CITY OF BERGEN

Blue-Green Infrastructure and Social innovation

Interreg
North Sea Region
BEGIN
European Regional Development Fund

EUROPEAN UNION

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City of Bergen (population 278.000)
The second largest city in Norway
Most rainy city in Europe

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City Masterplan for sewerage 2005 – 2015 adresses urban water possibilities

- Water in the City
  - Water planners, urban planners and gardeners should talk more together
  - Storm water should be considered a positive element and make the city more beautiful
  - Clean Storm water is a valued resource and should be used as a positive element in urban planning

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Masterplan for the city of Bergen

- Bergen shall have water and sewage systems that are robust and which can adapt to future population growth and Climate change including sea level rise and more heavy precipitation.

  Bergen shall be prepared to handle unexpected incidents.

  Adaptation to Climate Change shall be taken into account in the overall city planning

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How Bergen work regarding adaptation to Climate change

- **Storm water management**
  - **Requirement for Storm water plan for all area plans at early stage**
  - **A demand which is specified in the City masterplan (areaplan)**

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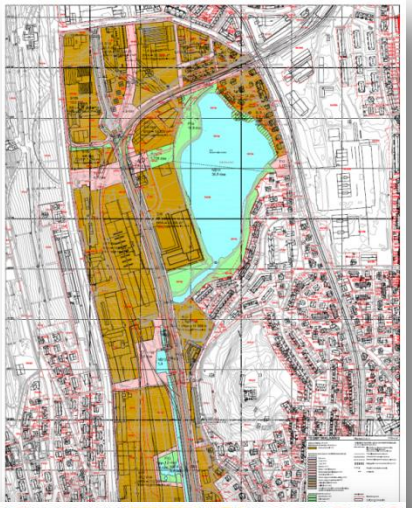
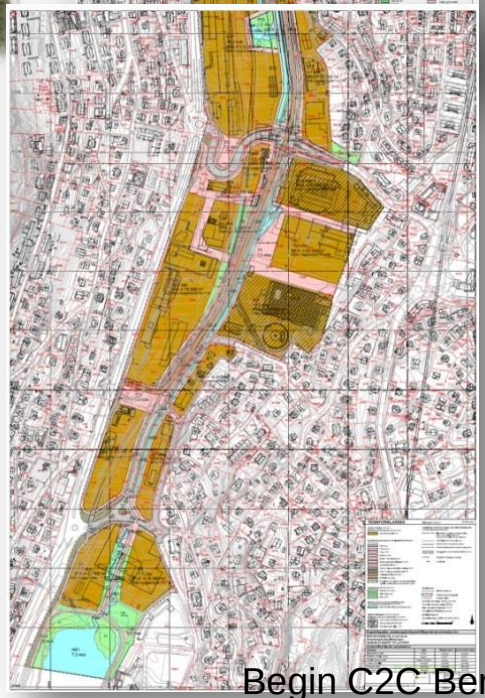
The municipal Master Plan in Bergen declares:

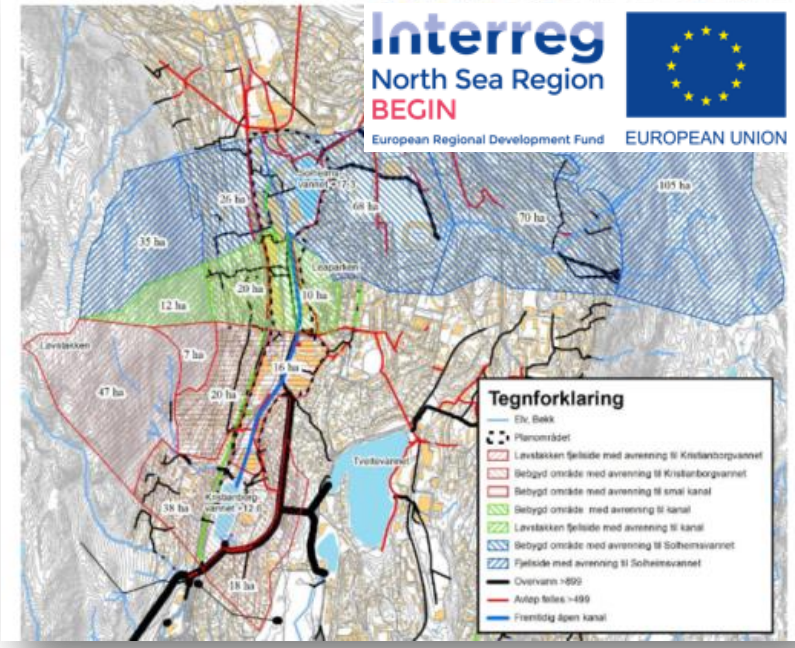
- *Chapter 20 Water, Sewerage and storm water handling*

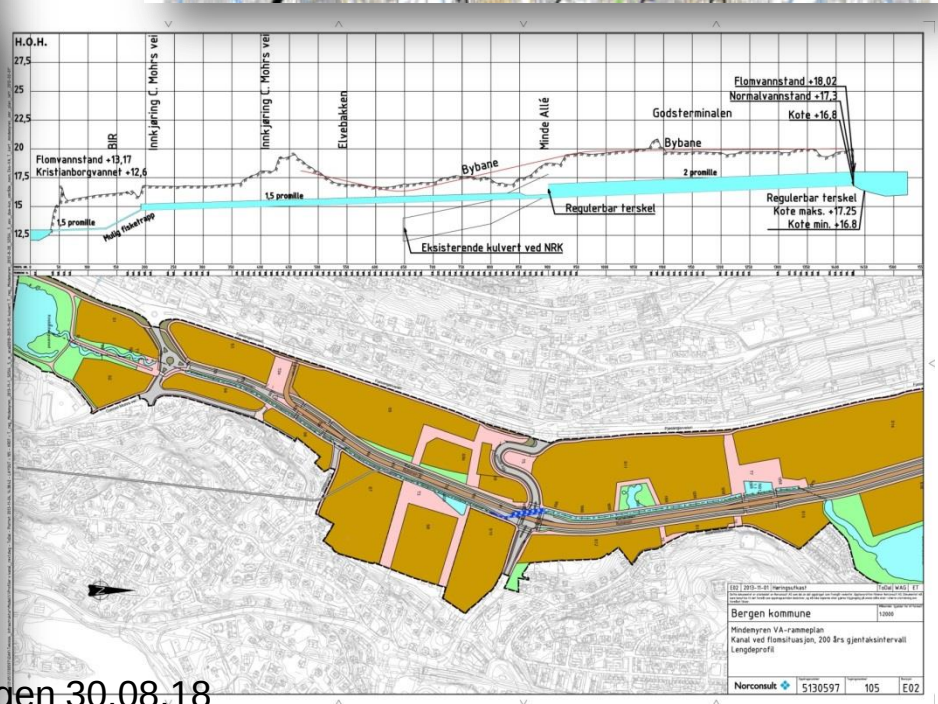
- A technical plan for water, sewerage and storm water should be made together with every area plan/zoning plan in the city befor approval process
- The plan shall draw up the principle solutions for handling water, sewerage and storm water.
- Precipitation/storm water should preferably be infiltrated into the ground or in open waterways (blue-green consept - SUDS).
- The plan shall identify and secure neccessary areas for handling of storm water

Area Zoning Plan Mindemyren





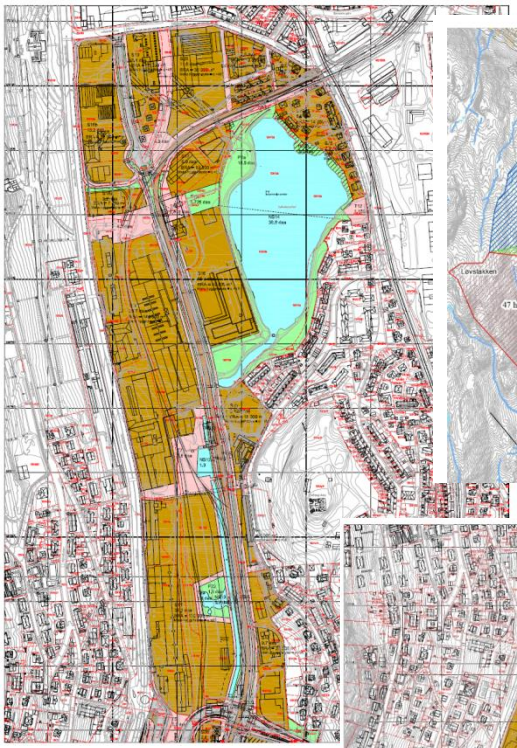


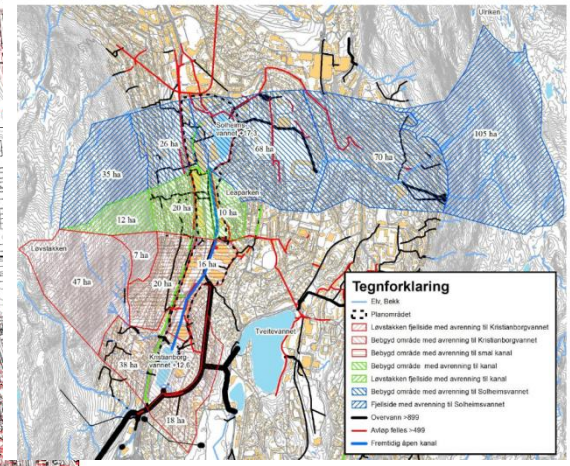


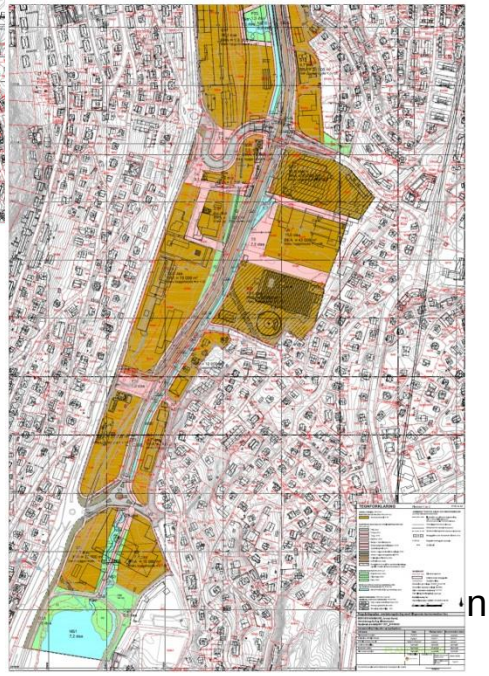
Mindemyren

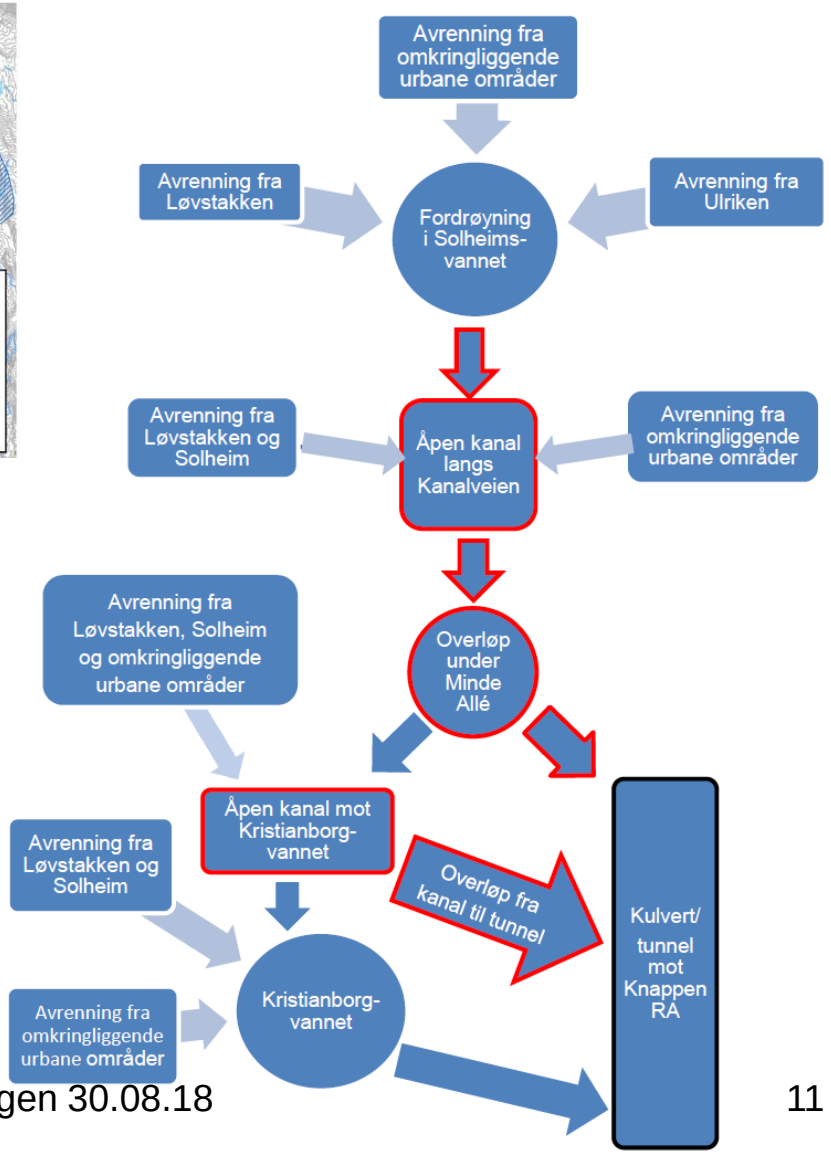
- New part of the city – 4.200 new apartments
- Light rail is going to be built through the area 2019-2022
- Important issue: How to develop the area with blue and green infrastructure
- Cooperation with inhabitants and stakeholders

Design of Masterplan – Storm water and urban water system







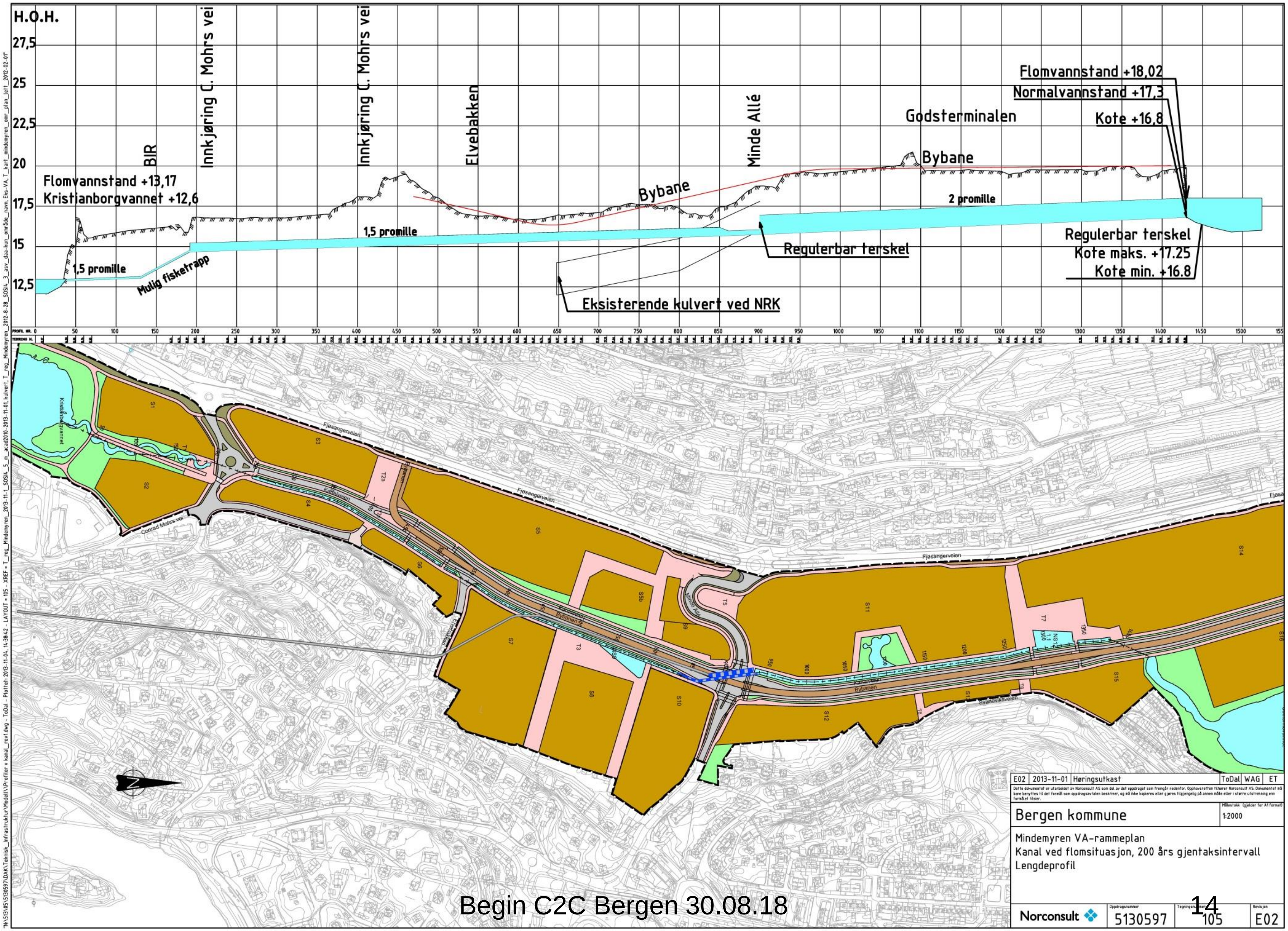


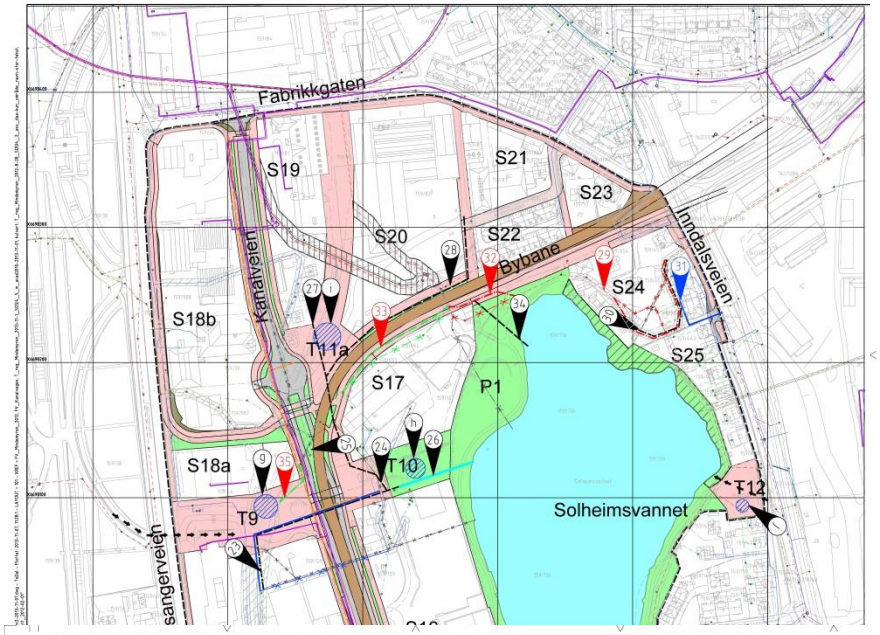
Calculation of runoff velocity channel from Solheim lake

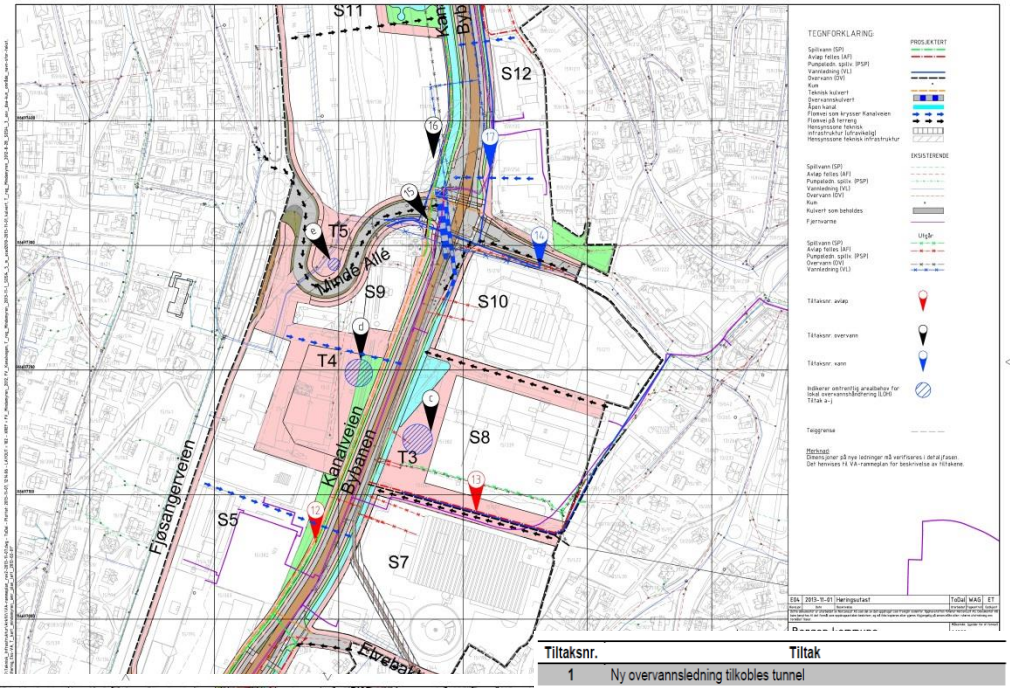
Gjentaksintervall	Dagens flom (separeringsgrad 20 %)	Fremtidig flom (separeringsgrad 80 %)	Fremtidig flom inkl. klimafaktor 1,5
2	3 m^3/s	6 m^3/s	9 m^3/s
10	4 m^3/s	7 m^3/s	11 m^3/s
100	6 m^3/s	10 m^3/s	15 m^3/s
200	7 m^3/s	11 m^3/s	17 m^3/s

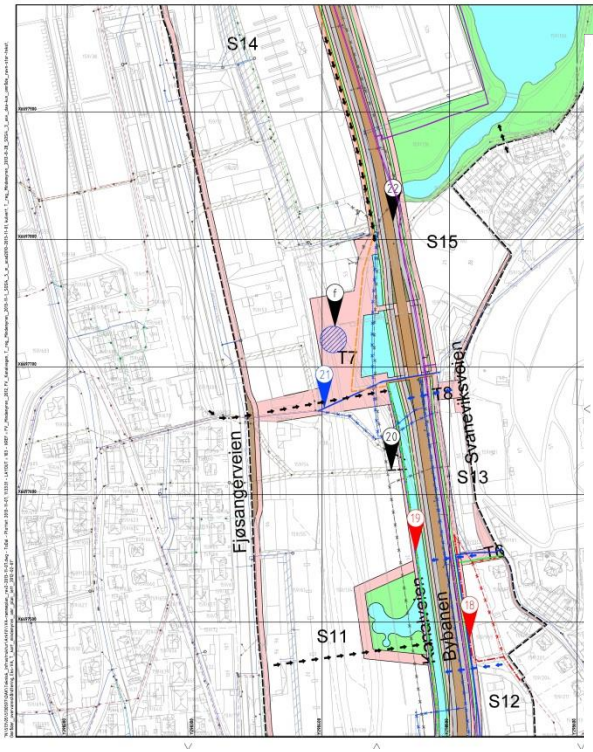
Calculation of runoff velocity flowing to Kristianborg lake

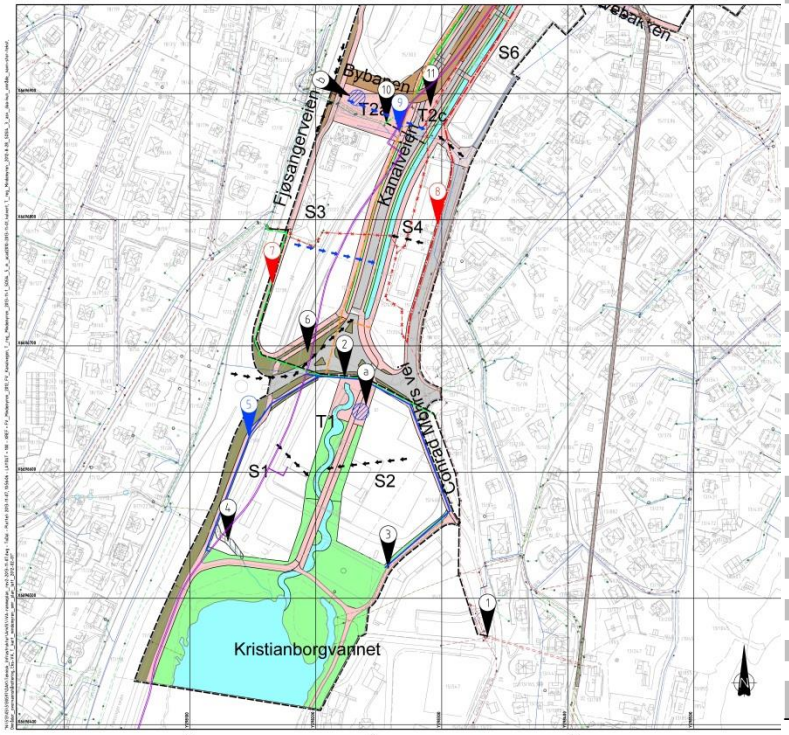
Gjentaksintervall	Dagens flom (separeringsgrad 30 %)	Fremtidig flom (separeringsgrad 80 %)	Fremtidig flom inkl. klimafaktor 1,5
2	1,6 m^3/s	3,4 m^3/s	4,1 m^3/s
100	2,8 m^3/s	6,0 m^3/s	9,0 m^3/s
200	3,0 m^3/s	6,4 m^3/s	9,6 m^3/s


H.O.H.
27,5
25
22,5
20
17,5
15
12,5
BIR
Innkjøring C. Mohrs vei
Innkjøring C. Mohrs vei
Elvebakken
Minde Allé
Godsterminalen
Flomvannstand +18,02
Normalvannstand +17,3
Kote +16,8
Flomvannstand +13,17
Kristianborgvannet +12,6
Bybane
Bybane
2 promille
1,5 promille
1,5 promille
Mulig fisketrapp
Regulerbar terskel
Regulerbar terskel
Kote maks. +17.25
Kote min. +16.8
Eksisterende kulvert ved NRK
Fjøsangerveien
Fjøsangerveien
Fjøsangerveien
Conrad Mohrs vei
Minde Allé
Bybanen
Svaneviksveien
E02 2013-11-01 Høringsutkast ToDal WAG ET
Bergen kommune
1:2000
Mindemyren VA-rammeplan
Kanal ved flomsituasjon, 200 års gjentaksintervall
Lengdeprofil
Norconsult
5130597
105
E02





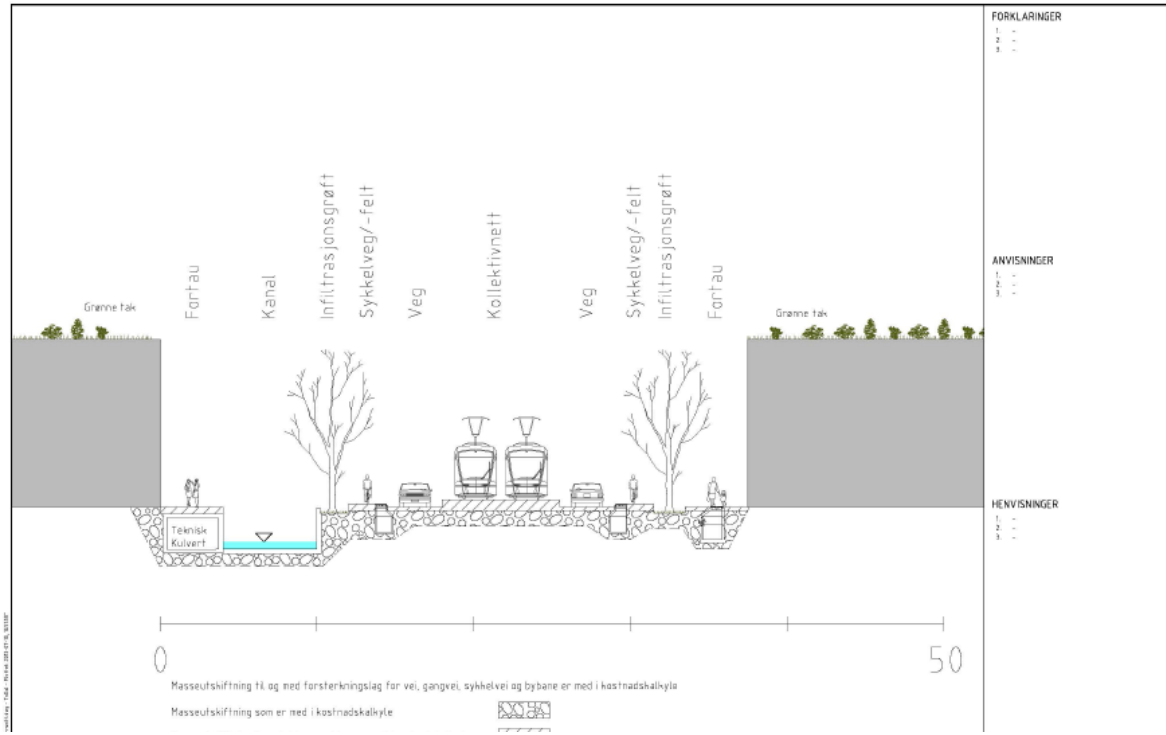


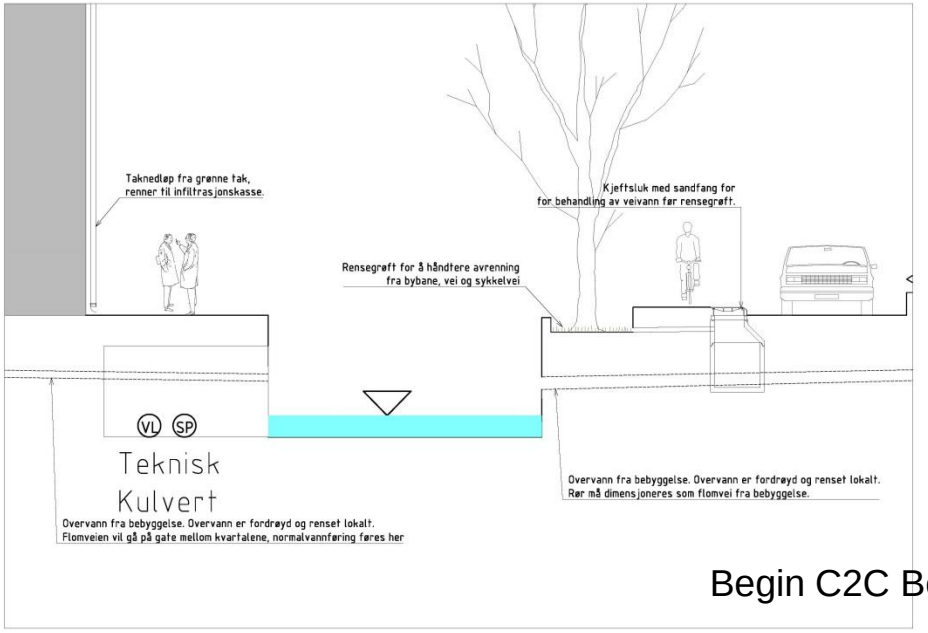


Tiltaksnr.	Tiltak
1	Ny overvannsledning tilkobles tunnel
2	Overløp i kanal
3	Tilkobling OV for område S2
4	Bevare åpen bekk
5	Ny VL for vannforsyning til områdene S1 og S2
6	Areal for rensing av veivann i grøntområder ved rundkjøring
7	Omlegging og separering av AF
8	Omlegging AF
9	Omlegging VL for kryssing av kanal
10	Utløp OV til kanal
11	Område for rensing av veivann
12	Ny spillvannsledning
13	Omlegging av AF, OV og VL
14	Omlegging VL for kryssing av kanal
15	OV utløp fra rensetiltak langs vei
16	Overløpskonstruksjon under krysset
17	Ny VL for vannforsyning til området S12
18	Omlegging AF 1000
19	Teknisk kulvert med VL og SP
20	2 stk. Utløp OV fra Løvstakken til kanal forlenges
21	VL legges om.
22	Innløpskonstruksjon til kanal
23	Omlegging OV fra S14 og Løvstakken
24	Omlegging OV fra S18 og Løvstakken
25	Regnbed for veiavrenning
26	Åpen kanal
27	OV fra S19, S20 og T1. Dimensjoneres som flomvei.
28	OV fra S21, S22 og S23. Dimensjoneres som flomvei.
29	Omlegging av eks. AF henhold til egen VA-rammeplan.
30	Omlegging av eks. OV henhold til egen VA-rammeplan.
31	Ny vannledning for brannvann
32	AF legges om pga. konflikt med området S17.
33	SP legges om pga. konflikt med området S17.
34	OV legges om pga. konflikt med området S 17.
Blå sirkler	Indikerer arealbehov for lokal overvannshåndtering på torg.

BERGEN KOMMUNE

Sketches of main street

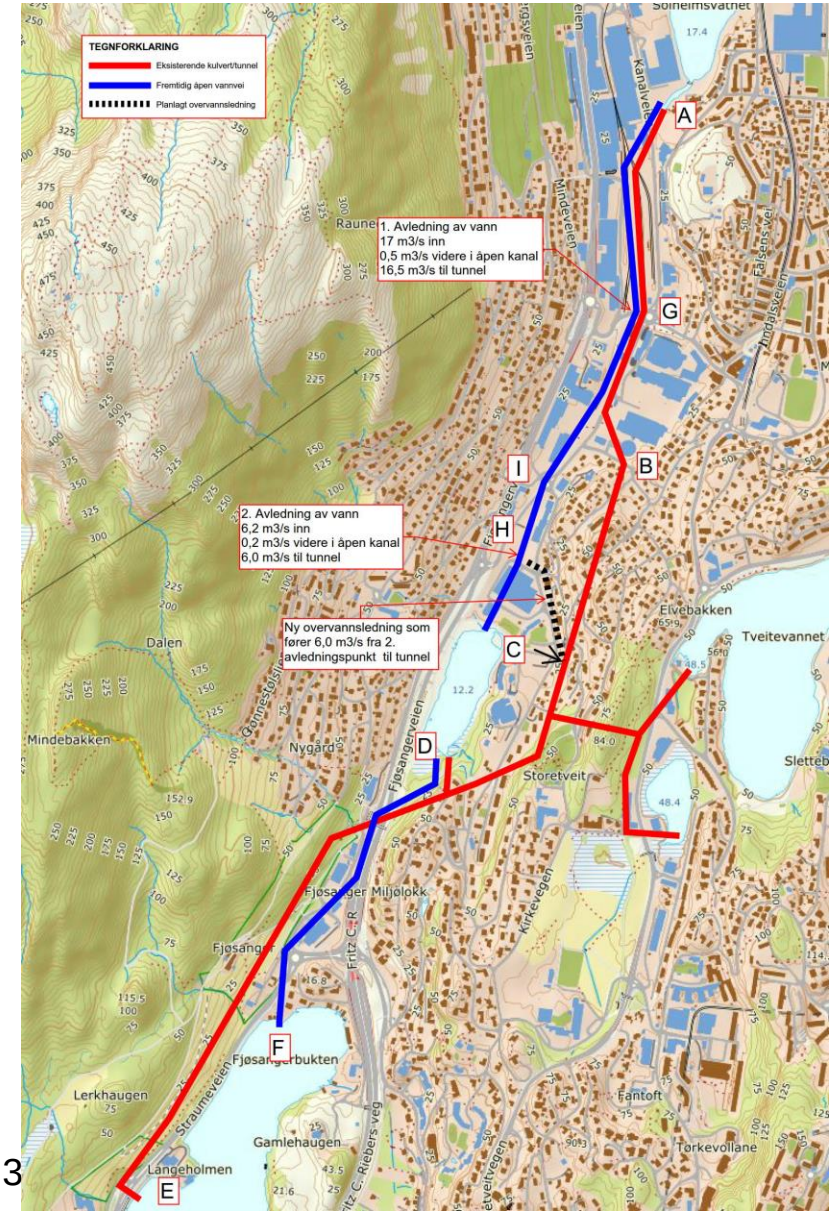




Further developments in planning.
5 Goals

1. Robust watersystem;
2. Visual Water;
3. Safer environment without fences;
4. Seatrout return;
5. Rail more smooth (no bumbs).

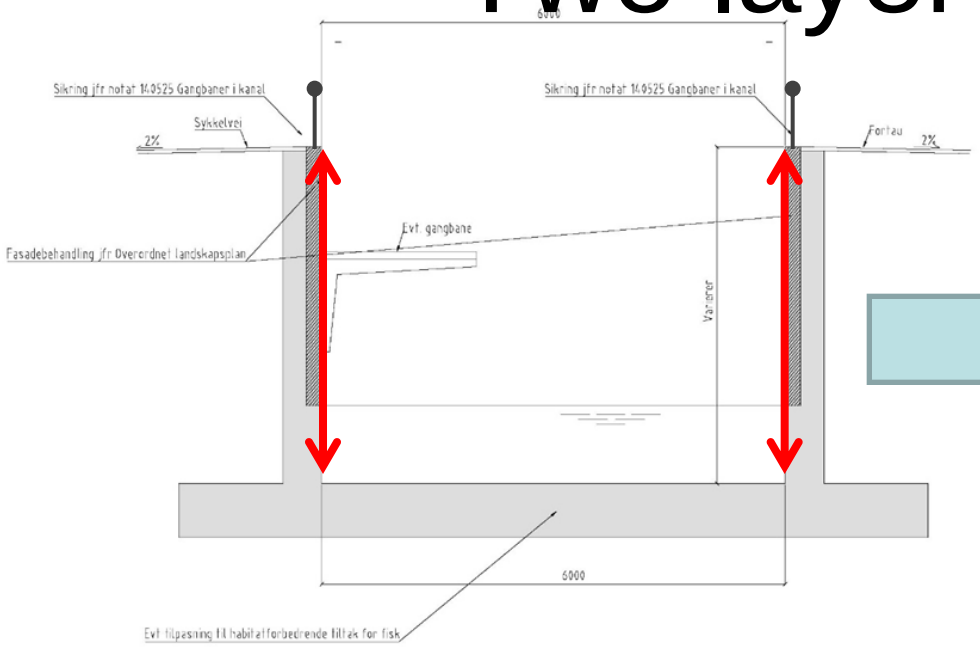
Design study - SWECO

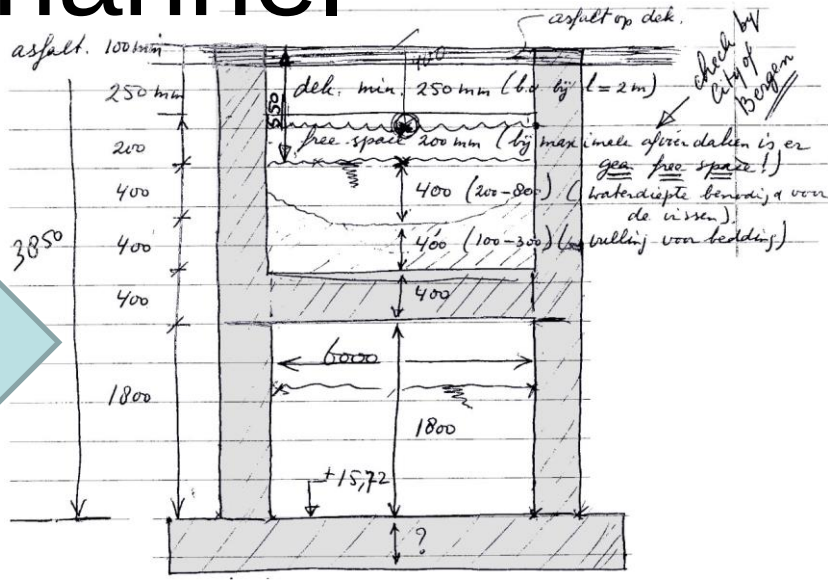


Design tools: the sound of water

Sweco

Two layer channel

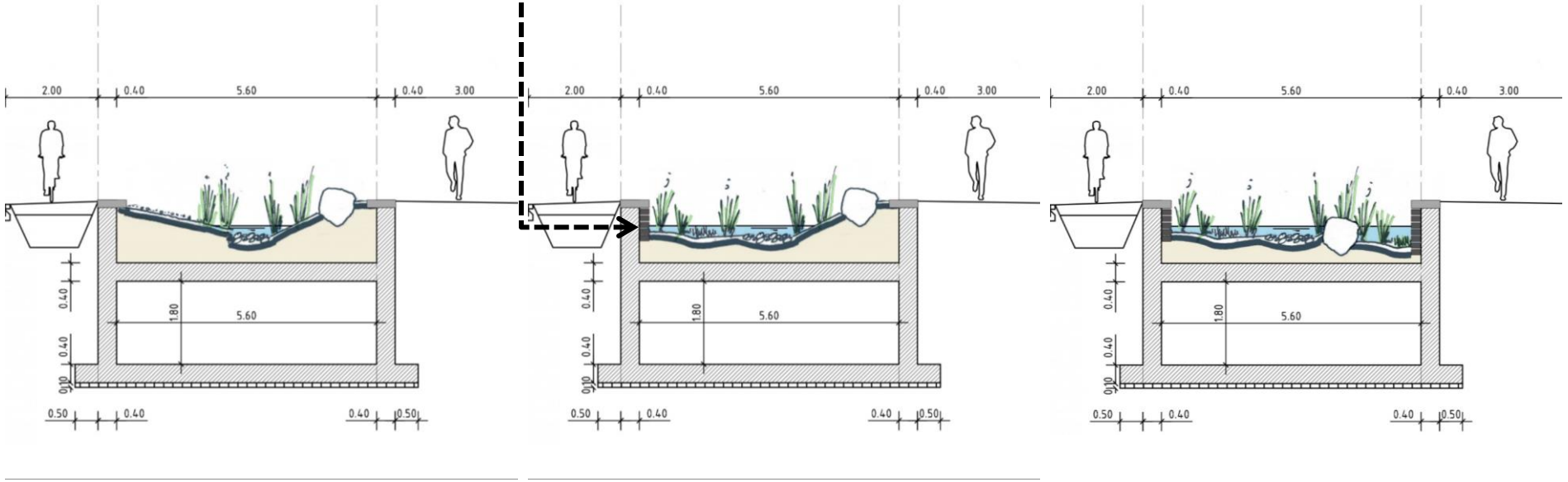




- Water invisible (very low)
- Sometimes really high walls
- A lot of fencing

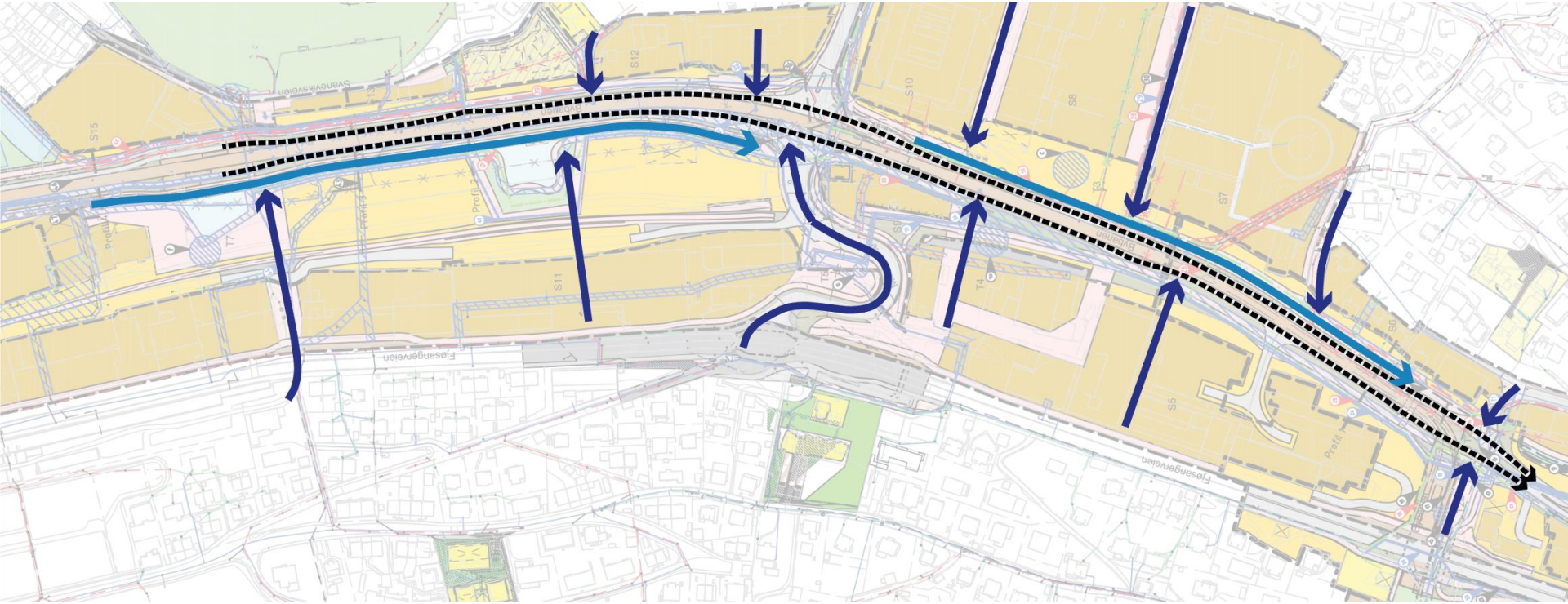
- Visual water (all perspectives)
- Green blue structure
- Attractive for the future development

Stones of the old railtracks as cover of the channel



Sweco

Flood ways



Surface runoff

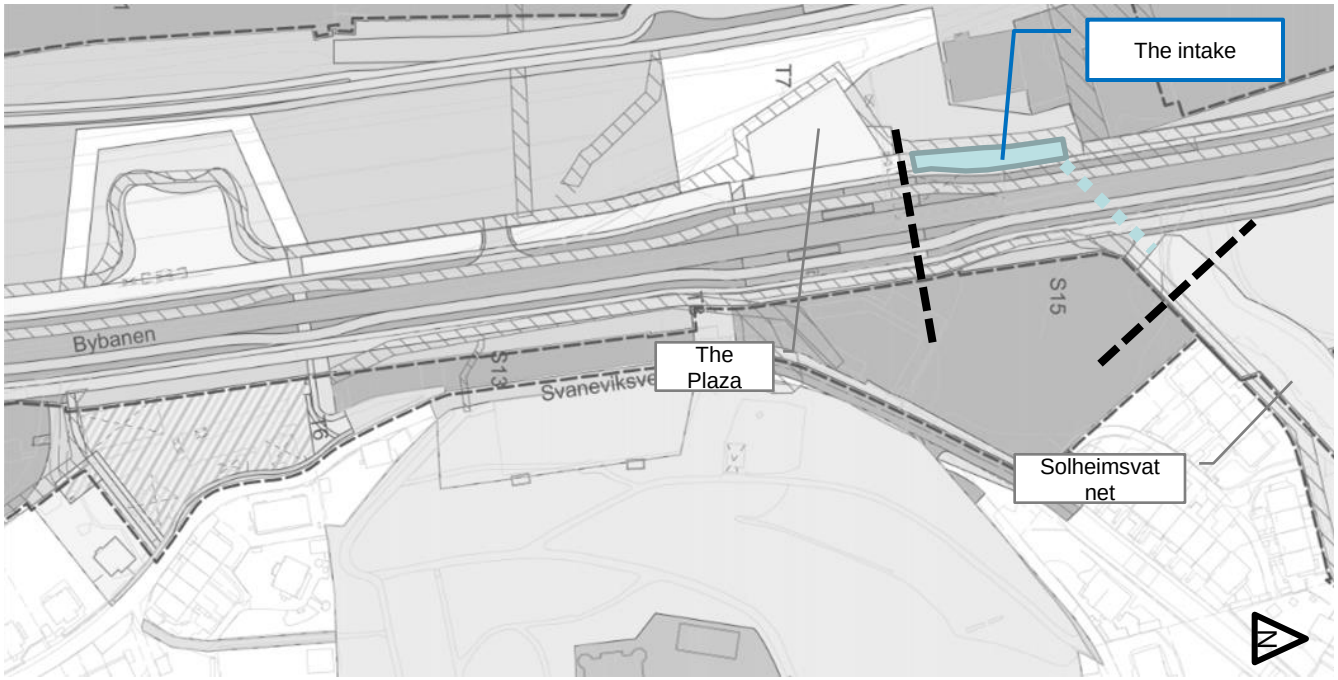
Top channel

Roads

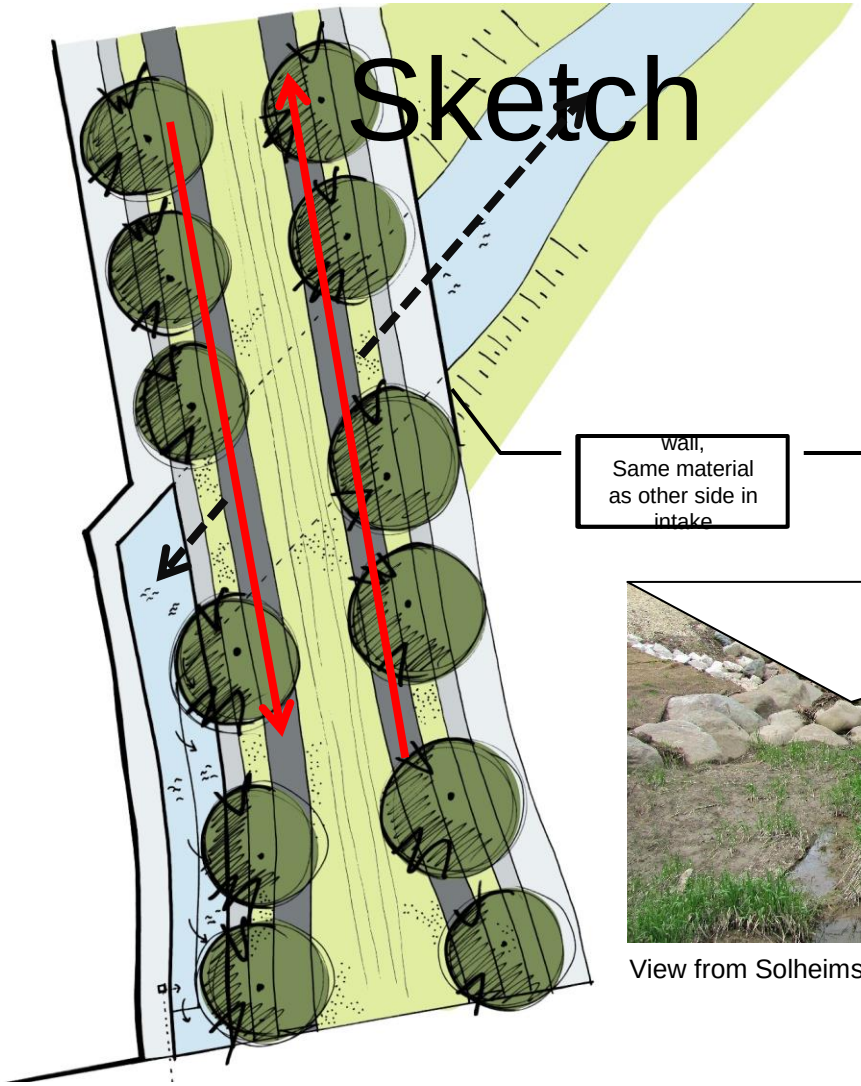
Sweco

1. THE INTAKE

Overview


The intake
T7
S15
Bybanen
S13
Svaneviksve
The Plaza
Solheimsvat net

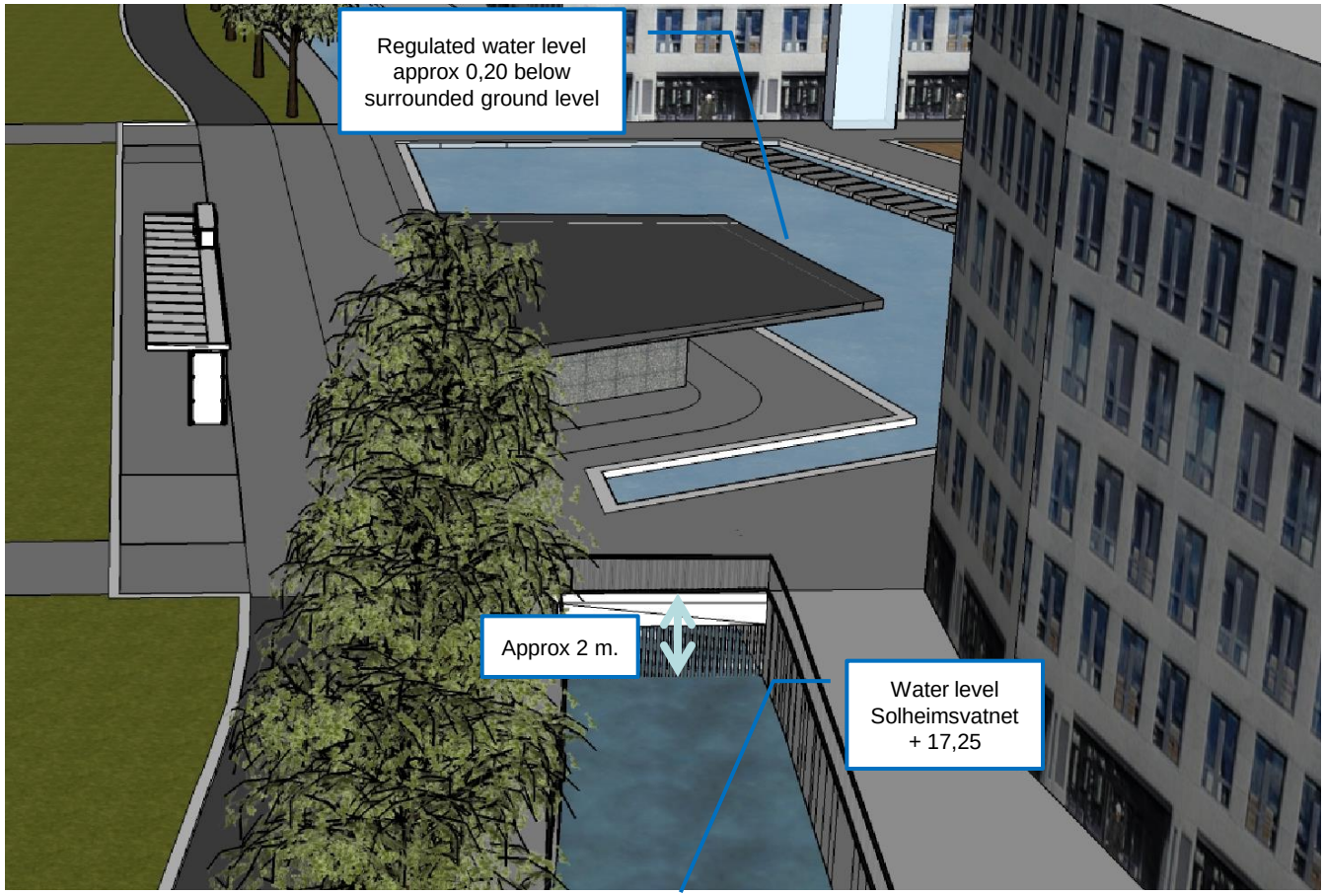
Sketch



View from Solheimsvatnet

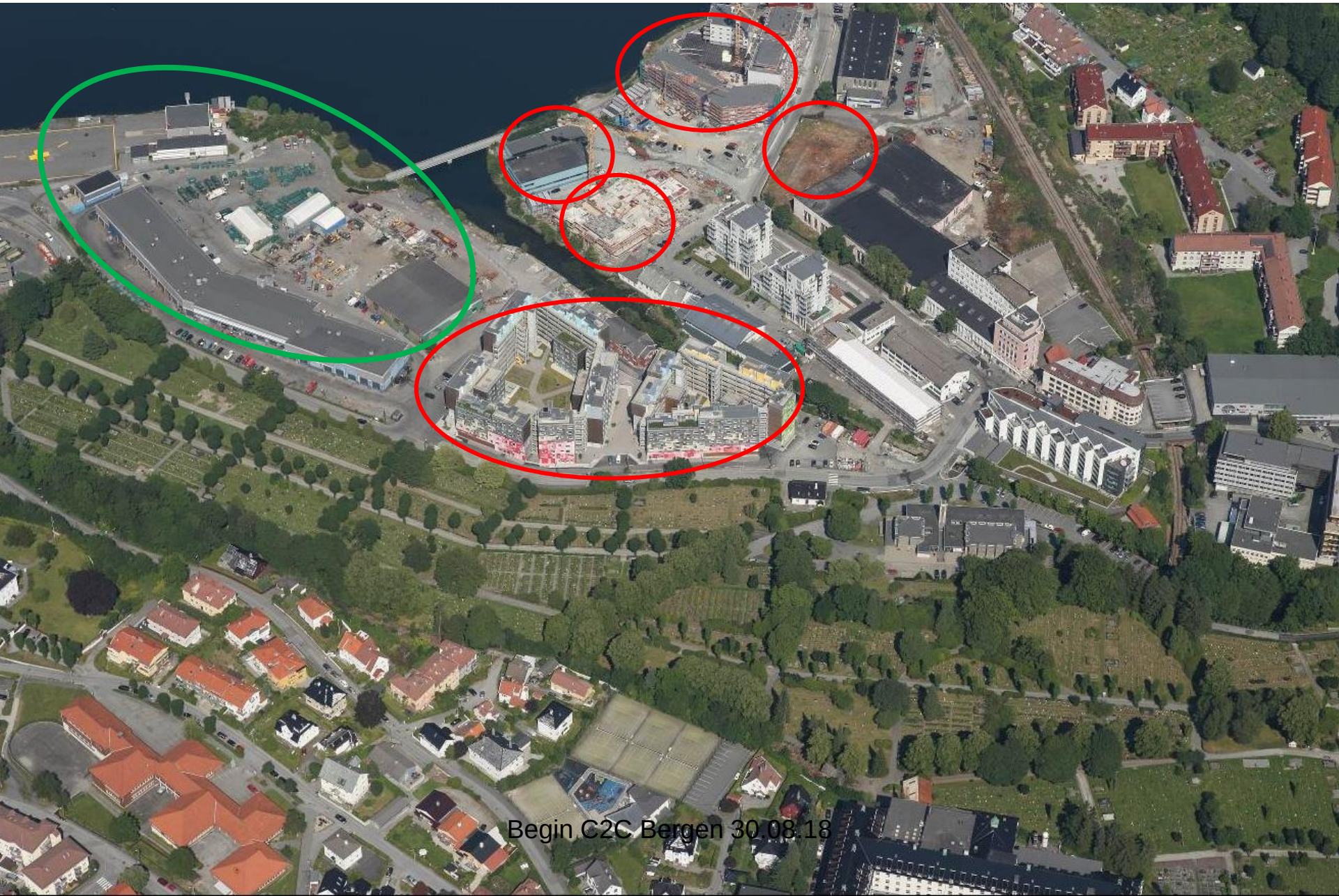
Sweco

Height difference with the water on the plaza



Height difference with the water on the plaza

Møllendal July 2014




Property Contracts, examples
Beach Park
Public Area
FG Eiendom private company
Bergen Academy of Art and Design
BiR – waste management
The municipality of Bergen
River Park
Tara eiend.
Møllendalsvn
Møllendalsvn.
SiB – student Welfare Organisation
Møllendalsbakken

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Interreg North Sea Region BEGIN European Regional Development Fund

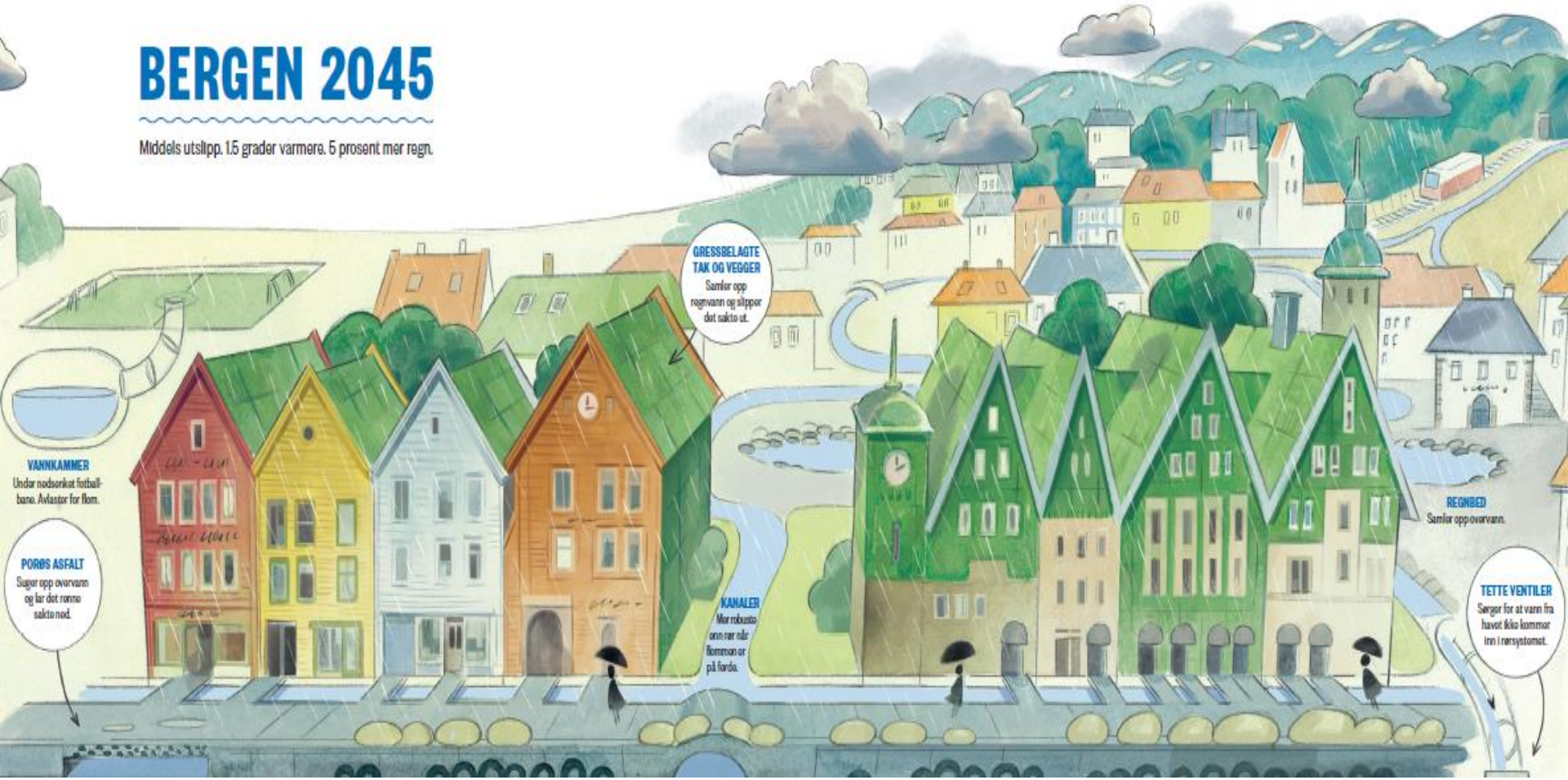
EUROPEAN UNION

BEGIN-team Bergen

- Department of Urban development
  - Agency for Water and Sewerage Works
  - Agency for Urban Environment
  - Agency for Planning and Development Control
  - City Architect
- Departement of Climate, Culture and Business
  - Climate Section
  - Agency for Agriculture
- Department of Social Services, Housing and Inclusion
- Head of the City Governments Department
  - Section for Civil Protection and Emergency Planning

BERGEN
KOMMUNE

Thank you for your attention!



Illustrasjon fra Morgenbladet

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City masterplan

- Bergen must achieve sustainable growth that protects the climate and environment
- Bergen must promote green architecture and renewable energy
- Bergen must encourage smart, green mobility that makes better use of the transport network's capacity
- The city authorities must promote joint use and a sharing culture so that resources are used more efficiently
- Bergen must facilitate, and support, a green transition in the research and business communities

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Adaptation to Climate Change

- **Climate change**
  - We have to take climate change into account in practical planning and design
  - Influences both water supply and drainage
  - Water in the city - robust drainage systems - floodways
    - Sustainable Urban Drainage Systems (SUDS)
    - The blue-green concept
  - Safe handling of storm water and flooding situations
  - Risk management and flood plans
  - Better systems for financing storm water systems (SUDS) is needed

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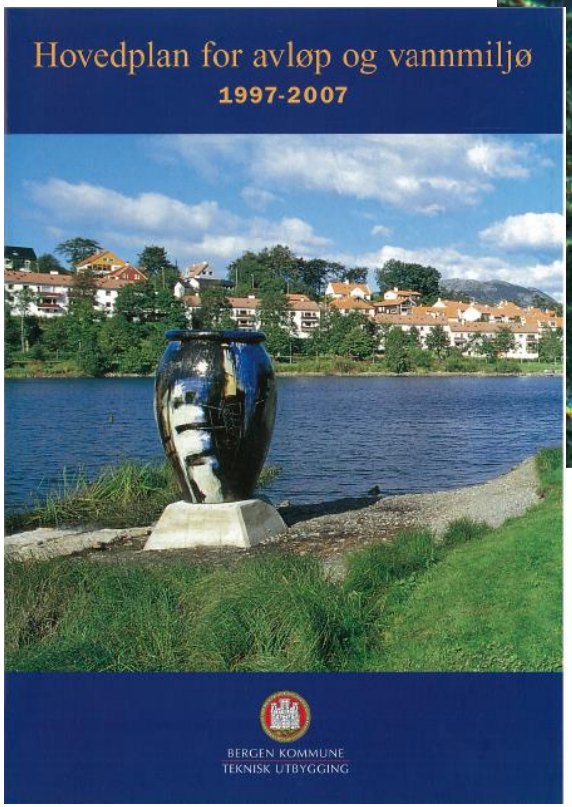
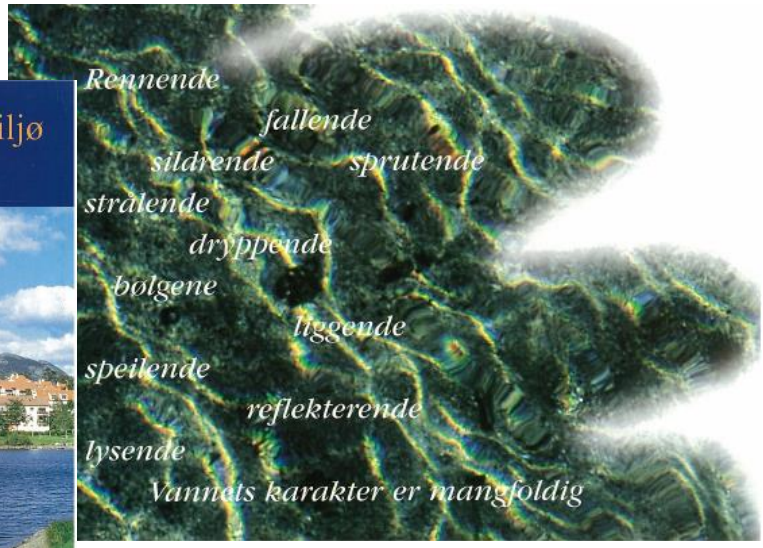
City Masterplan for Sewerage and Water Environment 1997 -2007

- **The City and the Water**
- **Cityvision 2020**
  - *Water as an important part of the quality of environment*
  - *Water should be valuated in city planning*
  - *Plays together with the Green plan for Bergen*





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- ***Water in the City***
  - ***Water planners, urban planners and gardeners should talk more together.***
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  - ***Clean Storm water is a valued resource and should be used as a positive element in urban planning.***

BERGEN KOMMUNE

Masterplan for Sewerage and Water Environment 2005 - 2015

- Focus on watercourses and water environment in the city
  - *Prioritizing watercourses and bathing places*
  - *Coordination with plan for watercourses oordinering*
  - *Choose of measures from an enviromental perspective*

BERGEN KOMMUNE

Masterplan for Sewerage and Water Environment 2005 - 2015

- Focus on watercourses and water environment in the city, 2

  – *Focus on storm water in the city as part of adaptation to climate change*
  – *Local handling of storm water – if possible*
  – *Consider and make water as a positive element in urban areas*

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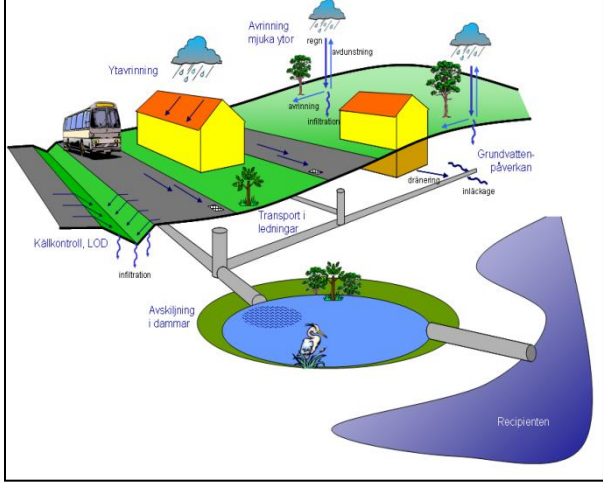
Sustainable management of surface water.



- Safety of citizens (life, health, economy)
- Avoid flooding and ensure that flood water is diverted into designated areas (temporary flood routes) away from buildings so they cause minimal damage.
- Ensure that flood risk areas are not developed
- Ensure the best possible water quality for surface water
- Reduce the overflow from the waste water system.
- Protect the vegetation areas within urban areas
- Make good use of the existing waterways in the design of new urban areas. Avoid replacing streams with pipes.
- Good planning can avoid disasters

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Guidelines for Surface Water Management in the city of Bergen

http\\www.bergenvann.no