

EGCA 2018, Umeå, Sweden

6. Quality of the Acoustic Environment

6A Present situation

In Umeå there are several noise sources. Road, train and aircraft are main sources of noise pollution but there is also noise from other activities such as industry, wind turbines, shooting ranges, rock quarries, and construction activities in the municipality. Umeå Airport is located only five km from the city center. Although there are several different noise sources in the city, there is a good availability of quiet environments. 88% of the citizens in Umeå Municipality are living within 300 m of quiet areas.

The city of Umeå has surveyed noise since the early 1980's with work initially concentrated on noise maps and measures from road traffic. The last mapping was made 2012 by environmental noise (road, railway, aircraft, industry) and is available online¹. It covers the entire municipality in accordance with the European Noise Directive (END 2002/49/EC). The Umeå map is very detailed. Grid resolution is 5×5 m in urban area and 10x10 m cells outside urban area. Noise levels have been calculated at different heights. In the urban area noise has also been calculated at every floor.

In 2013 Umeå adopted a Noise action plan 2013–2018. A noise map has been used in the process of developing the action plan and is also used for spatial planning and when dealing stakeholder and citizen complaints.

¹ <http://www.umea.se/buller>

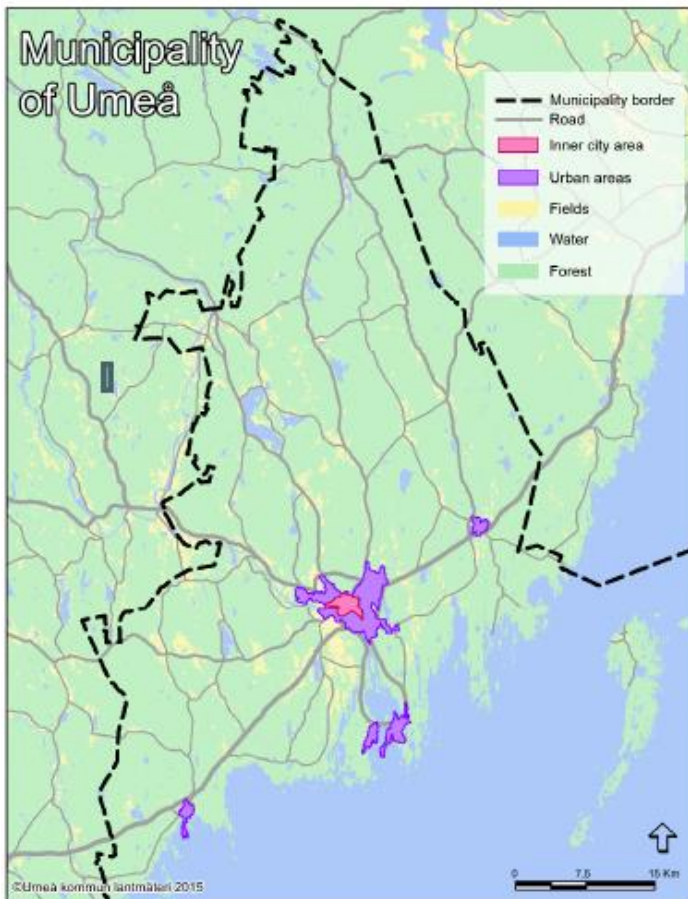


Figure 6A1. Urban areas with higher noise map resolution in the municipality of Umeå.

Umeå with 120,000 inhabitants is the centre of growth in northern Sweden, with the city doubling its population over the last 50 years . The comprehensive plan outlines a continued sustainable growth, implying an increased need for new housing, about 1,200 dwellings per year. This, in combination with the need to densify the city, could lead to more people getting exposed to noise. The comprehensive plan and noise action plan consequently provides guidelines for building development in noise exposed areas. When building in noise exposed areas it is required that indoor noise levels are low and that dwellings have access to a quiet courtyard. One guideline is that new dwellings should always have one side facing a quiet side or courtyard.

Umeå works broadly and integrated with noise issues and measures to reduce exposure to noise. Planning to reduce car use, financial contributions to windows insulation measures, noise protection walls and traffic regulations as well as focus on promotion electric buses in public transport system are some examples of work undertaken. The noise action plan specifies long-term goals to achieve healthy residential and school environments, and work to develop parks and recreational areas that provide opportunities for peace and quiet.

Share of population exposed to total noise values

Indicator		Unit	Year of data
Share of population exposed to total noise values of L_{den} above 55 dB(A)	28	%	2012
Share of population exposed to total noise values of L_{den} above 65 dB(A);	4	%	2012
Share of population exposed to total noise values of L_n (night noise indicator) above 45 dB(A)	14% >50 dB(A)	%	2012 Population exposed to L (night) 45-50 dB(A) is not calculated separately
Share of population exposed to total noise values of L_n (night noise indicator) above 55 dB(A)	5	%	2012
The percentage of citizens living within 300m of quiet areas.	88	%	2012

Table 6A2: Share of population exposed to total noise values.

In addition to L_{den} and L_{night} , Umeå also maps L_{eq} , L_{max} to compare results against Swedish guideline noise values. For railway and road traffic mapping the lower equivalent noise levels have been extended to 35–50 dB(A) to get increased knowledge of the areas with good acoustic environment.

The number of residents in different dB(A) fractions have been mapped in 2008 and 2012. The calculation method has however changed and thus, a trend comparison is not relevant. In 2011 a Swedish calculation model were developed to enable future comparisons between cities. In the new model, the most exposed façade of a building is set as the value for the entire building. Our assessment of the trend with these preconditions is that the number of people exposed to high levels of outdoor noise is not likely to have decreased in Umeå. This is due to the current densification of the city center. Where new buildings are built along noiseexposed streets. However, in all new developments, high standards have to be met regarding indoor environment noise levels and quiet side/inner yards.

Type	Number of residents 5 dB(A) interval							
	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85+
Train Lden		1400	500	0	0	0		
Train, Lnight	1200	300	0	0	0			
Train, Leq 24h	1200	300	0	0	0	0		
Train, Lmax				4600	2200	1300	600	100
Road, Lden		17300	9400	4000	400	0		
Road, Lnight	9500	4900	500	0	0			
Road, Leq 24h	19700	8600	5800	800	0	0		
Road, Lmax				16900	28000	14900	10100	2800
Flight, Lden		100	0	0	0	0		
Flight, Lnight	0	0	0	0	0			
Flight, Leq 24h	200	0	0	0	0	0		
Flight, Lmax				16000	13200	6600	2600	700
Industry, Lden		0	0	0	0	0		
Industry Lnight	0	0	0	0				

Table 6A3: Number of residents exposed to noise, from noise maps for road, train, aircraft traffic and industry 2012.

The percentage of citizens living within 300m of quiet areas

The opportunity of relaxation in quiet areas such as parks and recreation areas is important for human well-being. In Umeå Municipality, there are plenty of green and quiet areas. 88% of the citizens in Umeå Municipality are living within 300m of quiet areas 35–40 dB(A) Leq. There are several recreation areas that have low noise levels below 45 dB(A) Leq, which is of growing importance in a rapidly growing city.

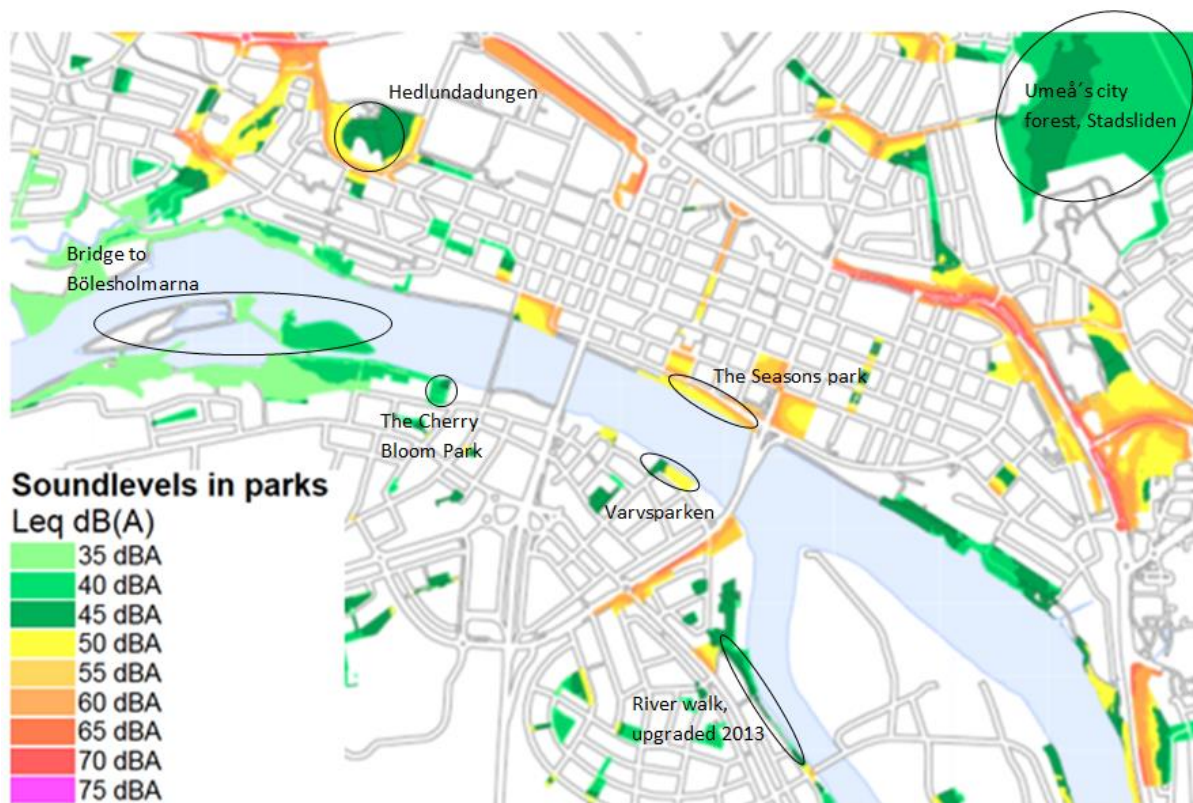


Figure 6A4: The figure shows sound levels Leq 24h dB(A) and parks in central Umeå where investments will/or have been made for increased access to a quiet recreation area. For more information see 6B, 6C and chapter 3, table 3B2 timetables and budget.

In central Umeå there are several parks that have noise levels up to 50 dB(A) at half the surface or more. The acoustic environment is not entirely satisfying in all parks and can be improved. The city's efforts to improve and preserve quiet areas will be described further in 6B and 6C. Umeå's city forest, Stadsliden, is used by a large number of local residents, walking, running, skiing, picking mushrooms and berries etcetera. The sound level is below 45 dB(A) in a large part of the area. A management plan will be adopted with the aim of developing Stadsliden. The plan aims to improve recreation values so that the experience of the quiet areas in city forest is secured.

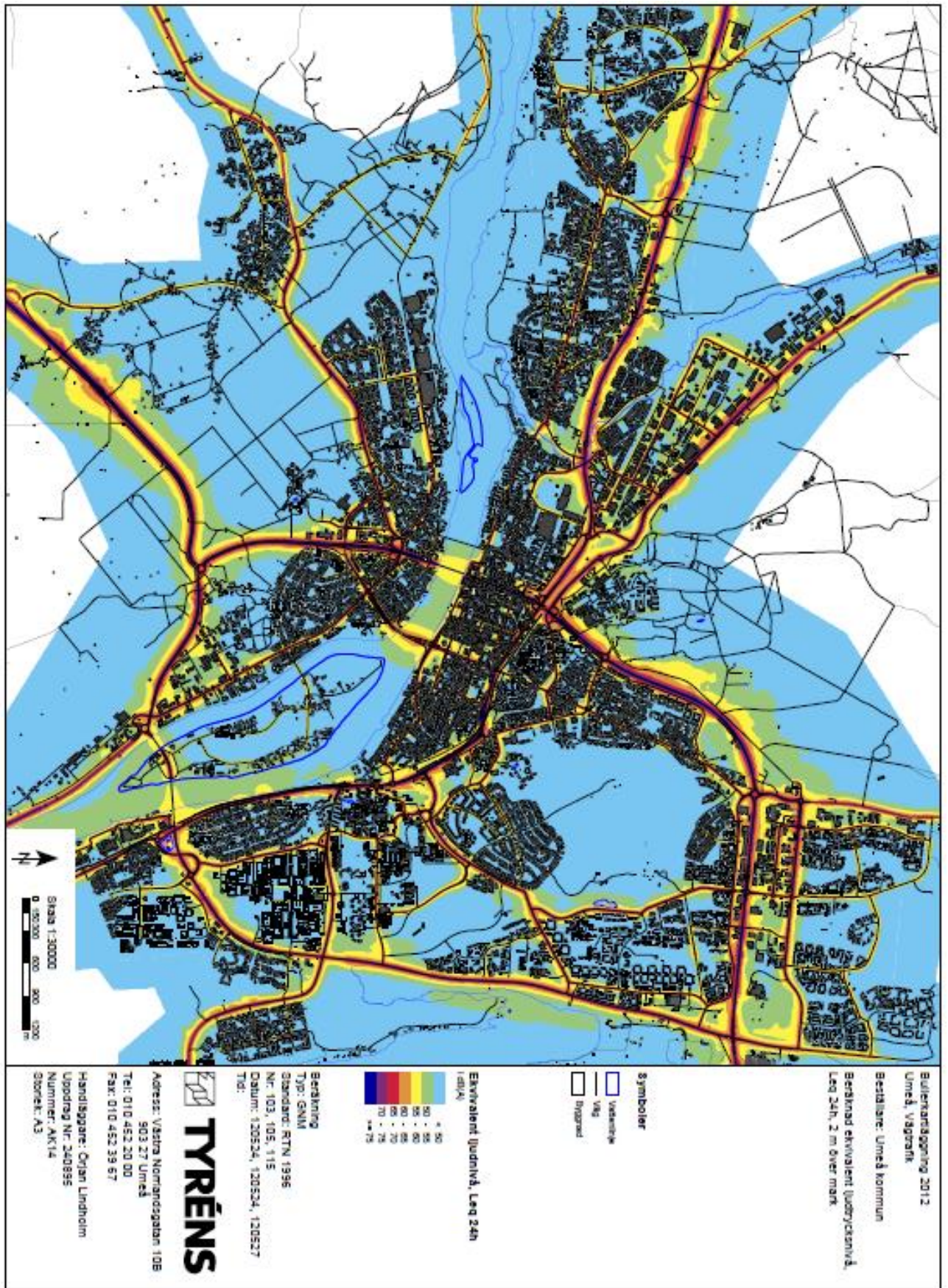


Figure 6A5. Road traffic, $Leq(24h)$ dB(A). Noise map Umeå city mapping 2012.

6B Past performance

Classification of territory

Umeå (and Sweden) are not using any specific classification of territory into different noise classes with appropriate noise limits (e.g. specially protected, hospitals/schools etcetera). However, in the noise action plan adopted in 2013, the long term goals put special focus on three territorial classes: Residential environments, Preschools and schools and Park and recreations areas (described more in 6C).



Figure 6B1: The new downtown "Seasons park" opening in 2015, the design has improved the acoustic environment. Boulders has been reused from a former bridge.

Stakeholder involvement and communication with citizens

During the development of Umeå's noise action plan formal stakeholder consultations were organised. This formal approach was complemented with the ongoing continuous communicative work of regular media advertisements, web page information and other communication modes such as letters, e-mails etcetera. Umeå has also made noise maps

available online². Information about the opportunities for financial support from the municipality is available online³ and communicated to relevant property owners for noise prevention measures; window changes, ventilation changes etc.

Umeå is developing parks along the down- town river front and in quiet areas in the city. The new Seasons park is one example. The park was projected with the working title “Peace and quiet” and had its grand opening in 2015. It has been developed in a co-creative process with citizens and stakeholders, as part of Umeå Urban Forum, a part of the European Capital of Culture year in 2014. The new park design has improved the acoustic environment. A large part of the park area used to be a four lane road a couple of years ago. The ground has also been excavated down and constructed with a stone wall towards the road as seen in *Figure 6B1*.

Preservation and improvement of good acoustic urban environments such as quiet areas

A number of recreation areas in Umeå have noise levels below 45 dB(A) Leq. These areas are of growing importance in a rapidly growing city. One of them, the lake Bäcksjön, is especially pointed out in Umeå’s comprehensive plan as a quiet area that should be protected. The noise level in the area is below 40 dB(A) Leq.

Noise reduction measures that influenced the current situation

Developing an noise action plan has resulted in a more structured work with noise issue. In this way, it is probably the most effective measure. In recent years, extensive noise reduction measures have been implemented in relation to all major noise sources. Ongoing development of electric buses will have considerable effect on reducing noise levels in the city.

Road traffic

For road traffic noise various measures have been implemented including:

- Noise barriers along the main traffic routes close to housing and preschools.
- Speed limits in urban areas are reduced since 2011–2013 to create a safer traffic and increased security. This action also reduces noise.

² <http://www.umea.se/buller>

³ <http://www.umea.se/bullerbidrag>

- From 2013, a ban imposed on through traffic inside the ring-road system. By this measure, heavy vehicle traffic will be moved out from central Umeå. That improves the noise situation in the city center, though it is increasing in less densely populated locations.
- The municipality has for several years been working on grants to property owners to improve the indoor noise situation. We use subsidies, mainly for improved façade insulation like window and noise reduced ventilation. Subsidies are given to the most noise exposed residential properties, levels > 61 dB(A) Leq or > 70 dB(A) Lmax more than five times a night.
- Umeå has been a partner developing the world's first ultra-fast charged electric buses with hybrid backup, in cooperation with European stakeholders from e-Traction, Opbrid to name a few and local company Hybricon Bus systems. By 2016 there will be 9 buses in traffic and the vision is to add another 24 buses by 2020.



Figure 6B2: Recently built noise barriers (2014), at pre-school in Umeå.



Figure 6B3: An image of an electric bus developed by Hybricon. The share of electric buses in the city transport system will increase from 0% to 70% from 2010 to 2020.

Air traffic

In Umeå, the airport is very centrally located. Only five km from the city center. Measures (improved insulation of façade and windows) have been made by the airport at 150 properties that are affected by aircraft noise at night according to the airport's environmental permit. The airport has also made changes in the admitted air routes over and close to the city in order to reduce noise disturbance. Night flights in certain routes are limited for the same reason.

Rail traffic

The construction of the Bothnia railway along the coastline has resulted in increased traveling and commuting by train in the region. That has also made it possible to move the cargo railway yard out of Umeå city center. The change of location of the yard combined with extensive noise protection measures (façade and window actions or noise barriers) along the railway line have reduced noise disturbance in the area surrounding the central

railway station. Measures like electrification of the railway has also been implemented which have reduced the noise levels.



Figure 6B4: Umeå C ,the central train station. Noise barriers have been set up to improve the sound environment for local residents and the cargo railway yard has been moved out of the city.

Action plan monitoring and cost allocation

The noise action plan was adopted in 2013 as the first of its kind in Umeå. The plan will be revised at least every five years. The follow-up on the whole implementation of the plan is to be made in 2017. All the actions are initiated. The responsible board annually monitor how the measures are achieved. One important aspect of the follow-up will be to determine the effectiveness of the implemented measures.

Examples of long- and short-term measures in Action plan against noise 2013–2018
Improve noise levels at pre-schools/schools both outdoors and indoors for example by noise barriers, reduced speeds etcetera. In Umeå 14 pre-schools/schools exceed sound levels.
Financial contribution to property owners for improved window insulation etcetera in dwellings exposed to high road traffic noise levels.
Program for noise barriers, both new and renovation of existing.
Reduced speeds in the city to reduce noise and increase road safety.
Stricter noise requirement for procurement of buses and vehicles and increased share of electric and hybrid vehicles.
Investigation – low noise road surfaces to reduce noise.
Investigation – acoustic environment in parks and recreation areas and in the squares.
Sociotope map describing area uses, what qualities they have and how they can improve.
Information on sustainable transport modes and how to reduce noise by selecting better tires, eco-driving etcetera.
Supervision of noise in residential areas, schools and industries.
Increasing proportion of electric vehicles (cars, service vehicles, buses) and charging infrastructure.

Table 6B5 Examples of long- and short-term measures in the noise action plan.

The annual municipal budget allocated to noise prevention measures is currently approximately €131,000. These are directed to measures for property owners in existing residential areas. The costs for additional measures in the action plan are indicative. When it comes to stricter noise requirement for procurements, vehicles or buses, it requires an additional decision in the annual city budget. The additional cost for electric buses currently is about €22,000 per vehicle. The total additional cost (including capital and fuel) is €175,000 for eight new busses. Measures for noise barriers at housing, kindergartens and grants to property owners to improve the indoor noise situation was €283,000 in 2013. In addition, in 2014, a school was expanded which resulted in reduced noise levels at the schoolyard. The costs for *Seasons park* was €3,6 million.

6C Future

Umeå puts focus on transportation, public spaces and parks in a way that supports low noise levels and peaceful places in the city.

The city's strategic long-term objectives:

Of special interest when it comes to the acoustic environment is:

Umeå's growth is reached with social, ecological and economic sustainability, aiming towards the vision of 200,000 citizens in 2050.

Umeå will have the best public health in Sweden by 2020

The other five strategic objectives ⁴also supports the first one.

The noise action plan 2013–2018 outline three long-term objectives focusing on the acoustic environment:

Residential environments: Noise levels indoors should not exceed national guidelines 30dBA Leq and 45dBA maximum night-time.

Pre-schools and schools: Noise levels should not exceed national guidelines for traffic noise, 55dBA Leq in playgrounds and 30dBA Leq indoors.

Parks and recreational areas: Half the park surface areas will have noise level below 55 dBA Leq. Parks should have lower noise level than surrounding urban environment. *(No Swedish guidelines for parks and recreational areas).*

Table 6C1: Long term objectives in Umeå concerning acoustic environment.

Stakeholder involvement and consultation with the population including noise perception survey

Umeå's current action plan against noise pollution was adopted in 2013 and will be revised every five years. For the next few years focus will be on implementation of the plan.

Involvement very much runs through the city – Umeå's European Capital of Culture 2014 vision was "Curiosity and passion – the art of co-creation.

In the process of developing parks and recreational areas, Umeå involves the citizens. Dialogue about the qualities and use of the area has therefor been held before rebuilding the old playground and park Hedlundadungen. In the ongoing work with a new extensive

⁴ The strategic long term objectives are more fully described in City introduction and Chapter 12.

The implementation of the noise actions plan are in focus to achieve both short and long term goals. In addition to the allocated funds specified earlier in 6B, the municipality has €105,000 per year during 2016–2018 to carry out maintenance operations on existing noise barriers, in order to maintain noise barriers function.

Foreseen reduction in share of population exposed to noise values

A dense city provides long-term potential for more sustainable travel by public transport and cycling as an alternative to the car. In the short term more people may get exposed to high noise levels since many of the areas planned for densification are located adjacent to road, rail or affected by aircraft noise.

In order to avoid citizens getting exposed to noise, new developments are built with closed blocks leaving a quiet courtyard/garden side. That is a new way of building in Umeå. The tradition is to build with open blocks leaving free sightlines and passage for noise into the citizens' living areas.

High standards also have to be met regarding indoor environment noise levels. Coupled with proposed actions and investments in the adopted action plan this makes us foresee the future reduction potential in share of population exposed to noise in a positive light. Outdoor noise on the roadside of housings may not be reduced on short-term. In the long-term, an increased share of electric vehicles, technology on vehicles and tires and road surfaces can result into lower levels.

Actions to maintain, extend, or improve urban quiet areas

Umeå is working to develop several parks in central Umeå . Next year the city is building a new pedestrian bridge for increased accessibility to a quiet recreation area (< 40 dB(A) Leq) Bölesholmarna, an island in Umeå river in the city center. Umeå will commit about €5,2 million to build the bridge.



Figure 6C3 The equivalent sound level $Leq\ 24h\ dB(A)$ at Bölesholmarna in Umeå river has been calculated in noise map below 35 dBA. To the right, an image of planned pedestrian bridge to Bölesholmarna in the city center at Umeå River.

This autumn, the old playground in the park Hedlundadungen will be rebuilt. The sound levels in the central parts of the park are low 45-50 dBA (Leq) which is a reason why this specific park is chosen to be developed as a more attractive meeting place and a place for children to be in. Umeå will commit about €1,4 million .



Figure 6C4 Image of the playground in the park Hedlundadungen that will be rebuilt this autumn. The park has a low level of background noise.

Holistic/qualitative approaches to the acoustic environment

As European Capital of Culture in 2014, Umeå sees sound, nature and culture as intertwined in the fabric of the city. One example is the upgraded railway station in downtown Umeå, and “Lev! (Live!) – a soundscape-like installation inspired by the works of the regionally acclaimed author Sara Lidman. The installation, the largest glass art work in Europe, opened in November 2012 inspired from train travel through a birch tree landscape, and is illustrated in sound by bird-song and the author reciting from her work.



Figure 6C5: The art-work “Lev!” (Live!) with sound installations at Umeå central railway station. By FA+ Ingrid Falk and Gustavo Aguerre in collaboration with The Sara Lidman Society, White Architects, The City and Traffic Authorities .

6D References

Action plan against noise pollution 2013-2018. Municipality of Umeå (in Swedish only):

www.umea.se/buller or direct link:

<http://www.umea.se/download/18.73474df7141ec1b19d1314b/1383204535120/%C3%85tg%C3%A4rdsprogram+mot+Buller+2013-08-26.pdf>

The Umeå Noise map, actions plan and information of contribution to property owners for noise measures (in Swedish only): www.umea.se/buller or direct link:

<https://secure.app.umea.se/mapserver2012/fusion/templates/mapguide/GSViewerFusion/index.html?ApplicationDefinition=Library%3a%2f%2fMiljo%2fBuller%2fBullerkarta.ApplicationDefinition>

Comprehensive plan, Municipality of Umeå (in Swedish), 2011 (in Swedish only)

<http://www.umea.se/umeakommun/kommunochpolitik/planerochstyrdokument/utvecklingochplanering/stadsplaneringochbyggande/oversiktsplan.4.bbd1b101a585d7048000168114.html>

In depth comprehensive plan for the city centre:

<http://www.umea.se/umeakommun/kommunochpolitik/planerochstyrdokument/utvecklingochplanering/stadsplaneringochbyggande/oversiktsplan/centralastadsdelarna.4.6d96946b127b1c6010c80002077.html>

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Mapping of surrounding noise and quiet areas in Umeå (2008) (in Swedish only)