

**THE URBAN LITTORAL FRONTIER: LAND RECLAMATION IN THE
HISTORY OF HUMAN SETTLEMENTS**

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INTRODUCTION

Describing the early development of the city we now know as Istanbul, Professor John Bagnell Bury wrote,

Constantine was more successful perhaps than he had hoped in attracting inhabitants to his eastern capital. Constantinople was dedicated in A.D. 330 (May 11), and in the lifetime of two generations the population had far outgrown the limits of the town as he had designed it. The need for space was partly met by the temporary expedient of filling up the sea, here and there, close to the shore, and a suburban town was growing up outside the Constantinian wall.¹

Bury was probably correct in believing that increasing population pressure and the consequent demand for more space to accommodate related urban development were among the reasons for this expansion into the sea. He was wrong, however, in describing the reclamation of littoral areas on the fringes the city as “a temporary expedient”, for its land area continued to be enlarged in this way over the following seventeen centuries. Much of this foreshore infilling has probably been the unintentional result of waste disposal. Nowland observes that around the superb natural harbour of the Golden Horn the land slopes steeply to the shore where “almost everywhere there is a ‘strandflat’ bench at sea level. This feature is apparently artificial, and results from the continual dumping of refuse in the water.”

² Around the world, the reclamation of land from the sea and other water bodies, such as lakes, rivers and wetlands, has long been undertaken for several reasons. The demand for additional space to accommodate urban growth is one, but there are other incentives, often overlooked, that are no less important. Land reclamation for urban expansion is the subject of Hudson's book, *Cities on the Shore: the Urban Littoral Frontier*, from which the title of my paper is taken.³ What follows is a brief survey of the role of reclamation in the history of human settlements, and some thoughts on this continuing process in the light of contemporary issues including climate change, rising sea levels, environmental impact and heritage concerns. As illustrations, examples are drawn from different places at various time periods.

THE LITTORAL FRONTIER: AN HISTORICAL PERSPECTIVE.

The Contested Margin

As Hudson explains, the urban waterfront may be regarded as the littoral frontier of human settlement. Typically, over the years, it advances, sometimes retreats, where terrestrial and aquatic processes interact and frequently contest this margin of occupation. A notable example of retreat is the English coast between Flamborough Head and the mouth of the Humber. Here the advance of the sea has caused the disappearance of some thirty townships since Roman times. Among these lost towns is Ravenser Odd. Formerly more important than the nearby port of Kingston upon Hull, it was swept away by the sea and had disappeared by the end of the 14th century.⁴ Because most towns and cities are sited beside water bodies, many of these urban centres on or close to the sea, their physical expansion is often constrained by the existence of aquatic areas in one or more directions from the core. It is usually much easier for new urban development to occur along or inland from the waterfront. Where other physical constraints, such as rugged terrain or precipitous mountains, make expansion difficult or expensive, building at greater densities or construction on steep slopes is a common response. This kind of development, though technically feasible, is usually more expensive than construction on level or gently sloping land, however. Moreover, there are many

reasons for developing along the shore or riverfront in preference to using sites further inland. Among these are access to navigable water, opportunities for trade and commerce and for fishing.

Reasons for Reclamation

Motivation for reclaiming land from water bodies varies from place to place and time to time. In ancient Tyre, built on a small offshore island, the limitations of space on that narrowly constricted site were, no doubt, the main reason for its high density multi-storey buildings and the creation of more land by reclamation. On Teesside, where Middlesbrough grew rapidly with its development based on the iron and steel industry in the late nineteenth and early twentieth centuries, reclamation along the river and out into the estuary was mainly a means of waste disposal. Here the made land was a by-product of the dumping of slag from the iron and steel works and dredgings from the River Tees. Until the latter part of the twentieth century, little use could be found for much of the land created in this way. Among the reasons for this were the problems associated with building on poorly consolidated silt and mud and the absence of deepwater frontage.⁵ Even where there are large tracts of undeveloped land available, the high cost of developing sites that present serious construction difficulties is often reason for creating new land from adjacent areas that are permanently or periodically under water. Another motive is the relatively high value of artificially created land close to the urban centre when compared with the value of existing developable space at a greater distance inland.

Pressure to create space for development is not the only motivation for urban expansion into aquatic areas. Commonly, urban places on the margins of the sea, estuaries, rivers or great lakes are, or were once, ports where shipping played an important role in the economy. The need for deep waterfronts to allow ships to berth alongside the quay and for adjacent space to accommodate various port facilities has encouraged the advance of the urban land area across marginal shallows in ports

around the world. The space and locational demands of port related industry and commerce, too, have contributed to this process.

Often closely related to these developments is the generation of waste, including domestic refuse, unwanted industrial by-products, site formation and demolition debris and harbour dredgings. From very ancient times, the foreshore has been used as a disposal area for waste from nearby settlements, a practice that continues on a huge scale today. Land formed in this way has long been used for urban development, despite problems that can arise from the nature of the dumped material and the way in which it is deposited. Disposal of waste material is a major factor in the creation of new urban land. Pollution of the foreshore and other water margin wetlands has encouraged the idea that the reclamation of these areas may be desirable on public health grounds.

From Neolithic to Twenty-first Century

Istanbul receives no mention in Hudson's book, but this large and ancient city appears to be typical of coastal settlements that have expanded their sites partly by reclaiming land from coastal shallows. Recent archaeological discoveries have revealed that human occupation of what is now Yenikapi, in the historic core of Istanbul, dates from the Neolithic period between 6400BC and 5800BC, at a time before the Bosphorus Strait had formed and the Marmara Sea was a lake. Evidence suggests that these people had abandoned the nomadic hunting lifestyle, making farming and fishing their chief occupations. They lived beside a river, their settlement sited next to a swamp where small tools, pieces of wood and bones were found during recent excavations.⁶ It was in environments such as this that the earliest examples of wetland reclamation mentioned by Hudson were found.

The infilling of small coastal inlets that commonly occurred in places such as Liverpool's Pool and San Francisco's Yerba Buena Cove was a feature of Constantinople's urban development from its early years. The formerly important

harbours of Eleutherios, Kontoskalion and Bucoleon, on the southern shore of the city, were among those that disappeared in this way. As happened elsewhere, this process gradually smoothed out the irregularities of the original coastline, replacing former bays with level land which became part of the historic urban core.⁷ One of the most outstanding examples of this kind of development is Boston, Massachusetts where the infilled Town Cove became the site of Faneuil Hall Market. In consequence of nineteenth century advances in mechanical and civil engineering, it became possible to undertake much more ambitious reclamation schemes. The most famous of these was the infilling of Back Bay, begun in 1857, which created one of the city's most expensive neighbourhoods. With the completion of this project near the end of the nineteenth century, the land area of Boston had been tripled by reclamation since the city's foundation in 1630. Much of the modern city beyond the historic core also stands on reclaimed land, including large parts of South Boston and East Boston. The latter neighbourhood was greatly enlarged by landfill for the construction of Logan International Airport. Reclamation for urban development commonly changed the physical form of the land in ways other than just extending it over areas formerly covered by water. Again, this is well exemplified by Boston where excavation for fill material levelled several hills, including most of the Trimountain ridge. Fashionable Beacon Hill is a much reduced remnant of this once prominent feature of the Boston skyline.⁸ Among the many other cities where coastal land reclamation, often combined with the levelling of hills, played a major role in urban expansion are San Francisco, Rio de Janeiro, Cape Town, Mumbai and Hong Kong.

In environments very different from those just discussed, cities such as Venice and Amsterdam developed and expanded on land created in other ways. Here in low lying wetlands near the mouths of rivers, canals were dug to facilitate drainage and provide fill material to raise levels. Buildings were constructed on thousands of tree trunks used as piles driven into the marshy ground. Other cities that developed on wetland sites where canals were used for drainage as well as for transport are St.

Petersburg and Bangkok. Somewhat similar development occurred at Tenochtitlan, the Aztec capital that eventually became Mexico City. In this case the settlement expanded from its original site on an island in a lake set high among mountains well inland from the sea. Chicago and Toronto are more recent examples of cities that have reclaimed land from lakes in order to create space for urban development.

It is clearly evident that urban expansion by reclaiming land from the sea and lakes has a long history, one that has been recorded in many different parts of the world. Indeed, Hudson suggests that it is a process far more common than has been generally recognized hitherto. He points out that most human settlements are sited close to, often beside, water, frequently on the banks of rivers and streams. Even where these watercourses are quite small they are commonly encroached upon. In villages and towns around the world, the local stream has been controlled, often straightened and confined between artificial banks, reducing its width and allowing the strips of useful land thus created to be used in a variety of ways. We see this on a larger scale in cities such as London where the street known as The Strand reminds us that the River Thames was once much wider than it is today. Nearby stands the seventeenth century York Watergate which originally provided access between the now vanished York House and the river that was formerly much used for passenger traffic. As a result of the construction of the Victoria Embankment, completed in 1870, the historic watergate is now separated from the Thames by a strip of reclaimed land about 140 metres wide.

Ports which developed at sites lacking natural deep water harbours have a strong incentive to reclaim the foreshore. This is particularly so where at low tide extensive mud flats are exposed separating the town or its port from the water's edge. Even for relatively small vessels, it is usually preferable to have berths where there is a permanent depth of water that allows them to remain afloat at all states of the tide. The simplest way to achieve this is to construct a jetty or mole that extends from the

shore into permanently deep water. This was Port of Spain's first response to the problem when the original Amerindian fishing village started to develop as Spanish Trinidad's major town in the eighteenth century. The coast here was fringed by extensive mangrove swamps and at low tide a broad muddy foreshore extended in front of the growing settlement. To facilitate shipping, a mole of earth was constructed extending over 200 metres into the harbour. At the seaward end of this structure there was a wharf built of local timber.⁹ The mole was, in fact, a narrow strip of reclaimed land aligned at right angles to the shore. Eventually, more extensive reclamation absorbed the mole, creating a wide strip of made land fronted with a quay. This is still known as South Quay, although it is now just a street, distinguished by an old lighthouse, a block inland from the present waterfront. Port of Spain's modern dock area is on a much larger reclaimed site immediately to the west.

The much older town of Southampton traces its history as a sea port back to Roman times, but, like Port of Spain and many other ports around the world, its modern dock system has developed away from the original town quays. Southampton's historic Town Quay, like Port of Spain's South Quay, is now a street separated from the present waterfront by a strip of reclaimed land. Southampton's fortunes fluctuated over the centuries but during the Victorian era it grew to be a major world port, the main British terminus of the transatlantic passenger liner route and the 'Gateway to the Empire'. The development of the port reflected the requirements of the much larger ships and the onshore facilities that expanding international trade and modern communications demanded. The need for deepwater quays and adjacent land for roads and railways, together with space for handling goods and passengers, encouraged land reclamation on a very large scale. This was made possible by the technological advances of the Industrial Revolution. The main method of reclamation was dredge and fill, this process deepening the shipping channels as well as providing material for raising levels behind retaining walls of more solid construction.¹⁰ From the nineteenth century, this method became common in port

developments around the world. Among the important exceptions where dredge and fill was relatively little used is Hong Kong, its deep harbour mainly free of wide fringing mudflats.

From its foundation by the British in the eighteen forties, Hong Kong's reclamations were undertaken for a variety of reasons. It was recognized at the very beginning that developable space had to be created by cutting down hills and using the excavate material to reclaim land from the sea. From the earliest days, the foreshore was used as a dumping ground for rubbish or all kinds. In addition, waterfront lot holders made irregular extensions into the harbour to create deep water frontages for their vessels. By interfering with tidal currents, this aggravated the pollution of the foreshore which was caused largely by the discharge of sewers above the low tide mark. Soon Hong Kong's waterfront became unsightly and smelly, a condition that many felt was injurious to public health. It was mainly on the latter grounds that proponents of the Praya Reclamation Scheme (1889 – 1904) argued for this ambitious project but there can be little doubt that it was really a speculative land development in which the profit motive provided the main incentive.¹¹

The profit motive continues to drive land speculation, including speculation in land that has to be won from the sea. No more dramatic examples can be found than the three Palm Island developments and the similar scheme known as The World on the coast of Dubai. The first of these artificial island developments, Palm Jumeira, was begun in 2001 but this was not the first large scale land reclamation to have helped transform the booming city of Dubai. In the 1960s, Dubai embarked on two major projects that changed what was little more than a small fishing village into a large metropolis. The first was the dredging of Dubai Creek to improve access by boats and dhows, at the same time adding significant amounts of land to the central area. The second was the creation of Jebel Ali Port, claimed to be the world's largest artificial harbour. In the 1990s the iconic Burj Al Arab Hotel was built on an artificial island after which came the more ambitious Palm Island and World

projects.¹² The following much quoted information conveys some idea of the scale of these developments. The three palm tree-shaped artificial islands represent the largest reclamation projects in the world. Palm Jumeira Island is 25 square kilometres in area and increases the Dubai coastline by 78 kilometres. Palm Jebel Ali Island is expected to accommodate 1.7 million people by 2020 (the total population of Dubai in 2008). Palm Deira Island will become the world's largest artificial island and will have a population of over a million people.

CONTEMPORARY ISSUES

Conservation of the Natural Environment and Heritage Areas

Promising to outdo Dubai, South Korea's Saemangeum reclamation began with the construction of probably the world's longest seawall, the 33 kilometre structure completed in 2006. Here a waterfront city, Ariul, is planned for construction on a 6,730 hectare site, occupying 24 percent of the land to be reclaimed from the Saemangeum estuary. This development threatens wetlands of great environmental importance, particularly because of their function as a stopover for migrating birds. Conservationist are continuing their campaign to halt this huge development and preserve the wetlands threatened with destruction.¹³ Today the loss of wetlands is regarded as a major environmental threat. The value of these biologically important ecosystems is now widely recognized and projects that involve their destruction by reclamation are commonly opposed. In Hong Kong, where reclamation from the sea and coastal wetlands reclamation has long played a vital role in urban development as well as in the extension of agricultural land, the internationally important Mai Po Marshes on the southern shore of Deep Bay are now protected as a nature reserve. Across the bay lies the growing city of Shenzhen where the demand for building land has led to the reclamation of wetlands for urban development, indicating the probable fate of the Mai Po Marshes in the absence of government protection. In recent years, the Hong Kong Government has come under increased pressure from environmental groups including some particularly concerned about coastal development in the region. Founded in 1995, the Society for the Protection of the

Harbour is trying to halt the reclamation of Hong Kong Harbour which, over the past 150 years has reduced this once magnificent expanse of water to a relatively narrow channel. The more recently established Save Our Shorelines organization seeks to protect what remains of Hong Kong's natural coast and to promote its enhancement and improved public access where it has already been developed.

Conservationists concerned with architectural and townscape heritage issues are also among those who often oppose waterfront development schemes that involve reclamation. As long ago as 1965, D.F. Wood observed, "Since the oldest portion of many cities is along the water, it is often a candidate for renewal treatment because of its age, if for no other reason."¹⁴ There are several reasons in addition to age for the continuing redevelopment of the historic waterfronts of towns and cities around the world. Apart from the incentive of getting the most economic value out of prime real estate, finding solutions to urban traffic problems and the perceived enhancement of the city image are among the reasons for waterfront redevelopment. Decayed dockland areas provide opportunities for profitable investment that can take the form of impressive new buildings, while it is often tempting to put a road along a city's waterfront to solve traffic congestion problems. This commonly involves further reclamation on waterfront sites that have experienced a succession of advances over time. Many examples at various scales can be found across the world from China to the Caribbean.¹⁵

Climate Change and Rising Sea Levels

A more indirect affect of human action on coastal settlements is climate change and consequent rising sea levels. The increasingly frequent inundations of Venice on its reclaimed site are well known but it was the flooding of New Orleans in August, 2005 that gained world attention to the potential disasters that might lie ahead for low lying cities on coasts around the world. Located, like Venice, on a deltaic site, New Orleans developed along natural levees of the Mississippi, expanding onto lower, swampy ground behind the relatively elevated riverfront. Over the years the

levees were artificially raised and strengthened while urban expansion was facilitated by systematic city-wide reclamation and forced drainage using a network of dredged canals and pumping stations to convey storm water to the Mississippi and Lake Pontchartrain. As in Venice and elsewhere, land subsidence is a major factor in the vulnerability of New Orleans to problems of flooding but rising sea levels and increasing frequency and severity of storms are threats which face waterfront cities around the world, many of them built largely on land that was won from the sea by reclamation.¹⁶ In addition to increasing danger from the effects of climate, parts of the world are under constant threat of tsunamis which was brought to world attention by the disastrous Indian Ocean event of Boxing Day, 2004 and, more recently, the Chilean earthquake of 27 February, 2010.

CONCLUSION

The reclamation of land from the sea, lakes, rivers and wetlands can be regarded as normal rather than exceptional in the development of human settlements great and small. From the earliest times to the present, villages, towns and cities have expanded on land won from areas previously under water permanently or periodically. The motivation for this varies. Perhaps the earliest reclamations were the merely the result of waste disposal, accumulations of rubbish dumped on the margins of rivers, lakes and swamps and in coastal shallows. Later, extensive areas land was reclaimed by the dumping of a much wider range of waste material, including domestic refuse, site formation and demolition debris, harbour dredgings and industrial waste. Reclamation to make room for urban development has occurred widely, especially where cities are built on constricted sites. The artificial creation of high value urban land close to both the city centre and the port has long been a major factor in waterfront development. Reclamation has also played a major role in the construction of docks, typically involving the dredging of rivers, estuaries and bays and the deposit of the dredged material and other material as fill. Coastal shallows have often been filled in order to extend land out towards deep water and

create quays where ships can lie alongside at all states of the tide. Polluted foreshores and swamps regarded as unhealthy have also been reclaimed as a public health measure but, with growing appreciation of the important ecological role played by wetlands, opposition to their destruction has grown in recent decades. Nevertheless, around the world reclamation for urban development continues on an ever more ambitious scale. This is occurring despite the threats posed by climate change and rising sea levels. The threat of destruction by tsunamis is another environmental hazard that faces low lying coastal settlements in some parts of the world. At a time of enormous advances of land into the oceans by reclamation on an unprecedented scale, the possibility of retreat along large stretches of the urban littoral frontier looms ever larger. In future, the history of the urban littoral frontier may become more about retreat than advance.

ENDNOTES

1. Bury, John Bagnall, *History of the Later Roman Empire from the Death of Theodosius I to the Death of Justinian*, vol. 1, (London: Macmillan, 1923), pp. 69 – 70.
2. Nowland, John L., *The Port of Istanbul*, *The Scottish Geographical Magazine*, vol. 77, no. 2, 1961, p. 68.
3. Hudson, Brian J. *Cities on the Shore: The Urban Littoral Frontier* (London: Pinter, 1996).
4. Hayton, Richard, 2006 *History of Ravenser Odd*
<http://www.yorkshirehistory.com/RAVENSER/index.htm> Accessed 11/02/2010.
5. Le Guillou, Michael, *A History of the River Tees 1000 – 1975* (Middlesbrough: Cleveland County Libraries, 1978).
6. Rainsford, Sarah, 2009, BBC News. *Istanbul's ancient past unearthed*.
<http://news.bbc.co.uk/2/hi/europe/7820924.stm> ; Watson, Ivan, 2009 CNN International. *Tunnel links continents, uncovers ancient history*.
<http://edition.cnn.com/2009/WORLD/meast/0921/turkey.bosphorus.tunnel.marmaray/> Accessed 8/02/2010.

7. Gül, Murat, *The Emergence of Modern Istanbul; Transformation and Modernisation of a City* (London and New York: Tauris Academic Studies, 2009);
Maclagan, Michael, *The City of Constantinople* (London: Thames and Hudson, 1968).
8. Whitehall, Walter Muir, *Boston: a Topographical History*, 2nd Edition (Cambridge, Mass. and London: Belknap Press, 1968).
9. Ottley, Carlton Robert, *The Story of Port of Spain from the earliest times to the present day* (London: Longman Caribbean, 1970).
10. Coughlan, J. *Aspects of Reclamation in Southampton Water*. In B. Knights and A.J. Phillips (Editors) *Estuarine and Coastal Land Reclamation and Water Storage* (Farnborough: Saxon House, 1979), pp. 99 – 124.
11. Hudson, Brian J. *Paul Chater and the Praya Reclamations: Wetland Development in Hong Kong 1887 – 1930*. *Journal of Oriental Studies*, vol. 16, nos. 1 7& 2, 1978, pp. 79 – 86; Hudson, Brian J, *Coastal Land Reclamation with Special Reference to Hong Kong*, *Reclamation Review*, vol. 2, 1979, pp. 3 – 16.
12. Elsheshtawy, Yasser, *Dubai: Behind an Urban Spectacle* (London & New York: Routledge, 2010).
13. Kang, Hyun-kyung, *The Korea Times*, ‘Ariul’ to Become Waterfront city in Saemangeum Site.
http://211.234.100.245/www/news/nation/2010/01/113_59932.html Accessed 12/02/2010;
Long, Kiernan, *Urbanism: an ideas competition in Saemangeum in South Korea has seen Florian Beigel’s ideas expressed on an epic scale*, *Architectural Review*, vol. 223, Issue 1348, 2009, pp. 84 – 89.
14. Wood, D.F. *Renewing urban waterfronts*, *Land Economics*, vol. 41, no. 2, 1965, p. 141.
15. Chen Yu , *Transformation of waterfront space in Asian cities: Macau, Hong Kong, Shanghai*. The 4th International conference of the International Forum on Urbanism (IFoU) 2009, Amsterdam/Delft. *The New Urban Question – Urbanism beyond Neo-Liberalism*, pp. 597 – 606; Dodman, David, *Post-independence*

optimism and the legacy of waterfront redevelopment in Kingston, Jamaica, *Cities*, vol. 24, no. 4, 2007, pp. 273 – 284; Hudson, Brian J. Waterfront development and redevelopment in the West Indies, *Caribbean Geography*, vol. 2, no. 4, 1989, pp.229 – 240;ULI – the Urban Land Institute, *Remaking the Urban Waterfront*, Washington, DC: the Urban Land Institute, 2004.

16. American Society of Civil Engineers, *The New Orleans Hurricane Protection System: What Went Wrong and Why. A Report by the American Society of Civil Engineers Hurricane Katrina Review Panel*. Reston, Virginia: American Society of engineers, 2007; Lewis, Pierce, F. *New Orleans: the Making of an Urban Landscape* (Cambridge, Mass.: Ballinger Publishing Company, 1976).