InfoWorks™ SD

Technical Review

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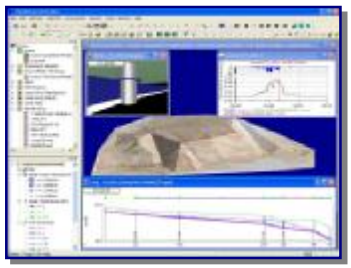
Using InfoWorks SD for Stormwater Drainage

InfoWorks SD combines a Relational Database with Geographical Analysis to provide a single environment that integrates asset planning with detailed and accurate modeling. InfoWorks allows planners and engineers to predict environmental impact following a rainfall event by providing fast, accurate and stable modeling of the key elements of stormwater systems. The software incorporates full solution modeling of backwater effects and reverse flow, open channels, complex pipe connections and complex ancillary structures.

InfoWorks SD incorporates full interactive views of data using geographical plan views, long sections, spreadsheet and time varying graphical data. A new 3-D Terrain view has been introduced for improved visual presentation of aboveground terrain and the impact of localized sewer failures.

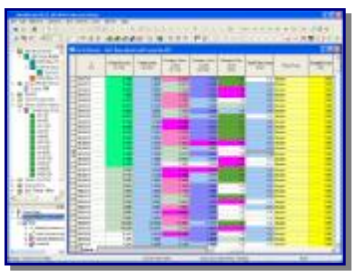


Access to the underlying model data is available from any graphical or geographical view.
Animated presentation of the results in Geographical Plan, Long Section, 3D junction and 3D Terrain views is standard, together with results reporting and flood frequency analysis using tables and graphs. The powerful 'Time Series' simulation engine provides automatic time-stepping and implicit numerical solution to optimize run time and ensures mathematical stability. The software contains comprehensive diagnostic error checking and warning, together with rapid access to full on-line documentation that is integrated with the help system.

InfoWorks SD contains many features that will help you work more quickly and accurately. The remainder of this document outlines the key aspects included in the product.

Database Management System with Version Control and Audit Trail

By using an Industry Standard Relational Database (choice of Microsoft Access, MSDE / SQL Server or Oracle), InfoWorks SD provides the ability to review current and historical model network versions and attribute data. As well as providing full details of each modification made to the network, it also provides version ID's, date stamps and modeler details. The data views show the confidence levels that have been attached to each asset data attribute within the system. A compare function allows the comparison of multiple model versions and the creation of a highly detailed report outlining the differences, including changes to the data flags describing confidence and/or source of all data items.



InfoWorks SD may be configured as a Workgroup providing access to models stored in a central 'master' database. The centralized version control system preserves data integrity and avoids model replication. Model data security, with respect to deletion and recovery, is provided through archive and back up of the 'master' model database. In addition, group project management techniques enable the centralized control of multiple users on multiple projects.

User Permissions

You have the option to apply a set of simple User Access Permissions at both the database level and the catchment group level. With access permissions activated there are three types of InfoWorks user:

- Database Owner - a database owner has full administrative powers over the database.
- Catchment Group Owner - appointed by a Database Owner, the owner of a Catchment Group has full edit and delete powers over that Catchment Group.
- Database User - a Database User has read-only access to the database. Catchment Group Owners are also Database Users and have read-only access to Catchment Groups that they don't own.

Straightforward Import and Export to third party applications

The direct import of data from other data sources is not only a fast way to transfer data but also highly accurate, certainly in comparison with some other historical routes.

Data Import

- InfoWorks SD supports the import of all network data from models such as HydroWorks, DHI/MOUSE and SWMM.
- The direct links between InfoWorks SD and ESRI ArcView GIS, ArcInfo or MapInfo Professional enable data to be converted directly into the InfoWorks SD model database for model build.
- InfoWorks SD is delivered with an Open Data Importer that enables asset data held within a Microsoft Access / Excel database to be imported directly into the InfoWorks SD model database. The user can configure the importer to map the data schema of the Access database to that within InfoWorks SD.
- InfoWorks SD also supports the import of data from .CSV files, .TXT files and TAB separated data.
- If necessary, InfoWorks SD allows you to set 'non earth' bounds in order to build a new network based on the local co-ordinate system.
- InfoWorks SD can import specific data sets from a number of commercial manhole database products. Those currently available include FastSTC, STC25, STC26, Thesis, MapDrain and the Examiner CCTV manhole database formats.

Data Export

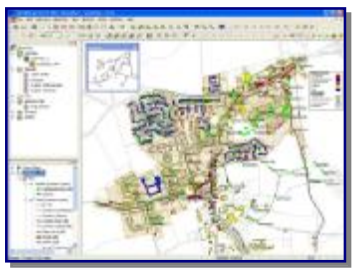
- InfoWorks SD supports the export of network data and maximum results to specific layers in ArcView GIS, ArcInfo or MapInfo Professional,
- InfoWorks SD provides facilities for the export of network and results data to .CSV files. These may subsequently be imported into Microsoft Access or Excel.
- InfoWorks SD can export .prn (text files) and .hyd ,.hyq ,.hyv (time varying event files), .log files and all Water Quality files.

Model build and simplification functionality

The selection tools within InfoWorks SD allow the geographical selection of model data, which then can be globally modified, deleted or copied and used to create a new model version.

Geographical model building tools

The InfoWorks Geographical View allows the node/link network to be shown in conjunction with raster or vector data in ArcView, ArcInfo or MapInfo formats. InfoWorks SD supports the on-screen creation of additional nodes, links and sub-catchment areas via the Geographical view in conjunction with a map background, making the addition of new data intuitive, simple and quick to do. The edit tools that allow the modification of node location and sub-catchment boundaries are also intuitive, simple and quick to use.



Sub-catchments and area take-off

InfoWorks SD offers the direct import or graphical creation of sub-catchment boundaries, over vector map backgrounds. This provides a geographical representation of the contributing area for each manhole, and allows automatic calculation of the total area. In addition, the different surface types and areas can be calculated using accurate area take-off from a vector map containing road and roof areas. This feature alone provides a significant timesaving when compared with the manual process, and it is repeatable and auditable.

Model merging

The merging of existing models into a larger macro model is performed quickly and accurately, utilising the copy and paste networks facility within InfoWorks SD. To merge, for example, 5 dendritically numbered models (of approx. 400 nodes each) into a single model within products like HydroWorks, DHI/MOUSE or SWMM, could take a couple of days and might potentially include a number of 'unintentional' errors. Within InfoWorks SD this task can be performed in minutes, and accurately represent the source models.

Interactive network simplification through SQL analysis and assignment

InfoWorks SD provides comprehensive SQL facilities that not only allow the query of node, link and sub-catchment tables, but also maximum results and cross table queries. All queries can be subsequently saved for future use. The SQL function allows SET and WHERE operations. By incorporating these two functions into your SQL's, you can manipulate data within the model, as well as simply selecting common data (i.e. SET pipe roughness on all pipes WHERE the material is Clay).

Network Overview

This tool analyses the network, and provides a numerical and graphical breakdown of the components that make up the whole network. If a polygon is used to select part of the network, the selected items will also be summarized. By clicking on the 'Selection Only' heading, the graphical display (in the form of a pie chart), and the Minimums, Maximums, and Ranges will be updated to reflect just the selected items.

Inference of Missing Data

Missing network values can be inferred from existing data, allowing you to fill in gaps in your data with reasonable values. For example, if the width of a conduit is missing but you have the width of the conduit immediately upstream, it is reasonable to assume that the missing width is the same.

InfoWorks SD includes a set of inference rules that you can apply to all or part of the network. The use of a common set of rules within the software means that all missing data can be inferred to the same standard, rather than depending on who does the inference or when it is done. InfoWorks SD has built-in inference rules for conduit sizes, conduit invert levels, node co-ordinates and node ground levels. In addition, every manhole and junction can also be scanned and the appropriate Headloss type and coefficient applied to the end of each connecting pipe, based on the angle of entry/exit from the manhole.

You can infer values for either the currently selected objects or the whole network. You can also choose which missing values are to be inferred and select the user-defined data flag that is to be applied to all inferred values. The use of a data flag is important for auditing purposes, as it allows you to distinguish between inferred data and data created in other ways.

Engineering Validation

The InfoWorks Engineering Validation option performs additional checks on network data to ensure that it is consistent with expected engineering values. Engineering Validation allows you to define your own set of validation rules, thus allowing you to modify the way in which Engineering Validation is performed, depending on the data concerned. The items are contained in engineering validation groups for easy reference. By setting up separate groups and objects you can define the exact criteria you wish to apply. An Information message is displayed in the Output window for each item of data that is outside normal values. You can use this window to investigate the fields for which messages have been included. When you open an engineering validation object for the first time you are supplied with the default validation rules in the Engineering Validation dialog.

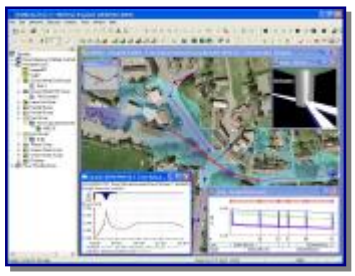
2-D Flood Mapping

This feature is able to demonstrate, in the GeoPlan, areas of the network that are likely to be inundated due to flooding from a manhole.

A “Flood Compartment” is defined to represent flood depths. Flood Compartments can be generated from existing subcatchments, or created using the Thiessen Polygon method, or user-digitized. Once Flood Compartments have been created they can be altered or merged. Flood levels are calculated over the entire flood compartment area, based on the levels at specified flood points (i.e. manholes).

The flood depth is determined from the flood level relative to the ground surface represented by an InfoWorks SD ground model. The ground model can either be a TIN or GRID. A theme representing the flood depth can be set.

An additional tool is included to enable the drawing of a cross section of the ground model showing the flood depth in profile.

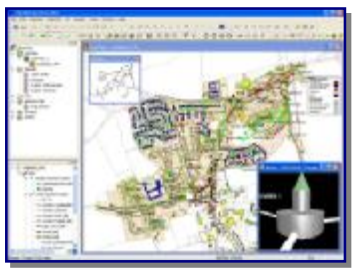


Automatic Additional Manhole Storage Compensation

In any system, there will always be a certain amount of storage available which is not explicitly defined in the model. It is possible that this additional storage volume, representing for example, small pipes from individual properties entering the system, may not be adequately represented in your InfoWorks model.

In the early days of model building, it was very difficult to quantify this storage, so an algorithm was developed at HR Wallingford in the mid 1980's. This set out some rules upon which to base the amount of 'lost' storage that needed to be added into the model to correctly account for the extra volume of storage available below ground in reality.

Today, GIS systems are much more powerful than 20 years ago, and the amount of information stored on such systems is of much greater accuracy and detail. It is therefore questionable if this approach is still needed when building a model directly from today's GIS systems.



However, if a model is predicting surcharging and flooding contrary to observations, then a possible cause is the absents in the model of the 'extra storage' that is available below the ground in the network of pipes and manholes. To compensate for this 'lost storage', one approach might be to apply the compensation algorithm to the network model. We have added extra fields for additional chamber storage and additional shaft storage, into which the user can specify some extra storage.

This tool has recently been expanded to account for lost storage on merging and pruning and for Preissmann slot compensation.

River Profiles

InfoWorks SD allows you to input river channel specific data which can be used to define a river. River channel data can be edited on either the Grid River View or the River Property Sheet available from the GeoView. Essentially, you need to enter a series of records which define the river channel cross section. InfoWorks interpolates linearly between values entered. You can define the start of a new conveyance panel at the boundaries of the river channel and the flood plains on either side. The highest point defined in the channel cross section is the point at which conveyance stops. For a river channel, you would typically define three panels i.e. the left flood plain, the main channel, and the right flood plain.

Built-in Rainfall Profiles as standard

The Rainfall Generators in InfoWorks SD enable you to create design storms that you can use in simulation runs. You can use these storms to simulate the operation of the drainage system for standard conditions of storm duration and return period (i.e. the average period between occurrences of an event greater than or equal to a given value).

These synthetic storms capture the statistical characteristics of rainfall, because they derive from analysis of long rainfall records of real events. Synthetic rainfall (or design rainfall as its sometimes known) represents a statistical event of known length and return period, derived from analysis of many years of rainfall records.

Synthetic rainfall will normally be used during analysis and design work with a calibrated model. It allows the rainfall characteristics of a region to be represented with a limited number of storms.

Time-series rainfall generally includes a wide range of conditions and is more likely to contain the conditions that are critical for each catchment. In some cases it might be more appropriate for modeling work than synthetic rainfall events. Typical synthetic time-series are available for several countries in the world. These are generated artificially by analysing past events. They reproduce the random variations in the timing and magnitude of actual rainfall events in the region and can easily be imported into InfoWorks.

Both Observed and Synthetic rainfall events can contain initial conditions for sediment on the subcatchment surface (water quality only) and runoff. You can import the initial conditions at the same time as a rainfall file or import the information into an existing rainfall event.

InfoWorks supports spatially varying rainfall by allowing rain-gauge regions to be stored with each the individual profiles of a rainfall event, or by the application of rainfall polygons over the network itself.

Varying Catchment Characteristic During a Long Simulation

When the Simulation encounters a sub-event in the Rainfall data, the values of UCWI, Antecedent Rainfall Depth, Evaporation and Wetness Index (SCS model) are updated from the start of that sub-event. This function allows for the more accurate analysis of very Long Time Series events, using any of the runoff models that are included in InfoWorks SD.

Infiltration Module

Flow in sewer systems frequently exceeds the sum of stormwater runoff and domestic and trade inflows. This residual flow is usually attributed to infiltration, which enters the sewer system through cracks. Unlike

runoff, which responds to a rainfall event in minutes, infiltration inflows have a much slower response. There are two main types of infiltration:-

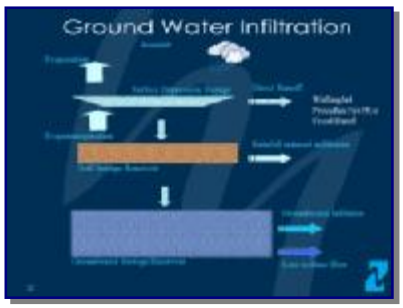
Rainfall-induced infiltration

Which results from soil water infiltrating directly into the sewer network. This has an effect on flow within hours or days of the storm.

Groundwater infiltration

Which occurs when the proportion of rainfall percolating deeper into the groundwater reservoir is sufficiently high enough to cause a response in the sewer. This type of response has an effect on flows in the weeks or months following the storm.

For single-event simulations, infiltration can be modeled as a constant inflow. For time-series simulations, however, some account of antecedent hydrological conditions is required; this data is included in the InfoWorks SD infiltration model.



The infiltration model uses bulk mass balance equations and simplified flow equations to approximate the physical processes. Because the model is simplified it requires some degree of calibration.

Rainfall runoff has three model components: initial loss (depression storage), runoff volume and runoff routing. Incident rainfall is initially stored in surface depressions, which are subject to evaporative loss (defined in the rainfall event). When rainfall exceeds depression storage The depth of water retained on the ground surface in puddles or other depressions in a given time step, a proportion of the excess rainfall goes to runoff according to the particular volume model used. The remaining rainfall is directed into the soil storage reservoir. When the soil reaches a given saturation threshold (the percolation threshold), water starts to percolate downwards. A proportion of this percolation flow (the percolation percentage infiltrating) infiltrates directly into the sewer network while the remainder penetrates deeper to feed the groundwater storage reservoir. Note that the volume in the soil storage reservoir is also subject to evapotranspiration, though at a reduced rate.

When the groundwater storage reservoir reaches a particular threshold water loss due to baseflow occurs. When the groundwater level reaches a further infiltration threshold, groundwater infiltration occurs.

The infiltration model can be calibrated so that the ground water storage level relates to the actual groundwater table level. In this case, the infiltration threshold type and baseflow threshold types are set to levels that are relative to the chamber floor of the node that the particular subcatchment drains to. This is a reasonable estimate of the realistic level at which infiltration may occur.

In networks where infiltration is dominated by tidal influences, you can create a time-varying profile for the groundwater storage level. This profile will override the level calculated by the infiltration model and groundwater infiltration is then based on this level.

Snow Melt Modeling

A Snow Melt model has been incorporated into InfoWorks SD. The model is derived from the SWMM4 continuous simulation model. The Rainfall Event Editor allow the user to define the initial snow conditions, temperature profile and wind profile in addition to the rainfall profile. The melt rate, snow depth and free water depth results are available for any subcatchments containing snow packs. The Snow Melt Model operates by affecting rainfall before it reaches the runoff surfaces. When temperature falls below the Dividing temperature between snow and rain, the rainfall profile is treated as snow. A melt rate is calculated for each surface type. For impervious surfaces, the melt rate is the area

weighted average of the melt rates from the ploughable and non-ploughable impervious areas. During periods when the temperature is below the base temperature of the snow pack surfaces, melt does not occur. Snowfall builds up snow depth.

When the snow depth is greater than zero and the temperature is above the base temperature of the snow pack surfaces, melt will only occur when the cold content of the snow pack is greater than or equal to zero. Runoff can only occur when the free water holding capacity of the snow pack has been filled.

Snow does not melt uniformly over the surface of the subcatchment; as melt occurs, the area of the subcatchment covered by snow is reduced. The Areal Depletion Curves define the relation between the area of the subcatchment that remains snow covered and snow pack depth.

Real Time Control Module

Real time control is the remote manipulation of control structures within a drainage system, based on conditions at any point in the system, in order to optimize storage and operation. You can apply Real Time Control (RTC) to individual, isolated, ancillary structures to provide local control of flows. It can also make global management of flows possible throughout an entire network.

You can combine RTC modeling parameters to build up complex rules. This gives you enormous scope to explore the potential storage capacity and optimal operating patterns within the system being modeled by routing and storing flows. The components of RTC for the management of stormwater networks are the use of sensors in the drainage network to monitor flows continuously.

By using telemetry, you can implement a control system using local operating rules, allowing you to change the state of the ancillary structures such as pumps, sluice gates and weirs during a storm.

Water Quality Module

The InfoWorks SD Water Quality Module is designed to help engineers develop cost effective solutions for pollution and sedimentation problems. The Water Quality Module can model physical processes such as the sediment built up behind closed gates and penstocks. This leads to recommendations for corrective action through storage and real time control.

The InfoWorks Quality Module contains facilities to model the main water quality parameters such as TSS (total suspended solids), BOD (biochemical oxygen demand, attached & dissolved), COD (chemical oxygen demand, attached & dissolved), NH4 (ammonia, dissolved), TKN (total Kjeldahl nitrogen, attached & dissolved), and Tph (total phosphorus, attached & dissolved). It also allows for user-defined pollutants, bed-load sediment fractions, and the modeling of bed-load movement separately from the suspended sediment movement.

Physical process models within the Water Quality Module include a Surface pollutant build-up Model, Surface pollutant washoff Model, Gully pot Model, Wastewater profile Generator, Sediment transport Model and an in-pipe water quality Model.

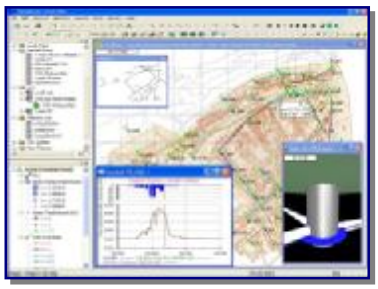
Fast, Stable and Fully Dynamic Simulation with Time Step Control

Significant savings in simulation time and also resultant file sizes can be obtained by using the 'Time Series' time step facility during dry weather flow periods and for continuous simulation over long time periods. Independent tests have shown the simulation times can be less than a quarter and file sizes down to a fifth when compared with the equivalent run performed using dynamic models such as HydroWorks, DHI/MOUSE or SWMM.

The Simulation engine in InfoWorks SD can process up to 100,000 nodes in a single model, offering the ability to more closely represent the true assets, and reducing the need to create simplified models.

Clear Graphical Presentation and Results Analysis

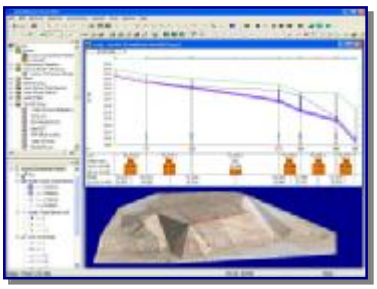
InfoWorks SD supports up to two different system types (stormwater overland) within any one model, and represents each using different colors. In addition, it provides support for separate contributing areas and floodable areas as separate data items. 'Break Nodes' have been introduced to prevent the need to create 'dummy' manholes in the model.



Themes can be used to highlight parameters graphically on the GeoPlan view. The chosen parameter could be a static network parameter with a fixed display, or you can use a theme to highlight a results parameter during a replay of a simulation. In this case the display will be continually updated during the course of the replay. InfoWorks allows you to set up exactly how your selections are displayed. You can set up the display entirely manually, or use the built in options to automate the process.

You can also display a contour plot of many different types of data on the GeoPlan View. Like themes, the chosen parameter could be a static network parameter (such as ground level), or a results parameter (such as water level) during a replay of a simulation. In this case the contours will be continually updated during the course of the replay.

A very useful option allows you to draw an arrow from the centre of each sub-catchment to the node (or nodes) that receives direct runoff from that catchment. Lines with a direction arrow are drawn from the centre of the sub-catchment to the receiving node(s).



InfoWorks SD provides simple and fast creation of summary tables for conduit surcharging, node flood volumes and Return Period Analysis, including the creation of 'x:x' diagrams within InfoWorks itself. By exporting this data to the GIS (MapInfo or ArcView) it is also possible to create simple and accurate 'x:x' drawings for other people within minutes. This is a task that could traditionally take days to do manually in AutoCAD.

Support for ORACLE, MSDE and SQL Server databases

There are a number of advantages for selecting an ORACLE, MSDE or SQL Server database instead of a Microsoft Access (JET) database to hold all your InfoWorks SD models and results.

Database Size

Microsoft Access and MSDE databases can be a maximum of 2 Gigabytes in size. This is more than adequate for most purposes, however using ORACLE or SQL Server allows databases of at least 1 Terabyte.

Multi-user System

The system is more robust, and the performance is better, because users are interacting with the server instead of working directly with shared files.

Scalability

MSDE databases are fully compatible with Microsoft SQL Server. You can upgrade from MSDE to SQL Server at any time and take advantage of the virtually unlimited (more than 1 Terabyte) database size and additional database management facilities. You can also copy SQL Server databases to an MSDE server installation as long as they don't exceed the 2 Gigabyte maximum for an MSDE database.

Improved Performance

Microsoft Access and MSDE databases provide good performance with up to five users accessing the database concurrently. Above this number, performance will tend to degrade. If you expect large numbers of concurrent database users, you should consider upgrading to the full Microsoft SQL Server product, or ORACLE, both of which are designed to perform well with large numbers of concurrent users. However, performance of MSDE with more than five users should still be better than an equivalent number of users trying to work with an Access (JET) database.

Improved Security

MSDE provides server level and database level security to improve data protection compared with Microsoft Access. InfoWorks implements a basic password security with one Administrator and one User account. You can take full advantage of the improved security available when using ORACLE or the full Microsoft SQL Server product.

Hardware configurations

The absolute minimum specification for InfoWorks is a Pentium 4 1.0GHz PC with 512Mb RAM, and a 1024x768 resolution screen with 16 bit color.

However, for bester performance from a GIS point of view, an Intel Core2Duo or AMD Athlon processor should be used and the RAM should be increased to a minimum of 1Gb. For the very best all round results use the latest Intel or AMD multi-core processor (the higher the clock speed and the more cores the better) and install at least 2Gb of RAM. The graphics resolution should be better than 1280x1024 and you should have at least 20Gb of local hard disk for working files. InfoWorks simulations are CPU intensive so the faster the CPU the shorter the simulation times.

For v7.0 and later, enhancements have been made to the simulation engine to increase the accuracy and speed of simulation. In particular, the engine can now also take advantage of multi-core processors to increase the speed of Simulations.

- A Pentium 4 with Hyper-threading enabled will provide a small gain over the same processor without Hyper-threading.
- Dual processors or dual core Xeon, Pentium D or Pentium Extreme Edition processors provide greater gains, however the Operating System may restrict the number of processors that are capable of being used.
- For best results use an Intel or AMD dual/quad core processor - the engine takes advantage of the new parallel programming technology (SSE2 vector operations) if the processor is a genuine Intel or AMD processor.

It's worth noting that in the last point above, the Simulation Engine takes advantage of dual core AMD processors for parallel processing from v7.5 of InfoWorks SD, Intel's range of multi-core processors were supported from v7.0. In all other situations the Simulation Engine will use generic linear code instead of SSE2 vector operations.

The Simulation Engine in InfoWorks SD is a 32-bit executable.

InfoWorks is designed for a Windows Vista (Premium, Business, Enterprise and Ultimate Editions), Windows Xp Professional or Windows 2000 based environment. We do not support the operation of InfoWorks on Windows 95, Windows 98, Windows Me, Windows NT v3.51 or Windows NT4 operating systems. This is because Microsoft no longer provides any support for these legacy products.

If you are using Windows 2000, you must have applied Service Pack 3 (or later) to use InfoWorks. We recommend applying Service Pack 2 for Windows Xp, although this is not a system requirement for InfoWorks to run. Those running Windows Vista should ensure they always have the latest fixes and security patches applied.

For large models (greater than 10,000 pipes/nodes), a significant amount of disk space will be required. This is both for simulation results and the numerous temporary files created during the model build / data transfer process. If data and results are to be held on the local machine, make sure you have at least 20Gb of free

disk space after installation of the operating system, InfoWorks, and any other software tools (i.e. Microsoft Office or your preferred GIS application). For best performance, use a good quality hard drive and make sure it has fast data access speed.
Large networks and ground models require lots of memory and more disk space to manipulate than standard data.

Be aware that large networks, particularly those with ground models containing DTM, DEM or LIDAR data, require lots of memory and more disk space to manipulate than standard data.

If the database is to be held on a Network Server, make sure the network itself can handle the large amount of traffic that will be created. At a minimum, we recommend Fast (100Mb) Ethernet, but a Gigabit network environment is preferable. If your system is based on a T1 connection (1.5Mb) or even 10Mb Ethernet, you may well find the network is unable to cope with the added demands that InfoWorks could place on the system.

InfoWorks, Windows Terminal Server and Citrix

InfoWorks works well on a Windows 2000 Terminal Server. Performing long simulation runs in this way is a good way of avoiding tying up an individual's personal desktop machine.

When more than one modeler will want to use each terminal server at the same time, more than one processor is highly recommended. Each modeler must log on using a different username and they must use separate InfoWorks local roots (which will be the case if they use the InfoWorks default location).

InfoWorks can use lots of memory for large networks and simulations use lots of CPU. Therefore you will need to size the server appropriately for the number of concurrent users and type of use.

For multiple users on a terminal server you must have a Network Dongle for InfoWorks.
If you run more simulations simultaneously than you have processors in the Server the total time taken to run them will be longer than if you ran them one after the other.

If you have a fast LAN you should not experience any network performance issues using InfoWorks remotely. If bandwidth is an issue note that GeoPlan results replay animations by sending a complete bitmap each frame.

On Windows 2000 Terminal Server remote windows only have 256 colors available which limits the effectiveness of using thematics on a GeoPlan. Windows 2003 Terminal Server when used with the new client software does not have this limitation supporting color depths up to 24 bits (True Color).

If you wish to just use the Terminal Server for running long simulations and analyse results (do replays etc) using your normal desktop PC here a few of tips:

- Use a different username when you log into the terminal server (otherwise you won't be able to easily run simulations on the terminal server and your desktop machine at the same time)
- Log into the Terminal Server and schedule the runs using only checked in network and select the option to put results files on the server.
- Close the main InfoWorks program and leave the simulation controller running. This reduces resource usage on the Terminal Server and releases the UI licence.

Generally speaking, any software that works on Terminal Server will also work with the Citrix MetaFrame Presentation Server.

Citrix MetaFrame Presentation Server and Client talk using the ICA protocol (not RDP that Microsoft use) and the server sits on top of Windows Server. They have more client options (including a browser one) and the protocol is suitable for low bandwidth connections - although we suspect that full screen bitmap animations won't be very fast on such a connection.

Software Protection

Licensing is on a per user basis, protection is provided with electronic Dongles attached to either the local PC or a network server.

We can supply the Dongle in either Parallel or USB format. Given that most modern day computers, particularly laptops, no longer have a parallel port, we recommend opting for a USB style Dongle. The cost of the software is not affected by your choice.

Implementing a Network Dongle solution is an alternative (and much more secure) way to authenticate the use of your Wallingford Software licences in a corporate environment. A Network Dongle remains resident on a corporate LAN, and provides access to InfoNet for individual users connected to the Local Area Network, without the need for a Dongle to be attached to a particular PC. This type of solution allows more flexibility, particularly when staff are working on projects involving the combined use of different Wallingford Software applications.

The limits of the authentication range for any one Network Dongle is determined by the Local Area Network on which the Dongle resides. Typically, this would be considered to be within an office complex. Where authentication is required to serve different office locations, it is necessary to deploy specific Network Dongles for those locations. Authentication over any Wide Area Network (WAN) that might exist between such offices is prohibited.

Installation

InfoWorks installation can be either locally on independent PC's (or a Laptop for mobile use) or installed on an intranet server for greater flexibility of use. Storage of data sets may be local or network server based depending on IT requirements.

Support and Training

Support of the solution is primarily a local function with standard 5-day week support. Additionally, due to Wallingford software's global nature, support from Europe, North America, Asia or Australia can be resourced if required.

User and Management training is offered on a number of levels to match client requirements. Standard and Advanced user courses are available.