Industry vs. Landscape

Landscape Planning and the Design of Industrial Facilities

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During the past 25 years, the leading philosophy has been to erase at any price all evidence of industrial activity from the landscape. This is a dangerous strategy, as it runs the risk of polarizing the landscape with broad, monotonous areas of industrial production interspersed with small, exclusive islands of untouched nature. Our ambition should instead be to accept the presence of industry in the landscape, and not be satisfied with minimizing the damage it causes, but rather demand that industry add something of architectural or experiential value to the landscape.

Monuments to the Progress of Technology

In 1909, the Swedish legislature ratified its first natural protection act. It comprised a law outlining the protection of natural landmarks and a law establishing a system of national parks. The act was initiated by Karl Starbäck, a liberal member of parliament, in a 1904 motion. In a study of the birth of natural protection legislation in Sweden, Ödman *et al.* (1982) claim that the real purpose of the early laws was to preserve noteworthy natural phenomena in the cause of patriotism. Nihlén (1966), however, maintains that the dominant motivation in Sweden was purely scientific, in contrast to the establishment of the national parks in the United States, which was at least in part a philanthropic gesture intended to provide the rapidly growing urban populations with an opportunity to encounter beautiful, untouched nature.

The first conflict between advocates of natural protection and representatives of industry was over hydroelectric power. As early as 1880, there was an established technique for the large-scale production of electricity from the movement of water, and for the transfer of that power by three phase alternating current, which was a pre-

Landscapes change continually. In the 20th century, much of the Swedish landscape has been marked by technical and industrial projects such as power stations, road construction, industrial plants, quarries, and landfills. Environmental awareness and public opinion have profoundly influenced the way industrial facilities are designed and sited in the landscape. Roughly speaking, this development can be divided into four periods. During two of these periods, 1900–29 and 1950–69, the ideal was to assert the facilities' industrial character; in the other two periods, 1930–49 and 1970–95, the goal was to hide those facilities, subordinating them to the natural landscape.

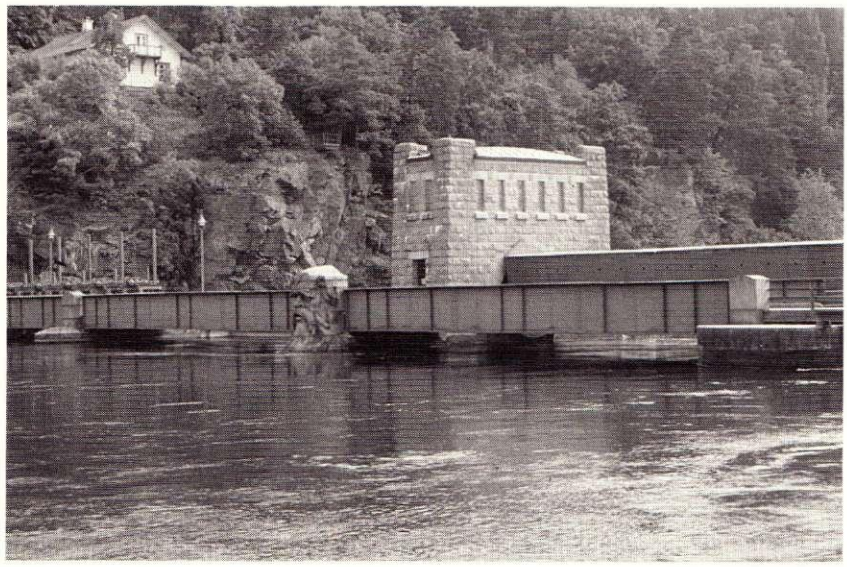

Figure 1. "Strömkarlen" ("The Neck") by Carl Eldh at Trollhättan's power plant. The idea at the turn of the century was to compensate the natural beauty lost due to construction with new aesthetic value. (Photo: Kjell Nilsson)

condition for moving large amounts of energy over long distances. Because of legal and institutional obstacles, however, the electrical power system in Sweden was not widely established until 1920 (Lundgren, 1978).

Not much care was given to the environment around the first hydroelectric stations. They were merely intended to meet economic and technical standards. Pits, dumps, and dried-out river beds were left entirely to nature to repair. Early representatives of the environmental protection movement saw the exploitation of natural resources as a necessity and assured their opponents that they did not intend to inhibit economic development. They did, however, stand strong in defense of the beauty of the natural environment, and demanded that resource development projects be carried out in an aesthetically pleasing manner (Svenonius, 1911). Ödman *et al.* (1982) describe this approach as an attempt to replace the beauty of nature with that of the industrial facility. An example of such an attempt was the "new element of beauty" given to the streams of Trollhättan, the country's first public power station, on the Göta River in 1906–10 (Fig.1).

There were, however, certain places in which building a hydroelectric power plant would have been inconceivable. Foremost among them was Stora Sjöfallet, one of the nine national parks which had been established under the new nature protection law. But only a year after creating the parks system, the parliament voted to build the Porjus hydroelectric station. Construction of the plant would in the end require regulation of Stora Sjöfallet's waterways. In 1917–18 came the decision to build a station at Harsprånget and a dam at Suorva. Above the Suorva dam, the government revoked the national park status of a huge area which included the entire system of lakes and rivers above the falls.

The environmental protection movement was divided over the issue. The secretary of the Swedish Society for Nature Conservation (Svenska Naturskyddsföreningen) called the alterations to the park "a sad defeat for the cause of nature protection" (Högdahl, 1920). The Society's protest, however, motivated two members of its board of directors to resign. They expressed their regret over the reduction in the size of the park, but asserted that the economic argument for building the power plant outweighed the need for conservation.

When it came to designing the facilities, there was never any question of trying to hide them visually. On the contrary, the Porjus plant is a work of monumental architecture. At the plant's opening in 1915, Minister of Civil Service Affairs Oscar von Sydow called it "a mighty creation rising from the wilderness like a proud monument to Swedish enterprise, to Swedish engineering genius, to Swedish resolve and perseverance." The bridge signal box, designed by Erik Josephsson, one of the most sought after architects of the day, demonstrates the pride and confidence of the work's commissioner, the public power company Vattenfall. The newspapers christened it "the temple in the wilderness" (Fig.2).

In the fall of 1924, a photography exhibition was held in Stockholm on the subject of technical and industrial facilities. Among them were the Swe-

dish hydroelectric plants of the day. The architectural design of the facilities in the exhibition was clearly reminiscent of older Swedish factories and mines. Their architects had, according to the exhibition, the expressed intention of adapting these industrial structures to the landscape through their choice of colors and building materials: "Here Nature herself is a powerful ally, for her laws, well heeded, produce strict but pleasing forms, while her greenery, if preserved and well employed, is the noblest of decorative features" (Åkerlund, 1925, p. 100).

Figure 2. The signal box building in Porjus designed by Erik Josephsson. Built in monumental style, it gained a great deal of attention when it opened in 1915. The papers called it "the temple in the wilderness." (Photo: Kjell Nilsson)

With Nature as a Prototype

In the 1930s and '40s, the system of roads and highways in Sweden was expanded to meet the growing demands of automobile traffic. The expansion covered the entire country, and produced some of the most drastic alterations to the landscape in modern times. The road system's expansion depended to a large extent on so-called emergency jobs created for the unemployed. Nature conservationists were critical of the new roads, especially the long, straight runs they called "whiplashes" cutting through the landscape. Perhaps the most active opponent was the Association of Local Historical Societies (Samfundet för Hembygdsvård), which in 1934 presented a list of eight points summarizing their demands for a more aesthetic routing of the roads to take advantage of beautiful views and protect cultural and natural landmarks along the way.

In 1939, the government created the post of highway advisor to monitor the road expansion, and the same year Sven Hermelin, a landscape architect, became the first to fill the position. Much of the inspiration for the post came from abroad. The German freeway system was impressive in its adaptation to the landscape. From the United States came the idea of providing rest stops at points with particularly beautiful views. In addition to the roads' routing, the highway advisor monitored a number of aesthetic aspects of the traveler's experience of the landscape. The issue of disturbing advertising along the roads gained early attention, as did the preservation of tree-lined avenues and historic bridges.

Another of the highway advisor's responsibilities was to insure that the scars created by road construction–the gravel pits and the cleared areas around roadways–were mended. Sven Hermelin followed the principle of using nature's own methods to heal those wounds. An example is the 1943 reconstruction of the exit from Stockholm toward Uppsala and Enköping: instead of planting grass, which "would create an unhappy contrast with the neighboring pine-covered slope", he had the exposed ground covered with fir brush to prevent erosion and give seeds from the surrounding vegetation a chance to take root naturally (Hermelin, 1943). Hermelin's predecessor in this form of biological landscape engineering was Alvin Seifert, the man chiefly responsible for the landscape conservation efforts undertaken in the major highway projects in Germany.

Hermelin was also a leader in Sweden in the design of the environment surrounding industrial plants. He was the landscape architect for Marabou's chocolate factory in Sundbyberg, which was built in two stages, 1937 and 1945. The factory is surrounded by a park

Figure 3. The Marabou corporation is the forerunner in Sweden when it comes to creating a good environment around its factories. The park at the Sundbyberg factory was designed by landscape architect Sven Hermelin, who was also aesthetic advisor to the Department of Roads from 1939 to 1949. (Photo: Leif Wiklund)

which fills two purposes: it is integrated into the work environment as a recreational area for employees, and it provides an impressive setting for the company (Fig. 3). Marabou's park not only benefits the factory's workers, it is widely frequented by the general public, which is allowed access all summer. It also contains an impressive art collection with pieces by famed sculptors like Bror Hjort and Gustaf Vigeland.

Simultaneous to the developments in the highway system, the expansion of hydroelectric power continued. Prior to the Second World War, the plants were usually intended to provide only the immediate vicinity with electricity. These projects were rather small and their disturbance to the landscape was not given particular attention. The public generally appreciated the exploitation of water resources and marveled at the progress of technology.

As the demand for electricity continued to grow, public and private power companies alike focused their attention on development opportunities in the north of Sweden, in southern and central Norrland. The outbreak of World War Two and the subsequent blockade led in 1939 to emergency legislation authorizing the rapid development of hydroelectric power without regard for the environmental consequences. The wholesale exploitation of the country's natural resources that followed produced some of the worst cases of environmental plundering in Swedish history. The power companies have since maintained that the negative public opinion against hydroelectric power stems from the projects authorized under the 1939 law (Rödén, 1982).

The first expert in landscape preservation in hydroelectric projects was

Sigurd Curman, who went to work for the hydroelectric company Vattenfall after retiring as director of the Central Board of National Antiquities. His first assignment was Nämforsen power station, built in 1944–47 on the river Ångermanälven near the village of Näsåker, about 40 km north of Sollefteå (Fig. 4). Curman used his influence to get the dam and power station moved upstream to preserve one of northern Europe's richest sites of prehistoric petroglyphs. His operating principle was to see to it that new construction be designed to as far as possible blend into the surrounding landscape. Though his efforts were as a rule greatly appreciated, even by opponents of hydroelectric power development, the task was at times impossible. Curman wrote that

> The conflict between nature's great aesthetic and recreational value and the growing demand for electrical power is truly a tragedy. It is in fact unrealistic to believe that one can harvest a river's power and leave the roar of its streams intact. (Curman, 1953, p. 216).

Increasing popular interest in nature conservation during the 1940s, together with new legislation that guaranteed vacation rights to workers and thus made it possible for the general public to pursue outdoor leisure interests, led to a new environmental protection act in 1952. The new law demonstrated a clear transition toward a more socially and aesthetically motivated conservation strategy. But the political powers were reluctant to delegate the resources necessary to make the legislation effective. Conservation interests were represented primarily by volunteers in not-for-profit organizations like the Association of Local Historical Societies and the Swedish Society for Nature Conservation. The 1952 law gave these organizations positions as expert authorities in legal cases such as those involving water issues.

Figure 4. Nämforsen Hydroelectric Power Station in Ångermanälven is one of the most beautiful in Sweden. The softly rounded shaping of the terrain and the planting of naturally occurring vegetation connect the power plant to the local landscape. (Photo: Kjell Nilsson)

Giving Expression to Man's Ability to Exploit Nature

The dramatic expansion of the hydroelectric power industry begun during the Second World War continued unabated throughout the 1950s. Erik Lundberg, Professor of Architecture at the College of Art in Stockholm, succeeded Sigurd Curman as Vattenfall's authority in landscape issues. Lundberg believed that the big hydroelectric projects could not and should not attempt to hide themselves in their natural surroundings. Contrary to Curman, Lundberg thought that power stations possessed an inherent beauty that should be asserted:

> The power plant bears witness to man's ability to harness the forces of nature, and thus should look like the work of man, a piece of nature humanized. (Lundberg, 1959, p. 120).

Lundberg tried to surround hydroelectric stations with an Arcadian landscape, a terrain composed of geometrically precise forms set off against a background of smooth, open, grassy lawns. His ideas are clearly expressed in the Stornorrfors power station, built in 1954–58 just north of Umeå. Testifying in a hearing in the Court of Water Issues, Chief Antiquarian K. A. Gustafsson, the court's nature conservation expert, stated that the open areas of grass would introduce an unnatural element to the landscape and would

Figure 5. Professor Erik Lundberg preferred geometrically precise terrain forms and open grass surfaces. At Stornorrfors Power Station, this aesthetic led to future problems with erosion and the encroachment of seedlings on the lawns. (Photo: Kjell Nilsson)

entail high maintenance costs. He proposed some simple alternative measures that would help the natural vegetation reestablish itself. As predicted, Lundberg's aesthetic composition brought the project future maintenance problems. The steep, naked slopes were exposed to the powerful forces of erosion, and continual work was required to prevent seedlings from sprouting up on the open lawns (Fig. 5).

The aesthetic ideals of the age were certainly strongly influenced by Lundberg, but may also have come from contemporary developments in Great Britain. In the extensive expansion of the coal, water, and atomic power industries at the end of the 1950s and the beginning of the '60s, British landscape architects like Brenda Colvin, Silvia Crowe, and Geoffrey Jellicoe accepted the vast scale of the facilities and sought to cultivate their impact on the landscape. The essence of their design concept was that the meeting between the enormous structures and the landscape should be as clean as possible and free of mitigating details. To that end they strove to hide subsidiary elements such as power lines, fences, and traffic behind vegetation, in so-called "ha-ha walls" or ditches, or under ground.

The stubborn resistance mounted by conservationists combined with the Water Issues Court's increasing concern for nature and for local interests convinced the power companies to investigate alternative energy sources, foremost among them nuclear power. The technical optimism that surrounded nuclear power in its early years was frequently used in arguing against continued expansion of the hydroelectric system. Bo Hammarskjöld, a county governor and leader of the governmental commission to inventory waterways in Norrland, called nuclear power "the lifebuoy of environmental conservation." When the first nuclear reactors were built in Sweden in the 1960s, conservationists supported the new power source.

The character and scale of nuclear power plants made it impossible to subordinate them to the surrounding landscape. When Per Friberg undertook the challenge of anchoring the Barsebäck reactors in the flat coastline 20 km north of Malmö on the Sound, he based his plans on the farms in the area, planting a band of forest around the entire facility. The purpose of the forest, however, was to contain rather than hide the reactors, to provide shelter from the wind, and to create an element that could balance the enormous structure (Friberg, 1972).

Though overshadowed by the lively debate over the future of hydroelectric power, work continued on the landscaping of the expanding system of roads. In the late '50s and early '60s, efforts were concentrated on the new highways. As in the past, the main source of inspiration was the German *Autobahn*. The long, straight stretches were replaced by a softer, more curvilinear routing, and special transition curves were introduced.

When E4 between Stockholm and Helsingborg was built, the Association of Local Historical Societies, represented by landscape architects Arne Segerros and Carl-Olov Orback, were employed as consultants for the segment Mjölby-Gränna-Huskvarna-Jönköping. Part of it, where the road

Figure 6. E4 along the eastern edge of the lake Vättern has been called "the most beautiful stretch of highway in Sweden." The curve of the road responds playfully to the line of the beach as well as the hilly terrain. (Photo: Kjell Nilsson)

follows the beach along the eastern edge of the lake Vättern, has been called the most beautiful highway in Sweden (Fig. 6). The line of the highway is drawn in concert with the landscape, harmonizing both with the undulating terrain and with the straight edge of the beach. In addition, travelers are treated to numerous views of the island of Visingsö caught in the mirror of the lake. The segment around Huskvarna gained particular attention: of three possible alternatives, the architects chose the so-called beach route, the solution that offered the most from the landscape point of view, including a walk along the edge of the lake and a small boat harbor.

Subordination to Nature

Eventually the government realized that the issue of environmental protection required more concerted attention. In 1960, Minister of Agriculture Gösta Netzén appointed a commission to study the matter, and their report was sharply critical of the government's past environmental policy (SOU, 1962: 36). A new law was proposed. The 1964 environmental protection act provided the desired administrative framework, the State Commission on Environmental Protection, which merged with a number of other public institutions in 1967 to become the Swedish Environmental Protection Agency. The law also provided a tenfold increase in budget allocations to nature conservation efforts.

Figure 7. ScanRaff in Lysekil in the Bro Fjord. The refinery was sited on the dry, sterile, rocky plateaus, preserving the valleys, with their luxuriant vegetation, as so-called living zones. (Photo: Kjell Nilsson)

The 1964 law and the establishment of a central governmental authority on the environment dismantled the earlier structure in which the Swedish Society for Nature Conservation and the Association of Local Historical Societies were employed as expert authorities on environmental issues. The two were now divided into separate camps, the former concentrating on preservation issues and the latter on lobbying for environmentally sensitive landscape design. As a result, design issues became less and less important in the debate on the environment. Meanwhile, the aesthetic ideal underwent a thorough change from asserting the industrial character of new structures to almost complete subordination to nature. Landscape design became equated with finding measures to hide the signs of industrial activity.

Characteristic for the industrial projects of the time was that design aesthetics were reduced to a mere formality in the planning process. This was particularly true of the diminishing number of hydroelectric station projects. The Vietas power plant was built in 1965–72 despite powerful protests against this further truncation of Stora Sjöfallet National Park. This time there was no longer any question of demonstrating engineering ingenuity and enterprise with monumental structures: the new facility was built completely underground. The surrounding land was planned without much care or aesthetic ambition, as if to say that here was a business with which no one wished to be identified.

Increased environmental awareness, however, occasionally produced good industrial landscape design. The 1960s saw a dramatic industrial expansion along the west coast of Sweden. It began with the construction of a central heat production plant and the country's first petrochemical industrial facility in Stenungsund. A pulp mill was built on the Värö Peninsula, and a nuclear power plant at Ringhals. Idyllic seaside resorts such as Stenungsund and Bua were rapidly transformed into modern industrial communities. Much criticism was voiced against plans to convert the country's picturesque west coast to a Swedish version of Germany's Ruhr region.

One project that brought on a wave of protest from conservationists was the cooperatively owned oil company OK's construction of an oil refinery at Lysekil in the Bro Fjord between 1970 and '73. The company proposed an ambitious program to integrate the industry with the landscape. The landscape plan by Sven-Ingvar Andersson and Ib Asger Olsen placed the refinery structures on the high ground, the site's rocky plateaus, and preserved the valleys between them with their meadows and woods as so-called living zones (Fig. 7). The client and design consultants were aware from the start of the conflict between the proposed industrial facility and the site's unique natural characteristics, and were also conscious of the powerful public opposition to the project, and these factors contributed to making OK's ScanRaff refinery one of the country's most interesting examples of industrial landscape design.

The landscape of production, whether an urban industrial area or rural farm, has developed toward

increasing specialization resulting in homogenous, single-species ecosystems. Preserving natural areas or building up new biotypes in the image of nature has therefor become a common method of post-construction site treatment, a way for the industry to enrich rather than impoverish the landscape. In the field of hydroelectric power, this form of biological landscape engineering was employed by Henning Segerros in developing a method for quickly establishing vegetation in the tough climate of mountain areas. An example of the preservation of existing natural areas is IBM's offices in Kista. The site design for the project, which was completed in 1978, was by the landscape firm Landskapsarkitekterna Söderblom & Palm AB. Their plan provided immediate access to untouched nature right outside the offices' windows, and the costs for both construction and maintenance were significantly lower than for conventional facilities.

In the field of road construction, however, there was basically no interest in aesthetic issues or the experience of the traveler throughout the 1970s and until the end of the '80s. That changed with the 1987 requirement that all road project proposals be accompanied by an environmental impact assessment, and the establishment in 1989 of a cultural and aesthetic advisory committee to the Department of Roads. The environmental impact assessment, however, has reduced the issue of environmental sensitivity to a matter of restrictions. These restrictions stand in opposition to economic and traffic safety requirements. The results of the policy's inherent conflict can be seen in the latest Swedish roads, which often are routed through areas with no scenic value. An example is the E4 highway through Småland. When Carl von Linné traveled through Småland in May of 1749 on his journey through southern Sweden, he described a dramatic landscape of steep mountains and deep lakes, light-filled meadows, heather-clad grazing grounds, thatch-roofed barns, and tall beech forests (von Sydow, 1975). The trip through Småland today offers none of that variation: instead, one is shuttled along a corridor through monotonous coniferous forest. The traveler's need to experience the landscape has been sacrificed in order to minimize the conflict with conservation interests.

Figure 8. Thanks to a well-planned construction process and new methods of biological landscape engineering, employees at IBM's Kista offices enjoy forest right outside their windows. (Photo: Pär Söderblom)

Discussion

Industrial construction often means a disruption of the current land use and pattern of life on the site. That disrup-

Figure 9. The windmill in Trelleborg, one of two prototypes built in Sweden, was finished in 1982. The meeting between a structure of such formal clarity and dominant size (85m) and the landscape is best if unmitigated by subsidiary elements. Fences, smaller buildings, and a meteorological mast are distracting and detrimental to the overall impression of the facility. (Photo: Kjell Nilsson)

tion is more readily accepted if the new construction is deemed interesting or useful than if it is judged to be unnecessary or detrimental to the site. A good example is the contrast between a windmill and a nuclear reactor: most people's impression of the two depends on their view of how the problem of energy production should be resolved. For most kinds of industrial construction, the observer's opinion of the facility is profoundly affected by his or her attitude toward the business it houses. This is particularly true in cases where local residents depend upon that business for their livelihood. Security in the form of employment must often be weighed against security in the form of a clean and unspoiled environment. In the debate over hydroelectric power expansion in Norrland during the 1960s, the generation of employment opportunities became a critical argument for continued exploitation at sites such as the River Vindelälven.

Establishing a relationship between an industrial facility and its surrounding environment, resolving the meeting of building and landscape, is an important aspect of landscape design. There are two basic principles to choose from: either the new construction harmonizes or it contrasts with its surroundings. In my dissertation, *Industry Meets Landscape* (Nilsson, 1988), I attempt to describe such harmony and contrast as functions of form, color, pattern, scale, and texture.

The designer must be able to use the facility's exterior **form** to convey a message about its function to the observer. The observer needs to understand why the building looks the way it does. Most industrial buildings have a neutral, expressionless form. The gray, corrugated metal facade enclosing and hiding an unknown business has become something of a trademark for industrial buildings. The contents of this shell are indicated only by the subsidiary facilities and supplies that surround it.

Nuclear power plants are an example of a technology that from the beginning lacked an explanatory physical form. The reactors at Barsebäck were enclosed in a neutral metal sheath. The only sign that energy is produced there is the abundant aggregation of wires. "It could just as well be a shoe factory, but then the electricity would have gone in the other direction," said a person I interviewed about the plant. The windmill's form is an example of the opposite phenomenon in which the relationship between form and function is completely self-evident (Fig. 9). Even the largest and most technologically advanced windmills express their function with the same direct clarity of the weathervane on an old barn. The windmill's siting, exposed to the wind on an open ridge, is likewise entirely logical and easy to understand.

The treatment of the terrain is also important to the overall impression of the project. It is the precipitous cliffs at a quarry and the artificial slope of a landfill that define their relationship to the landscape. Man-made topography can be placed along a continuum from the strictly geometric to the softly curving organic. The city of Lund's refuse tips at Sankt Hans Hills and at Rögle exemplify the opposing ends of

the spectrum. Sankt Hans Hills demonstrates a bold geometry (Fig. 10), with broad topographical variation and a regular formal language emphasized by the plantings. It is a typical example of the ideal of the 1950s and '60s. The forms at Rögle are smoothed over, leveled out, making it difficult to read any sort of functional intention from the landscape. It's a dump that has been flattened and covered with grass, but it is difficult to determine the purpose of the finish treatment. This sort of landscape adaptation is typical of the 1970s and '80s.

Scale is about the relationship between sizes. A landscape can be said to have a large and a small scale. At the small scale are registered the details such as individual trees, bits of gravel on the ground, or the wires on a fence. The large scale comprises major elements like the formations in the terrain, the fields, villages, and forests. The boundary between the two scales is approximately the height of the tallest trees. Further increases in height are of diminishing importance.

Contrasts arise when large-scale facilities meet a small-scale landscape and vice versa. A good principle to follow is to keep the two scales separated as far as possible to minimize those contrasts. Crowe (1958) suggests that one should leave a uniform free zone between a large-scale building structure and the other elements of the landscape. The effect is ruined if the intermediate space is too small or is interrupted by stray trees or buildings, which bridge the gap between the scales one is trying to separate (see Fig. 9).

The quality of construction of a facility is conveyed not by the main

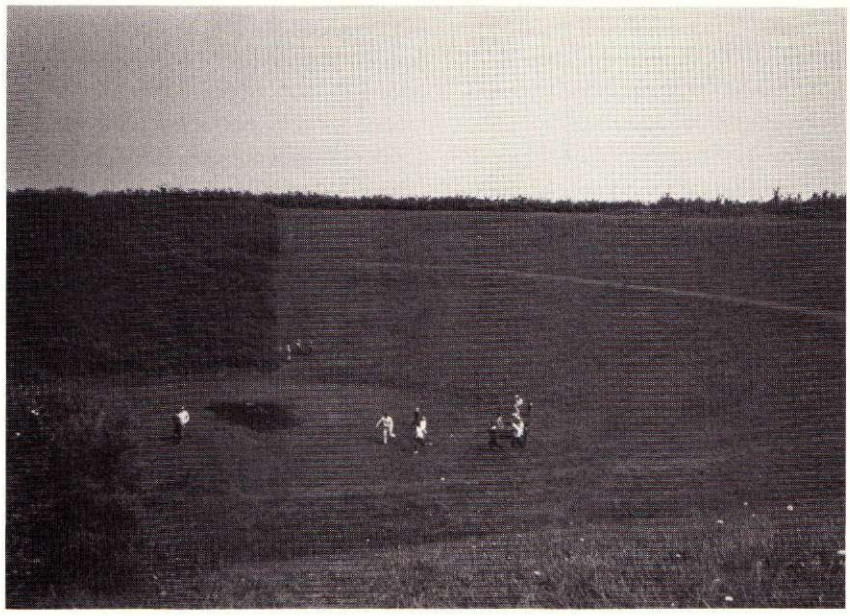

Figure 10. Sankt Hans Hills in Lund, a landfill turned into a recreation area with strongly geometric forms. Topographical variations are further accentuated by changes in the texture of the planted areas. (Photo: Kjell Nilsson)

Figure 11. Ringhals Nuclear Power Plant. The brilliant bright yellow color clashes with the colors of the barren, rocky heath. The contrast is conscious and clear. (Photo: Kjell Nilsson)

building alone; the landscaping and the treatment of subsidiary facilities (fencing, power lines, material stores, parking) also leave an important impression. An American study of proposals for industrial construction showed that the effects of the alterations to the landscape were often underestimated or overlooked in presentations of environmental consequence analyses (Sheppard, 1983). A common approach is to keep the buildings' immediate surroundings as clean as possible. Subsidiary facilities are either enveloped in vegetation or hidden behind earth berms.

In terms of **color**, the nuclear power plants in Barsebäck and Ringhals represent opposite poles. The reactor building at Barsebäck is painted gray with a darker vertical band dividing it about in the middle - presumably an attempt to somewhat diminish the scale of the massive building volume. The gray color may be interpreted as a conscious attempt to make the facility more discrete by allowing it to disappear in the fog that drifts in from the sea. The conditions at the Ringhals plant are the opposite (Fig. 11). The brilliant bright yellow of the reactors is not to be found among the coastal rocks and scanty heath. The subject/background contrast is clearly intentional, an effort to make the structure float like a mirage in its surrounding landscape.

A facility which does connect with the natural colors of that same west coast landscape is the ScanRaff refinery. Process industries such as oil refineries sometimes use color scheme to convey the flow of their various products. At ScanRaff, as the crude oil is refined into its various constituent parts, the colors of the facility describe the process, changing from earth tones to primary-colored product tanks. A closer look, however, reveals that most of the cisterns are painted in the soft pastel tones of the barren Bohuslän coast. The red may be found in the rain- and wind-worn rock, the lavender color in the flowering heather, the blue-green in the leaves of the bog whortleberry and the protective wax layer on the needles of the pine. In addition to describing the industry's production process, the color scheme resonates with the natural color that surrounds it, connecting it to the local landscape.

Texture is primarily an expression for the various materials of which a building and its grounds are made and for their treatment. The texture of a surface is important for the perception of the form it covers. Fine textures, such as a flat, smooth asphalt surface or a short cropped lawn, accentuate the form of the underlying terrain and strengthen the formal expression. Rough textures like high grass or cobblestone do the opposite: they draw attention away from the underlying form and to the surface itself. In the same way, a flat and smooth facade texture emphasizes a building's form, while wall surfaces with a strong relief have the opposite effect. In building projects, the use of local materials on the facade or the ground surface is a common method of making the connection to the surrounding landscape. At hydroelectric power stations it is common to find dam buildings, support walls, and other secondary elements made of local stone.

The texture of ground that is covered with vegetation depends on the type of plant and its arrangement and maintenance. The juxtaposition of wooded and open ground creates a sharp textural contrast, as where alleys are opened through forested terrain for power lines. To minimize such contrast, federal authorities in the United States recommend that scrub vegetation be encouraged in these alleys. Variations in soil fertility give rise to variations in the character of vegetation. Vegetative cover develops slowly and sparsely in the poor soil over former gravel pits and blast stone dump sites, while landfills with household garbage or compost heaps are rapidly overgrown with thick, tall, luxuriant flora. At Sankt Hans Hills (see Fig. 10), the maintenance of the land produces a texture that reinforces the topographical forms.

Pattern encompasses the lines of a project, the grouping of its elements, its directional gestures, and other aspects of its relationship to the compositional organization of the landscape. The presence of a pattern usually implies a certain repetition, but even a single building element can have a pattern relationship with elements in the surrounding landscape. Pattern first and foremost describes how a facility's outline corresponds to the landscape's other lines. The effect of constructed lines on hilly terrain has been studied in connection with the routing of power lines. Many suggest that power lines should in general be drawn parallel to topographical curves and in agreement with the dominant pattern of the landscape. However, these rules that uniformly advise subordinating constructed features to those of the landscape are far from irrefutable.

Figure 12. Kallax Airport, Luleå, in the middle of one of the country's largest pine heaths. Despite the adaptation to site conditions, the boundary between preserved nature and planted park is clear. (Photo: Ulf Nordfjell)

Routing power lines perpendicular to topographical curves may expose those lines, but it also adds life to the landscape by accentuating its topographic variation. Constructed patterns can strengthen the natural forms of the terrain, as when the height of a hill is emphasized by lines that rise with the ground to the summit, while lines that wrap around the a hill diminish the impression of height, flattening out the landscape.

Industrial construction creates new boundaries in the landscape. Here the designer can choose between two principles based on the particular situation: either a gradual transition in which the degree of industrial influence increases successively or a distinct dividing incision between artificial and natural elements in the landscape. An elegant example of the latter form of boundary is Kallax Airport, ten km southwest of Luleå, in the midst of one of the country's largest pine-covered heaths (Fig. 12). Despite its barrenness, the heath makes a strikingly rich impression due to the dignity of the tall, straight trunks of its pines. Landscape architect Ulf Nordfjell's design of the exterior environment makes the most of Kallax's aesthetic qualities. Pines and lichen grow right up against the buildings and paved surfaces, framing roads and parking places. Next to the facades of the main building lie stones smoothed by glacial action, bearing witness to the geological history of the area. Despite the adaptation to the natural conditions of the site, the distinction between preserved nature and planted park is perfectly clear. The boundary between them is marked by strategically placed boulders and old-fashioned fences.

Conclusion

Robert L Thayer Jr., an American researcher and landscape architect, describes the relationship between man and technology as a state between

"technophilia" and "technophobia" (Thayer, 1994). For example, we gladly take advantage of technology in the form of cheap energy and rapid transportation, but would rather not have to look at the large-scale technical apparatuses that make it all possible. This technophobia is typified by the expression "Not in my back yard." If we are to raise the awareness of the relationship between industrial facilities and the landscape, whether we advocate adaptation or contrast, we must first gain acceptance for the presence of industry in nature.

The primary task for the landscape architect is not merely to clean up and repair the damage done by construction to nature. Our primary task is creation, and creation in a way that prevents environmental damage. Patching and mending are only details in post-construction site work. The real job is to shape the landscape of tomorrow's industries, energy production, and traffic systems using modern technology and a keen awareness of economic parameters, and in so doing to provide that landscape with new aesthetic and ecological qualities.

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