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for Climate Change Adaptation

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Wuppertal Pilot:
Product Validation Report V2

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0.5	2012-03-02	Lars Gidhagen	Co-ordinator approval

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1. Management Summary

This document D6.3.2 Product Validation Report V2 provides an assessment on the usability of the SUDPLAN product from the Wuppertal pilot's point of view.

After an experimentation phase, the pilot validations are performed in two steps. The first is for WP leaders and site leaders to encourage as many relevant individuals as possible to fill in the LimeSurvey web questionnaire. The second step is to merge the answers of these testers into this pilot product validation document. In an organization like the City of Wuppertal it is extremely risky to confront the intended end users with software that is under development without any attendance and explanation. To avoid aversions to SUDPLAN it was necessary to perform structured interviews with the testers and to fill in the questionnaire together. Moreover, this avoids misunderstandings of the English questionnaire.

In V2 the testers should cover the following different categories of primary and secondary users foreseen for the Wuppertal pilot application (cf. D6.1.3): storm water managers and system administrators as primary users, urban planners representing other departments of the urban administration as secondary users.

The results of the validation LimeSurvey questionnaire comprise input from one storm water manager who is responsible for the specification of the functional requirements for the Wuppertal pilot, one system administrator who will be in charge of running the application in the future and one environmental planner who potentially will evolve into a primary user in the SUDPLAN air quality domain. In addition one IT expert who represents Wuppertal in the project meetings filled in the questionnaire and led the interviews with the other contributors. He also covers the professional profile of an urban planner (Land Registry Office) and may therefore be regarded as another secondary user. The inclusion of storm water managers working for other organizations, e. g. Wuppertaler Stadtwerke (WSW) and Wupperverband (WV), is planned not until the validation of V3, since it is even more demanding to involve external personnel in the validation of software that is in need of explanation.

The results of the LimeSurvey questionnaire after project's second year (2011) are collected in Annex A and also summarised in the main text document. The following conclusions can be aggregated based on the Wuppertal product validation V2:

- To make the Wuppertal pilot application self-explanatory and easy to use a lot of descriptive information for all objects in the SMS catalogue has to be provided on the description pages. The same applies for the WMS layers of the overall system and for the climate models and scenarios mentioned in some of the wizards.

- In some of the dialogues contextual information is missing that would be helpful to guide the users through the more complex workflows.

- The communication between the Wuppertal pilot application and the Common Service "Rainfall" works well in principle though some minor issues have to be fixed. The tools to identify an extreme storm water event in a time series and to extract and store it as a rainfall event have to be implemented in P3. The computation of an "Euler 2" model rainfall event from an IDF table is still missing, too.

- The integration of the local models GeoCPM and DYNA is satisfactory. Two identified advanced methods to manipulate the Digital Elevation Model have to be implemented in P3.

- The 2D visualizations already part of the pilot application are sufficient for the basic work with the system. However, the visualization of simulation results in 2D is only required in simple maps. The more sophisticated 3D and 4D visualizations are expected to be provided by the forthcoming component "Visualization wizard".

- The WMS layers providing information about climate change all over Europe are useful for general risk assessments and to raise awareness of this issue in discussions with politicians and decision-makers. For concrete urban planning processes Air Quality Downscaling would be necessary.

- The integration of external services is easy with OGC services. At the moment, there is no direct support of more general services like SOAP services, however this is not required to finalize the Wuppertal pilot application from today's point of view. The communication with back-end services via SPS/SOS is functional but appears to be time consuming.

All participants in the validation process agreed that SUDPLAN applications like the Wuppertal pilot have got the potential to become powerful tools for introducing climate change considerations into urban planning processes. The Wuppertal pilot application itself is expected to evolve both into a stable component of Wuppertal's SDI and into an essential tool for the mid- and long-term planning of Wuppertal's sewer system. However there is a significant amount of work to do in P3 including the development of some key functionalities of the Wuppertal pilot application.

2. Methodology

The common methodology for all V2-V3 Product Validation Reports is described in detail in D2.1 Product Validation Plan (revised after 1st ATR) document dated June 15, 2011; hereafter only referred to as D2.1 Product Validation Plan.

2.1. Documents involved

D2.1 Validation Plan describes the methodology used for the deliverables D[5-8].3.x Product Validation Report and the three versions of deliverable D2.2.x Validation and Evaluation Report.

The D[5-8].3.x Product Validation Report objective is to validate the usability of the SUDPLAN product from the Pilot's point of view. There are three versions of the D[5-8].3.x Product Validation Report for each of the four pilots. These are used as the main input for the three versions of the D2.2.x Validation and Evaluation Report.

Each of the three versions of the D2.2.x Validation and Evaluation Report summarises the input from the four instances of D[5-8].3.x Product Validation Report from the pilots. Here a main focus is the potential usability of the SUDPLAN product beyond the project and for an arbitrary city in Europe. Furthermore the SUDPLAN product is assessed against the impacts expected by the call which are defined as SUDPLAN objectives in the DoW.

A table of all documents used or referenced in this deliverable is given in the Section 6 at the end of this document.

2.2. Validation aspects

2.2.1 Professional profiles taking part of pilots product validation

The pilot validation procedure has been performed in two steps. The first is for WP leaders to encourage as many relevant individuals as possible to fill in the LimeSurvey web questionnaire. The second step is to merge all individual answers into this pilot product validation document. The criteria for identifying the persons that should fill in the questionnaire is that they know about SUDPLAN as being either a developer, a primary (using the system hands on) end user or a secondary (using SUDPLAN results without operating the system) end user. More formally SUDPLAN defines three types of professional profiles that are suited to validate the product:

- Analysts – primary users: End users of SUDPLAN output, e.g. city planners or their technical staff, working directly with the system.
- Analysts – secondary users: End users of SUDPLAN output, e.g. city planners or their technical staff, using SUDPLAN results but without working directly with the system.
- Modellers: Developing, integrating and configuring the different models of the type used in SUDPLAN applications for a city. They are considered secondary end users, as they normally do not work directly with the system.

- System Managers: Installation, maintenance and system administration. They are considered secondary end users, as they normally do not work directly with the system.

The results of the validation LimeSurvey questionnaire should include impressions from all four professional profiles, but one individual can only belong to one professional profile.

2.2.2 Interaction between WP3 and WP4 and usability of the SUDPLAN Product

This deliverable assesses and documents the usability of the main results of WP3 Scenario Management System and WP4 Common Services for the SUDPLAN pilot applications.

The summary and generalization of the pilot validations are compiled as a part of the WP2 work, and reported in D2.2.x Validation and Evaluation reports. That document also draws conclusions on the pilot validations to provide feedback to WP3 and WP4. It is essential for them to know whether they are on track and where improvement or even changes have to be implemented. Furthermore, this document also assesses the independence of the implementation of the SUDPLAN product from the specific pilots and the usability for an arbitrary European city.

In order to allow overall project evaluation, all four Product Validation Reports have to be based on the document template provided by WP2.

2.3. Rating

SUDPLAN product validation contains questions of the following types:

1. Rating starting with 1 for lowest (not fulfilled at all) to 7 for highest rating (fulfilled beyond expectations, which should be awarded only in exceptional cases and explained in the text), or NA (not applicable). Please answer the question with NA rather than leaving it open in the case you are for any reason unable to answer the question. Please give here the number of answers given for each alternative. ***Example where 5 persons related to this pilot have filled in the questionnaire:***

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Define scenario:			*2*		*1*	*2*		
Execute scenario					*1*	*3*		*1*

2. Rating from 0 to 7 indicating the comparison with e.g. state of the art solution, with 4=on pair with the state of art, 1=way below state of the art, and 7=way above the state of the art. NA can be used to indicate that the comparison is impossible, useless or beyond your knowledge. Please give here the number of answers given for each alternative. ***Example where 5 persons related to this pilot have filled in the questionnaire::***

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Compared to state of the art solutions					*2*	*2*	*1*	
Compared to SUDPLAN project objectives					*1*	*4*		

3. Yes|No|NA type of questions. Please give here the number of answers given for each alternative. ***Example:***

Dynamic workflow composition supported by	Y	N	NA
Pilot application:		5	
SUDPLAN product:	4		1

4. Multiple choice questions, where a single question can have only a limited number of answers. (with or without NA). Please give here the number of answers given for each alternative. For example, in Q 2.2.1 the users are asked to list the SUDPLAN service interfaces and indicate their type (OS = Existing Service Interfaces with open standard specifications, re-used in the SUDPLAN; P = Existing proprietary Services with no open specifications, re-used in the SUDPLAN (if any); (N) New service Interfaces defined in the SUDPLAN (if any):

Service interface	OS	P	N
Dummy 1:			
Dummy 2:			
Dummy 3:			
Dummy 4:			

5. Free text fields are used to collect overall impressions and comments beyond the simple yes/no or rating level. Quite often, the users are given the opportunity to explain the way a requirement has been fulfilled. In case of partial fulfilment or failure to fulfil the requirement, the description should also explain e.g.:

    - Which part of the requirement was not fulfilled?
    - Why the requirement was dropped/not fulfilled?
    - What are the consequences of not-fulfilling the requirement?
    - Will the requirement be fulfilled later (e.g. “planned for 2-nd development cycle”)

Note1: in some cases the number of answers may be larger than the number of free fields in the table. Feel free to add new table rows if needed.

Note2: In the first phase, the questionnaire has to be filled in before the release of the SUDPLAN tool. Consequently, the questions should be answered based on the software already made available, the mockups and specifications.

Note3: For the Wuppertal pilot a first running prototype of an integrated SMS was available very shortly before the validation report V2 had to be finalized, therefore only personnel of the City of Wuppertal was involved in the validation process. The validation by externals will be done on the basis of P3 results that will be close to the final application.

3. Validated components and aspects of the pilot product

The following table identifies the components and aspects validated during the V2 period, as well as how many individuals have given their opinion. A complete list of the validated requirements is given in Annex A.

A summary of the validation results is given in Section 4.

Components and aspects evaluated:	**V2**	**V3**
Graphical User Interfaces	4	
3D Visualisation	0	
Common Services: Pan-European visualisation	2	
Common Services: Rainfall	2	
Common Services: Air Quality	1	
Common Services: Hydrology	0	
Local models	3	
External services	1	
SOA interfaces	0	
SOA services	0	
Usage of standards	1	
Open source software	1	
Completeness of functionality	4	
Conclusions	4	

4. Summary

A complete list of all questions and answers in the LimeSurvey is available in Annex A. In V2 the testers should cover the following different categories of primary and secondary users foreseen for the Wuppertal pilot application (cf. D6.1.3): storm water managers and system administrators as primary users, urban planners representing other departments of the urban administration as secondary users.

The results of the validation LimeSurvey questionnaire comprise input from one storm water manager who is responsible for the specification of the functional requirements for the Wuppertal pilot (No. 4 in table below), one system administrator who will be in charge of running the application in the future (No. 2) and one environmental planner who potentially will evolve into a primary user in the SUDPLAN air quality domain (No. 3). In addition one IT expert who represents Wuppertal in the project meetings filled in the questionnaire and led the interviews with the other contributors (No. 1). He also covers the professional profile of an urban planner (Land Registry Office) and may therefore be regarded as another secondary user.

At the extended WP6 deadline February 28, 2012 we counted in total 4 persons in the LimeSurvey log, of which 2 persons are members of the SUDPLAN project.

In this section the characteristics of the validation participants are given, followed by summaries of the conclusions concerning the most important validated components and aspects.

4.1. Professional profiles and user categories of respondents

The following tables are taken from Annex A.

Name	1: Stefan Sander 2: Reinhard Verkennis 3: Ute Bücker 4: Bernard Arnold
E-mail address	1: stefan.sander@stadt.wuppertal.de 2: reinhard.verkennis@stadt.wuppertal.de 3: ute.buecker@stadt.wuppertal.de 4: bernard.arnold@stadt.wuppertal.de
Organization	1: City of Wuppertal, Land Registry Office 2: City of Wuppertal, Land Registry Office 3: City of Wuppertal, Environmental Agency (Environmental Planning) 4: City of Wuppertal, Environmental Agency (Coordination of urban drainage)

The particular interest and profile of the participants have been classified according to the following table (note that one person can be interested in more than one environmental risk):

Type of environmental risk	Analyst primary	Analyst secondary	Modeller	System Manager
Urban storm water flooding during intense rainfall	1			2
Dimensioning of sewage water systems				
Risks of flooding of rivers				
Hydrological conditions				
Air pollution	1			1
Other: Climate change (pan european use case)				2

SUDPLAN deals with both long term and short term planning. Apparently all of the questionnaire participants are interested both in short term and in long term planning where climate change is of importance.

Temporal planning interest	Y	N	NA
Present conditions and short term (<10 years) planning	4	0	
Long term planning (>10 years) planning	4	0	

This report is based mainly on persons that marked interest in the Wuppertal pilot. One analyst was interested in the overall application to get general information on climate change and air quality evolution.

Application	Y	N
Stockholm pilot	0	4
Wuppertal pilot	3	1
Linz pilot	0	4
Czech pilot	0	4
Overall application	1	3

The professional profiles have been classified according to the following table:

Type of user	Y	N
SUDPLAN team member	2	2
Analyst	2	2
Modeller	0	4
System manager	1	3
IT expert	2	2
Climate change expert	0	4
Have seen presentations and documentations	1	3
User of the SUDPLAN / model results	0	4

Type of user	Y	N
Working with the actual system	4	0

4.2. Summary for Graphical User Interfaces

A total of 4 persons gave input to this aspect. Most important comments:

Overall user friendliness is sufficient. It depends mainly on appropriate content on the description pages that are technically available for all objects of the SMS catalogue. Currently the GUI is a mixture of German and English.

Appropriate legends for 2D and 3D maps should be provided. Flexible definition of user styles or the possibility to select from different predefined styles would be helpful.

There is no strict workflow support, however this is not required for the Wuppertal pilot.

Definition and execution of scenarios is supported by appropriate wizards. Results are stored automatically in the repository. Thus they can be easily shared with other users. The visualization of the results is also generated automatically but currently only a fix style is available. Export in different formats is possible via WFS and WMS. Support of export in domain specific text formats for simulation results and for rainfall data is not implemented yet.

Visualization was only tested in 2D, where it is restricted to simple maps. 3D will provide the more sophisticated visualizations.

Temporal visualization of time series is possible via diagrams. This works fine in principle but the information given in the diagram has to be extended.

Comparison of simulation results is currently only possible in a poor style by overlaying map layers and playing with the transparency rather than providing statistical information. Comparison of time series (rainfall downscaling results) is possible by showing them in the same diagram. Map layers with differences of different simulation results might be useful.

Recurring task configuration and profiling of the GUI is supported by storing / loading user specific profiles that control the visibility of GUI elements, data and functionality. But this does not lead to a fully automatic eradication of predefined workflows.

Efficient work with the Wuppertal pilot applications requires a large display > 1280 x 800 px. Best usability is achieved with 2 displays. The usability with 3D Displays has not been tested yet.

There is neither a sophisticated error handling nor a contextual help system implemented yet.

Avoiding the reliance on the users' short term memory could be achieved, but a lot of "overlapping" contextual information is still missing. Ease of learning, memorability and transparency of the system depends on the availability of descriptive information on the description pages of all catalogue objects and in the abstracts of WMS layers.

4.3. Summary for Common Services: Pan-European visualisation

A total of 2 persons participated in the validation of this component. Comments:

There is no homogenous assessment of the number of different climate scenarios provided (ranked 2 of 7 and 5 of 7 respectively).

The spatial and temporal coverage of the provided climate scenario information is regarded as good (ranked 6 of 7).

Weak point: there is no scenario documentation available.

4.4. Summary for Common Services: Rainfall

A total of 2 persons participated in the validation of this component. Comments:

Both downscaling of time series and IDF tables is possible after P2. Problems with the format of the Wuppertal rainfall time series Buchenhofen have to be solved (no successful downscaling run yet).

The identification of a certain rainfall event is not adequately supported. Furthermore it must be possible to extract a certain part of the time series to use this as a rainfall event for a model run.

The computation of an Euler 2 rainfall event from an IDF curve is still missing.

4.5. Summary for Common Services: Air Quality

A total of 1 person participated in the validation of this component. Comments:

SMS and CS have not been tested for Air Quality The WMS layers of the overall system provide good information on the general influence of climate change, but they are to coarse for the usage in concrete urban planning. This would of course require the use of CS Air Quality Downscaling.

Long term air quality simulation is available with the time series provided via getFeatureInfo-request on the WMS layers of the overall system. This works well, although the performance is rather slow.

4.6. Summary for Local models

A total of 3 persons participated in the validation of this component. Comments:

Integration of a new local model requires Java programming skills, therefore it can't be done by the end user. Service chaining is not in the scope of the Wuppertal pilot application. Model validation, model calibration and distinguishing between model versions are not in the scope of V2.

Configuration of models: it would be better to enable the user to manipulate the height of a breaking edge directly on the map (enhanced feature renderer). Furthermore there is still a major functionality missing: it should be possible to change the height of all points of a certain part of the TIN - specified by a polygon - with a single operation.

4.7. Summary for External services

A total of 1 person participated in the validation of this component. Comments:

The usage of external services is restricted to OGC services (WMS and WFS configurable by the end user, SPS and SOS demand configuration by an administrator or developer.

It takes programming skills to integrate SOAP services (no task for the end user). The integration of SOAP services out of the box is not within the focus of the Wuppertal pilot application.

4.8. Summary for Usage of standards

A total of 1 person participated in the validation of this component.

The following set of OGC services was named as standardized services used in the SOA context by SUDPLAN: WMS, WFS, SPS and SOS.

WMS and WFS usage works well, but the performance of SPS/SOS used as interface for communication with the SUDPLAN Common Services is problematic.

4.9. Summary for Open source software

A total of 1 person participated in the validation of this component.

The *Cids Geointegration platform* and its SUDPLAN extensions are available as open source. The Cids platform is already in productive use in Wuppertal, providing the integration tier and the main part of the application tier of the city's SDI.

Most of the WMS layers used in the overall system are implemented with Geoserver, an open source framework for establishing OGC compliant web services.

4.10. Summary for Conclusions

A total of 4 persons participated in the validation of this component.

None of them had access to similar information as available in SUDPLAN.

Two persons considered the SUDPLAN output to be scientifically sound and credible, for the other 2 it was not possible to judge on the quality based on the currently available information.

Two persons stated the SUDPLAN output to be useful as a base for planning to a certain extent, while the other 2 regard it as even highly useful. The intended use covers the general assessment of risks coming from climate change, the raising of awareness for climate change issues and the concrete use in the planning of the sewer system in Wuppertal, mainly for the simulation of surface run-off after heavy storm water events. In the latter context the Wuppertal pilot application is regarded as the only tool that enables the planners to simulate the effect of different planning options in conjunction with the effects of climate change.

For 2 persons most information which they expected is given by the current SMS WP6 state. One person regards all aspects as covered, the last one states that a lot of information is missing. The following missing features were named: full integration of 3D visualization, easily understandable German descriptions of climate models and scenarios.

The graphical presentation of SUDPLAN results were considered to be ordinary for 2 persons, the other 2 regard them as excellent and contributing to a better understanding. It is criticized that the 3D and 4D visualizations are not yet integrated in the Wuppertal pilot application. Both maps and diagrams are considered to give a good understanding. The poor legends of the WMS-Layers and the missing connection between map- and diagram-representation of data are mentioned as weak points.

According to the 4 testers the strength of SUDPLAN output is:

- the chance to introduce climate change aspects into urban planning processes (lowered threshold)
- the availability of a tool that enables the simulation of different planning options in

combination with climate change considerations

- the possibility to share simulation results with other stakeholders

The weakness of the current SUDPLAN output is considered to be:

- the lack of descriptive information that would make the application self-explanatory
- the half English – half German user interface

The following further comments were given:

- From the point of view of a system manager SUDPLAN is expected to become a stable operational component of Wuppertal's SDI.
- SUDPLAN applications have got the potential to become powerful tools for certain steps of urban planning processes.
- The Wuppertal pilot application is a promising tool for introducing climate change considerations in the planning process of the sewer system. Moreover Air Quality Downscaling and 3D/4D Visualizations are interesting for air quality management in Wuppertal as well.

Further proposals for the improvement of the SUDPLAN comprise:

- Add descriptive information (in German!) to make the system self-explanatory.
- Enhance the problematic performance of SPS/SOS communication with the Common Services.
- Improve ergonomics in the important operation of manipulation the Digital Elevation Model.

5. Conclusions

The following conclusions can be summarised based on the Wuppertal product validation V2:

- To make the Wuppertal pilot application self-explanatory and easy to use a more descriptive information (metadata) for all objects in the SMS catalogue has to be provided (German language required!) on the description pages. (These pages are technically available for all objects of the catalogue.) The same applies for the WMS layers of the overall system where the abstracts and appropriate legends are still missing and for the climate models and scenarios mentioned in some of the wizards.

- In some of the terminal dialogues “overlapping” contextual information is missing that would be helpful to guide the users through the more complex workflows (e. g. using the Common Services, parameterizing and running the local models). This applies also for the export of diagrams where additional information should be added both in the title and in the legend.

- Basically, the communication between the Wuppertal pilot application and the Common Service “Rainfall” works well though some minor errors have to be fixed. Both downscaling of historical time series and IDF tables is available now. However, the Wuppertal pilot needs single precipitation events rather than complete time series or IDF tables. The tools to identify an extreme storm water event in a time series and to extract and store it as a rainfall event have to be implemented in P3. The computation of an “Euler 2” model rainfall event from an IDF table is needed.

- The integration of the local models GeoGPM and DYNA is satisfactory. Two advanced methods to manipulate the height of breaking edges have to be implemented in P3. One is the changing of a breaking edge’s height by direct interaction on the map. The other one is to change the height of all points of a certain part of the TIN - specified by a polygon - with a single operation. The integration of further local models (model wrapping) requires Java programming skills and would take at least some days of work. From the point of view of the City of Wuppertal this has to be done by an experienced external contractor rather than by a system administrator.

- The 2D spatial and spatial-temporal visualization of climate WMS Layers, model input parameters and model results fulfills the pilot requirements, provided one uses a large display or 2 regular displays. The visualization of simulation results in 2D is only required in simple maps. The more sophisticated 3D and 4D visualizations are expected to be provided by the 3D map (component "Visualization wizard") that has not been integrated in the Wuppertal pilot application up to this validation report. These visualizations are considered as a key factor for the successful inclusion of secondary and tertiary users.

- For more exhaustive studies of different local model runs it would be useful to provide WMS layers showing the differences between the respective model results.

- The WMS layers of the overall SUDPLAN system providing information about climate change all over Europe are useful for general risk assessments and to raise awareness of this issue in discussions with politicians and decision-makers. For concrete urban planning processes Air Quality Downscaling would be necessary. It would be interesting for the City of Wuppertal to use these SUDPLAN services, too.

- The integration of external services is easy with OGC services. At the moment , there is no direct support of more general services like SOAP services, however this is not required to finalize the Wuppertal pilot application from today's understanding. The communication with back-end services via SPS/SOS is functional but time consuming. The performance should be enhanced!

Following the validation results, the overall status of the Wuppertal pilot application can be considered as satisfying for an intermediate version. The contributors are convinced that the pilot objectives can be met in the project life time. The tools provided by SUDPLAN will evolve into an integral part of Wuppertal's SDI.

6. References

This is the list of documents and software deliverables that have been be used as input for this document.

Document	Version
DoW	2009-12-01
D2.1 Validation Plan (revised after 1st ATR)	2011-06-15
D3.1.2 Requirement Specification V2	2011-11-28
D3.3.1 Integrated Scenario Management System	2011-07-20
D6.1.3 Pilot Definition Plan for Wuppertal V3	2011-12-22

Table 1: List of documents and software deliverables that has been referenced or used for this document

7. Glossary

2D	Two-dimensional, typically a field that varies in east-west and north-south direction. The field may also vary in time –this is typical for e.g. air pollution and population density. The former varies from one hour to another while the latter maybe varies from one year to another.
3D	Three-dimensional, typically a field that varies in east-west and north-south direction as well as vertically. The field may also vary in time.
4D	Four-dimensional. Most often 3D field that explicitly also varies in time. It could also be when a certain 3D parameter (e.g. a particular air pollutant) also varies according to another 3D parameter (e.g. temperature). It will then be possible to study the variation of the first 3D parameter as a function of space (x,y,z) and the second parameter.
Airviro	Air quality management system consisting of databases, dispersion models and utilities to facilitate data collection, emission inventories etc, see http://www.Airviro.smhi.se/
Climate scenario	*Climate scenarios* means the resulting climate evolution over time, as simulated by global (GCMs) and regional (RCMs) climate models. Climate scenarios are products of certain emission scenarios that reflect different economic growth and emission mitigation agreements.

Common Services	*Common Services* is the climate downscaling services for rainfall, river flooding and air quality, developed in the SUDPLAN project and accessed through the SUDPLAN platform (Scenario Management System)
Common Services server	*Common Services* models will be executed at a SMHI server, accessible through OGC communication.
Emission scenario	These are of three types, of which the first one is behind the climate scenarios used in all SUDPLAN Common Services. The two remaining emission scenario types are only relevant for air quality downscaling.
- *IPCC emission scenarios*	*IPCC emission scenarios* are estimates of future global greenhouse gas concentrations based on assumptions about global development (economic growth, technical development, mitigation agreements, etc). During the first two years of the SUDPLAN projects, the climates scenarios based on SRES (Special Report on Emission Scenarios) A1B scenario from the 4th assessment have been used. The SRES emission scenarios do not include emissions of the pollutants of interest for air quality. If available the climate scenarios based on the 5th assessment RCP (Representative Concentration Pathways) emissions scenarios will also be used within the SUDPLAN project. They include emissions of air pollutants.
- *European tracer gas emissions (air pollutants)*	*European tracer gas emissions (air pollutants)* thus may or may not be included in IPCC emission scenarios. For creating Pan-European air quality fields under climate scenarios driven by the SRES A1B emission scenario, SUDPLAN uses tracer gas emissions from the more recent RCP emission scenarios. This inconsistency will be solved when climate scenarios based on RCP emission scenarios are available.
- *Local emission scenarios*	*Local emission scenarios* (to the atmosphere) are those of a particular European city. These will to a large extent influence future air quality in the city, but have little influence on global climate, nor do they influence air pollution concentrations in incoming long-range transported air. SUDPLAN will typically need gridded emissions with 1x1 km or finer spatial resolution as input to its urban air quality downscaling model.

Hind cast	A simulation of a historical period. Often done to compare model simulations with data which is available during that period.
Hot spot	Point (or small area) which is very different from its surroundings. In the present context, most often high concentrations of air pollutants, or extreme meteorological conditions.
Information product	Raw data, such as the results of mathematical modelling, and the analysis thereof, will often need to be packaged in such a way as to be accessible to the various stakeholders of an analysis. The medium can be one of a wide variety, such as print, photo, video, slides, or web pages. The term *information product* refers to such an entity.
Mockup	A model of a design used for demonstrating the functionality of a system.
Model	A *model* is a simplified representation of a system, usually intended to facilitate analysis of the system through manipulation of the model. In the SUDPLAN context the term can be used to refer to mathematical models of processes or spatial models of geographical entities.
PM_{10}	'PM10' shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM10, EN 12341, with a 50 % efficiency cut-off at 10 μm aerodynamic diameter;
$PM_{2.5}$	'PM2,5' shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM2,5, EN 14907, with a 50 % efficiency cut-off at 2,5 μm aerodynamic diameter;
Profile	Within SUDPLAN a *profile* is a set of configuration parameters which are associated with an individual or group, and which are remembered in order to facilitate repeated use of the system.
Regional downscaling	A climate scenario may be downscaled to a higher spatial resolution, typically 25-50 km, by a Regional Climate Model (RCM). The regional downscaling in SUDPLAN will be performed by SMHI's RCM (RCA, see below) and will generate climate scenarios at 44 or 22 km resolution.

Report	A *report* is a particular type of information product which is usually static and might integrate still images, static data representations, mathematical expressions, and narrative to communicate an analytical result to others.
Scenario	A *scenario* is a set of parameters, variables and other conditions which represent a hypothetical situation, and which can be analysed through the use of models in order to produce hypothetical outcomes. In SUDPLAN a scenario is an individual model simulation outcome to be used in urban planning. The model simulation may or may not include Common Services downscaling (with specific input) and may or may not include a local model simulation (with specific input and parameters).
Scenario Management System	*Scenario Management System* is synonymous with SUDPLAN platform
Scenario Management System Framework	The *Scenario Management System Framework* is the main Building Block of the Scenario Management System. It provides the Scenario Management System core functionalities and integration support for the other Building Blocks.
Scenario Management System Building Block	Scenario Management System Framework is composed of three distinct *Building Blocks*: The Scenario Management System Framework, the Model as a Service Building Block and the Advanced Visualisation Building Block.
Street canyon	Volume between high buildings in cities. Due to poor circulation (and high emissions) prone to poor air quality. Street canyons have unexpected circulation patterns, thus dedicated models are needed to study air pollution here.
SUDPLAN application	A *SUDPLAN application* is a decision support system crafted by using the SUDPLAN platform and integrating models, data, sensors, and other services to meet the requirements of the particular application.
SUDPLAN platform	The *SUDPLAN platform* is an ensemble of software components which support the development of SUDPLAN applications.
SUDPLAN system	*SUDPLAN system* is synonymous with SUDPLAN application

Urban downscaling	This refers to further downscaling of the regional climate scenarios for Europe to the urban scale within SUDPLAN. This will be possible for a) *rainfall/precipitation* where the temporal resolution will be 30 minutes or less. The spatial resolution will be that of a precipitation gauge, i.e. representative for a point rather than a certain area. b) *hydrological variables (river runoff, soil moisture etc*) where the temporal resolution is daily and the spatial resolution linked to catchment areas which presently count approximately 35000 and with average size 240 km^2. *c) air quality (PM, NO2/NOx, SO2, O3, CO).* The temporal resolution will be hourly for gridded output fields and the spatial resolution typically 1x1 kilometres.
User	The term *user* refers to people who have a more or less direct involvement with a system. Primary users are directly and frequently involved, while secondary users may interact with the system only occasionally or through an intermediary. Tertiary users may not interact with the system but have a direct interest in the performance of the system.
Web-based	Computer applications are said to be *web-based* if they rely on or take advantage of data and/or services which are accessible via the World Wide Web using the Internet.

8. Acronyms and abbreviations

Acronym	Description
A1B	Emission scenario used for global climate modelling in IPCCs Fourth Assessment Report (AR4)
Airviro	Air quality management system to facilitate data collection, emission inventories etc, see http://www.airviro.smhi.se/
cids	Component Integration for Distributed Systems
CS	Common Services
AVDB	Airviro Time Series database (used for storage in Common Services)
AR4, AR5	Fourth and Fifth Assessment Report of IPCC
AQ	Air Quality
C API	Application Programming Interface written in C
CA	Consortium Agreement
CMIP5	Coupled Model Intercomparison Project, phase 5 (coordinated model exercise in support to AR5)
COD	Chemical Oxygen Demand
concall	conference (phone) call
CS	Common Services (SUDPLAN functionality)
CSO	Combined Sewer Overflow
CTM	Chemistry Transport Model
CTREE	FairCom CTREE database (Index database, core of AVDB)
DBS	Distribution-Based Scaling, a method to bias-correct (i.e. remove systematic errors in) the temperature and precipitation of the RCM output
DoW	SUDPLAN Description of Work
DSS	Decision Support Systems
ECHAM5	GCM developed at Max Planck Institute for Meteorology, DE
ECMWF	The European Centre for Medium-Range Weather Forecasts (also co-ordinating FP7-SPACE project MACC)
EDB	Airviro Emission database
EEA	European Economic Association
E-HYPE	HYdrological Predictions for the Environment (European set-up), hydrological rainfall-runoff model developed and used by SMHI
EM&S	Environmental Modelling and Software
ESA	European Space Agency
ESDI	European Spatial Data Infrastructure
EU	European Union
GCM	Global Climate Model or, equivalently, General Circulation Model. Physically based computer model that simulates the global climate on a 200-300 km resolution. Can be used both to reproduce historical climate and estimate future climate, e.g. in response to changes in greenhouse gas concentrations.

GHG	GreenHouse Gases
GTE	Georeferenced Time-series Editor
GIS	Geographic Information System
GSA	Global Sensitivity Analysis
HadCM3	GCM developed at Met Office Hadley Centre, UK
HIRLAM	HIgh Resolution Limited Area Model, numerical weather prediction model developed and used operationally by SMHI
ICT	Information and Communication Technologies
ID	Identifier
IDF-curve	Intensity Duration Frequency-curve, a curve (or a table of values) showing the rainfall intensity associated with a certain duration (i.e. time period) and frequency (i.e. probability, generally expressed as a return period). Calculated from short-term rainfall observations and widely used in design of urban drainage systems.
iEMSs	International Environmental Modelling & Software Society
IFIP	International Federation for Information Processing
IPCC	The Intergovernmental Panel on Climate Change, the leading body for the assessment of climate change
IPR	Intellectual Property Rights
ISAM	Indexed Sequential Access Method, a method for indexing data for fast retrieval
ISO	International Standardization Organisation
ISESS	International Symposium on Environmental Software Systems
IST	Information Society Technology
MATCH	Multiple-scale Atmospheric Transport and Chemistry modelling system, a CTM developed and used by SMHI.
MODSIM	International Congress on Modelling and Simulation
NA	
netCDF	Network Common Data Form
OASIS	1) Organization for the Advancement of Structured Information Standards 2) Open Advanced System for Disaster and Emergency Management (FP6 project)
OGC	Open Geospatial Consortium
O&M	Observation and Measurements
OpenSDM	Open Scientific Data Management
ORCHESTRA	Open Architecture and Spatial Data Infrastructure in Europe (FP6 IST-511678)
OSGeo	Open Source Geospatial Foundation
OSIRIS	Open architecture for Smart and Interoperable networks in Risk management based on In-situ Sensors (FP6 IST-33799)
PM	Person Month
PMC	Project Management Committee

QA	Quality Assurance
RC	Rossby Centre, climate research unit at SMHI
RCA	Rossby Centre Atmospheric model, RCM developed by SMHI and used in SUDPLAN
RCM	Regional Climate Model, commonly used to increase the spatial resolution of climate scenarios to 25-50 km in a specific region.
RCP4.5	Radiative Concentration Pathways: A set of four emission scenarios to be used for the AR5 simulations. The scenarios are named according to their radiative forcing at 2100, e.g. 4.5 W/m^2.
RNB	Airviro Field database
SANY	Sensors Anywhere (FP6 IST-033654)
SDI	Spatial Data Infrastructure
SISE	Single Information Space in Europe for the Environment
SISE	Single Information Space in Europe for the Environment
SMHI	Swedish Meteorological and Hydrological Institute
SMS	Scenario Management System
SOA	Service Oriented Architecture
SOS	Sensor Observation Service
SPS	Sensor Planning Service
SWE	Sensor Web Enablement
SUDPLAN	Sustainable Urban Development PLANner for climate change adaptation
SWE	Sensor Web Enablement
SWMM	Storm Water Management Model
tbd	To be determined
TIN	Triangulated Irregular Network
TSS	Total Suspended Solid
U.S.-EPA	United States Environmental Protection Agency
UWEDAT	AIT environmental data management and monitoring system
WCC	World Computer Congress
WCS	Web Coverage Service
WFS	Web Feature Service
WP	Work Package
WPS	Web Processing Service
WMS	Web Map Service
wrt	with respect to
WWTP	Waste Water Treatment Plant

Annex A – Lime Survey

1.1. Type of users

Name	1: Stefan Sander 2: Reinhard Verkennis 3: Ute Bücker 4: Bernard Arnold
E-mail address	1: stefan.sander@stadt.wuppertal.de 2: reinhard.verkennis@stadt.wuppertal.de 3: ute.buecker@stadt.wuppertal.de 4: bernard.arnold@stadt.wuppertal.de
Organization	1: City of Wuppertal, Land Registry Office 2: City of Wuppertal, Land Registry Office 3: City of Wuppertal, Environmental Agency (Environmental Planning) 4: City of Wuppertal, Environmental Agency (Coordination of urban drainage)

Please indicate for what type of environmental risk SUDPLAN has been used (Y= SUDPLAN used, N = SUDPLAN not used, NA= concept not applicable). For other, please indicate what other risk.

Type of environmental risk	Analyst primary	Analyst secondary	Modeller	System Manager
Urban storm water flooding during intense rainfall	Y(1)	N	N	Y(2)
Dimensioning of sewage water systems	N	N	N	N
Risks of flooding of rivers	N	N	N	N
Hydrological conditions	N	N	N	N
Air pollution	Y(1)	N	N	Y(1)
Other: Climate change (pan european use case)	N	N	N	Y(2)

Please indicate what is the temporal planning interest (Y= of interest, N = not of interest, NA= not applicable).

Temporal planning interest	Y	N	NA
Present conditions and short term (<10 years) planning	4	0	
Long term planning (>10 years) planning	4	0	

Please indicate what part of SUDPLAN the validation is made (Y= Yes, N = No). Only one answer per user possible.

Application	Y	N
Stockholm pilot	0	4
Wuppertal pilot	3	1
Linz pilot	0	4
Czech pilot	0	4
Overall application	1	3

Please describe the user's knowledge with respect to the SUDPLAN product (Y= Yes, N = No).

Type of user	Y	N
SUDPLAN team member	2	2
Analyst	2	2
Modeller	0	4
System manager	1	3
IT expert	2	2
Climate change expert	0	4
Have seen presentations and documentations	1	3
User of the SUDPLAN / model results	0	4
Working with the actual system	4	0

SUDPLAN team member: You were developing SUDPLAN.

Analysts are those people who will be using the SUDPLAN applications on a regular basis to carry out analyses in order to arrive at an environmental management decision. In some cases they may be the decision makers, and in other cases they may be supporting the decision makers. This category of user would include expert planners and city planners, as defined in the DoW, and are likely to be primary users (i.e. they will use the SUDPLAN applications directly and regularly).

Modellers are those people who develop, integrate, and/or configure mathematical models to be used within SUDPLAN applications. While these users might be expert planners as well, this category is reserved for people performing specific model development tasks; if and when they work as planners, they revert to the Analyst category. Modellers may be seen as secondary users in that they will not generally, in this role, use the SUDPLAN application on a regular basis, and might not use it directly at all.

System Managers are those people who install and maintain SUDPLAN applications and carry out general system administration tasks. This would include the integration of components, such as models, into SUDPLAN applications. While this task might be performed by the same people who developed the models, when they are carrying out the integration into an application they have switched into a role as a System Manager. These users could be considered secondary users. While they will definitely use the SUDPLAN applications directly, it will only be occasionally (in this role).

IT-Experts are people working in the development or administration of IT systems. If you have some GIS and SOA background please select this also.

Climatic Change experts are people with knowledge in the Climate Change domain. They may or may not act as any of the other roles within SUDPLAN.

1.2. 1 Graphical user interface

1.2.1 1a – GUI specific

SUDPLAN shall provide user-friendliness of services and interfaces, in particular ergonomics of the graphical user interface (GUI) and the visualization components
Enable usage by untrained users, not only "SUDPLAN" experts.
REQ-DOW-2.10: Offer user-friendly interfaces

9 1a/Q1a: Please indicate the key concepts used in SUDPLAN to assure the GUI ergonomics (Y = concept used, N = concept not used, NA = concept not applicable). Please give the number of answers for each alternative.

Key concepts	Y	N	NA
Task-Oriented Menu structure	1	0	3
Multi-lingual user interface	0	2	2
Smart scaling for small screens	2	0	2

Workflows for common tasks	1	0	2
Colour-coding for colour-blind	0	2	2
Contextual help system	0	2	2
Alerts when processing finished	2	0	2
Panning/browsing through results (in time)	2	0	2
Panning/browsing through results (in space)	2	0	2
Highlighting recently changed data	0	2	2
Comparing two result sets	2	0	2

10 1a/Q1c: Please give a short textual explanation on the user friendliness of the SUDPLAN application and suggestions for improvement.

Overall user friendliness is sufficient. It depends mainly on appropriate content on the description pages that are technically available for all objects of the SMS catalogue. Currently the GUI is a mixture of German and English. *(Validator 1)*

Task oriented Menu structure: at least there are task specific tools in the toolbar in the WUP configuration. Workflow for common tasks: there is no strict workflow support, however this is not required for the WUP pilot. *(Validator 4)*

SUDPLAN shall provide easy-to-use planning, prediction, decision-support and training tool.
The main idea of the SUDPLAN project is to develop an easy-to-use web-based planning, prediction, decision support and training tool, for the use in an urban context, based on a what-if scenario execution environment, which will help to assure population's health, comfort, safety and life quality as well as sustainability of investments in utilities and infrastructures within a changing climate.
REQ-DOW-1.1: Build an easy-to-use system

SUDPLAN shall employ user-centred design principles in the design of the user interface. SUDPLAN shall provide user-friendly services and interfaces, graphical user interfaces (GUI), and data visualization components.
Systematic user-centred design helps ensure that the intended users are successful and improves overall productivity. Furthermore it enables the use of the SUDPLAN product by untrained users, not only SUDPLAN experts.
REQ-USR-1.1.1: User-centred design

11 1a/Q1d: Please assess the ease of use of the SUDPLAN application (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Define a scenario					*1*	*2*		*1*
Execute existing scenario "as is"						*3*		*1*
Execute existing scenario with changed parameters						*3*		*1*

Save results						*1*	*2*	*1*
Share results with others						*2*	*1*	*1*
Visualize results				*2*	*1*			*1*
Visualize uncertainties	*3*							*1*
Compare the results of various scenarios		*1*	*1*	*1*				*1*
Export results in different formats		*2*	*1*					*1*

12 1a/Q1e: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

Definition and execution of scenarios is supported by appropriate wizards. Results are stored automatically in the repository. Thus they can be easily shared with other users. The visualization of the results is also generated automatically but currently only a fix style is available. Comparison of results is possible in a visual manner (transparent map layers, parallel visualization of diagrams) rather than providing statistical information. Map layers with differences of different simulation results (water levels) might be useful. Export in different formats is possible via WFS and WMS. Support of export in domain specific text formats for simulation results and for rainfall data is not implemented yet. *(Validator 1)*

Layer tree of WMS/WFS-client should be refreshed periodically to show automatically generated layers with results of model runs. *(Validator 2)*

Working with scenarios is not within the scope of the validator, therefore no answers are given. *(Validator 3)*

Visualization was only tested in 2D, where it is restricted to simple maps (cells of the TIN in different colours depending of the maximum depth of water occuring during a storm water event). 3D will provide the more sophisticated visualizations. Comparison of simulation results is currently only possible in a poor style by overlaying map layers and playing with the transparency. Comparison of time series (rainfall downscaling results) is possible by showing them in the same diagram. *(Validator 4)*

SUDPLAN shall allow automation of recurring tasks wherever possible.
In SUDPLAN application analysis and management there will be tasks which must be performed repeatedly. Allowing the users to automate such tasks will greatly enhance ultimate productivity.
REQ-USR-1.2.1: Recurring task automation

SUDPLAN shall allow users to configure tasks which are to be executed on a recurring basis.
Recurring tasks will generally require configuration of input data, parameters, and other variables.
REQ-USR-1.2.2: Recurring task configuration

SUDPLAN shall support the development and maintenance of user interface profiles for different users.
User interfaces generally allow configuration by users to suit their needs or preferences. Keeping these configurations in a profile prevents any given user from having to reconfigure the application each time they use it.
REQ-USR-1.3.1: Profiling of the user interface

SUDPLAN shall support establishment of user groups with shared profiles.
Some aspects of the user interface configuration may be associated with categories of users rather than individual users.

REQ-USR-1.3.2: Establishement of user groups

SUDPLAN shall support the development and maintenance of automation task profiles. Automatically recurring task configurations should be stored in a profile to allow users to re-establish similar task executions without having to completely re-enter configuration information.
REQ-USR-1.3.3: Profiling of automation tasks

SUDPLAN shall support profiling of business processes for different users and user groups. SUDPLAN applications will often require combinations of information and services requested from diverse sources, and these request transactions will need to be configured. Saving of request transaction profiles will help users and user groups to streamline their analyses by avoiding extensive reconfiguration.
REQ-USR-1.3.4: Profiling of business processes

13 1a/Q1f: Please assess the ease of use of the profiling and automation capacities of SUDPLAN (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Recurring task automation	*1*		*1*					*2*
Recurring task configuration				*1*		*1*		*2*
Profiling of the user interface				*1*		*1*		*2*
Establishment of user groups						*1*		*3*
Profiling of automation tasks			*1*					*3*
Profiling of business processes			*1*					*3*

14 1a/Q1g: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

The cids framework allows the definition of user groups with user group specific profiles, user specific accessibility of catalogue objects and functionality. Individual configurations can be stored and loaded. But there is neither support for fully automated tasks (batch mode) nor an explicit workflow support. *(Validator 1)*

Recurring task configuration and profiling of the GUI is supported by storing / loading of user specific profiles that control the visibility of GUI elements, data and functionality. But this does not lead to a fully automatic eradication of predefined workflows. However, this is not expected from the Wuppertal pilot application. *(Validator 4)*

SUDPLAN shall enhance the current state of the art in interactive visualization by the support of different types of output devices (the system can be adapted to a wide variety of hardware from single-user desktop to immersive multi-user environments)
Depending on the systems available to the user proper visualization techniques have to be used.
REQ-DOW-10.4: Provide support of different output devices

15 1a/Q2a: Please assess the usability with various output devices used (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Overall					*2*			*2*
High resolution PC monitor (22-26 Inch, 1080p)						*1*	*1*	*2*
Laptop (15-17 Inch, 1280x800 pixel or better)						*1*	*1*	*2*
Small Laptops (12-14 inch, 1024x800 pixel)					*2*			*2*
Netbooks (about 10 inches, below 1024x800 pixel, low processing power)			*1*	*1*				*2*
Small 3D Displays (Desktop monitors)								*4*
Large 3D displays (for presentation to a large audience)								*4*

16 1a/Q2c: Please give a short textual explanation of the special features allowing the use of the SUDPLAN's GUI elements across the large range of screen sizes, key advantages of SUDPLAN wrt. to state of the art (if any), and suggestions for improvement.

Efficient work with the Wuppertal pilot applications requires a large display > 1280 X 800 px. Best usability is achieved with 2 displays. The usability with 3D Displays has not been tested yet.
(Validator 1)

For a convenient use of the Wuppertal pilot application a large display is necessary. Working with two displays 1200x800 px or better appears ideal. 3D Displays have not been tested yet.
(Validator 4)

Certain general elements of the user interface design enhance system usability.
REQ-USR-1.1: Usability

SUDPLAN shall employ user-centred design principles in the design of the user interface. SUDPLAN shall provide user-friendly services and interfaces, graphical user interfaces (GUI), and data visualization components.
Systematic user-centred design helps ensure that the intended users are successful and improves overall productivity. Furthermore it enables the use of the SUDPLAN product by untrained users, not only SUDPLAN experts.
REQ-USR-1.1.1: User-centred design

SUDPLAN shall employ user interface design features that help prevent users from making errors when possible, allow users to reverse an error if one is made, or minimize the consequences of user errors if neither of these is possible.
Preventing or successfully mitigating user errors is necessary to ensure a productive outcome of the users' use of the system.
REQ-USR-1.1.2: User errors

SUDPLAN shall employ design features which allow the software to carry the burden of remembering information needed from one part of an application by another.

Avoiding a reliance on the users' short-term memory significantly increases productivity, reduces error rates, and increases user satisfaction.
REQ-USR-1.1.3: Short-term memory

SUDPLAN shall provide contextual help to users.
When users are expected to provide input to an application they may need clarification or explanation of the input that is expected of them.
REQ-USR-1.1.4: Contextual Help

SUDPLAN shall be easy to understand and to learn.
SUDPLAN users should be able to learn how to use the user interface easily and to readily understand its functionality.
REQ-USR-1.1.5: Ease of learning

SUDPLAN's user interface shall be easy to remember.
SUDPLAN users should be able to readily remember how to use the user interface.
REQ-USR-1.1.6: Memorability

SUDPLAN shall present a transparent user interface.
SUDPLAN users should not need to have technical knowledge outside of their domain.
REQ-USR-1.1.7: Transparency

17 1a/Q3a: Please assess the usability of SUDPLAN (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
User-centred design					*1*	*1*		*2*
User errors		*2*						*2*
Short-term memory		*1*				*1*		*2*
Contextual Help	*2*							*2*
Ease of learning				*1*	*1*			*2*
Memorability				*1*	*1*			*2*
Transparency				*1*	*1*			*2*

18 1a/Q3c: Please give a short textual explanation on the (dis)advantages of the usability in SUDPLAN, and suggestions for improvement.

There is neither a sophisticated error handling nor a contextual help system implemented yet (not surprising after P2). Ease of learning, memorability and transparency are mainly dependent on the content that is provided on the description pages. These pages are technically available for all catalogue objects. This content has to be amended in P3. *(Validator 1)*

Error handling is rudimentary in V2. Contextual help is not implemented yet. Avoiding the reliance on the users' short term memory could be achieved, but a lot of "overlapping" contextual information is still missing (=> needs more configuration). Ease of learning, memorability and transparency of the system depends on the availability of descriptive information on the description pages of all catalogue objects and in the abstracts of WMS layers. *(Validator 4)*

SUDPLAN shall support visualization based on geo-spatial paradigms.
Environmental data are very often spatial in nature, and therefore require geo-spatial visualization techniques.

REQ-USR-2.5.2 Spatial visualization

SUDPLAN shall support visualization of time-based phenomena.
Environmental phenomena are dynamic in nature, and therefore often require the use of visualization techniques representation variation of one or more variables as a function of time.
REQ-USR-2.5.3 Temporal visualization

SUDPLAN shall support visualization of phenomena varying in both time and space.
More complex environmental data sets vary in both time and space.
REQ-USR-2.5.4 Spatio-temporal visualization

SUDPLAN shall support the visualization of an individual model run.
Many SUDPLAN modelling runs will generate spatial and/or temporal data which need to be visualized to be interpreted by the analyst.
REQ-USR-2.5.5 Visualization of a model run result

SUDPLAN shall support the visual comparison of multiple model runs.
Analysis of the results from multiple comparable model runs (such as under different scenarios) requires the ability to simultaneously represent model results visually.
REQ-USR-2.5.6 Comparison of model run results

19 1a/Q4a: Please assess the usability of SUDPLAN for visualization (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Spatial visualization					*2*	*2*		
Temporal visualization					*4*			
Spatio-temporal visualization					*3*	*1*		
Visualization of a model run result				*1*	*2*			*1*
Comparison of model run results		*2*		*1*				*1*

20 1a/Q4c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

Spatial and spatio-temporal visualization in 2D has successfully been tested via WFS and (enhanced) WMS. The visualization of simulation results in 2D is only necessary in a simple manner, the more sophisticated visualizations shall be provided in the 3D map that is not integrated in the Wuppertal pilot application yet (only first tests so far). Temporal visualization of time series is possible via diagrams. Comparison of results is possible in a visual manner (transparent map layers, parallel visualization of diagrams) rather than providing statistical information. Map layers with differences of different simulation results (water levels) might be useful. *(Validator 1)*

Appropriate legends for 2D and 3D maps should be provided. Flexible definition of user styles or the possibility to select from different predefined styles would be helpful. Map layers showing differences of model run results might be useful (subject of further investigation). *(Validator 2)*

Working with model runs is not within the scope of the validator, therefore no answers to the last 2 questions are given. The visualization of time series via WMS GetfeatureInfo-requests works fine in principle, but the information given in the diagram has to be extended (Position in lat/lon the diagram is referring to, name of climate model (should be available from the WMS-Layer name or abstract). Note: this information has to be given for each graph that is shown in the diagram, e.g. via a small legend. *(Validator 3)*

Comparison of simulation results is currently only possible in a poor style by overlaying map layers and playing with the transparency. Comparison of time series (rainfall downscaling results) is possible by showing them in the same diagram. *(Validator 4)*

1.2.2 1b – 3D GUI

SUDPLAN shall extend the state-of-the-art in the field of environmental decision support systems by offering to users highly integrated and interactive 3D / 4D
Rationale: Proper visualization is needed to understand large data sets, especially if they are georeferenced. The visualization will not only be used by experts for themselves but also to inform other persons.
REQ-DOW-3.2

22 1b/Q1a: *Please indicate the usability of the SUDPLAN 3D/4D visualization as compared to state of the art applications (1 to 7 or NA, with 4=on par, 1=way below, and 7=way above. NA can be used to indicate that the comparison is impossible, useless or beyond your knowledge).* Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Large data sets								*4*
Geo-referenced data								*4*
3D data								*4*
3D data, georeferenced, on a map								*4*
1D Time-series								*4*
2D Time-series								*4*
3D Time-series								*4*
Multi-dimensional data								*4*

23 1b/Q1c: Please give a short textual explanation for the above marks, key advantages and suggestions for improvements. Please indicate also the "state of the art" applications used in the comparison above.

(This was not tested and validated since the 3D map is not integrated in the Wuppertal pilot application yet.)

SUDPLAN shall enhance the current state of the art in interactive visualization by a highly interactive, extendable 3D / 4D visualization framework combining geometric, volumetric and information visualization algorithms as well as interaction techniques for analyzing, comparing and presenting of simulated what-if scenarios (in the area of sustainable urban development).
A proper visualization is required to understand and compare complex or large data sets. This is needed to understand the implications of different scenarios.

REQ-DOW-10.1: Provide 3D / 4D visualisation framework

24 1b/Q3a: Please assess the capabilities of the SUDPLAN 3D/4D visualization framework (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Overall impression								*4*
Interactive applications								*4*
Geometric visualisation algorithms								*4*
Volumetric visualisation algorithms								*4*
Other information visualisation algorithms								*4*
Presenting of simulated what-if scenarios								*4*
Comparing of simulated what-if scenarios								*4*
Analyzing of simulated what-if scenarios								*4*

25 1b/Q3b: Please give a short textual explanation for the above marks, key advantages of SUDPLAN wrt. to state of the art (if any), and suggestions for improvement.

(This was not tested and validated since the 3D map is not integrated in the Wuppertal pilot application yet.)

SUDPLAN shall enhance the current state of the art in interactive visualization by an extendable framework; regarding visualization as well as interaction metaphors (the system can be adapted to a wide variety of data)
The 3D/4D visualization shall also be usable for direct interaction with the SUDPLAN system to allow an intuitive use.

REQ-DOW-10.2: Provide interaction framework

26 1b/Q4a: Please describe the key enhancements of the “state of the art” in interactive visualization developed by SUDPLAN.

(This was not tested and validated since the 3D map is not integrated in the Wuppertal pilot application yet.)

1.3. 2 Common Services

1.3.1 2a – Climate Scenario Information

All forecast models depend on the selected climate scenario. So information about the available scenarios is needed by the user.

28 2a/Q1a: Please indicate the usability of the provided climate scenario information (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Available number of different climate scenarios		*1*			*1*			*2*
Available area over Europe						*2*		*2*
Available time range						*2*		*2*
Available scenario documentation	*2*							*2*

1.3.2 2b – Common Services Rain

SUDPLAN shall provide the possibility to assess maximum rain intensity
Maximum rain intensity to be expected over sealed surfaces is needed to know how water run-off systems must be dimensioned.
REQ-DOW-1.3: Assess maximum rain intensity

SUDPLAN shall extend the state-of-the-art in the field of extreme precipitation by providing statistical measures (IDF curves) for future intense rainfalls, based on climate model results
This data is needed (at least in WP7) to plan efficient strategies to prevent damage, as input to a local model of the waste water infrastructure caused by future storm water events.
REQ-DOW-5.1: Provide IDF curves

SUDPLAN shall extend the state-of-the-art in the field of extreme precipitation by enabling the user to improve the quality of the simulated precipitation results by adding local historical precipitation data.
REQ-DOW-5.2 Improved precipitation simulation results

SUDPLAN shall extend the state-of-the-art in the field of extreme precipitation by identifying future periods – typically 1-2 months – with extreme precipitation events, for which SUDPLAN provides precipitation grids with high temporal (30 min) resolution
This data is needed to plan efficient strategies to prevent damage caused by future accumulations of heavy rain events.
REQ-DOW-5.3:Identify extreme precipitation events

30 2b/Q1a: Please assess the quality of the SUDPLAN precipitation prediction with respect to the state of the art (1 to 7 or NA, with 4=on par, 1=way below, and 7=way above. NA can be used to indicate that the comparison is impossible, useless or beyond your knowledge). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Maximum rain intensity						*1*		*3*
IDF curves						*1*		*3*
High temporal resolution rain data					*1*			*3*
Identification extreme precipitation events		*1*						*3*
Upload of historical data to improve the results					*1*			*3*

31 2b/Q1c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

Uploading of historical rainfall data for WUP (long term time series) seems to be implemented but produces an error, allegedly caused by the unknown format of the time series. The identification of a certain rainfall event (for WUP typically 30 ... 60 min) is not adequately supported in the moment, only visual identification is possible. Furthermore it must be possible to extract a certain part of the time series and to store it as a rainfall event that can be used to define a simulation. *(Validator 4)*

SUDPLAN shall provide the possibility to assess maximum rain intensity
Maximum rain intensity to be expected over sealed surfaces is needed to know how water run-off systems must be dimensioned.
REQ-DOW-1.3: Assess maximum rain intensity
SUDPLAN shall extend the state-of-the-art in the field of extreme precipitation by providing statistical measures (IDF curves) for future intense rainfalls, based on climate model results
This data is needed (at least in WP7) to plan efficient strategies to prevent damage, as input to a local model of the waste water infrastructure caused by future storm water events.
REQ-DOW-5.1: Provide IDF curves
SUDPLAN shall extend the state-of-the-art in the field of extreme precipitation by enabling the user to improve the quality of the simulated precipitation results by adding local historical precipitation data.
REQ-DOW-5.2 Improved precipitation simulation results
SUDPLAN shall extend the state-of-the-art in the field of extreme precipitation by identifying future periods – typically 1-2 months – with extreme precipitation events, for which SUDPLAN provides precipitation grids with high temporal (30 min) resolution
This data is needed to plan efficient strategies to prevent damage caused by future accumulations of heavy rain events.
REQ-DOW-5.3: Identify extreme precipitation events

32 2b/Q2a: Please assess the ease of use of the SUDPLAN precipitation prediction results. So this question is not about the GUI but the provided results, which might be used for visualisation or as input to other models (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Maximum rain intensity					*1*	*1*		*2*
IDF cuves					*1*	*1*		*2*
High temporal resolution rain data					*2*			*2*
Identification extreme precipitation events		*2*						*2*
Upload of historical data to calibrate the results					*2*			*2*

33 2b/Q2c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

Both downscaling of time series and IDF curves is possible after P2. Problems with the format of the WUP rainfall time series Buchenhofen have to be solved (no successful downscaling run yet). The identification of an extreme precipitation event (for WUP pilot typically 30 min.) from a downscaled time series is available only in a visual way. For the Wuppertal pilot application a functionality has to be provided to identify extreme events and to cut out a certain part of a time series to use this as a rainfall event for the model run. The computation of an Euler 2 rainfall event from an IDF curve is missing, too. *(Validator 1)*

Uploading of historical rainfall data for WUP (long term time series) seems to be implemented but produces an error, allegedly caused by the unknown format of the time series. The identification of a certain rainfall event (for WUP typically 30 ... 60 min) is not adequately supported in the moment, only visual identification is possible. Furthermore it must be possible to extract a certain part of the time series and to store it as a rainfall event that can be used to define a simulation.
(Validator 4)

1.3.3 2c – Air Quality

SUDPLAN shall provide possibility to assess the risk from air pollution and extreme temperature
Spatial distribution of air pollution, risk for extreme events and high ambient temperature in built-up residential and work areas.
REQ-DOW-1.4: Assess risk from air pollution and extreme temperatures
SUDPLAN shall extend the state-of-the-art in the field of air pollution by offering the possibility for countries or groups of countries to assess future exposure and health risks caused by air pollutants and high ambient temperature
Air quality has a huge impact on human health, so assessing the air quality means also to assess human health risks. For example a visualization of air quality together with population density will help to make proper decisions.
REQ-DOW-7.4: Assess future health risks

35 2c/Q1a: Please assess the capability of SUDPLAN to assess the risk of pollution and extreme temperature (1 = below, 4 = on par, 7 = far above). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Air pollution: Compared to the state of the art						*1*		*3*
High ambient temperature: Compared to the state of the art						*1*		*3*
High ambient temperature: Compared to SUDPLAN objectives								*4*
Air pollution: Compared to SUDPLAN objectives								*4*

36 2c/Q1b: Please assess the usability of the SUDPLAN tool as the basis for assessment of the air pollution and extreme temperature risks (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Overall			*1*					*3*
Scenario Management System (SMS)								*4*
Common Services (CS)								*4*

37 2c/Q1c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN, and suggestions for improvement.

SMS and CS have not been tested for Air Quality, therefore no answer is given for the last 2 questions. The WMS layers provide good information on the general influence of climate change, but they are to coarse for the usage in concrete urban planning. This would require the use of CS Air Quality Downscaling. (*Validator 3*)

SUDPLAN shall extend the state-of-the-art in the field of air pollution by delivering long term (10 year) air quality and temperature simulations over the entire Europe, for different climate scenario windows (e.g. 2006-2015, 2026-2035, 2046-2055 etc), enabling the end user to identify trends in poor air quality and heat wave incidents.
REQ-DOW-7.1: Provide long term air quality simulation

38 2c/Q2a: Please indicate the level of support for following functionality (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Long term (10 year) air quality and temperature simulations over entire Europe						*1*		*3*
Choice of climate scenario windows (e.g. 2006-2015, 2026-2035, 2046-2055 etc)						*1*		*3*
Identify trends in poor air quality						*1*		*3*
Identify trends in heat wave incidents						*1*		*3*

39 2c/Q2c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN, and suggestions for improvement.

These functionalities are available with the time series provided via GetFeature Info-request. *(Validator 3)*

SUDPLAN shall extend the state-of-the-art in the field of air pollution by performing year long downscaling air quality and temperature simulations that allow the assessment of how local sources, activities and land use impact future air quality in particular European cities
REQ-DOW-7.2: Assess local influence to air quality

40 2c/Q3a: Please indicate the level of support for following functionality (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Perform year long downscaling air quality simulations								*4*
Perform year long downscaling temperature simulations								*4*
Assess how local sources, activities and land use impact future air quality in particular European cities								*4*

41 2c/Q3c: Please give a short textual explanation on your experience with assessing the impact of local sources, activities and land use on future air quality in European cities (in SUDPLAN), and suggestions for improvement.

This requires the use of Air Quality Downscaling, that was not tested in WUP. Therefore no answers are given. *(Validator 3)*

SUDPLAN shall extend the state-of-the-art in the field of air pollution by allowing local emission scenarios and dispersion models to be nested to the downscaled air quality grids, demonstrating the relative importance of local sources within individual industrial, urban and residential environments
REQ-DOW-7.3: Connect local emission models

42 2c/Q4a: Please indicate the level of support for following functionality (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Use of the downscaled air quality grids in local emission scenarios and dispersion models								*4*
Allow users to estimate the relative importance of local sources within individual industrial, urban and residential environments								*4*

43 2c/Q4c: Please give a short textual explanation on your experience with assessing the importance of local sources to future air quality (in SUDPLAN), and suggestions for improvement.

(Not validated.)

SUDPLAN shall extend the state-of-the-art in the field of air pollution by offering the possibility for countries or groups of countries to assess their possibilities to fulfill national air quality standards and environmental objectives, also in a climate change perspective
Assess the implications of decisions met now to the fulfillment of actual and future air quality standards (Strictly spoken this would also require a model of future air quality standards).
REQ-DOW-7.5: Assess future fulfilment of air quality standards

44 2c/Q5a: Please indicate the usability of SUDPLANs air quality results (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
As information about expected future environmental conditions						*1*		*3*
Comparing the results of future city development plans								*4*
Assess the feasibility of fulfilling national air quality standards and environmental objectives, in a climate change perspective								*4*

45 2c/Q5c: Please give a short textual explanation on your experience with the usability of SUDPLANs air quality results, and suggestions for improvement.

Questions 2 and 3 require the use of Air Quality Downscaling, that was not tested in WUP. Therefore no answers are given. *(Validator 3)*

1.3.4 2d – Hydrology

SUDPLAN shall provide the possibility to assess river flooding scenarios
Risk for river flooding and inundations of built-up areas and other developed areas have to be assessed based on future climate scenarios
REQ-DOW-1.2: Assess risk for river flooding and inundations

47 2d/Q1a: Please assess the capability of the application to assess the river-flooding scenarios (1 = below, 4 = on par, 7 = far above). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Compared to state of the art solutions?								*4*
Compared to SUDPLAN objectives?								*4*

48 2d/Q1b: Please assess the usability of the SUDPLAN tool as the basis for river-flooding assessment applications (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Overall								*4*
Scenario Management System (SMS)								*4*
Common Services (CS)								*4*

49 2d/Q1c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN wrt. to state of the art (if any), and suggestions for improvement. Please state also which state-of-the art product was used for comparison.

(Not validated.)

SUDPLAN shall extend the state-of-the-art in the field of flood and draughts by leaving local end users the possibility to improve SUDPLAN model results by adding local precipitation, river runoff and land use data.
To get more accurate results some fine grain local data can be used by the downscaling services.
REQ-DOW-6.2: Provide better downscaling results by using local data

50 2d/Q4a: Please assess the usability of SUDPLAN to improve the model results by adding local and historical data (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
River runoff								*4*
Land use								*4*

51 2d/Q4b: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

(Not validated.)

SUDPLAN shall extend the state-of-the-art in the field of flood and draughts by forming a tool which evaluates how different local land use and urbanization scenarios respond hydrologically to climate changes
Land use, and to a somewhat lesser extent the urbanisation (e.g. building architecture, requirements on infrastructure, sustainable population density) are very sensitive to climate changes.
REQ-DOW-6.3: Assess future land use scenarios

52 2d/Q5a: Can the end user evaluate the impact of different scenarios? (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Climate change scenarios								*4*
Land use scenarios								*4*
Urbanisation scenarios								*4*

53 2d/Q5b: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

(Not validated.)

SUDPLAN shall extend the state-of-the-art in the field of flood and draughts by delivering time series output of future river runoff suitable to feed local hydraulic flooding models
To protect existing and plan future infrastructures the risk of flooding has to be assessed.
REQ-DOW-6.4: Provide future runoff time series

54 2d/Q6a: Please assess the quality of the future runoff time series (1 = below state of the art, 4 = on par with state of the art, 7 = above state of the art). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Ease of use								*4*
Data quality								*4*
Suitable to feed into local hydraulic flooding model								*4*

55 2d/Q6c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement. Please state also which state-of-the art product was used for comparison.

(Not validated.)

56 2d/Q7a: Please indicate the usability of SUDPLANs result in the hydrological domain (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
As information about expected future environmental conditions								*4*
Comparing the results of future city development plans								*4*

57 2d/Q7c: Please give a short textual explanation on your experience with the usability of SUDPLANs results in the hydrological domain, and suggestions for improvement.

(Not validated.)

1.4. 3 Local models

SUDPLAN shall extend the state-of-the-art in the field of extreme precipitation by enabling the user to improve the quality of the simulated precipitation results by adding local historical precipitation data Local historical data can be used to calibrate the results according the local conditions
REQ-DOW-5.2: Provide input for local models

SUDPLAN shall support modellers in integrating their models into a SUDPLAN application.
Integrating models into a SUDPLAN application, possibly with other models, means that the modeller needs to be able to specify the role of the model(s) within the application and to make the necessary connections between the model(s) and other components of the application.
REQ-USR-3.1.1: Model Integration

SUDPLAN shall support modellers in the configuration of models for analysts.

Modellers need to be able to configure models by specifying those data which are necessary for the model but which will not be under the control of the analyst.
REQ-USR-3.1.2: Model configuration

SUDPLAN shall support modellers in calibrating their models within a SUDPLAN application.
If a SUDPLAN application provides access to sufficient measurement data, it may be desirable to calibrate the model(s) used within the application to those data.
REQ-USR-3.2.1 Model calibration

SUDPLAN shall support modellers in validating their models within a SUDPLAN application.
If a SUDPLAN application has access to sufficient measurement data, using these data to validate the model(s) can increase confidence in the results of the model(s) within the context of the application.
REQ-USR-3.2.2: Model validation

59 3/Q1a: Please assess the ability of SUDPLAN in the field of model integration (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Ease of integration of models as a service	*2*	*1*						*1*
Running models directly from the SUDPLAN GUI						*3*		*1*
Specifying parameters for model runs					*1*	*2*		*1*
Using model results as input for another model (Service chaining)	*3*							*1*
Configuration of models				*1*	*2*			*1*
Model validation	*3*							*1*
Model calibration	*3*							*1*
Distinguish between different model version	*3*							*1*

60 3/Q1b: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

Integration of a model (model wrapping) requires Java programming skills and takes at least some days of work (depending on the complexity of the model). It can't be done by the end user. Service chaining is not in the focus of the Wuppertal pilot application. Model validation and calibration have not been tackled yet (this is extremely difficult with storm water surface run-off since there is hardly any historical data on flooding after extreme storm water events available). Configuration of models means for the WUP pilot to modify the DEM that is used for the simulation. This is possible in an interactive way via the breaking edge editor. It would be helpful to do this directly on the map with an extension of the feature renderer for the breaking edges. *(Validator 1)*

Configuration of models: it would be better to enable the user to manipulate the height of a breaking edge directly from the map (enhanced feature renderer). Hence the context (current alternative of the Digital Elevation Model) has to be determined with a suitable GUI element. *(Validator 2)*

Integration of models is not possible for an analyst, this requires programming skills. Service chaining is not in the scope of the Wuppertal pilot application. Model validation, model calibration and distinguishing between model versions is not in the scope of V2. The main aspect of "Specifying parameters for a model run" is the modification of the Digital Elevation Model (a TIN) in different variants. There is still a major functionality missing: it should be possible to change the height of all points of a certain part of the TIN - specified by a polygon - with a single operation. *(Validator 4)*

1.5. 4 Usage of external services

SUDPLAN shall extend the state-of-the-art in the field of environmental decision support systems by offering ubiquitous integration with information sources and services in SOA-based infrastructures Needed for easy integration of existing and future services.
REQ-DOW-3.4:Provide integration with SOA-based infrastructures

62 4/Q3a: Please indicate the level of support offered by the SUDPLAN product (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Service and resource discovery	*1*							*3*
Service and resource integration	*1*							*3*
Access standardised SOA services	*1*							*3*
Interpret underlying data model	*1*							*3*
Transform data to different models	*1*							*3*
Data interpolation / extrapolation	*1*							*3*
Fusion of data from heterogenous sources	*1*							*3*

SUDPLAN shall extend the state-of-the-art in the field of environmental decision support systems by offering ubiquitous integration with information sources and services in SOA-based infrastructures Needed for easy integration of existing and future services.
REQ-DOW-3.4: Provide integration with SOA-based infrastructures

SUDPLAN shall support the integration of spatial layers through standardized services.
Spatial data will play a crucial role in SUDPLAN applications, and integration of these data using standard tools is essential.
REQ-DEV-1.2.1: Web map services

SUDPLAN shall support the integration of models through standardized web services.
Integration of distributed models through standardized web services is essential to support the development of SUDPLAN applications.
REQ-DEV-1.2.2: Model service integration

SUDPLAN shall support information product modelling.
Elements of SUDPLAN application information products can also be structured using information modelling methods.
REQ-DEV-1.2.3: Sensor Service integration

63 4/Q3b: Please indicate which external service types can be used by SUDPLAN. Please give the number of answers for each alternative.

	Yes without any configuration	**Yes with some configuration by the user**	**Yes with configu-ration by the administrator / developer**	**No**	**NA**

OGC WMS (Web Map Service)		1			3
OGC WFS (Web Feature Service)		1			3
OGC WCS (Web Coverage Service)		1			3
OGC SOS (Sensor Observation Service)			1		3
OGC SPS (Sensor Planning Services)			1		3
OGC WPS (Web Processing Service)					4

64 4/Q3c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN (if any), and suggestions for improvement.

The usage of external services is restricted to OGC services. It takes programming skills to integrate SOAP services (no task for the end user). The integration of SOAP services out of the box is not within the focus of the WUP pilot application. *(Validator 1)*

1.6. 5 SOA

1.6.1 5a – Provide a SOA interface

SUDPLAN shall define and publish interfaces to access SUDPLAN (in order to access results or to invoke services), which are based on open standards
This will allow other systems to use data and services provided by SUDPLAN.
REQ-DOW-2.2: Publish interfaces

SUDPLAN shall extend the state-of-the-art in the field of service-oriented infrastructures by adding to SOAs new types of services (both specifications and implementations)
If there are no proper service specifications SUDPLAN will provide new specifications and implementations.
REQ-DOW-9.3: Provide new SOA specifications

66 5a/Q1a: Please name the SUDPLAN service interface specifications. This includes standard interfaces, extended or new interfaces as well as proprietary interfaces.

(Not validated.)

67 5a/Q1b: Please describe the SUDPLAN service interface specifications from the previous question. Please give the number of answers for each alternative.

	pre-existing service specification	extension	new SUDPLAN development	open source specification	proprietary
Please fill in interfaces from question 66 5a/Q1a!	*(not validated)*				

68 5a/Q1c: Please indicate the level of completion (at least of the new or extended) service interface specifications. Please give the number of answers for each alternative.

	No specification	Functional description	Complete formal description	Considered "best practice" by relevant community	De-facto industry standard	De-facto standard e.g. OGC/ISO/CEN standard	No answer
Please fill in interfaces from question 66 5a/Q1a!	*(not validated)*						

69 5a/Q1d: Please give pointers to publicly available service documentations / specifications (at least for new or extended specifications). Please give the number of answers for each alternative.

Please fill in interfaces from question 66 5a/Q1a!	*(not validated)*

70 5a/Q1e: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

(not validated)

1.6.2 5b – Provide SOA service

SUDPLAN shall define and publish interfaces to access SUDPLAN (in order to access results or to invoke services), which are based on open standards

REQ-DOW-2.2: Publish interfaces

72 5b/Q1a: Please name the service instances and data sets used in SUDPLAN. This includes new as well as pre existing services, models and data sets. Examples: Model of Linz sewerage system, Rain time series.

(not validated)

73 5b/Q1b: Possible usage of the service instances and data sets named in the previous question. Please give the number of answers for each alternative.

	Free of charge	Commercial	SUDPLAN internal only	NA
Please	*(not validated)*			
fill in data sets				
from				
question				
72 5b/Q1a!				

SUDPLAN shall provide user-friendliness of services and interfaces, in particular ergonomics of the graphical user interface (GUI) and the visualization components

REQ-DOW-2.10: Offer uses-friendly interfaces

74 5b/Q3a: Please indicate the key concepts used in SUDPLAN to assure the usability of the service interfaces. Please give the number of answers for each alternative.

	Yes	Uncertain	No	NA
Self-describing service interfaces	*(not validated)*			
Self-describing data models				
Service ontology				
Data ontology				
Response time estimate				
Response size estimate				
User-requested limits for response time				
User-requested limits for response size				
Subscribe / alert mechanism				
Panning / browsing through results (in time)				
Panning / browsing through results (in space)				
Fetching the recently changed data only				

75 5b/Q3c: Please give a short textual explanation on the user friendliness of the SUDPLAN service interfaces and suggestions for improvement.

(not validated)

SUDPLAN shall extend the state-of-the-art in the field of service-oriented infrastructures by complementing SOAs in the field of modelling services
The models used within SUDPLAN will be provided as services
REQ-DOW-9.4: Provide new SOA modelling services

76 5b/Q4a: Please list the "model as a service" services developed in SUDPLAN. This includes common services as well as local models integrated as services.

	Service name	Type (e.g. OGC SOS)	URL to access the service

(not validated)

SUDPLAN shall contribute to the extension of the state-of-the-art in the area of model integration and expose the models used in SUDPLAN applications as services in loosely coupled SOA
The models used within SUDPLAN shall be offered as services to allow re-using them in multiple contexts without repeated model development efforts.
REQ-DOW-8.1.: Provide models using SOA

SUDPLAN shall support the integration of models through standardized web services.
Integration of distributed models through standardized web services is essential to support the development of SUDPLAN applications.
REQ-DEV-1.2.2: Model Service Integration

77 5b/Q4b: Please assess the ease of use of "models as services" (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
using already configured model services								*4*
integrating a new model service								*4*

78 5b/Q4c: Please give a short textual explanation on your experience with integrating and using the models as services (in SUDPLAN), and suggestions for improvement.

(not validated)

SUDPLAN shall contribute to the extension of the state-of-the-art in the area of model integration as models become more available to administrative end users
Models available as services should be offered to SUDPLAN users.
REQ-DOW-8.2: Provide models for the end user

SUDPLAN shall support modellers in integrating their models into a SUDPLAN application.
Integrating models into a SUDPLAN application, possibly with other models, means that the modeller needs to be able to specify the role of the model(s) within the application and to make the necessary connections between the model(s) and other components of the application.
REQ-USR-3.1.1: Model integration

79 5b/Q5a: Please assess the capability of SUDPLAN "model as a service" concept (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Dynamic linking the models with data sources								*4*
Configuration of the models								*4*
Running of the models continuously								*4*
Running of the models on request								*4*
Informing the users about the model run progress								*4*
Propagation of the data and model uncertainties								*4*
Providing rich self-describing data models for model results								*4*
Handling large data sets								*4*

80 5b/Q5c: Please give a short textual explanation on your experience with the SUDPLAN's "model as a service" concept, and suggestions for improvement.

(not validated)

SUDPLAN shall contribute to the extension of the state-of-the-art in the area of model integration as emerging SOA development is fostered
Techniques and tools used for model integration in SUDPLAN shall also be available outside of SUDPLAN.
REQ-DOW-8.3: Foster SOA development in the area of model integration

81 5b/Q6a: Please name the extensions of the state of the art in the area of "model as a service" achieved by SUDPLAN (if any).

(not validated)

SUDPLAN shall extend the state-of-the-art in the field of service-oriented infrastructures by supporting the spreading of SOA-type service networks
Since SUDPLAN will allow the access to and from SOA based service networks users will have an interest to use SOA networks
REQ-DOS-9.2: Spread SOA-type service networks

82 5b/Q7a: Please list the projects and products using (parts of) the SUDPLAN service infrastructure (if any).

	Service name	Type (e.g. OGC SOS)	URL to access the service
(not validated)			

83 5b/Q7b: Please give a short textual report on the achievements wrt. spreading of the SOA infra-structures by SUDPLAN, and suggestions for improvement.

(not validated)

1.7. 6 Usage of standards

The SUDPLAN product service interfaces, data and meta-information models shall be entirely based on open standards
The usage of open standards is needed to enable connections to other (existing and future) systems. For example, we need to access already existing city-local data and services which are not based on open standards. This should be done by providing standard based interfaces to this data storages and services.
REQ-DOW-2.1: Use open standards

SUDPLAN shall contribute to the extension of the state-of-the-art in the area of model integration as existing standards (e.g. OGC Web Processing Service) are tested and validated in terms of their usability
SUDPLAN will collect experience in using existing SOA standards.
REQ-DOW-8.4: Validate existing standards

SUDPLAN shall extend the state-of-the-art in the field of service-oriented infrastructures by taking up existing developments, validating and improving them
Rationale: SUDPLAN will use and where necessary improve existing standards

REQ-DOW-9.1: Improve existing SOA standards

85 6/Q7a: Please name the standards that were tested / extended / validated for their usability / actually used in the SOA context by SUDPLAN). This includes service interfaces, data coding standards and more.

	Yes	No	Name (for Others)
OGC WMS	1	3	
OGC WFS	1	3	
OGC WCS	0	4	
OGC SOS	1	3	
OGC SPS	1	3	
OGC WPS	0	4	
Other 1	0	4	
Other 2	0	4	
Other 3	0	4	
Other 4	0	4	
Other 5	0	4	

SUDPLAN shall contribute to the extension of the state-of-the-art in the area of model integration as existing standards (e.g. OGC Web Processing Service) are tested and validated in terms of their usability
SUDPLAN will collect experience in using existing SOA standards.
REQ-DOW-8.4: Validate existing standards

SUDPLAN shall extend the state-of-the-art in the field of service-oriented infrastructures by taking up existing developments, validating and improving them
Rationale: SUDPLAN will use and where necessary improve existing standards
REQ-DOW-9.1: Improve existing SOA standards

86 6/Q7b: Please assess the usability of the standards named in the previous question (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
OGC WMS						*1*		*3*
OGC WFS						*1*		*3*
OGC WCS								*4*
OGC SOS			*1*					
OGC SPS			*1*					
OGC WPS								*4*
Other 1								*4*
Other 2								*4*
Other 3								*4*
Other 4								*4*
Other 5								*4*

SUDPLAN shall contribute to the extension of the state-of-the-art in the area of model integration as existing standards (e.g. OGC Web Processing Service) are tested and validated in terms of their usability
SUDPLAN will collect experience in using existing SOA standards.
REQ-DOW-8.4: Validate existing standards
SUDPLAN shall extend the state-of-the-art in the field of service-oriented infrastructures by taking up existing developments, validating and improving them
Rationale: SUDPLAN will use and where necessary improve existing standards
REQ-DOW-9.1: Improve existing SOA standards

87 6/Q7c: Please describe the key shortcomings of the above mentioned standards that were discovered in the pilot, and give suggestions for improvement.

The usage of SPS / SOS for communicating with the Common Services is effective, but time consuming. The performance should be enhanced! *(Validator 1)*

The SUDPLAN product service interfaces, data and meta-information models shall be entirely based on open standards
The usage of open standards is needed to enable connections to other (existing and future) systems. For example, we need to access already existing city-local data and services which are not based on open standards. This should be done by providing standard based interfaces to this data storages and services.
REQ-DOW-2.1: Use open standards

88 6/Q2a: Please indicate the proprietary solutions used in this pilot (if any) and explain why no open standard has been used (e.g. “existing system, replacing too costly”, “no open standard exists”).

	Solution	**Reason**
1	Integration of local models GeoCPM / DYNA	no open standard exists
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

The SUDPLAN product service interfaces, data and meta-information models shall be entirely based on open standards
The usage of open standards is needed to enable connections to other (existing and future) systems. For example, we need to access already existing city-local data and services which are not based on open standards. This should be done by providing standard based interfaces to this data storages and services.
REQ-DOW-2.1: Use open standards

89 6/Q2b: Please give a short textual explanation for the above marks, and suggestions for improvement.

No additional suggestions. (*Validator 1*)

1.8. 7 Open source software

SUDPLAN shall be based on open source products, and will itself be an open source product
Should enable simple extensibility, reuse and make the product easily available to all interested parties at minimal cost
REQ-DOW-2.3: Use and provide open source

91 7/Q1a: Please name the software elements of SUDPLAN. This might include libraries, service implementations, GUI elements and so on.

	Solution
1	TS-Toolbox http://ts-toolbox.ait.ac.at
2	Cids Geointegration Platform http://www.cismet.de/en/products.html
3	Cids SUDPLAN extensions http://sudplanwp3.cismet.de/sms/
4	Geoserver http://geoserver.org
5	Rainfall downscaling
6	
7	
8	
9	
10	
11	

SUDPLAN shall be based on open source products, and will itself be an open source product

Should enable simple extensibility, reuse and make the product easily available to all interested parties at minimal cost
REQ-DOW-2.3: Use and provide open source

92 7/Q1b: Possible usage of the service instances and data sets named in the previous question. Please give the number of answers for each alternative.

	Pre-existing software	SUDPLAN extension	New software	Available as open source
1	1	1	0	0
2	1	1	0	1
3	0	0	1	1
4	1	0	0	1
5	1	1	0	0
6…				

93 7/Q1c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement. Especially if some new developed software is not open source: please state why!

The Cids Geointegration platform is already in productive use in Wuppertal, providing the integration tier and the main part of the application tier of the city's SDI. *(Validator 1)*

1.9. 8 Completeness of functionality

Decisions based on the SUDPLAN applications may have great impact (e.g. financial impact on city planning). It is therefore important to adequately store all the facts and results leading to the decision, e.g. to allow a-posterior reconstruction of the decision making process and audits. Every piece of data within the internal repositories therefore has to be assessed with descriptions about the origin and processing of these data.
REQ-DOW-2.7

95 8/Q2a: Please list quality controlled data repositories used within SUDPLAN.

	Name
1	*(not validated)*
2	
3	
4	
5	
6	
7…	

96 8/Q2b: Please indicate which aspects of the repository QA are covered.

	uncertainties of input/output data known and visualized	Data snapshot (input data, model results) used for decision making saved with scenario instance	Decision & reasoning/comments saved with scenario instance)
1	*(not validated)*		
2			
3			
4			
5			
6…			

97 8/Q2c: Please give a short textual explanation on the (dis)advantages of "quality controlled repositories" in SUDPLAN, and suggestions for improvement.

not a V2 target *(Validator 1)*

98 8/Q3a: Please describe at least one "worst case" scenario illustrating the need for "security" when using SUDPLAN.

not investigated so far *(Validator 1)*

no comment *(Validator 2)*

The technical information the WUP pilot application deals with are not highly confidential, but it takes quite a long time to generate them. Worst case would be a destruction or corruption of the data by an unauthorized intruder. *(Validator 4)*

99 8/Q3b: Please indicate the worst case scenario consequences, in terms of the human or monetary losses, legal liabilities, etc (example: 100M€ on productivity loss in case of false alert).

not investigated so far *(Validator 1)*

no comment *(Validator 2)*

Data loss, dimension 10.000 to 100.000 €. *(Validator 4)*

100 8/Q3c: Please give a short textual explanation on the (dis)advantages of "security" in SUDPLAN, and suggestions for improvement.

not investigated so far *(Validator 1)*

no comment *(Validator 2)*

not in the scope of an analyst *(Validator 4)*

Web publishing is becoming a main information source for large parts of the population. SUDPLAN does not intend to implement a full Content Management System functionality, but it should allow the export of results in proper formats to publish them in the WWW to inform the public.
REQ-DOW-2.9

101 8/Q4a: Please assess the usability of the "result publication" on the web as offered by SUDPLAN (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Tables	*1*							
Graphic representations					*1*			
Animations			*3*					
Videos	*1*							
3D Material			*1*					
Complete reports	*1*							

102 8/Q4c: Please give a short textual explanation on the (dis)advantages of "web publication" in SUDPLAN, and suggestions for improvement.

This is subject of V3. *(Validator 1)*

not in the focus of a system manager in WUP *(Validator 2)*

Production of Web publications have not been tested by the validator. Therefore no answers are given. *(Validator 3)*

"Animations" and "3D material" is validated against demo material of the component "Visualization wizard" that is not yet integrated in the Wuppertal pilot application. Available "Graphic representations" comprise 2D maps and charts that can both be publish via service URL or as png image. (*Validator 4*)

SUDPLAN shall extend the state-of-the-art in the field of environmental decision support systems by offering to users the dynamic composition of scientific work flows
Allow users to define their own workflows as needed
REQ-DOW-3.1:Provide dynamic composition of work flows

103 8/Q5b: Please indicate the level of usability of the “dynamic workflow composition” offered by SUDPLAN as compared to the state of the art workflow solutions (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Dynamic workflow composition								*4*

104 8/Q5c: Please indicate the "state of the art" applications used to compare SUDPLAN with.

There will be no possibility to define a workflow for the end user. However – all the information needed in a workflow can be “grouped” to support an arbitrary workflow. (*Validator 1*)

105 8/Q5d: Please give a short textual explanation for the above marks, key advantages of SUDPLAN wrt. to state of the art (if any), and suggestions for improvement.

no suggestions *(Validator 1)*

SUDPLAN shall extend the state-of-the-art in the field of environmental decision support systems by offering automation of model runs, analysis and reporting
Simplify the use of modelling, analysis and reporting tools for end users
REQ-DOW-3.3

106 8/Q6a: Please indicate the level of support for following functionality offered by SUDPLAN product (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Automated model runs								*4*
Automated analysis								*4*
Automated reporting								*4*

107 8/Q6c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN (if any), and suggestions for improvement.

no suggestions *(Validator 1)*

SUDPLAN shall offer a powerful tool for assessing environmental factors and their interaction with urban subsystems such as infrastructure, waste water and transport systems, in a climate change perspective to be used for city management.
Model based decision support applications are used to better understand the effects of city management decisions in a complex system.
REQ-DOW-4.1: Support city management

108 8/Q7a: Please assess the usability of SUDPLAN in the city management scenario (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Compared to state of the art solutions						*2*		*2*
Compared to SUDPLAN project objectives				*1*				*3*

1

109 8/Q7b: Please assess the usability of the SUDPLAN tool as the basis for city management applications product (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Overall						*3*		*1*
SMS (Scenario Management System)				*1*	*1*			*2*

CS (Common Services)				*2*				*2*

110 8/Q7c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN (if any), and suggestions for improvement.

SMS and CS are a sound basis for certain city management applications that deal with climate change and simulations of environmental matters. Moreover the cids framework enables the development of all kinds of municipal information systems. *(Validator 2)*

WMS Layers concerning climate change can be integrated easily in Wuppertal's SDI. This means that it will be easy to design Web GIS- Applications that use this kind of information. SMS and CS have not been tested, therefore no answers are given to questions 2 and 3. *(Validator 3)*

CS are specialised, therefore only a limited set of possible city management applications can be supported. SMS is a generic component, but the model integration is always an individual time consuming step in the development. The overall system based on the cids framework is a flexible basis for the implementation of a large variety of possible information systems (proved by several examples in the City of Wuppertal). *(Validator 4)*

SUDPLAN shall enhance the current state of the art in interactive visualization by allowing easy customization of the visualization and interaction by the user/planer, which can produce presentations tailored for different recipient groups
This is needed to present facts and document the reasons of decisions outside the interactive SUDPLAN environment.
REQ-DOW-10.3: Provide tools to create customizable presentation material

SUDPLAN shall support the users' efforts to produce accessible information products from the results of their analyses.
The value of an analysis can be greatly enhanced by producing information products which contain or reflect the results but which are also accessible to other stakeholders. Analysts will require system support to help them generate such information products.
REQ-USR-2.71: Creation of information products

SUDPLAN shall support the generation of reports.
Basic reports making the results of scenario execution accessible to non-analysts are necessary in order to communicate the results to the other stakeholders of the SUDPLAN application.
REQ-USR-2.7.2: Report generation

SUDPLAN shall support the publishing of its artefacts for use of other services.
SUDPLAN analysts may wish to make their data and other information available to other web-based services, and therefore need a mechanism for publishing this information to the Internet.
REQ-USR-2.9.1: Information publishing

111 8/Q8a: Please assess the level of SUDPLAN's achievement while creating presentation material in the following categories (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Interactive visualization						*3*		*1*
Customization for different recipient groups				*1*	*2*			*1*
Exporting the results for further dissemination		*1*		*1*	*1*			*1*

112 8/Q8c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN wrt. to the state of the art (if any), and suggestions for improvement.

Interactive visualisation is possible in a very flexible way in 2D, 3D and 4D (3D and 4D with component "Visualization Wizard"). Exporting of map images is possible via clipboard functionality. *(Validator 1)* Interactive visualization has only been tested in 2D which is sufficient for the coarse resolution of the WMS-layers. 3D Visualization would be interesting for the results of Air Quality Downscaling. Customization (storing named profiles) is (in WUP) a well known feature of the cids framework. Exporting the time series diagram is problematic, since there is no contextual information neither in the title of the diagrams nor as a description of the graphs (legend that should contain the lat/lon position the graph is referring to and the climate model / scenario that is underlying the time series. *(Validator 3)* Exporting the results for further dissemination is still rudimentary. 2D visualization is as expected but the more sophisticated visualizations are expected to come from the 3D map (component Visualization Wizard) that is not integrated in the Wuppertal pilot yet. *(Validator 4)*

REQ-USR-2.1: Information management (specific to analysts)

SUDPLAN shall allow users to manage their information sources easily.
An information-intensive application must facilitate the finding, storing, and utilization of information within the application in order to support user success and satisfaction.
REQ-USR-2.1.1: Information source management

SUDPLAN shall support users in the management of information related to their activities.
Besides actual input data, there may be other information valuable to the analyst, and this information needs to be readily accessible to the users.
REQ-USR-2.1.2: Management of related knowledge

SUDPLAN shall allow users to find and utilize information sources distributed globally via the Internet.
SUDPLAN applications will often rely on data from multiple external sources.
REQ-USR-2.1.3: Distributed information sources

SUDPLAN shall allow users to manage the results of analysis easily.
SUDPLAN applications will produce results in a wide variety of forms. These data need to be easily accessible to and manipulated by the analysts.
REQ-USR-2.1.4: Output data management

SUDPLAN shall support processing of the results of users' analyses.
Given the complexity of SUDPLAN applications, output data resulting from primary analytical techniques may need to be post-processed by the user, and system support for these activities is necessary.
REQ-USR-2.1.5: Result processing management

SUDPLAN shall support the management of information products.
Information products produced by analysts must be stored and managed in an organized and accessible fashion.
REQ-USR-2.1.6: Information product management

SUDPLAN shall support spatial reference system conversion.

Information products produced throughout the platform must be easily convertible to other spatial reference systems.
REQ-USR-2.1.7: Coordinate conversion

SUDPLAN shall support tracing of user actions.
SUDPLAN shall provide support the tracing of user and system component interactions
REQ-USR-2.1.8: Tracing

113 8/Q9a: Please assess the usability of SUDPLAN with respect to the information management requirements of analysts (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Information source management				*1*	*1*			*2*
Management of related knowledge		*1*		*1*				*2*
Distributed information sources				*1*	*1*			*2*
Output data management				*1*				*3*
Result processing management				*1*				*3*
Information product management				*1*				*3*
Coordinate conversion						*2*		*2*
Tracing						*1*		*3*

114 8/Q9c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

Some of the questions are beyond the scope of the validator. Only questions that are meaningful with respect to the SUDPLAN WMS Services have been answered. The capabilities of the system for information source management and management of related knowledge are huge, but appropriate content describing the data sources is still missing! (Abstracts of WMS-Layers, description pages for catalogue objects). Coordinate conversion capabilities are impressive (functionality of the cids framework). *(Validator 3)*

To the first 6 categories: to utilize the high potential of SUDPLAN a lot of descriptive information for all objects in the catalogue has to be provided (German language required). The same is valid for the WMS layers where the abstracts are still missing. *(Validator 4)*

REQ-USR-2.2 Interactivity (Special to analysts)

The SUDPLAN user interface shall be highly interactive.
SUDPLAN needs to support and encourage analysts who want to interact with the system by including design features which facilitate manipulation of elements of the modelled system (e.g. parameters, variables, and input data).
REQ-USR-2.2.1: General interactivity requirements

Where feasible, the SUDPLAN user interface shall respond immediately to changes in parameters.
When the analyst has manipulated an input to the modelling system, the system needs to provide an immediate response to this change in situations where that makes sense and is possible.
REQ-USR-2.2.2: Responsiveness

Where feasible, the SUDPLAN system shall pre-fetch and cache data.

Pre-fetching and caching data locally (on users' computers or on a fast LAN) can greatly improve the users' experience of interactive exploration of the data.
REQ-USR-2.2.3: Local data copy

Where feasible, the SUDPLAN system shall download only the part of the data that actually changed since the last request.
Repeated fetching of data over a network is slow and inefficient.
REQ-USR-2.2.4: Differential data download

115 8/Q10a: Please assess the usability of SUDPLAN with respect to the interactivity requirements of analysts (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
General interactivity requirements					*1*	*1*		*2*
Responsiveness			*1*	*1*				*2*
Local data copy		*1*	*1*					*2*
Differential data download		*1*	*1*					*2*

116 8/Q10c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

The responsiveness of every request that works over SPS/SOS services is quite slow. Local data copy for maps is possible via clipboard function and for the diagrams via download of png-files. Problem with the download of diagrams is the missing contextual information (lat/lon-position and climate model). *(Validator 3)*

Responsiveness: the service requests that are processed via SPS/SOS are rather slow. Local data copy and differential data download is not a generic feature, it works only in certain situations. *(Validator 4)*

REQ-USR-2.3: Model management (specific to analysts)

SUDPLAN shall support users in choosing initial and boundary conditions.
Mathematical models generally require parameters describing initial and boundary conditions as constraints for internal variables in the model. It is essential that users be permitted, and assisted where possible, in choosing and establishing those conditions.
REQ-USR-2.3.1: Initial and boundary conditions

SUDPLAN shall support users in storing, managing and re-using sets of conditions.
Particular combinations of initial and boundary condition parameters can be stored as a set, and then reused in subsequent model runs.
REQ-USR-2.3.2: Condition sets

SUDPLAN shall support end users executing models synchronously.
Models which generally run to completion quickly can be run by users who choose to wait for completion.
REQ-USR-2.3.3: Synchronous model execution

SUDPLAN shall support users executing models asynchronously.
Since some models will take considerable time to complete, users may choose to run these models asynchronously.
REQ-USR-2.3.4: Asynchronous model execution

SUDPLAN shall permit users to instantiate repeated executions of models with a variation of conditions.
Extending the concept of asynchronous model execution, users can run multiple instances of the same model combination with varying sets of parameters, producing a "family" of results.
REQ-USR-2.3.5: Model set execution

SUDPLAN shall support users performing and/or using pre-calculated model executions.
For computationally intensive models limiting the number of times the model has to be executed, and using stored results from previous runs, can help model combinations which use these results to execute in a timely fashion, and can also reduce redundant use of computational resources.
REQ-USR-2.3.6: Pre-calculated model execution

SUDPLAN shall allow users to monitor model execution progress and shall notify users of changes in model status.
Computationally intensive models can take considerable time to execute, and during their execution analysts will need to be able to check their status and learn if a run has completed, failed, etc.
REQ-USR-2.3.7: Model run status

REQ-USR-2.6 Result documentation/annotation

SUDPLAN shall support the documentation of an individual model run.
The results of each model run need to be annotated before being stored in order to facilitate search and recovery.
REQ-USR-2.6.1 Documentation of a model run

SUDPLAN shall support the documentation of a scenario set execution
In addition to storing annotations about individual model runs, analysts will need to annotate scenario sets as well.
REQ-USR-2.6.2 Documentation of scenario set execution

117 8/Q11a: Please assess the usability of SUDPLAN with respect to the model management and result documentation requirements of analysts (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Initial and boundary conditions	*1*							*3*
Condition sets						*1*		*3*
Synchronous model execution	*1*							*3*
Asynchronous model execution						*1*		*3*
Model set execution	*1*							*3*
Pre-calculated model execution	*1*							*3*
Model run status					*1*			*3*
Documentation of a model run						*1*		*3*
Documentation of scenario set execution	*1*							*3*

118 8/Q11c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

Model execution was not in the scope of the validator. *(Validator 3)*

Initial model configuration comes from the local model component (not in the scope of the Wuppertal pilot application). Execution is always asynchronous - that is necessary because of the long time a model run takes (up to several hours). Documentation of model runs is sufficient. In V2 only single model runs are possible (no execution of sets). *(Validator 4)*

REQ-USR-2.7: Information products

SUDPLAN shall support the users' efforts to produce accessible information products from the results of their analyses.
The value of an analysis can be greatly enhanced by producing information products which contain or reflect the results but which are also accessible to other stakeholders. Analysts will require system support to help them generate such information products.
REQ-USR-2.7.1: Creation of information products

SUDPLAN shall support the generation of reports.
Basic reports making the results of scenario execution accessible to non-analysts are necessary in order to communicate the results to the other stakeholders of the SUDPLAN application.
REQ-USR-2.7.2: Report generation

SUDPLAN shall support the export of its artefacts to external formats.
In order to support the generation of information products beyond basic reports, the analyst will need to be able to export artefacts (such as model execution results or visualized data) to other formats so that they can use tools outside of SUDPLAN to develop more information products.
REQ-USR-2.7.3: Export

REQ-USR-2.8: Sharing

SUDPLAN shall support the sharing of information among different users.
Information regarding a SUDPLAN application, including but not limited to input data, should be readily shared between consenting analysts to facilitate collaboration and efficiency.
REQ-USR-2.8.1: Information sharing

SUDPLAN shall support the sharing of results among different users.
The results of model and scenario set execution can be useful for analysts working on the same or related applications, and should be readily shared along with their documentation annotations.
REQ-USR-2.8.2: Result sharing

SUDPLAN shall support the sharing of information products among different users.
Multiple analysts might be producing similar information products to communicate their results. Sharing of these products encourages efficiency and consistency.
REQ-USR-2.8.3: Information product sharing

SUDPLAN shall support the sharing of automation tasks among different users.
The configuration of automation tasks can become complex for some complicated modelling systems. Sharing these configurations for re-use brings increased efficiency and quality control.
REQ-USR-2.8.4: Automation sharing

SUDPLAN shall support the sharing of annotations among users.
Sharing of annotations among analysts working on the same data sets can increase their efficiency and support additional quality control.
REQ-USR-2.8.5: Annotation sharing

REQ-USR-2.9: Publishing

SUDPLAN shall support the publishing of its artefacts for use of other services.
SUDPLAN analysts may wish to make their data and other information available to other web-based services, and therefore need a mechanism for publishing this information to the Internet.
REQ-USR-2.9.1: Information publishing

SUDPLAN shall support the publishing of its artefacts as web content.
Other SUDPLAN application information, such as visualizations and information products, may also be shared with others as web content in order to enhance the value added by the application analyses.
REQ-USR-2.9.2: Web publishing

SUDPLAN shall use standards for the publishing of information content.
Adherence to standards will increase the availability of SUDPLAN application information to the wider community.
REQ-USR-2.9.3: Web publishing standards

119 8/Q12a: Please assess the usability of SUDPLAN for the creation of reports, publications and data export with respect to the requirements of analysts (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Creation of information products			*1*					*3*
Report generation	*1*							*3*
Export		*1*						*3*
Information sharing						*1*		*3*
Result sharing						*1*		*3*
Information product sharing						*1*		*3*
Automation sharing	*1*							*3*
Annotation sharing	*1*							*3*
Information publishing			*1*					*3*
Web publishing		*1*						*3*
Web publishing standards	*1*							*3*

120 8/Q12c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

These tasks were not in the scope of the validator. *(Validator 3)*

Information and result sharing is perfect among the users of the Wuppertal pilot application. Production of reports etc. is in an early stage of development. (Validator 4)

REQ-USR-4.1: Platform management

SUDPLAN shall support system managers in managing users.
In order to manage access to a SUDPLAN application the system manager needs to be able to specify users and groups of users to the system.
REQ-USR-4.1.1: User management

SUDPLAN shall support system managers in managing system security and access rights.
System managers need to be able to specify which users are authorized to have what level of access to which parts of the application.
REQ-USR-4.1.2: Security and rights management

REQ-USR-4.2:

Integration SUDPLAN shall support system managers in integrating data sources.
A SUDPLAN application may use data from a variety of sources. The system manager needs to be able to integrate these data sources into the application for the system analyst.
REQ-USR-4.2.1: Data source integration

SUDPLAN shall support system managers in integrating sensor services.
SUDPLAN applications may use sensor services that are either local to the application or that are distributed and accessible via the web.
REQ-USR-4.2.2: Sensor service integration

SUDPLAN shall support system managers in integrating arbitrary services.
SUDPLAN applications may use other non-modelling services that are either local to the application or that are distributed and accessible via the web.
REQ-USR-4.2.3: Service integration

121 8/Q13a: Please assess the usability of SUDPLAN with respect to the requirements of system managers (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
User management					*1*			*3*
Security and rights management					*1*			*3*
Data source integration					*1*			*3*
Sensor service integration								*4*
Service integration				*1*				*3*

122 8/Q13c: Please give a short textual explanation for the above marks, key advantages of SUDPLAN and suggestions for improvement.

Service integration is easy with respect to OGC services. Integration of SOAP services demands programming skills and is out of the focus of a system manager in WUP. Integration of SPS/SOS should be easy but so far no experiences have been gathered. (*Validator 2*)

1.10. 9 Conclusions

Information about climate scenarios, downscaling of rain, air quaity and hydrogogical conditions.

123 9/Q4a: Have you had access to similar information as available from SUDPLAN before?

	Y	**N**	**NA**
1	0	4	
2			
3…			

124 9/Q4b: Compared to the earlier information SUDPLAN results are: (1 = not fulfilled at all, 4 = on par, 7 = fulfilled beyond expectations). Please give the number of answers for each alternative.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Quality								*4*
Usefulness								*4*

125 9/Q4c: Which information sources where used for comparison? Please describe the reasons for your judgement.

(not validated)

126 9/Q4d: What is your impression of the SUDPLAN output?

	Not scientifically sound nor credible	Not possible to judge on quality	Scientifically sound and credible
1	0	2	2
2			
3…			

127 9/Q5a: Do you find the SUDPLAN output to be useful as a base for your planning? Choose one of the following answers.

	Not at all	To certain extent	Highly useful
1	0	2	2
2			
3…			

Please enter your comments here.

Modelling of surface run-off is a conditional step in the mid term planning of the sewer system in Wuppertal (mandatory if risk is detected). (*Validator 1)*

SUDPLAN tools might be a good basis for the implementation of a certain category of municipal planning and information systems (in cooperation with external companies). *(Validator 2)*

The overall SUDPLAN system (without Air Quality Downscaling) is useful for general risk assessments coming from climate change and to raise awareness of this issue. For concrete urban planning processes Air Quality Downscaling would be necessary (not tested in WUP). *(Validator 3)*

The Wuppertal pilot application is the only tool that enables the planners in Wuppertal to simulate the effect of different planning options on surface run-off in the course of a heavy storm water event and to consider the effect of climate change. This is a conditional step in the urban planning process for the Sewage system (mandatory if a risk is detected). *(Validator 4)*

128 9/Q6a: Did SUDPLAN provide you with the data output expected? Choose one of the following answers.

	A lot of information missing	Most information given	All aspects covered
1	1	2	1
2			
3…			

Please enter your comments here.

There is still some information missing, especially the full integration of 3D visualization. *(Validator 1)*

out of the focus of a system manager *(Validator 2)*

Descriptions of Climate models / scenarios are missing. These should be in German and on a simple level since there are no experts for climate change working for the City of Wuppertal. *(Validator3)*

Only minor details are missing. *(Validator4)*

129 9/Q7a: How did you find the graphical presentation of the SUDPLAN results? Choose one of the following answers.

	Not useful	**Ordinary**	**Excellent and contributing to a better understanding**
1		2	2
2			
3…			

Please enter your comments here.

no comment *(Validator 1)*

out of the focus of a system manager *(Validator 2)*

Both maps and diagrams give a good understanding. Legends for the WMS-Layers are quite poor: no units are given (seem to be generated). Connection between map- and diagram-representation of data could be better, for example by marking the temporal point shown in the map in the diagram when it is initially loaded. *(Validator 3)*

3D and 4D visualizations are not yet integrated in the Wuppertal pilot application. *(Validator 4)*

130 9/Q8a: What is in your opinion the strength of SUDPLAN output?

The SUDPLAN application lowers the threshold to address the climate change impact for an urban planner. SUDPLAN makes it easier to share simulation results with other planners in the municipality, with decision-makers and with the general public. *(Validator 1)*

out of the focus of a system manager *(Validator 2)*

SUDPLAN provides the first chance to introduce climate change aspects into urban planning processes. *(Validator 3)*

The Wuppertal pilot application is the only tool that enables the planners in Wuppertal to simulate the effect of different planning options on surface run-off in the course of a heavy storm water event *and* to consider the effect of climate change. This is a conditional step in the urban planning process for the Sewage system (mandatory if a risk is detected). *(Validator 4)*

131 9/Q9a: What is in your opinion the weakness of SUDPLAN output?

Currently a lot of describing information for all objects of the SMS catalogue and for the WMS layers (abstracts) is missing. This information is necessary to make the system self-explanatory for an urban planner. For WUP the textual information has to be in German. In the moment it is not clear who will provide this content. *(Validator 1)*

out of the focus of a system manager *(Validator 2)*

Currently a lot of descriptive information that would make the system self-explanatory is missing! *(Validator 3)*

A lot of descriptive information that would make the application self-explanatory is still missing. *(Validator 4)*

132 9/Q10a: Would you recommend the SUDPLAN tool to colleagues in other European cities? Choose one of the following answers.

	No	**Maybe for a few specific cases**	**Yes, would be useful for most cities**
1		2	2
2			
3…			

Please enter your comments here.

The transfer of the Wuppertal pilot application to other European cities is not reasonable until V3 is finalized. There are way too many explanations necessary for an early transfer of V2. *(Validator 1)*

Recommendation would be focused on technical issues, e.g. the use of standardized interfaces etc. *(Validator 2)*

The overall system with the WMS Services is regarded to be useful for most cities. The pilot applications are more specialised. It depends on the technological infrastructur and the availabe data and models if they are useful for other cities. *(Validator 3)*

This depends on the technical conditions of the city, the available data and models! *(Validator 4)*

133 9/Q1a: Please give a short summary of your impression of the SUDPLAN product.

SUDPLAN has the potential to become a powerful tool for certain steps of urban planning processes. But to achieve this goal there is still a lot of work to do, mainly in the fields of explanatory content (description pages) and 3D/4D visualisation. *(Validator 1)*

From the point of view of a system manager SUDPLAN is expected to become a stable component of Wuppertal's SDI. *(Validator 2)*

A promising tool for introducing climate change considerations in urban planning processes in WUP. Air Quality Downscaling and especially 3D / 4D Visualization are interesting for air quality management in WUP, though not tested yet. *(Validator 3)*

The Wuppertal pilot is expected to become a operational part of Wuppertal's SDI and the standard tool for a conditional step of the mid- and long-term planning of Wuppertal's sewer system. *(Validator 4)*

134 9/Q2a: Please give some proposals for improvement of the SUDPLAN product.

For the Wuppertal pilot it is important to improve ergonomics in the important operation of changing the breaking edges heights (modifying the Digital Elevation Model). *(Validator 1)*

Performance of SPS/SOS communication with the Common Services seems to be problematic. *(Validator 2)*

Add descriptive information (in German!) to make the system self-explanatory. *(Validator3)*

The descriptive information required to make the system self-explanatory has to be provided (this is easily forgotten in a software project). *(Validator 4)*

135 9/Q3a: Please give some proposals for the optimization of this survey.

Please review the explanations given to the questions. In some cases they are rather confusing. Examples would be more helpful than quotations from the DoW. *(Validator 1)*

Some questions are overlapping. The number of questions should be reduced. Not everything mentioned in the DoW is a relevant aspect of the Wuppertal pilot application. *(Validator 4)*