

Review of modelling software for piped distribution networks

In early 1998, the Swiss Centre for Development Cooperation in Technology and Management (SKAT) published a first edition of an "Overview of computer programs on drinking water distribution". A selection of 10 widely used commercial software packages for designing and analysing piped water distribution systems was presented in a uniform and rapidly accessible format, based on information provided by the respective developers and distributors. The document responded successfully to an expressed demand from practitioners in developing countries who regularly addressed inquiries through SKAT, asking about currently available software for drinking water distribution systems design and analysis.

Over recent years, there has been a significant increase in the number of software applications that have been released in this field — both in the commercial and in the public domains. As this process continues, it is again becoming difficult for systems managers and designers to select a software package most adapted to local needs and circumstances; some would go further and claim that selection is once again turning into a process based on the principles of a lucky dip.

On the following pages, Skat Consulting has therefore tried to present an updated selection of appropriate and commonly encountered computer programs for the design and upkeep of drinking water distribution networks in developing countries. The document provides comprehensive but concise facts, presented in a homogeneous format. The investigation has been extended towards non-commercial software and the information, covering a revised listing of 15 programs, is categorised according to the sophistication of the applications under review. The facts have been compiled from information given by the respective software developers and/or distributors as well as by its users.

The aim of this overview is to provide general information only. It allows the reader to rapidly gain an overall insight of the available software and make an informed choice according to actual requirements. The document therefore does not go into elaborate details of software design. For further information on a specific program, the reader is invited to contact the respective interlocutors or to check the relevant websites, details of which can be found on the corresponding fact sheet for each application reviewed.

Skat Consulting consists of a team of experts with extensive experience in the fields of water supply and sanitation, handpump technology, building materials, architecture, environmental protection, rural road and trail-bridge construction and urban development (including municipal solid waste management). The documentation unit contains more than 5'000 publications focusing on the main areas of our activities as well as many books relating to more general aspects of development, technology transfer and technology management. Furthermore, together with its sister organisation Skat Foundation, Skat Consulting produces manuals, project reports, working papers and a comprehensive range of books on appropriate technology and management.

The preparation of this working paper has been made possible through a backstopping mandate established with the Swiss Agency for Development and Co-operation (SDC). An html version of this paper will be available on the SKAT Internet site. The intention is to update the information that appears on the website at regular intervals. Your feedback and suggestions for future revisions via this website will be very welcome.

St. Gallen, June 2002

Please note:

As the information about the programs has been provided by the different software developers, distributors and/or users, Skat Consulting is unable to guarantee the accuracy of all statements in this overview. This overview has been finalised in early 2002. It does not claim to be complete. Skat Consulting reserves the right to add, change or remove pages.

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QUICK START

PROGRAM	PURPOSE	ADDITIONAL FEATURES ¹				LIMITATION max. nodes	ROM/RAM MB	DEMO available	COSTS approx. comparison in US\$
		Simulation	WQA ²	GUI ³	GIS/CAD/DB				
AquaNet	"Simulation and modelling for pressurised pipe systems"	X	X	X	GIS linkable	unlimited	10/16		\$1,999
Archimede	"Simulation and verification of fluid pressurised distribution networks in steady state flow conditions"	X	-	X	DXF files	100 to unlimited	10/8	Yes	Full release: \$490 - 980 Lite release: \$180 Free release: (10 nodes)
Branch / Loop	"Least-cost design and calculation of branched / looped water distribution networks"	-	-	-	-	125 750	0.5/0.25		Free
Cross	"Hydraulic calculation for water supply pipes"	X	-	X	CAD module GIS linkable	10'000	10/256		Base module: \$3,700 CAD module: \$3,900
Epanet 2.0	"Extended period simulation of hydraulic and water-quality behaviour within pressurised networks"	X	X	X	-	unlimited	2/16		Free
Eraclito	"Modular system for the management of fluid underpressure networks and open channel systems"	X	-	X	GIS module DB module	200 to unlimited	16/10	Yes	Base module: \$2,600 Each add-on 100 nodes: \$520 GIS module: \$780
H2Onet/ H2Omap	"A comprehensive GIS-based water distribution analysis, design and optimisation software"	X	X	X	DB-driven GIS-enabled	1'000 to unlimited	200/64		Base module: \$4,000 Unlimited nodes: \$16,000
Helix delta-Q	"Designs & optimises pipe networks quickly & easily for compressible & incompressible fluids"	-	-	X	DXF files	unlimited	4/32		\$950
Mike Net	"Advanced EPANET based water distribution modelling software"	X	X	X	DB-linked GIS-enabled	250 to unlimited	20/16	Yes	Basic: \$995 to \$10,995 WQA: \$1'495 to \$12,495
Netis	"Design and analysis of intermittent water distribution systems"	X	X		Exp – Imp DB	unlimited	100/16		Free
OptiDesigner	"Optimal design of water distribution systems" (EPANET based)	-	-	-	-	unlimited	5/32	Yes	\$350
Pipe2000	"Hydraulic modelling software for simple or complex pipe systems"	X	X	X	AutoCAD files GIS-enabled	250 to 20'000	20/128	Yes	Base module: \$1,495 Each add-on 1000 node: \$500 GIS-CAD module: \$500
Stanet	"Simulation and analysis of distribution networks"	X		X	Exp – Imp CAD/GIS/DB	200 to unlimited	20/16	Yes	Base module: \$1,910 Light version: dep. on nodes
Wadiso SA	"Comprehensive computer program for the analysis and design of potable water distribution systems"	X	X	X	Integr. CAD Exp – Imp GIS	1'000 to 16'000	100/128	Yes	Base module: \$3,500
WaterCAD 5.0	"Complete water distribution analysis and design tool"	X	X	X	CAD interface GIS integrated	10 to unlimited	25/32	Yes	\$195 – \$25,000

¹ Features additional to "network design and optimisation"

² Water Quality Analysis

³ Graphical User Interface

AquaNet

Commercial



Software Developer:

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Internet: www.finite-tech.com

Simulation and modelling for pressurised pipe systems

Short Description of Program:

AquaNet first shipped in 1992 and is currently used in 17 countries. AquaNet's structure includes a graphical user interface (GUI) for user input and data analysis and a separate computational engine that can be used with or without the GUI. AquaNet provides components to model pipes, pumps, valves, storage tanks, reservoirs and nodes. AquaNet's strengths are its reliability (the computation engine hasn't had a support call in years), its unlimited model size, speed and operating system portability.

With the release of version 2.x of AquaNet it will become PPNS, which is a merge of the AquaNet and PipeNet software lines. AquaNet's new version PPNS will have a Java based GUI that will run on most operating systems. The computational engine will also be made available on most operating systems, providing a consistent interface and computational engine regardless of the desktop operating system.

Other features:

- Computational engine can be separated from the GUI for integration with other systems such as GIS. GUI and Text file input available. Available across a number of operating systems.

Link to users:

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Additional Information:

Program version:	AquaNet v1.x shipping, 2.x Q1 2002
Distribution support:	Diskettes, CD, Web download, updates available via Internet for both new features and fixes.
OS requirements:	MS-Windows (98, NT, 2000, ME, XP), Linux, Solaris, AIX
Hardware requirements:	- Processor: starting from 80486 PC - Harddisk: 10 Megabytes - RAM: 16 Megabytes
Calculation method:	Hazen-William, Darcy-Weisbach, Chezy-Manning.
Calculation capacity:	Nodes, pipes pumps and valves no practical limit (approx. 2.1 Million).
Data Input:	ASCII file, GUI
Data Output:	Graphic, ASCII file
Network Layout:	True scale, scaled, incl. input data and calculation results in a graphic form
Language:	English
Handbook:	English
Support:	Help-online, web page
No. of installations:	International distribution > 1000
Pricing:	Individual license: US\$1,999, Educational pricing: US\$1,835

ARCHIMEDE

Commercial



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Short Description of Program:

The program ARCHIMEDE is a Windows based software package, aimed at engineers and distribution networks companies (water and gas). It is able to verify and simulate steady state flow conditions in pressurised gas and water networks. ARCHIMEDE was developed by PROTEO S.r.l., a software house involved with hydraulic network analysis, remote control and automation of major water systems since 1986.

The software is very user friendly with a graphical user interface (GUI) and a resolute computational module. The graphic editor is based on an elemental description of the fluid network (reservoirs, delivering nodes, pipes, pumps, valves, etc.). Network description is simple and visualisation can be customised with personalised colours and line thickness. Results are easy to interpret and can be visualised graphically or in a numeric form. The computational module controls the simulation stage and directly interacts with the GUI receiving the topological information of the network.

ARCHIMEDE has an algorithm able to solve complex network formulas to calculate energy losses in pipes. It calculates the continuity equations at the nodes and the equations of motion within the elements, obtaining a non-linear system that is solved by iterations with an efficient algorithm. It can be used to calculate flow in different points of the network without sensors, using real field data as input.

Other features:

- Libraries of elements such as pipes, pumps and valves that the end user can simply handle.
- Presents the management of different units systems for each quantity
- Automated simulation of working conditions according to the variation of supplies during the year and at different hours of the day.
- Opportunity for integration with a module for the minimisation of leakage in the network.
- Integrates with "Report Maker", a powerful instrument that permits the best representation of calculation results

Link to users:

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Additional Information:

Program version: ARCHIMEDE, Version 1.4.

Distribution support: Via installation CDs to be ordered (website, e-mail, etc.). Demo and freeware releases to download from the website.

OS requirements: MS Windows 3.1, Windows 95, Windows 98

Hardware requirements: - **Processor:** starting from 80486 PC - **Harddisk:** 10 Megabytes
- **RAM:** 8 Megabytes - **Monitor:** starting from 14"

Calculation method: Nodal method (Colebrook-White, Hazen-William, Bazin, Strickler, Renouard LP/ MP and HP, Kutter, Manning)

Calculation capacity: Thousands delivering nodes and reservoirs; pipes, pumps and valves depending on the nodes number acquired through the software

Data Input: Graphic and/or from ASCII file; graphic imports data from DXF and BMP files.

Data Output: Graphic, to ASCII file, to database and other CAD packages through DXF files

Network Layout: Including input data and calculation results in a graphic form

Language: Italian, English, French, German

Handbook: Italian, English, and German, without examples.

Support: Help-online, internet assistance, training courses, web support, maintenance program contract

No. of installations: 50 in the water, gas and hydrocarbons fields (Italy), 3 abroad (Germany, Hungary, Switzerland)

Pricing: € 490 (up to 100 nodes); € 980 (up to 200 nodes).
There is a demo release, a freeware release, with up to 10 nodes (delivering nodes and reservoirs), both downloadable for the website, and a lite release, with up to 40 nodes (€180).

BRANCH / LOOP

Software Developer:
University of North Carolina

Public domain

Phone:
e-mail:

Fax:
Internet:

BRANCH: A computer program for the least-cost design of branched water distribution networks

LOOP: A computer program for the hydraulic simulation of looped water distribution networks

Short Description of Program:

The various program releases and user instructions available today are based on software that was originally developed during the 1970s by the University of North Carolina. The software was written in an attempt to help developing countries to plan and design water distribution systems that are better suited to their needs. The development was supported financially by the World Bank and the UNDP Inter-regional Project. Also having been superseded by newer and more elaborated software in recent years, we discuss here the public domain BRANCH and LOOP applications, knowing that they were fundamental in the development of later software packages and that they still have their uses even today.

BRANCH is used to design pressurised, branched (tree-type, non-looped) water distribution networks by choosing from among a set of candidate diameters for each pipeline so that the total cost of the network is minimised subject to meeting certain design constraints. Both construction costs and the design constraints can be expressed as linear, mathematical statements. The network is characterised by links (individual pipes) connected by nodes, which are points of flow input, outflow or pipe junctions. Version 3.0 of the software can handle up to 125 pipes. BRANCH formulates the linear programming model for the least cost design, solves the model and outputs the design as well as corresponding hydraulic information. Data required include description of network elements such as pipe lengths, friction coefficients, nodal demands and ground elevations, data describing the geometry of the network, the candidate diameters and their unit costs, and system constraints (minimum pressures, minimum and maximum gradients). Outputs include optimal lengths and diameters of pipes in each link, total network costs and hydraulic information.

LOOP simulates the hydraulic characteristics of a pressurised, looped (closed circuit) water distribution network. The network is characterised by pipes and nodes (points of inputs/demand or pipe junctions). Data required are the description of the elements of the network such as pipe lengths, diameters, friction coefficients, nodal demands and ground elevation, and data describing the geometry of the network. The program outputs include flows and velocities in the links and pressures at the nodes. It does not accommodate inline booster pumps or pressure reducing valves. LOOP 4.0 handles up to 1000 pipes and can simulate up to 10 nodes with known hydraulic grade lines (e.g. storage reservoirs). It will accept any looped, partially looped / branched or completely branched network. LOOP's normal use is to simulate the hydraulic response of a network to a single or multiple input with at least one known hydraulic gradient line elevation. It also contains a sub-program for generating a cost summary once a final design is completed.

Other features:

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Link to users:

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Additional Information:

Program version:	BRANCH Version 3.0 (June 1991) and LOOP Version 4.0	
Distribution support:	Web download (http://www.emcentre.com/)	
OS requirements:	DOS (written in QuickBASIC)	
Hardware requirements:	- Processor: PC80486	- Harddisk: 0.5 Megabytes
	- RAM: 256 K-bytes	
Calculation method:	Hazen-William, Darcy-Weisbach	
Calculation capacity:	BRANCH: 125 pipes, 126 nodes, 30 diameters LOOP: 1000 pipes, 750 nodes, 20 reservoirs, 20 booster pumps, 20 PRVs, 20 check valves, 30 diameters	
Data Input:	ASCII file, Menu Driven	
Data Output:	Tabular, ASCII file, Printing, Graphic (LOOP)	
Network Layout:	-	
Language:	English	
Handbook:	English, >30 pages each with examples	
Support:	-	
No. of installations:	Thousands worldwide	
Pricing:	Free	

CROSS (WATERPAC)

Commercial

Software Developer:

Rehm Software GmbH

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Hydraulic calculation for water supply pipes

Short Description of Program:

CROSS is designed for the hydraulic calculation of water supply networks. All existing network elements (reservoirs, pumps, hydraulically operated valves, pressure controls, etc.) can be considered. It is possible to calculate branched distribution, ring distribution or a combination of the two. Ring-systems are generated automatically by the program. A water intake can be defined as nodal intake, a section intake or a combination of the two. The water can be fed in the pipelines through rotary pumps, piston pumps and elevated tanks.

The program calculates flow rates, velocity, pressure heads and loss of pressure. Different pressure zones can be considered in the calculations through pressure regulators, pressure boosting and pressure reductions. In addition, the program can construct a site plan, if coordinates are available. All data is stored in a Microsoft Access database format, so it can easily be linked with GIS applications.

Other features:

Other complementary software packages are:

- The program package **CROSSDESIGN**, which allows graphical on-screen planning and stock data management of water supply grids. For the hydraulic calculation of the grids, the program package CROSS is accessed directly through the design package. AutoCAD from R14 or AutoCAD Map from R3 is required. CROSS-DESIGN accesses the Database LISY, which can hold information about any conduits in and under the street (canal, water, gas, district heating, etc.). Along with the original AutoCAD/AutoCAD Map data output functions, it features various other functions, for example printing or plotting cut-out parts of a drawing.
- The program package **CROSSPLOT** can be applied to draw longitudinal sections of the pipelines of the water supply. CROSSPLOT automatically fetches data from the program package CROSS. The pipelines, the ground sections and the pressure gradients can be drawn for a maximum of three operating states.
- The program package **CROSSPLAN** is applied to construct drafts and site plans for water supply. CROSSPLAN automatically retrieves data from the program package CROSS. In the drafts, the nodes and pipeline sections are drawn in corresponding to their physical coordinates. The results of the calculations are also shown. In the site plans, the symbols are shown according to DIN 2425 and REWas.

Link to users:

CROSS is used by consulting engineers, water supply firms and administrations. Rehm Software GmbH can provide contact details.

Additional Information:

Program version: CROSS 7.0

Distribution support: CD

OS requirements: MS-Windows (Me, XP, 2000, NT4.0)

Hardware requirements: - **Processor:** starting from Pentium - **Harddisk:** 10,000 Megabytes
- **RAM:** 256 Megabytes

Calculation method: Prandtl – Colebrook, Hardy - Cross

Calculation capacity: 10'000 nodes (Windows)
30 elements of each type

Data Input: List orientated, graphically, Input from ASCII-File

Data Output: List orientated and graphically, RTF-Format, HTML-Format

Network Layout: Including input data and calculation results

Language: German, English, French

Handbook: German, 70 pages, with examples

Support: Hotline, Webpage, ftp-Server

No. of installations: > 550 world-wide (e.g. Zambia, Kenya, Morocco, Ivory Coast, Uganda, Bolivia, Venezuela and Brazil)

Pricing: First license € 3'700 (CROSSDESIGN - € 3'900, CROSSPLOT – €2 '800; CROSSPLAN – € 2'900)

EPANET 2.0



Public Domain

Software Developer:

Water Supply and Water Resource Division, U.S. EPA

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Cincinnati, OH 45268, USA

Phone: +1-513-5697603

Fax: +1-513-5697185

Internet: www.epa.gov/ORD/NRMRL/wswrd

Extended period simulation of hydraulic and water-quality behaviour within pressurised networks.

Short Description of Program:

EPANET is a Windows based program that performs extended period simulation of hydraulic and water-quality behaviour within pressurised pipe networks. A network can consist of pipes, nodes (pipe junctions), pumps, valves and storage tanks or reservoirs. EPANET tracks the flow of water in each pipe, the pressure at each node, the height of water in each tank, and the concentration of a chemical species throughout the network during a simulation period comprised of multiple time steps. In addition to chemical species, water age and source tracing can also be simulated.

The Windows version of EPANET provides an integrated environment for editing network input data, running hydraulic and water quality simulations, and viewing the results in a variety of formats. These include colour-coded network maps, data tables, time series graphs, and contour plots.

EPANET was developed by the Water Supply and Water Resources Division (formerly the Drinking Water Research Division) of the U.S. Environmental Protection Agency's National Risk Management Research Laboratory. It is public domain software that may be freely copied and distributed.

EPANET was specifically developed to help water utilities maintain and improve the quality of water delivered to consumers through their distribution systems. It can be used to design sampling programs, study disinfectant loss and by-product formation, and to conduct consumer exposure assessments. It can assist in evaluating alternative strategies for improving water quality - such as altering source utilisation within multi-source systems, modifying pumping and tank filling/emptying schedules to reduce water age, utilising booster disinfection stations at key locations to maintain target residuals and planning a cost-effective program of targeted pipe cleaning and replacement.

EPANET can also be used to plan and improve a system's hydraulic performance. Pipe, pump and valve placement and sizing, energy minimisation, fire flow analysis, vulnerability studies, and operator training are just some of the activities that EPANET can assist with.

Other features:

EPANET does not have any direct linkages to external CAD, GIS, or database programs. Network physical and positional data can be imported through ASCII text files using a simple tabular format. Analysis results can be exported to files or the Windows clipboard in text or graphics formats to be shared with other programs. Observed data can be plotted against simulation results to aid in network calibration. The EPANET Programmer's Toolkit allows developers access to EPANET's computational engine for customised applications, such as automated calibration and optimisation studies. EPANET's computational engine has been further adapted in various commercial products (DHI, Haestad Methods, KYPIPE, MW-Soft)

Link to users:

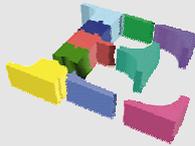
- Studying chlorine decay in distribution systems (EPA, Montgomery Watson, AWWARF)
- Tracing source of Salmonella outbreak in Gideon, MO (EPA)
- Historical reconstruction of exposure to different well field water in study of elevated childhood cancer rates in Toms River, NJ (CDC's ATSDR & New Jersey DHSS)
- Development of a design methodology for locating chlorine booster stations in distribution systems (University of Cincinnati & EPA)

Additional Information:

Program version:	EPANET Version 2.0 (Release 2.00.09a)
Distribution support:	Web download (http://www.epa.gov/ORD/NRMRL/wswrd/epanet.html)
OS requirements:	DOS, MS-Windows (95, 98, ME, NT, 2000)
Hardware requirements:	- Processor: 80486 or higher - Harddisk: 2 Megabytes - RAM: 16 Megabytes
Calculation method:	Hazen-Williams, Darcy-Weisbach (Colebrook-White), Chezy-Manning
Calculation capacity:	No limit on number of nodes, pipes, pumps, valves, reservoirs, etc.
Data Input:	Graphic oriented input with optional import of ASCII text file
Data Output:	Graphic and tabular output including export to Windows clipboard and files
Network Layout:	True scale or unscaled network layout with optional background map
Language:	English
Handbook:	English, 200 pages with tutorial (pdf-file, downloadable)
Support:	On-line help, web page, EPANET Users Group listserv (not affiliated with US EPA)
No. of installations:	Thousands of users world-wide
Pricing:	Free Full source code and Programmer's Toolkit (for customisation) freely available

ERACLITO

Commercial



Software Developer:

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Modular system for the management of fluid underpressure networks and open channel systems

Short Description of Program:

ERACLITO is a Windows 95 and NT based software package, intended for the hydraulic and technical management of fluid networks. ERACLITO was developed by PROTEO S.r.l., a software house involved with hydraulic network analysis, remote control and automation of major water systems since 1986.

Through ERACLITO's modules, which can be configured by the user, it is possible to simulate pressurised fluid networks (water and gas networks, pipe lines, etc) and open-channels systems (waste water networks, etc) in steady, unsteady and gradually varied unsteady state flow conditions. Besides, it is possible to compute and evaluate the networks, to integrate them with GIS applications, remote-control systems and management systems.

The core of the ERACLITO environment is based on a user-friendly graphical interface. Data input is made easy thanks to the possibility to import files in vector or raster format. Calculation results can be viewed rapidly in both numeric and graphic output.

Further ERACLITO features a rapid and easy description of the network under study. A wide range of libraries is included, which permit selection of particular network elements (delivering nodes, pipes, pumps, valves, wells, etc.). The software caters for the management of different units of measurements for any type of value.

Other features:

- Provided with Report Maker, which can be customised according to user preferences and company standards. The results can be exported in different formats that the most common office software is able to interpret (text editors, data sheets, Office packages, etc).
- Besides the central core, which represents the basic graphic interface, it is possible to integrate optional modules, depending on the level of user requirements. Various add-on modules allow for steady / unsteady /gradually varied unsteady flow state conditions, for the automatic generation of pipe profiles, for the diffusion of polluting materials, for GIS as well as Supervisory Control and Data Acquisition Systems Interfaces

Link to users:

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Additional Information:

Program version: ERACLITO, Version 3.x

Distribution support: Via installation CDs to be ordered (website, e-mail, etc.).

OS requirements: Windows 95, Windows 98, Windows NT

Hardware requirements: - **Processor:** starting from 80486 PC - **Harddisk:** 16 Megabytes - Coprocessor: needed
- **RAM:** 10 Megabytes - **Monitor:** starting from 17"

Calculation method: Nodal method (Colebrook-White, Hazen-William, Bazin, Strickler, Renouard LP/ MP and HP, Kutter, Manning)

Calculation capacity: Thousands delivering nodes and reservoirs; pipes, pumps and valves depending on the nodes number acquired through the software

Data Input: Database, GIS, ASCII file

Data Output: Database, Graphic, ASCII file

Network Layout: Including input data and calculation results in a graphic form

Language: Italian, English

Handbook: Italian, English, without examples.

Support: Help-online, internet assistance, training courses, web support, maintenance program contract

No. of installations: 70 in the water, gas and hydrocarbons fields (Italy), 1 abroad (Germany)

Pricing: € 2,600 (base module up to 200 nodes)
€ 4,650 (module addressing unsteady and gradually varied unsteady flow state),
€ 780 (interface module - Geographical Information Systems)
€ 780 (interface module - External Database's Acquisition Module)
€ 520 (additional 100 nodes group)
€ 3100 (additional 1000 nodes group)
30% discount for Universities and High Schools
There is a demo release as Italian and English version.

H₂ONET / H₂OMAP

Commercial

Software Developer:

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A comprehensive GIS-based water distribution analysis, design and optimisation software.

Short Description of Program:

H₂ONET / H₂OMAP is a stand-alone, database-driven GIS-enabled software for complete modelling, analysis, design, rehabilitation and optimisation of water distribution and supply systems. It was released as a commercial product in 1996 and currently enjoys a worldwide base of satisfied clients.

The program performs fast, reliable and comprehensive hydraulic and dynamic water quality modelling, energy consumption/cost evaluation, leakage management, reliability assessment, valve tracing, real-time simulation and control, fire flow and hydrant analysis, unidirectional flushing, and includes an automated on-line SCADA interface. Its state-of-the-art optimisation capabilities include automated network skeletonization, reduction and calibration, pump scheduling/optimal operations, and optimal design and rehabilitation.

The program is developed using ESRI MapObject and object oriented technology in an open-architecture GIS environment to provide a powerful decision-support application that combines spatial analysis tools and mapping functions with sophisticated and accurate network modelling and optimisation for complete infrastructure planning and management. An entire library of network elements can be considered, including pipes, pumps (constant / variable speed), turbines, static and control valves (including check, pressure regulating, pressure sustaining, pressure relief, pressure breaker, flow control, flow meters / totalizers, throttle control, general purpose, and float valves), tanks (cylindrical / variable area) and reservoirs.

The program bridges the gap between network modelling and GIS software to support many types of applications in distribution system analyses including master planning, fire flow assessment, facility sizing, operations study, rehabilitation, emergency response, real-time simulation, sensitivity analysis, water quality improvement, source blending, source tracking, sampling program design, model calibration, operator training, energy management, pump scheduling, leakage control, water conservation, system expansion, new system design, reliability assessment, valve tracing, business planning and asset management.

Easy to use; stand alone with seamless GIS interface using native GIS data formats; multiple themes and layers; open architecture database-driven environment for comprehensive data customisation, manipulation and management; complete hydraulic and water quality analyses with powerful Genetic Algorithm optimisation capabilities; and sophisticated graphing, reporting and querying tools.

Other features:

- Unparalleled flexibility in file sharing capabilities with GIS, spreadsheet, and database applications. A unique open-architecture framework makes it easy to manage and distribute geospatial data as well as exchange important modelling information with other applications and enterprise systems.
- Using powerful GIS thematic mapping functionality, the program makes it easy to turn database information into colourful, fully dimensional visualisations incorporating a range of sophisticated graphical presentation tools.

Link to users:

Thousands of users worldwide including the majority of the largest US cities and ENR top design firms.

Additional Information:

Program version: H2ONET Utility Suite and H2OMAP Utility Suite

Distribution support: CD with Web download of updates

OS requirements: MS-Windows 95, 98, NT, 2000, Me

Hardware requirements: - **Processor:** Pentium III with math. coprocessor - **Harddisk:** 200 Megabytes
- **RAM:** 64 Megabytes - **Display:** VGA graphics adapter and monitor

Calculation method: Colebrook-White/Darcy-Weisbach, Hazen-William and Manning

Calculation capacity: Unlimited number of nodes and links

Data Input: Graphic, ASCII file, database, GIS, import formats

Data Output: Graphic, ASCII file, database, export formats

Network Layout: Network models can be generated at any scale or to precisely match actual system layout based on user-definable drawing scales. Pipes can be of any shape (curvilinear pipes) and their lengths are automatically computed to the scaled drawing length. Multiple mapping layers/themes (e.g., street, land use and parcel maps) can be displayed as background images to create a true living network model.

Language: English

Handbook: English with example tutorials and comprehensive context sensitive on-line help

Support: Support by engineering professionals is provided by means of telephone, fax, email, and training.

No. of installations: Thousands of users from utilities, municipalities, cities, government industries, and engineering organisations worldwide.

Pricing: From US\$4,000 for 1,000 links to US\$16,000 for unlimited links.

Discount is available when purchasing multiple licenses. A special educational price is also available.

Helix delta-Q

Commercial

Software Developer:

Helix Technologies Pty Ltd

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Internet: www.helixtech.com.au

Designs and optimises quickly and easily pipe networks for compressible and incompressible fluids

Short Description of Program:

delta-Q is a powerful tool for engineers and equipment suppliers to quickly and easily design and optimise complex pipe system networks for compressible and incompressible fluids. It can produce economically and technically sound pipe system designs in a very short time.

The program considers pumps, tanks, junctions, nozzles (sprinklers) and any fittings such as bends, valves, tee's, etc. It can calculate friction losses and pressure drop in pipes and fittings for liquids, slurries and gasses. It models complex process flow pipe networks and solves for unknown flow rates and node pressures at the press of a button. delta-Q has database files for liquids, slurries, gasses, pipes, pipe fittings and pumps. Data from the database files can be pasted by clicking on an element in the network diagram.

delta-Q was first developed in 1991 as a DOS program with continuing development and improvements. A powerful new network analysis engine was added in 1998 utilising linear theory and Newton Raphson methods. A CAD DXF file generator was added in 1999 for creating large drawings of complex networks. Some features of the actual version are:

Other features:

- Quick and easy to use and very powerful network analysis engine.
- Export data to Excel and create a CAD DXF file drawing of the network at the click of a button. This documents the complete design, on an easy to read format drawing up to A0 in size.
- Drag and drop network components onto the screen for quick and easy network creation.
- Add individual fittings to pipes using the fitting database or enter an estimate of the total K value.
- Calculate fitting losses using the standard K value method or the Kf method, which compensates for fluid viscosity and turbulence.
- Model 'what-if' scenarios - closes off certain pipes and views the effects on the network.
- Display the network calculation results such as pipe flows, velocity, head loss, node pressure and many others on the network diagram.
- 'Network reports' display and print the network pipe and node data as well as calculation results
- Click on a pipe to view the system curve with the network duty point shown.
- The network diagram and system head curves can be printed and design reports are produced simply in a compact table format which can be printed or pasted into any Windows compatible spreadsheet or word processor.

Link to users:

Widely distributed around the world with many users in countries like Cambodia, India, Burma, Brazil and Canada.

Additional Information:

Program version: Helix delta-Q ver 2.28 (2001)

Distribution support: CD, Web download and on-line registration

OS requirements: MS-Windows (95, NT, 2000, XP)

Hardware requirements: - **Processor:** starting from Pentium II - **Harddisk:** 4 Megabytes
- **RAM:** 32 Megabytes - **Monitor:** Minimum 14", 800x600 or better

Calculation method: Colebrook, White, Hazen-William, Darcy, Linear Theory and Newton Raphson Network Analysis engine. Orifice plate calculator included and also Settling Slurry, Bingham Plastics and Compressible Fluid (Isothermal and Modified Darcy method) calculations.

Calculation capacity: Unlimited number of pumps, tanks, junctions, sprinklers, pipes and fittings and valves, etc.

Data Input: Graphic - drag and drop. Set-up default liquids, pipes for quick creation of network.

Data Output: Graphic, ASCII file, Excel copy and paste, create a CAD DXF file drawing of network.

Network Layout: Diagrammatic - view all pipe, fluid and calculation results on screen

Language: English

Handbook: English with examples - Context sensitive Help file is very comprehensive.

Support: Help-online, Annual Support Contract offered, web page downloads, after sales service provided via the internet and email

No. of installations: More than 500 installations in 25 countries

Pricing: US\$ 950 per licence or Australian Dollar \$1850 plus shipping AU\$58 if applicable. Holders of the Annual Software Support contract are entitled to free minor upgrades of the software. Existing licence holders get preferential pricing on new major versions of the software.

MIKE NET

Commercial

Software Developer:

BOSS International, Inc.

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e-mail: info@bossintl.com

Fax: 1-608-2589943

Internet: www.bossintl.com

Advanced EPANET based water distribution modelling software

Short Description of Program:

MIKE NET is the most advanced EPANET based water distribution modelling package available. It can analyse an entire water distribution system, or selected portions, under steady state or extended period simulations, with water quality analysis if needed. In a complete graphical modelling environment it considers pipes sizes, flow rates, velocities, head losses, nodal pressures, nodal demands, hydraulics grades, elevations, water age, water quality concentrations, etc.

Network models can be easily and quickly developed, using a variety of different means. For example, network components can be read-in directly from an ArcInfo[®], ArcFM[®], ArcView[®], or MapInfo[®] GIS, or can be interactively created using a mouse by simply pointing and clicking. Graphical symbols are used to represent network elements such as pipes, junction nodes, pumps, control valves, tanks, and reservoirs. In addition, data can be shared with any standard Windows spreadsheet (e.g., Microsoft Excel) or relational database (e.g., Oracle[®], Microsoft SQL Server, Informix[®], Sybase[®]) either directly or using ODBC links, or by simply cutting to and pasting from the Microsoft Windows clipboard.

MIKE NET's graphical capabilities are unparalleled, providing multiple horizontal plan plots, profile plots - either of which can be animated for extended period simulations—and time series plots. All graphical plots can be printed at any user-defined scale. MIKE NET can share water distribution data with any ArcInfo, ArcFM (Facilities Manager), ArcView, or MapInfo GIS database, allowing MIKE NET to be part of the infrastructure management and planning system. Comprehensive input data and output analysis reports can be automatically generated using the provided report templates. MIKE NET uses the Microsoft Access database engine for storing and manipulating network data.

Other features:

- Genetic model calibration and optimisation
- Automated network demand processing
- Energy consumption analysis
- Scenario manager
- Built-in model checker
- SCADA Real-Time Modelling
- Generate Web page HTML report
- Continual massive development, regular updates, and yearly upgrades

Link to users:

Used in USA, Europe, Middle East, Asia, Australia, South America, etc. For a selection of success stories, see the testimonial site at http://www.bossintl.com/html/client_views_of_mike_net.html

Additional Information:

Program version: MIKE NET 2001

Distribution support: CD-ROM, Web download

OS requirements: MS-Windows (95, 98, NT), network capability

Hardware requirements: - **Processor:** 80486 or higher - **Harddisk:** 20 Megabytes
- **RAM:** 16 Megabytes

Calculation method: Hazen-Williams, Darcy-Weisbach, Chezy-Manning

Calculation capacity: From 250 to unlimited nb. of pipes, according to software package purchased

Data Input: Interactive, graphical, import DXF files or developed in many other pipe network input file formats (e.g. WaterCAD, KYPIPE, H2Onet)

Data Output: Graphic and tabular, DXF files, connect to external GIS, relational database, or spreadsheet (e.g. ArcView, MapInfo, Oracle, Microsoft Access, Microsoft Foxpro, Corel Paradox, Microsoft Excel, Lotus 123)

Network Layout: True scale or scaled network layout with background map

Language: English, French, German, Spanish, Czech, Polish, Russian, etc

Handbook: English, 352 pages, with examples, tutorial - both downloadable

Support: Telephone Tech Support, Training Sessions, Supplemental Documents, Webpage, Interactive Forums, etc

No. of installations:

Pricing: Based on number of nodes for Hydrodynamics (HD) and need for water quality (WQ). E.g.:

250 pipes:	HD-US\$995.00	WQ (incl. HD)-US\$1,495.00
1,000 pipes:	HD-US\$2,495.00	WQ (incl. HD)-US\$3,995.00
Unlimited:	HD-US\$10,995.00	WQ (incl. HD)-US\$12,495.00

Free DEMO CD-ROM available

NETIS

Public domain



Software Developer:

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Design and analysis of intermittent water distribution systems

Short Description of Program:

The NETIS software package is a tool for the design of new systems as well as the reinforcement of existing systems. It uses formal optimisation techniques to perform analysis of least cost pipe sizing subject to different level of service specified by the user.

NETIS is a network design tool, incorporating specific routines to account for the unique features that exist in intermittent water distribution systems. These are systems that operate with insufficient quantities of water and are therefore unable to provide 24 hours supply (but only a few hours a day). Intermittent water systems generally occur through necessity and not design, but correspond to the level of provision of most systems in developing countries.

NETIS consists of four main components:

- **Preliminary design model:** Calculation of equity equation and calculation of water tower storage capacity.
- **Demand model:** Using queuing theory and reservoir routing, the model forecasts the end-user demand profile (intensity and distribution of usage). It includes a secondary network model establishing pressure dependent outflow functions for a single node (primary node) from a group of nodes (secondary network).
- **Network charging model:** Uses a pressure head iterative method that simulates the charging up of the network prior to pressurised flow.
- **Modified Network Analysis Method:** Program that incorporates pressure dependent demand during pressurised flow

Optimisation tools consist of a) a least cost design routine, which minimises cost (optimal diameters of pipes) while ensuring that pressures at all nodes are above the minimum; b) an effective pressure zoning, strategically placing flow reduction valves to control the network as there will be an excess capacity before the design horizon is reached.

Conventionally, water network analysis tools assume that nodal outflow is equal to demand and that it is met irrespective of network pressure. In contrast, NETIS recognises that nodal outflow varies with system pressure and models outflow with pressure dependent terms relationships

NETIS was coded in the Visual C/C++ language. The program allows the user to edit NETIS input data files for the demand model, design model and valve location model. Users can then run the simulator and view the results graphically in a variety of ways, including on the schematic of the network. The development of NETIS is still ongoing.

Other features:

- Water quality management tool (points of pollution, contaminant movement, effective monitoring)

Link to users:

NETIS was jointly developed with Indian Institute of Technology Madras (IITM) and specifically developed for developing countries.

Additional Information:

Program version:	NETIS Version 5.01 (released 2001)
Distribution support:	CD, Web download
OS requirements:	MS-Windows 95 +
Hardware requirements:	- Processor: starting from Pentium I - Harddisk: 100 Megabytes - RAM: 16 Megabytes
Calculation method:	Hazen-Williams
Calculation capacity:	Use of dynamically allocated memory, only limit on network size is the available memory in the computer
Data Input:	ASCII file, import formats, list orientated
Data Output:	ASCII file, export formats
Network Layout:	Scaled, include calculation results in a graphic form
Language:	English
Handbook:	English; forms part of a design manual, with examples
Support:	Help-online, supplemental document, web page
No. of installations:	
Pricing:	Free

optiDesigner

Commercial

Software Developer:

OptiWater

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e-mail: selad@optiwater.com

Fax: +972-15154-716712

Internet: www.optiwater.com

Optimal design of water distribution systems

Short Description of Program:

optiDesigner is a Windows software for the optimal design of water distribution systems using "Genetic Algorithms" (GA). The program uses EPANET, a hydraulic simulator freely distributed by the US EPA (see this document). optiDesigner will design the system pipes and find their minimal cost under a set of constraints like:

- Minimal and maximal pressures at networks nodes.
- Minimal and maximal velocities at networks pipes.
- Maximal sources flow.

The system is drawn and the properties set using EPANET. The network is then exported to optiDesigner (as an INP file), which then runs the simulation once design options, pipes to be designed, junctions / sources constraints and optimisation parameters have been set. Results can be listed or viewed using EPANET.

With optiDesigner it is easy find the most cost effective design, rehabilitation strategy and expansion strategy for a water distribution system. It can make a steady state design, do a design under a number of load patterns or run the design as an extended period simulation.

Other features:

The development of optiDesigner version 2 is on its way. The next version will introduce new features like pumps design and scheduling, tank design and system operation.

Link to users:

-

Additional Information:

Program version: optiDesigner ver. 1

Distribution support: Web downloads (optiDesigner and EPANET)

OS requirements: MS Windows (95, NT, 2000, XP)

Hardware requirements: - **Processor:** Pentium III - **Harddisk:** 5 Megabytes
- **RAM:** 32 Megabytes

Calculation method: Genetic algorithms

Calculation capacity: No limitation

Data Input: List orientated and graphic, import of INP file from EPANET

Data Output: List orientated, ASCII file (for text editor or spreadsheet), graphic through export of INP file to EPANET

Network Layout: See EPANET

Language: English

Handbook: English, 36 pages with example tutorial.

Support: User manual, e-mail support

No. of installations: -

Pricing: Registration fee of US\$350 for single user (EPANET for free). Free 30 days evaluation copy downloadable.

Pipe2000

Commercial



Software Developer:

Civil Engineering Software Centre

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Lexington, KY 40506-0281, USA

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e-mail: kpfs@bigfoot.com

Fax: ++1-859-3234996

Internet: www.kypipe.com

Hydraulic modelling software for simple or complex pipe systems

Short Description of Program:

PIPE2000 is a general-purpose pipe network hydraulic modelling program, which handles both steady state (KYPIPE2000) and transient (SURGE2000) analysis. KYPIPE2000 provides both hydraulic and water quality modelling. PIPE2000 is typically used for steady state and transient modelling municipal and rural water distribution systems. It is also widely used for hot, chilled, and process water systems. It is used for fire protection and irrigation sprinkler systems. It is also used for other liquids (oil, etc.).

Continuous research and development over the past 20 years has resulted in the most advanced hydraulic modelling capability available. KYPIPE 4 is the engine used for hydraulic calculations for the KYPIPE2000 modelling package. KYPIPE 4 is the fourth generation KYPIPE engine, which is the most widely used and trusted hydraulic analysis engine in the world. This engine has been an industry standard for 30 years and has been verified by numerous field tests and qualified for nuclear applications. It provides many capabilities not available with other hydraulic analysis engines. EPANET developed by the EPA (USA) is utilised by KYPIPE2000 for water quality modelling. SURGE2000 is a 6th generation transient flow modelling program, which carries out complex transient modelling.

Standard PIPE2000 node elements include junctions, tanks, reservoirs, pumps, sprinklers, rack sprinklers, regulating valves, loss elements, loss elements defined by manufacturer data from a library, variable pressure supplies, active valves, check valves, hydrants, valves, metered connections, surge control devices, inline meters, and user-defined devices, etc.

The strength of PIPE2000 is in its advanced modelling capabilities, which include the direct calculation of operational and design parameters, development of system curves, optimised calibration (GA), automated ageing of pipes (roughness) and many other capabilities.

The PIPE2000 advanced graphical environment is extremely user-friendly, allowing graphical Model development and data entry. PIPE2000 has also been adapted to other calculation engines in addition to KYPIPE and SURGE. These include analysing gas (GAS2000), steam (STEAM2000), fire sprinkler systems (GOFLOW2000) and stormwater systems (STORM2000).

Other features:

A number of powerful data exchange tools have been developed to provide interfacing with other important applications (particularly CAD and GIS). These tools can directly use existing data to create the PIPE2000 data. This includes an ArcView and AutoCad exchange modules and Excel exchange capabilities.

Link to users:

PIPE2000 is used worldwide. Potential users: Herer Shay (Israel) herer-s@tahal.co.il; Stewart Sargent (New Zealand) s.sargent@xtra.co.nz; Danilo Mihic (South Africa) mihic@mweb.co.za.

Additional Information:

Program version: PIPE2000 version 1.2 and up

Distribution support: CD, Web download

OS requirements: MS-Windows (95, 98, 2000 NT)

Hardware requirements: - **Processor:** starting from Pentium - **Harddisk:** 20 Megabytes
- **RAM:** 128 Megabytes - **Monitor:** VGA, 15" at 1024 x 768 or better

Calculation method: Hazen-William, Manning, Darcy-Weisbach

Calculation capacity: Up to 20,000 pipes. All type of nodes, reservoirs, pipes, pumps, valves, etc.

Data Input: Graphic, ASCII file, AutoCAD, GIS, Excel

Data Output: Graphic, ASCII file, AutoCAD, GIS, Excel

Network Layout: Scaled and unscaled network layout and calculation results

Language: English

Handbook: English, QuickStart Guide, 42 pages

Support: Free Tech Support by the software developers, on-line Help, over 40 Audio/Video Tutorials, over 20 Demonstration Files, Training Courses, Mailing list and Web Page with free updates.

No. of installations: Thousands of installations world-wide by consulting firms, water utilities, universities and businesses in the field of water

Pricing: PIPE2000 250-pipe standard version, US\$1495
Add US\$500 for each additional 1000 pipes, add US\$500 for Professional features (GIS, AutoCad exchange).
Free 30-pipe demo version.

Ongoing developments include optimised operation and design, free upgrades via web site download, networking capabilities

STANET

Commercial

Software Developer:

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Fax: +49-30-3054305

Internet: www.stafu.de

Simulation and analysis of distribution networks

Short Description of Program:

STANET[®] is an integrated application for network analysis. It is used to calculate fluid and gas (including steam) flowing in pipes. The typical usage is for water and other fluid networks, gas and pressure air networks, steam and saturated steam networks, district heating networks and electrical networks.

Besides calculation, graphic input, output, a database browser is included. The browser may be displayed together with the network map. STANET[®] may be used as a network information system because it uses standard database files, which may be extended by the user. Because graphics and database are integrated, data exchange with other applications is simple.

The program performs stationary simulation (calculation) of looped networks (water, gas, electricity, and district heating including steam, oil). Graphical input (mouse, digitizer) and output to monitor, printer or plotter are provided. STANET[®] allows simple creation and modification of networks, flexible ways to design and edit networks as well as analysis and simulation (extended period simulation, diameter and routing optimisation, etc.).

The first version of STANET[®] was published in 1984 running on the operating system CP/M with dBase II database. Together with the growing PC market, two years later an MS-DOS version was available. The first graphical functions for data input and output were ready to use 1988. Since 1993 STANET[®] is available for MS-Windows.

Other features:

- Coloured presentation of network (dependent on pressure, flow, etc.), zooming, moving, etc.
- Optional quality tracking, temperatures, cooling.
- Automatic creation/detection of sub-networks, cutting and pasting of networks via clipboard, graphic filters, background images, configuration files.
- Integrated database.
- Hybrid graphic with raster images (36 formats) or CAD (DXF) drawings, managing of variants, network optimisation.
- Presentation in topographic or schematic coordinates.
- Network export/import to AutoCAD, MapInfo, ArcView, Smallworld, SICAD, and others.

Link to users:

-

Additional Information:

Program version: STANET Version 7.2

Distribution support: CD, Web download

OS requirements: MS-Windows (3.1, 95, NT, 2000, XP)

Hardware requirements: - **Processor:** starting from Pentium I - **Harddisk:** 20 Megabytes
- **RAM:** 16 Megabytes

Calculation method: Darcy-Weisbach, Prantl-Colebrook, Nikuradse

Calculation capacity: No programme constraints

Data Input: Graphical editing with mouse, digitizer tablet or mouse over background image / list oriented / text files / filters to GIS and CAD systems, ODBC import

Data Output: Graphic and list oriented output and report generator, export to GIS/CAD

Network Layout: True to scale, including input data and calculation results with node and pipe colouring

Language: English, German, Polish

Handbook: English (140 pages), German (140 pages), with example networks and description of mathematical equations.

Support: Help-online, Q&A service, training, supplemental documentation, web page.

No. of installations: More than 300 (total, about 60 % water)

Pricing: Starting at € 2.100

Light version (dependent on no. of nodes), free demo (max. 15 nodes)

Wadiso SA



Commercial

Software Developer:

GLS Engineering Software Pty Ltd

Technopark, PO Box 814

ZA-7599 Stellenbosch, SOUTH AFRICA

Phone: +27-21-8800388

e-mail: software@gl.co.za

Fax: +27-21-8800389

Internet: www.wadiso.com

Short Description of Program:

The program originated from the WADISO model developed by Colorado State University for the Army Corps of Engineers. It was substantially improved by GLS Engineering Software (Pty) Ltd. with regard to optimisation, user friendliness and speed as well as interfacing with other application software. The resulting Wadiso SA integrates steady state simulation, time simulation, optimisation, and water quality analysis with graphical displays of data. The result is a single, multi-purpose tool for water engineers. It offers several modules for the design, calibration, modelling, analysis and management of a distribution system:

- **Steady State Analysis Module:** Basic module which allows for the input and editing of system data and parameters, and which calculates the flow and pressure distribution in the system under specific "snapshot" steady state conditions. Full graphical display of flows, pressures, etc. is available.
- **Extended Period Simulation Module:** For modelling of diurnal fluctuations in water demand, and control of pumps, valves, etc. in order to monitor system performance over an extended period of time.
- **Optimisation Module:** For the determination of future improvement needs, with the objective to minimise capital expenditure and the present worth of operational costs, while adhering to specified operational criteria. The cost trade-off between pipes and pumping costs, and pipes and storage costs are taken into account.

Seamless integration with the public domain EPANET software allows for improved extended time simulation analysis. Further EPANET is used for the modelling of all water quality aspects. All link elements supported by the latter are supported, including pipes, check valves, pumps, pressure reducing valves, pressure sustaining valves, pressure breaker valves, throttle control valves and general purpose valves. Furthermore secondary losses can be modelled and pump curves can be defined by user-defined curves. Node elements include tanks, reservoirs and demand nodes. Five different demand scenarios can be defined.

Other features:

- Fully integrated with an independent high-speed CAD system.
- Multiple spreadsheet tables allow fully synchronised editing of all model properties as well as the presentation of results in tabular form. Results can be exported to HTM format or XLS format.
- A fully customisable charting routine displays pump graphs, time simulation results cost functions and optimisation results, which can be exported as BMP files for inclusion in reports.
- Wadiso SA is being developed for AutoCAD™ 2002 Integration, extended optimisation and web integration

Link to users:

Client-base in excess of 120 municipalities and consulting engineers (e.g. Africon, BKS, V3, and GLS) from mainly Southern Africa. Projects include the analysis and design of the Greater Pretoria bulk water supply, Greater Cape Town bulk water supply and reticulation for several major cities, Greater Johannesburg reticulation for several major cities, Windhoek bulk water supply and reticulation.

Additional Information:

Program version: Wadiso SA, version 4.3, July 2001

Distribution support: CD, 30 day evaluation web download

OS requirements: MS-Windows (95, 98, ME, NT 4, 2000, XP)

Hardware requirements: - **Processor:** starting from Pentium II 350 MHz
- **RAM:** 128 (or 256) Megabytes
- **Harddisk:** 100 Megabytes
- **Resolution:** 800x600 or better

Calculation method: Darcy-Weissbach and Hazen-Williams

Calculation capacity: Currently limited to 16000 pipes and 16000 nodes

Data Input: Spreadsheet or graphical input from integrated CAD, also alternatives are ASCII file, fixed database format (DBF, MDB, and DB) and GIS import formats (SHP).

Data Output: Graphical to CAD (DXF, DWG), XY-graphs to Bitmap, ASCII file, database (DBF, MDB, DB) and GIS (SHP & DBF)

Network Layout: True scale or scaled in coordinate format, or tabular without coordinates

Language: English, German in prep.

Handbook: English, German in prep. 100 pages with quick start guide and examples. 500 pages online help.

Support: Comprehensive online help available. Discussion forum and FAQ service on website. Onsite training optionally available in Southern Africa. Additional Web page tutorials in preparation. Maintenance contract.

No. of installations: 200+ installations in mainly Southern Africa

Pricing: List Price for 1 Installation (1000 Pipes, 1000 Nodes), all modules, stand-alone Graphics Engine: US\$ 3500. Other pipe / module combinations, network variations, floating user versions and education pricing available.

WaterCAD[®] 5.0

Commercial

Software Developer:

Haestad Methods, Inc.

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Fax: +1-203-597-1488

Internet: www.haestad.com/

Complete water distribution analysis and design tool. Analyses water quality, determines fire flow requirements, calibrates large distribution networks, and more with powerful hydraulic analysis tools

Short Description of Program:

Haestad Methods has been involved in the water distribution modelling field since the original release of WaterCAD (a.k.a. CYBERNET) version 1.0 more than a decade ago. They continue to advance network-modelling technology by combining state-of-the-art matrix solutions with an intuitive, easy-to-use interface.

WaterCAD is used to analyse potable water networks, sewage force mains, fire protection systems, well pumps, raw water pumping, and more. It allows calibration of large distribution networks, development of master plans, conducting operational studies and performing cost analysis. Users can perform a steady-state analysis for a "snapshot" view of the system, or perform an extended period simulation to see how the system behaves over time. The highlights of the most recent version are: advanced graphical editor, animated contouring and colour-coding, graphing and profiling, scenario management, automated fire flows, hydraulic analysis, water quality analysis, customisable tables, GIS and database connectivity.

WaterCAD[®] 5.0 is the most significant version upgrade of WaterCAD and offers a wide range of new hydraulic features, including powerful data management and timesaving interface enhancements. Some of the more significant new capabilities are Active Topology Alternatives (ATA), Automated Calibration, Logical Rule-Based Controls, and Variable-Speed Pumping (VSP).

Other features:

- **Stand-alone Interface:** Define the entire system using an exclusive CAD-style drag-and-drop interface. Import a DXF background map if you prefer to work in a scaled environment.
- **AutoCAD Interface:** Create the network within AutoCAD by adding the figures directly to the drawing. Use AutoCAD native commands to manipulate the system. Work with WaterCAD elements the same way you work with the standard AutoCAD elements, using layer control, font styles and more.
- **GIS Integration:** Allows to build and maintain the network directly inside of ArcInfo or ArcView. Use native GIS commands to manipulate data and work with water network elements the same way you work with GIS elements. Share your data and results with other users, no matter which interface they use.

Link to users:

References can be provided by Haestad Methods on an individual basis. Thousands of client testimonials are available on the [developer's website](#).

Additional Information:

Program version:	WaterCAD [®] 5.0 (a.k.a. Cybernet) released in December 2001. Version 6 upcoming.
Distribution support:	Clients initially install WaterCAD via installation CDs that accompany the user's manual.
OS requirements:	Windows 98, ME, 2000 and XP
Hardware requirements:	- Processor: Pentium-166 - RAM: 32 Megabytes - Harddisk: 25 Megabytes - Display: 800 x 600 resolution, 256 colours
Calculation method:	Darcy-Weisbach, Manning's, Hazen-Williams
Calculation capacity:	Unlimited number of pipes, nodes, reservoirs, pipes, pumps, and valves
Data Input:	Via detailed dialog boxes for elements, FlexTables, data and GIS import utilities, or polyline to pipe conversion. Import existing data sets from any other hydraulic model, incl. earlier versions of WaterCAD and Cybernet
Data Output:	Customise any table completely, or create your own. Perform queries and other operations, (filtering, sorting, applying mathematical operations to selected elements). Colour-code and annotate the system according to any characteristic. Create graphs of any time-variable data, such as tank levels, pump operations, pipe flow rates, and so forth. Link your hydraulic model to a GIS, SCADA, or other data management tool. Connect directly to databases and spreadsheets, including Jet (Microsoft Access), dBase, Paradox, Btrieve, FoxPro, Excel, and Lotus, or use ODBC to connect to Oracle, SQL Server, and other popular database application
Network Layout:	Create scaled drawings using a base map, or work schematically if you choose. You can even mix and match scaled and schematic sections in the same project. Maintain intelligent network connectivity. Set default element characteristics using prototypes.
Language:	English, Spanish, Portuguese, Chinese
Handbook:	English, 300+ pages with examples, on-line tutorials and examples.
Support:	ClientCare Program. Subscriptions are designed to keep you up-to-date with the latest developments in technology, in addition to providing clients with unlimited access to technical and engineering support 7 days a week. Access to an on-line knowledgebase with modelling tips and frequently asked questions.
No. of installations:	More than 125,000 users in 170 countries.
Pricing:	From US\$195 for a 10-pipe to US\$25,000 for unlimited pipes, Stand-alone version. Option of individual or network licenses. For detailed price list see the website. Free Demo-CD available.