

This is an extract from the ECD from the working plan of Norra Länken (november 1999). Since then some alternatives have disappeared. The text for these disappeared alternatives is diminished. Some alternatives were obsolete already in the ECD. The ECD is enclosed.

1 INTRODUCTION

PURPOSE

The purpose of this Environmental Consequence Description (ECD) is to present information that will enable an overall assessment to be made of the impact of the project on the environment, health and conservation of natural resources, before the working plan for Norra Länken is decided.

SCOPE

/Figure page 5/

Norra Länken and its surroundings, with the Nationalstadsparken (National City Park) boundaries shown

The working plan covers principally tunnelled connections from Norrtull, past Roslagstull to Lidingövägen at Värtan. In addition, tunnels between Roslagstull and Frescati are included. The working plan also includes junctions at Norrtull and Roslagstull. At Norrtull, the additional part of Norra Länken is connected to the already built part and to Uppsalavägen within the existing road area. Norra Länken is connected to Roslagsvägen at Frescati via the underground junction. In addition, connections are included to the local street network at Norrtull, Roslagstull, Frescati and Värtan. The working plan area is in the Stockholm and Solna municipalities. For further particulars, see Section 4.3 Design of road system and the **appended map** at the end of this ECD.

This ECD deals mainly with the local impact that will occur in the construction and operation of *the traffic arrangements included in the working plan*. Particulars are also given of other work, e.g. municipal pedestrian and cycle lanes that *will be built at the same time* as the road parts of the working plan. *Opportunities* that arise through the construction of Norra Länken are described under separate headings.

The ECD describes alternative designs for certain places. Final choice of alternative will be made in the working plan process. In this ECD, the information on planning targets, investigation and general plans in Stockholm and Solna are also linked to the consequences of the construction of Norra Länken. The consequences for the entire traffic system in general have previously been presented in the Dennis Agreement, principally in the two

studies “Dennis and the environment” and “Effects of the Dennis agreement”. New conditions have arisen by Österleden being withdrawn/delayed and the road toll system being shelved. In certain respects, the studies still have relevance for the current traffic system. It should be pointed out here that this ECD has been drawn up in accordance with the legislation in force in the autumn of 1998.

BACKGROUND

Two working plans were originally drawn up for Norra Länken, each with its associated ECD. The ECD for the first plan (western part) was exhibited early in 1995, and for the second plan (eastern part) in the autumn of 1995. In the Stockholm political process, the Norra Länken project was subjected to “expanded environmental assessment” in cooperation with environmental organizations. A renewed and joint exhibition of the ECDs, now with some supplementary material, took place in the spring of 1996. The opinions received from the ECD exhibitions, with comments from the Road Administration, Stockholm Region, were available at the Head Office decision assessment of the working plans. Confirmation by the Road Administration of the working plans for Norra Länken on 13 September 1996 was the subject of an appeal to the Government. The plans were then withdrawn by the Road Administration. The Government revoked the confirmation decision of the Road Administration regarding the previous working plans.

The earlier planning was based on the “Dennis Agreement”. The Government announced on 7 February 1997 that the Dennis Agreement was no longer valid. At about the same time, on 31 January 1997, the Supreme Administrative Court decided to revoke the Government decision on one of the detail plans for Norra Länken, with reference to the fact that the decision was not in conformity with the provisions of the Natural Resources Law (NRL) 3:7 concerning Nationalstadsparken (National City Park). The Government then revoked the municipality’s adoption of this detail plan, and renewed planning of a new exhibition was therefore required. In later rulings on 21 October and 29 May 1998 for two other detail plans for the road, the Supreme Administrative Court declared that the Government decision concerning these plans shall remain in force.

In the draft bill of 19 February 1998, the Government proposed, among other things, that the planning for Norra Länken should be implemented. The Government intends to revert to Parliament at a later date with financing proposals. This ECD for a new (revised) working plan deals with the whole of the stretch that was earlier divided into two working plans. It sheds light on the processing of these, and includes alternatives against the background of the Government’s decision concerning the Dennis Agreement and the ruling of the Supreme Administrative Court on the planning matters.

Alternative designs of Norra Länken at Bellevue were developed to take into account the ruling of the Supreme Administrative Court concerning legal examination of the detail plan for Norrtull. Alternative, environmentally

improving designs and locations of the road tunnel, exhaust tower and operating areas are given in this ECD. The alternatives are presented for the purpose of environmental adaptation, regardless of the fact that the rulings of the Supreme Administrative Court concerning the relevant detail plans were found to be consistent with the legislation concerning the Nationalstadsparken.

A political solution was adopted by the Stockholm City Council, whereby part of Norra Länken would be run under Cederdalsgatan south of the Wenner-Gren Center, instead of under Bellevue (this document). Before the final choice between the Bellevue and Cederdalsgatan alternatives, the latter alternative must be carefully studied as regards matters such as geotechnology, technical executions, production and costs. The investigation was expected to be completed towards the end of the year 2000. Only then would it be possible to begin new planning work for the Norrtull – Roslagstull section.

ARRANGEMENT

In addition to the introduction and concluding particulars, etc., this ECD basically consists of three parts:

- Summary, Section 2, in which the project is briefly described and the most important conclusions concerning traffic, impact, effects and environmental consequences are compiled and commented on. The summary concludes with a brief section concerning inspection and follow-up.
- A descriptive part, Sections 3 - 5, that describes the project, its alternatives and background in the form of studies and decisions. Important conditions, assessment grounds and general interests are also presented here.
- Environmental consequences, Section 6, that also takes up measures and conclusions in important sectors, viewed against the background of environmental objectives, guideline values, legislation, and other factors. The presentation represents a summary of broader investigation material.

In addition, a cost description is presented in Section 8. Costs.

2 SUMMARY

2.1 THE PROJECT IN BRIEF

OBJECTIVE

Norra Länken is included in the traffic system for the region. The master objective that underpins the proposed construction of roads and public transport is to improve the environment, increase accessibility and create better conditions for the development of the region.

The main objective of Norra Länken, together with other measures, is to relieve the northern region of Stockholm and Lill-Jansskogen from a significant part of today's road traffic. Construction is expected to begin in 2002 at the earliest, and be completed in 2006 at the earliest.

TRAFFIC EFFECTS

Three figures showing traffic volumes in thousands vehicles per day (Monday-Friday) is enclosed. The figures are from the ECD of the latest town-plan (september 2003). The traffic is from 2000, 2015 (without Norra Länken) and 2015 (with Norra Länken).

- Today's rush hour traffic situation on radial roads and on the main street network in the city is characterized by difficult traffic jams and long journey times, with accessibility and availability problems. The construction of Norra Länken will offer faster, more environment-friendly and more conflict-free travel alternatives to part of the through traffic now carried by the main street network, principally the Nortull - Roslagstull - Valhallavägen - Lidingövägen stretch, and also Birger Jarlsgatan.
- Traffic relief for the street network in the inner city provides benefits not only for the living environment, but also for the inner city traffic in terms of accessibility and the environment. This also applies to bus traffic. Conflicts between pedestrian and cycle traffic and motor traffic will be reduced. The risk of accidents involving unprotected road users will also be reduced by the opportunities arising for improving the pedestrian and cyclist links. Scope will be provided for rebuilding the streets with the aim of both improving safety and improving the city environment.
- Construction of Norra Länken will enable Björnnäsvägen and Baron Rålambs väg to be shut off to motor traffic, which will reduce disturbances and improve accessibility of recreation and outdoor activities in Nationalstadsparken.

- The traffic flows are discussed in the section dealing with traffic forecasts. However, the conditions for these calculations have changed by the abandonment of Österled, abandoned road tolls and change in traffic flows since 1990, which in total caused increased but assessable uncertainty. In addition, great uncertainty arises due to the effect on traffic of possible future environmentally guiding charges. However, the traffic calculations made are considered to provide sufficient grounds for assessing the differences between construction and a zero alternative. The forecasts show, for instance, that traffic on Valhallavägen will be reduced to less than half of today's traffic. Above all, heavy traffic will be reduced. This will result in improved road safety, while accessibility will simultaneously also be improved.

DESIGN OF ROAD SYSTEM, INCLUDING ALTERNATIVES

Norra Länken comprises mainly tunnel links from Nortull, past Roslagstull and to Lidingövägen at Värtan. At Nortull, the additional section of Norra Länken will be connected to the already built section and to Uppsalavägen. At the Roslagstull junction, Norra Länken will be connected to Roslagsvägen at Frescati. In addition, there will be links to the local street network at Nortull, Roslagstull, Frescati and Värtan. The construction of Norra Länken will take place principally as construction below ground level. Only at connections to the surface road network, limited use will be made of land that currently mainly consists of road, rail track or industrial areas. Exhaust towers will be provided at the three large tunnel exits at Nortull, Frescati and Ryttsstadion.

/Figure page 9/

In order to improve the environmental adaptation at Nationalstadsparken with respect to the legislation, alternative designs of Norra Länken are given along several sections. The locations of these alternatives are shown in the overview map in this Summary. These alternatives are described in more detail in the project description, Section 4.3 Design of road system. Obsolete alternatives investigated earlier have also been included to facilitate comparison. Junctions and part-sections, including proposed alternatives, are briefly described below:

Nortull junction

Connection will be made directly to the existing section of Norra Länken in the west. Connection to Uppsalavägen will be made by means of ramp tunnels connected to the existing road network on each side of the northern exit of Eugeniätunneln.

Moreover, limited rebuilding of the surface road network will be carried out. A 36 m high exhaust tower will be located to the west of the junction.

A new railway bridge with pedestrian and cycle lanes will be built in conjunction with the working plan.

Norrtull - Roslagstull section

The road will be run in a concrete tunnel under the former petrol-station site and the adjacent car park north of the Wenner-Gren Center and under the western part of Bellevue Park. Under the eastern part of the park, Bellevueberget, the road will run in a rock tunnel.

There are three alternatives for the Wenner-Gren Center - western part of Bellevue Park section. *See also figures on pages 38-39*

Alternative V01: Open excavation (obsolete). The concrete tunnel for Norra Länken will be built from the surface up to about 100 m east of the pedestrian tunnel under the railway track. Open excavation in the Bellevue Park over a long period.

Alternative V02: Winter excavation. Compared to alternative V01, the works will be limited so that the stretch east of the pedestrian and cycle lanes will be excavated to a depth of about 2 m and in stages during one or two winter seasons. The Bellevue Park will thus be accessible from spring to autumn.

Alternative V03: Extended earth tunnel. The entire stretch east of the pedestrian tunnel north of the Wenner-Gren Center will be built from below and in a deeper position in order to avoid affecting Bellevue Park.

Roslagstull junction

The junction will be built in rock entirely below ground level. The connection to the surface road network at Roslagstull roundabout takes place only to and from the eastern part of the road.

Three alternatives are presented for the passage under Roslagsvägen - a fairly short concrete tunnel. *See also figures on pages 40-41*

Alternative V11: Surface excavation (obsolete). In this alternative, excavation will take place from the surface, and the vegetation along the sides of the trench will have to be felled.

Alternative V12: Deeper surface excavation. The tunnels will be run deeper than in alternative V11. Excavation will take place principally from the surface. Due to the greater depth of the excavation, most of the vegetation along the sides will be saved.

Alternative V13: Underground excavation (obsolete). In this alternative, the tunnel works will be done entirely below ground level, with access from the adjacent rock tunnels.

In conjunction with the working plan outside the tunnel exits at Roslagstull, limited rebuilding of the roundabout will be carried out. In addition, pedestrian and cyclist links will be arranged at different levels.

Roslagstull - Frescati section

The entire section is included in the working plan and will run entirely in a rock tunnel. Visible installations are three fresh-air intakes adjacent to already developed land or street.

Frescati junction

Connection of Roslagsvägen will be made to the main Norra Länken system and adjacent ramps. The junction will contain only connecting ramps between Roslagsvägen in the north and the Roslagsvägen/Fiskartorpsvägen intersection. Connection to the local street network in Stockholm will be made via the southern part of Roslagsvägen.

The alternatives presented, V31 - V32, relate to the height position at the tunnel exit. *See also figure on page 43*

Alternative V31: High position (obsolete). The transition between the rock tunnel and concrete tunnel is such that the vegetation in height will have to be felled.

Alternative V32: Low position. Due to the deeper profile position, the transition between the rock tunnel and the concrete tunnel will be moved. This, combined with soil stabilization, will create the opportunity for entirely avoiding impact on the vegetation.

The alternatives presented, V41 - V43, relate to the location of an exhaust tower. *See also figure on page 43*

Alternative V41: Tower at the foot of the hill. The tower will be located among tall bushes on the former arable land below the edge of the hill. The tower height will be 32 m.

Alternative V42: Tower on the petrol-station site (obsolete). The tower will be located on the petrol-station site outside the edge of the wood. No vegetation will be affected. The tower height will be 32 m.

Alternative V43: Tower at Roslagsbanan (obsolete). The tower will be located on open grass surface where another building stood previously, up on the hill along the Roslags railway line. No vegetation ought to be affected. The tower height will be 28 - 32 m.

The present large traffic-light crossing will be rebuilt and Frescativägen will be moved.

Roslagstull - Värtan section

Norra Länken will run in rock tunnels up to Ryttaarstadion. From the passage under Storängsvägen and eastwards to the exit in the rail track area, Norra Länken will run in a concrete tunnel. The road will then run in the open along the rail track area up to the Värtan junction.

At Ryttaarstadion, the fan room will be located entirely below ground level and in a concrete structure adjacent to the concrete tunnel. There are two alternatives, i.e. Ö01 - Ö02. *See also figure on page 45*

Alternative Ö01: Larger fan room. Due to the size of the fan room, together with the re-running of the cables, the works from the surface will also take place on developed land at Nya Ridhuset. Some trees will be felled.

Alternative Ö02: Smaller fan room. The fan room will be smaller and will be located entirely outside the developed land. A shaft will be sunk at Storängsvägen. No trees will be affected.

There are three alternatives, Ö11 - Ö13, for the location of the tower.

See also figure on page 45

Alternative Ö11: Tower south of Storängsvägen. The tower will be located about 17 m south of Storängsvägen on developed land, about 12 m from Nya Ridhuset. Some trees will be felled. The tower height will be 28 m.

Alternative Ö12: Tower north of Storängsvägen (obsolete). The tower will be located in the road slope north of Storängsvägen in a position outside Nationalstadsparken, and no trees will be affected. The tower height will be 32 m.

Alternative Ö13: Tower adjacent to Nya Ridhuset. The tower will be located on developed land in a more southerly position than alternative Ö11, about 3 m from Nya Ridhuset, and no trees will be affected. The tower height will be 28 m.

To achieve the necessary noise attenuation towards Hjorthagen, a “noise barrier” about 8 m in height will be built about 130 m from the tunnel exit and about 240 m to the east. The structure will be partially open upwards and will be made of glass and steel.

Värtan junction

/Figure page 12/

Värtan junction viewed from the east

The junction will consist of roadways for through traffic to/from Lidingövägen, with connections to a two-lane roundabout located above. In addition, Hjorthagen will be connected to the roundabout through Jägmästargatan and the southern part of Lidingövägen, towards the city.

The pedestrian and cycle network will be rebuilt and supplemented.

Opportunities created by the construction of Norra Länken

The street environment and road safety in adjacent parts of the city can be improved. Construction of Norra Länken will provide substantial relief for the street network. The relief will be particularly great at Valhallavägen.

New pedestrian and cycle connections can be arranged in order to improve the contact between the built-up part of the city and the surrounding recreation and green areas, including Nationalstadsparken, when traffic is reduced on the surface road network.

City development areas. “Semi-central belt” between the city centre and the suburbs can be developed. Accessibility will be improved.

The green structure and biological spreading paths can be preserved and, to a certain extent, improved by plantations, since the roads will be run predominantly below ground level.

A well-designed city entrance will be made possible by means such as a new railway bridge being built.

Pedestrian and cyclist connections of regional importance along the railway bridge at Nortull can be run to the east to Brunnsviksvägen, with improved accessibility to Nationalstadsparken.

Roslagsvägen will be relieved along the Frescati-Roslagstull stretch and the road width can be reduced and rebuilt to a city entrance, with tree plantations.

A pedestrian and cyclist bridge north of the junction in Frescati will provide an opportunity to improve contact between the areas to the west and east of Roslagsvägen.

Björnnäsvägen and Baron Rålamb's väg will be closed to motor traffic and rebuilt for pedestrian and cycle traffic.

2.2 ENVIRONMENTAL CONSEQUENCES - CONCLUSIONS

INTRODUCTION

The Environmental Consequence Description provides the basis for an overall assessment of the aspects of the environment, health and conservation of natural resources. The description concerns principally the neighbouring area around Nya Länken and, to a limited extent, the remainder of the affected area.

The ECD was written in 1998. Reference is therefore made to the Natural Resources Law and not to the Environmental Code. However, certain provisions/consequences of subsequent ordinances and traffic policy decisions are presented.

An assessment of the impact of the project is given in accordance with the headings below. Several of these interests concern more than one of the aspects of the environment, health and conservation of natural resources.

In addition to the type of impact, the following “word scale” specifies the magnitude of the impact: none, insignificant, low, moderate, high and very high impact.

The consequences are compared between *construction in 2004* and *zero alternative in 2004* or, in certain cases, present situation. The zero alternative means that the present traffic system remains unchanged, including public transport, and no environmental charges are introduced.

CITYSCAPE AND LANDSCAPE

- It is considered that construction of Norra Länken in accordance with alternatives V02/V03, V12, V32, V41, Ö01/Ö02 and Ö11/Ö13 could be carried out with none, insignificant or low impact on the cityscape and landscape within Nationalstadsparken.
- It is considered that for the obsolete alternatives such as V01, V11, V13, V31, V42, V43 and Ö12, the impact on the cityscape and landscape within Nationalstadsparken would have varied between insignificant and high.
- It is considered that *outside Nationalstadsparken*, the impact will be high at Nortull and Värtan. However, it is considered that the impact will be moderate at Tullhusen and Hjorthagen. The proposed or possible measures will result in predominantly positive change to the cityscape and landscape.

- In relation to the zero alternative and by suitable choice of alternative, it is considered that construction of Norra Länken could be made with predominantly insignificant impact on the cityscape and landscape within Nationalstadsparken. The proposed design of the surface parts, with plantations and landscaping, would result in improvements to the cityscape and landscape along several sections of Norra Länken.

NATURAL ENVIRONMENT

/figure page 14 Nationalstadsparken/

Norra Länken and its surroundings, with the boundaries of Nationalstadsparken shown.

- It is considered that construction of Norra Länken within Nationalstadsparken in accordance with alternatives V03, V12, V32, V41, Ö01/Ö02 and Ö11, Ö13 could be made with generally insignificant impact on the natural environment and with preservation of natural values within Nationalstadsparken. These combinations of alternatives do not involve any felling of trees within the parts of Nationalstadsparken that comprise a natural environment.
- Alternative V02 involves moving seven maple trees at Wenner-Gren Center and moving a two-stem bird cherry in Bellevue park. It is considered that surface excavation in winter will have low impact on the natural environment.
- Obsolete alternatives V01 and V11 would involve the felling of trees, with impact on the natural environment that is considered to be low. Alternative V31 (**obsolete**) would necessitate a vegetation section comprising about 70 trees being felled on the slope of the hill south of the petrol station at the Frescati junction. The alternative would have an impact on an important biological spreading path between the Brunnsviken area and Lill-Jansskogen. The impact on the natural environment would be high. It is considered that the other alternatives, V13, V42/V43, Ö12 (**obsolete**) would have had no impact or insignificant impact on the natural environment.
- *Outside Nationalstadsparken*, the construction of Norra Länken will have little impact on the natural environment. Trees would be felled in the natural area and parkland, mainly adjacent to the Karolinska hospital and at the junction at Värtan and Hjorthags park.
- Compared to the zero alternative, Norra Länken would most probably offer improved opportunities for the spreading of vegetation and fauna, and thereby the preservation of the biological diversity and the high natural

values of the region. In the longer term, the biological diversity within Nationalstadsparken will be maintained. New planting of bushes and trees will strengthen weak spreading corridors at Brunnsviken and Storängsbotten. For the area around Björnnäsvägen, the situation for the fauna will be improved when Björnnäsvägen is closed to motor traffic, which will be made possible by the construction of Norra Länken. A bigger and more contiguous ecosystem will thereby be achieved within Nationalstadsparken. Norra Länken is therefore considered to be consistent with the maintenance of biological diversity in accordance with the Haga - Brunnsviken programme.

CULTURAL ENVIRONMENT

/Figure page 15/

Bellevue park east of the Wenner-Gren Center.

- It is considered that Norra Länken could be built in accordance with alternatives V02, V03, V12, V32, V41, Ö01/Ö02 and Ö11/Ö13 with none, insignificant or low impact on cultural values in the historic landscape within Nationalstadsparken.
- It is considered that the impact of the obsolete alternatives V01, V11, V13, V31, V42, V43 and Ö12 on the cultural environment values in Nationalstadsparken could vary from low to high.
- *Outside Nationalstadsparken*, it is considered that the cultural environment may sustain low or moderate impact due to the change to the edge of Hjorthags park or the construction of a noise barrier.
- Compared to the zero alternative, it is considered that, by selecting suitable alternatives, Norra Länken could be built with mainly insignificant impact on the cultural values in the historical landscape within Nationalstadsparken.

RECREATION AND OUTDOOR LIFE

/figure page 16/

The recreation areas in Norra Djurgården are important to Stockholm

- It is considered that Norra Länken could be built in accordance with alternatives V02/V03, V12, V32, V41 and Ö01/Ö02, Ö11/Ö13 with very insignificant impact on recreation and outdoor life. The impact made would consist principally of the changed opportunities of experiencing the natural

and cultural environment. The changes consist of new installations in the existing environment and lower noise levels in nature and the park area adjacent to the present surface road network.

- It is considered that if the obsolete alternatives V01, V11, V13, V31, V42/V43, Ö12 were selected, the impact on recreation and outdoor life would at most be low.
- The Norra Länken construction stage will have the highest impact on recreation and outdoor life. During this stage, the impact is considered to be moderate to high due to the barriers created locally by the work areas and the noise caused by the work.
- The planned possible new links for pedestrian and cycle traffic and the reduced traffic on the streets in and adjacent to Nationalstadsparken will result in improvements to the recreation and outdoor life when Norra Länken is built. Closure of Björnnäsvägen will be of greatest importance.
- Depending on the alternative selected and compared to the zero alternative, construction of Norra Länken in 2004 will have mainly insignificant impact on recreation and outdoor life within the area affected.

NOISE AND VIBRATIONS

- Construction of Norra Länken will relieve very noisy inner city streets, e.g. Valhallavägen, of **traffic noise**. The planning target specified by the Government for maximum indoor sound level of 45 dB(A) is now exceeded more than 2000 times/24 hours. Since heavy traffic to/from Värtan will choose Norra Länken, this environmental disturbance will be substantially reduced. Other heavy traffic, such as city buses and local distribution trucks, do not cause the same high maximum sound levels. The already adopted measures on windows will thereby have a greater effect.
- After construction of Norra Länken, the planning targets of the city for the existing environment, i.e. 70 dB(A) equivalent sound level outdoors and 40 dB(A) equivalent sound level indoors, will be met along many of the noisy inner city streets. On the other hand, the plan of action specified by the Government for the existing environment, i.e. 65 dB(A) equivalent sound level outdoors at building frontages, will be met without further action. There are technical measures that could be taken so that the guideline value of 30 dB(A) equivalent sound level indoors as specified by the Government will be met also in the existing environment.
- Within the neighbourhood area along Björnnäsvägen, closure to motor traffic will lead to a significant noise reduction, which will substantially improve the quality in this part of Nationalstadsparken. In other parts of northern Djurgården, construction will not lead to any significant changes.

- In the shore area at Stallmästargården, traffic noise disturbances will decrease after construction of the noise barrier along Uppsalavägen.
- Compared to the zero alternative, worsening will occur due to the open run of Norra Länken along the present rail track area in the southern part of the residential built-up area in Hjorthagen. However, the planning target adopted by the city and the guideline value of 55 dB(A) outdoors for dwellings (at the frontage) adopted by the city and specified by the Government will still be met, in spite of the worsening, after provision of the noise-shielding barrier and noise protection barriers on ramp viaducts.
- Road traffic during the operation stage will not cause any **vibration** problems to the surrounding dwellings or those located above. (During part of the construction stage, the Eldh studio will remain closed.)
- **Structure-borne sound** from fan installations in tunnels, for instance, is not considered to cause problems, provided that the mountings are designed in an acoustically appropriate way.

AIR

/Figure page 17/

Exhaust tower at Rytтарstadion viewed from Hjorthags park

Outdoor environment

- The situation after construction of Norra Länken in 2004 will generally lead to improved air quality everywhere compared to the present situation. Particularly significant improvements after construction will occur along Cedersdalsgatan, Sveaplan, Roslagsvägen at Albano, Valhallavägen and Lidingövägen, and in the inner parts of Norra Djurgården.
- However, the nitrogen dioxide contents in the area nearest to the south and east of Hjorthagen will remain virtually unchanged compared to the present situation. In 2004, the contents at the closest dwellings were between 45 and 60 µg NO₂/m³.
- Compared to the zero alternative in 2004 (which also gives a generally improved air quality), the construction of Norra Länken will offer improvements in the inner parts of Norra Djurgården and along Cedersdalsgatan/Sveaplan, Valhallavägen and Lidingövägen. Somewhat elevated nitrogen dioxide contents are expected to occur along the E4 highway at Nortull and adjacent to the tunnel exits. The contents may also be somewhat higher in the southern part of Hjorthagen and in the eastern

part of Lidingövägen. Construction will lead to lower contents than the zero alternative in the neighbouring area along Björnnäsvägen.

- The design guideline values for air quality for the outdoor environment will be maintained by exhaust towers being built at the Norra Länken tunnel exits at Norrtull, Frescati and Ryttsarstadion. Fans in the underground fan rooms adjacent to the towers will exhaust the tunnel air high up into the atmosphere and the exhaust air will thus be spread so that the NO₂ content will not exceed anywhere the value of 110 µg/m³ of air. The limit value will not be exceeded even in the zero alternative.
- Compared to the provisions concerning environmental quality standards for nitrogen dioxide, the limit value of 90 µg/m³ of air is not expected to be exceeded in 2006 anywhere within the working plan area for Norra Länken. This also applies to the zero alternative. The highest one-hour values occur at the Norra Länken tunnel exits and are estimated to be 70 - 80 µg/m³ in 2006. The limit values for sulphur dioxide and lead specified in the environmental quality standards will be met with a broad margin, both today, for the zero alternative, and after construction of Norra Länken.
- Norra Länken will have only a marginal effect on the air pollutant situation in Lidingö.

Impact on the vegetation

- Nitrogen deposition will decline during the coming 5 - 10 years as a result of the vehicle population becoming younger, which will result in cleaner exhaust gases. Compared with the zero alternative, the construction of Norra Länken will lead to distinct improvements in Lill-Jansskogen and other parts of Nationalstadsparken. At Hjorthagen, the deposition will be somewhat higher than in the zero alternative.
- Dry deposition of nitrogen following construction of Norra Länken in 2004 will be reduced by approximately 5 - 10 kg per hectare per year compared to the present situation and the zero alternative. Regardless of whether or not Norra Länken is built, the Stockholm region has a high nitrogen deposition caused by factors such as high traffic density per unit of area and by imported nitrogen pollutants.
- "Critical loading" of nitrogen will be exceeded both following construction and in the zero alternative, which will probably lead to continued soil acidification, and the consequent indirect and direct damage. However, some vegetation benefits from the nitrogen precipitation and will come uppermost in the competition with other vegetation. In the protection of vegetation in accordance with the environmental quality standards (SFS 1998:897), the arithmetic mean value is expected to be lower than the specified limit value of 30 µg/m³ for both the zero alternative and following construction of Norra Länken.

Air in the tunnels

- In “Environment 2000”, the municipal environmental authority has set the target that the content of nitrogen dioxide in traffic tunnels should not exceed the limit value of 400 µg/m³ of air, measured as the one-hour mean value. The Road Administration has adopted this value as the target for the air quality in the Norra Länken tunnels.
- Control equipment that increases or decreases the air flows will be installed so that the specified air quality requirements will not be exceeded. A measurement programme will be set up to continually follow up the tunnel air.

Dust collection

- The Road Administration and Stockholm City have made the appraisal that the environmental improvements that could be achieved by dust collection devices are relatively limited and are not in reasonable proportion to the investment and operating costs to which such devices would lead. Evaluation of the operating stage from installed ventilation systems, washing and other cleaning of tunnels will be made in accordance with the agreement between the Road Administration and the City before the dust collection issue is taken up again.

WATER AND SOIL

Water management

- Implementation of the Norra Länken project, with the resulting estimated traffic reduction on the surface road network and the proposed measures, will result in a reduction in pollutant loading at Brunnsviken, Laduviken and Lilla Värtan.
- Emission of treated surface water and washing water to Husarviken will cause a marginal addition to the present inflow to Husarviken. The additional pollutants emitted to Husarviken are considered to be extremely marginal compared to today's loading.
- Compared to the zero alternative, the construction of Norra Länken will lead, in total, to a reduction in pollutant emissions from the traffic installations, and also a reduction in the risk of emissions following accidents involving dangerous goods. The recipient conditions will be improved in the long term.

Groundwater

- Norra Länken will be built predominantly below the existing groundwater level. Water leakage into the tunnels will give rise to varying degrees of impact on the groundwater balance. The quantity of water and the extent of

the impacted area are dependent on the reservoir capacity of the bedrock and the soil layer above it, and their water-conveying properties. An excessive impact on the water balance may cause lowering of the groundwater level, with possible consequent settlement damage to the ground and building on loose earth strata. The condition imposed on the implementation of the Norra Länken project is that no harmful lowering of the groundwater level may occur.

- In order to reduce the risk of harmful impact, the rock tunnels will be sealed by cement grouting, and concrete structures will be made tight up to the lowest level for drainage. Reverse infiltration of groundwater leaking in is planned, whereby consideration will be given to particularly sensitive areas. These measures are considered to be sufficient for maintaining satisfactory groundwater balance. However, additional measures will be taken as necessary, e.g. additional injection and infiltration. An inspection programme for the construction and operation stages will serve as the basis for decisions concerning the necessary local measures.
- Compared to the zero alternative, construction of Norra Länken will result in impact on the groundwater levels. The proposed measures are considered to be satisfactory for maintaining the groundwater balance.

Soil pollutants

- Compared to the zero alternative, construction of Norra Länken will lead to excavated soil with existing soil pollutants being removed in the areas in which excavation is carried out.

SAFETY

- The construction of Norra Länken in its entirety will have positive consequences from the safety aspect to people, property and the environment. This assessment is based on a collective quantitative analysis of the number of accidents and the measures adopted for limiting their effects.
- Relieving the loading on the surface road network, and the risk limiting measures planned for the tunnel sections will lead in total to meeting the targets for improved safety compared to both the zero alternative and the present situation. This applies particularly to the part of the targets that relates to the risk to unprotected road users. Measures will be taken to improve safety in the transport of dangerous goods.

CONSTRUCTION STAGE

/Figure page 20 Teknikhöjden/

Establishment area for the working tunnel at Teknikhöjden

- During the construction period, the surroundings will be affected at the places where work is in progress on the surface. Apart from Nortull, Frescati and Värtan, these places are relatively limited. Most of the construction work for Norra Länken will take place in rock tunnels below ground level.
- The Inspection Programme for the Environment (IPE) will specify the environmental requirements and checks, etc. that are made on the contractor during the construction stage.
- The cityscape and landscape will be affected to varying extents during the construction stage, principally by the workplaces at street level and the noise attenuation fences set up. The effect will be of limited duration and is considered to be moderate.
- Requirements (penalties, etc.) concerning protection and measures for the vegetation during the construction period are considered to lead to low impact on the natural environment within and outside Nationalstadsparken. The impact on the fauna will be greater locally, but will represent no threat, since the disturbances will be of limited duration and extent.
- Due to the demands for protective measures for buildings of historical value, the impact on the cultural environment will be only temporary. Eldh's studio will remain closed during part of the construction period.
- Recreation and outdoor life will be affected during the construction stage. Provisional pedestrian and cycle connections and noise-attenuating measures are proposed. The consequences are therefore considered to be moderate.
- The construction stage will give rise to noise disturbances, principally by construction works, excavation rubble transport and diversion of traffic. Activities such as sheet piling and piling often give rise to high sound levels. Airborne shock waves from blasting and structure-borne sound in the dwellings above during rock drilling are other disturbances that will occur. In addition to noise-suppressing fencing of the working areas in certain sensitive sections and special noise barriers/attenuation at the source of noise, limiting the duration of disturbing operations can be introduced. The Road Administration has drawn up a special plan of action that describes a number of remedial action stages aimed at preventing inconvenience during the construction stage. Temporary evacuation of the residents may sometimes also be needed.
- Vibrations caused by piling and blasting may have a short-term disturbing effect in parts where surface works are in progress. In addition to

precautionary measures, information and time adjustments are the possibilities available for reducing the effect of vibration-generating works.

- Discharge of blasting gases from the tunnel exits should not cause any problems for the residents. The exhaust gases from diesel-powered machines and equipment may cause locally worsened air environment. In the future, environmental classification and tightened-up requirements on emissions from contracting machines may be necessary. Raising of dust and fouling can be reduced by spraying with water.
- Construction water (dewatering and surface water from the construction works) will contain pollutants from the building operations, including nitrogen residues from blasting agents. Cleaning measures will be required at several workplaces in order to meet the emission requirements to the recipient, soil and municipal sewage network. The building water and the groundwater leaking in will be sampled. Sealing measures and checks will be made so that the groundwater balance will be maintained.
- Special requirements, routines and checks are specified for excavation of contaminated soil, and measures for dealing with it are specified in the Inspection Programme for the Environment.
- Rock rubble from the construction of Norra Länken will provide good opportunities for reducing the extraction of gravel in the Stockholm region. The handling of excavated rubble will lead to traffic and noise disturbances, regardless of where it is disposed of, and also, in unfavourable circumstances, may cause raising of dust and leaching out of nitrogen-rich blasting agent residues.

CONSERVATION OF NATURAL RESOURCES

- The construction work will generally not involve the use or loading of natural resources that are not compatible with long-term conservation targets. During the construction stage, the present conditions will be worsened by factors such as local and temporary weakening of biological spreading paths, with local impact on genetic variation and biological diversity.
- Replanting and other care measures for quick establishment of new vegetation will be taken in order to prevent the negative effects becoming enduring. Regardless of whether or not Norra Länken is built, air pollutants will be reduced in areas that are now heavily loaded. The use of energy for operation and maintenance of the traffic system will increase compared to the zero alternative. However, the construction of Norra Länken will lead to reduced fuel consumption, the energy content of which should balance out the extra energy consumption for ventilation and lighting installations.
- The use of water as natural resource is considered to be compatible with the conservation targets in the Natural Resources Law (NRL) by measures

being taken to protect the groundwater and by the pollutant loading on the recipients being reduced. The rock rubble is expected to be used as replacement for material from existing rock quarries and gravel pits.

- The construction of Norra Länken will offer improved opportunities for “greening”, plantations, etc. in the immediate surroundings of the project and on the streets of the inner city. In the long term, the construction of Norra Länken is considered to be compatible with the conservation of resources targets as regards the maintenance of biological diversity in accordance with the NRL.

/Figure page 21/

Brunnsviken viewed from Stallmästargården

2.3 INSPECTION AND FOLLOW-UP

INSPECTION PROGRAMME

The Road Administration is preparing a follow-up and inspection programme for the Norra Länken operation and construction stages. The purpose of the programme is to verify that the environmental targets set up are met and that suitable corrective action be taken if the targets are not met.

The checks and follow-up that are intended to be undertaken during the operating stage, including technical inspection, comprise: Traffic censuses, noise measurements, air pollutant measurements, groundwater checks, bottom sediments sampling, and water analyses.

For the **construction stage**, an Inspection Programme for the Environment (IPE) will be drawn up to specify the requirements, checks and preventive action aimed at minimizing environmental disturbances. The inspection programme for the construction stage will begin before the works are started and will be pursued continuously during the whole of the construction time and for a period after completion.

The IPE concerns, among others, the following: general requirements, transport vehicles and fuels, construction rubble handling and transport, demolition rubble and other building waste, dust raising, fouling and spillage, polluted soil, groundwater and settlement checks, water management, noise, vibrations and airborne shock waves, and also protection of vegetation.

FOLLOW UP

Follow up of the results must be viewed in the context of other changes that may take place in the vicinity of the road, e.g. various types of construction.

The *natural environment* and safeguarding of biological spreading paths includes all restorative “greening” being done as early as possible, and green areas being restored in accordance with future care plans. During the operation stage, the vegetation and green areas planted will be checked with regard to behaviour and survival capability. Follow-up checks of the trees in Bellevue park will also be carried out.

Measurements of air pollutant contents in the tunnels will be taken continuously during the operating stage. Measurements will be taken by long-term meters for NO and NO₂. At the surface road network, supplementary immission measurements will be taken for NO_x, NO₂ and Volatile Organic Compounds (VOCs). The total quantity of suspended particles will also be measured adjacent to the Karolinska hospital and Hjorthagen.

Noise measurements after commissioning of Norra Länken will be taken at about 12 measurement points that are already documented from the noise aspect by noise measurements carried out earlier. Additional measures may be necessary if the noise targets are not met. No *vibration measurements* during the operation stage are planned.

After commissioning of Norra Länken, *traffic censuses* will be taken as a basis for additional environmental measures related to noise and air pollutant contents, but also as a basis for checking the primary and secondary traffic effects that are expected to arise due to the construction of Norra Länken.

*Checking and recording of **groundwater quantities leaking in** and **groundwater levels*** will be carried out.

During the operating stage, the **drain water** leaking into tunnels, the **surface water** from roads and major routes, and the **flushing water** from cleaning of tunnels will be analyzed.

Sampling of sediment from Brunnsviken will also be carried out in the operating stage.