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KEEPING THE NETHERLANDS DRY

A LAKE THAT BECAME AN AIRPORT

Planes touching down at Schiphol Airport land roughly four meters below sea level, on the bed of a lake that no longer exists. The Haarlemmermeer was pumped dry by steam engines in the middle of the nineteenth century, and its clay floor now carries runways, MOTORWAYS, and houses. Land won from water this way is called RECLAMATION, and each drained compartment is a POLDER: a piece of ground ringed by dikes whose water level is decided by people, not by nature. About a quarter of the Netherlands lies below sea level.

SPELL Spell: **POLDER**

POLDER

SPELL Spell: **MOTORWAYS**

MOTORWAYS

KNOWN What is the term for land won back from water by draining it?

RECLAMATION

OPEN Planes land there four meters below the sea, on the bed of a lake that was pumped away. Where near you is built on top of something that used to be there?

Open response - use practitioner judgment

MATH The Haarlemmermeer was declared dry in 1852, and the Afsluitdijk sealed off the Zuiderzee in 1932. How many years separate those two projects?

80

HOW THE WATER LEAVES

A polder fills from three directions: RAIN falling onto it, SEEPAGE pushing up through the soil from the higher water outside, and LEAKAGE through the dikes themselves. Ditches gather all of it and carry it to a pumping station, which lifts the water into a BOEZEM, a ring of storage canals held above the polder floor. When the tide drops, a SLUICE, a gate set into the outer dike, swings open and the boezem drains seaward by gravity; when the sea sits too high, pumps that were once WINDMILLS push the water out instead.

SPELL Spell: BOEZEM

BOEZEM

SPELL Spell: WINDMILLS

WINDMILLS

KNOWN What is the name for the gate set into the outer dike that swings open when the tide drops, letting the stored water drain seaward by gravity?

SLUICE

SEMI_OPEN Name two of the three sources of water that fill a polder.

NEEDS 2 OF RAIN / SEEPAGE / LEAKAGE

OPEN When the sea is too high for the gate to open, the pumps take over. What in your own life has a backup like that?

Open response - use practitioner judgment

FOUR KINDS OF DEFENSE

Outside the polders, four kinds of defense stand between the country and the North Sea: DUNES, DIKES, DAMS, and BARRIERS. The dunes are natural; the rest were built. In 1932 the Afsluitdijk sealed off the old Zuiderzee, turning a tidal inland sea into the freshwater IJsselmeer and shortening the coastline that had to be defended. A storm SURGE - wind piling SEAWATER against the coast at high tide - broke the dikes of Zeeland in 1953. Afterward the Delta Works closed most of the southwestern ESTUARIES with dams and movable barriers.

SPELL Spell: ESTUARIES

ESTUARIES

SPELL Spell: SEAWATER

SEAWATER

KNOWN What is the term for wind piling the sea up against the coast at high tide?

SURGE

SEMI_OPEN Name two of the four kinds of defense that stand between the country and the North Sea.

NEEDS 2 OF DUNES / DIKES / DAMS / BARRIERS

OPEN What do you think happened to the fish in the Zuiderzee once the Afsluitdijk turned that salty sea into a freshwater lake?

Open response - use practitioner judgment

MATH The Afsluitdijk runs 32 kilometers across the water. Suppose a cyclist crosses it at a steady 16 kilometers per hour. How many hours does the crossing take?

2

THE SINKING GROUND

Draining the land does not end the problem; it deepens it. Much of the western Netherlands sits on PEAT, a soil made of waterlogged plant remains. Once pumps pull the water table down, air reaches the peat and OXIDATION begins: the fibers rot away and the ground compacts. This SUBSIDENCE has lowered parts of the country by meters since the Middle Ages, so the pumps must lift water ever higher. Salt groundwater seeps upward under the dikes as well, and SALINIZATION, the slow souring of soil with salt, spreads across low farmland.

SPELL Spell: SALINIZATION

SALINIZATION

SPELL Spell: OXIDATION

OXIDATION

KNOWN What is the name of the soil made of waterlogged plant remains that much of the western Netherlands sits on?

PEAT

KNOWN When the fibers in drained soil rot away and the ground compacts, the whole surface sinks lower over the centuries. What is the term for that lowering of the land?

SUBSIDENCE

OPEN The ground under those farms has sunk a little lower every year for centuries. What is something that changes so slowly you only notice it years later?

Open response - use practitioner judgment

ROOM FOR THE RIVER

If you live in Amsterdam, Rotterdam, or almost anywhere in the western Netherlands, your ground floor sits below the sea, and part of your tax bill goes to an elected water board, a regional authority for dikes and pumps whose ANCESTORS date to the Middle Ages, older than the Dutch state itself. Newer policy accepts that walls alone cannot win: under Room for the River, ENGINEERS lowered stretches of FLOODPLAIN and moved dikes inland to give high water somewhere to spread. The pumps under Schiphol never stop.

SPELL Spell: ANCESTORS

ANCESTORS

SPELL Spell: ENGINEERS

ENGINEERS

KNOWN What is the term for the flat low land alongside a river that the water spreads across when the river runs high?

FLOODPLAIN

OPEN The pumps under the airport never stop. What is something that never stops working where you live?

Open response - use practitioner judgment