Challenges

CLIMATE CHANGE

Most scientists and policy-makers accept climate change as a fact. In the case of the Netherlands, the widely-accepted, most probable changes in this century are a sea level rise of 100 centimetres, coastal erosion, wetter and warmer winters with expected higher river discharges, drier and warmer summers, more precipitation in shorter periods and heavier hail storms and thunderstorms. The prediction for the coming century is that sea level rise will accelerate. River floods will occur more often due to heavier precipitation of longer duration. Sea level rise will increase the water level in rivers, causing salt intrusion to the inland areas close to the coast. [KNMI'14, Klimaatscenario's voor Nederland, 2014]

The changing climate in the Netherlands

In its 2014 report, the KNMI (the Dutch Meterological Institute) describes climate scenarios for future climate change in the Netherlands. Temperatures in the Netherlands continue to rise and this increase is greater than the world average. In the past 30 years temperatures in the Netherlands rose almost twice as fast as the world average, 1,4°C in the Netherlands versus 0,7°C average worldwide between 1951 and 2013. The higher average temperature in the Netherlands can be attributed to the increase in westerly winds during the winter. More sunlight, primarily from a decrease in air pollution, was the cause of higher temperatures in the summer. In future the expected temperature rise is greatest in the winter; this means a significant decrease in the expected number of frost and ice days. The temperature rise is greatest for warm summer days and cold winter days.

Annual precipitation in the Netherlands increased an average of 14% between 1951 and 2013. This increase can be partially attributed to the fact that warmer air can contain more water vapour. There is more precipitation, particularly in the winter. The temperature increase causes more extreme showers throughout the year, especially along the coast: one degree of warming increases the amount of precipitation per hour during extreme showers by around 12%. [KNMI'14, 2014]

Besides the increase in precipitation in the Rhine River catchment area in winter – which causes higher water levels – and heavier showers in the summer, increasing periods of drought are also a problem. This causes lower water levels in rivers and thus salt intrusion to river mouths and estuaries. In the summer of 2003, we saw the consequences of hot, dry summers. That summer fresh water from the IJsselmeer had to be pumped to the low-lying coastal areas to counter the salt intrusion through the river mouths. In the same year river water could almost not be used as cooling water for power plants due to the combination of low water levels and higher than normal water temperatures. In 2003 the 'peat' dike in Wilnis collapsed because it had dried out. Sea level rise, which is caused by a rise in sea water temperatures and the

melting of the polar ice caps, causes further salt intrusion, with consequences for agriculture and nature. [Watervakblad, 2011]

Land subsidence INCREASES RISK OF FLOODING

The Netherlands is essentially one large delta. The Rhine, Ems, Meuse and Scheldt rivers flow into the North Sea here. In a “natural” delta without dikes (levies) and dams, overland flooding from the rivers and the sea would deposit sediments (clay and sand) which would raise the level of the land (even in the case of sea level rise). Due to human interference this process doesn’t occur anymore in the Netherlands. About 1000 years ago, the inhabitants of the delta started constructing dikes to reclaim agricultural land. Additionally, peat was extracted for fuel from the wetlands behind the dunes, creating lakes that were metres deep. From the 17th century on, these lakes were drained to create polders. This caused a subsidence of the ground water level, and thus land subsidence due to soil settling and soil oxidation. As a consequence the water levels in the polders had to be lowered which caused more land subsidence and so on. This has resulted in the ground level in the western part of the Netherlands subsiding several metres since the Middle Ages, a process which continues until this day.

Almost two-thirds of the Netherlands would flood regularly without the presence of dunes, dikes and dams. A large majority of Dutch citizens live below sea level in or near the areas of the largest economic value. The risk of flooding can be controlled by raising dike levels but also by accepting the consequences of any flooding during planning by building on local land mounds (so-called ‘terpen’). There can be more variation in the flood risks and land use of a given area. For example, we can more easily accept the flooding of recreational areas than of residential areas. [Brinke et al., 2008]

Desiccation

In addition to periods with a surplus of water, problems concerning droughts due to longer periods without precipitation and rapid discharge are becoming more noticeable. This has consequences for flora and fauna and requires a different way of managing urban green space and use of different species of plants, but can also cause damage to the foundations of buildings. Water managers are confronted not only with climate change, but other challenges as well, such as scarcity of drinking water sources due to salinisation and droughts. Increased use of drinking water will likely lead to an increase in sewage water volume and higher costs for sanitation.

Surface water pollution and droughts will have large effects on flora and fauna. Moreover, floods will occur due to rapid discharge of rain water and decreased buffer capacity of urban areas and rivers. [Pötz et al., 2009]

Awareness

Urban citizens have lost their awareness of water because water and its cycles have become less noticeable since the second half of the last century. Rain water is nowadays discharged through underground sewage systems, and city canals have been covered or filled in. The transportation of drinking water over large distances and the treatment of sewage water outside the cities, the decreased importance of waterways for transport, and the low cost of drinking water have all contributed to a further decrease in the awareness of the importance of water. Less awareness leads to less commitment and the waste of natural resources, potential qualities and ecological values. The water cycle is just one example of this problem. Centralisation of water management is reaching its limits, and there is therefore rising interest in alternatives for urban water management with regard to developed areas. Recently there has also been renewed interest in ecological values and the quality of experiencing urban water and nature. Only when we again give water and nature a valuable place in our cities will they also have a prominent place in our consciousness. Or do they first need to become more prominent in our consciousness before they re-appear in our cities as the spiritual bearer and origin of all life? Through the effects of climate change, water and nature are literally reclaiming the position robbed of them in the last century.