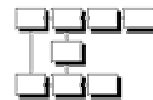


A Quick Introduction to



*State-of-the-Art Software for the Design and
Cost Estimation of Wastewater Treatment Plants*



Hydromantis, Inc.
Consulting Engineers

Introducing CapdetWorks

Accurate and rapid preliminary design and cost estimating for wastewater treatment plant construction projects is a worldwide priority. Spreadsheet models are commonly used to provide planning or design level cost estimates, but these models are relatively inflexible and time consuming to modify.

CapdetWorks has been designed to give public and private planners, design consultants and construction companies the ability to quickly evaluate design alternatives. The software calculates the design of each unit process based on the influent to the process and then costs the design. This two-step approach gives the user the option to review the produced design and modify the design by using the design override features in the program, if necessary. Typical design defaults have been used for each unit process to increase the acceptability of the calculated designs and make the software easier to use for planners that require a planning-level cost estimates of a new facility or an upgrade to an existing facility.

Installing CapdetWorks

CapdetWorks requires the following hardware and software as a minimum for acceptable performance:

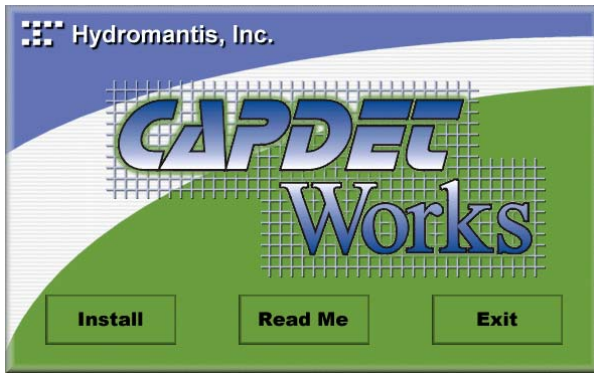
- 300 MHz Pentium II Processor
- 128Mb RAM
- 50Mb of free hard disk space for installation
- SVGA (800 x 600, 256 colour) graphics card
- CD ROM drive

Windows 98, 2000, Me, XP, NT 4.0

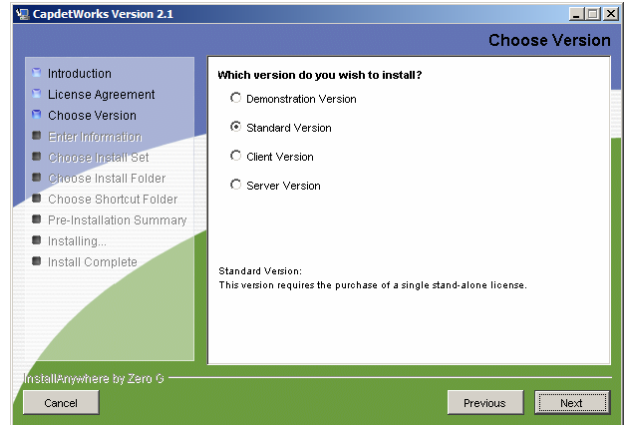
CapdetWorks Installation

CapdetWorks must be installed using the CapdetWorks installation program (note that a hardlock protection device is required to use all the features of the software). The CapdetWorks CD contains a program called Autorun.exe that is located in the root directory. When the CD is placed in the drive the install screen will be displayed.

Note: If the install screen does not automatically appear, browse the CD and run the program called Autorun.exe.



Select the 'Install' option to start the installation process.



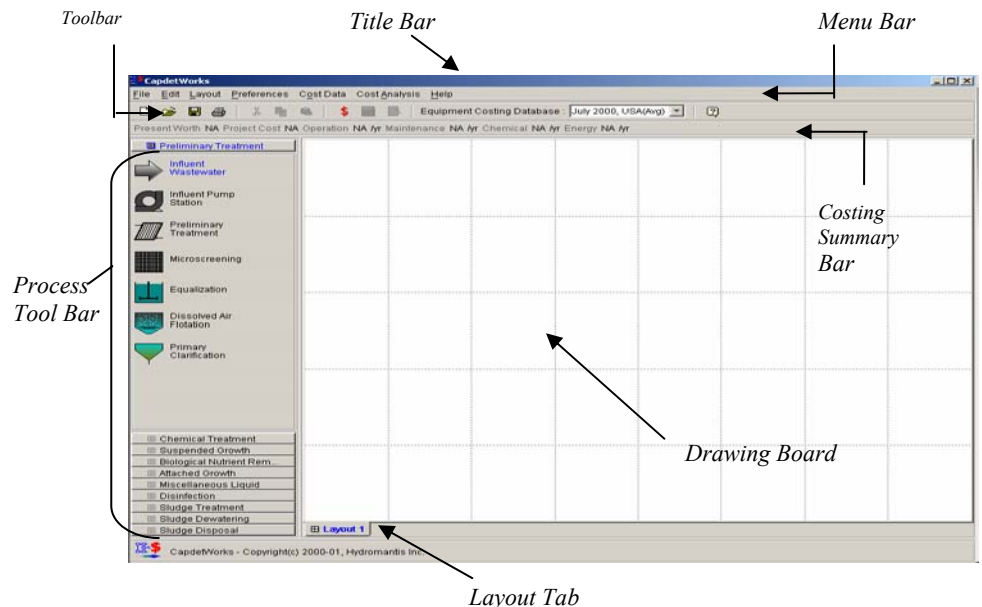
Once the installation has started you will be prompted for various pieces of information including the CapdetWorks version you would like to install, your name, company name and keycode. If you do not have a hardlock, protection device, select 'Demonstration Version', when prompted.

After selecting an appropriate location for the program and associated icons, the installation will take a few minutes to complete. Restart your computer before using CapdetWorks. CapdetWorks is now installed and ready for use.

Getting Started

To start CapdetWorks: Click the 'Start' button, click 'Programs', click the 'Hydromantis CapdetWorks' program group, and select CapdetWorks. When CapdetWorks is first launched, the user will see the Main Window. The Main Window consists of the following key components:

- Title Bar
- Menu Bar
- Toolbar
- Costing Summary Bar
- Process Tool Bar
- Drawing Board with Layout Tab(s)



CapdetWorks has many unique features that make it a powerful tool for the design and preliminary costing of wastewater treatment facilities. As you become acquainted with CapdetWorks, you will quickly see ways it can be used to make your engineering tasks more productive.

Using CapdetWorks

This introduction is intended for first-time users of CapdetWorks and is meant to introduce the major features of CapdetWorks. To best understand this material, you should have a background in the fundamentals of wastewater treatment including unit processes and typical wastewater treatment facility design criteria. It is assumed that you have a working knowledge of your computer's operating system and that CapdetWorks is properly installed on your computer.

Limitations of the Demo

When the software protection device is attached to the parallel port (or USB port if applicable) then CapdetWorks will detect its presence and operate in Full mode. Without the software protection device CapdetWorks works in Demo mode and has the following limitations:

- No printing or export to files/spreadsheets.
- No saving of layouts.
- Influent settings are fixed.
- Limited number of process objects are draggable to the drawing board.

Example Layouts

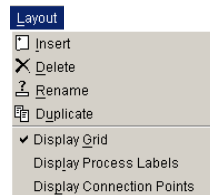
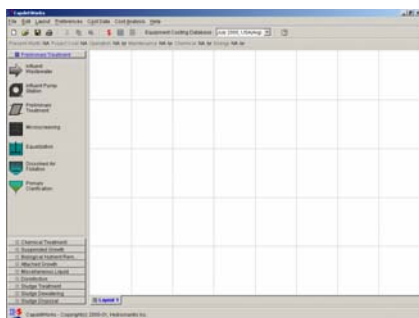
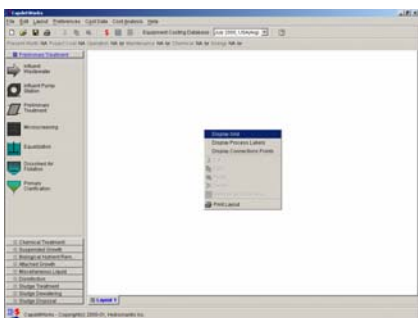
CapdetWorks comes with several example layouts which are located in the Examples sub-directory of the CapdetWorks installation directory. You can access these examples from the Windows Start menu.

These example layouts have been prepared as resources to help you learn more about CapdetWorks. However, there are process objects in these layouts that may not be “draggable” while in Demo mode so some of these layouts may not open in Demo mode.

Building a Simple Layout

After starting CapdetWorks, display the drawing board grid (if not already displayed).

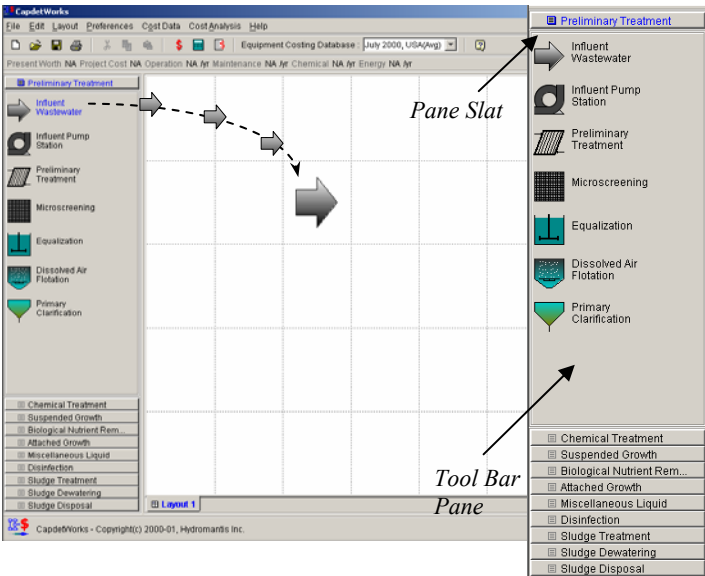
1. Access the Layout Menu by left-clicking on ‘Layout’ on the Menu Bar.
2. Choose ‘Display Grid’. The drawing board grid will be displayed on the active sheet.



3. The next step is to drag-and-drop the required unit processes from the Process Tool Bar to the drawing board.
4. Ensure that the Process Tool Bar is visible. If not, select the ‘Process Tool Bar’ Menu item in the Preferences drop-down menu to display the tool bar on the left side of the drawing board.
5. Click on the ‘Preliminary Treatment’ Pane Slat to reveal the Preliminary Treatment unit processes.
6. Click and drag the ‘Influent Wastewater’ process icon from the Process Tool Bar to the drawing board.

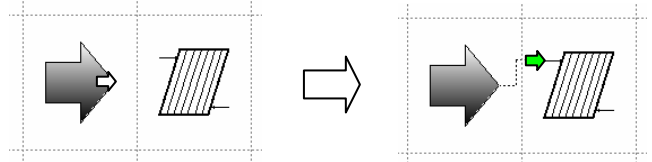
The Process Tool Bar has a number of Tool Bar Panes that group the unit processes into functional categories. The name of the functional group is displayed on the Pane Slat. Clicking on the Pane Slat will reveal the unit processes included in that grouping. In the demo version of the program not all of the processes are available in the Process Tool-Bar.

Follow a similar procedure for a ‘Preliminary Treatment’ object (Preliminary Treatment Pane), and a ‘Complete Mix Activated Sludge’ object (Suspended Growth Pane).

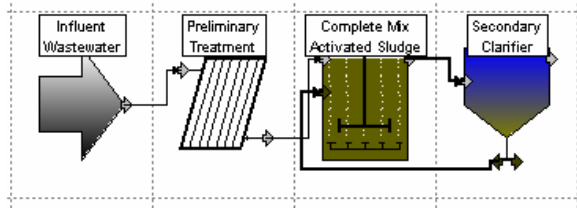


After each of the objects has been placed on the drawing board, the objects must be connected to define the flow stream.

7. Place the cursor over the connection point of the influent arrow. The cursor will change to a white block arrow.
8. With the cursor as a white block arrow, click and drag a pipe to the inlet connection point of the preliminary treatment object. Once the cursor turns to a green block arrow, release the mouse button. A connection pipe will be drawn. [Note: If placed at an appropriate connection point, the white arrow will turn green to signify a suitable connection point. If an unacceptable connection is attempted, the cursor will turn into a red icon.]

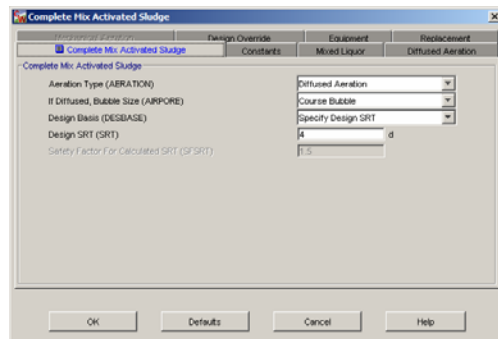
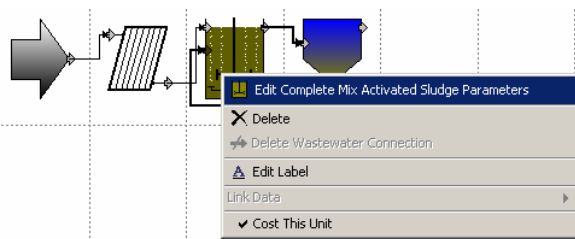


Follow a similar procedure and draw connection pipes for each of the unit processes on the drawing board. A completed layout will have each object connected to one or more other objects.



With the process stream drawn, the next step is to specify the particulars of the process and the design requirements. In this example we will change the design solids retention time of the Complete Mix Activated Sludge treatment process.

9. Right-click on the 'Complete Mix Activated Sludge' object and bring up the object's edit menu.
10. Select 'Edit Complete Mix Activated Sludge Parameters' from the listed items.



11. In the Complete Mix Activated Sludge dialog, change the 'Design SRT to 6 days from 4 days.
12. Click 'OK'.
13. From the 'Cost Analysis' drop-down menu, choose 'Estimate Cost of Current Layout'. [Alternatively, the layout can be designed and costed by clicking on the 'Estimate Cost of Current Layout' button on the Tool Bar.]

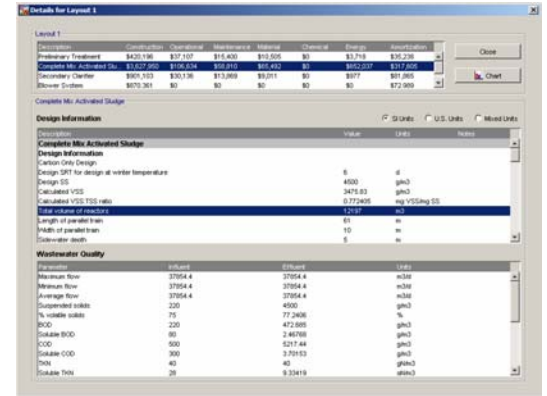
Present Worth \$31,100,000 Project Cost \$18,700,000 Operation \$292,000/yr Maintenance \$87,400/yr Chemical \$0/yr Energy \$644,000/yr

The Costing Bar now displays a summary of the estimated cost for this layout given the design criteria entered. In addition to getting this cost summary, it is also possible to review the details of the cost estimate.

14. From the 'Cost Analysis' drop-down menu, choose 'Details of Cost Estimate'. [Alternatively, the details can be accessed by clicking on the 'Details of Cost Estimate' button on the Tool Bar.]



The 'Details for Layout 1' window should now be displayed. This window has two sub-sections: one which lists the unit processes in the layout; and one which lists the particulars of the highlighted unit process. The unit process section is further divided into two sections: 'Design Information' and 'Wastewater Quality'.

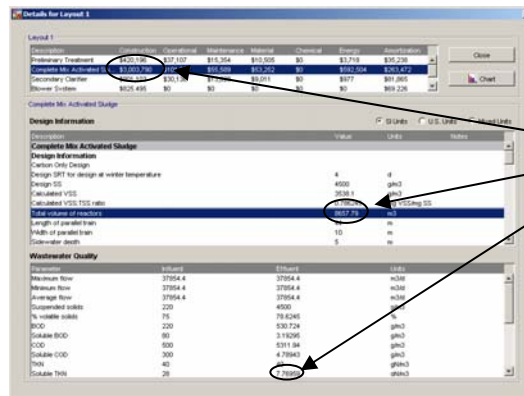


15. Left-click on the Complete Mix Activated Sludge unit process and scroll the 'Design Information' to the 'Quantities Required' section.

Here you can see some of the design information, including the volume of each aeration tank and the process air requirement. Now we shall redesign the layout with a lower solids retention time.

16. Click 'Close'. Repeat the above steps and change the Design SRT to 4 days. Re-cost the design.

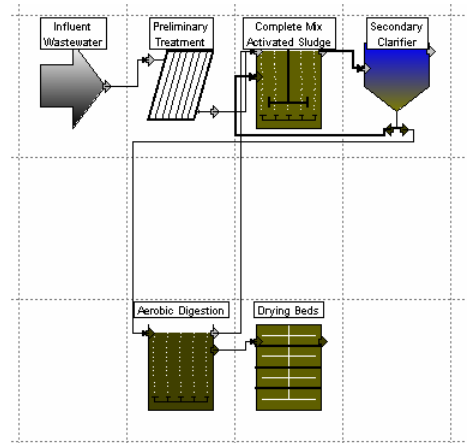
By comparing the details generated previously with these more stringent details, you can gain some insight into the design algorithms in CapdetWorks. Left-click on the Complete Mix Activated Sludge unit process, and scroll the 'Design Information' to the 'Quantities Required' section. Here you can see that with the more stringent effluent requirement, bigger tanks are required which cost more to build.



Illustrative example of the solids retention time impact on the CapdetWorks design

The sludge treatment stream is equally important to the design.

- To add a sludge stream to the layout, drag and drop, an 'Aerobic Digestion' object (Sludge Treatment Pane), and a sludge Drying Beds object (Sludge Dewatering Pane) to the drawing board.
- Connect the secondary underflow and the waste sludge connection from the bottom of the secondary clarifier to the inlet of the Aerobic digester.
- Connect the sludge outlet from the digester to the drying beds.
- Connect the supernatant recycle to the inlet of the Complete-Mix activated sludge process. Your drawing board should now look something like the drawing board shown.
- With the effluent soluble BOD requirement at 10 mg/L Re-design the layout by selecting 'Estimate Cost of Current Layout' from the Cost Analysis drop-down menu. A new set of costing data will be displayed on the Costing Bar.
- Display the details of the cost estimate by selecting 'Details of Cost Estimate' from the Cost Analysis drop-down menu.

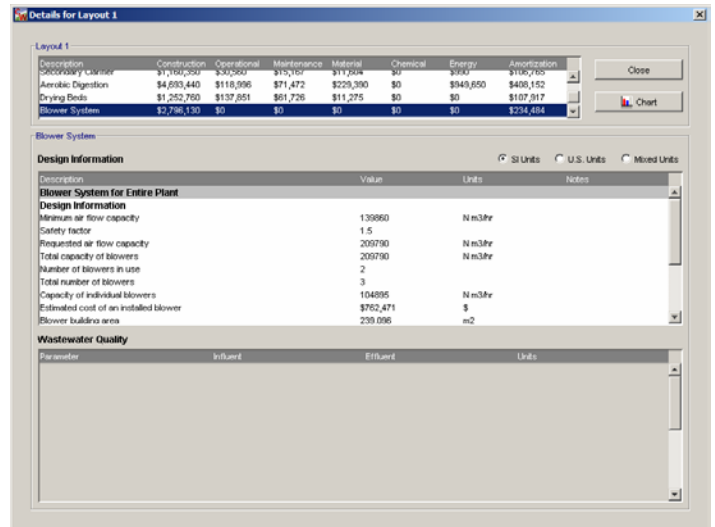


The details of the cost estimate are the crucial part of the CapdetWorks design. It is important to realize how the costs are calculated and how they are grouped together. For instance, aeration is not associated with its unit process, but rather CapdetWorks designs a blower system for the whole plant irrespective of what processes require air. Hence, aeration costs in this example are not associated with the complete mix activated sludge process. You will find that a separate unit process, 'Blower System', is listed at the top of the details window. The listed details of this blower system encompass the total air requirement for the whole plant.

23. With the Details for Layout 1 window open, left-click on the 'Blower System' unit process.

Note that the Wastewater Quality section of this window is now blank. This occurs because there is no flow through the blower system. Other items and unit processes (i.e. other direct costs, chemical additions) are handled in the same way and do not have associated wastewater quality data.

This example has provided a simple illustration of the basic drawing and designing features of CapdetWorks.



More...

Tutorials covering customizing the Cost Information, comparing multiple layouts and performing sensitivity Analysis can be found in the CapdetWorks User's Guide provided on the CD. There are also supporting Tutorial layouts available from the Windows Start menu under the Hydromantis CapdetWorks selection. If you have any questions regarding the use of CapdetWorks, please contact us at:

info@hydromantis.com

The CapdetWorks Demo is a free download from our website. Please check back regularly for the most recent version. Our website address is:

www.hydromantis.com

This quick introduction document is also available as a download in Adobe Acrobat format. Also at our website are license pricing, order forms, and support resources.

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Printing Date: October, 2003

Hydromantis Inc,
1685 Main Street West, Suite 302
Hamilton, Ontario, Canada L8S 1G5
Tel: +1 (905) 522-0012
Fax: +1 (905) 522-0031
info@hydromantis.com
www.hydromantis.com