IOIC.

<sup>42</sup> ‘Embankments in Bengal: Note on their Origin Development and Utility (1772-1850)’, Land Revenue Records, 28th March 1851, 20-21, in *Index to Land Revenue Records 1838-1859, Vol. II*, [National Archive of India].

*Drainage Committee Report of 1907* (quoted in turn from the *Epidemic Commission Report of 1864*):.

The drainage of all villages...in Lower Bengal is effected by the water first running into the nearest paddy-fields lying in the direction of their slope, thence it collects in the *bheels* from which it rushes through *khals* into larger streams, which again communicate with navigable rivers.<sup>43</sup>

The above description suggests that, historically perhaps, villages and their production contexts in the delta were strategically situated with regard to drainage. Water, in effect, was kept circulating between different types of depressions and basins and finally led unhindered to a flowing stream or river. Such an equilibrium, however, was fragile or tenuous, as a single disturbance or obstruction could upset an entire network of carefully maintained circulation. Something, perhaps, akin to the 'butterfly effect' in Chaos theory. Despite the delicate nature of the drainage pattern, colonial rule, had during the course of the nineteenth century, inaugurated a number of projects for road, railway and embankment construction in the region. These modes of transport with their emphasis on permanent all weather structures and mostly built in unrelentingly straight lines marked a sharp break from movement in the earlier era, which was predominantly based on circuitous rough paths and 'crooked' routes.<sup>44</sup> The colonial transport network in Bengal, in fact, radiated along the East-West axis, while the region's natural drainage lines, in contrast, dropped from North to South.

By the second half of the nineteenth century, official concern built up over what was rapidly discussed as the problems caused by the obstruction to drainage. Several enquiry committees were commissioned to deliberate on issues of water-logging, the impacts of stagnant water bodies on Malaria and the question over the railways and roads in interrupting natural drainage. One of the first of these Commission's, which debated the impacts of drainage congestion on the spread of malaria, was the Epidemic Commission of 1864. In the course of its enquiry, the Commission had to contend with a somewhat comprehensive response on the issue of drainage from one Raja Digamber Mitter (more about him later). In the years 1867 and 1868 another set of elaborate enquiries were held on the subject and their conclusions were summed up by Colonel Nicolls, then Chief Engineer of Bengal. According to the Colonel, stated in a Note of 4<sup>th</sup> March 1869,

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<sup>43</sup> *Report of the Drainage Committee, Bengal (Presidency Division)*, The Bengal Secretariat Press, Calcutta, 1907, pp.20-21.

<sup>44</sup> See Jean Deloche, *Transport and Communication in India: Prior to Steam Locomotion*, vol. I & II, Oxford University Press, 1993 & 1994.

...roads and railways in Bengal have not obstructed the drainage of the country so far as to cause or to aggravate sickness. But some obstruction is inevitable and should be remedied as soon as possible.<sup>45</sup>

Colonel Nicoll's mixed assessment, which firmly dismissed the claims about the impacts of roads in causing malaria through water-logging despite recognising that the latter did occur, marked the general tenor of the findings and conclusions by a succession of similar investigations. It appears, that, for the authorities, there was an inability to conclude that a straight correspondence existed between malaria and the construction of roads and railways. On the other hand, there could be no doubt that all weather transport structures would logically interrupt and cause several scales of drainage impacts. In fact, it was precisely over this contradictory colonial assessment that two sharply opposed ideas on the issue of drainage began to congeal. On one end, formulated chiefly by Raja Digamber Mitter, it was argued that Bengal's drainage problems were entirely man-made, in that the 'natural drainage system' had been systematically interrupted by obstructions. The solution, according to this view, was for restoring the 'natural' pattern by reconnecting the circuits for water circulation. In effect, drainage should flow from 'villages to the arable lands, from paddy fields to beels and from the beels through khals and water courses to the navigable rivers'.<sup>46</sup>

In contrast, the other proponents argued that drainage congestion was characteristic and intrinsic to the Gangetic delta, and that only man-made interventions through artificial drainage schemes could cure the delta from its stagnant malarial swamps. Thus, in this latter assessment, the deltaic tract was not perceived as a single organic bloc made up of intricate patterns of drainage but instead appeared as a disconnected aggregation of marshes and waterlogged sites. This divide over the question of drainage, between those arguing for the restoration of natural circuits against those insisting that the delta had to be cured of its naturalness, was most dramatically played out during intense discussions over the Bengal Sanitary Drainage Act, that had been introduced at the meeting of the Governor's Council on 9<sup>th</sup> February of 1894.

In a subsequent debate by the Council on the 24<sup>th</sup> of the same month, the members broke out into various kinds of dissenting voices over the Bill. One of the members, Mr. L. Ghosh, averred that the solution to drainage congestion in the delta lay in carrying out schemes that facilitated 'surface drainage' in the villages. Ghosh, however, contrasted his advocacy of village

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<sup>45</sup> *Report of the Drainage Committee, Bengal (Presidency Division)*, The Bengal Secretariat Press, Calcutta, 1907, p.33.

<sup>46</sup> W. A. Inglis, *A Review of the Legislation in Bengal*, Bengal Secretariat Press, Calcutta, 1911, p.69.

level surface drainage schemes as being in sharp opposition to those who were arguing for 'subsoil drainage', which would mean the draining of maidans, paddy-fields and beels.<sup>47</sup> In fact, the differences between the proponents of surface and sub soil drainage respectively, mirrored the larger disagreements over the question whether the delta's unsanitary conditions could be relieved through the restoration of the natural drainage pattern (surface schemes) or, on the reverse, removing its naturalness (subsoil schemes). Along the same curve of differences, was the other fear that the Bill had evolved a string of procedures for addressing the issue of drainage only through the narrow optic of propertied interests. According to the format specified in the Bill, the government would act on a drainage 'complaint' only if it was moved, at the local level, through a Drainage Commissioner, who had been qualified by his 'interests in the land'. The Drainage Commissioner was then expected to conduct a survey of the afflicted locale and submit a report based not only on the physical nature of the undertaking but, more specifically, with an eye towards the 'particulars as to the estate and tenure holders and cultivating raiyats of the local area with the annual value of the estates, tenures and holdings...'.<sup>48</sup>

This procedure for addressing, both, how drainage was to be assessed and solved was clearly weighed in with an obvious bias towards the landed elements in the delta. That is, drainage was to be perceived only as an adjunct to the land question, with the reasoning for relieving congestion based entirely on its 'value' in terms of meeting the revenue demand. Thus drainage was treated as a localised affair; that too, though not obviously stated, preferably in only remunerative zones. In effect, the Drainage Bill, in terms of its operative part, was slanted clearly in favour of those who had suggested that the delta had to be delivered from its naturalness and the government should, in the main, push for sub soil drainage, while only carrying out financially remunerative surface schemes.

The Bengal Sanitary Drainage Act finally passed in late 1895, however, deleted section 3 which had urged for the general drainage of marshy lands and even rice lands. The Bill instead concentrated on stating that drainage measures were to be taken only when obstructions deteriorated sanitary conditions in the locale. Nevertheless, the Bill was a little too late and not enough in terms of reversing the congestion that almost a century of colonial rule had brought about in the delta. More specifically, to highlight just one example, in the extreme fringes of the delta, in the districts

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<sup>47</sup> Ibid., p.68.

<sup>48</sup> Ibid., p.67.

of the 24 parganas and in areas abutting the sunderbans, a rabid period of land reclamation had been ongoing from the earliest decades of the nineteenth century.

In the normal course of tidal action, lands were continuously raised with the deposition of silt by slack ebb currents from the Bay of Bengal. After a point these raised lands became high enough to encourage the growth of jungles, which after some years could be cleared for settled agriculture after an embankment was thrown around it. This strategy for reclamation of land from the sea, however, if prematurely carried out — without the lands being sufficiently raised — could result in drainage complications such as water logging or the silting up of the river's beds trapped behind the embankments. More so from the fact that the deltaic rivers when approaching the sea are extremely sluggish and are prone to rapidly dissipate into marshes, creeks or just stagnant lakes. To explain the consequences of such premature reclamation enterprise, I quote C. Addams Williams, then Executive Engineer in the Public Works Department, who details a telling example:

On the south-east of Calcutta are situated what are called the salt lakes. On the flow side the water finds its way from the Bidyadhari river through side branch khals into the lakes and deposits its silt; on the ebb tide the water flows back into the river and the flow and ebb keep the river open. A part of the northern portion of the lake called the Panchannagram basin was some years ago cut off from tidal spill into the lakes by an embankment and brought under cultivation. In the meantime the tides have continued to spill into the lakes to the south of the embankment; the land has continued to rise in consequence... We have therefore a low depression ... from which it is almost impossible to drain the rain water... it is quite possible that these low lands will become entirely waterlogged before long and cultivation will entirely cease....<sup>49</sup>

The pursuit of premature reclamation was, in fact, the dominant response amongst the colonial authorities to drainage in the region; as it was linked to extending the cultivable frontier and the hoped impact of realising revenue from settled cultivation. The conundrum over drainage in the Bengal delta and its often times baffling consequences, nevertheless, haunted British engineering expertise. By the latter decades of the nineteenth century, as I have all too briefly alluded to above, colonial officialdom found itself sharply divided over the issue of drainage. The split essentially occurred over the question of whether to restore the 'natural regime' of the delta or, in contrast, command the flow of the waters through a spectrum of drainage schemes. For

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<sup>49</sup> C. Addams-Williams, Executive Engineers, Public Works Department, *Drainage Problems in the Ganges Delta : A Series of Six Lectures Delivered At the Sibpur Engineering College*, March 1913. Calcutta, The Bengal Secretariat Book Depot, 1913, p.6.

various reasons of political economy the colonial dispensation overwhelmingly chose the latter path by taking up often costly works such as the Magra Hat Drainage Scheme, Dankuni Drainage works, Rajapur Drainage scheme and so on and so forth.<sup>50</sup> But shadowing these elaborate undertakings was a fairly consistent critique by both local opposition and members within the administration and engineering branches as well, who argued that the delta's hydraulic regime would only be further complicated and aggravated by such initiatives. The congealing of these two opposed views on the question of drainage, in fact, mirrored similarly intense opinions on the issue of river navigation and flood control in the delta. That is, drainage was defined as a stable channel and as an adjunct to the productivity of land, in sharp contrast to the possibility of treating it as an aspect that adjusts the continual shifts between soils and flows in the delta.

### **Inundation Irrigation: Mixing Water and Soil**

The fourth and final snapshot concerns the concept of inundation irrigation as voiced by Sir William Willcocks (1852-1932), arguably amongst the most celebrated hydraulic engineers of the British Empire. Born in India and having survived the events of the 'Indian sepoy mutiny' of 1857, Willcocks launched himself through the Indian Irrigation Service and acquired a considerable reputation for his services in Egypt and Mesopotamia (modern day Iraq).<sup>51</sup> In March 1930, in the twilight years of his career, he delivered four lectures at Calcutta University, which were subsequently published in June of that year. Oddly enough, for one who had spent a lifetime espousing the ideals and virtues of modern canal irrigation, Willcocks chose to deliberate instead on what he claimed was the physical erasure by colonial rule of a once vibrant tradition of inundation irrigation in the Bengal region. According to him, a large network of 'overflow canals' traversed the deltas of the Ganges\* and Damodar basins and irrigated almost 7,000,000 acres of land, all this much prior to the great civilising and modernising impetus of British rule. These broad and shallow inundation canals were designed to tap the silt laden crest waters of the flooding rivers

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<sup>50</sup> Some of the excellent debates around the issue of drainage are available in the following sources: W.A. Inglis, *The Canals and Flood Banks of Bengal*, Calcutta, Bengal Secretariat Press, 1909, pp.465-561; *Papers from 16<sup>th</sup> March 1901 to 14<sup>th</sup> April 1914 Relating to the Magra Hat Drainage Scheme in the 24 Parganna District*, Selections from the Records of the Bengal Government, Calcutta, The Bengal Secretariat Press, 1915; G.C. Machnonchy, Superintending Engineer, Public Works Department, *Problems Regarding Flood Drainage*, Calcutta, The Bengal Secretariat Book Depot, 1905; C. Addams-Williams, Executive Engineers, Public Works Department, Bengal, *History of the Rivers in the Gangetic Delta 1750-1918*, Calcutta, Bengal Secretariat Press, 1919.

<sup>51</sup> For a brief account of Willcocks' experiences in Egypt, especially his bitter fight with Sir Murdoch Macdonald on the question of the flow data records of the Nile river see Herbert Addison, *Sun and Shadow at Aswan*, (London, 1959), pp.69-78. For an autobiographical sketch see Sir William Willcocks, *Sixty Years in the East*, (London, 1935).

that also carried rich fine clay. These canals were, furthermore, long and continuous and ran almost parallel to each other. The most striking feature of flood or overflow irrigation, however, was its importance as a fertilizing agent and not merely as a source for water. Willcocks argued that the ‘rich red water of the river and the poor white water of the rainfall’ had to in fact be made to combine in order for agrarian production to be sustainable and successful.

... if your rice fields have been irrigated by rain water alone, they are weak and cry for irrigation in October with excessive and costly supplies of poor river water ... If however you have irrigated your rice fields with rain and river water mixed together in the early months of the monsoon when the river water is rich and full of mud, you so strengthen the plants of rice that they resist the hard condition of an early failure of the monsoon in a way rice irrigated by rain water alone has no knowledge of. River water in the early months of the floods is gold.<sup>52</sup>

On these muddy waters, moreover, bobbed a multitude of fish eggs which then floated into the subsidiary channels, tanks and rice fields. These eggs, according to Willcocks soon hatched into young fish, who then instantly fell on the larvae of the mosquitoes and ‘lived on them’, thereby eliminating malaria.<sup>53</sup> The other significance of overflow irrigation, he claimed, was that it did not obstruct the build-up of the delta; by widely diffusing silt deposition over the alluvial plains it allowed the annual inundations to actively function as geomorphologic agents which through time raised the land and thereby blunted the ferocity of flood currents.<sup>54</sup> Cultivators who harnessed overflow irrigation, moreover, did not view inundations as natural calamities that needed to be shut out from productive lands, rather they saw them as being saturated with red silt and fish eggs to be harnessed to check malaria, build lands and fertilize fields. Thus, inundation irrigation did not recognise the hard separation between land and water. Rather, flooding lands was a strategy aimed at fertilizing soils and harnessing the productive possibilities of flows.

Perennial canal irrigation, on the other hand, rested on opposite principles to that of overflow irrigation. Permanent headworks such as barrages or weirs (with shutters or gates) were erected across the beds of rivers. These constructions, in turn, were intended to regulate flows: during lean periods water would be impounded behind the headwork and then diverted into a canal system. The reverse would hold during high flows when the ‘excess waters’ would be discharged

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<sup>52</sup> Sir William Willcocks, *Ancient System of Irrigation in Bengal*, (Delhi, 1984), p.32

<sup>53</sup> *Ibid.*, p.60.

\* Orthography retained as Ganges and not Ganga for the sake of convenience.

<sup>54</sup> ‘The ancients by increasing the supplies of muddy water, steadily improved the lands as time went on, and also decreased the danger of an inundation.’ See Willcocks, *Ancient System of Irrigation in Bengal*, pp.35-36.

along the river channel after the 'required' amount was diverted to the canals. By such a seemingly simple and elegant use of technology, it was contended that the river's flow regimes could be manipulated to ensure a near perennial supply of irrigation water. Unlike inundation irrigation—which depended on harnessing flood pulses — perennial irrigation canals sought to divert stable and controlled flows onto fields. Secondly, instead of using essentially local experiences and tactile skills to replenish soils with silt-bearing flows, modern irrigation was elaborated as a centralised technical and bureaucratic project aimed at delivering precise volumes of water. Hence, for modern irrigation enthusiasts land and water appear as separate domains, which are linked through technical arrangements and economic calculations.

In the course of the nineteenth century, several colonial modern irrigation initiatives were attempted in the Bengal delta. Notably, the Orissa canals, the Midnapore canals, Eden canals and several other minor schemes.<sup>55</sup> To highlight, however, the consequences brought on by modern irrigation I will briefly dwell on some of the experiences that the British experienced in the Orissa canal tracts. In August 1862, a design for the Orissa scheme to be built across the Mahanadi river in the lower provinces of Bengal (now in the state of Orissa) was completed. The actual work on the canals commenced in November 1863 and water was made available by the end of 1865. The scheme as realized, after a fairly staggered construction schedule, consisted of seven weirs with an aggregate length of 3½ miles.<sup>56</sup>

On 20<sup>th</sup> April 1866, the first irrigation lease was signed for an area of 3½ acres. At the end of February 1867, the area irrigated amounted to approximately 6,675 acres, at a time when water sufficient for 60,000 acres was meant to be available. In effect, at the height of the great Orissa famine of 1866-67, which had overwhelmed 3 million inhabitants in the coastal districts, the canal system was barely functioning.<sup>57</sup> In November of 1884 widespread disaffection had begun in the canal tracts. Two major protests against the Orissa Canal took place. The first, in 1881, occurred when cultivators of 61 mouzahs [villages] in pargana Sasungara resigned their leases and made petitions to the Collector against the canals.<sup>58</sup> The second, of a more determined nature, took place in April 1884, when,

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<sup>55</sup> A review of the 'performances' of these projects are available in W. A. Inglis, *The Canals and Flood Banks of Bengal*, The Bengal Secretariat Press: Calcutta, 1909, pp. 1-198.

<sup>56</sup> L.S.S.O 'Malley, *Cuttack Gazetteer* (Patna, 1933), pp.106-108.

<sup>57</sup> Patnaik, *The Famine and some Aspects*, pp.16-53.

<sup>58</sup> *Canal Commission 1885*, Questions put to and Answers give by Baboo Gauree Shanker Roy, Honorary Secretary, Orissa Association, Appendix C, p.49.

The [raiylats, cultivators] met in large bodies at different places resolved never again to apply for water under any circumstances...the cultivators have struck to the determination notwithstanding the occurrence of a drought during the past summer.<sup>59</sup>

In great measure, the cultivators in the irrigated tracts complained that their lands were actually experiencing a decline in yields. Such complaints are, in fact, palpably evident in a large number of petitions submitted to the Balasore National Society and the Canal Commission of 1884. Many cultivators repeatedly claimed that their lands suffered a steep loss in fertility, caused by the canal's physical obstruction to low intensity inundation, which deprived the soil of the river's nourishing silt. A petition from several villages in the pargana of Sungda, Mathanagar and Asureswar (Cuttack district) points to this:

Since the excavation of the canal there has been no good out-turn of the crop in our fields. Owing to the embankments no silt is deposited in our fields, caused by the overflow of rivers, therefore the out-turn has fallen off. Still we are paying the land revenue, the Road and Public work cess, the zemindaree dak-cess, bribe and other cesses for which we have become poor and involved in debt.<sup>60</sup>

Another petition from the raiylats of Nalia Killah Darpan, echoed a similar claim; that their crop output actually declined after their traditional irrigation sources were interrupted by the canal.

...the land in question is fertilised by the water from the seven ponds, spring water from the majhar [spring], and the muddy water coming from the hills, jungles and village...For the presence of the canal the water from the above sources have been stopped, so the produce has been reduced...<sup>61</sup>

Though accurate estimates of the gross average decline in yields or net reduction in total output are unavailable and make for hazardous speculation, the above petitions, especially can nonetheless be broadly surmised as being indicative of trends that may have been fairly widespread in the irrigated tracts. Even if one were to uncharitably assume that the raiylats or cultivators had stakes in understating the benefits from canal irrigation and were therefore prone to undue exaggeration about its negative impacts, there is still need to account for a fairly wide and consistent reportage by cultivators across the delta that their yields tended to decline. This loss in output, moreover, was repeatedly attributed by the

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<sup>59</sup> *Canal Commission 1885*, p.129.

<sup>60</sup> Balasore National Society, p.49.

<sup>61</sup> *Canal Commission 1885*, Petition 13, p. 32.

cultivators to the introduction of the Orissa canals which was extended alongside the destruction of other irrigation sources such as springs, tanks, bunds, drainage channels etc.<sup>62</sup> Allegedly, besides depleting the fertility of the land by preventing silt deposition, the canal water also waterlogged the low-lying lands (the *pats*).

The Orissa Irrigation Scheme, in other words, by seeking to separate land and water as two discrete entities came to grief as a project. The colonial administration, on the one hand, could not harness the fertilizing impacts of the inundations, on the other, the canals tended to destroy a vast number of non-canal sources for irrigation.<sup>63</sup> Perennial irrigation, hence, was deployed to initiate a new economic calculus between land and rivers by seeking to transform the latter into a quantifiable input assessed as costs.

## Conclusion

By the early 1940's, in the twilight years of the British Indian Empire, Bengal's rivers were declared to be an indisputable 'water problem'. For the official colonial imagination, the delta's fluvial arms were too temperamental and snaked their way across the capacious flood plains only to wastefully empty 'millions of tons' of their watery burden into the Bay of Bengal. Usually a swollen rage during the monsoon and an irrelevant trickle by the winter, such hydrographic quirks, it was authoritatively held, regularly depressed and enfeebled the Bengal peasant. Around December of 1945 in a radio broadcast, R.G. Casey, then governor of Bengal, argued for a definitive response to this perplexing hydrology:

...the water problem of Bengal necessitate[s] our so handling [of] the great rivers that their flow is equalised and controlled as between summer and winter in order that they may provide an adequate and balanced output ... . This would avoid the disastrous flooding in the monsoon and would cure the dry or stagnant state of many of our rivers in the winter.<sup>64</sup>

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<sup>62</sup> *Canal Commission 1885*, See Appendix B, petitions 10, 11, 12 and 16, pp. 31-2.

<sup>63</sup> For a full discussion on the impacts of the Orissa Canals see 'Rigidity and the Affliction of Capitalist Property: Colonial Land Revenue and the Recasting of Nature' *Studies in History*, 20 (2), 2004. pp.237-72.

<sup>64</sup> R.G. Casey, "Poverty or Plenty", Broadcast Speech by the Right Honourable R. G. Casey, Governor of Bengal — On All-India Radio, Calcutta, On Saturday, December 8<sup>th</sup>, 1945 in *Personal Diary R. G. Casey*, MSS.EUR. F48/4, May 1945-February 1946. Oriental India Office Collection (henceforth **OIOC**), The British Library, London.

The governor's declarations seemingly held much technological seduction and a potentially grand solution. By 'equalising' the rivers and moderating its discharges, the Bengal delta's fluvial tapestry, it appeared, could be rationalised and its troubling variability finally rendered consistent, becalmed and tractable. The broadcast, however, was not restricted to simply announcing a quest for engineering elegance. The governor's emphatic suggestions for 'balancing' the Bengal rivers, in the remaining portion of the radio address, was most profoundly dramatised in terms of a productivist cornucopia: controlled rivers, he claimed, through a slew of large dams and barrages across the *Teesta*, *Ganges*, *Damodar* and the mighty *Brahmaputra* rivers could be harnessed for the simultaneous realisation of irrigation, electricity, flood control and navigation. In effect, 'rationalised' rivers could lubricate an intense economic moment that could rescue Bengal's starving millions from their dismal fate, that was so clearly borne of a fickle and hostile fluid environ.

Governor Casey's remarkably self-assured clarity on how the water problem of Bengal could be solved was not exceptional for its times. The 1940's witnessed the emergence of a new era in river control: the promotion of multi-purpose river valley development, the national quest to replicate the 'triumph' of the Tennessee Valley Authority (TVA) and that science and technology could be neutral drivers of the economy.<sup>65</sup> These robust tropes were made to rapidly combine, in this period, to energise and substantiate the soon to be formulated Truman doctrine of 1949 — the grand master text, according to Arturo Escobar, that laid out and announced the rearrangement of the world along a new hierarchy based on 'development'.<sup>66</sup> Nonetheless, it would be inadequate, if not entirely flawed, to reveal this hydraulic utopia of Governor Casey as being a simple unequivocal effect of the post second world war development paradigm. Rather, the framing of the Bengal delta's river as a particular kind of water problem in the 1940s, as this paper has suggested, was made possible and drew upon roughly a century and half of colonial hydraulic practices in the region. A period in which hydraulic interventions were repeatedly aimed at separating land and water into two distinct domains. While land was made coherent as exclusive property, the Bengal rivers instead were sought to be engineered as a resource; lands generated revenue through ownership while rivers through technical arrangements such as navigation, drainage and irrigation were sought to be economically rationalised.

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<sup>65</sup> Rohan D'Souza, *Drowned and Dammed: Colonial Capitalism and Flood Control in Eastern India*, Oxford University Press, New Delhi, 2006.

<sup>66</sup> See Escobar, Arturo, *Encountering Development: The Making and Unmaking of the Third World*. Princeton, NJ: Princeton University Press. 1995.

The great hydraulic transition in Eastern India, hence, I argue was driven not centrally by the emergence of studier and centralised technologies but instead by the soil-water separations fostered by colonial economic rationalities. The modern hydraulic moment, in effect, was vitally premised on the erasure of the soil-water admixture.

Perhaps, *The Drowned World* was prescient enough to foresee the subversive possibilities of the lagoon and marsh in the defeat of exclusive property in land and the technical control of rivers as resource.