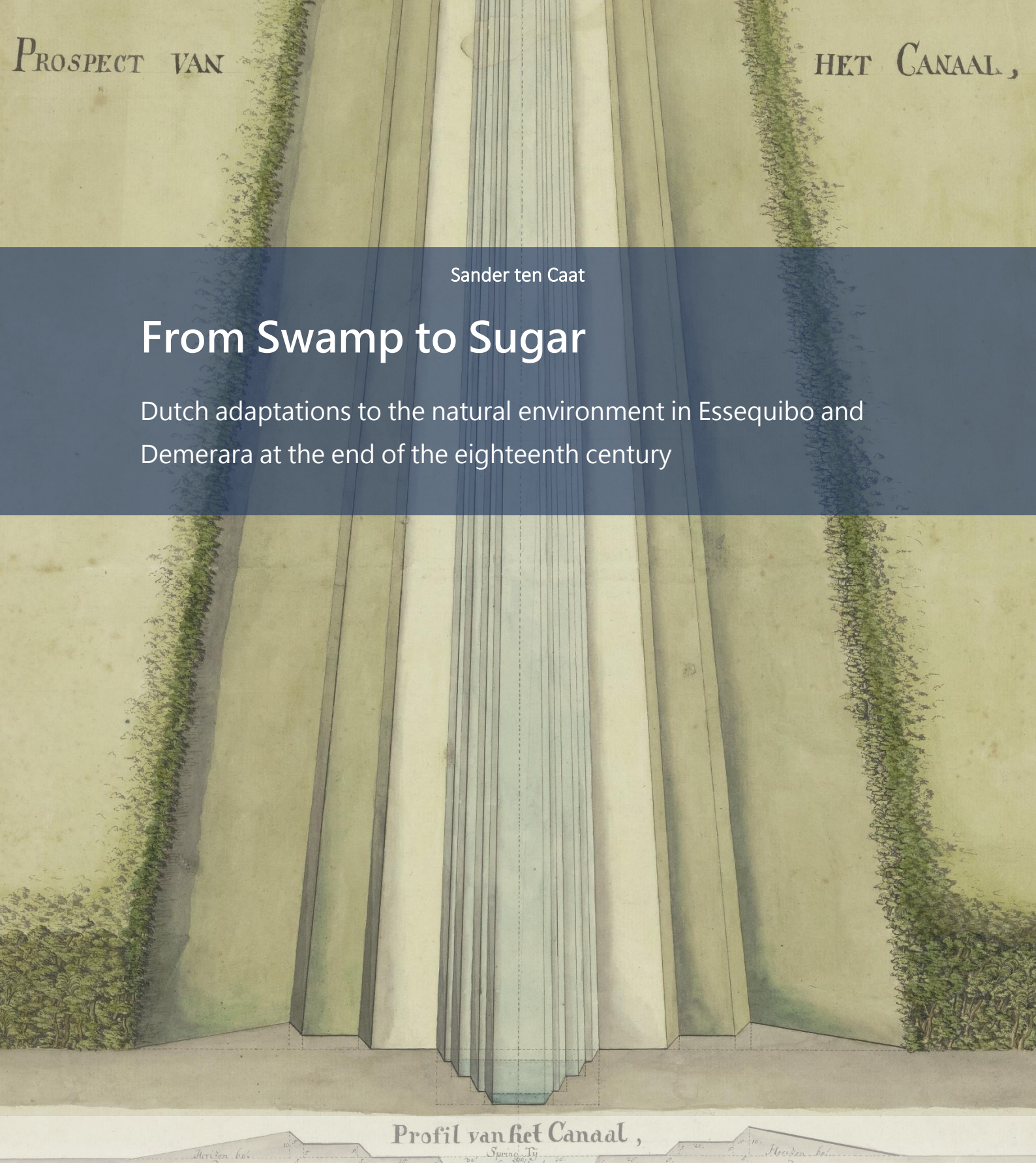


Sander ten Caat

# From Swamp to Sugar

## Dutch adaptations to the natural environment in Essequibo and Demerara at the end of the eighteenth century

**Personal information:**

Sander ten Caat

**Paper information:**

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|---|---|
| Paper type: | MA History Thesis |
| Specialisation: | Colonial and Global History, subtrack Maritime History |
| ECTS: | 20 |
| Supervisor: | Prof.dr. M. van Groesen |
| Date: | November 26, 2020 |
| Word count: | 17,761 |

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[1] Cover: J.C. Heneman, 'Plan III', Nationaal Archief, The Hague (HaNA), Verzameling Buitenlandse Kaarten Leupe, 4.VEL, inventory number 1525A, Prospect van een Canaal op Borselen.

## Introduction

The Dutch are well known for their continuous battle against the threatening seas, rivers and lakes of the Netherlands. Over time, countless dams, dikes, sluices, canals and polders have been constructed. In the seventeenth and eighteenth centuries, the Dutch claimed several colonies in what is now called Guyana; a country known as the land of many waters. Somewhat similar to the Netherlands, albeit in a tropical climate, this area consisted of large, low-lying river deltas with vast areas of swampy marchlands. From the 1740s onward, the Dutch started developing plantations high up along the rivers Essequibo and Demerara. In just a couple of years, plantation owners struggled with significant soil depletion. This challenge could be overcome by constructing new plantations on the fertile but swampy soils close to the river estuaries.[2] After a few short years, the majority of the plantations was no longer found on the dry lands high up the river, but was situated on the former swamps close to the sea. The Dutch had to construct many new plantations, canals, fortifications and towns in an unfamiliar and harsh tropical environment, characterised by an abundance of water. How did Dutch experience in water management influence their construction of plantations, canals, forts, and towns in the wet tropical environment of Essequibo and Demerara in the second half of the eighteenth century?

Already in the 1770s, almost the entire area along the lower course of the Essequibo and Demerara rivers had been put into cultivation. More lands could be used if proper waterways existed, next to which new plantations could be constructed. Several plans for canals were created in the period between 1768 and 1796. One of those canals, first planned in 1771, was supposed to stretch all the way from the Essequibo river to the Demerara. This was a distance of some thirty kilometres through more or less unknown terrain. The canal was meant to facilitate communications between the two rivers, and therefore needed to be several metres wide and deep. Preferably, it stayed that way without demanding too much maintenance. On top of that, it needed proper roads on both sides, to facilitate communication by horse-drawn cart, and had to accommodate the construction of plantations.[3] Because of the financial situation of the Dutch West India Company (WIC), especially in the 1780s, the canal

[2] H. Ehrenburg and M. Meyer, *Bouwen aan de Wilde Kust. Geschiedenis van de civiele infrastructuur van Suriname tot 1945* (Volendam, 2015) 21-23; C. Goslinga, *The Dutch in the Caribbean and in the Guianas, 1680-1791* (Assen, 1985), 438.
[3] The National Archives (TNA), Kew, Colonial Offices 116, inv.nr. CO 116/38, Extract uijt de Notulen van d' Ed. Achbaeren Raed van Politie Ordinair Vergaederden Rio Essequebo aan het Fort Zeelandia, fl. 155-157.

was never built as planned, but the plans were in fact serious.[4] In 1773, the Gentlemen X, the directors of the WIC, sent surveyor and engineer Johan Christoph Heneman to Essequibo and Demerara. Based on his survey of the colonies, he wrote an extensive report and created fourteen beautiful maps detailing his plans for all-new canals, fortifications and a town.[5] His report and maps form the central case study of this thesis, which will be used to examine the interaction between the Dutch and the natural environment of the Guianas.

Due to the natural circumstances of the Netherlands, water management had become part of Dutch culture, and the acquired knowledge was, and still is, exported to countries around the world. Petra van Dam has extensively studied the effects of the omnipresent risk of flooding on culture in the low-lying areas of the Netherlands. She concludes that the myriad of material, societal and cultural adaptations to floods created an 'amphibious culture'.[6] Van Dam and Greg Bankoff agree that Dutch society could thus also be identified as a 'risk society […] whose people have had to adapt to one or more related hazards as a "frequent life experience".'[7] Such a risk society existed both in England and the Netherlands where low-lying areas dealt with an abundance of water and the risks that accompanied it.[8] The knowledge that the Dutch gathered was subsequently exported across Europe, with many Dutchmen developing drainage projects or creating plans for water management in rivers and towns in regions like England, France, Italy, Germany, Eastern Europe and Russia.[9] In the

[4] Essequibo and Demerara kept growing, both economically and in number of inhabitants, but that was mainly thanks to British planters. J. de Vries, 'The Dutch Atlantic Economies', in: P.A. Coclanis, *The Atlantic Economy During the Seventeenth and Eighteenth Centuries: Organization, Operation, Practice, and Personnel* (Columbia, 2005) 1-29, specifically 12-13; B.M. Hoonhout, *Borderless Empire: Dutch Guiana in the Atlantic World, 1750–1800* (Athens, 2020) 153-161; J.P. van de Voort, *De Westindische Plantages van 1720 tot 1795: Financiën en Handel* (Eindhoven, 1973) 201-207; P.M. Netscher, *Geschiedenis van de Koloniën Essequebo, Demerary en Berbice, van de vestiging der Nederlanders aldaar tot op onzen tijd* (The Hague, 1888) 147-148.

[5] At different times, Heneman preferred different ways of spelling his own name. He used (among others) J.C. Heneman, J.C. van Heneman, J.C. von Heneman, C. Heneman, C.V. Heneman. Others also spelled his last name as Henneman. Netscher, *Geschiedenis*, 147-148; J.B.Ch. Wekker, Historie, technieken en maatschappelijke achtergronden der karteringswerkzaamheden in Suriname sinds 1667, proefschrift in de Sociale Wetenschappen aan de Universiteit Utrecht (Utrecht, 1983) 51. The report can be found in HaNA, 1.05.01.02, inv.nr. 184, fl. 1220 onwards. The maps and drawings are spread across the collection by Leupe, HaNA, 4.VEL.

[6] Van Dam first defended the idea of a Dutch amphibious culture in 2010: P.J.E.M. van Dam, 'De amfibische cultuur: een visie op watersnoodrampen' (Amsterdam, 2010, inaugural speech). Her latest case for the amphibious culture is written in 2017: P.J.E.M. van Dam, 'An Amphibious Culture. Coping with floods in the Netherlands', in: P. Coates, D. Moon and P. Warde, *Local Places, Global Processes. Histories of Environmental Change in Britain and Beyond* (Oxford, 2017) 78-93.

[7] G. Bankoff, 'The 'English Lowlands' and the North Sea Basin System: A History of Shared Risk', *Environment and History* 19 (2013) 3-37, specifically 19.

[8] Ibidem; G. Bankoff, 'Malaria, Water Management, and Identity in the English Lowlands', *Environmental History* 23 (2018) 470-494.

[9] S. Ciriacono, *Building on Water: Venice, Holland and the Construction of the European Landscape in Early Modern Times* (New York, 2006) 194-264; K. van Berkel, ''Cornelius Meijer inventor et fecit'. On the Representation of Science in Late Seventeenth-Century Rome', in: P. Smith and P. Findlen, *Merchants & Marvels: Commerce, Science, and Art in Early Modern Europe* (New York and London, 2013) 277-294.

New World, Dutch knowledge in regulating water was also put to use. In 1614, the Spanish tasked Dutchman Adrian Boot with preventing Mexico City from flooding, which he achieved by adapting Dutch techniques to the Mexican environment.[10] The application of such knowledge in Dutch colonies differed. Chelsea Teale found no evidence for a typically Dutch way of using wetlands in New Netherland, compared to practices in New France and New England. If anything, the Dutch concerned themselves less with water management than the French and British did.[11] On the other hand, Hillebrand Ehrenburg and Marcel Meyer, like Gert Oostindie and Alex van Stipriaan, claim that the Dutch found uniquely Dutch ways of dealing with the abundance of swamps and rains in Suriname.[12]

However, the colonies of Essequibo and Demerara[13] have been little researched, not just in terms of environmental history. An important reason for this is that most of the Dutch archive is currently kept in The National Archives in Kew, where most scholars cannot read Dutch.[14] That is not to say that nothing has been done. Important histories of the colonies have been written by Pieter Marinus Netscher in 1888 and Charles Alexander Harris and John Abraham Jacob de Villiers in 1911.[15] Naturally, these are in need of an update. More recently, important studies have been conducted into Dutch trade and society by Erik van der Oest, Gert Oostindie and Bram Hoonhout.[16] The relationship between the Dutch, their slaves and the Amerindians has been examined in great detail by Marjoleine Kars and Neil Whitehead.[17]

[10] J.F. López, '"In the Art of My Profesion": Adrian Boot and Dutch Water Management in Colonial Mexico City', *Journal of Latin American Geography* 11 (2012) 35-60.
[11] C. Teale, Informing environmental history with historical ecology: Agricultural wetlands in New Netherland, 1630-1830, Philosophy dissertation at the Pennsylvania State University (Pennsylvania, 2013) 58, 99, 225, 273.
[12] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 21; G. Oostindie and A. Van Stipriaan, 'Slavery and Slave Cultures in a Hydraulic Society: Suriname', in: S. Palmié, *Slave Cultures and the Cultures of Slavery* (Knoxville, 1995) 78-99, specifically 79-80; A. Van Stipriaan, *Surinaams Contrast: roofbouw en overleven in een Caraïbische plantagekolonie* (Leiden, 1993) 74, 81.
[13] From 1746, when the Dutch first expanded to the Demerara river, to 1773, the Essequibo and Demerara rivers were governed as one colony. In 1773, each river got its own Court of Policy, but these were once again merged in 1789. See Hoonhout, *Borderless Empire*, 43-68.
[14] E.W. Van der Oest, 'The Forgotten Colonies of Essequibo and Demerara, 1700-1814', in: J. Postma and V. Enthoven, *Riches from Atlantic Commerce: Dutch Transatlantic Trade and Shipping, 1585-1817* (Leiden and Boston, 2003) 323-361, specifically 323-324; Oostindie, '"British Capital"', 31-33.
[15] Netscher, *Geschiedenis*; C.A. Harris and J.A.J. de Villiers, *Storm van 's Gravesande, The Rise of British Guiana, Compiled from His Despatches Volume I and Volume II* (Farnham, 1911).
[16] Van der Oest., 'The Forgotten Colonies'; G. Oostindie, '"British Capital, Industry and Perseverance" versus Dutch "Old School"? The Dutch Atlantic and the Takeover of Berbice, Demerara and Essequibo, 1750-1815', in: *BMGN – Low Countries Historical Review* 127:4 (2012) 28-55; B.M. Hoonhout, *Borderless Empire: Dutch Guiana in the Atlantic World, 1750–1800* (Athens, 2020).
[17] M. Kars, '"Cleansing the Land", Dutch-Amerindian Cooperation in the Suppression of the 1763 Slave Rebellion in Dutch Guiana', in: W.E. Lee, *Empires and Indigenes: Intercultural Alliance, Imperial Expansion, and Warfare in the Early Modern World* (New York and London, 2011) 251-275; M. Kars, 'Dodging Rebellion: Politics and Gender in the Berbice Slave Uprising of 1763', *The American Historical Review* 121:1 (2016) 39-69; N.L. Whitehead, *Lords of the Tiger Spirit* (Dordrecht and Providence, 1988).

In order to learn how the Dutch experience in hydraulic engineering was reflected in their construction projects, we have to know how exactly these construction projects were shaped to fit in the natural environment. Studying the literature on neighbouring colony Suriname still provides the most detailed information on the role of the natural environment on the construction of large infrastructural works and plantations. All Dutch colonies in the Guianas made use of polders, as we will see. The natural environment of these colonies was also comparable. The construction, daily life, economy, and society of plantations in Suriname have been extensively researched by Van Stipriaan and Oostindie.[18] Ehrenburg and Meyer took on the tremendous task of examining the history of infrastructural works in colonial Suriname from 1683 to 1945.[19] All this literature provides us with a proper understanding of plantations in Suriname, albeit with little focus on the natural environment. Obviously, it is less than ideal to rely on these for studying construction projects in Essequibo and Demerara, as these colonies are hardly dealt with in these studies. Canals, towns and forts are even less thoroughly researched in the case of Essequibo and Demerara, with most relevant work having been written by Jos Fontaine on Suriname and Lex Bosman on Berbice.[20] The importance of separately studying the relationship between infrastructure and natural environment in Essequibo and Demerara was already noticed by Tj. Pyttersen in 1924.[21] These rivers, however, remain overshadowed by their Dutch neighbour Suriname.

Whereas the Guianas were a swampy delta like the Netherlands, important differences in the natural environment existed. Climate, weather, landscape, flora, fauna, and soils all differed considerably from those in Europe. Most importantly, Essequibo and Demerara experienced great amounts of rain, which had to be taken into account during construction projects. Located close to the equator, the summer was only two degrees Celsius warmer than the winter. Rainfall patterns created more significant differences between seasons, with two wet and two dry periods each year. The short dry season ran from February to the middle of April, followed by the primary rainy season, lasting until early August. Then, the primary dry season started, which ended mid-November, when the short wet season began. Come

[18] Van Stipriaan, *Surinaams Contrast*; G. Oostindie, *Roosenburg en Mon Bijou. Twee Surinaamse plantages, 1720-1870* (Leiden en Dordrecht, 1989).
[19] H. Ehrenburg and M. Meyer, *Bouwen aan de Wilde Kust. Geschiedenis van de civiele infrastructuur van Suriname tot 1945* (Volendam, 2015).
[20] J. Fontaine, 'Het Saramacca-kanaal = The Saramacca Canal', *Suralco magazine* 17:2 (1985) 16-25; J. Fontaine, *Zeelandia. De geschiedenis van een fort* (Zutphen, 1972); L. Bosman, 'Stabroek in Demerara, het ontstaan van de stadsplattegrond van Georgetown (Guyana) in de achttiende eeuw', *Bulletin KNOB* 4/5 (2003) 186-195.
[21] Tj. Pyttersen, 'Waarom landwegen in Demerary wel, in Suriname niet noodzakelijk waren', *De West-Indische Gids* 5:6 (1923-1924) 277-280.

February, the short wet season ended and the short dry season returned.[22] The landscape surrounding the lower courses of the Essequibo and Demerara rivers was mostly made up of dense, swampy forests or swampy savannah. The soils mainly consisted of heavy but fertile clay.[23] Together, this created a natural environment with an abundance of swamps and rains not seen in most other plantation colonies.[24]

The construction of canals and fortifications along these two rivers is not completely unknown, but has been studied mainly in relation to the trade with and governance of the colonies. The proposed canal between the Essequibo and the Demerara rivers was the cause of much debate in the Netherlands. The Chamber Zeeland of the Dutch West India Company had approved of the plans for this waterway, whereas the Chamber Amsterdam felt that Zeeland did not have the right to decide such things by itself. This canal in particular has thus been studied thoroughly, but only in relation to this debate and the concurrent question of whether private traders should be allowed to trade with the colony.[25]

Plans for the canal and fortifications were serious and not just part of a debate on trade. The question which plans best fit the environment, the colonies and the needs of the Company was debated in the Dutch Republic. Hence, many primary sources remain in existence. This makes it possible to qualitatively analyse how the Dutch searched to employ their knowledge of hydraulic engineering in a completely different natural environment. Most sources created by the debate on trade and governance naturally focus on other topics than the natural environment of the colonies. However, the plans and their flaws and possibilities were still discussed.[26] Applications for permits and discussions regarding the construction of canals

[22] Y.V.R. Rao, L. Alves, B. Seulall, Z. Mitchell, K. Samaroo and G. Cummins, 'Evaluation of the weather research and forecasting (WRF) model over Guyana', *Natural Hazards* 61 (2012) 1243-1261, specifically 1244-1245; A. Blom, Verhandeling over den Landbouw in de Colonie Suriname, volgens eene negentien-jaarige ondervinding zamengesteld (Haarlem, 1786) 4-5; L. van 't Leven, 'Construction of Polders in Suriname', in: W.A. Segeren, *Papers International Symposium Polders of the World Volume II* (Lelystad, 1982) 227-240, specifically 229.

[23] Bird, E.C.F., 'Guyana', in: idem, *Encyclopedia of the World's Coastal Landforms. Volume I* (Dordrecht, Heidelberg, London and New York, 2010) 245-247, specifically 245; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 21; L. Potter, *The Amerindians of Guyana and their environment* (Georgetown, 1993) 3-4; Van 't Leven, 'Construction of Polders', 228-229.

[24] J.H. Galloway, *The Sugar Cane Industry. An historical geography from its origins to 1914* (Cambridge, New York, New Rochelle, Melbourne and Sydney, 1989) 99-104; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 21; Oostindie and Stipriaan, 'Slavery and Slave Cultures', 79-80.

[25] H. den Heijer, 'A Public and Private West India Interest', in: G. Oostindie and J.V. Roitman, *Dutch Atlantic Connections, 1680-1800. Linking Empires, Bridging Borders* (Leiden and Boston, 2014) 159-182, specifically 171-174; Hoonhout, *Borderless Empire*, 47-49.

[26] Most of the printed documents on this discussion in the Dutch Republic have been bundled by grand pensionary Laurens Pieter van de Spiegel in his personal archive. This is currently kept in the Nationaal Archief in The Hague, 3.01.26, inv.nr. 450, Gedrukte extract-resolutiën van de Staten-Generaal en andere stukken betreffende de koloniën Essequebo en Demerary, het graven van een kanaal van communicatie, invoer van vreemde slaven, oprichten van een bijzondere raad van Demerary enz. (1769-1776).

and fortifications also remain in the archives of the British Colonial Offices and the archives of the Dutch colonial government stored in Guyana.[27] Surveyor Heneman's report and maps, together with many different maps and plans, remain the most important sources, however. Using these, this thesis will look into the ways in which the Dutch modified their construction projects to fit the natural environment of Essequibo and Demerara and how this process was shaped by Dutch knowledge of hydraulic engineering. Comparing these colonies to others will indicate whether the modifications were in fact unique.

[27] Documents in Kew consist of letters sent by the governors of the colony to the Netherlands. Information on the communications canal is to be found in TNA, Colonial Offices 116, inv.nr. 38-39. The Dutch archives in Guyana have been digitised and are available in the Nationaal Archief, 1.05.21.

# 1. The canal and the report

*Is it not the same Chamber Amsterdam, which together with the other Chambers, […] without consulting the Chamber Zeeland, addressed the Honourable Gentlemen, and requested to put a halt to the useful and for the Colony so beneficial digging of a Canal […] ?*[28]

*Did the other Chambers even care for the entire Colony since 1750?*

- Chamber Zeeland discussing Essequibo and Demerara[29]

These words were written by the angered and frustrated directors of the Chamber Zeeland of the Dutch West India Company. At the time, in 1772, the Zeeland directors found themselves in conflict with the mighty Chamber Amsterdam. Although Zeeland itself was a prominent Chamber as well, Amsterdam was backed by all other Chambers of the WIC. In essence, the conflict between these two most powerful Chambers had been dragging on for decades. Plans for a canal linking the Essequibo and Demerara rivers, submitted by George Hendrik Trotz, member of the Essequibo Council of Justice, severely aggravated the disagreement between the two factions. In the following months, the argument between Zeeland and Amsterdam dominated the general meetings of the Gentlemen X. The Gentlemen ultimately decided to split Essequibo and Demerara, but they still sent engineer Johan Christoph Heneman to the colonies to study the feasibility of a canal. This was the end of the major discussions between Amsterdam and Zeeland.[30] How could a simple proposal for a canal lead to a discussion that would dominate the WIC for months?

## Amsterdam and Zeeland as rivals

The conflict between the two Chambers had its roots in the seventeenth century, when Zeeland established a colony along the Essequibo river. The rest of the WIC reluctantly

[28] 'Is het niet dezelve Kamer Amsterdam, welke benevens de verdere Kameren, […] buiten eenige communicatie van de Kamer Zeeland, aan Hun Hoog Mog: heeft geäddresseerd, en surcheance tegen de zoo nuttige als voor de Colonie voordeelige graving van een Canaal, verzogt […]?'. Nationaal Archief Den Haag (HaNA), Laurens Pieter van de Spiegel, 3.01.26, inv.nr. 450, Berigt van Bewindhebberen der Kamer Zeeland of December 14 1772, p. 11.

[29] 'Hebben die andere Kameren zig zedert den Jare 1750 wel met die geheele Colonie bemoeid?'. HaNA, 3.01.26, inv.nr. 450, Berigt van Bewindhebberen der Kamer Zeeland of December 14 1772, p. 16-17.

[30] Paragraph constructed from: HaNA, 1.05.01.02, inv.nr. 16, fl. 409 recto- 621 verso; HaNA, 3.01.26, inv.nr. 450, in its entirety; H. den Heijer, 'A Public and Private West India Interest', in: G. Oostindie and J.V. Roitman, *Dutch Atlantic Connections, 1680-1800: Linking Empires, Bridging Borders* (Leiden and Boston, 2014) 159-182, specifically 166-177.

agreed in 1674 that only Chamber Zeeland, as founder, had authority over Essequibo. An important provision was that the ultimate authority rested with the Gentlemen X.[31] This division of authority was the main subject of the discussion between Amsterdam and Zeeland. In essence, however, the organisational structure of the West India Company was an important cause of the conflict. The policy of the WIC was always a compromise between the Chambers, which represented individual cities, regions or provinces. As Amsterdam and Zeeland provided most of the capital for the Company, they received the most influential positions. More than half of the Gentlemen X were appointed by Amsterdam (four) and Zeeland (two). The three remaining Chambers (Maze, Noorderkwartier and Stad & Lande) and the States General provided one director each, totalling ten.[32] This meant that the top directors of the Company were also focused on defending the interests of their home region. In the Zeeland-Amsterdam discussion, both Chambers were backed by their respective city governments and other authorities of their provinces.[33] This organizational structure led to conflicts when one of two Chambers felt they were put at a disadvantage by (changes in) the policy of the Company. This first posed a problem in the case of Dutch Brazil in the seventeenth century. Initially, the WIC had a monopoly on the trade with this colony. Chamber Zeeland felt that this monopoly was useful in the commercial and military fight against the Spanish. Amsterdam wanted the Company to focus on lucrative trade instead of costly war and to allow free trade with the colony.[34] And when Amsterdam merchants controlled the slave trade in western Africa in the 1720s, Zeeland wanted to take part in it by changing WIC policy.[35]

In the second half of the eighteenth century, as European demand for sugar and coffee rose and the number of plantations in the Guianas increased, debates surrounding the colonies became more heated. Director-General Laurens Storm van ‘s Gravesande complained time and again about the insufficient number of goods and slaves that Chamber Zeeland shipped to his colony. The Gentlemen X then asked all Chambers to increase shipping to Essequibo and Demerara. This was against the will of Zeeland, which was convinced that its rights had been

[31] Goslinga, *The Dutch in the Caribbean, 1680-1791*, 431-433.
[32] Hoonhout, *Borderless Empire*, 47; H. Den Heijer, ‘The Dutch West India Company, 1621-1791’, in: J. Postma and V. Enthoven, *Riches From Atlantic Commerce: Dutch Transatlantic Trade and Shipping, 1585-1817* (Leiden and Boston, 2003) 77-112, specifically 82-83; HaNA, 1.05.01.02, inv.nr. 1323B, Octrooi voor de Tweede West-Indische Compagnie, verleend door de Staten-Generaal, eleventh item.
[33] Den Heijer, ‘A Public and Private’, 168, 174; HaNA, 3.01.26, inv.nr. 450, Resolution of the States of Zeeland of March 6 1773.
[34] A. Weststeijn, ‘Dutch Brazil and the Making of Free Trade Ideology’, in: M. van Groesen, *The Legacy of Dutch Brazil* (New York, 2014) 187-204, specifically 188-193; Den Heijer, ‘A Public and Private’, 166-171.
[35] Den Heijer, ‘A Public and Private’, 166-171.

violated. However, the Gentlemen X never officially handed the ultimate authority over to Chamber Zeeland.[36] In October 1770, a new agreement was reached regarding shipping rights to the colony. After years of discussion, Zeeland only retained the right to annually choose which sixteen ships were allowed to sail to the colonies first, after which merchants from other Chambers were allowed to join the trade. The first nine ships of each year that were loaded with goods in Essequibo and Demerara and returned to Europe should also be from Zeeland.[37]

**Rights to canal construction**

On November 4, 1771, George Hendrik Trotz sent a letter to Chamber Zeeland in which he requested permission to construct a waterway between the Demerara and Essequibo rivers. Chamber Zeeland and Director-General Storm acknowledged that this project would be beneficial to the colony, as will be discussed extensively in the next chapter.[38] Both the Zeeland and Amsterdam directors of the WIC saw the advantages of this canal.[39] Conflict between the two Chambers only arose because Chamber Zeeland decided to approve this project on its own. Chamber Amsterdam, backed by Maze, Stad & Lande and Noorderkwartier, petitioned the Gentlemen X to repeal Trotz' permit.[40] This completely restarted the discussion regarding the authority over Essequibo and Demerara.

Chamber Amsterdam had several important complaints about the proposed canal. The most important was that Zeeland did not have the authority to act on their own in the Guianas. By agreeing to Trotz' plan for a canal, Chamber Zeeland granted him the land for the canal, but also gave him authority over a large area of land for future plantations, and allowed several tax exemptions for new plantation owners. These grants would mean the loss of future

[36] Goslinga, *The Dutch in the Caribbean, 1680-1791*, 431-433; Hoonhout, *Borderless Empire*, 47-48.
[37] Den Heijer, 'A Public and Private', 171-173; Hoonhout, *Borderless Empire*, 48; Van de Voort, *De Westindische Plantages*, 130-132.
[38] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 4-5; HaNA, Dutch Series Guyana, 1.05.21, inv.nr. AG.1.2A, Miscellaneous letters and letterbooks from the 'Heeren X' of the West India Company 1747-1773, p. 323-325; TNA, CO 116, inv.nr. CO 116/38, fl. 374 recto - 337 verso.
[39] HaNA, 3.01.26, inv.nr. 450, Contra-Berigt van […] Kamer Amsterdam, in dato 31 December 1772 […], p. 15; HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 9-12.
[40] HaNA, 3.01.26, inv.nr. 450, Retro acta van het gepasseerde omtrent Essequebo &a. Anno 1772/3. This part has no page numbers.

tax money for the WIC.[41] According to Chamber Amsterdam, this would inevitably harm the planters, the colony and thus the Company.[42]

When the Amsterdam directors had a good look at the plans in December 1772, they grew even more suspicious of the idea. According to Trotz, the proposed canal would be most useful if it was constructed between two plantations that he owned. The Amsterdam directors therefore wondered if this was actually the most useful course.[43] Moreover, Amsterdam criticised the lack of details in Trotz' plan. When Zeeland approved his plans in 1772, Trotz had not specified the width and depth of the canal. He and his business partners also chose not to commit themselves to any timeframe in which construction had to be completed.[44] Trotz could thus stop the project whenever he saw fit, without reaching the other river or making the canal sufficiently wide, all the while still reaping the profits from the adjacent lands and the tax exemptions. For these reasons, the directors of the Chamber Amsterdam, joined by those of Maze, Noorderkwartier and Stad & Lande decided that the permit would be repealed.[45]

Chamber Zeeland did not try to defend Trotz' plans. Zeeland was more concerned about the majority decision of the Gentlemen X to repeal the permit, because Zeeland thought that only they themselves had such authority.[46] Both Chamber Zeeland and Chamber Amsterdam then appealed to the States General of the Dutch Republic to decide over the matter. In their provisional resolution, the States General decided in favour of Chamber Amsterdam. They repealed the permit, but would investigate matters further.[47] The main shareholders of Chamber Zeeland could not accept this provisional resolution and asked Stadtholder William V to intervene in his role as chief-director of the WIC.[48] On March 6, 1773, the States of Zeeland went so far as to question the authority of the States General.[49] The States General, however, still decided to turn their provisional resolution into a permanent one when their research into the case was finished on the 23rd of April. From then

[41] The WIC granted land for free, the Company's income was based of taxes: Oostindie, '"Britisch Capital"', 36.
[42] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen van de Generale Geöctroiëerde Nederlandsche West-Indische Compagnie uit de Kamer Amsterdam, op de Maze, in 't Noorder-Quartier en van Stad en Land […] den 10 november 1772 […], p. 12.
[43] HaNA, 3.01.26, inv.nr. 450, Contra-Berigt van […] Kamer Amsterdam, in dato 31 December 1772 […], p. 15.
[44] TNA, CO 116, inv.nr. CO 116/38, fl. 372 recto – 377 verso.
[45] HaNA, 3.01.26, inv.nr. 450, Contra-Berigt van […] Kamer Amsterdam, in dato 31 December 1772 […], p. 15-19.
[46] HaNA, 3.01.26, inv.nr. 450, Berigt van Bewindhebberen der Geöctroiëerde West-Indische Compagnie ter Kamer Zeeland […] van den 14 December 1772 […], p. 1-17.
[47] HaNA, 3.01.26, inv.nr. 450, Resolutie van H: Ho: Mog: in dato 25 January 1773 […], p. 3-4; HaNA, 1.05.21, inv.nr. AG.1.2A, p. 500-509.
[48] HaNA, 3.01.26, inv.nr. 450, Requeste van de Hoofd-Participanten van de West-Indische Compagnie ter Kamer Zeeland […].
[49] HaNA, 3.01.26, inv.nr. 450, Resolutie van den 6 Maart 1773 […], p. 9-10.

on, Essequibo and Demerara belonged to the entirety of the WIC, which meant that no Chamber could govern the colonies on its own.[50] Hence, Amsterdam, with its significant influence on the Gentlemen X, got what it wanted: more authority over the colonies.[51] The governing structure of the colony was also reworked to fit the wishes of Amsterdam, against those of Zeeland.[52] And when it suited Amsterdam, new plans were created for the construction of the canal between the Essequibo and the Demerara.[53]

**Devising proper plans**

Two weeks before the States General issued their final decision regarding Trotz' canal, the directors of Chamber Zeeland asked the other Chambers once again to reconsider their stance on the permit for this project. Chamber Amsterdam used this request to reshape the project according to its own will. Amsterdam wished for the local authorities of Essequibo and Demerara to discuss possible plans for a canal with an engineer. The authorities would need to lend him their best surveyors, in order for the engineer to thoroughly research where, how and to what specifications and costs a most useful canal could be dug. Unsurprisingly, the original report should then be sent to Amsterdam, Zeeland only received a copy.[54] A week later, all Chambers, including Zeeland, agreed to let this engineer also study new defences for the Demerara river.[55]

The WIC expected the Society of Suriname, owner of neighbouring colony Suriname, to be able to send an engineer to Essequibo and Demerara.[56] The Society then ordered their German engineer Johan Christoph Heneman to start his research in the colonies not later than October 1773.[57] That the Society sent a German engineer to study water management in a Dutch colony did not worry the Company. Heneman could speak, read and write Dutch and his plans were of good quality. The only problem was that he created complicated plans that

[50] HaNA, 1.05.01.02, inv.nr. 16, fl. 413 verso – 415 recto; HaNA, 3.01.26, inv.nr. 450, Rapport en Resolutie van H: Ho: Mog: in dato 23 April 1773 […].
[51] HaNA, 1.05.01.02, inv.nr. 16, fl. 425.
[52] Ibidem, 417 recto – 418 recto, 423 recto – 453 recto; HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie uit de Kamer Amsterdam, op de Maze, in 't Noorder-Quartier en van Stad en Land […] den 10 november 1772, p. 2-11; HaNA, 3.01.26, inv.nr. 450, Berigt van Bewindhebberen der Geöctroiëerde West-Indische Compagnie ter Kamer Zeeland […] van den 14 December 1772 […], p. 11.
[53] HaNA, 1.05.01.02, inv.nr. 16, fl. 551 recto – 551 verso.
[54] Ibidem.
[55] Ibidem, 617 verso – 619 recto.
[56] HaNA, 1.05.01.02, inv.nr. 16, 621 verso. The WIC was one of the co-owners of the Society.
[57] HaNA, 1.05.03, inv.nr. 63, p. 138, 170-171, 271.

demanded a lot of work by many slaves and were thus too expensive for the Company's liking.[58] Heneman began his career overseas as an ensign in the army of the Society of Suriname and arrived in South-America in November 1770. Initially, he was tasked with producing a general map of the colony, but also devised plans for improving the defences and infrastructure. He was subsequently promoted to the rank of captain-lieutenant and was officially called 'engineer and inspector' when he returned from his assignment in Essequibo and Demerara.[59]

Once Heneman arrived in Essequibo and Demerara, he encountered nothing but resistance from the authorities, according to his report. The Gentlemen X had ordered the Director-General of Essequibo and the Commander of Demerara to provide the engineer with the necessary surveyors, slaves and ships. However, Heneman wrote that the commanders refused to believe that the Society and the WIC sent him. Heneman claimed that he had to beg for five months before he received a small rowing boat and four slaves that did not speak a single word of Dutch.[60] He also received no help from the local surveyors, although the colonies employed at least nine surveyors at the time.[61]

Heneman did not know why exactly the Director-General and Commander did not believe him and were unwilling to support him. The proceedings of the combined Council of Policy of Demerara and Essequibo simply read that the commanders decided to ignore the orders that Heneman received and that the Director-General refused to allow him to create plans for new fortifications.[62] The Director-General then explained his own plan for a canal in a letter to the Gentlemen X.[63] This Director-General was George Hendrik Trotz. Had his permit for a canal not been repealed, then he would have been able to personally reap the profits, which would now benefit the Company. This most likely explains why he refused to support Heneman.

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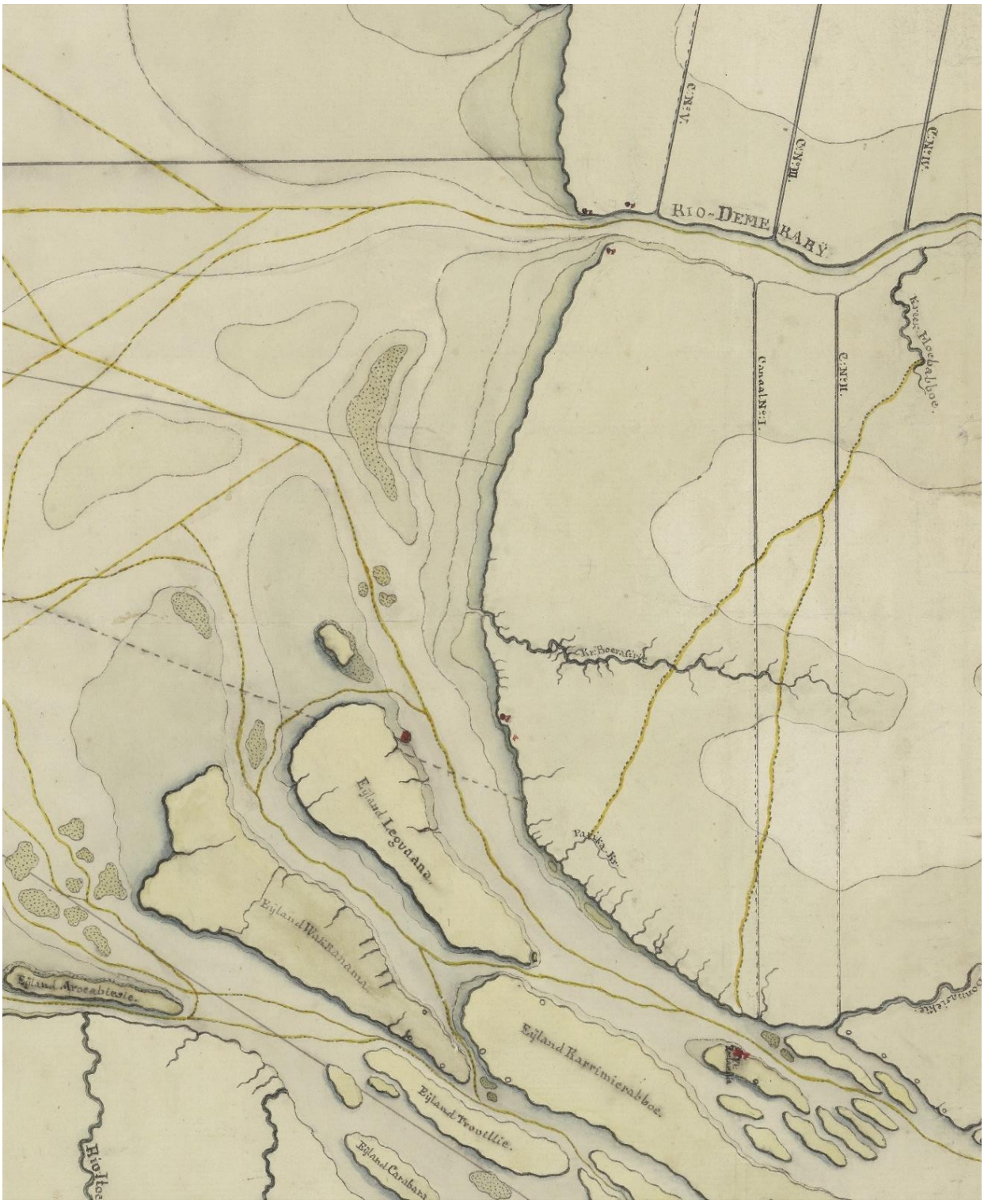
[58] HaNA, 1.05.06, inv.nr. 942, "Consideratien op het plan van den ingenieur Heneman nopens de gebouwen en forten op te regten in Rio Demerary", p. 2-4, 11; HaNA, 1.05.21, inv.nr. AB.3.42B, Miscellaneous minutes on proceedings of the Combined Council of Essequibo & Demerara, January 1774 – February 1776, p. 24-26.
[59] J.B.Ch. Wekker, Historie, technieken en maatschappelijke achtergronden der karteringswerkzaamheden in Suriname sinds 1667, Social Sciences dissertation at Utrecht University (Utrecht, 1983) 51; G.J.J. Aleva and L. Krook, 'Early reconnaissance and cartography of Suriname', in: Th.E. Wong, D.R. de Vletter, L. Krook, J.I.S. Zonneveld and A.J. van Loon, *The history of earth sciences in Suriname* (Amsterdam, 1998) 175-201, specifically 179-180.
[60] HaNA, 1.05.01.02, inv.nr. 184, p. 1223-1224, 1249; HaNA, 1.05.01.02, inv.nr. 16, fl. 551 recto – 551 verso, 617 verso – 619 recto.
[61] Wekker, Historie, technieken en maatschappelijke achtergronden, 51.
[62] HaNA, 1.05.21, inv.nr. AB.3.42A, Miscellaneous minutes on proceedings of the Combined Council of Essequibo & Demerara, January 1774 – February 1776, p. 8.
[63] TNA, CO 116, inv.nr. CO 116/39, fl. 166 recto – 167 recto.

Once Heneman received his boat, he studied the colony as thoroughly as possible for a year. In that time, he managed to write a report of 52 pages and added fourteen maps and plans in amazing detail, focusing on a new city, improved defences at the mouth of the Demerara, and the canal that could improve communications and allow the development of new, highly profitable plantations. Starting with the canal, we will examine how these plans, and those of other colonists, were adapted to the natural environment of Essequibo and Demerara and how these adaptations were shaped by Dutch knowledge of hydraulic engineering.

## 2. The Essequibo-Demerara canal

Director-General Storm had been the leading man in Essequibo and Demerara for thirty years and was about to retire when Trotz requested permission to construct a canal between the Essequibo and Demerara rivers.[64] In all these years, he had never seen such a large construction project in his colony. However, when Storm's time in the Americas was coming to an end, the idea of digging canals became more and more popular. In 1768, Joseph de la Chau and Johannes Fredrik Boode had been the first planters who were permitted to construct a canal. It was meant to stretch from the Hoebabo creek outwards to the savannah. This is the creek on the Demerara river visible on Map 1. Heneman produced this map for the WIC, but sometime after the report. Eventually, digging had begun much closer to the river mouth, and formed the start of Canal I visible on the map.[65] Although Map 1 shows canal I running all the way to the Essequibo, it never reached that far. In the years following the plan of De la Chau and Boode, the Director-General approved plans for three additional canals on the Demerara, bringing the total number of planned waterways to four. When Heneman arrived in Essequibo and Demerara in 1773, he noted that work had begun on three of these canals.[66] On his later map, Map 1, he drew a fifth proposed canal on the eastern bank close to the river mouth, and a map from 1796 even shows ten canals.[67] What spurred the colonists to dig all these waterways and how did they plan to construct these?

[64] TNA, CO 116, inv.nr. CO 116/38, fl. 375 recto – 377 verso.
[65] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], Bylage L[a]. C., p. 24-25.
[66] HaNA, Tweede West-Indische Compagnie (WIC), 1.05.01.02, inv.nr 184, p. 1225-1229. A copy of the report by Heneman was sent to the Chamber Zeeland as well, archived as number 1038.
[67] HaNA, 4.VEL, inv.nr. 1489, Generale en speciale kaart der Colonien van de republicq der Ver. Nederl., geleegen in Guyana, langs de Zeekust der rivieren Poumaron, Essequebo, Demerary; van de grensen van Berbice tot de rivier Morocco aan de grens in de Spaansche Bezitting Oronoco.




**Map 1**. Part of the sketch map of the Demerara and Essequibo rivers Heneman produced as part of his report for the WIC. North is to the left, the Essequibo on the west and Demerara on the east.

Source: J.C. Heneman, 'Schetskaart van de Colonien van Rio Demerary en Rio Essequebo, alsmede van de Verlaatene Colonie van Rio Pomeron, mitsgaders een gedeelte der Colonie van Berbice enz.', HaNA, 4.VEL, inv.nr. 1488.

**Necessity of canals**

Plantation owners in the Guianas had to deal with excessive amounts of water, especially in the wet seasons. The rains provided crops with too much water and caused surrounding swamps to flood the plantations.[68] In order to get rid of this water, plantations had to be constructed along natural or man-made waterways, which functioned as drainage canals. Although both the Essequibo and Demerara rivers are long, planters only wanted to establish their plantations on the fertile clay grounds near the mouths of the rivers and along the sea shore.[69] As the rivers and the coast in this area were quickly occupied by planters, new waterways had to be made.

Digging a narrow trench near the mouth of a river was not enough, however. The colony lacked proper roads at the time, as the few existing paths turned to mud in the wet seasons.[70] People therefore depended on waterways for the transportation of themselves and their products.[71] This dependence is illustrated by the five boats and accompanying rowing slaves that the Gentlemen X bought for the Director-General and Commander of the two rivers. They deemed these absolutely necessary if the commanders wanted to govern their rivers properly.[72] A waterway to a plantation had to be both deep and wide enough to be traversable.

Access to a proper waterway for drainage and transportation had a positive impact on the value of a plantation. The canal of De la Chau and Boode was specifically meant to improve the drainage of several plantations constructed on the coast to the west of the Demerara river.[73] These plantations could then lose excess water both to the ocean and to the new canal, improving their water management. De la Chau and Boode presented Storm with a map in 1769 which convinced the Director-General that the plantations on the seaside could rise as much as 50% in value, thanks to their canal.[74] Sadly, it is unknown if this map still

[68] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 9.
[69] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 37, 77-79; Potter, *The Amerindians of Guyana*, 3-4.
[70] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 40 ; M. ten Horn-van Nispen and W. Ravesteijn, 'The road to an empire. Organisation and technology of road construction in the Dutch East Indies, 1800-1940', *The Journal of Transport History* 30:1 (2009) 40-57, specifically 40.
[71] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 28-29; Oostindie and Van Stipriaan, 'Slavery and Slave Cultures', 80.
[72] HaNA, 1.05.01.02, inv.nr. 16, Registers van de resoluties van de Vergadering van Tienen, 1773 mrt. 16 –1773 apr. 24, fl. 622 verso – 626 recto.
[73] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], Bylage L[a]. A., p. 18-19.
[74] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], Bylage L[a]. D., p. 26.

exists. To Storm's amazement, the prediction came true in 1772, when the canal had partly been dug. He reported that a planter had offered thirty guilders per Dutch acre for a plot of land that had not yet been cultivated in any form. To Storm's surprise, the owner still refused the offer![75]

In contrast to the other proposed canals, the Essequibo-Demerara waterway was meant specifically to link the two rivers. This was necessary to improve communications. In Dutch Suriname, many rivers ran parallel to the coast that were connected to each other by a large number of creeks.[76] Such connections did not exist between the Essequibo and the Demerara rivers. Although Storm had governed the two rivers as one single colony since the 1740s, there was no way to properly travel from one to the other. A traveller had to cut his way through dense forests and deep swamps if he wanted to travel over land. Hence, the sea was the best connection between the Essequibo and the Demerara rivers. This was problematic, however, as a seaworthy ship was necessary. Map 1 shows that the coast was riddled with treacherous shoals. The yellow sailing routes on this map make clear that a ship coming from Demerara had to sail far out to sea, before manoeuvring past sand banks to get to the Essequibo river.[77] Unsurprisingly, this journey could be costly. A planters had to own a large sea-worthy ship and a sufficient number of slaves to man it, or pay someone who owned a ship. Although most sand banks were avoided by sailing through open sea, ships were still regularly wrecked on the many mud banks at the mouth of the Essequibo river. This meant the loss of precious ships, goods and lives.[78] The British Captain Thomson Walker explicitly advised sailors not to navigate up the river without a local pilot.[79]

Canals were a necessity because of the natural environment, but people like De la Chau and Boode and the WIC also saw opportunities to turn a profit. By constructing new plantations, they could establish new plantations and sell land to others.[80] Chamber Zeeland saw canals as a way to attract more people to the colony. Using the profits made by the many polders in Holland and Zeeland as an example, the Chamber concluded that the lands made

[75] HaNA, 3.01.26, inv.nr. 450, Contra-Berigt van […] Kamer Amsterdam, in dato 31 December 1772 […], Bylagen Litt. X., p. 18.
[76] Pyttersen, 'Waarom landwegen', p. 277.
[77] See also HaNA, 4.VEL, inv.nr. 658, Kaart van de Monden der rivieren Essequebo en Demerary.
[78] HaNA, 1.05.06, inv.nr. 942, p. 1; HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 9; TNA, CO 116, inv.nr. CO 116/38, fl. 375 verso.
[79] The captain's name was consistently spelt Thomson on the map itself. HaNA, 4.VEL, inv.nr. 661, A Chart of Coast of Guyana, comprehending the colonies of Berbice, Demerary and Essequebo.
[80] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 18-19, 24-25; TNA, CO 116, inv.nr. CO 116/38, fl. 375 recto – 376 verso.

accessible by the new canals in the Guianas would be profitable as well.[81] Heneman's report, which discussed both the Essequibo-Demerara waterway and smaller canals for new plantations, indicates that the comparison to the Dutch Republic convinced the other chambers of the Company. Working on to the orders of the WIC, Heneman wrote that the canals would be used for two things: 'more Cultivation and more substantial population of the Land [of Essequibo and Demerara]'.[82] Before this plan could be carried out, Heneman first needed to find out where to dig the Essequibo-Demerara canal.

**The planned course**

That the Director-General of Essequibo and the Commander of Demerara did not help Heneman as much as they had to, impeded him in fulfilling his task. Without slaves to create a path, he could not walk the distance between the two rivers and study the landscape. The reason why this bothered him differed from what one would expect. Although the WIC seriously considered possibilities for canal building for at least eighteen years,[83] Heneman was not so much worried about his resulting lack of knowledge on the landscape between the Essequibo and Demerara rivers. Instead, he only remarked that he would have liked to accurately measure the distance between the two rivers. Still, his measurements, without accurate chronometers, were remarkably close to the real distance of around 33 kilometres.[84] This lack of interest in the course of the waterway and the fact that by far the most pages in his report dealt with fortifications, point to Heneman's military background.

However, the example of the Saramacca canal in Suriname indicates that Heneman's lack of interest in the landscape was unusual and not like Dutch practices of canal digging. The Saramacca canal was constructed between the Suriname river and the Saramacca river. Before digging began, surveyors of the Society of Suriname first thoroughly studied the proper course for the canal in 1765. They examined the soil, trees, swamps, and the effects of the tide on the proposed canal.[85] The lands between the Essequibo and Demerara were not particularly well-known either. In 1789, surveyor Hendrik van Cooten remarked that he knew

[81] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 10-11.
[82] 'tot meerdere Cultivering en sterkere bevolkering van het Land'. HaNA, 1.05.01.02, inv.nr 184, p. 1254.
[83] Surveyor Hendrik van Cooten was asked his opinion on the feasibility of an Essequibo-Demerara canal in 1789: HaNA, 1.05.06, inv.nr. 101.
[84] HaNA, 1.05.01.02, inv.nr. 184, p. 1223-1224.
[85] HaNA, 4.VEL, inv.nr. 1765, Situatie Kaart van het terrein tusschen de Plantagie Beekhuysen en Saramaca; HaNA, 4.VEL, inv.nr. 1770B, Situatiekaart van de geprojecteerde doorsnyding tusschen de rivieren Suriname en Saramaca (ter hoogte van de redout Purmerend).

nothing of possible elevations or swamps in that area.[86] This was, however, important knowledge, as digging a canal through sandy hills made the whole project significantly more difficult and expensive.[87] The mere possibility of encountering such sandy soils had caused the Saramacca canal to be delayed for years, until the Society found a course with an acceptable amount of sandy soil.[88] However, both Heneman and Trotz chose not to concentrate on such obstacles. When Heneman was conducting his measurements in 1774, the only thing that Director-General Trotz knew about the terrain, was that it consisted of impassable woods, which were flooded in two, three, four or more feet of water for most of the year.[89] This was Trotz' reason not to scout the terrain, because that would demand a large number of slaves and take several years. That would be too costly. Fortunately, the Amerindians had also told him that there were *probably* few to no hills located between the rivers.

Indeed, canal building should have been relatively easy, because the land between the rivers was flat and low-lying, lower than the river banks. Throughout the years, the rivers and the tide had formed ridges consisting of sand and shells along the river banks that could be one to three metres higher than the surrounding lands. These functioned like levees surrounding a polder. The ridges stopped the rivers from flowing onto these lands, but also prevented rainwater from flowing into the rivers. Like a tropical polder that is not drained properly, this resulted in vast swampy forests and savannahs.[90] Heneman expected that this would pose a problem in the rainy seasons, when the east-west canals he proposed would probably not be able to discharge the inflowing rainwater in the rivers. Therefore, he proposed digging additional drainage canals at the halfway point of the east-west canals. These waterways, visible on Map 2, should end in creeks that discharged directly into the ocean. If necessary, these could also accommodate even more plantations.[91]

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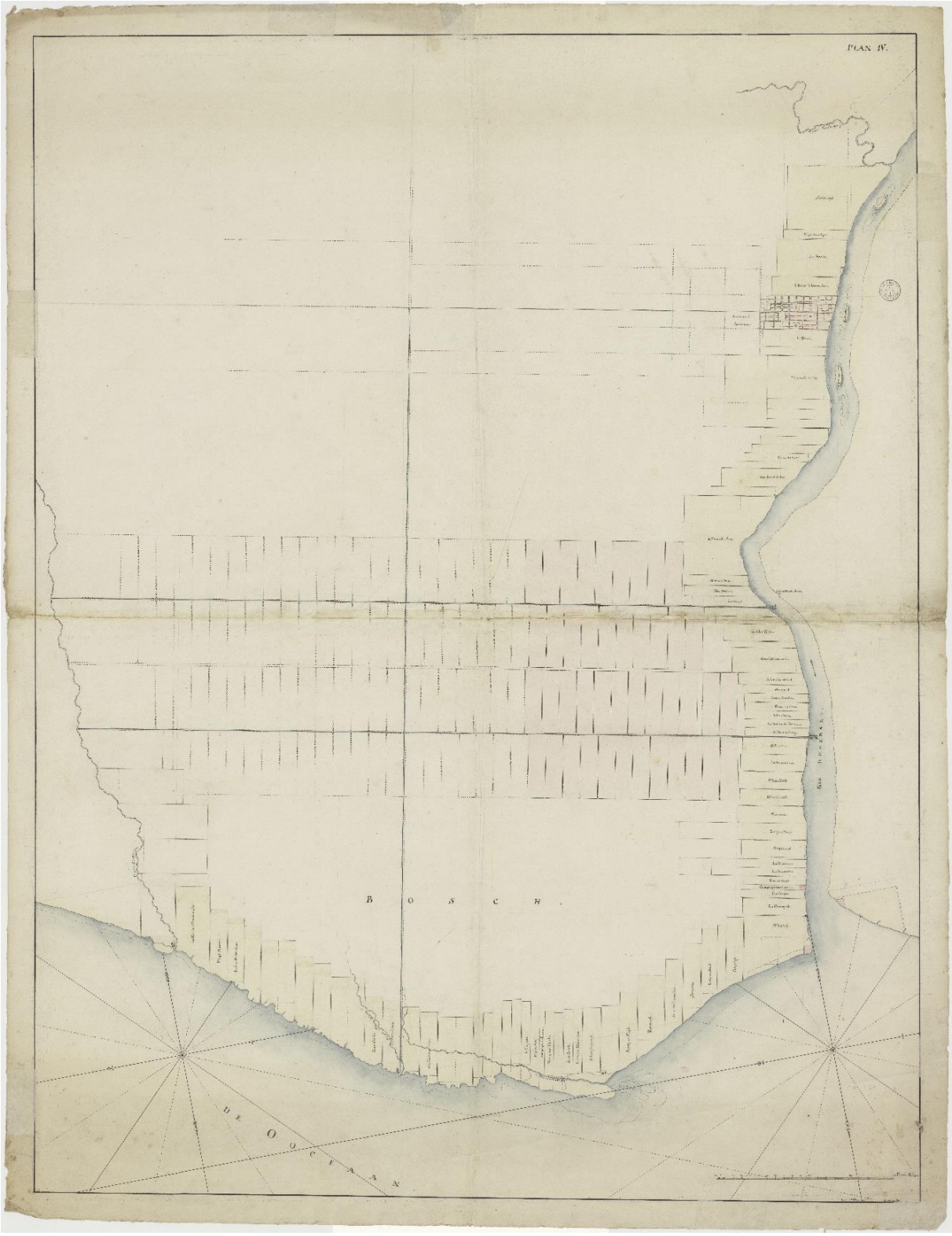
[86] HaNA, Verspreide West-Indische Stukken, 1.05.06, inv.nr. 101, "Plan wegens het maken van een canaal strekkende van de rivier Demerary tot de rivier Essequebo door den landmeter van Cooten.".
[87] HaNA, 3.01.26, inv.nr. 450, Contra-Berigt van […] Kamer Amsterdam, in dato 31 December 1772 […], p. 16-17.
[88] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 79; Van 't Leven, 'Construction of Polders', 228; A. Blom, *Verhandeling*, 13-14.
[89] 'Also het ontoegankelijke boschen zijn, dewelke de meesten tijd van 't Jaar twee, drie, vier en op Sommige Streeken meer voeten waater hebben.' TNA, CO 116, inv.nr. CO 116/39, fl. 166 verso. See also: A. Blom, *Verhandeling over den Landbouw in de Colonie Suriname, volgens eene negentien-jaarige ondervinding zamengesteld* (Haarlem, 1786) 5-6; HaNA, 1.05.06, inv.nr. 942, p. 2.
[90] HaNA, 1.05.01.02, inv.nr. 184, p. 1226, 1229-1230; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 21-22.
[91] HaNA, 1.05.01.02, inv.nr. 184, p. 1226, 1229-1230; HaNA, 4.VEL, inv.nr. 1504, Kaart van de Oostwal der rivier Demerary en de daaraan gelegene plantages; HaNA, 4.VEL, inv.nr. 1506, Kaart van de Westwal der rivier Demerary en de daaraan gelegene plantages.

The addition of the drainage canals was the most thought that Heneman put into the course of his waterways. The Company knew of the importance of a thorough consideration of the proper course, and would have liked to see this experience in hydraulic engineering applied in Essequibo and Demerara.[92] Instead, Heneman was unfamiliar with the terrain and simply proposed to dig the canals in a straight line. This is revealed by Map 1 and Map 2. The southern canal on Map 2 was the only one on which work had not started yet. This meant that Heneman could decide where it would start and end. All future plantations visible on Map 2 match the allowed size, width and length of a coffee plantation.[93] Map 2, together with other maps, therefore tells us that Heneman based the location of this canal on the possible size of future plantations.[94] Trotz and other canal builders simply chose strategic positions based on the location of their own plantations, and the possibility to sell land to new plantation owners. They could choose to stop digging when continuing would prove too expensive.[95] The Company expected a lot of large and deep swamps in several locations, and knew that digging in a straight line was either impossible or really expensive.[96] Apart from swamps, the digging of canals, being non-natural waterways, usually has to deal with naturally occurring watersheds as well, especially when connecting two separate rivers. Even in a flat country like the Netherlands, the contours of the land were followed precisely for the easiest construction and water management.[97] Whereas Heneman and the planters demonstrated little experience with Dutch hydraulic engineering in determining the course of the canals, the example of Saramacca, and the opinion of the WIC, indicate that the Dutch Society and Company did try to implement Dutch experience in water management.

[92] HaNA, 1.05.06, inv.nr. 942, p. 1-2.
[93] HaNA, 1.05.21, inv.nr. AG.1.7, Miscellaneous letters and letterbooks from the 'Heeren X' of the West India Company, 1772-1775, p. 15-16; HaNA, 1.05.01.02, inv.nr. 16, fl. 589 recto – 589 verso.
[94] HaNA, 1.05.01.02, inv.nr. 184, p. 1226; HaNA, 4.VEL, inv.nr. 1504, Kaart van de Oostwal der rivier Demerary en de daaraan gelegene plantages.
[95] HaNA, 3.01.26, inv.nr. 450, Contra-Berigt van […] Kamer Amsterdam, in dato 31 December 1772 […], p. 15-17; HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 24-26.
[96] HaNA, 1.05.06, inv.nr. 942, p. 1-2.
[97] R. Filarski, Kanalen van de koning-koopman. Goederenvervoer, binnenscheepvaart en kanalenbouw in Nederland en België in de eerste helft van de negentiende eeuw (PhD dissertation at Leiden University, 1995) 55.




**Map 2**. Map of lands east of the Demerara river Heneman produced as part of his report for the WIC. North is at the bottom. The northern most canal is canal III, the southern one canal IV.

Source: J.C. Heneman, 'Plan IV', HaNA, 4.VEL, inv.nr. 1504, Kaart van de Oostwal der rivier Demerary en de daaraan gelegene plantages.

**Design of the canals**

Work on Canal I visible on Map 1, the canal of De la Chau and Boode, had just started when Heneman arrived in the colonies. As they simply wanted the canal to drain the excess water from the plantations on the sea side, they made it relatively small. When Heneman inspected it, the canal could only be accessed by small boats during high water levels in the rivers or high tide at sea, which affected this canal as well.[98] To turn this canal into the main Essequibo-Demerara waterway and improve communications between the two rivers, Canal I had to be modified significantly.

Once again, both Heneman and Trotz paid little attention to Dutch practices. George Hendrik Trotz only explained what size he wanted the Essequibo-Demerara canal to be in 1774, when Heneman had already started work on his report. The Director-General tried to make the construction of the canal as cheap as possible. He envisioned the canal 36 feet wide at the surface (11.3 metres) and 6 feet deep (1.8 metres).[99] The width at the bottom of the canal was much smaller. These were likely the minimum width and depth necessary for the canal to be navigable. The dimensions were comparable to those of the Saramacca canal and a plan by surveyor Hendrik van Cooten, but lacked elements that would have helped to maintain proper depth. The Saramacca canal was comparably narrow to save costs, but less shallow, whereas Van Cooten's proposal was wider, but equally deep as Trotz' plan in order to become less expensive.[100] Trotz' waterway was also smaller than most navigable seventeenth and eighteenth-century canals in the Netherlands, which on average measured 12.5 metres wide at a depth of 2.25 metres.[101]

In 1789, surveyor Van Cooten also calculated the proper specifications for a canal between the two rivers. Like Trotz, he searched for the most inexpensive way to do it, but struggled with the proper depth and width. He proposed to make it sixty feet wide at the mouths (18.8 metres). At such a width, he claimed that the river current would help keep the area near the mouths of the canal at the proper depth. To save costs, he proposed to let the canal reach just half the original width at the halfway point. A depth of six feet (1.8 metres)

[98] HaNA, 1.05.01.02, inv.nr. 184, p. 1225.
[99] Note that the original measurement were provided in *Rijnlandse voeten*. TNA, CO 116, inv.nr. CO 116/39, fl. 166 verso.
[100] HaNA, 1.05.06, inv.nr. 101; HaNA, 4.VEL, inv.nr. 1770B, Situatiekaart van de geprojecteerde doorsnyding tusschen de rivieren Suriname en Saramaca (ter hoogte van de redout Purmerend); HaNA, 4.VEL, inv.nr. 1769, Nadere kaart van de geprojecteerde doorsnyding tusschen de rivieren Suriname en Saramaca (ter hoogte van de redout Purmerend).
[101] Filarski, Kanalen van de koning-koopman, 78.

would also save costs, comparable to Trotz' plan and Heneman's smaller canals. According to Van Cooten, this would necessitate sluices to keep enough water in the canal, something Trotz did not worry about. Stopping the canal from draining into the river, however, would ruin the possibility for plantations to discharge their excess water in the canal. But without sluices, the canal would probably only be navigable at high tide.[102]

Heneman solved this problem by focusing on functionality instead of costs, leading to his decision to make the Essequibo-Demerara canal much bigger. The bottom width of the waterway was similar to Dutch canals. However, the minimum depth at low tide should become 15 feet, or 4.7 metres. This meant that the width at the Dutch standard depth of 2.25 metres deep was at least 16.5 metres (see Plan 1 on page 25). Maximum depth at spring tide could rise to more than nine metres![103] In the primary wet season, the depth would be even greater.[104] This ensured that the Essequibo-Demerara canal would be navigable at all times and that it could reliably serve as a drainage canal. Plan 2 shows his proposal for all smaller drainage canals. These should become more like Trotz's plans and the Saramacca waterway, at 20 feet wide (6.3 metres) and only five feet deep (1.6 metres).[105] Canal I was meant to be large enough for large and heavily loaded boats coming from the Essequibo and the Demerara rivers at the same time, whereas the smaller canals were meant primarily for drainage and access to several plantations.[106] This indicates that Heneman first and foremost wanted to create canals that were as useful as possible, instead of canals that were as cheap as possible. This was also true for his forts, as we will see in Chapter 4.

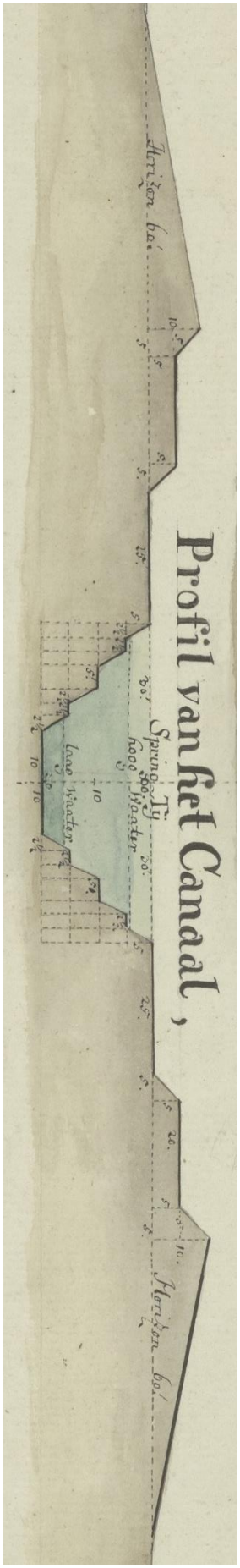
[102] HaNA, 1.05.06, inv.nr. 101.
[103] HaNA, 4.VEL, inv.nr. 1525B, Prospect van een Canaal op Borselen. Plan II. In Dutch, this name claims that this plan shows a canal which could be constructed at the island of Borselen in the Demerara. However, in his report, he writes that this specific plan II shows the Essequibo-Demerara canal. The same goes for plan III. HaNA, 1.05.01.02, inv.nr. 184, p. 1225-1226.
[104] TNA, CO 116, inv.nr. CO 116/39, fl. 166 verso.
[105] HaNA, 4.VEL, inv.nr. 1525A, Prospect van een Canaal op Borselen. Plan III. See footnote 50 for further explanation.
[106] HaNA, 1.05.01.2, inv.nr. 184, p. 1226.


**Plan 1 (left)**. Part of the plan Heneman made for the Essequibo-Demerara canal included in his report to the WIC. It shows a cross-sectional view of the canal. Three water levels are indicated: low tide, high tide and spring tide. Measurements are in Dutch Rhenish feet.

Source: J.C. Heneman, 'Plan II', HaNA, 4.VEL, inv.nr. 1525B, Prospect van een Canaal op Borselen.

**Plan 2 (right).** Part of the plan Heneman made for smaller canals included in his report to the WIC. Same three water levels are included. Measurements in Dutch Rhenish feet.

Source: J.C. Heneman, 'Plan III', HaNA, 4.VEL, inv.nr. 1525A, Prospect van een Canaal op Borselen.



To protect the plantations built along canals, levees had to be constructed. These were usually made from the clay removed for the canal, which was the usual practice in the Netherlands as well.[107] These were not just heaps of sand, but were meant to carry roads too. Just like in the Netherlands, these roads were usually unpaved and muddy or grassy. In the wet seasons, these could hardly be called roads anymore.[108] These paths are described as having been *on* the levees, most clearly in the case of the main Essequibo-Demerara canal.[109] Plan 1 indicates that these roads should have been on the side of the dike where the river flows and which could flood in the wet season. This is the opposite of the usual situation in the Netherlands, where roads are either on top of a dike or on the landside. Why Heneman did not simply design a levee with a flat top is not clear. Plans for the Saramacca canal only featured flat-top levees.[110] Perhaps Heneman thought that this shape would be stronger or more durable, or his decision was influenced by his military background, as his designs for parapets are somewhat similar.[111]

**Construction and maintenance**

Neither Heneman, Van Cooten nor Trotz explained exactly how the canals would be dug. However, some parts of the process can be uncovered. The first step was getting rid of the woods and shrubs. When building plantations, trees were only cut during the primary dry season, when trees and bushes could be (partially) burned down.[112] However, none of the plans for canals worry about the right time for felling trees. It was either assumed that all

[107] S. Zeischka, *Minerva in de polder: Waterstaat en techniek in het hoogheemraadschap van Rijnland (1500-1856)* (Hilversum, 2008) 64.
[108] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 40; Filarski, Kanalen van de koning-koopman, 76-79; Ten Horn-van Nispen and Ravesteijn, 'The road to an empire', 40; 'Reglement voor publieke wegen en bruggen (onvolledig)', 1789-07-27, in: J.Th. de Smidt, T. van der Lee and H.J.M. van Dapperen, *Plakaatboek Guyana, 1670-1816* (The Hague, 2014) http://resources.huygens.knaw.nl/retroboeken/guyana/#page=167&accessor=search_in_text&view=transcriptiePane&source=essequibo.
[109] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 9; 'Concept-tarief van leges bij het Hof van Justitie van Demerary. Voorkoming van overbodig procederen', 1779-08-11, in: De Smidt, Van der Lee and Van Dapperen, *Plakaatboek Guyana*, http://resources.huygens.knaw.nl/retroboeken/guyana/#page=61&accessor=search_in_text&view=transcriptiePane&source=demarary.
[110] HaNA, 4.VEL, inv.nr. 1770B, Situatiekaart van de geprojecteerde doorsnyding tusschen de rivieren Suriname en Saramaca (ter hoogte van de redout Purmerend); HaNA, 4.VEL, inv.nr. 1769, Nadere kaart van de geprojecteerde doorsnyding tusschen de rivieren Suriname en Saramaca (ter hoogte van de redout Purmerend).
[111] HaNA, 4.VEL, inv.nr. 1554A-1554B, Fort aan den mond der rivier Demerary op 's Comps. Pad Oostwal; HaNA, 4.VEL, inv.nr. 1555, Plan van een fort aan den mond der Rivier Demerary; HaNA, 4.VEL, inv.nr. 1557, Plan van het fort aan de Hoofdplaats van Demerarij (Stabroek).
[112] Van 't Leven, 'Construction of Polders', 230; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 45.

woodcutting should be done in the dry season, or that canal builders could do such work year round.[113]

When the forests were gone, the canal itself could be dug. Canals were not simply constructed in one go, but were divided into plots with dams in between, to prevent everything from flooding when something went wrong in one part. Encountering layers of sand instead of the usual heavy clay could be especially destructive. These could destabilize the sides of the new canal and were very hard to dig through. That is why work on the Saramacca canal only started when the Society knew where sand would be encountered.[114] The only tools available for digging were spades and pickaxes. In the Netherlands, inflowing groundwater was pumped away by hand or with horse-powered mills. As slaves were cheaper than horses, pumping was likely done by hand in the Guianas.[115]

In fact, almost all work was done by slaves, for reasons of cost. Only parts like bridges and sluices were constructed by paid craftsmen. Only a few of these were needed, but the high wages of the craftsmen resulted in high costs. Heneman calculated for the Essequibo-Demerara canal that the work of craftsmen alone would cost 400,000 guilders. In comparison, using one thousand slaves to do all the digging, feeding them for five years and providing them with living spaces and spades and pickaxes would cost 600,000 guilders.[116]

Slaves had to do backbreaking work in harsh conditions. Each slave was expected to clear between 9.2 and 12.3 cubic metres of soil every day. Van Cooten thought the latter number to be the maximum without having exceptionally good slaves and supervisors.[117] Actual productivity depended on the soil types encountered. Heneman expected that on average, one slave would die every four days doing this work. This only worried him because dead slaves could not be sold at the end of the project and thus cost the Company more money.[118] Illnesses were also widespread in the Guianas. If one wanted a certain number of slaves to work on a project, then he had to expect one fourth of them to be ill at all times, therefore making it necessary to buy 25% more slaves. Heneman thought he needed eight

[113] HaNA, 1.05.01.02, inv.nr. 184, p. 1260-1261; HaNA, 1.05.06, inv.nr. 101; TNA, CO 116, inv.nr. 116/39, fl. 166 verso.
[114] Filarski, Kanalen van de koning-koopman, 56; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 47, 79; Van 't Leven, 'Construction of Polders', 228-230, 238; Blom, *Verhandeling*, 13-14; HaNA, 3.01.26, inv.nr. 450, Contra-Berigt van […] Kamer Amsterdam, in dato 31 December 1772 […], p. 16-17.
[115] Filarski, Kanalen van de koning-koopman, 56; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 47; Van 't Leven, 'Construction of Polders', 230.
[116] HaNA, 1.05.01.02, inv.nr. 184, p. 1260.
[117] HaNA, 1.05.06, inv.nr. 101.
[118] HaNA, 1.05.01.02, inv.nr. 184, p. 1260-1261.

hundred slaves to construct the main canal in five years. Taking the ill men into account, he proposed to buy one thousand.[119]

Something Heneman, Van Cooten and Trotz did not take into account, was what slaves thought of this work. Historians Gert Oostindie and Alex van Stipriaan found that the oral tradition in Suriname suggested that digging canals and trenches in heavy sea clay was especially hated by slaves. They disliked it so much that they actively tried to resist doing it and saw it as one of the more important reasons for marronage.[120] It could therefore very well be that several slaves would also run away when they were forced to dig the canals. Heneman, however, calculated the 25% surplus of slaves specifically for ill slaves, and never mentioned marronage in his report.

When canals were put to use, maintenance was still required. The most difficult challenge was keeping the canals at the right depth. Usually, the current in canals was not strong enough to keep sand and silt from depositing. Van Cooten thought about this problem, but concluded that making the mouths of his canal wider would only keep those mouths deep enough.[121] Heneman and Trotz did not mention any way to maintain depth. In the Netherlands, multiple ways existed to get rid of sediments.[122] One was using the natural tidal range of the area. This was tried in Suriname when the Saramacca canal was built. There was both a difference in elevation and effects of the tide on the two rivers it connected. This did not create strong enough currents but instead brought large amounts of sediment to the halfway point of the canal.[123] Current could also be created artificially. A large amount of water would then be stored in a canal at high tide, which was let go at low tide, creating a strong current. In 1796, Jan Sabrier probably proposed to employ this technique in Demerara. He created a map for the future extension of canal III (a different plan from the one visible in Map 1). He wanted a ship lock where the canal would flow into the Demerara, but a discharge sluice on the other end.[124] This second type of sluice is usually meant for two things: keeping a constant water level, and dredging canals.

If these options did not help, there was only one option left in the Guianas: using slave labour. In the Netherlands, so called mud mills, dredging boats powered by horses, were used in such cases. Whereas these worked great on mud or peat soil, these could not deal with large

[119] HaNA, 1.05.01.02, inv.nr. 184, p. 1260.
[120] Oostindie and Van Stipriaan, 'Slavery and Slave Cultures', 87.
[121] HaNA, 1.05.06, inv.nr. 101.
[122] Described options for dredging are taken from Filarski, Kanalen van de koning-koopman, 52, 80.
[123] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 81-82.
[124] HaNA, 4.VEL, inv.nr. 1500, Kaart van een gedeelte der rivieren zeekusten van Demerary, met de langs geleegen plantagien enz.

amounts of sand and clay.[125] This made them unsuitable for Essequibo and Demerara. Slaves thus had to do the trick with simple tools like long spades that could reach the bottom of a canal.

Maintenance also provided one last difference between water management in the Dutch Republic and the Guianas. No communal systems, institutions or practices developed to battle the common threat of dike failure, whereas these were an important part of the risk societies of the Dutch Republic and the English Lowlands.[126] The Netherlands had many different water authorities, each responsible for water management and the maintenance of levees, sluices and waterways in a certain area.[127] In 1771, Trotz wanted the authorities of Essequibo and Demerara to pay for maintenance work on dikes, but this did not become common practice.[128] Instead, canals, levees and the roads on these had to be maintained by the plantation owners that built their plantations along the canals and used the dikes as protection. Planters had to instruct their slaves to clean and repair the roads and dikes four times each year, but the canals had to be dredged twice as often.[129]

The unfamiliar natural environment of Essequibo and Demerara, especially the large amounts of rain, made it necessary to dig new canals for new plantations. The fact such canals were dug, is not clear evidence of the application of Dutch knowledge of hydraulic engineering. Dutch experience in water management was not reflected in the design of the canals either. This mainly seems to be the result of the wish to build these canals as cheap as possible and to make these fit in the natural environment of the Guianas. In Heneman's case, his military background and the lack of support from the authorities also played a role. Courses were not planned as thoroughly as in the Netherlands, specifications were completely different, and construction and maintenance depended on (privately owned) slaves.

[125] Filarski, Kanalen van de koning-koopman, 52.
[126] Bankoff, 'The 'English Lowland'', 30-32.
[127] Van Dam, *An Amphibious Culture*, 80; Zeischka, *Minerva in de polder*, 33-34, 52, 63.
[128] TNA, CO 116, inv.nr. 116/38, fl. 376 verso – 377 recto.
[129] 'Aanleg en reglement van een openbare weg van Boerassierie via de Westpunt […] naar de kreek Madewijne. Toestemming om over de weg te rijden', 1777-06-19, in: De Smidt, Van der Lee and Van Dapperen, *Plakaatboek Guyana*, http://resources.huygens.knaw.nl/retroboeken/guyana/#page=51&accessor=search_in_text&view=transcriptiePane&source=demarary; 'Concept-reglement voor het kanaal no. 2', 1779-04-23, in: De Smidt, Van der Lee and Van Dapperen, *Plakaatboek Guyana*, http://resources.huygens.knaw.nl/retroboeken/guyana/#page=58& accessor=search_ in_text&view=transcriptiePane&source=demarary; 'Reglement voor publieke wegen en bruggen (onvolledig)', 1789-07-27, in: De Smidt, Van der Lee and Van Dapperen, *Plakaatboek Guyana*, http://resources.huygens.knaw.nl/retroboeken/guyana/#page=167&accessor=search_in_text&view=transcriptiePane&source=essequibo.

The continuous need for maintenance was an important reason why most proposed canals were never constructed as planned. Canals that were actually dug were often left to deteriorate. Maintenance simply cost too much, especially because the supply of slaves was low. The need for the Essequibo-Demerara waterway was furthermore lessened when the two rivers became two more or less independent colonies. Wars with the British and a period of French rule in the 1780s interfered with the plans.[130] Construction of various canals, however, had already started. Canal I and II eventually reached a length of eight kilometres and the lands newly made available were quickly put to use.[131] How then, did planters shape and construct their new plantations in the wet Guianas?

[130] Netscher, *Geschiedenis*, 146-147; Goslinga, *The Dutch in the Caribbean, 1680-1791*, 454-460.
[131] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 36.

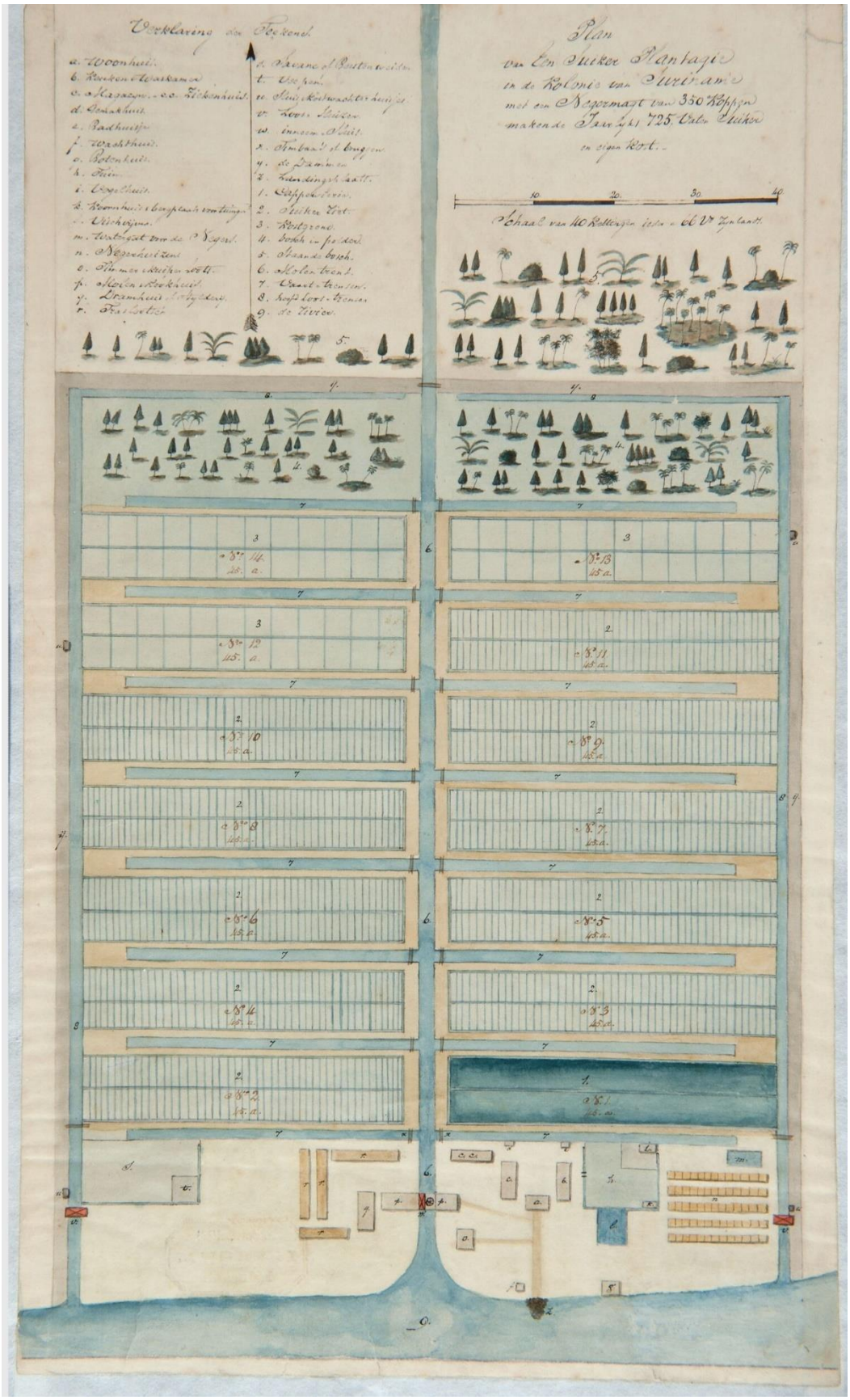
## 3. Polder plantations

*Without the proposed Canal, by far the greatest part of the Lands will remain as either useless Savannahs or Swampy and mostly flooded Lands, or, because of the lack of necessary resources, as completely useless soils for cultivation, as no one that even remotely knows the composition and condition of the Colony could contradict.*

- Chamber Zeeland arguing the advantages of the Essequibo-Demerara canal[132]

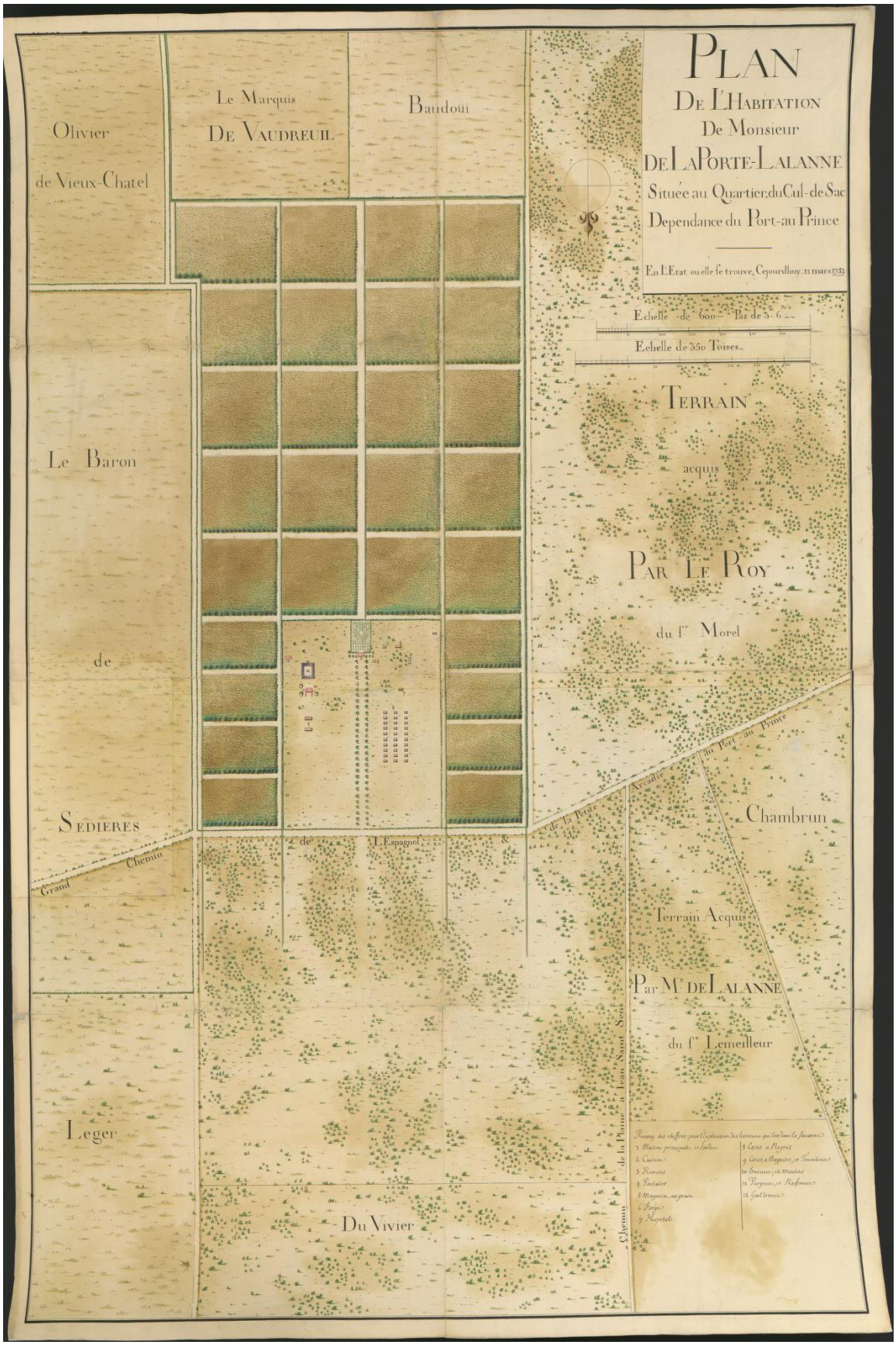
This statement by the directors of Chamber Zeeland illustrates that the natural conditions between the Essequibo and Demerara were not immediately suitable for the cultivation of sugar cane or coffee. A lot of work had to be done before a plantation owner could sell their first crop. Although Heneman projected a canal which would ideally suit many new plantations, he never explained the possibilities for plantation construction in his report.[133] The Gentlemen X never asked him to.[134] However, plantation construction in the harsh environment of the Guianas was difficult. Moreover, historians like Van Stipriaan and David Alston claimed that plantations in Essequibo and Demerara had many unique aspects when comparing those to plantations in other colonies in the Americas.[135] What did this unique plantation construction look like, and how was it influenced by the environment?

[132] '… dat zonder het te graven Canaal verre het groottere gedeelte derzelve zoude zyn gebleven, of onbruikbare Savanen of Moerassige en meest al onder water leggende Landen, of by gebrek van de noodige avenuës ter cultuure geheel en al ongeschikte gronden, gelyk niemand de constitutie en gelegendheid der Colonie maar eenigsints kundig, zal konnen tegenspreken.' HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 11-12.
[133] HaNA, 1.05.01.02, inv.nr. 184.
[134] HaNA, 1.05.01.02, inv.nr. 16, fl. 551 recto – 551 verso, 617 verso – 619 recto.
[135] Van Stipriaan, *Surinaams Contrast*, 74, 81; D. Alston, '"The habits of these creatures in clinging one to the other": Enslaved Africans, Scots and the Plantations of Guyana', in: T.M. Devine, *Recovering Scotland's Slavery Past. The Caribbean Connection* (Edinburgh, 2017) 99-123, specifically 102.




**Plan 3**. Sugar plantation in Suriname. Anonymous.

Source: Anonymous, Stichting Nationaal Museum van Wereldculturen, inv.nr. TM-H-3350, Plattegrond van een suikerplantage.




**Plan 4**. Sugar plantation in Haiti. Anonymous.

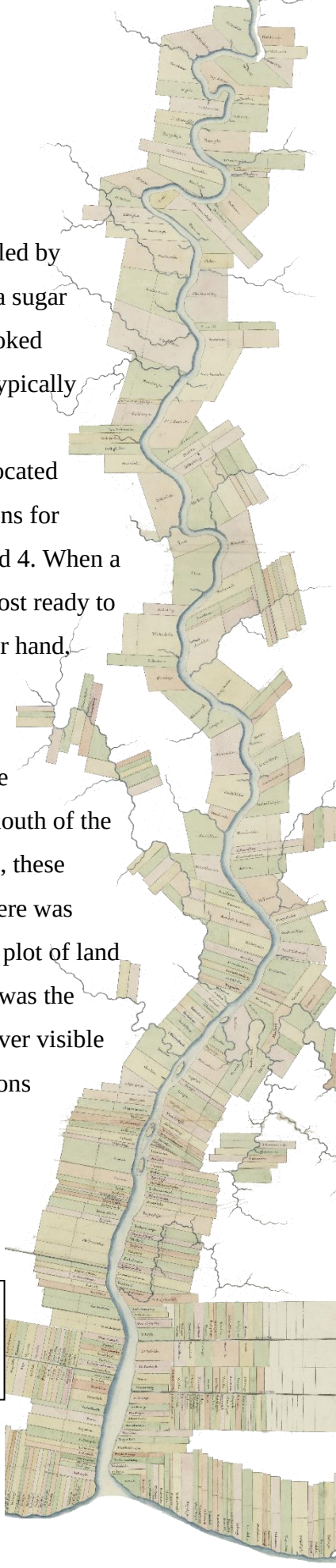
Source: Anonymous, University of Michigan, William L. Clements Library Image Bank, inv.nr. 7495, Plan de l'Habitation de Monsieur de La Porte-Lalanne Située au Quartier du Cul-de-Sac Dépendence du Port-au-Prince : En l'Etat où elle se trouve Cejourd-juy 12 mars 1753.

## ‘Wet’ and ‘dry’ plantations

In what ways plantations in the Dutch Guianas were unique, is revealed by Plan 3 and Plan 4 on the previous pages. Plan 3 displays the ideal layout of a sugar plantation in the Dutch Guianas, but coffee, cotton and cocoa plantations looked almost identical.[136] Plan 4 shows a beautiful example of a sugar plantation typically constructed in less swampy colonies.

Along the Essequibo and Demerara, the very first plantations were located far up the rivers and looked similar to Plan 4. I will call these ‘dry’ plantations for short. The reason that these were constructed first is obvious from Plan 3 and 4. When a future plantation owner had cut down the trees on his ‘dry’ plot, he was almost ready to start farming sugar or coffee.[137] If the owner dealt with wet soils on the other hand, felling trees was just the beginning of a complicated construction process.

This initial preference for dry plantations is visible on several maps. On Map 3, at the right side of this page, plantations are large at the top of the map, on the upper part of the Demerara river, but get smaller closer to the mouth of the river. When the Demerara river was opened up to plantation owners in 1746, these larger plantations were some of the first to be constructed.[138] At the time, there was plenty of land available along the river, enabling everyone to take as large a plot of land as he or she wanted. This changed quickly for two reasons. The first reason was the popularity of the Demerara. Within thirteen years, the entire stretch of the river visible on Map 3 was already occupied by plantations.[139] As we have seen, plantations were always established along waterways. This severely limited the area available for plantations. A second reason emerged when the earliest dry plantations were faced with significant soil depletion. In the relatively dry areas, the harvest of the second year was already much smaller than that of the first.[140] In contrast, soils near the river mouth mostly



**Map 3.** Plantations along the Demerara.
Source: J.C. Heneman, ‘Origineele kaart van de Colonie en Riviere van Demerary’, HaNA, 4.VEL, inv.nr. 1502.

[136] Blom, *Verhandeling*, 20-28, 172, 255, 289; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 40-41. For an example of a coffee plantation, see Stichting Nationaal Museum van Wereldculturen, inv.nr. TM-H-3351, Plattegrond van een koffieplantage.
[137] Blom, *Verhandeling*, 41-42.
[138] HaNA, 4.VEL, inv.nr. 1492A, Caerte van de rivier Demerary van Ouds Immenary, gelegen op Suyd Americaes Noordkust op de Noorder Breedte van 6 Gr. 40 Min. enz.
[139] Ibidem. The map was made in 1759, the first plantation in Demerara was established in 1476.
[140] Goslina, *The Dutch in the Caribbean, 1680-1791*, 438.

consisted of very fertile clay, which did not nearly deplete as fast as the dry soils.[141] This combination of reasons quickly led to a shortage of space along the river banks of the lower parts of the Essequibo and Demerara rivers. As everyone needed direct access to the river for drainage and transportation, increasingly narrow and small plots of land were offered by the governments of the Dutch Guianas.[142] Soil depletion was also the reason why plantations further up the river remained large. Close to the coast, planters could use a plot for up to sixteen years before it needed to recover for eighteen years, but further upstream, this could reduce to just two years. This necessitated future extension of plantations. The plantations most often did not occupy the entirety of a plot, but a bigger plot made this extension possible.[143]

Another important reason for plantations owners to settle far upstream on the Demerara and Essequibo rivers was flooding. Planters searched for spots where combinations of spring tide and storms did not result in flooding. Preferably, these location also did not flood when river levels rose in the primary wet season. Naturally, this was further upstream, where both the effect of the tide and the river itself were smaller. This had the advantage that fewer and smaller flood defences sufficed, compared to downstream.[144]

**Milling practices**

Preferred locations differed along each river for more complicated reasons as well, like the tidal range. Tidal range affected milling practices on some plantations. Mills were used to power a sugarcane press, which extracted the sweet juice from the canes. Mills were also the one type of building which differed the most between plantations in different environments. Hence, these can illustrate both the role of the environment and the impact that a planter's background had on plantation construction.

Oostindie, Van Stipriaan, and Ehrenburg and Meyer all mention that planters in Suriname made grateful use of the tides.[145] This was not the case in Essequibo and Demerara. The effectiveness of tidal mills was known from Dutch experience, as these were sometimes

[141] Goslinga, *The Dutch in the Caribbean, 1680-1791*, 438; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 37; Van Stipriaan, *Surinaams Contrast*, 75-76.
[142] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 30-31.
[143] Oostindie, *Roosenburg en Mon Bijou*, 19-21; Blom, *Verhandeling*, 51-52; HaNA, 4.VEL, inv.nr. 1526, Kaart van de kolonie Essequebo; HaNA, 4.VEL, inv.nr. 1541, Kaart van 't Varken Eyland in Rio Essequebo enz.
[144] Wekker, Historie, technieken en maatschappelijke achtergronden, 40.
[145] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 57; Oostindie, *Roosenburg en Mon Bijou*, 41; Van Stipriaan, *Surinaams Contrast*, 173-174.

used to grind wheat in the Netherlands.[146] The construction of water mills in the Guianas was expensive, because it necessitated sluices, water basins, ditches, the large mill itself and a wooden building in which the mill was built. However, in the long run, this was cheaper on large plantations than an animal mill. Animal feed was expensive, and buying new animals, especially horses, even more so. Therefore, as many as 150 water mills existed in Suriname at the end of the eighteenth century.[147] Water mills did not occur equally often in Essequibo and Demerara. The only map detailing mills is a 1759 map by main surveyor Laurens Lodewyk Bercheyck, visible as Map 4 on the next page. He only mapped a small stretch of the Essequibo, but depicted all plantations and mills on the Demerara. Animal mills are visible as crosses, water mills as crosses inside circles (⊕). In total, he drew seven water mills, whereas he found 31 horse powered mills.[148]

This was not due to a difference in tidal range. Spring tide range near the mouth of the Demerara is nowadays measured at 2.6 metres, which is comparable to the range encountered along the coast of Suriname.[149] A larger tidal range is depicted on Plan 1 and 2 in Chapter 2, but Heneman's calculations probably also took river water levels during different seasons into account. The Essequibo and Demerara rivers could rise more than six metres above normal level in several places in the primary wet season.[150] In Suriname, Essequibo and Demerara, the tide effected river water levels tens of kilometres up the river. Only in Suriname this effect was used to power water mills on almost all polder plantations.[151] Many plantations close to the mouth of the Demerara were constructed only a few years before Bercheyck surveyed the river. For some plantations, this could mean that their mills were not yet finished, as these were usually built at a late stage of plantation construction.[152] On the other hand, Bercheyck also drew mills which were still under construction (┐, with an added arc for water mills). Although sugar plantations on the proposed canals would have been able to use tidal mills, doing so would have been a departure from usual practice in Essequibo and Demerara.

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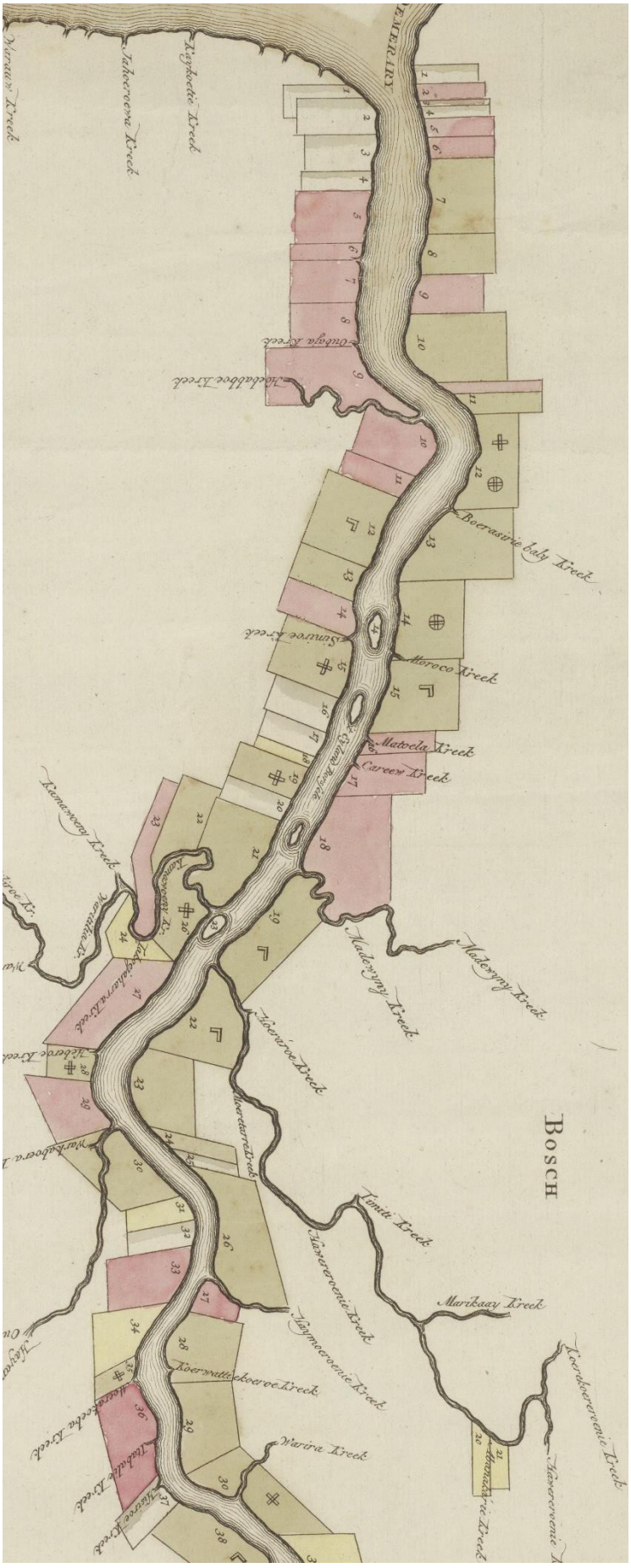
[146] A.T. Nolthenius, 'Getijmolens in Suriname', *De West-Indische Gids* 35 (1955) 219-225, specifically 219.
[147] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 55-61; Blom, *Verhandeling*, 120-159; Van Stipriaan, *Surinaams Contrast*, 173-174; Nolthenius, 'Getijmolens in Suriname', 219.
[148] HaNA, 4.VEL, inv.nr. 1492A, Caerte van de rivier Demerary van Ouds Immenary, gelegen op Suyd Americaes Noordkust op de Noorder Breedte van 6 Gr. 40 Min. enz.
[149] Bird, 'Guyana', 245; N. Psuty, 'Surinam', in: E.C.F. Bird, *Encyclopedia of the World's Coastal Landforms. Volume I* (Dordrecht, Heidelberg, London and New York, 2010) 243.
[150] Blom, *Verhandeling*, 5-6.
[151] Oostindie, *Roosenburg en Mon Bijou*, 41; Van Stipriaan, *Surinaams Contrast*, 173-174; Nolthenius, 'Getijmolens in Suriname', 219, 221-222.
[152] Blom, *Verhandeling*, 56-57; Letter by Storm to Chamber Zeeland of December 7, 1746, in: De Villiers, *Storm*, 99.




**Map 4**. Part of the map of the Demerara by Laurens Lodewijk van Bercheyck, main surveyor of the two colonies. North is on top.

Source: L.L. van Bercheyck, 'Caerte van de rivier Demerary van Ouds Immenary, gelegen op Suyd Americaes Noordkust op de Noorder Breedte van 6 Gr. 40 Min. enz.', HaNA, 4.VEL, inv.nr. 1492A.

In contrast, windmills were found more frequently along the Demerara and Essequibo rivers than in Suriname. Of course, the Netherlands is famous for its windmills, but windmills in Essequibo and Demerara were most often constructed by the large numbers of British planters. Director-General Storm had specifically tried to attract them to his colony in the middle of the eighteenth century. From the 1760s onward, the British even outnumbered the Dutch in Demerara.[153] Ehrenburg and Meyer write that the few windmills in Suriname were built by these British plantation owners from Barbados. Tidal mills were also frequently used in Britain,[154] but windmills and horse powered mills were normal practice on relatively dry Barbados. However, planters in Suriname did not manage to make effective use of the wind. In the eighteenth century, practically no windmills were still in use in Suriname.[155] More of these could be found in eighteenth-century Essequibo and Demerara, but horse mills were still preferred. Windmills only functioned close to the mouths of the rivers. Ehrenburg and Meyer only mention two windmills on the Demerara in 1750.[156] Gedney Clarke, however, was an Englishman from Barbados who owned a plantation at the mouth of the Essequibo with a windmill. Storm wrote that this windmill had worked very well. His reason to report this, was that the WIC itself also built a windmill on their plantation Duijnenburg on the island Vlaggeneiland in the Essequibo.[157] The only reason not to use a horse powered mill was a contagious disease among horses.[158] This windmill became one of at least three of its type along the river. Another was located on plantation Dundee on the eastern bank, and the third was situated on another WIC plantation called Luixbergen on Hog Island.[159] Towards the end of the eighteenth century, two more windmills were built on coastal plantations several kilometres east of the Demerara. The owners of these two plantations had British names as well.[160]

[153] Oostindie, '"British Capital"', 36-37; D. Alston, '"The habits of these creatures in clinging one to the other": Enslaved Africans, Scots and the Plantations of Guyana', in: T.M. Devine, *Recovering Scotland's Slavery Past. The Caribbean Connection* (Edinburgh, 2017) 99-123, specifically 102.
[154] Nolthenius, 'Getijmolens in Suriname', 223.
[155] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 61; Galloway, *The Sugar Cane Industry*, 90.
[156] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 61.
[157] Letter by Storm to Chamber Zeeland of the WIC of March 18, 1761, in: De Villiers, *Storm*, 201.
[158] Letter by Storm to Chamber Zeeland of June 15, 1758, in: De Villiers, *Storm*, 183.
[159] Ibidem; HaNA, 4.VEL, inv.nr. 1492A, Caerte van de rivier Demerary van Ouds Immenary, gelegen op Suyd Americaes Noordkust op de Noorder Breedte van 6 Gr. 40 Min. enz.; HaNA, 4.VEL, inv.nr. 1526, Kaart van de kolonie Essequebo; HaNA, 4.VEL, inv.nr. 1529, Kaart van een gedeelte der Colonie Essequebo; HaNA, 4.VEL, inv.nr. 1534, Kaart van de Plantagies Duinenburg en Luixbergen, gelegen tusschen Mazaronie-en Cajounikreken; HaNA, 4.VEL, inv.nr. 1543, Grond Teykening der nieuw aangelegde Erven op het groot Vlaggen Eyland; TNA, CO 116, inv.nr. CO 116/39, fl. 105 recto.
[160] The owners were John Haslen and Thomas Cumming. HaNA, 4.VEL, inv.nr. 661, A Chart of Coast of Guyana, comprehending the colonies of Berbice, Demerary and Essequebo.

Were winds blowing stronger in Essequibo and Demerara than in Suriname? The Hydrometeorological Service of Guyana and the *Meteorologische Dienst* of Suriname both do not track wind speeds,[161] but NASA does. These data indicate that wind speeds in Georgetown on the Demerara and in Parika on the Essequibo are almost the same as in Paramaribo, Suriname, regardless of the time of year.[162] Clearly, the lack of watermills and the more frequent use of windmills by British planters indicates that Dutch knowledge and the natural environment of the Guianas did not always determine what was built.

The preference for animal powered mills could not be explained by the environment or Dutch knowledge either. An important advantage of animal powered mills over windmills and tidal mills was the constant availability of power, provided that the planter owned a sufficient number of horses or oxen.[163] The wind does not always blow and tidal power could only be used on sixteen days of each month.[164] A disadvantage of animal powered mills in the Guianas was the difficulty in transforming the many swamps into pastures for feeding the livestock.[165] The ability to use the mill at any time was important, however. Mills and the slaves operating these had a certain level of productivity, whereas demand for milling was high. Increasing the time available for processing sugar was preferred over working slaves to death. Fortunately, the climate in the Guianas made it possible to grow sugar cane year round. This enabled plantation owners to spread the harvests of different fields over several months.[166] However, sugar cane loses a significant amount of its sucrose (sugar) if it is not processed within 48 hours.[167] Sugar plantations in Essequibo and Demerara also outnumbered mills. Mills were often constructed by European skilled labourers, which made these expensive.[168] Plantation owners paid high prices to have their canes processed at someone else's mill. Hence, when Gedney Clarke moved from Essequibo to Demerara, he started work

[161] See the Map Room: Guyana Ministry of Agriculture Hydrometeorological Service, 'Map Room', http://181.199.253.14/maproom/Climatology/index.html, last visited May 5, 2020; Meteorologische Dienst Suriname, http://www.meteosur.sr/, last visited May 8, 2020.
[162] NASA data displayed by Weather Spark. Weather Spark, 'Average Weather in Georgetown', https://weatherspark.com/y/29070/Average-Weather-in-Georgetown-Guyana-Year-Round, last visited May 5, 2020; Weather Spark, 'Average Weather in Paramaribo', https://weatherspark.com/y/29437/Average-Weather-in-Paramaribo-Suriname-Year-Round, last visited May 5, 2020; Weather Spark, 'Average Weather in Parika', https://weatherspark.com/y/29068/Average-Weather-in-Parika-Guyana-Year-Round, last visited May 5, 2020.
[163] Nolthenius, 'Getijmolens in Suriname', 219.
[164] Oostindie and Stipriaan, 'Slavery and Slave Cultures', 82; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 55; Oostindie, *Roosenburg en Mon Bijou*, 45; Van Stipriaan, *Surinaams Contrast*, 173-174.
[165] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 48-49.
[166] Oostindie and Stipriaan, 'Slavery and Slave Cultures', 82; Galloway, *The Sugar Cane Industry*, 90-91.
[167] U. Bosma, *The Sugar Plantation in India and Indonesia. Industrial Production, 1770–2010* (Cambridge, 2013) 23.
[168] Galloway, *The Sugar Cane Industry*, 90-91; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 37-38.

on his mills before constructing his plantations.[169] Demand was so high that milling went on for 24 hours each day, with slaves working in shifts.[170]

**Construction and maintenance**

Johan Christoph Heneman did not try to answer the questions of how and where plantations should be constructed when he proposed his canals. Map 5 (on page 43) shows the proposed canals surrounding the lower area of the Demerara river. The uncoloured rectangles are possible locations for future plantations, whereas coloured rectangles were lands already sold to new owners. This sale happened before the construction of the canals had even begun.[171] Heneman simply chose to draw plantations with a total area of five hundred Dutch acres (approximately 215 hectares). This was the maximum size of coffee plantations,[172] which were becoming increasingly prevalent along the Demerara in the 1770s.[173]

A quick look at the plots of land already sold reveals a discrepancy between Heneman's plans for future plantations and those of actual plantation owners. Especially the first few plantation owners who were granted land on the new canals wanted much smaller pieces of land than they were allowed to buy.[174] Some twenty years later, Heneman realised his mistake and drew a new map on which the plots for future plantations were much smaller.[175] A possible reason for this discrepancy are the enormous costs and efforts associated with constructing a polder plantation. When Otto Keye wrote of the differences between the Guianas and North-America in 1659, he repeated countless times how easy it was to cultivate crops in the Guianas.[176] Almost 130 years later, Anthony Blom instead concluded

[169] Letter by Storm to Chamber Zeeland of August 31, 1752, in: De Villiers, *Storm*, 139.
[170] Oostindie and Stipriaan, 'Slavery and Slave Cultures', 82.
[171] TNA, CO 116, inv.nr. CO 116/38, fl. 377 recto – 377 verso.
[172] HaNA, 1.05.01.02, inv.nr. 16, fl. 589 recto – 589 verso; 'Condities voor de uitgifte van grond in Demerary', 1746-04-03, in: De Smidt, Van der Lee and Van Dapperen, *Plakaatboek Guyana*, http://resources.huygens.knaw.nl/retroboeken/guyana/#page=45&accessor=search_in_text&view=transcriptiePane&source=essequibo.
[173] HaNA, 4.VEL, inv.nr. 1492A, Caerte van de rivier Demerary van Ouds Immenary, gelegen op Suyd Americaes Noordkust op de Noorder Breedte van 6 Gr. 40 Min. enz.; HaNA, 4.VEL, inv.nr. 1489, General en Speciale kaart der Colonien van de republicq der Ver. Nederl., geleegen in Guyana, langs de Zeekust der rivieren Poumaron, Essequebo, Demerary; van de grensen van Berbice tot de rivier Morocco aan de grens in de Spaansche Bezitting Oronoco; Blom, *Verhandeling*, 193.
[174] For exact measurements of the first plantations along canal 1, see for example: HaNA, 4.VEL, inv.nr. 1510, Kaarte van de Plantagien geleegen aan de Westwal van de Rivier Demerary van den mond der rivier af tot aan de Kreek Hobabo.
[175] HaNA, 4.VEL, inv.nr. 1502, Origineele kaart van de Colonie en riviere van Demerary. Als ook de Oostelycke en Westelycke zeekusten van dezelve met de plantagien en gronden en aanleggingen tot coultuure derzelver kusten. This map was probably created in 1795 or later, as Heneman created the map for Council of American Colonies of the Batavian Republic.
[176] O. Keye, *Het Waere Onderscheyt tusschen Koude en Warme Landen* (The Hague, 1659) 96-109.

that it was very hard to farm in the Guianas, as complex polders had to be constructed.[177] The completion of these polders took several years. Construction and maintenance necessitated a large number of slaves, compared to plantations in other colonies. Only buildings, sluices and mills were made by European labourers. Construction of a plantation took as long as it did, because slaves only had shovels and pickaxes at their disposal.[178] Twenty slaves could only prepare twenty Dutch acres for planting in one year.[179] Construction of a one thousand acre plantation therefore demanded a long time, a great deal of money and a lot of (rented) slaves.

In general, construction of all types of plantations was the same. Sugar, coffee, cotton and cocoa all grew on polder plantations because of the abundance of rain in the wet seasons.[180] Actual cultivation of these crops differed significantly and was also strongly influenced by the environment in which a polder plantation was situated. However, this story will not be discussed here, as this thesis studies construction projects, not farming practices.[181]

The proper way to start the construction of a polder plantation was copied from the Amerindians and everything regarding this construction was influenced by the environment. Work on plantations had to start at the end of June or the first weeks of August, because that was when the primary wet season came to an end and the long dry season started. As dry conditions were absolutely necessary, it was not wise to start in the short dry season. That season often turned out too short.[182] This practice could very well be copied from traditional Amerindian slash-and-burn methods. At the start of the long dry season, Amerindians first cleared the undergrowth from a specific part of the woods, after which they cut down the trees. Instead of removing the trunks, they simply burned everything to the ground. Then, when the short wet season started in November, they planted their crops on the remaining ashes.[183] The Dutch did roughly the same. They let their slaves fell the trees and cut off the largest branches. Then, everything was left to dry for four weeks, after which it was set aflame. At that point, the peaty soil and bigger trunks were still wet enough not to burn. If

[177] Blom, *Verhandeling*, 20-29.
[178] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 37-38, 47; Oostindie and Stipriaan, 'Slavery and Slave Cultures', 81; Galloway, *The Sugar Cane Industry*, 88; Van 't Leven, 'Construction of Polders', 230; Oostindie, *Roosenburg en Mon Bijou*, 27.
[179] Blom, *Verhandeling*, 21-29.
[180] Blom, *Verhandeling*, 20-28, 172, 255, 289; Van Stipriaan, *Surinaams Contrast*, 76.
[181] Farming practices in Suriname have been studied thoroughly. Blom discussed all of the most prevalent types of crops: A. Blom, *Verhandeling over den Landbouw in de Colonie Suriname, volgens eene negentien-jaarige ondervinding zamengesteld* (Haarlem, 1786). For a more recent work providing details of sugar cultivation in Suriname: Oostindie, *Roosenburg en Mon Bijou*, 26-65. Next to sugar, Van Stipriaan also focuses on coffee and cotton: Van Stipriaan, *Surinaams Contrast*, 145-191.
[182] Blom, *Verhandeling*, 39; Van 't Leven, 'Construction of Polders', 229.
[183] Potter, *The Amerindians of Guyana*, 6.

peat layers on top of the clay were thick enough (a couple of feet), these trunks were stored as fire wood. If peat layers were smaller, the felled trees were allowed to rot for a full year, adding more nutrients to the soil. On sandy soils higher up the river, even the largest trunks should be burned down completely, to add fertile ashes to the soil, like the Amerindians did.[184]

Building plantations in places where rains were less extreme was entirely different. There, removing the forest was basically all that was needed to start planting. This was the case high up the rivers, or in the Caribbean for example.[185] Looking at Plan 4, this dry plantation was situated on a road and was surrounded on all sides by more roads, plantations and forests. The inner layout of the plantation was a neat grid of paths which provided access to different fields of sugar cane. Walking onto the plantation, one first entered the savannah, on which the necessary buildings were constructed and which served as a pasture for the animals powering the mills. The rain in the Guianas changed this entire layout. The Spanish and Amerindians often simply used the relief of the landscape higher up to rivers to get rid of excess water.[186] The Dutch, however, used flat, low-lying polders, which meant that plantations had to be constructed on a river or canal for dewatering purposes.

Authors like Ehrenburg and Meyer, and Oostindie and Van Stipriaan claim that the practice of making polders was unique and copied from polders in the Netherlands.[187] The Dutch certainly saw similarities between Dutch polders and Guianese polders. They knew that polders were a way to get access to the most fertile clay grounds, which enabled large harvests and profits, both in the provinces of Holland and Zeeland and in the Guianas.[188]

[184] Blom, *Verhandeling*, 21-22; Van Stipriaan, *Surinaams Contrast*, 81; Oostindie, *Roosenburg en Mon Bijou*, 27; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 45.
[185] Blom, *Verhandeling*, 41-42; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 49.
[186] Potter, *The Amerindians of Guyana*, 7; Blom, *Verhandeling*, 259.
[187] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 21; Oostindie and Stipriaan, 'Slavery and Slave Cultures', 80; Alston, '"The habits of these creatures"', 102.
[188] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 10-12.


**Map 5**. Part of a map of the mouth of the Demerara and the planned canals made by Heneman.

Source: J.C. Heneman, 'Kaart van het Inkoomen en het opzeilen van het beneedenste gedeelte der Rivier Demerary, zig strekkende van den mond derzelver tot aan het rif van het Eerste Eyland, met de aanteekening der aan de Oost- en Westwall geleegene Plantagien, met alle deszelfs gronden, banken en dieptens enz.', HaNA, 4.VEL, inv.nr. 660.

However, the actual construction process was significantly different in the Guianas. To dewater future and existing polders, windmills, animal-powered mills or man-powered mills were often used in the Dutch Republic, but not in the Guianas.[189] In the primary dry period, the three or four feet of water in the woods and savannahs evaporated. Hence, new planters only had to stop the water from coming back. When the woods were cleared, a planter started building dikes around the entirety of his plantation.[190] This was combined with the excavation the main drainage ditch. This ditch surrounded the plantation and discharged in the river. The dike and ditch are visible on Plan 3 as the outermost blue and grey lines. Naturally, trees and plants along the entire course of this dike and ditch had to be cut down. Then, *all* peat and *all* tree-stumps were removed. Remaining peat or stumps considerably increased the risk of a levee failure. This fact was learned the hard way in the Netherlands, but later improvements in dike protection, using wood and stone, were not used in the Guianas.[191] Underneath the peat was clay, which was one of the best materials available for dikes. The dike was thus created from the clay removed for the ditch.[192]

The main levees and ditches of a plantation were constructed in such a way that these prevented fire from spreading. In contrast to what is visible on Plan 3, the levees and the main ditch lay a couple of metres apart. Building such fire stoppers was a usual practice everywhere, regardless of plantations being polders or dry plantations. On dry plantations, these consisted of wide pathways on which no plants grew.[193] These paths had also been usual practice in Suriname, Berbice, Demerara and Essequibo since the seventeenth century, when Surinamese Governor Cornelis van Aerssen van Sommelsdijck made these mandatory.[194] The added levees and ditches made polder plantations even more secure. Not without reason, because forests burned easily in the primary dry season and were purposefully set on fire by both Amerindians and Europeans to create farmland. For example, enormous stretches of forests between the Suriname and the Essequibo rivers burned down in 1769. Many plantations were, however, spared thanks to the fire stoppers.[195]

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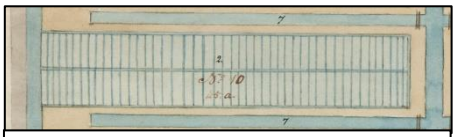
[189] Zeischka, *Minerva in de polder*, 53-55.
[190] Blom, *Verhandeling*, 23-24.
[191] Zeischka, *Minverva in de polder*, 65-66.
[192] Blom, *Verhandeling*, 23-25, 109; Zeischka, *Minerva in de polder*, 64-65.
[193] Galloway, *The Sugar Cane Industry*, 91.
[194] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 29.
[195] J.J. Hartsinck, *Beschryving van Guiana, of de wilde kust in Zuid-America* (Amsterdam, 1770) 866-867; HaNA, 4.VEL, inv.nr. 1490A, Carte Generale et Particuliere de la Colonie d'Essequebe et Demerary, située dans la Guiane en Amerique etc.; HaNA, 4.VEL, inv.nr. 1491, Kaart van een gedeelte der rivieren Demerary; Essequebo, Ponmaron enz., met aanwijzing der grensscheiding tusschen de Republiek en Spanje.



One set of beds from Plan 3. Main drainage ditch on the left. Navigable canals separate from the beds.

Once the main dike and main drainage ditch were created, the next step was to create the plots for crops, or 'beds' as these were called. These beds are the smallest rectangles visible on Plan 3. Such a bed was usually only ten metres wide, but almost one hundred metres long. Beds were completely surrounded by small ditches for drainage. One row of beds side-by-side could be hundreds of metres long. Two rows of beds formed one set that was usually connected to one larger ditch, the *trekker*, which discharged in the main drainage ditch. On Plan 3, each set of beds shows three *trekkers* connecting to the main ditch, which was usual practice on large plantations.[196]

Right through the middle of the plantation, and in between each set of beds, navigable canals were dug. This system of canals was completely separate from the drainage ditches and thus did not serve to maintain a proper ground water level for the crops. On Plan 3, the main canal connects to the river on one end, but continues into the woods past the back end of the plantation. There are sluices on both sides. The part in the woods was only constructed on plantations close to the mouth of the rivers, as water there was too brackish to drink or to irrigate the crops with. Fresh water was therefore let in from the woods and rainwater was collected as well. The sluice on the riverside was meant to maintain a water level at which the canals remained navigable.[197] Because it was necessary to keep water in the navigable canals, whereas the planter wanted to lose water from the drainage ditches, the two systems were not connected.

Some plots of land on Plan 3 were different from the rest. The back of the plantation on Plan 3 was covered in trees, and the sets of beds in front of it had larger beds than the rest of the plantation. Usually, the plots furthest from the river could not be kept properly dry for sugar, coffee, cocoa or cotton. Instead, these were used for growing wood.[198] The plots with bigger beds were used for food, which could be cultivated everywhere on a plantation. Often, food was grown on plots that had recently been cleared of forest, which improved the soil. This had the added benefit that slaves almost always had enough to eat.[199] The blue plot near the river was exhausted soil that was flooded and left to recover for up to eighteen years.[200]

[196] Blom, *Verhandeling*, 26; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 43-47; Oostindie, *Roosenburg en Mon Bijou*, 27.
[197] Blom, *Verhandeling*, 109; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 61; Van Stipriaan, *Surinaams Contrast*, 85.
[198] Blom, *Verhandeling*, 213.
[199] Ibidem, 28, 41-42, 172, 288; Oostindie and Stipriaan, 'Slavery and Slave Cultures', 80, 85.
[200] Blom, *Verhandeling*, 51-52.

Eventually, when all plots along the rivers were taken, new plantations were established on the coast itself. Cultivating crops there was however even more difficult, because of the salinity of the soil.[201] The main challenges on the coast were the transportation of crops and the protection of the plantation against the ocean. As we have seen on Map 1, the ocean near the coast was very shallow and riddled with sand banks and shoals. This meant that coffee and cotton had to be transported by roads, whereas these were usually in a bad shape due to the rain. The other problem was that the ocean claimed more and more of the coast. To solve this problem, heavy dikes had to be built and continuously rebuilt.[202] Drainage was also insufficient on the coast, for which several inland canals were proposed.[203]

This complex form of water management was not one of a kind in the entire world. No ingenious Dutch techniques or tools were used for this purpose. Instead, slaves had to do all necessary labour, using only the most basic tools.[204] Moreover, the majority of the plantations in Demerara was not constructed by the Dutch, as most of the planters were British.[205] Water management also played an important role on almost all sugar plantations in the World. Water basins, ditches, canals and even aqueducts were created to irrigate the dry plots.[206] Of course, these dry sugar plantations, and most coffee plantations,[207] were not complex polders, and the canals were meant to deal with a shortage of water, not an excess. However, paddy fields in Indonesia (*sawahs*) started functioning as polders when crop rotation of sugar and rice was applied in the eighteenth and nineteenth century.[208] Although *sawahs* were Indonesian, the country was also a Dutch colony. Rice plantations in Georgia and South Carolina were completely non-Dutch plantations, however, and still resembled polders in Essequibo and Demerara. In the early eighteenth century, these rice planters also moved from relatively dry areas to low-lying swamps. Large numbers of slaves were tasked with clearing woods, and burning the trunks, similar to the usual practice in the Guianas. Then, they had to drain the

[201] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 79.
[202] Pyttersen, 'Waarom landwegen', 277-278; Van Stipriaan, *Surinaams Contrast*, 97.
[203] HaNA, 3.01.26, inv.nr. 450, Missive van de Bewindhebberen der Generale Geöctroiëerde Nederlandsche West-Indische Compagnie ter Kamer Zeeland, van den 30 November 1772 […], p. 18-19, 24-25. See for example also HaNA, 4.VEL, inv.nr. 1490A, Carte Generale et Particuliere de la Colonie d'Essequebe et Demerary, située dans la Guiane en Amerique etc.; HaNA, 4.VEL, inv.nr. 1500, Kaart van een gedeelte der rivieren zeekusten van Demerary, met de langs geleegen plantagien enz. These maps show a proposed canal which follows the plantations at the coast, to aid their drainage.
[204] Blom, *Verhandeling*, 21, 24; Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 47; Van 't Leven, 'Construction of Polders', 230; Oostindie and Stipriaan, 'Slavery and Slave Cultures', 81.
[205] Oostindie, '"British Capital"', 36-37; Alston, '"The habits of these creatures"', 102.
[206] Bosma, *The Sugar Plantation*, 23-25, 136-138; M.W. Hauser, 'A Political Ecology of Water and Enslavement: Water Ways in Eighteenth-Century Caribbean Plantations', *Current Anthropology* 58:2 (2017) 227-256, specifically 228-230.
[207] Van Stipriaan, *Surinaams Contrast*, 76.
[208] Bosma, *The Sugar Plantation*, 26.

swamps by creating extensive networks of levees, canals and water reservoirs. Sluices were used to precisely control the inflow of water, making use of the tide. Rice plantations often even occupied five hundred acres, like coffee in Essequibo and Demerara.[209] The only real difference is that rice paddies are usually flooded, whereas the sugar plantations in the Guianas were drained. None of the Dutch sources ever compared practices in the Guianas to the rest of the World. Although the techniques used in the Guianas were most probably not copied from South Carolina or Indonesia, these were not unique.

Not only were slaves used for all steps in the construction process, from clearing forests to digging ditches and building dikes, slaves were also tasked with maintaining the polders. Due to the tropical climate and heavy rains, ditches regularly had to be cleared of aquatic plants and inflowing sand. Maintenance was especially hard because of the heavy clay and even harder if the soil consisted of the layers of sand that also caused problems for the canals of the previous chapter.[210] One slave could therefore only maintain four and a half Dutch acres of plantation according to Blom. More often however, slaves had to work larger plots.[211] Polder plantations and the way these were maintained thus had a terrible consequence: mortality among the slaves was much higher in the Dutch Guianas than in other plantation colonies.[212] Not surprisingly, this heavy labour spurred many to resist their enslavement. Escaping plantations was much easier when the savannahs had run dry. Because this happened in the primary dry season, when most of the construction happened, many slaves ran away.[213]

The Dutch thus found a way of dealing with the natural environment of the Guianas by copying certain practices from the Amerindians and constructing polders. The fact that all crops in the Guianas were grown in polders was certainly unique, but there is little evidence to support the claim that these polders were the result of Dutch experience in water management. The only impact that a planter's nationality had on plantations, seemed to be limited to the type of mill that was built. That the British were the majority of the Europeans in Demerara, shows that it was not thanks to the Dutch that polders were constructed, but simply thanks to

[209] M. Mulcahy, *Hubs of Empire: The Southeastern Lowcountry and British Caribbean* (Baltimore, 2014) 97-98, 102; S.M. Edelson, 'Clearing Swamps, Harvesting Forests: Trees and the Making of a Plantation Landscape in the Colonial South Carolina Lowcountry', *Agricultural History* 81:3 (2007) 381-406, specifically 382-386, 391, 393.
[210] Oostindie and Stipriaan, 'Slavery and Slave Cultures', 81-82; Blom, *Verhandeling*, 13-14, 92.
[211] Blom, *Verhandeling*, 91-94.
[212] Oostindie and Stipriaan, 'Slavery and Slave Cultures', 83-85.
[213] Alston, '"The habits of these creatures"', 111.

the environment. They constructed polders as well, and their fellow countrymen did the same in Georgia and South Carolina. This focus on polders had its limitations, as every planters in Essequibo and Demerara wanted to construct plantations on rivers and on fertile clay. This was also difficult and costly, both in terms of money and enslaved lives, but offered high rewards for the plantation owners. The popularity of these plantations had another strange effect. Plantation owners gladly created plantations along a river and on a coast that were hardly defended and lacked a city and a harbour. Johan Christoph Heneman thus had one more thing to find out: how to build fortifications and living spaces in the harsh environment of Essequibo and Demerara.

## 4. Fortifications and towns

Defences and towns had been an afterthought when Demerara was established as a plantation colony. In 1746, when Storm allowed the first Dutchmen to grow sugar and coffee along the river, the Director-General set out to construct a *Brandwacht* in the new colony. This type of fortification was also located at the mouth of the Essequibo and Berbice rivers and served to raise the alarm in case of any sort of danger. Whereas *Brandwacht* means fire watch, it was a military outpost, not meant to combat fire. The *Brandwacht* on the Demerara also facilitated communications between the Dutch authorities and the many Amerindians in the area, to maintain peaceful relations.[214]

For almost thirty years, no other fortifications were constructed to protect the growing number of plantations on the Demerara, and no new towns were created for the colonists. Demerara became known as one of the only European colonies without a capital city.[215] The Dutch West India Company did not worry about the security of the colony and its planters. Dozens of plantations were situated on the unprotected coast, basically laying there for the taking.[216] The main reason to finally let Johann Christoph Heneman study options for new fortifications was the wish of the Company to limit contraband trade, which ran rampant.[217] The Company worried so little about defending the colony that it did not keep strategic locations on the Demerara to itself. Hence, when the WIC finally decided to build forts, redoubts and artillery batteries, the Company had to buy back the necessary land.[218] Deciding on what type of fortifications to build proved difficult, however, and many plans were made. These were also affected by the natural conditions of the Guianas, but not as much as the canals and plantations.

[214] Netscher, *Geschiedenis*, 116-117; Goslinga, *The Dutch in the Caribbean, 1680-1791*, 446.
[215] Bosman, 'Stabroek in Demerara', specifically 190.
[216] HaNA, 1.05.01.02, inv.nr. 184, p. 1245-1246.
[217] HaNA, 1.05.01.02, inv.nr. 16, fl. 614 verso – 619 recto; HaNA, 1.05.06, inv.nr. 939, Brieven van B. Roelofswaert aan (de Vergadering van Tienen) betreffende de geprojecteerde versterking aan de mond van de rivier de Demerary en de Brandwacht aldaar, first letter of July 1, 1776; Hoonhout, *Borderless Empire*, 111-112, 122, 134-135.
[218] HaNA, 1.05.01.02, inv.nr. 184, p. 1233, 1242; HaNA, 4.VEL, inv.nr. 1516, Kaart figuratif van de Zeekust tusschen de Kreeken van Mahaica, Mahaicony en Abary, gelegen aan de Oostwal van Demerary door:; HaNA, 4.VEL, inv.nr. 1522, Kaart van de Plantagies toebehoorende den heer B. Albinus, geleegen op de Westpunt aan den mond van de rivier Demerary.

**Early defences of the colonies**

Whereas the Demerara river was only developed as a Dutch colony from 1746 onwards, the Dutch had been trading along the Essequibo river since the early seventeenth century.[219] Still, the earliest seats of government of the two rivers developed in similar ways. The Dutch established their first fort, Fort Kijk-Over-Al, on the confluence of the Cuyuni and Mazaruni rivers. This was more than seventy kilometres from the mouth of the Essequibo. At the time, however, it was at the centre of the colony and the first small settlement of the colony, Cartabo, was situated nearby. Even when the fort had long been abandoned, the Company still owned several plantations there.[220] Jonathan Samuel, son of Director-General Storm,[221] first ruled from his father's place on the Essequibo when he became Commander of Demerara in 1750. Five years later, he chose to rule Demerara from his new plantation De Standvastigheid.[222] At the time, this plantation was close to the mouth of the Demerara, compared to the other plantations. De Standvastigheid was plantation 22 on the eastern bank of the river on Map 4. The first village was planned at a more central location along the river, at number 37 on the western bank, but was never developed into a city.[223]

As we have seen, planters were quickly fed up with the soil depletion of the upper reaches of the rivers and instead opted to settle closer to the river mouths and along the coast. This meant that Fort Kijk-Over-Al, Cartabo and the village in Demerara were no longer centrally located. Already in the seventeenth century, Abraham Beekman, then Commander of Essequibo,[224] realised that his fort was built inconveniently far upstream.[225] He proposed to relocate to Groot Vlaggeneiland, also called Fort Island or Marrirauwa, at the mouth of the Essequibo. This is indicated by the blue arrow on Map 6. When Storm arrived in Essequibo as

[219] Wekker, Historie, technieken en maatschappelijke achtergronden, 17; De Villiers, *Storm*, 4; J.B. Haviser, 'The 'Old Netherlands Style' and Seventeenth-Century Dutch Fortifications Of The Caribbean', in: E.C. Klingelhofer, *First Forts: Essays on the Archaeology of Proto-colonial Fortifications* (Leiden, 2010) 167-187, specifically 175.
[220] HaNA, 4.VEL, inv.nr. 1526, Kaart van de kolonie Essequebo; Goslinga, *The Dutch in the Caribbean, 1680-1791*, 433-437; De Villiers, *Storm*, 4-5; Bosman, 'Stabroek in Demerara', 187.
[221] Jonathan Samuel's full name was Jonathan Samuel Storm van 's Gravesande. His father, Director-General Laurens Storm van 's Gravesande, is usually referred to as 'Storm'. To prevent confusion, I will only use the name Storm to refer to the Director-General Laurens Storm van 's Gravesande.
[222] Bosman, 'Stabroek in Demerara', 187.
[223] Ibidem; Netscher, *Geschiedenis*, 134; HaNA, 4.VEL, inv.nr. 1492A, Caerte van de rivier Demerary van Ouds Immenary, gelegen op Suyd Americaes Noordkust op de Noorder Breedte van 6 Gr. 40 Min. enz. It concerns De Standvastigheid on the eastern bank of the Demerara (number 22), not the one on the creek Hawereroenie (number 21).
[224] The Commander of Essequibo only became Director-General in 1750, when the first Commander of Demerara was appointed. See Netscher, *Geschiedenis*, 127.
[225] Goslinga, *The Dutch in the Caribbean, 1680-1791*, 434.

secretary of Commander Hermanus Gelskerke, the two men set out to construct a proper fort on this island. Both the old and new forts were located in the type of spot that the Dutch usually chose since their first fortifications overseas. Not high up on hills along the rivers, like the Portuguese initially preferred, but in low-lying spots very close to the water (on islands in this case), where the British often settled as well.[226] Sadly, none of the plans made for the old or the new fort still exist. Gelskerke himself moved to the island in 1739, and the few inhabitants of Cartabo quickly followed him. Fort Kijk-Over-Al and its town quickly turned to ruins when Fort Zeelandia was finished in 1743.[227]

Demerara had part of its government located closer to the mouth of the river. Commander Jonathan Samuel's assistant settled on the island of Borselen, indicated by the black arrow on Map 6. The colony would eventually be governed from this island. According to Pieter Marinus Netscher and Lex Bosman, the island of Borselen was chosen because it was near De Standvastigheid, but they do not provide any sources for this claim. They furthermore claim that the councils of the river stayed on Borselen because the next two commanders lived on plantations near the island. However, they cannot explain why the following commander, Paulus van Schuylenburg, also wanted to stay on this island when the Gentlemen X proposed a different location.[228] This is strange, because Borselen has important natural disadvantages. It is very small, with hardly enough room for the necessary buildings for the Commander, his assistants, the Councils, their members and the fortifications. The island eroded as well, because of the strong river currents.[229] Borselen also lacks wood, it lacks fresh water (the river is too muddy and brackish), and most of it floods at high water levels, which the Council of Policy of Demerara openly admitted.[230]

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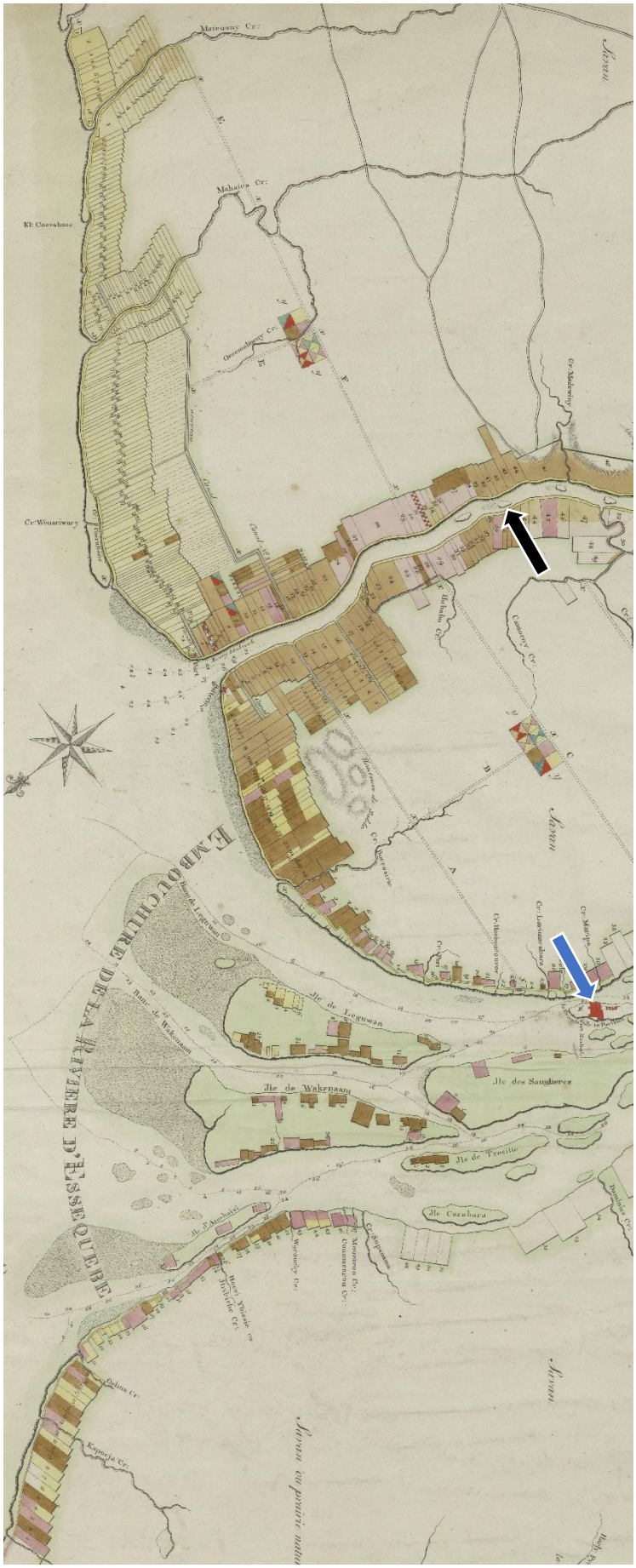
[226] O.F. Hefting, 'High Versus Low: Portuguese and Dutch Fortification Traditions Meet in Colonial Brazil (1500-1654)', in: E.C. Klingelhofer, *First Forts : Essays on the Archaeology of Proto-Colonial Fortifications* (Leiden, 2010) 189-208, specifically 192, 195, 202-204; E. Mann, 'To Build and to Fortify: Defensive Architecture in the Early Atlantic Colonies', in: D. Maudlin and B.L. Herman, *Building the British Atlantic World. Spaces, Places, and Material Culture, 1600-1850* (Chapel Hill, 2016) 31-53, specifically 41-42.
[227] Letter by Storm of April 1, in: De Villiers, *Storm*, 90; Netscher, *Geschiedenis*, 109-110; Goslinga, *The Dutch in the Caribbean, 1680-1791*, 434-437; Bosman, 'Stabroek in Demerara', 187.
[228] Netscher, *Geschiedenis*, 134-135; Bosman, 'Stabroek in Demerara', 187-188. See also HaNA, 4.VEL, 1492A, Caerte van de rivier Demerary van Ouds Immenary, gelegen op Suyd Americaes Noordkust op de Noorder Breedte van 6 Gr. 40 Min. enz. After Jonathan Samuel, Laurens Lodewyk van Bercheyck became commander and lived on plantation nr. 17 on the eastern bank. This became De Parel and was later owned by the third commander Jan Cornelis van den Heuvel. See plantation nr. 40 or 41 on the eastern bank on HaNA, 4.VEL, inv.nr. 1498, Carte de la Colonie de Demerary. On a later map, De Parel is drawn slightly further from Borselen, as nr. 39. The Gentlemen X proposed De Jonge Rachel, nr. 21 on the western bank, both on: HaNA, 4.VEL, inv.nr. 1499B, Kaart van de rivier en zeekusten van Demerary.
[229] HaNA, 1.05.06, inv.nr. 942, p. 7.
[230] Bosman, 'Stabroek in Demerara', 188; Netscher, *Geschiedenis*, 136, 147; HaNA, 1.05.01.02, inv.nr. 184, p. 1239-1242; HaNA, 1.05.21, inv.nr. AB.3.28, Miscellaneous minutes of the proceedings of the Court of Policy of Demerara, January 1780- December 1780, p. 341.




**Map 6**. Part of a map of the mouths of the Essequibo and Demerara with plantations. Made by F. van Bouchenroeder.

The added black arrow points to Borselen, the blue arrow to Fort Zeelandia.

Source: F. van Bouchenroeder, 'Carte Generale et Particuliere de la Colonie d'Essequebe et Demerary, située dans la Guiane en Amerique etc.', HaNA, 4.VEL, inv.nr. 1490A.

It seems more likely that it was not just the proximity which led to the choice for Borselen, but military considerations as well. Firstly, Borselen was not near Jonathan Samuel's plantation. It was at least eleven kilometres from the outermost tip of Borselen to the closest point on De Standvastigheid. Along the way, one had to sail past two other islands. At the time, Heneman wrote that it took three quarters of an hour to get from Borselen to Soestdijk, the first island encountered on the way between Borselen and De Standvastigheid.[231] Soestdijk and the other island, Nieuw St. Eustatius, were not much smaller than Borselen, according to maps of the time.[232] Nowadays, Soestdijk is bigger, whereas Nieuw St. Eustatius has become part of the river bank.[233] There even is a much bigger island, Land Canaan, just downstream of Borselen. However, Land Canaan and Nieuw St. Eustatius had already been sold to plantation owners in 1755, when Jonathan Samuel moved to Demerara.[234] The majority of the plantations were located upstream of Borselen and Land Canaan at the time. This left Borselen as the second best place from where most plantations could be defended properly. The important advantage of Borselen and Land Canaan was that these made the river much narrower. The drawback was that the islands caused stronger currents in the shallow river, which made shipping water, wood, food and people to the island harder, especially with big seafaring ships (there was no other harbour).[235] However, Schuylenburg feared that relocating the seat of government would become too expensive.[236] Borselen had the added benefit that its features made it a useful choke point. Maps like Map 1 in Chapter 2, showing sailing routes, also indicate that Fort Zeelandia was located in a similar choke point.[237] Heneman and other surveyors knew that building a fort on Borselen and perhaps some artillery on the river banks made it much easier to stop an invading force there

[231] HaNA, 1.05.01.02, inv.nr. 184, p. 1241-1242.
[232] HaNA, 4.VEL, 1492A, Caerte van de rivier Demerary van Ouds Immenary, gelegen op Suyd Americaes Noordkust op de Noorder Breedte van 6 Gr. 40 Min. enz.; HaNA, 4.VEL, inv.nr. 1498, Carte de la Colonie de Demerary; HaNA, 4.VEL, inv.nr. 1499B, Kaart van de rivier en zeekusten van Demerary.
[233] All maps in the previous footnote consistently show four islands. Netscher also clearly stated that there were four islands in the Demerara when he wrote his book in 1888, see: Netscher, *Geschiedenis*, p. 386-387. The fourth, Nieuw St. Eustatius/Kamawoeny/Camouny, has completely disappeared. I have not been able to discover why or how, but the creek Kamuni still exists. The island was often drawn very close to the riverside at the mouth of this creek, especially on HaNA, 4.VEL, inv.nr. 1498, and Bibliothèque nationale de France, département Cartes et plans, Portefeuille 162 du Service hydrographique de la marine consacré à la Guyane anglaise et Guyane hollandaise, div. 6, nr. 6, Plan topographique de la Colonie de Démérari. This leads me to believe that it has become part of the river bank. On a side note, Google Maps and the Atlas of Mutual Heritage both wrongly label Inver Island (former Land Canaan/Monplaisir/Chantilly) as Borselen/Borslem.
[234] HaNA, 4.VEL, inv.nr. 1492A, Caerte van de rivier Demerary van Ouds Immenary, gelegen op Suyd Americaes Noordkust op de Noorder Breedte van 6 Gr. 40 Min. enz.
[235] Netscher, *Geschiedenis*, 136; HaNA, 1.05.01.02, inv.nr. 184, p. 1245.
[236] HaNA, 1.05.06, inv.nr. 942, p. 14-15; HaNA, 1.05.21, inv.nr. AB.3.28, p. 341.
[237] HaNA, 4.VEL, inv.nr. 1488, Schetskaart van de Colonien van Rio Demerary en Rio Essequebo; HaNA, 4.VEL, inv.nr. 1489, Generale en speciale kaart der Colonien van de republicq der Ver. Nederl., geleegen in Guyana; HaNA, 4.VEL, inv.nr. 1526, Kaart van de kolonie Essequebo.

than it could ever be with multiple forts on the river mouth. To do so, Borselen had to become a polder, but that was no problem, as everything in Essequibo and Demerara was built as a polder.[238]

**New designs by Heneman, Roelofswaert and Kanne**

The fortifications along the Essequibo and the Demerara faced several problems and challenges. Starting with the most obvious conclusion from the previous paragraph: if Borselen was an important choke point, so was Land Canaan. Heneman called the choice to give Land Canaan to a private planter 'very disadvantageous Considering the Defence of the Colony'.[239] An invading force landing on Land Canaan could effectively control the greatest part of the colony, because they could completely block the river. As the only existing 'infrastructure' was the river, the Dutch on Borselen could go practically nowhere and would be trapped. Looking at Map 6, the sailing routes for seagoing vessels make it clear that such a problem did not exist for Fort Zeelandia.[240] Map 6 does reveal another problem with Fort Zeelandia and Borselen. In the course of time, the majority of the plantations, especially the most profitable ones, had moved from the area protected by the fortifications to the almost entirely undefended coast and estuaries. The situation in Essequibo and Demerara was therefore opposite of Suriname, where plantations were only constructed on rivers with proper defences, according to Ehrenburg and Meyer.[241] Heneman did not know how to properly defend the plantations on the coast without immense manpower and subsequent costs. Therefore, he proposed to simply stop the spread along the coast and instead build more canals like the ones he proposed.[242] Still, new forts were desperately needed at the river mouths.

The plans by Heneman, Benjamin Roelofswaert and Carl Christiaan Kanne show slight additions which would improve fortifications for the tropical environment of the Guianas. Sadly, no plans for fortifications on the Essequibo exist. Benjamin Roelofswaert's

[238] HaNA, 1.05.01.02, inv.nr. 184, p. 1239-1242; HaNA, 1.05.06, inv.nr. 703, "Aanwijzing der gebouwen op het eijland Borselen in Rio Demerary te plaatsen volgens 't plan door den ingenieur C. van Henneman gemaakt."; HaNA, 4.VEL, inv.nr. 1523A, Het Eiland Borselen in de rivier Demerary; HaNA, 4.VEL, inv.nr. 1524, Het Eiland Borselen in de rivier Demerary, met de daar tegenover liggende stad; HaNA, 4.VEL, inv.nr. 1562, Plan van het eiland Borselen; HaNA, 4.VEL, inv.nr. 1563A, Plan van het eiland Borselen.
[239] 'Zeer nadeelig in Opsigte van de Defensie der Colonie'. HaNA, 1.05.01.02, inv.nr. 184, p. 1242.
[240] Most often, a foreign enemy would of course sail to the colony with seagoing vessels, whereas the Dutch would also have smaller boats in the colony.
[241] Ehrenburg and Meyer, *Bouwen aan de Wilde Kust*, 35.
[242] HaNA, 1.05.01.02, inv.nr. 184, p. 1246-1248.

drawings of forts on the Demerara are most remarkable.[243] He was the Master of Artillery of the city of Amsterdam and devised plans for fortifications in Demerara and Guinea for the Chamber Amsterdam. He did so without visiting the colonies, simply staying in Amsterdam and Delft.[244] His maps and plans in the Leupe collection of the Nationaal Archief in The Hague (4.VEL) are most often simply credited with 'Anonymous'. Roelofswaert usually did not sign his work. However, stumbling upon his letters in a different collection, *Verspreide West-Indische Stukken* (1.05.06), made clear that the letters explain what is drawn on the supposedly anonymous maps.[245] Combined, these indicate that he thought of ways to deal with the excessive rains in the Guianas. Just like Kanne, surveyor in Demerara, he designed the roofs of several of his buildings with very large overhangs.[246] This was necessary to protect both the people and the wooden structures from the scorching sun and tormenting rains.[247] He also specifically designed his fortifications in Demerara with a complex drain running underneath the parapet. These drains were specifically meant to remove rainwater from the redoubts. He even consulted someone familiar with the mouth of the Demerara to be able to take the tidal range into account when designing the drains and the heights of the parapets and embankments.[248] That these drains were specifically meant for Guianese rains, although he had not felt them, is indicated by his plans for fortifications in Guinea. He did propose drains in Guinea as well. Whereas the drains in Demerara led to the sea, those in Guinea would lead to a water storage area, to save scarce water for future use.[249]

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[243] Almost all his letters, maps and plans are signed with B. Roelofswaert. His first name is made clear by a council meeting of the municipality of Amsterdam in 1800: 'Vergadering Woensdag, 27 Augustus, 1800. Het zesde Jaar der Bataafsche Vrijheid. 's Namiddags, ten één uur', *Dagblad der Vergaderingen van de Municipaliteit van Amsterdam. Zevende Stuk. Van den 1sten Maij tot den 31sten Augustus 1800* (Amsterdam, no date [1800]) 372-377, specifically 376.

[244] HaNA, 1.05.06, inv.nr. 574, Brieven en rapporten van de artilleriemeester B. Roelofswaert aan de Kamer Amsterdam betreffende de toestand van het geschut van de forten ter Kuste van Guinea, de aanbesteding van geschut ten behoeve van de West-Indische Compagnie. Met betreffende stukken; HaNA, 1.05.06, inv.nr. 676, Brief van B. Roelofswaert aan de X betreffende de aanleg van eenige batterijen of redonten op de oost- en westhoek van de rivier Demerary; HaNA, 1.05.06, inv.nr. 939, Brieven van B. Roelofswaert aan (de Vergadering van Tienen) betreffende de geprojecteerde versterking aan de mond van de rivier de Demerary en de Brandwacht aldaar.

[245] The inventory numbers of 4.VEL which are thus clearly made by him (or copied from his work) are: 1551A-1551F and 1558A-1558B1. Sadly, the letters also show that some of his plans cannot be found in 4.VEL. 1551E and F are explained in HaNA, 1.05.06, inv.nr. 676. 1551A, B, C, D are explained in the first letter in 1.05.06, inv.nr. 939. 1558B is explained in the second letter, 1558A is explained in the third.

[246] HaNA, 4.VEL, inv.nr. 1551A and 1551B, Plan van een redout op de Oostpunt van de rivier Demerary; HaNA, 4.VEL, inv.nr. 1564.1-1564.4 and 1564.21, Grondteekeningen en opstanden van Militaire en Burgerlyke gebouwen te Demerary, van verschillende groote en afmeetingen; HaNA, 1.05.06, inv.nr. 939.

[247] Netscher, *Geschiedenis*, 148-149.

[248] HaNA, 4.VEL, 1551D and 1551E, Plan van een redout op de Oostpunt van de rivier Demerary; HaNA, 1.05.06, inv.nr. 676; HaNA, 1.05.06, inv.nr. 939, first letter of July 1, 1776.

[249] HaNA, 4.VEL, inv.nr. 757 and 757A, Plan van de platte grond des nieuw te bouwene Fortres tot Taccorary op Guinea in Afrika.

Roelofswaert's unique plans for drains were exemplary of the way in which the Dutch adapted their defensive works to the natural environment. The overall shape and layout of the fortifications were usually not changed significantly. Especially Heneman's plans resemble the old Dutch style of building fortifications. These were no compact forts on hilltops, but rather large, spacious forts with a wet moat, bastions and glacis on a flat piece of land.[250] Historians usually focused on the way in which the landscape was used to create proper defences, instead of looking at adaptations to the climate. It seems that such adaptations were non-standardized and small, like Roelofswaert's drains, window blinds, and roofs to protect canons.[251] In some places, the heavy tropical rains necessitated a parapet made out of stone instead of the usual clay.[252] In the delta of the Essequibo and Demerara rivers, rocks were not used to make bricks, which therefore had to be imported from Europe, or baked locally, which made these expensive.[253] Hence, dikes and canals were constructed to protect the fortifications against the river and the sea. These featured more prominently on plans for Demerara than on plans made for Berbice or Suriname. In Suriname and Berbice, water most often only featured as such moats in fortification plans. If a fort or redoubt had no moat, it was often located right on the river.[254]

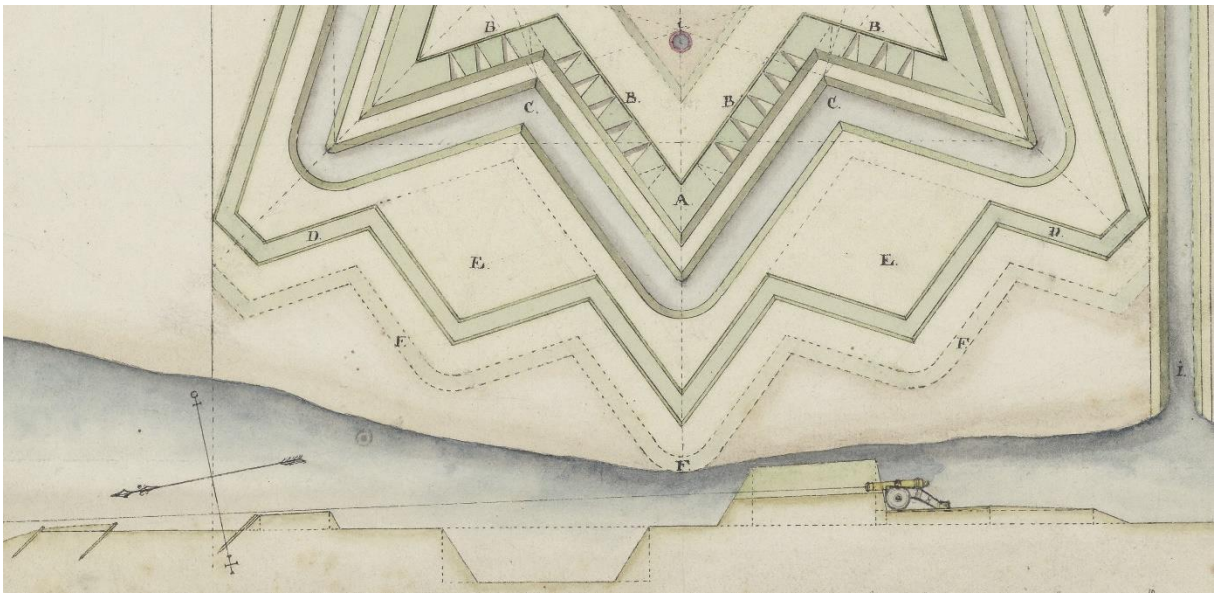
Both Heneman and Kanne included dams and canals on their plans which were meant to protect fortifications against the river and the sea, not so much against attacks. We need to keep in mind that Heneman's plans were never carried out. His ideas were not meant to be

[250] R.M. Jayasena and P.M. Floore, 'VOC vestingbouw op Ceylon en Mauritius, een historisch-archeologisch perspectief', in: K. Ampt, A. Littel and E. Paar, *Verre Forten, Vreemde Kusten. Nederlandse verdedigingswerken overzee* (Leiden, 2017) 85-116, specifically 86; Haviser, 'The 'Old Netherlands Style'', 182. See also Heneman's plans in HaNA, 4.VEL, 1554A-1554B, 1555, 1557.
[251] Y. Sumalyo, 'Dutch Colonial Architecture and City Development of Makassar', *Dimensi Teknik Arsitektur* 30:1 (2002) 46-53, specifically 48; J.R. Verbeek, 'De in fortificaties opgestelde artillerie van de VOC', in: K. Ampt, A. Littel and E. Paar, *Verre Forten, Vreemde Kusten. Nederlandse verdedigingswerken overzee* (Leiden, 2017) 85-116, specifically 187, 202-203.
[252] Jayasena and Floore, 'VOC vestingbouw', 86.
[253] Bosman, 'Stabroek in Demerara', 187; HaNA, 1.05.01.02, inv.nr. 184, p. 1254-1255.
[254] Several plans show canals at the back of fortifications, probably for drainage or access to fresh water. HaNA, 4.VEL, inv.nr. 1614B, Plaan van het nieuw angelegde fort of de geprojecteerde Batterie Andries in de geoctroyeerde Colonie de Berbice; HaNA, 4.VEL, inv.nr. 1615, Plaan en profil sub no. 2 geprojecteert enz.; HaNA, 4.VEL, inv.nr. 1616, Plaan van het Nieuw angelegde fort Andries enz.; HaNA, 4.VEL, inv.nr. 1619, Caarte figuratif van een gedeelte van de rivier de Berbice, benevens het nieuwe gemaakte project van het fort St. Andries; HaNA, 4.VEL, inv.nr. 1644, Project tot Etablissement van het Gouvernement van de Colonie de Berbice, by het geweese fort Nassau; HaNA, 4.VEL, inv.nr. 2014.026, Plan van verdediging der rivieren Suriname en Commowyne enz.; HaNA, 4.VEL, inv.nr. 2044A, Nieuw Project der Verbreeding van de redout Purmerent. HaNA, 4.VEL, inv.nr. 2045A, De Redout Purmerent, soo als deselve teegenwoordig sig in staad bevind met de voorgestelde verbeteringen; HaNA, 4.VEL, inv.nr. 2051, Nieuwe Redout Leyden; HaNA, 4.VEL, inv.nr. 2046, Plan en defensie van de redout Purmerent; H. den Heijer, *Grote Atlas van de West-Indische Compagnie II: De nieuwe WIC, 1674-1791* (Voorburg, 2012) 360. A plan of Fort Nassau in Berbice features a drain as well, like Roelofswaert's plans, but outside the main part of the fort and, strangely, outside the moat. Its purpose is therefore not clear to me: HaNA, 4.VEL, inv.nr. 1625, Plan tot een concept op het fort Nassau.

cheap, but to be effective in defending the Essequibo and Demerara rivers. He did think of ways to cut costs, but not by changing the size and shape of the structures in any way.[255] So, when he noted that iron canons quickly deteriorated due to the humidity of the Guianas, he proposed to make them 'metal' instead (probably bronze), whereas Roelofswaert proposed to limit the number of canons to the bare minimum.[256] This made Heneman's ideas expensive. The WIC could not and did not want to spend tens of thousands of guilders on such fortifications.[257]

Kanne, as surveyor, made plans of fortifications that had already been constructed during the period of French rule in the 1780s. These plans also show protection against the elements, and make two things clear. First, that it was not uniquely Dutch to think of ways in which to protect your fortifications against the elements. Secondly, that Roelofswaert was not familiar with the natural environment. At first, Roelofswaert wrote that he designed a new *Brandwacht* simply on ground level. He was told that the location of this fortification was excellent for growing food, so he assumed that it would not flood and did not need protection against the river.[258] The location was indeed used by the WIC to grow food, but did need a dam to prevent flooding. When Heneman proposed to turn the small *Brandwacht* into a proper fort, visible on Plan 5, he gave it two layers of protection against the river. In his report, Heneman wrote that the fort needed a dam specifically designed to protect it against high water levels, marked with the letter 'D'. He also proposed a palisade, marked with letter 'F', which was meant first and foremost to prevent the parapet of the fort (A) from washing away.[259] His other plans featured similar flood defences.[260]

[255] HaNA, 1.05.01.02, inv.nr. 184, p. 1232-1242, 1246-1256.
[256] HaNA, 1.05.01.02, inv.nr. 184, p. 1255-1256; HaNA, 1.05.06, inv.nr. 939; Verbeek, 'De in fortificaties opgestelde artillerie', 187.
[257] HaNA, 1.05.06, inv.nr. 942, p. 3; Netscher, *Geschiedenis*, 147-148; Den Heijer, 'A Public and Private', 163.
[258] HaNA, 1.05.06, inv.nr. 939; HaNA, 4.VEL, 1558B, Plan van een redout voor de Brandwagt aan de rivier Demerary (Oostwal).
[259] HaNA, 1.05.06, inv.nr. 184, p. 1238; HaNA, 4.VEL, inv.nr. 1557, Plan van het fort aan de Hoofdplaats van Demerarij (Stabroek).
[260] HaNA, 4.VEL, inv.nr. 1554A, Fort aan den mond der rivier Demerary op 's Comps. Pad Oostwal; HaNA, 4.VEL, inv.nr. 1555, Plan van een fort aan den mond der Rivier Demerary. One fortification does not show a flood defence, but is instead located somewhat further from the river: HaNA, 4.VEL, inv.nr. 1554B, Fort aan den mond der rivier Demerary op 's Comps. Pad Oostwal.

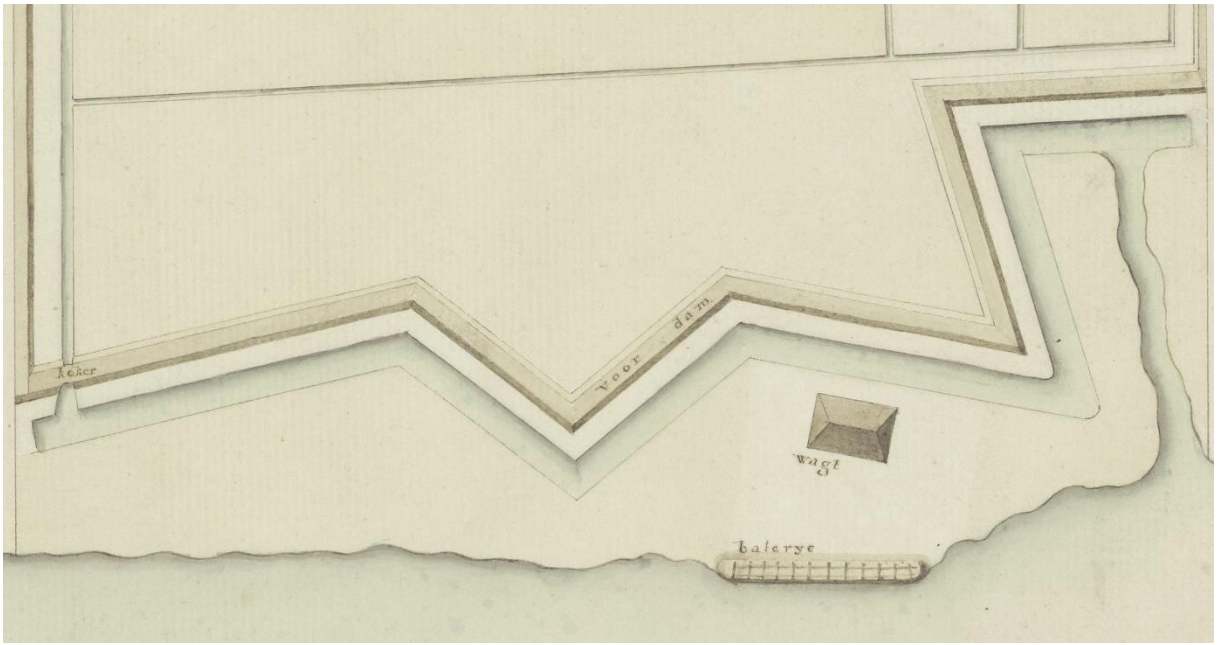



**Plan 5**. Part of Heneman's plan for the *Brandwacht* as part of his report. The flood defences are also visible on the cross-section on the bottom of this plan.

Source: J.C. Heneman, 'Plan IX', HaNA, 4.VEL, inv.nr. 1557, Plan van het fort aan de Hoofdplaats van Demerarij (Stabroek).

**Plan 6**. Part of Van Cooten's plan of the *Brandwacht* as it was in 1779.

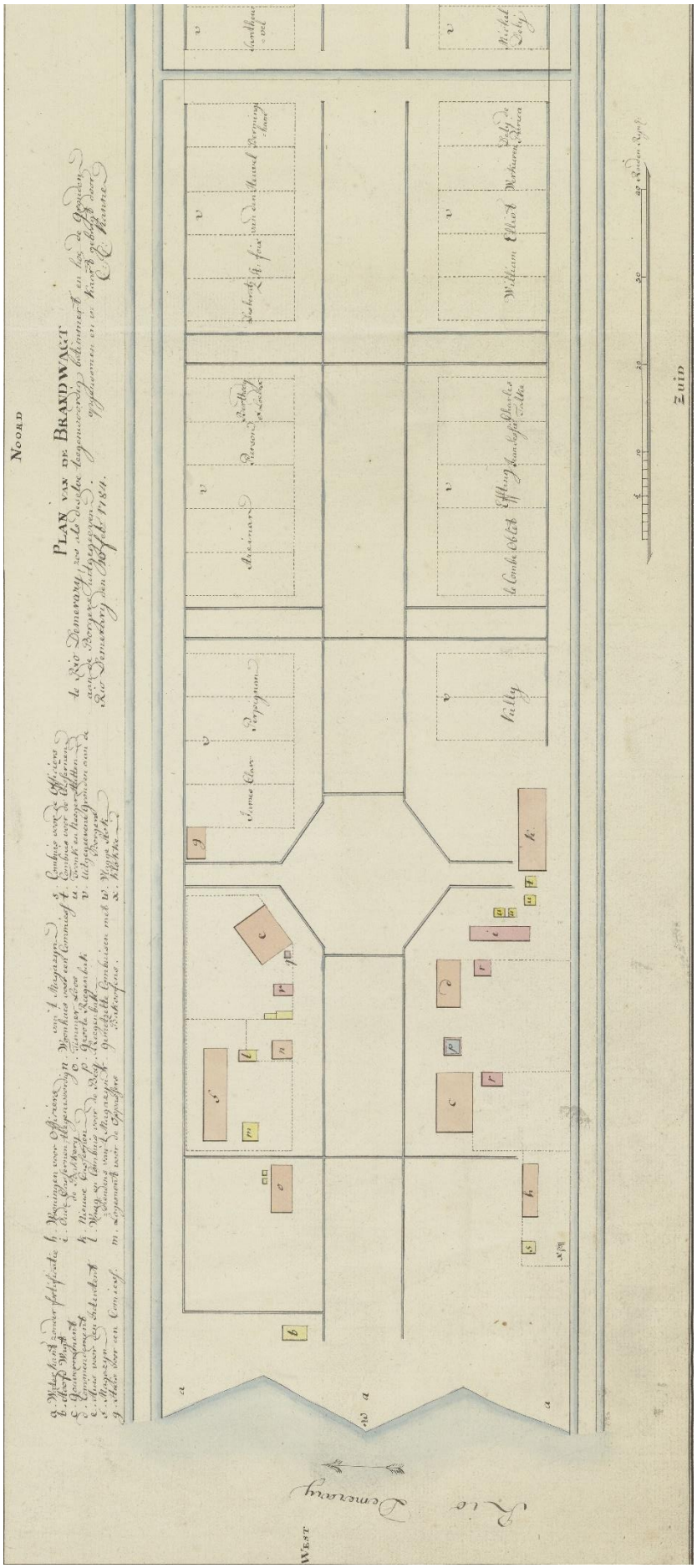
Source: H. van Cooten, 'Kaart van het land van de Brandwacht, gelegen aan de Oostwal der riviere Demerary', HaNA, 4.VEL, inv.nr. 1559.



It is hard to determine whether these flood defences were more necessary in Demerara than in Berbice and Suriname. Later maps and plans reveal that the dams were a smart addition in Demerara. A plan of the *Brandwacht* made by surveyor Hendrik van Cooten in 1779 (Plan 6) indicates that the dam was constructed like Heneman proposed.[261] Note the drainage canal, guard house and artillery battery not protected by the dam. Five years later, after French occupation of the colony, Kanne also created a plan of the *Brandwacht* (Plan 7). The particular shape of the dam still existed, just like old barracks and slave houses. However, the canal, guard house and artillery were lost to the river. Three more maps from the 1780s and 1790s show that the 'Sea Coast [was] gradually lost' and filled with remnants of trees and man-made objects. In 1798, the coast east of the Demerara had almost moved a kilometre inland from where it was in 1768 and the newest sea dam had already been partly destroyed.[262] This, however, could also have been a result of Dutch plantation construction on the coast. The remnants of trees indicate that the important coastal mangrove forests might have been cut down. These mangroves played a crucial role in coastal protection, as the forests dissipated oceanic wave-energy.[263]

Except for the buildings, sluices and bridges, slaves were once again tasked with constructing fortifications. As most of the new fortifications were proposed close to or at the coast, heavy sea clay had to be removed from the moat and used to create the parapets and bastions.[264] This work was even more backbreaking than constructing a plantation or digging a canal. Heneman expected a slave to be able to dig through just 4.6 cubic metres of clay each day.[265] This is half of what Heneman thought a slave could remove when constructing a canal and even less than half of what Van Cooten calculated.[266] For that reason, digging the deep and wide moat of a fort would take half of the total time allocated for the construction.

[261] The original plan by Van Cooten was sent to Roelofswaert, who used it to change several details in his version of the *Brandwacht*: HaNA, 4.VEL, inv.nr. 1558A, Plan van een redout voor de Brandwagt aan de rivier Demerary (Oostwal); HaNA, 1.05.06, inv.nr. 939.
[262] HaNA, 4.VEL, inv.nr. 661, A Chart of Coast of Guyana, comprehending the colonies of Berbice, Demerary and Essequebo; HaNA, 4.VEL, inv.nr. 1664, Plan van de stad Stabroek aan de monding van de Demerara; Bibliothèque nationale de France, pf. 162, div. 6, nr. 6, Plan topographique de la Colonie de Démérari.
[263] E.J. Anthony and N. Gratiot, 'Coastal engineering and large-scale mangrove destruction in Guyana, South America: Averting an environmental catastrophe in the making', *Ecological Engineering* 47 (2012) 268-273, specifically 270.
[264] Hefting, 'High Versus Low', 198, 202-204.
[265] HaNA, 1.05.01.02, inv.nr. 184, p. 1262-1265.
[266] HaNA, 1.05.01.02, inv.nr. 184, p. 1260-1261; HaNA, 1.05.06, inv.nr. 101.




**Plan 7**. Part of Kanne's plan of the *Brandwacht* or Stabroek as it was in 1784. The plots with names scribbled in them are were residents built their houses.

Source: C.C. Kanne, 'Plan van de Brandwagt te Rio Demerary', HaNA, 4.VEL, inv.nr. 1560.

**Plan 8**. Part of Heneman's design for a capital city in Demerara as part of his report to the WIC.

Source: J.C. Heneman, 'Plan XII', HaNA, 4.VEL, inv.nr. 1524A, Het Eiland Borselen in de rivier Demerary, met de daar tegenover liggende stad.

**The polder-town of Stabroek**

Next to Borselen, Heneman envisioned a city for Demerara, visible on Plan 8. Surprisingly, Heneman did not indicate any flood defences, whereas Borselen could not be used without dikes. It has to be noted, however, that Heneman probably only designed a new city, because he thought that it was necessary. Neither the Gentlemen X nor the Society of Suriname ever asked him to create plans for a town.[267] He also felt the need to explain in his letter why a town would be useful for the colony, only devoting four out of the 52 pages of his report to the town and creating just one map.[268] This unusually brief discussion of something as complex as a new town could have caused some of the details in his plans to be missing (like a dam). Plan 8 demonstrates that Heneman did still envision the city as a polder, as with everything in Essequibo and Demerara.

Heneman chose to design a town that fit well in the natural environment of Essequibo and Demerara and shared some of its features with other Dutch colonial cities. Lex Bosman explained that the plot for the city used to be plantation Jerusalem, number 15 on the eastern bank of the Bercheyck map (Map 4). Heneman would thus simply have copied the layout of the plantation for his town.[269] Heneman himself thought differently. He planned the town on three adjacent plots: Soetermeer, Charlton Hall and a not yet properly cultivated plot.[270] The layouts of these plantations would normally not be exactly the same, so these did not fit as neatly together as the plots on Plan 8. The ditches would not be connected either. That the town was a polder, was thus a conscious choice by Heneman. This served the same function as on plantations: keeping the town and the farmland dry and supplied with fresh water. The canals also functioned as sewers, as Heneman drew ditches that connected single house to the canals. The resulting layout, basically a long rectangle consisting of a neat grid of smaller squares and rectangles, was characteristic of most Dutch colonial cities. It was not unique, as Spanish towns featured similar grid layouts.[271]

Planning the town near the seat of government might have been the obvious choice for Heneman, but the inhabitants settled somewhere else. Plan 7 shows the beginning of what

[267] HaNA, 1.05.01.02, inv.nr. 16, fl. 551 recto – 551 verso, 617 verso – 619 verso; HaNA, 1.05.03, inv.nr. 63, p. 133-138, 170-171, 271.
[268] HaNA, 1.05.01.02, inv.nr. 184, p. 1243-1245, 1272; HaNA, 4.VEL, inv.nr. 1524, Het Eiland Borselen in de rivier Demerary, met de daar tegenover liggende stad.
[269] Bosman, 'Stabroek in Demerara', 188.
[270] HaNA, 1.05.01.02, inv.nr. 184, p. 1243.
[271] R. Raben, 'Klein Holland in Azië. Ideologie en pragmatisme in de Nederlandse koloniale stedebouw, 1600-1800', *Leidschrift* (1993) 44-63, specifically 46-47.

would become Stabroek, and later Georgetown. Several residents built their houses on former plantation Lestin, close to the *Brandwacht*.[272] The *Brandwacht* was the only fortification on the river, and thus the safest place to live. When the French controlled Essequibo and Demerara from 1781 to 1784, they allowed several residents to live on the agricultural lands immediately behind the *Brandwacht* and erected the buildings visible on Plan 7. These were meant for the commander and councils. The French also built new fortifications on the eastern tip of the mouth of the river.[273]

Similar to Heneman's town, Stabroek developed like a polder. This time however, it was started on a narrow piece of land which the WIC had reserved for agricultural plots. So, in contrast to Heneman's town, Stabroek was not consciously planned as a polder. Surveyor Jan Hoffman did propose a layout for Stabroek with many canals, more akin to a city in the Netherlands, but this was never carried out.[274] Whereas most Dutch colonial cities were planned,[275] Stabroek grew organically and happened to become like Nieuw-Amsterdam in Berbice. Nieuw-Amsterdam moved from a place high up the Berbice to a swampy piece of land downstream. In their search for dry land to build a house on, residents of Stabroek used the layout of the surrounding polder plantations, whereas the new inhabitants of Nieuw-Amsterdam had to construct their own polders. The situation for Paramaribo in Suriname turned out to be different, necessitating less of a polder-like layout.[276]

The natural environment of Essequibo and Demerara changed the fortifications and towns of the Guianas, not merely because it made construction and maintenance significantly more difficult and costly. The course of the rivers determined where fortifications were most effective. The fertile soils of the coastal areas made defence especially difficult, as every future plantation owner wanted to construct his plantation in the most vulnerable places: on the coast and on the mouth of the river. Water threatened buildings in all kinds of ways, for which these were adapted in small ways. Humidity ruined canons and wooden buildings, and the ocean and rivers quickly eroded the land on which towns and forts were built, making elaborate flood defences necessary. Finally, the heavy rains made polders once again a necessity if forts and towns were to stay dry.

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[272] Netscher, *Geschiedenis*, 148.
[273] HaNA, 4.VEL, inv.nr. 1552, Plan van het fort Le Dauphin, op de Oostzeepunct van Demerary gelegen; Goslinga, *The Dutch in the Caribbean, 1680-1791*, 454-456; Bosman, 'Stabroek in Demerara', 190; Netscher, *Geschiedenis*, 269-271.
[274] HaNA, 4.VEL, inv.nr. 1664, Plan van de stad Stabroek aan de monding van de Demerara; Den Heijer, *Grote Atlas*, 145.
[275] Raben, 'Klein Holland in Azië', 46.
[276] Den Heijer, *Grote Atlas*, 196; Bosman, 'Stabroek', 193-194.

## Conclusion

Water stands at the centre of all human life and perhaps even more so in Essequibo and Demerara. During construction projects, the Dutch were certainly well aware that they had established colonies in the land of many waters. Water could be found in more places than the inhabitants liked. Therefore, finding ways to manage this water was always important when constructing canals, plantations, fortifications and towns. Often, the solution lay in creating polders. That the Dutch once again inhabited a land dominated by polders, caused authors studying Suriname, like Oostindie, Van Stipriaan, and Ehrenburg and Meyer, to conclude that this was a uniquely Dutch practice, unheard of in other plantation colonies. Although the Dutch, water managers *par excellence*, lived in Essequibo and Demerara, hydraulic engineering in the colonies was neither typically Dutch nor unique.

The Society of Suriname did try to implement Dutch knowledge in the construction of canals, but the surveyors, planters and authorities of Essequibo and Demerara did not. The infrastructure in Essequibo and Demerara was influenced by the natural environment in almost every single way possible. As rain was in excess, all roads quickly deteriorated and turned to mud in the wet seasons. On top of that, the rains made proper drainage of the plantations a central aim of the Dutch and British planters. The turn of events through which Essequibo and Demerara, two clearly separated rivers, were governed as one colony, brought the Dutch and British many environmental challenges to overcome. There were no natural connections, like creeks, between the two rivers, only a bureaucratic one. The sea-route was long, treacherous and therefore costly, as it was filled with sand banks and shallow waters waiting for ships to run aground. This made it necessary to construct canals both between and in Essequibo and Demerara.

However, planters and authorities set out to construct the canals in the cheapest or most lucrative ways possible. The dense forests of the Guianas made it expensive to search for the proper course of future canals. Whereas such research received a lot of attention in the Netherlands, the colonists in Essequibo and Demerara tried to save costs by skipping this step. Surveyors and engineers set out to create canals that were deep and wide enough to aid transportation, drainage and maintenance, but the Dutch and British planters in the Guianas opted to make canals cheaper by making these smaller and shallower. These were subsequently constructed and maintained by slaves using the most basic tools and techniques.

No water authorities existed. Instead, each plantation owner was responsible for their own stretch of canal. The tropical climate, simple planning and cheap canals made maintenance expensive, however, and many canals were left to deteriorate.

Fortifications, plantations and towns were all polders filled with canals. Whereas these might seem unique and typically Dutch, that was not the case. Demerara could hardly be called Dutch, as the majority of its planters were British. Methods for polder construction were also hardly comparable to the techniques used in the Netherlands. Some Dutch techniques did make their way to the Guianas, but most did not. Usually, however, sugar and coffee plantations were not polders. Most often, sugar plantations in the Americas were dry, facing a shortage of water, whereas the situation in the Guianas was the other way around. Nevertheless, similar polder-like practices existed on the rice fields of South Carolina and Georgia, and on the *sawahs* of Indonesia. Still, polders were particularly ubiquitous in Essequibo and Demerara. Stabroek and the Dutch and French fortifications in Demerara shared more characteristics of a polder than towns and defensive works in Suriname and Berbice, although making Stabroek a polder was not a conscious choice.

Rainwater not only affected the shape and layout of canals, plantations, fortifications and towns, it also affected the construction process. Work on the necessary polders could only commence in a few months of the year, during the primary dry season. During these months, lands were developed by following a specific set of steps. For an important part, these practices were not discovered by the Dutch and British themselves, but were learned from the Amerindian population.

Next to rainwater, the sea and the rivers had a noticeable impact on construction as well. The constant erosion of the coastal plains and river banks made expensive flood defences necessary on both fortifications and plantations. Whereas the sea caused a prevalence of tidal mills in Suriname, milling practices in Essequibo and Demerara were not so much influenced by the environment. Instead, a combination of British planters, the possibility to harvest sugar year round, the high demand for milling and the high construction costs of watermills, caused a preference for animal powered mills.

Construction in Essequibo and Demerara was also influenced by the soil. Soil depletion of sandy soils along the upper parts of the rivers spurred many planters to move to the coast and the estuaries, which necessitated the construction of polder plantations. Layers and hills of sand were also found along the lower reaches of the rivers, and were hated by both plantation owners and canal builders. Sand was infertile, easily compromised the strength of levees, caused waterways to demand more upkeep, and was hard to dig through.

The abundance of clay, especially heavy sea clay, affected slaves as well. Canals, polders, forts and towns were all constructed on clay, and the constant need for maintenance meant that slaves faced backbreaking work on a daily basis. This took its toll on the slave population and caused much resistance.

The combined effects of climate, landscape, soil, sea and river point out that the natural environment took centre stage in construction projects in Essequibo and Demerara. Instead of being uniquely affected by the Dutch, Essequibo and Demerara were uniquely affected by nature. This thesis repeatedly hinted that this impact goes beyond mere construction, but also had a significant effect on the lives of the Dutch, the British, the enslaved Africans, and the Amerindians. Nature had a pronounced effect on the fabric of society in the Guianas, but only a small number of historians have studied this impact. For example, in ‘Slavery and Slave Cultures in a Hydraulic Society’, Gert Oostindie and Alex van Stipriaan convincingly argued the effects of nature in the Guianas on the slave society of Suriname. Although slavery in Berbice has also been studied thoroughly, in light of the slave revolt of 1763, the role of nature is often overlooked.

Moreover, it should not be necessary to rely on studies focusing on Suriname or Berbice for information on Essequibo and Demerara. As somewhat similar Dutch colonies in the Guianas, it is not surprising that authors focus on the more thoroughly researched Suriname and merely mention that processes in Essequibo and Demerara played out in a similar way. However, Essequibo, Demerara, Berbice and Suriname are as much part of the Guianas, as Belgium, the Netherlands, Germany, Denmark and Poland are part of the North European Plain. Important differences exist, and the impact of nature on the society of Amerindians, Africans and Europeans in two centuries of Dutch Essequibo and Demerara therefore deserves more scholarly attention.

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- Inventory number 1522. Kaart van de Plantagies toebehoorende den heer B. Albinus, geleegen op de Westpunt aan den mond van de rivier Demerary.
- Inventory number 1523A. Het Eiland Borselen in de rivier Demerary.
- Inventory number 1524-1524A. Het Eiland Borselen in de rivier Demerary, met de daar tegenover liggende stad.
- Inventory number 1525A-1525B3. Prospect van een Canaal op Borselen.[277]
- Inventory number 1526. Kaart van de kolonie Essequebo.
- Inventory number 1529. Kaart van een gedeelte der Colonie Essequebo.
- Inventory number 1534. Kaart van de Plantagies Duinenburg en Luixbergen, gelegen tusschen Mazaronie-en Cajounikreken.
- Inventory number 1543. Grond Teykening der nieuw aangelegde Erven op het groot Vlaggen Eyland.
- Inventory number 1551A-1551F. Plan van een redout op de Oostpunt van de rivier Demerary.
- Inventory number 1552. Plan van het fort Le Dauphin, op de Oostzeepunct van Demerary gelegen.
- Inventory number 1554A-1554B. Fort aan den mond der rivier Demerary op 's Comps. Pad Oostwal.
- Inventory number 1555. Plan van een fort aan den mond der Rivier Demerary.
- Inventory number 1557. Plan van het fort aan de Hoofdplaats van Demerarij (Stabroek).

[277] Although the archive states that these plans depict future canals on the island Borselen, these actually concern Heneman's plans for canals near the mouth of the Demerara. See Heneman's report: HaNA, 1.05.01.02, inv.nr. 184, p. 1225-1226, 1260-1261. His description of the canals matches these seen in the plans.

- Inventory number 1558A-1558B1. Plan van een redout voor de Brandwagt aan de rivier Demerary (Oostwal).
- Inventory number 1559. Kaart van het land van de Brandwacht, gelegen aan de Oostwal der riviere Demerary.
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- Inventory number 1562. Plan van het eiland Borselen.
- Inventory number 1563A. Plan van het eiland Borselen.
- Inventory number 1564.1-1564.4 and 1564.21. Grondteekeningen en opstanden van Militaire en Burgerlyke gebouwen te Demerary, van verschillende groote en afmeetingen.
- Inventory number 1614B. Plaan van het nieuw angelegde fort of de geprojecteerde Batterie Andries in de geoctroyeerde Colonie de Berbice.
- Inventory number 1615. Plaan en profil sub no. 2 geprojecteert enz.
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- Inventory number 1619. Caarte figuratif van een gedeelte van de rivier de Berbice, benevens het nieuwe gemaakte project van het fort St. Andries.
- Inventory number 1625. Plan tot een concept op het fort Nassau.
- Inventory number 1644. Project tot Etablissement van het Gouvernement van de Colonie de Berbice, by het geweese fort Nassau.
- Inventory number 1664. Plan van de stad Stabroek aan de monding van de Demerara.
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- Inventory number TM-H-3351. Plattegrond van een koffieplantage.

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- Inventory number 7495. Plan de l'Habitation de Monsieur de La Porte-Lalanne Située au Quartier du Cul-de-Sac Dépendence du Port-au-Prince : En l'Etat où elle se trouve Cejourd-juy 12 mars 1753.


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