Management of Urban Watersheds and Re-naturalization of Derelict Lands as a Part of Holistic Ecological City Planning Effort

by

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Abstract

The Baltic City of Eckernfoerde, Germany, has successfully demonstrated how an ecological planning concept can be applied in the re – naturalization of sensitive urban watersheds, the integration of stormwater systems in biotopes near housing and commercial areas and the restoration of derelict military and commercial facilities.

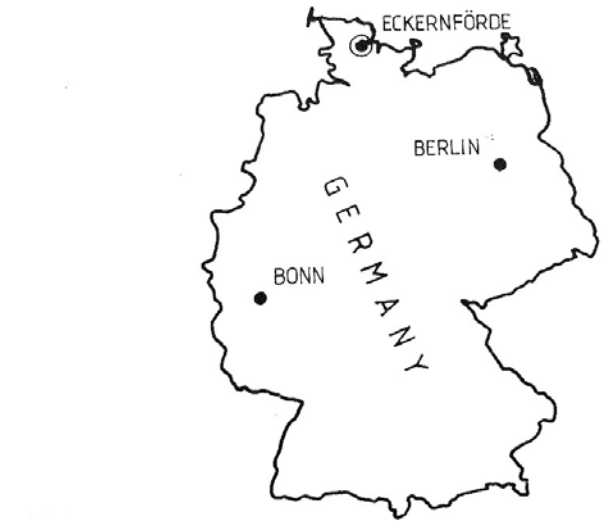


Fig. 1 The City of Eckernfoerde lies in the North of Germany at the coast of the Baltic Sea.

Introduction and Problem Background

In 1984, the Eckernförde City Council voted to undertake a year-long environmental study of the City. Using the conclusions of the study, the City Council acted to limit any adverse ecological effects by steering all development away from the environmentally sensitive, but stressed, northern-edge "Lachsenbach" wetland (Packschies 1997). The Lachsenbach wetland was stressed due to inappropriate land-use which had drained and depleted the wetlands. Parallel to this effort, the City also agreed to concentrate development on to the ecologically poorer southern region of the city. The restoration of the Lachsenbach was undertaken by re-routing stormwater from a culvert – which previously diverted water away from the watershed – back into the wetland. The consequence was the creation of the "Oberer Eimersee", a small lake which only afforded a polythene bucket to become initiated.

New housing and commercial areas in the City's environmentally degraded southern section would be built according to strict standards that not only protected, but enhanced the environmental quality and landscape. The development was to be characterized by introduction of more pervious surfaces – primarily through the creation of a series of interconnected stormwater channels and ponds. The ponds would not only filter rainwater and purify it, but also add natural amenities to the residents.

Parallel to the reduction of development on the agricultural areas in the northern section, the City also naturally redeveloped the Sandkruggelände, a former military manufacturing area. The Sandkruggelände occupies approximately 6 hectares, of which already 5 hectares had been renaturalized over the course of the past 25 years. The last of the facility's buildings were torn down in 1998 and the remainder of the area was converted into an "idea park" for alternative gardens – for example, it is now possible to see fences constructed from willow trees, pathways from woodblocks and stones from adjacent fields piled up to create natural habitats especially for reptiles.

Actions Taken and Results

In the second half of the seventies Germany saw an increase in environmental consciousness which led to new approaches in the field of local politics also in Eckernförde. At first the ideas of how to integrate ecology in town planning were quite obscure but in 1984 the city council voted to undertake a year-long environmental study as a basis for further decisions (Packschies/Riedel 1987, Riedel/Müller/Packschies 1987 and 1989). The entire municipal area

Fig. 2 Aerial view of the City of Eckernfoerde towards East. The old town lies on a peninsula between the bay (background) an the Windebyer Noor Lagoon (foreground).

occupying some 18 km², and inhabited by 23.000 people was mapped regarding types of vegetation, geological and hydrological structures and structures of landuse, later on supplemented by faunistic and pedological surveys. The results were displayed in maps, charts and texts (Buß, 1992, Packschies/Riedel 1986 and 1987).

In addition to the main map in the scale 1:5.000 and the collection of data a lot of measures for environmental improvement were proposed and the land utilization plan was compared with the results of the study. In many respects the land utilization plan collided with the goals of nature conservancy. The municipal bodies discussed the points of conflict for 1 ½ years until they agreed to about 95 % of the proposals made in the environmental study (Packschies 1992).

The most remarkable thing was that the city council of Eckernförde followed the recommendation to protect the northern edge of town which is characterized by high biological diversity and environmental sensivity from further urban development.

Fig. 3 Aerial view of the northern edge of Eckernfoerde. Within the Lachsenbach-watershed several housing areas were intended until the environmental survey pointed out this should be an area for renaturalization measures.

Instead the existing biotopes became subject to improvement measures and the rural landscape was re-naturalized step by step. However a municipality with a rising number of citizens can save such a landscape from urbanization only if alternative areas for city development are offered.

Such areas were detected by the environmental study at the southwestern edge of town where in contrast to the northern edge biotopes and biotope-connecting elements were few among the agricultural land.

Fig. 4 Aerial view of the southwestern edge of Eckernfoerde. Developing housing areas on this ag land not only saves biotopes but also offers a chance to create new green structures.

This even offered the chance to create new and ecologically planned green and aquatic elements in addition to the existing ones.

Today this area is built up to a large degree, finally aiming at 450 housing units. It fits in well with the landscape, because the ecological concept was designed prior to the housing development plan (Packschies 2000). In fact german planning practice unfortunately normally pursues the opposite way, so most landscape planners' work is rather cosmetic than conceptionnel.

In preparing the housing area “Domsland” the first step was an intensive mapping of the area followed by designing green structures suitable to compensate deficiencies in biotope protection and connection. This led to an obligatory boundary for the extension of future building sites. The detailed planning of the building sites themselves lay within the responsibility of the architects and engineers. An important part of the green concept dealed with rainwater-runoff. A chain of interconnected naturelike ponds is fed with rainwater from paved and built-up surfaces thus serving as an aquatic buffer zone at the edge of a small peat bog which profits from the accumulation of rainwater.

Fig. 5 Aerial view of the landscape shown in the middle ground of Fig. 4 after developing the housing area "Domsland". Chains of newly excavated interconnected ponds purify the rainwater and add natural amenities to the residents. The surroundings are left to natural succession.

Other positive effects are the improved connection of the peat bog to other biotopes and adding of natural amenities to the residents.

The rainwater ponds and interconnecting ditches were dug out as soon as the actual development of the housing area started. In the surroundings partly an initial planting with endemic trees was carried out but mostly this was left to natural succession. Over the years the area around the ponds will grow to form wood- and shrubland. Footpaths provide access enabling residents to experience nearby nature.

The ponds were constructed with respect to the topographic conditions, so unnecessary disturbances of soil could be avoided. The shoreline was designed flat where easily accessible and steeper in other sections to raise habitat diversity.

Fig. 6 One of the ponds shown in Fig. 5 right after excavating und flooding. On the accessible right side the shoreline was designed flat, on the left side steep to enhance biotope diversity.

No plants were put into the water or on the shore because in the climate of Northern Germany natural spreading is quite rapid. Natural spreading of plants is not only unexpensive, it also guarantees that only those plants will settle which find adequate living conditions and match with the biotope character. Invasive species are only a minor threat.

Only a few years later ponds laid out like this can hardly be recognized as artificial ones. Submerse, floating and erect plants grow in the water, on the shoreline trees like willows and alders are spreading. With the spreading of vegetation the capability of the pond to purify water rises.

In the best case the rainwater-runoff feeding the ponds should be of a quality making purification unnecessary. But as pollution cannot be excluded, it is important to know what purification rates can be expected from naturelike ponds, so purification rates were analyzed in a pond with a remarkably polluted inlet over a period of 1 ½ years. The reduction rate between inlet and outlet was 90 % of ammonia and 95 % of phosphorus during the vegetation period (i. e. April to October) and 45 % of ammonia and 67 % of phosphorus even in winter when most plants are inactive.

Feeding naturelike ponds with rainwater-runoff from paved and built-up areas certainly means an improvement compared to the traditional way of culverting, but ecologically seen it is only the second best possibility. Wherever the composition of the ground

allows it the City of Eckernförde prefers to let rainwater seep in directly on the building sites. This principle was realized for example in the housing area Steenbek not far from the source of a small creek.

Fig. 7 In the newly developed housing area "Steenbek" rainwater from the streets is led into parallel shallow ditches where it percolates to the upper groundwater horizon. The pavement is partly pervious.

The rainwater percolating through the ground of the housing area contributes to feed the springs which are just some 150 m away. Culverting would have led to a reduction of springwater and would have caused damage to the adjacent brook.

In this housing area no rainwater is led into culverts for even on streets and paved places the water seeps through pervious surfaces or flows into parallel ditches which gather the water until it seeps away there. For extreme situations like heavy rainfall on frozen ground there is an emergency outlet sending the water to a pond of the type described above. In Eckernförde it was figured out that a combination of seeping away on the building sites and sending the rest of the rainwater to naturelike ponds would save about 10 to 20 % of the costs compared to conventional culverting, because pipes can be smaller or are even unnecessary. The costs are even lower if excavation for ponds can be minimized due to the topographic situation. On the other hand ditches along the streets may cause a certain increase of costs because these plots of land cannot be sold to the residents. Finally a long-term balance will say something more for the nature-like system: Maintenance is much easier and less expensive than it is with conventional culverting systems.

The development of new housing areas in ecologically less sensitive areas made it possible to re-naturalize the Lachsenbach-watershed on the northern edge formerly meant for building (Packschies 1992). In 1985 vast parts of the Lachsenbach-creek were still culverted, thus invisible and unknown to the citizens.

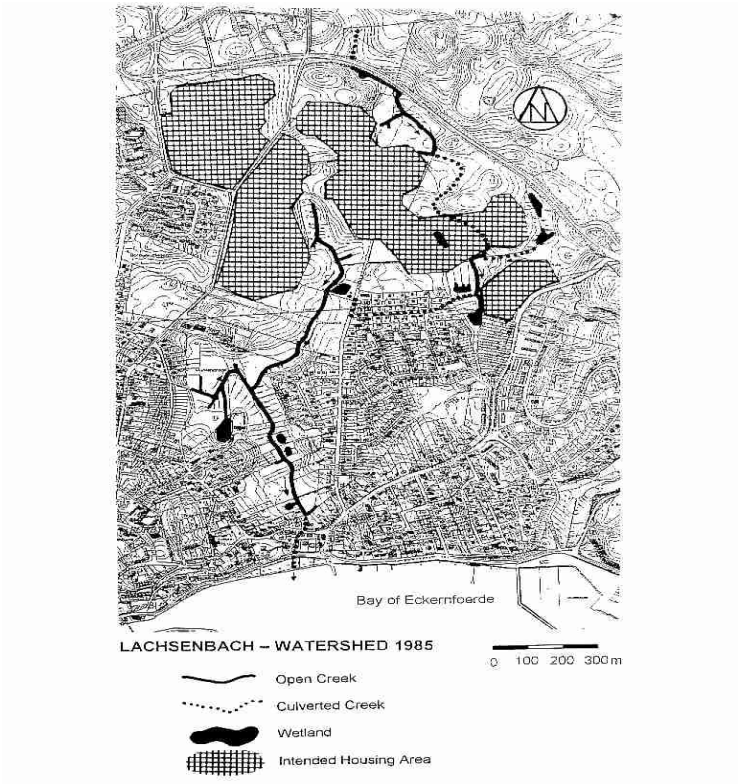


Fig. 8 Lachsenbach – watershed in 1985. The creek was partly culverted, wetlands were drained and wide parts were intended as housing areas.

By now it has been achieved to re-route the water of the Lachsenbach from nearly all of the culverts, to re-develop drained valleys to wetlands and to turn the whole landscape into an attractive recreational area for nature lovers.

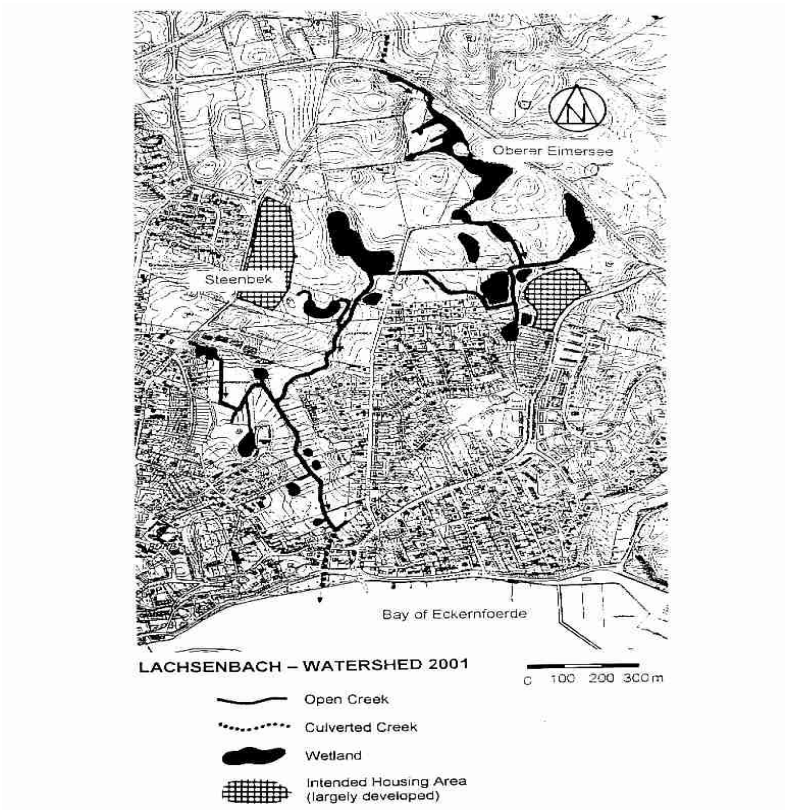


Fig. 9 Lachsenbach – watershed in 2001. The creek has been daylighted nearly throughout its whole course, wetlands have been reflooded and only two minor lateral housing areas have been developed. The northernmost wetland complex is the Oberer Eimersee (comp. Fig. 11).

In the course of re-routing as little soil as possible was moved. The riverbeds were excavated extremely cautiously.

All further shaping was left to the creek itself. Obstructions like rocks and branches of trees forced the stream to meander thus developing a natural appearance with undercut and slipoff slopes.

Fig. 10 After having been daylighted the Lachsenbach-creek started immediately to meander due to accidental obstructions.

Vegetation too is allowed to develop freely, so after a period of dominance of annuals and herbaceous perennials alders and willows settle on the banks of the creek.
Within a few centuries the alders have spread so wide and grown so big that their roots are able to stabilize the banks and to shade the water thus decreasing the water temperature. This is the ideal state in the eye of the ecologist as well as of the hydraulic engineer.

Also in restoring the wetlands run through by the Lachsenbach work was carried out as cautiously as possible trying to gain a maximum for nature with minimal effort. In some cases even excavators could be done without. For example the culvert crossing a dry and shallow ag land basin at a depth of 2 meters below the surface got simply blocked with a polythene bucket to make the creek rise to see daylight again. The complete measure cost only about 3 $ which was the price of the polythene bucket used as a plug. Right after the polythene bucket was plugged into the pipe the water rose to the surface and extended over 1,5 hectare within a few weeks. Simultaneously it wettened several hectares of adjacent fallow grazing land. At the lowest point of the surrounding moraine

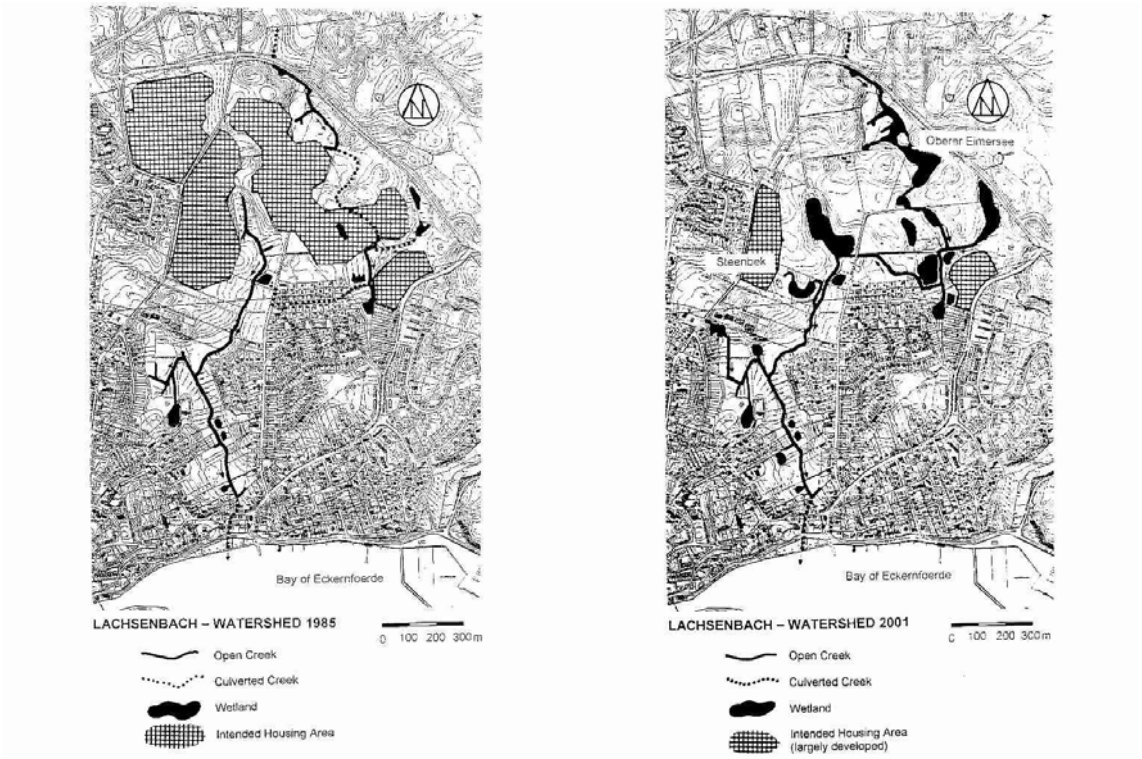
the water finally flowed over and built its own riverbed. The “Oberer Eimersee”, meaning Upper Bucket Lake, was born and the name established.

Fig. 11 The Oberer Eimersee (Upper Bucket Lake) 10 years after having been initiated by plugging a polythene bucket into the pipe draining the area. Vegetation and wildlife have developed freely in this low-cost biotope.

Since its formation in 1991 the Oberer Eimersee has seen an uninfluenced development of vegetation. The lake and its surroundings have become an attractive habitat for lots of animal species. Furthermore it is a popular hiking destination and catchy advertisement for nature conservancy efforts (Packschies 2000a).

The lake's outlet is crossed by a footpath, but instead of a bridge there are only stepping stones to reach the other bank. This place is very attractive, especially to children. Children take every opportunity to play with the running water, to build dams and to divert the creek. And incidentally they experience nature.

With all that one should keep in mind that the formation of the Oberer Eimersee and the development of its surroundings was only made possible because the general direction of city development got shifted to the southwest. Without that ecologically founded shift in city planning the whole Eimersee-area would be probably built up today.



Parallel to developing new housing and commercial areas in the southwest and restoring the landscape around Lachsenbach and Eimersee, derelict industrial buildings were torn down and the sites given back to nature. The Sandkruggelände, situated on the southeastern edge of town in a sensitive and beautiful landscape, was in World War II built up with barracks and huts for workers at a nearby military facility and some bigger factory buildings. After the war the huts were put at disposal to refugees and the factory halls were used for various purposes. In the mid-70ies the huts were demolished and the site was levelled. Afterwards the area was left to itself.

Fig. 12 Aerial view of the southeastern edge of Eckernfoerde. The shrubby area surrounded by grazing land is the Sandkruggelände, a former military manufacturing facility partly left to natural succession and partly designed as an "idea park" for natural gardening.

During the years vegetation of great diversity established due to the many differences in soil, moisture and exposition. This area is now dedicated to experiencing nature, i. e. interested persons or groups of pupils can scout the terrain on their own or systematically with a brochure made out by the municipal administration.

The city of Eckernförde bought the last remaining factory halls,

Fig. 13 Some of the factory buildings in the northwestern part of the Sandkruggelände before they were torn down in 1998.

had them torn down in 1998 and after having checked eventual pollution laid out the site. In this case design was given preference to natural succession, because something special should be offered to those taking the hiking trail leading alongside the site.
Who walks along the trail nowadays will see no more old and dirty factory halls but a green area raising curiosity and inviting to take a closer look.

Fig. 14 Since the buildings shown in Fig. 13 were torn down the area is designed step by step to show visitors how to construct sheds with green rooftops, nature like garden ponds, living willow fences and many more.

Visitors are directed onto a pathway made up of various material. Woodblocks, bricks, stones from adjacent fields and other building material are arranged to display examples for pathways in gardens.

The entire area is a kind of an exhibition of garden-designing elements, no mass-produced articles but only elements made of natural or recycled material. Ideas how to lay out a garden pond, a shed or a herb patch are examples worth getting adopted in private gardening as well as in designing parks. These elements were installed in a win-win co-operation with a project to qualify long-term unemployed.

A dry stonewall, habitat of reptiles and insects, can be an alternative to a wall laid in mortar. It can be examined in the Sandkruggelände as well as benches and playing devices made of timber.

Visitors are also shown how fences can be constructed using branches and twigs from shrubs and trees getting cut down in one's garden. A choice of different constructions is displayed.
A special emphasis is put on how to construct living fences or huts. Branches of willows dug in soil of sufficient moisture will sprout and grow. The young twigs can get woven thus forming dense fences or roofs.
One of the buildings in the Sandkruggelände, a small bunker at the foot of a slope was not torn down but re-designed to function as a cave for bats. The entrance gate has given way to a narrow opening for bats and a hatch to observe them.

The Sandkruggelände is not the only derelict area in Eckernförde to be given back to nature. In July 2001 the factory hall of an ironmonger was emptied, in August it was torn down and in September asphalt and concrete were removed from the ground, crushed an re-used in some other place.
In 2002 the site will be covered with topsoil and planted with shrubs and trees. The center of the area is designated for a maze of hedges.
Then hardly anything will remind the visitors of the former factory hall. Vast parts of the site will here too be left to natural succession and resemble the Sandkruggelände some years later.
This measure too is not solitary and accidental but integrated part of the ecological city planning concept.

Incidentally it has been proved in Eckernfoerde, that the consequent consideration of ecological interests in town planning has in contrast to earlier fears not hampered economic development but become an important locational factor (Packschies 2001b).

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