Netherlands: Dutch Continue to Reclaim Land from the Sea

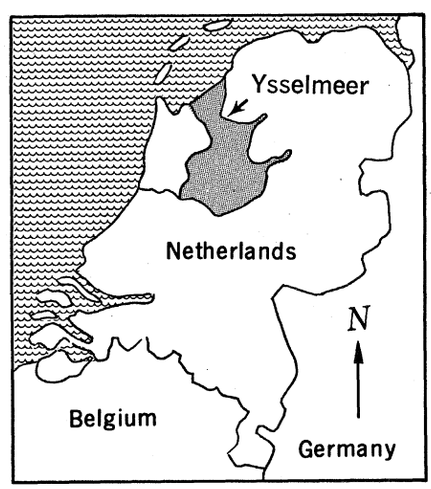
The sea has always been the true Dutch frontier; and while the Americans closed theirs 70 years ago, the Dutch is still open. In the Netherlands they are still conjuring good, cheap land out of the sea—an economist's dream, and perhaps an environmentalist's too. This new land, after all, lies at the heart of one of Europe's richest and most populous regions, bordering on a busy sea and close not only to the heavy river traffic of the Rhine, but to Europort, the largest port in the world. Under the Ysselmeer Scheme, there will be, by the year 2000, 550,000 acres of land reclaimed from the sea for urban, industrial, and agricultural use.

The Ysselmeer Scheme is a curiosity of planning, among other things. Since the work was begun 40 years ago, the population of the Netherlands has grown from 6 to 12 million, the densest in the world, averaging about 1000 people per square mile. Half the population lives in a fifth of the total area, in the western part of the country. By the end of the century, the population will have reached 18 million and living space will have to be found outside the existing urban areas for another 1 million people. As the population has increased, the economy has become an industrial one and agriculture has diminished in importance. What began as a search for more farmland has become an answer to the new demand for space and recreation.

The Netherlands form the common delta of the Rhine, the Meuse, and the Scheldt rivers. In the Ice Age, the Elbe and the Weser rivers met the sea there as well. Geologically, this has made the country for countless centuries a vast, low-lying sedimentary dump, about a fifth of which is below sea level. The elevation of this polder region, as it is called, along the coast of the North Sea varies from about 6 feet above sea level to about 16 feet below it. Without the protection afforded by dunes, dykes, windmills, and pumping stations, about two-fifths of it would be flooded.

In the 13th century, the Dutch were aready reclaiming land that was occasionally flooded by building dykes as the waters retreated. The invention of the rotating turret windmill in the 15th century supplied the energy for pumping out permanently flooded land, and in 1528 the first small lake was drained. By the 17th century, the reclamation of the Zuyder Zee was theoretically possible.

In Roman times, according to Tacitus, the Zuyder Zee was Lake Flevo, a lake in the middle of the northern Netherlands cut off by peatlands from the North Sea. By 1600, the sea had broken in and formed a tidal basin that was only 9 or 10 feet deep, but was a cause of salt pollution of the surrounding land and a danger to it at times of storm and high tide. The money brought into the Netherlands by overseas trade in the 17th century provided the capital for small private reclamation schemes in northern Holland, but 19th-century steam and 19th-century capital were needed before larger ones could be attempted.



The barrier dam across the mouth of the Ysselmeer created, on its completion in 1932, a freshwater lake nearly a million acres in extent. More than half the Ysselmeer has been reclaimed in the form of dry land areas, or polders, the most recent of which was completed last year.

The first big scheme was the reclamation in 1852 of the Harlemmeer, the site of Schiphol Airport. Here for the first time the state took charge, the object was not profit but safety from flood, and heavy investment was required. The Dutch government has controlled reclamation ever since; for that matter, safety has probably remained the only consistent objective of land reclamation since those days. About 1848, it was thought that reclamation of the Zuyder Zee would relieve agricultural poverty and compensate for the loss of Belgium, which had broken its union with the Netherlands in 1830. The economic boom of the 1860's promised a good return on new agricultural land; but by 1880 there was a severe agricultural slump, and there seemed little point in reclaiming land except for safety from the sea.

When Cornelius Lely first drew up the Ysselmeer Scheme in 1890, control of the Zuyder Zee's waters was uppermost in his mind. What finally persuaded the Dutch parliament to pass it into law in 1918 were the effects of a great storm in 1916 and the food shortages caused by World War I. Lely closed the mouth of the Zuyder Zee with a barrier dam (the Afsluitsdijk) 20 miles long, from North Holland to Friesland, 24.5 feet high, and 300 feet thick at the base. The construction of the dam was, in itself, a national epic and an unprecedented feat of engineering. On its completion in 1932, the Zuyder Zee became the Ysselmeer, a freshwater reservoir. The salt coastline of the Netherlands was reduced by 185 miles, and the threat of salt pollution, storm damage, and flood to the surrounding land removed. It would have paid to build the barrier dam for the supply of fresh water alone.

But Lely's scheme proposed, in addition, the reclamation from the Ysselmeer of five polders occupying about 550,000 acres of the old Zuyder Zee and leaving about 300,000 acres under water. The first and smallest polder, the Wieringermeer—50,000 acres—was drained in 1930 and completed in 1942. The second, the North East Polder—120,000 acres—was begun in 1942 and completed in 1957. Both, as Lely intended, were devoted to agriculture; but intentions about the other three

have changed as agricultural productivity has increased and agricultural employment has fallen, as population has increased and industry has expanded, and finally, as the Common Market's agricultural policy has lessened the demand for farmland.

Three government agencies supervise the Ysselmeer Scheme. The Zuyder Zee Project Service carries out the hydraulic engineering works, building the dykes, pumping stations, locks, canals, and roads. The Ysselmeer Development Authority provides the technical development of the land and the Southern Ysselmeer Polders Public Authority, whose director is also director of the Development Authority, puts in the public services needed by the new communities and provides local government for 10 to 15 years until an elected local government can take over.

The cost of the work comes out of the government's central budget: to be precise, out of the annual vote for the Department of Transport and Waterways. There is no special fund and never has been. Annual costs are not easy to reckon because, in addition to the expenditure on land reclamation, there is also the expenditure on servicing and developing the reclaimed land over a period of years. For example, estimates for construction in the reclaimed polders in 1971 amounted to about $22 million, together with additional costs in East and South Flevoland of $8 million. Laying water pipes and electricity cables cost more than $1 million, and other service work about $2 million. There are, too, heavy expenses not included in the cost of reclamation: for example, the service bureau for the Zuyder Zee works, which supplies staff, machinery, and other services for the reclaimed land, cost about $19 million in 1971. Expenditures in 1971 were about 10 percent greater than in the two previous years because of inflation.

The reclamation of the polders may be a source of national inspiration, but it would be hard to found a mystique on it. To the layman looking from the shore, it seems a slow, messy, and dispiriting business. The dyke enclosing the site of the polder is built first. Under gray skies, its foundations protrude from the gray waters like a threatening reef. Here and there lie small vessels, apparently idle. A wind like an ax comes off the North Sea, cleaving the watcher to the bone. How much Dutch domestic warmth, he wonders, will be needed to counteract the mournful landscape and biting weather when the community arrives, in a few years' time?

The Dutch, who have done it all before, are unruffled. They are applying a technology that, whatever modern aids it employs, has centuries of experience behind it; and of all the civil engineers in the Netherlands, those specializing in hydraulics enjoy by far the greatest prestige. After the line of the dyke has been plotted, a channel is dredged in the seabed and filled with sand. Boulder clay walls are built on this base and sand is pumped between them by suction dredgers. Below the water, the dyke is given a protective layer of fascine mattresses weighted with stones and gravel. Above the water, it is covered first with brushwood mattresses held down with rubble and then finished off with stones, concrete blocks, bricks, or asphalt. Sometimes the crest of the dyke is finished off with clay, which is then sown with grass.

Within the dyke, the pumping out of the water leaves behind a desert plain of glittering sludge. For 5 years it will be a reclamation farm, operated by the state. First, aircraft sow reeds to hasten the drying out of the soil and smother weeds. A network of drainage watercourses and roads is added as cultivation advances. The reeds are burned off, field ditches are dug, and the land is prepared for the first crop —usually winter rape. At the same time, the reclamation farm is moving across the polder; it is about 50,000 acres in extent at any one time. Each year it takes in another 10,000 acres of mud on one side, while releasing to private users 10,000 acres of land fully prepared for cultivation.

Early in this stage too the polder looks forbidding: a half-drowned marsh speckled with timid vegetation. But the Dutch soon put their mark on it emphatically to produce the order, if not the antiquity, that we recognize from 17th-century paintings. Ditches become underground drains; buildings go up; water, electricity, and telephone lines arrive; and the villages, with their shops, schools, and community services are laid out.

The establishment of one population has meant, to a small extent, the displacement of another—the fisherfolk who used to depend on the saltwater herring and anchovy fishing trade of the old Zuyder Zee. But fish-breeding ponds have been built to help keep up the level of freshwater fishing for anglers—the largest of all recreational groups in the Netherlands—and for the fishermen who still follow their trade. Loans and retraining schemes are available for those who are displaced. Nor is wildlife completely forgotten. In East Flevoland, for example, 150 acres are set aside for the undisturbed development of plant and animal life, 500 acres of meadow for a bird preserve, and 120 acres for a migratory bird refuge.

The early crops are those best suited to a soft, poorly ripened soil: winter rape, spring barley, oats, winter wheat, and spring wheat. Because some profit

NAE Elects 11 New Members

On 18 May the National Academy of Engineering elected new members, bringing the total membership to 363. Election to the academy is the highest professional distinction that can be conferred upon an engineer. Members are chosen because they have made significant contributions to engineering theory and practice or have demonstrated unusual accomplishments in new or developing fields of technology.

The new members and their affiliations are

Albert L. Babb, University of Washington
John Bardeen, University of Illinois, Urbana
Lynn S. Beedle, Lehigh University
Morris Cohen, Massachusetts Institute of Technology
Alfred J. Eggers, Jr., National Science Foundation
James R. Johnson, 3M Company, Minnesota
John D. Kraus, Ohio State University
Thomas W. Lambe, Massachusetts Institute of Technology
Ralph Landau, Halcon International, Inc., New York
Cedomir M. Sliepcevich, University of Oklahoma
Morris Tanenbaum, Western Electric Company, New York.

is made on them, they mean a savings on government investment capital. When the private farmers arrive, the land is turned mostly to arable farming, wheat, colza, and seed potatoes. Unlike most marine soils, the soils in the Ysselmeer polders contain plenty of lime, and the heavier soils are also rich in potash and phosphates. Crops like potatoes and sugar beets can be grown for years without fertilizer. There are plenty of applicants for leases, and they are carefully chosen. Not only must they have capital and agricultural skills, but also the temperament for settling in a new community. And since the political system of the Netherlands depends on a balance of Protestant and Roman Catholic interests, they must also be selected to reproduce the proportions of the religions in the rest of the country.

East Flevoland, the third polder, was the latest to be completed. It is 135,000 acres in extent, was begun in 1957, and was completed last year. Its greater part is agricultural, as in the first two polders, but in its capital, Lelystad, the first city—or projected city—has made its appearance, and the future of the new polders is to be urban, industrial, and recreational.

Only 5 percent of the land in the first two polders was reserved for towns, forests, and recreation, and even poor soil was treated to make it fit for farming. But the fourth and fifth polders, South Flevoland and Markerwaard —not yet drained—will give over half their land to nonagricultural use. Influences on planning now change quickly. As recently as 1954. East Flevoland was assigned ten villages not more than 10 kilometers apart, that being the greatest tolerable distance for a farmer or a villager on a bicycle. But as the number of people working on the land fell, and the demand for amenities grew, the scheme had to be changed to one providing only for Lelystad, a secondary town called Dronten, and two villages.

By the year 2000 Lelystad will, it is expected, have 100,000 inhabitants. Not so long ago, a visit to it was a journey through a featureless mire to a bleak outpost looking out on bleak waters. Now it has more than 4000 inhabitants, its first residential squares free of traffic, and its first shops and schools. The city still expresses a hope rather than a reality with its neat planners' apartment blocks overlooked by cranes, its signposted and demarcated industrial area, its community center, and its park, all awaiting the 10,000 people expected in the next 4 years to establish the comfortable, closely knit pattern of Dutch urban life. But by way of the new road along the edge of the South Flevoland polder, Lelystad is now only 33 miles from Amsterdam, the heart of what is now known as the Holland conurbation.

Only 14 years after the encircling dyke was laid down, East Flevoland already has a well-established air. The trees may look younger than they do on the old mainland, the farm buildings may look newer, and the horizon, where the pumping stations rear their tall chimneys into the sky, may appear even flatter. The publicity handouts talk not of potatoes and sugar beets, but of woods, nature preserves, water sports, and beaches. The future lies not with selected religious farmers, but with the conurbation's thousands and hundreds of thousands of people pouring along the motorways from the west.

Contention being the greatest pastime of the Dutch, within the framework of their tolerant society, there is contention about the polders. Some argue that Markerwaard should not be reclaimed. It will not have its encircling dyke until 1980 and will not be completed until the end of the century. While the Common Market agricultural policy is throwing land out of use, reclamation costs are increasing. Already the development of Markerwaard has been delayed in favor of the smaller South Flevoland polder, partly because of the cost to the national budget and partly because South Flevoland lies nearer to the Holland conurbation. It is argued that the water that now covers the site of Markerwaard should be kept to supply the faucets of the expanding conurbation and to take its small boats—for where the car was yesterday's symbol of prosperity, tomorrow's is the boat. Time and environmental pressures will presumably resolve this argument. But if Lely's scheme is completed, it will have enlarged the arable area of the Netherlands by 10 percent and its total area by 7 percent. Every year the Netherlands loses about 7500 acres of land to cities, roads, and airfields. At that rate, by a happy chance, Lely's scheme has given the country a 70 years' supply.

—MICHAEL BUTLER

A former British journalist, Michael Buter is now a producer for the British Broadcasting Company's external service.

RECENT DEATHS

Carey Croneis, 70; retired chancellor, Rice University; 22 January.

Harrell E. Garrison, 63; president emeritus of Northeastern State College, Oklahoma; 26 February.

Richard L. Glenn, 56; assistant director of research, Bituminous Coal Research, Inc.; 31 January.

Alice B. Greene, 77; former dean, psychology department, Park College, Missouri; 21 March.

Robert O. Haxby, 59; professor of physics, Iowa State University; 11 January.

Leslie B. Hohman, 80; former professor of psychiatry, Duke University; 28 January.

George James, 56; dean, Mount Sinai School of Medicine and president, Mount Sinai Medical Center; 19 March.

Donald P. Kent, 55; head, sociology department, Pennsylvania State University and former director, Institute of Gerontology, University of Connecticut; 20 March.

William A. Manning, 95; former professor of mathematics, Stanford University; 29 February.

H. Murray McIlroy, 66; former professor of mechanical engineering, University of British Columbia; 9 January.

Bernard J. McMahon, 79; former chairman, otolaryngology department, St. Louis University; 4 January.

Ralph E. Noble, 72; former Vermont Commissioner of Education; 16 March.

Eugene Pacsu, 80; professor emeritus of chemistry, Princeton University; 25 March.

George E. Phillips, 59; director, biochemistry department, Warner-Lambert Research Institute; 28 January.

Henri S. Sack, 68; professor of engineering and applied physics, Cornell University; 17 March.

John J. Sheinin, 71; president emeritus, Chicago Medical School; 9 January.

Richard H. Shryock, 78; former professor of the history of medicine, Johns Hopkins University; 30 January.

Norman R. Sparks, 71; professor emeritus of mechanical engineering, Pennsylvania State University; 23 January.

Marion R. Trabue, 81; dean emeritus, College of Education, Pennsylvania State University; 11 January.

G. Stafford Whitby, 84; professor emeritus of rubber chemistry, University of Akron; 10 January.