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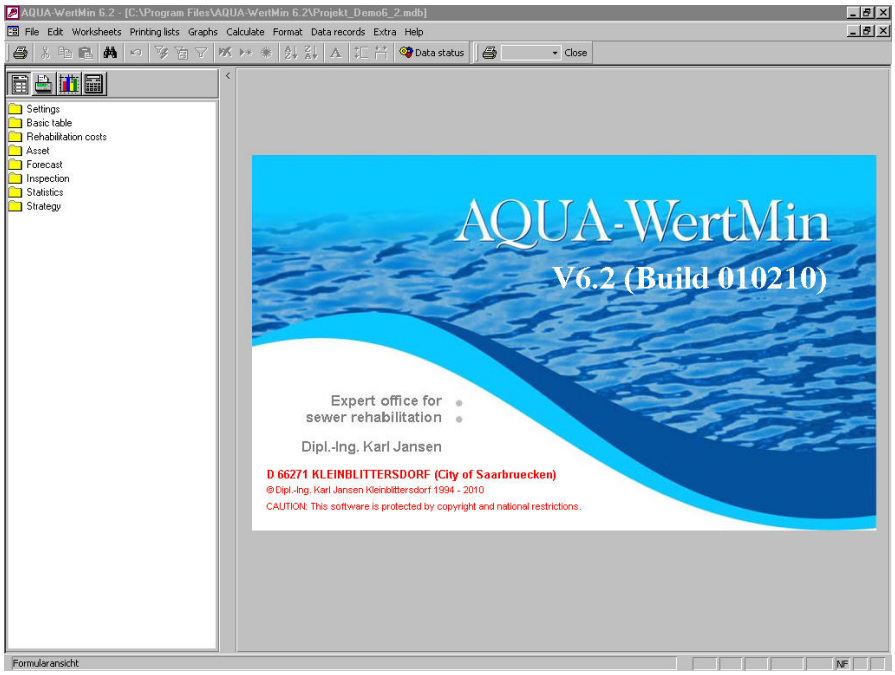
AQUA-WertMin V 6.2 (Build 010210)

for an ageing and condition forecast model for the development of rehabilitation strategies[1] for a costminimising maintenance of sewer networks[2]

[1] complies with at least the requirements of the new DWA data sheet M 143-14 „Rehabilitation strategies“

[2] approved since the beginning of 2001 for the amended self control regulation in the German federal state Baden-Württemberg



Purpose

AQUA-WertMin allows for a prognosis-based maintenance planning and prognostic rehabilitation planning according to the guidelines for cost-minimizing maintenance of sewers by the Ministry of Environment and Transport of the German federal state Baden-Württemberg of December 2000. With this program the inspection requirements for any maintenance interval and the condition forecast according to the federal state-specific self control regulation (EKVO) in Germany can be planned. For the self control regulation of Baden-Württemberg dated 20 February 2001 the exception of Appendix 1, paragraph 1.1 can be demonstated.

Moreover, already today future requirements of the new DWA data sheet M 143 / Part 14 „Sewer rehabilitation strategies“ from Nov. 2005.

AQUA-WertMin allows for the development of global sewer rehabilitation strategies including forecast of the rehabilitation and financial requirements to ensure compliance with the circular dated 3 January 1995 by the SüwVKan of the German federal state Nordrhein-Westfalen (see pilot project Rheine). This, however, requires a net asset value classification according to the guidelines of Baden-Württemberg.

Previously the usual operational useful life of sewers was calculated without including the structural condition. With the increasing level of development of sewer systems with TV inspections, the rehabilitation priority and sequence as well as the transport value are becoming increasingly important. In order to find cost-effective rehabilitation measures, new operational inspections based on the transport volume of the sewer system are required.

Using the AQUA-WertMin computer simulation model for Windows these evaluation aspects can be carried out simply and easily. Thanks to the **modular structure of Version 6.x** users can use **the Basic Module /RND** to calibrate the local deterioration process with the years of construction and condition classes and thereby calculate the actual and remaining useful lives. Additional **structure modules** allow users to calculate the **Rehabilitation Costs (/SKOST)**, of the **Transport Value (/WERTM)** and the **Repeat Inspection (/INSP)** with deterioration and condition forecasts.

The **Expansion Module / BUD** allows you to carry out forecasts of the condition and cost development including the calculated costs and transport values of sewer systems for specified structural and hydraulic rehabilitation concepts. The development of budget-related rehabilitation strategies taking into consideration the available finances is also possible.

System Requirements

- Processor with minimum 2 GHz
- Operating System MS-Windows 2000 / XP / Vista / Windows 7.
- MS-Access 2000/ 2003 or Runtime from MS Access 2000.
- Memory: minimum 1 GB RAM.
- Available disk space 1 GB with MS-Access 2000 installed or 2003.
- Recommended monitor with VGA resolution 1024 x 768.

Operation

- Simple operation of the Windows 32-Bit program using Explorer-style navigation structure. Program operation is similar to MS Windows and Office programs.

Functions

- Simple installation using the setup program.
- Consistent and easy-to-use interface with Explorer-style navigation structure.
- Online Help
- Comprehensive, detailed program documentation included as a print file.
- Freely-configurable import function for Access databases from Version 2.0 and databases linked using ODBC or with external import wizard.
- All import data and calculated data can be edited in the worksheets
- Undo incorrect input (Undo function)
- All data can be selected using specific fields and exported to MS Access 2000 or 97 databases.

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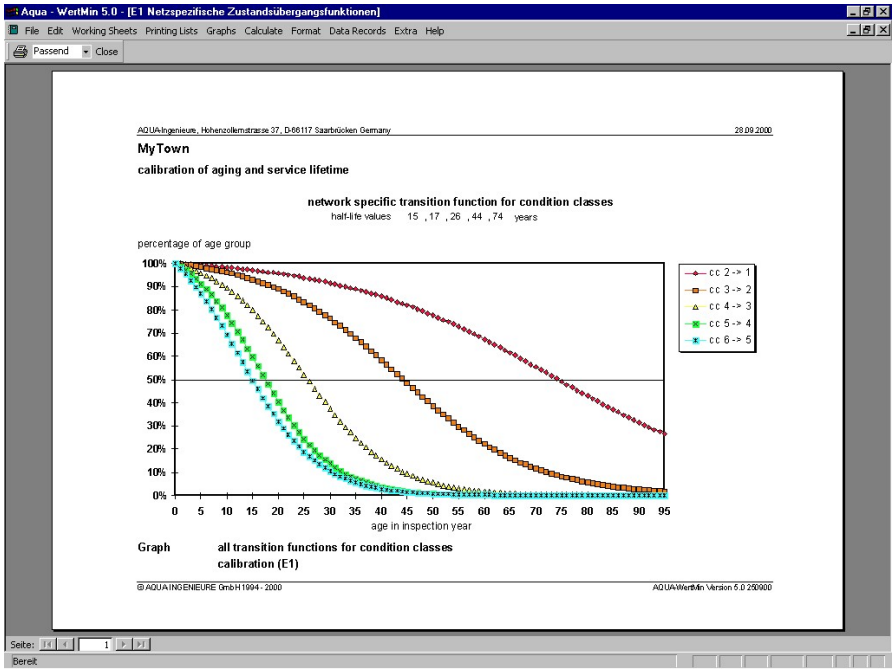
Age calibration and service life

Basic Module > **/ RND** incorporates a calibration model for calculating the **total and remaining useful life**

- **The Calibration Model** displays the local deterioration processes for reaches and shafts. The local deterioration processes for reaches and shafts are determined from the year of laying and the condition classes of the entire stock. These are described using the relative time spent by reaches and shafts in the condition classes related to their total useful life.
- **Standard calibration (First calibration) and individual calibration** (Second calibration) of the ageing function with the alternative calibration of the condition transition functions the user can now enter the parameters of the condition transition functions as set term or initial value of the iteration. Moreover, there is the possibility of individual determination of the half-lives period on the transition functions.



- **The model** uses different deterioration processes and speeds for reaches and shafts. It is used for calculating the remaining useful life for adapting to changed structural and operating conditions in accordance with DWA A133, Chapter 4.5, (August 2005).

- Output of results in freely-definable worksheets, print lists and diagrams.

- The basic module contains the transfer model /TRA3 for converting external data in MS Access format into AQUA-WertMin-Format. The conversion takes place using freely-definable reference tables. Reverse conversion takes place in an MS Access format file.

- For the external KDB exercise, S&K-Tiffany and the results from AQUA-Selekt specific data base imports are available. Moreover, external data bases can be integrated by means of an ODBC-interface and access tables can be imported with the AQUA-WertMin Import Wizard.

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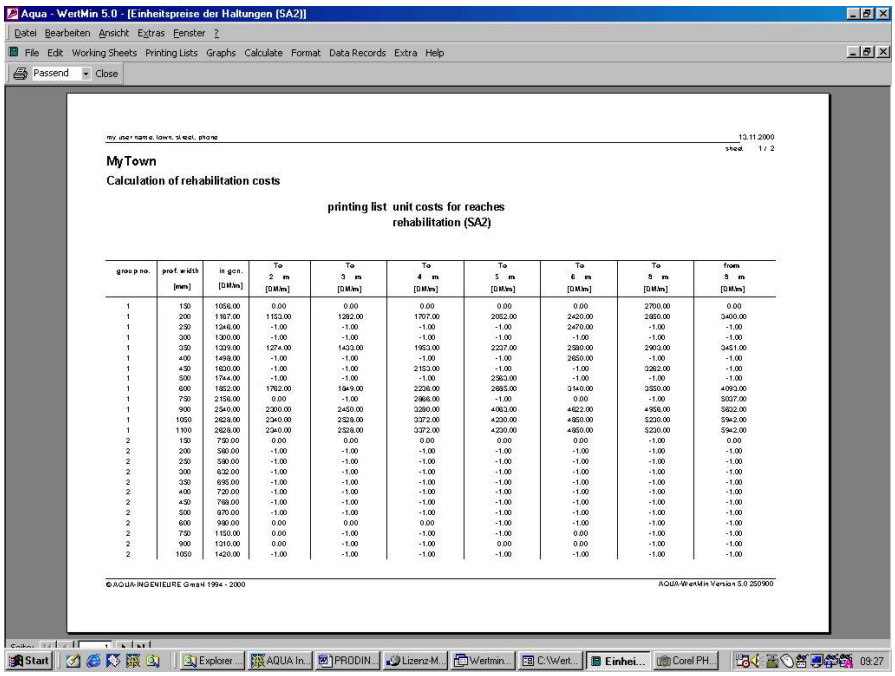
Rehabilitation Costs (Replacement / Renovation)

Structure Module > **/ SKOST** allows you to calculate the **rehabilitation costs** for replacement and renovation on several levels of precision, even if the data import is missing.

- The level of precision can be adapted to match the requirements taking into consideration increasing cost determinants (for example, in conjunction with the depth, the pipe material and the pipe diameter, profile type and construction process).
- The replacement costs can also be used as the basis for calculating the restoration costs of the sewer plant structure module.
- Output of results in freely-definable worksheets, print lists and diagrams.



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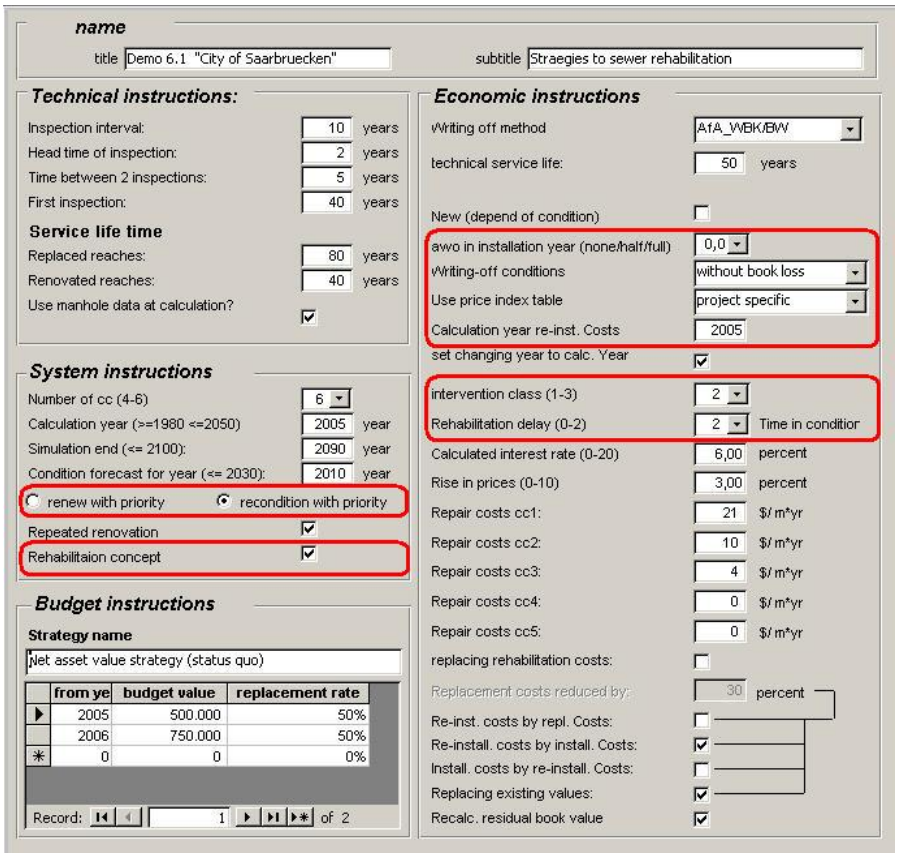
Sewer assets and market values

Structure Module > **/ WERTM** is used for calculating the sewer plant on the books and the **transport values.**



- Implementation of initial evaluation of restoration costs from the replacement costs by which the previously unavailable cost types (riser/restoration of road surfaces, removing old pipes, sewage rate, restricted conditions, diversions and so on) can be reduced across the board by the location-specific cost percentages.
- Using the index procedure the acquisition costs can either be calculated from the restoration and/or restoration costs from the acquisition costs.
- The calculated costs (calculated interest and write-offs) are determined for both the technical and actual useful life. Here, the write-offs are determined from the acquisition and restoration costs for book and transport values.
- The calculation procedure takes into consideration the previously expired write-offs. In the result, the residual value which was not previously written off, is now written off using the straight-line method for the individual remaining useful life of the reaches and/or shafts.
- Existing plant evaluations can be updated for the declining- balance-method write-off of a specific technical useful life (for example, 66 years) and the objectively calculated remaining useful life with the available transport value (loss of usefulness).
- The depreciation conditions „without book losses“ (Standard DWA A133 and HGB / tax law) and „with book losses“ (OVG judgement Münster) can be considered separately.
- Determining a desired reach and shaft changeover year.
- Determining any desired calculation and evaluation year.
- Output of results in freely-definable worksheets, print lists and diagrams.

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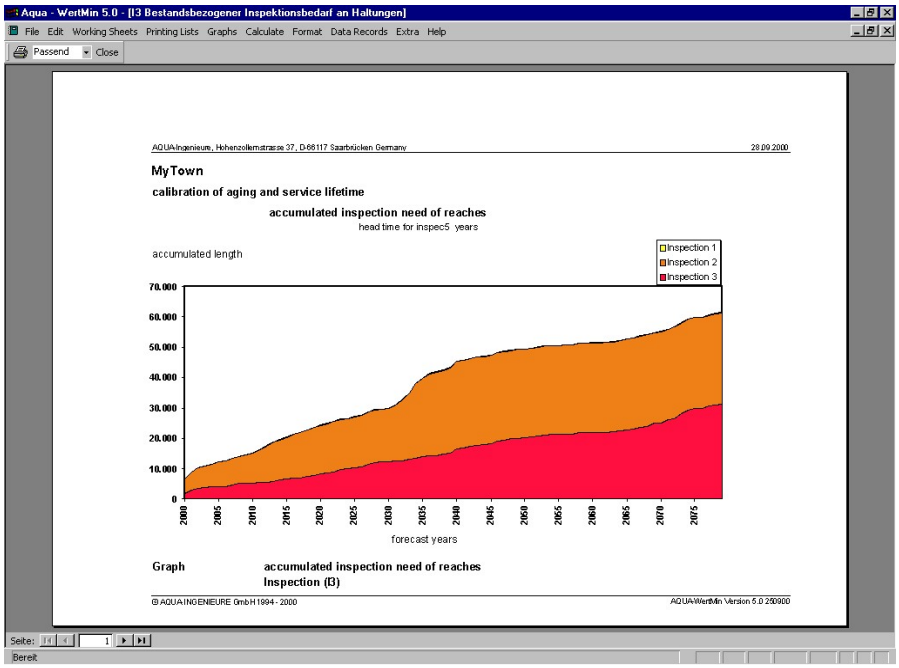
Inspection Planning (Initial and repeat-TV)

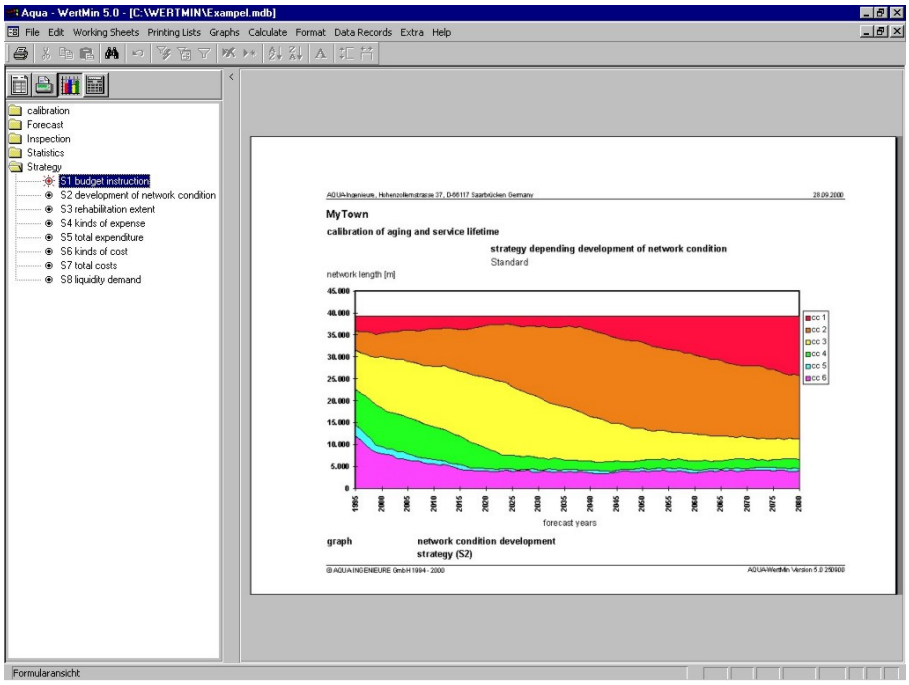
Structure Module > **/ INSP** is used for calculating the **initial and repeat inspection time points.**



- Calculating the inspection time points in accordance with SüwVKan, EÜV, EigVo and so on.
- Forecast-based inspection planning for condition dependent maintenance intervals according to the guidelines of Baden-Württemberg (Dec. 2000).
- Determining any desired minimum timeframe between two inspections.
- Determining any desired timeframe for initial inspections of uninspected reaches.
- The forecast model determines the deterioration rate for each individual reach and shaft with which the previously calibrated deterioration process is run through.
- Forecast for each reach for the postponed initial and repeat inspection dates with a selected inspection process.
- The condition classes of each reach and shaft can be forecast for a specified calendar year for the purposes of coordinating the renewal requirements of different infrastructural systems (for example, gas, water and electricity lines, telecommunications lines, roads and so on).
- The statistics module performs standards-based evaluations of the deterioration-specific status and inspection data for reaches and shafts.
- Output of results in freely-definable worksheets, print lists and diagrams.

Strategy Forecasts

Expansion module > **/ BUD** allows for a prognostic rehabilitation planning according to the guidelines of Baden Württemberg with a forecast of **condition and cost development** including calculatory costs and market values of sewers for completed and future constructional and hydraulic rehabilitation concepts (per reach) back dated from 1980. The success of previous rehabilitation measures can thus be evaluated with the condition and cost development and also be considered for future measures.



- Development of **global sewer rehabilitation strategies per reach** on the basis of constructional and hydraulic conditions and constraints with the rehabilitation and financial requirements to ensure compliance with the circular dated 3 January 1995 by the SüwVKan of Nordrhein-Westfalen (see pilot project Rheine).

- Taking into consideration the existing rate of deterioration, the effects of any strategies in the future can be simulated while at the same time providing concrete planning routes.

SV-Büro Jansen Kleinblittersdorf/Krefeld Fon/Fax: 0049-(0)700-87992290 31.10.2005

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Printing list Stochastic rehabilitation strategys with resp. without rehabilitation concept

sewer number	reach number	initial manhole	ending manhole	Cc TV	cons tr.	Final year	Service life time: Rest serv.	Ileg. res.	Ileg. res.	Rehab.-	Reh. Kind	Rang-folge	Rehabilitation concept: Repl.- lenght [m]	Renov.- lenght [m]	Repl.- costs	Renov.- Costs
23	185	90510626	90510628	3	1967	2016	7,0	-14,0	0,0	2009	B	0	0,00	55,00	0,00	23.024,00
24	90	90413612	90412613	3	1969	2017	8,0	-12,0	0,0	2009	B	0	74,00	0,00	49.410,00	0,00
24	130	90406611	90406612	3	1968	2017	8,0	-13,0	0,0	2009	B	0	60,00	0,00	40.450,00	0,00
232204	60	90406632	90406634	2	1917	2017	8,0	-31,0	0,0	2009	B	0	0,00	44,00	0,00	9.720,00
4510	55	90504617	90504618	2	1933	2018	9,0	-25,0	0,0	2009	B	0	0,00	64,00	0,00	15.640,00
23	75	90520634	90515602	2	1928	2019	10,0	-26,0	0,0	2009	B	0	0,00	40,00	0,00	10.120,00
45	55	90509601	90509602	2	1950	2020	11,0	-17,0	0,0	2009	B	0	0,00	56,00	0,00	12.120,00
4510	105	90504645	90504662	2	1933	2022	13,0	-22,0	0,0	2009	B	0	0,00	74,00	0,00	27.715,00
453216	55	90504604	90504605	2	1950	2022	13,0	-16,0	0,0	2009	B	0	0,00	39,00	0,00	8.720,00
2220	65	00421625	00421626	2	1920	2023	14,0	-26,0	0,0	2009	B	0	0,00	51,00	0,00	12.650,00
2232	55	00421614	00421615	2	1920	2024	15,0	-26,0	0,0	2009	B	0	0,00	52,00	0,00	11.320,00
2236	55	00525643	00525646	2	1920	2027	18,0	-24,0	0,0	2009	B	0	0,00	35,00	0,00	7.920,00
4510	107	90504662	90504663	2	1933	2029	20,0	-18,0	0,0	2009	B	0	0,00	58,00	0,00	21.988,00
4504	60	90505615	90505616	2	1932	2030	21,0	-18,0	0,0	2009	B	0	0,00	49,00	0,00	10.720,00
4524	85	90509629	90509630	2	1933	2030	21,0	-17,0	0,0	2009	B	0	0,00	49,00	0,00	12.680,00
45	210	00525604	00525605	2	1932	2031	22,0	-17,0	0,0	2009	B	0	0,00	47,00	0,00	19.854,00
4524	70	90509626	90509627	3	1933	2032	23,0	-16,0	0,0	2009	B	0	0,00	52,00	0,00	13.400,00
4510	110	90504646	90504647	3	1933	2035	26,0	-14,0	0,0	2009	B	0	81,00	0,00	47.410,00	0,00
231016	50	90505641	90505642	3	1928	2036	27,0	-15,0	0,0	2009	B	0	0,00	40,00	0,00	8.920,00
22160404	60	00421633	00421634	3	1928	2037	28,0	-15,0	0,0	2009	B	0	0,00	40,00	0,00	8.920,00
4510	125	90504648	90504650	3	1933	2037	28,0	-13,0	0,0	2009	B	0	99,00	0,00	57.490,00	0,00
23	90	90515604	90515606	2	1928	2040	31,0	-13,0	0,0	2009	B	0	0,00	51,00	0,00	14.180,00
45	128	90504665	90504666	3	1924	2041	32,0	-14,0	0,0	2009	B	0	0,00	13,00	0,00	5.883,00
45	120	90509621	90509622	3	1917	2042	33,0	-15,0	0,0	2009	B	0	0,00	30,00	0,00	11.967,00
2044	55	80509636	80509637	3	1924	2042	33,0	-13,0	0,0	2009	B	0	43,00	0,00	15.720,00	0,00
													439,00	**2.325,00**	**253.020,00**	**706.764,00**

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- In this way, taking into consideration the rehabilitation targets, the possible rehabilitation process (repair, renovation and replacement), the annual maintenance costs and investments, the progress of the plant value (book and current market value) and the calculated costs an economical and ecological optimum solution is developed interactively.

- For the purposes of calculating future annual costs, individual annual budgets for rehabilitation and replacements can be specified. Furthermore, the annual repair costs for maintaining the remaining condition classes 1 and 2 can be taken into consideration when calculating costs development. Any desired useful lives can be specified for reaches and shafts to be rehabilitated and replaced.

- Moreover, the economic reduction in usefulness (hydraulic pipe enlargement) can also be taken into consideration. In addition, additional functions are available for initial and follow-up rehabilitation (renovation / replacement) with any desired useful life data.

- The development of rehabilitation strategies taking into consideration the available finances is also possible.

- These evaluations then form the basis for subsequent implementation of structural and hydraulic rehabilitation of the sewer system with accepted condition and cost determination.

- Any end of year can be input for strategy forecasts (deterioration limit). Output of results in freely-definable worksheets, print lists and diagrams.