Collection Systems (CS)

Technical Review
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Using InfoWorks CS for Wastewater Collection Systems and Treatment Works Analysis

InfoWorks CS 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 wastewater, stormwater and/or combined sewer systems. The software incorporates full solution modeling of backwater effects and reverse flow, open channels, trunk sewers, complex pipe connections and complex ancillary structures.

InfoWorks CS 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 localised 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 optimise 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 CS 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 CS 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 CS may be configured as a Workgroup providing access to models stored in a central 'master' database. The centralised 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 centralised 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 CS supports the import of all network data from models such as HydroWorks, DHI/MOUSE and SWMM.
- The direct links between InfoWorks CS and ESRI ArcView GIS, ArcInfo or MapInfo Professional enable data to be converted directly into the InfoWorks CS model database for model build. Such data includes sub-catchment (contributing) areas, area breakdown (road/roof polygon areas) and population data (address point count).
- InfoWorks CS 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 CS model database. The user can configure the importer to map the data schema of the Access database to that within InfoWorks CS.
- InfoWorks CS also supports the import of data from .CSV files, .TXT files and TAB separated data.
- If necessary, InfoWorks CS allows you to set 'non earth' bounds in order to build a new network based on the local co-ordinate system.
- InfoWorks CS 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 CS supports the export of network data and maximum results to specific layers in ArcView GIS, ArcInfo or MapInfo Professional,
- InfoWorks CS provides facilities for the export of network and results data to .CSV files. These may subsequently be imported into Microsoft Access or Excel.
- InfoWorks CS can export .prn (text files) and .hyd, .hyq, .hyv (time varying event files), .log files and all Water Quality files.
- InfoWorks CS supports the export of network and event data required for simulation in HydroWorks.
Model build and simplification functionality
The selection tools within InfoWorks CS 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 CS 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 CS 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. InfoWorks CS also provides quick and accurate calculation of population from 'Address-point' or 'building seed' map data.

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 CS. 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 CS this task can be performed in minutes, and accurately represent the source models.

Interactive network simplification through SQL analysis and assignment
InfoWorks CS 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 summarised. 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 CS 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 CS 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 CS 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.

**Treatment Works Controls**

InfoWorks CS support a variety of specialised control types to make modeling of treatment works more practical:

- Contracted rectangular thin-plate weir
- Trapezoidal weir
- V-notch weir
- Round nosed broad crested weir
- Rectangular, Trapezoidal and U-Shaped flumes
- Siphon overflow
- Bar Screen

Most of the parameters you need to define for these new controls correspond to their use in the old Wallingford Software application for the Hydraulic Analysis of Treatment works, called CHAT.
Implementation is also as in CHAT, with the additional functionality that these modules can handle -ve as well as +ve flow, although this is not necessarily appropriate in all cases.

**River Profiles**

InfoWorks CS 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 CS 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 modelling 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 CS.

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 CS 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 Modelling**

A Snow Melt model has been incorporated into InfoWorks CS. 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 optimise 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. For example, a level meter at the top of the sewer system may operate a sluice gate near the treatment works.

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 sewer 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 CS 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 first foul flush, sediment built up behind closed gates and penstocks. Using the Water Quality Module, engineers can control pollution by targeting the SSOs and CSOs problems, and predict quality components such as the volume of spillage and flooding. 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.

**InfoWorks 2D Module**

The InfoWorks 2D module facilitates fast, accurate and detailed surface flood modelling, which is equally applicable to both "Collection Systems" and "Storm Drainage" analysis. Two-dimensional (2D) simulation is much better for modelling flows through complex geometries such as urban streets and buildings, road intersections and other transport infrastructure. This becomes a critical requirement in times of high intensity rainfall, where the situation in urban areas is exacerbated by the presence of sewer networks, in which flows can both enter and exit the system during flood events. Clearly, modelling such complex flow scenarios both accurately and efficiently requires a model with both 1D and 2D engines. In rural areas or on open ground a 2D approach is also preferable, especially where the source or direction of flow is problematic to assume.

InfoWorks 2D combines a number of distinctive features:

- Analysis and prediction of potential flood extent, depth, velocity and direction.
- Comprehensive functionality to completely model the interaction of surface and underground systems.
- Fully integrated 1D and 2D modelling environments.
- Multiple surface mesh design optimises modelling flexibility and accuracy.
- Multiple results views, both static and animated.
InfoWorks 2D is available as a fully integrated module within InfoWorks CS for collection system and stormwater modelling.

**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 CS 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 CS supports up to four different system types (wastewater, stormwater, combined or other) within any one model, and represents each using different colours. 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 CS 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 and Microsoft SQL Server databases

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

- **Database Size** – Microsoft Access databases can be a maximum of 2 Gigabytes in size. This is more than adequate for most purposes, however using ORACLE or Microsoft 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** - You can upgrade from Microsoft Access to ORACLE or Microsoft 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 an ORACLE or Microsoft SQL Server databases to an Access installation as long as they don't exceed the 2 Gigabyte maximum for an Access database.
- **Improved Performance** – Microsoft Access 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 Microsoft SQL Server or ORACLE products, both of which are designed to perform well with large numbers of concurrent users.
- **Improved Security** - 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 the Microsoft SQL Server product or an ORACLE database.

Hardware configurations

The minimum specification for InfoWorks is an Intel Pentium D, Pentium Extreme Edition or Dual Core Xeon processor with at least 2Gb of RAM. However, for better performance, an Intel Core2Duo, Core2Quad or AMD X2 Athlon processor should be used and the RAM should be increased to 4Gb.

For the very best all round results use the latest Intel (i.e. Core-i5 or Core-i7 or multi-core Xeon) or AMD (i.e. Opteron or Phenom II) processor and install at least 4Gb of RAM. As a general rule, the more cores your PC has the better, although the gains do start to tail off once you reach 12 cores.

Approximate timings are:-

- Single Core to Dual Core = 40% improvement.
- Single Core to Quad Core = 60% improvement.
- Single Core to Dual Quad (8) Core = 65%-70% improvement.

Clock speed is also an important consideration. InfoWorks simulations are CPU intensive so the faster the CPU clock speed, the shorter the simulation times.

You may like to use this site to compare performance of the various processors that are currently available -> [http://www.cpubenchmark.net/cpu_list.php](http://www.cpubenchmark.net/cpu_list.php). It’s not a definitive guide, but they do have benchmarking data for most of the common AMD and Intel processors, which can be compared with those going back two or three years.

The graphics resolution should be at least 1280x1024. The important point for InfoWorks (especially if you want to take full advantage of the 3D rendering in the GeoPlan) is that you have a dedicated graphics card, rather than relying on any on-board graphic capability of the PC's
motherboard. Examples would be graphics cards from manufactures like ATi or NVIDIA. These cards have their own dedicated memory, which is typically either 256Mb or 512Mb. Don't go for less than 256Mb.

You should have at least 20Gb of local hard disk space for working files.

The Simulation Engine in InfoWorks CS is a 32-bit executable, but will run quite happily on a 64bit machine and operating system. Full support is provided for the 64-bit edition of Windows Xp and Windows Vista (Service Pack 1) from v10.0 of InfoWorks. InfoWorks v10.5 was the first version to provide full support for the Windows 7 platform (x86 and x64). Support is also provided for Microsoft Windows Server 2003, 2003 R2 and Windows Server 2008. Under these Operating Systems the software can support more than 2GB of memory, which gives InfoWorks more address space (up to a limit of 4Gb), making it capable of creating much larger 2D meshes.

Please note that InfoWorks is only supported on x64 versions of Microsoft operating systems, not on Itanium versions.

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 3 for Windows Xp, although this is not a system requirement for InfoWorks to run. Those running Windows Vista should ensure they are at Service Pack 1 (SP1) and that the latest fixes and security patches have been 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, particularly those with ground models containing DTM, DEM or LIDAR data, require a lot more memory and a lot more disk space to manipulate than standard data.

If the database and results files are to be held on a Network Server, make sure the network itself can handle the large amount of traffic that could 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 modeller will want to use each terminal server at the same time, more than one processor is highly recommended. Each modeller 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 colours 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 colour depths up to 24 bits (True Colour).

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 Authentication**

Licensing is on a per user basis, authentication is provided by electronic Dongles attached to either the local PC or a Network Server. We supply the Dongle in either USB or Parallel format. Given that most modern day computers, particularly laptops, no longer have a parallel port, we recommend opting for a USB style Dongle when opting for a Local Dongle solution.

The InfoWorks licence restricts the movement of licences controlled by a Local Dongle. The use of a Network Dongle gives much more flexibility in this respect and provides a much more secure way to authenticate the use of your Innovyze licences in a corporate environment. A Network Dongle remains resident on the corporate Network, and provides access to InfoWorks for individual users connected to the Network, without the need for a Dongle to be attached to a particular PC.
Licences that are authenticated by a Local Dongle can be upgraded to 'seats' on either a LAN based or WAN based Network Dongle at any time. Our definition of LAN based authentication is considered to be within an office complex/building. In the situation where an organisation operates a number of offices on a Business Park, or where the main office is supplemented by staff in one or more nearby satellite offices, the people working in these offices are considered to be on the same LAN from an InfoWorks licensing point-of-view.

Where network 'seats' are destined for staff in a variety of very disparate offices, then you will either need to deploy a specific LAN based Network Dongle for each those locations, or opt for WAN based configuration, where anyone in any of your regional offices can gain authentication to use InfoWorks from a WAN based Network Dongle in a remote location. WAN based authentication outside the original country of purchase is strictly prohibited.

We have chosen to keep our Network Dongle implementation as simple and straightforward as possible. It will work over virtually any TCP/IP or UDP network configuration. The configuration is such that even a VPN (Virtual Private Network) connection is possible. Such VPN access is permitted for occasional use, such as when staff are required to work from Home for short periods of time.

**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 global nature of the Innovyze business, 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.